

Mapping Deprivations in the Darjeeling Himalaya: a case study of Kurseong Municipality

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Abstract: Deprivation means lack of access to resources; it can be either lack of material resources or social resources. A poor household can be deprived in multiple levels and may be suffering from multiple disadvantages than a household which is not relatively deprived. Therefore, it is not only important to construct an index for measuring deprivation but it is equally important to identify the areas of deprivations at a micro-level in an urban area. In India, an urban area is divided into numerous small electoral units called as wards; the different data related to housing and socio-economic conditions for the urban areas are provided at the ward wise level by The Census of India report. This study uses the ward level data derived from the Primary Census Abstract (PCA), 2011 and House Listing Primary Census Abstract (HPCA), 2011 to construct indices of deprivation by using Principal Component Analysis. These indices are further combined to form one single Composite Index of Deprivation and mapped by using ArcGis 10.2.1 software to spatially identify areas experiencing multiple levels of deprivations. The Municipality of Kurseong is located on steep slopes of the Darjeeling Himalaya and owes its existence to the colonial establishment. The paper shows that around 35% of the wards suffer from very high to high levels of deprivation at multiple levels. These highly deprived wards can be identified as target areas where intervention programmes and policies could be prioritized by the Municipal authorities.

Keywords: Deprivation, Darjeeling Himalaya, Principal Component Analysis, Composite Index.

I. INTRODUCTION

The concept of poverty though often linked with income and consumption has a multidimensional character (Sen 1999; Atkinson 2003; Baud et al. 2008). A poor household experiences multiple deprivations that may impede their attainment of overall wellbeing. Therefore, the measurement of deprivations in an area level scale becomes imperative to understand the multidimensionality of deprivation and poverty. There are many methods which try to study multiple dimensional aspect of poverty by trying to reduce the range of socio-demographic information of the geographical area; the simple additive index, signed χ^2 , multivariate techniques and feedback approach are some of the common methods by which deprivation indices are constructed to understand this multidimensional nature of deprivation and poverty (Folwell 1995; Nobel et al. 2006; Bell et al. 2007; Havard 2008; Mari-Dell'Olmo et al. 2011). In the case of multivariate techniques, the principal component analysis and factor analysis are the mostly used methods by the scholars. The principal component analysis was primarily used by the geographers since the 1970s to construct territorial indicators (Jones and Flax 1970; Smith 1972; Smith and Gray 1972). The standard scores or Z scores obtained from such multivariate techniques are used for ranking purpose and mapped accordingly (Stimson and Marans 2011). However, growing socio-economic inequalities in the context of public expenditure in England led to growth of numerous indexes of deprivation (Senior 2002; Norman 2009). These indices of deprivation were developed from the data derived from census (Townsend 1970; Townsend 1979; Jarman 1983; Townsend et al. 1988; Carstairs and Morris 1989). Some of the important indices which were generally used by international agencies, countries and scholars are United Nations Development Program's (UNDP) Human Development Index (HDI) of 1990 (Lai 2003), which the UNDP in 2010 replaced with Alkire-Foster's Multidimensional Poverty Index (MPI) (Alkire and Foster, 2007), the English Indices of Deprivation (ID) (Noble et al. 2000) and its surrogates like the Welsh Index of Multiple Deprivation (Noble et al. 2000), Northern Ireland's Index of Multiple Deprivation (Noble et al 2001) and Scottish Indices of Deprivation (Noble et al. 2003), Royal Government of Bhutan's Gross National Happiness Index (GNH) (Ura et al. 2012), Relative Deprivation Approach (Townsend, 1979), Jarman Underprivileged Area index (UPA) (Jarman 1983), Majority Necessity Index (Mack and Lansley 1985), the Townsend Index (Townsend 1987), the Carstairs Index (Carstairs and Morris 1989), the Index of Multiple Deprivation (IMD 2004; Noble et al. 2006) , etc. It is very difficult for any index of deprivation to have universal set of indicators yet they are increasing used in health related studies, development studies and welfare studies (Krieger et al. 1997; Salmond et al. 1998; Galobardes et al. 2006; Pampalon et al. 2010; Mari-Dell'Olmo et al. 2011; Fusco et al. 2013).

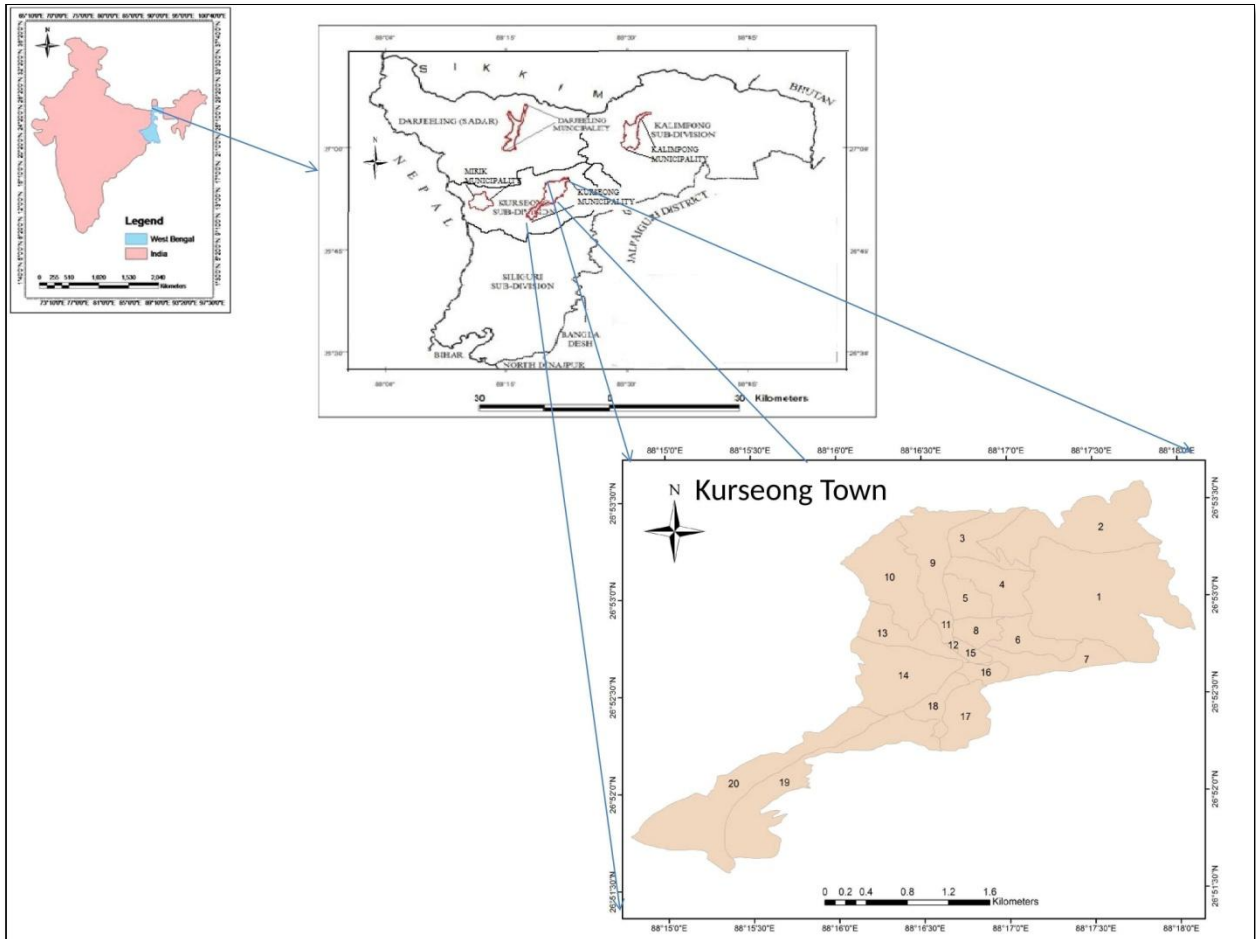
This paper uses principal component analysis to develop the index of deprivation (Salmond et al. 1998; Mckenzie 2003; Havard et al. 2008) as it is one of the frequently used techniques that has been utilized in studying similar issues like, socio-economic inequality, wellbeing, poverty, quality of life, etc. (Vyas and Kumaranayake 2006; Wong 2012; Haq and Zia 2013; Movahedd et al. 2016). Once the index has been constructed then GIS has been used for mapping the deprivation to identify the target area for prioritization of schemes and poverty mitigation measures (Henninger 1998; Baud et al. 2006; Tongdara et al. 2011).

II. STUDY AREA

Urbanization in the Himalayas occurred due to many reasons and the main among them being, geo-strategic reasons and search for sanatoria for recuperating soldiers. Many of the Hill towns in India were developed for geo-political and strategic reasons or were developed as sanatorium or as the hill border trading posts (Lama 2005). The Darjeeling Himalaya saw urbanization only after the area was handed over to the British East India Company. The area during the 18th century was part of the Kingdom of Sikkim and was subsequently annexed by the Kingdom of Nepal in 1780 (Dash 1947). In 1814 there were hostilities between the Kingdom of Nepal and the British East India Company which ended in 1816 with the treaty of Seogulee (Aitchison 1909). This region was ceded to the East India Company as a consequence of the Anglo-Gorkha war (Malley 1907), but the company officials restored it back to Sikkim with the treaty of Titalia of 1817, signed between East India Company and the Raja of Sikkim (Malley 1907). However, with the request from the Governor General of British India in 1835, the Raja of Sikkim ceded a strip of five to six miles of territories of Kurseong along with the Darjeeling spur to the East India Company (Malley 1907). It was only a very narrow strip of British enclave which was surrounded by Kingdoms of Sikkim and Nepal on all sides. In fact to reach the hill stations of Darjeeling and Kurseong, one could only enter through the territories under the Kingdom of Sikkim (Ray 2014). This precarious geo-strategical position was quickly rectified in 1849, when the two British nationals who had ventured into the Kingdom of Sikkim were captured by the Sikkimese. The Britishers quickly dispatched forces which crossed over to Sikkim and dealt a humiliating defeat to the Sikkimese forces. Subsequently, the Britishers annexed additional territories which comprise the areas of present day Darjeeling district (Malley 1907). Once the territory, passed into the hands of the Britishers, the area saw large scale development in terms of establishment of tea plantations, settlements, construction of roads and railway lines which led to rapid influx of people from the surrounding areas (Malley 1907). The word Kurseong means 'The Land of the White Orchids' and comes from the Lepcha word 'Kurson Rip' meaning the white orchid, it was a small village and saw rapid transformation due to construction of roads and railway lines and quickly developed as a secondary resort and halting point for the travelers going to Darjeeling (Malley 1907). The Municipality of Kurseong was established in 1879 as a second class municipality with an area of 5.18 km² and was administered by a Board consisting of 12 Municipal Commissioners, out of which the Chief Medical Officer was the ex-officio, while 6 were elected and 5 were nominated by the Government (Malley 1907).

According to 2011 census of India report, there are four statutory urban centers in Darjeeling Himalayas. These four towns of Darjeeling Himalayas have been established at different time periods and the oldest and largest among them is Darjeeling town, which was established in the year 1850 as a Municipality followed by Kurseong (1879), Kalimpong (1945) and Mirik (1991). Darjeeling Municipality is the administrative headquarter of the District of Darjeeling, Kurseong Municipality and Kalimpong Municipality are medium sized towns where as Mirik Town is small sized town and of very recent development. Kurseong town is the sub-divisional headquarter of Kurseong subdivision of Darjeeling district. The town is spread over an area of 7.5 km² and has been divided into 20 wards with 42,346 persons as per census of India report, 2011. It is surrounded by steep mountain slopes which are under tea plantations which has restricted urban expansion thereby leading to linear growth along the main roads.

Figure 1 Location of the study area

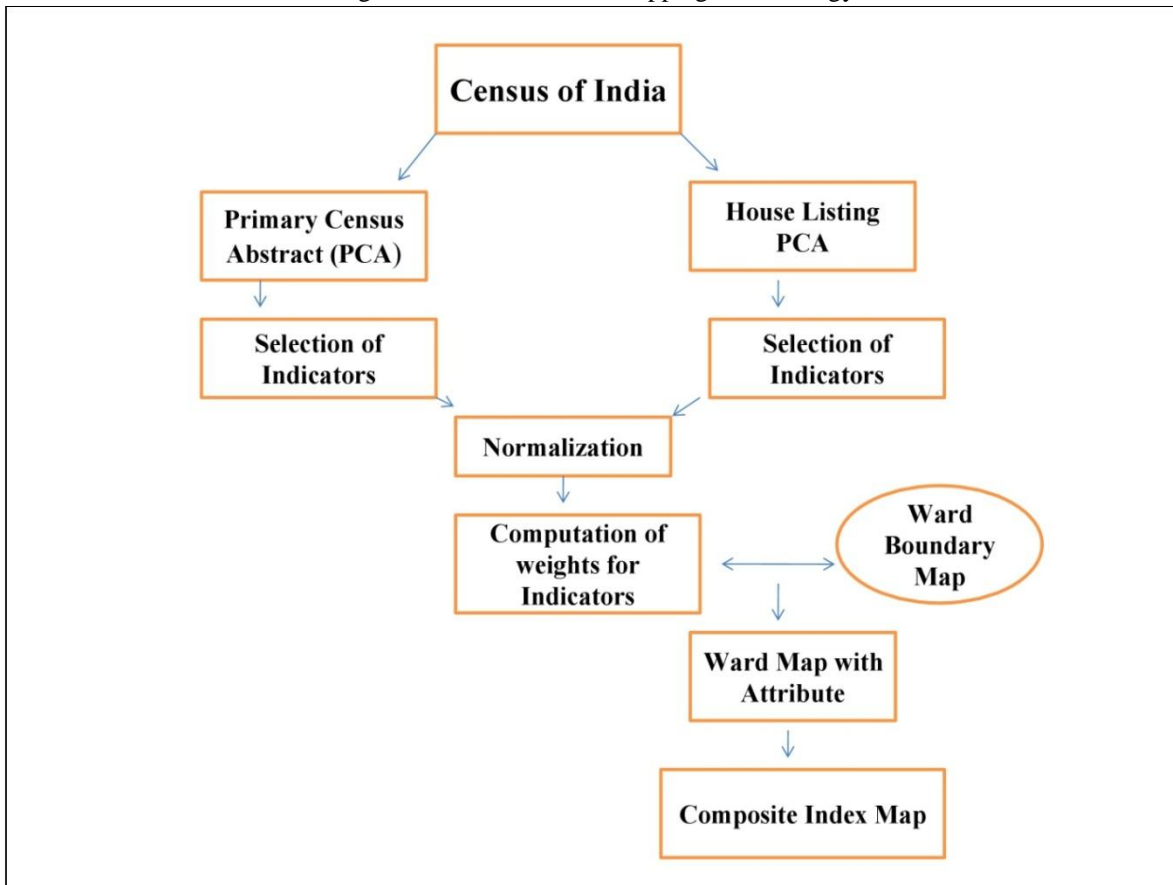


III. DATABASE AND METHODOLOGY

3.1 Database

This study uses two major sources of secondary data i.e. Primary Census Abstract (PCA) 2011 and House listing Primary Census Abstract (HLPCA) 2011 both of which were derived from Census of India Report of 2011. Primary Census Abstract has been used to collect socio-economic data mainly pertaining to literacy (Female) and the information related to different types of assets, basic amenities and services like households having motorcycles, housing conditions, drinking water facilities, access to banking services, drainage, electricity, etc were derived from House listing Primary Census Abstract. This study has used ward-wise level data derived from both PCA and HLPCA for developing the various Indices of Deprivation, which were then matched to the digitized ward map of the Kurseong town to develop the deprivation maps and Composite index was constructed and mapped accordingly (Figure 2).

Figure 2 Flowchart of the mapping methodology



3.2 Selection of domains and indicators

To determine the spatial pattern of deprivation in Kurseong Municipality, 13 indicators such as households having motorcycles, single room households, water within the premises, absence of kitchen, households having permanent structures, access to banking, house ownership, households with LPG connections, households living in dilapidated census house, households using Kerosene as source of lighting, households having no electricity, female literates and households lacking drainage were selected (Table 1). These indicators were further classified into four domains of Assets and Services, Housing and Service, Housing Condition and Social, and Access to Lighting Facilities with the help of Principal Component Analysis. These four domains or Indices of Deprivation were combined to develop composite index of deprivation for the town.

Table 1 Important indicators and their source

| Notation | Indicator | Source |
|----------------|----------------------------------------------------|---------------------------------------------------|
| X ₁ | % of households having motorcycle | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₂ | % of households having Own house | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₃ | % of households having Water (within the compound) | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₄ | % of households accessing Banking service | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₅ | % of households lacking drainage | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₆ | % of households lacking kitchen | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₇ | % of households having LPG connection | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₈ | % of households having permanent structures | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₉ | % of households having one room | House Level Primary Census Abstract (HLPCA, 2011) |

| | | |
|-----------------|------------------------------------------------------|---------------------------------------------------|
| | house | |
| X ₁₀ | % of households having dilapidated census house | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₁₁ | % of Female literates | Primary Census Abstract (PCA, 2011) |
| X ₁₂ | % of households using kerosene as source of lighting | House Level Primary Census Abstract (HLPCA, 2011) |
| X ₁₃ | % of households lacking electricity connection | House Level Primary Census Abstract (HLPCA, 2011) |

3.3 Methodology

The paper tries to examine the ward-wise level of deprivation among the households of Kurseong town in Darjeeling Himalaya and the process of preparing the indices are as follows.

3.3.1 Normalization of the indicators

Data normalization is a technique used to transform the data set within a range of 0-1 when the variables present have different range of variance. Here, Min-Max normalization technique was applied for converting the variables within the range of 0-1 by using two equations; one linear increasing and one linear decreasing. The data were arranged in a matrix and normalized using the functional relationship, where the value of 1 represents high deprivation and 0 represents low deprivation. The normalization was achieved by employing the following formula.

$$X_n = \frac{X_0 - X_{\min}}{X_{\max} - X_{\min}} \tag{1}$$

Where, X_n= new value for variable X, X₀= actual value of variable X, X_{min}= minimum value in the data set, X_{max}= maximum value in the data set.

However, if a variable (X₀) is negatively associated with the index of deprivation, as, for example, the percentage of female literates should decline with increase in deprivation then (Eq. 1) can be written as,

$$X_n = \frac{X_{\min} - X_0}{X_{\max} - X_{\min}} \tag{2}$$

3.3.2 Principal component analysis

Once the normalized values (Table 2) are derived, the next step is to assign factor loadings and weights. This study uses Principal component analysis (PCA) to determine factor loadings and to assign weights. PCA is a statistical process that uses orthogonal transformation to convert a set of observations of correlated variables into a set of values of linearly uncorrelated variables called components (Haq and Zia 2013). The number of Principal components should always be equal to or less than the number of original variables. The transformation occurs in such a manner that the largest possible variance will be represented by the first principal component, the second largest variance by the second principal component and so on. One of the main advantages of using PCA is that it is very easy to calculate and uses the type of data which is usually collected during the survey and uses all the variables during the dimensionality reduction process (Jobson 1992, Vyas and Kumaranayake 2006). The four principal components having eigen value of 1 and more were selected, each individual principal component has been used as an indices of deprivation and has been linked with the ward boundaries to develop attribute maps for the town. Later these four indices were combined together to construct the Composite Index of Deprivation. The PCA has been calculated with the help of following formula.

$$X_i = \lambda_{i1}F_1 + \lambda_{i2}F_2 \dots + \lambda_{ij}F_j \tag{3}$$

(After: Haq and Zia, 2013)

Where, X_i= ith indicator, λ_{ij} = Factor loading which represents the proportion of the variation in X_i which is accounted for by the jth factor. ∑λ_{ij} is called the communality and it is equivalent to the multiple regression coefficients in regression analysis. F_j symbolizes jth factor or component.

Table 2 The normalized scores of the indicators

| Wards | X ₁ | X ₂ | X ₃ | X ₄ | X ₅ | X ₆ | X ₇ | X ₈ | X ₉ | X ₁₀ | X ₁₁ | X ₁₂ | X ₁₃ |
|-------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|
| 1 | 0.91 | 0.87 | 0.6 | 1.0 | 1.0 | 1.0 | 0.82 | 0.63 | 1.0 | 0.96 | 1.0 | 0.76 | 0.71 |
| 2 | 0.93 | 1.1 | 0.93 | 0.93 | 0.45 | 0.74 | 1.0 | 0.86 | 0.04 | 0.36 | 0.0 | 0.71 | 1.0 |
| 3 | 0.89 | 0.71 | 0.88 | 1.0 | 0.5 | 0.74 | 0.87 | 0.81 | 0.0 | 0.0 | 0.12 | 0.76 | 1.0 |
| 4 | 0.59 | 0.73 | 0.76 | 0.8 | 0.27 | 0.68 | 0.84 | 0.81 | 0.07 | 0.29 | 0.02 | 0.52 | 1.0 |
| 5 | 0.89 | 0.74 | 0.93 | 0.93 | 0.37 | 0.51 | 0.84 | 0.79 | 0.04 | 0.31 | 0.56 | 0.62 | 1.0 |
| 6 | 0.91 | 0.82 | 0.87 | 1.0 | 0.5 | 0.58 | 0.71 | 0.71 | 0.06 | 0.41 | 0.52 | 0.0 | 1.0 |
| 7 | 0.87 | 0.88 | 0.97 | 0.59 | 0.53 | 0.0 | 0.0 | 0.0 | 0.19 | 0.68 | 0.63 | 0.7 | 1.0 |
| 8 | 1.0 | 0.79 | 0.97 | 0.63 | 0.73 | 0.82 | 0.87 | 0.71 | 0.3 | 0.6 | 0.41 | 0.91 | 1.0 |

| | | | | | | | | | | | | | |
|----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 9 | 0.67 | 0.85 | 0.54 | 0.83 | 0.49 | 0.71 | 0.59 | 0.86 | 0.17 | 0.33 | 0.87 | 0.84 | 1.0 |
| 10 | 1.0 | 0.99 | 1.0 | 0.88 | 0.95 | 0.48 | 0.57 | 0.6 | 0.0 | 0.45 | 0.58 | 0.85 | 1.0 |
| 11 | 1.0 | 0.77 | 1.0 | 1.0 | 0.86 | 0.23 | 0.59 | 0.31 | 0.06 | 0.57 | 0.55 | 0.84 | 1.0 |
| 12 | 0.26 | 0.28 | 0.51 | 0.0 | 0.27 | 0.61 | 0.61 | 0.92 | 0.3 | 1.0 | 0.75 | 0.33 | 0.0 |
| 13 | 0.72 | 0.71 | 1.0 | 0.56 | 0.46 | 0.7 | 0.78 | 0.99 | 1.0 | 0.71 | 0.52 | 0.81 | 1.0 |
| 14 | 1.0 | 0.82 | 0.81 | 1.0 | 0.21 | 0.66 | 0.82 | 0.79 | 0.0 | 0.34 | 0.43 | 0.91 | 1.0 |
| 15 | 0.0 | 0.0 | 0.0 | 0.37 | 0.0 | 0.47 | 0.59 | 1.0 | 0.0 | 0.61 | 0.48 | 1.0 | 1.0 |
| 16 | 0.78 | 0.85 | 1.0 | 0.76 | 0.75 | 0.39 | 0.27 | 0.58 | 0.51 | 0.82 | 0.38 | 0.36 | 1.0 |
| 17 | 0.78 | 0.83 | 0.99 | 0.95 | 0.78 | 0.48 | 0.57 | 0.84 | 0.1 | 0.47 | 0.57 | 0.92 | 1.0 |
| 18 | 0.93 | 0.72 | 1.0 | 1.0 | 0.51 | 0.98 | 0.86 | 0.98 | 0.09 | 0.14 | 0.34 | 0.8 | 1.0 |
| 19 | 0.67 | 1.0 | 1.0 | 0.88 | 0.47 | 0.76 | 0.99 | 0.65 | 0.0 | 0.96 | 0.59 | 0.7 | 1.0 |
| 20 | 0.74 | 0.91 | 0.92 | 0.71 | 0.17 | 0.21 | 0.75 | 0.36 | 0.0 | 0.17 | 0.72 | 0.77 | 0.79 |

3.3.3 Correlation analysis

Karl Pearson’s coefficient correlation analysis was applied to assess the relationships between various variables used in the study.

$$r = \frac{N(\sum xy) - (\sum x)(\sum y)}{\sqrt{\{N\sum x^2 - (\sum x)^2\} \{N\sum y^2 - (\sum y)^2\}}}$$
 (4)

Where, r = Pearson’s correlation, N = number of pairs of scores, $\sum x$ = sum of x scores, $\sum y$ = sum of y scores, $\sum x^2$ = sum of squared x scores, and $\sum y^2$ = sum of squared y scores.

3.3.4 Construction of Composite Index

This study uses a composite index of deprivation (CI_d) to identify the extent of deprivation among the different wards of Kurseong town. CI_d is one form of composite score index, which has been calculated as a simple average. The principal component scores of the different wards were extracted by varimax rotation after which the total scores were summed up and divided by the number of the extracted component to get the CI_d. The construction of CI_d through composite score is well preferred as it is very comprehensive and multidimensional in nature and can represent multiple indicators by one aggregate value (Kararach et. al. 2017). The following formula was used for calculating the CI_d.

$$CI_d = \frac{\sum ID_1 + \sum ID_2 + \sum ID_3 + \sum ID_4}{N}$$
 (5)

Where, ID₁= index of deprivation by first principal component, ID₂= index of deprivation by second principal component, ID₃= index of deprivation by third principal component, ID₄= index of deprivation by fourth principal component, and N= number of extracted principal components.

3.3.5 Software used

The statistical analysis of the data was carried out by using IBM- SPSS 16 software and ArcGis 10.2.1 software has been used to prepare different maps.

IV. RESULTS AND DISCUSSION

This study uses the findings based on the results obtained from PCA. The main objective of PCA is to reduce the original number of explanatory variables to a smaller number of independent factors; these independent factors can be used to explain the whole set of variables. Therefore, PCA is considered a robust technique for determining the role of various components in the study as the indicators can be described by smaller set of components (Das et al. 2016). The intra-urban variation of deprivation of the households in Kurseong town has been measured by 13 indicators. These 13 indicators have been classified into four components by PCA. The variables within the component are strongly correlated with each other but not with the variables of the other components. The four Principal Components explains 78.9% of the total variance in Table 3.

Table 3 Total variance explained

| Component | Initial Eigen values | | | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
|-----------|----------------------|---------------|--------------|-------------------------------------|---------------|--------------|-----------------------------------|---------------|--------------|
| | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % | Total | % of Variance | Cumulative % |
| 1 | 4.162 | 32.017 | 32.017 | 4.162 | 32.017 | 32.017 | 3.972 | 30.556 | 30.556 |
| 2 | 2.814 | 21.645 | 53.662 | 2.814 | 21.645 | 53.662 | 2.499 | 19.220 | 49.777 |
| 3 | 2.091 | 16.084 | 69.746 | 2.091 | 16.084 | 69.746 | 2.460 | 18.924 | 68.700 |
| 4 | 1.192 | 9.173 | 78.919 | 1.192 | 9.173 | 78.919 | 1.328 | 10.219 | 78.919 |
| 5 | .725 | 5.578 | 84.497 | | | | | | |

| | | | |
|----|------|-------|---------|
| 6 | .558 | 4.290 | 88.787 |
| 7 | .410 | 3.153 | 91.941 |
| 8 | .391 | 3.005 | 94.946 |
| 9 | .231 | 1.774 | 96.720 |
| 10 | .173 | 1.331 | 98.051 |
| 11 | .113 | .867 | 98.918 |
| 12 | .081 | .622 | 99.540 |
| 13 | .060 | .460 | 100.000 |

The KMO and Barlett’s test of sphericity is a sampling adequacy measure that is suggested to check the case to variable ratio for the analysis being conducted. The result of KMO is 0.622 which indicates that the factor analysis can be carried out for the data set and Barlett’s test of sphericity is less than 0.05, which means that the result is significant implying that some correlation exists among the variables (Table 4).

Table 4 KMO and Bartlett’s test

| | | |
|-----------------------------------------------------|--------------------|---------|
| Adequacy value of sampling Kaiser-Meyer-Olkin (KMO) | 0.622 | |
| Barlett’s test of sphericity | Chi-Square | 139.700 |
| | Degree of Freedom | 78 |
| | Significance level | 0.000 |

4.1 Index of deprivation (assets and services)

Table 3 shows that the first principal component explains 30.556% of the variance and has the Eigen value of 3.972. Five indicators in the order of the magnitude of loading, namely the percentage of households having motorcycle, the percentage of households owning house, the percentage of households having water within their compounds, the percentage of households accessing banking services and the percentage of households lacking proper drainage system in their compound load positively with this component in Table 5. Since this component includes the indicators related to house and motorcycle ownership along with various service related indicators like water, banking and drainage, therefore, this can be regarded as the index of deprivation based on assets and services. Assets can be considered as resources which are accumulated over time and are used as security against contingencies, the presence or absence of assets in the household can be used to determine poverty level of the household. The access to banking service has been seen as an indicator of financial inclusion (World Bank 2015) and exclusion from such services is viewed as deprivation. The access to safe drinking water is fundamental towards improving living standards. Efficient drainage system is vital for safety and productivity, defunct or absence of drainage system can pose threat to both the community and healthcare (Blom 2015). Moreover in the mountainous terrains faulty drainages can lead to environmental disasters such as landslides. The combination of these indicators in this domain becomes an important measurement for determining the status of wealth, financial inclusion, quality of life, health and security of the households. The high positive index value which is derived from the factor score, indicate higher levels of deprivation as shown in Table 6.

Table 5 Rotated component loadings matrix with communalities

| Notation | Components | | | | Communalities |
|-----------------|------------|------|------|---|---------------|
| | 1 | 2 | 3 | 4 | |
| X ₁ | .941 | | | | .705 |
| X ₂ | .904 | | | | .789 |
| X ₃ | .854 | | | | .930 |
| X ₄ | .782 | | | | .844 |
| X ₅ | .687 | | | | .807 |
| X ₆ | | .946 | | | .895 |
| X ₇ | | .849 | | | .820 |
| X ₈ | | .825 | | | .785 |
| X ₉ | | | .809 | | .751 |
| X ₁₀ | | | .801 | | .769 |

| | | | | | |
|-----------------|--|--|------|------|------|
| X ₁₁ | | | .715 | | .622 |
| X ₁₂ | | | | .919 | .849 |
| X ₁₃ | | | | .525 | .694 |

The spatial variation of the index of deprivation based on access to assets and ownership has been done by dividing the factor scores into five categories of very high deprivation (0.52 to 0.88), high deprivation (0.35 to 0.49), moderate deprivation (0.1 to 0.32), low deprivation (-0.39 to -0.08) and very low deprivation (-3.17 to -0.99). The households present in ward number 1, 2, 6, 10, 11, 16 exhibit very high levels of deprivation in relation to access to assets and services, while ward number 15 and 12 have very low deprivation levels. The other wards where high levels of deprivation exists are 8, 17, 18 and 19 while the rest of the remaining wards either have low or moderate levels of deprivation on the basis of access to assets and services as shown by Figure 3. The very high levels of deprivation exist in those wards which are located on steep slopes. Ward numbers 1, 2 and 6 are situated far above the hill cart road and are spread over the steep slopes of Mahaldiram–Senchel ridge. The degree of the slopes range between 15° to 45° in these areas (Das et al. 2011), the steep slopes of Victoria, Dowhill and upper Sherpa busty area falling under ward numbers 1, 2 and 6 respectively have been experiencing expansion of the settlements fairly recently owing to huge population increase due to migration; lack of gentle slopes and presence of forest land especially in ward numbers 1 and 2 coupled with immense population pressure has led to occupation of whatever non- forest vacant lands in these parts of the town. People have constructed multi-storied semi-pucca and kutcha houses with no or very little road connectivity and water connections. Ward numbers 11 and 16 are situated on the very steep slopes just below the hill cart road and ward number 10 is located far away from the main road. The location of these wards has caused them to be deprived of many services like water and roads. It has been observed in other towns of Darjeeling Himalaya, that the steep slopes and situation of the localities away from the main roads have led decline in municipal functions such as water supply. Water scarcity is a major problem in the town; only 3.7% of the households have access to water connections within their premises while 96.3% of the households had sources of water outside their premises out of which 34.6% of the households obtained water from untreated sources (Census of India 2011). Moreover, the residents of those wards where the very high deprivation levels exists face severe water crises as they lack water supply from the municipality; the location of these wards on steep slopes and their lack of proximity to the main roads have forced the residents to use water from untreated sources like the springs and *jhoras* (small gullies or gorges). These springs and *jhoras* run dry during the summer season as they are rain fed. The steep slopes of the area along with the presence of impermeable rocks like gneiss, do not allow percolation of the rain water into the soil during the monsoon which ultimately results in drying up of the spring and *jhoras* in drier months in the town (Das et al. 2011) thereby causing the households to face severe water scarcity. These wards have also experienced landslides in the past due to both physical and anthropogenic factors (Das et al. 2011).

4.2 Index of deprivation (housing and service)

The second principal component has an Eigen value of 2.814 and accounts for 19.22% of the total variance explained as shown in Table 3. The three indicators that have strong positive loadings against it are, percentage of households lacking kitchen, percentage of households having LPG facilities and percentage of households having permanent structures. There are two indicators that are related to housing condition i.e. kitchen and permanent housing structure and one related to access to LPG service due to which this has been called as housing and service index. Therefore this is an index of deprivation based on access to housing and service. Low quality housing causes reduced wellbeing and increased psychology stress among the households (Abdallah and Stoll 2012). Permanent housing structures are important for psychological wellbeing of the people as it gives some sense of safety and security. Similarly, usage of unclean fuel for cooking is detrimental to human health as it leads to premature death and disabilities, moreover, the health and economic burden arising out of the use of unclean fuels is born by women and girls due to the traditional gender based roles around cooking, this makes reliance on solid fuels (wood and coal) a major source of gender inequality (Austin and Mejia 2017).

The spatial variation of the index of deprivation on the basis of housing and service has been shown by Figure 4. The factor scores have been categorized into five classes of very high deprivation (0.72 to 1.25), high deprivation (0.47 to 0.71), moderate deprivation (0.04 to 0.43), low deprivation (-0.93 to -0.09) and very low deprivation (-2.96 to -1.09). The ward numbers of 1, 2, 3, 13, 18 and ward numbers 4, 8 and 19 have very high disparity and high deprivation index values respectively. The ward numbers of 1, 2 and 3 situated above the hill cart road on very steep slopes have again exhibited very high deprivation levels. While 13 and 18 are low class neighborhoods which are situated very near to the market place. The first three wards owing to their situation on

the steep slopes has led to construction of semi-pucca and kutchha shelters by using bricks, woods and corrugated sheets which are of semi-permanent and temporary nature and since these are located away from the market place and are surrounded by forest area, people tend to use other sources of fuel like firewood for cooking purpose. The remaining two wards of 13 and 18 have very high deprivation on the basis of housing and service because they are low class neighborhoods usually having shelters built of flimsy materials by the urban poor. The high deprivation levels are observed also in the other wards which are located on steeper slopes like 4, 8 and 19. The very low levels of deprivation exists in ward number 7 and 11 which are located in the market place i.e. the central business district of the town; deprivation is also low in the ward number 20, which is a mixed residential neighborhood having number of institutions like tea research center and sericulture along with the high end hotels on the southern slopes of the town along the Pankhabari road. The other remaining wards have low to moderate levels of deprivation.

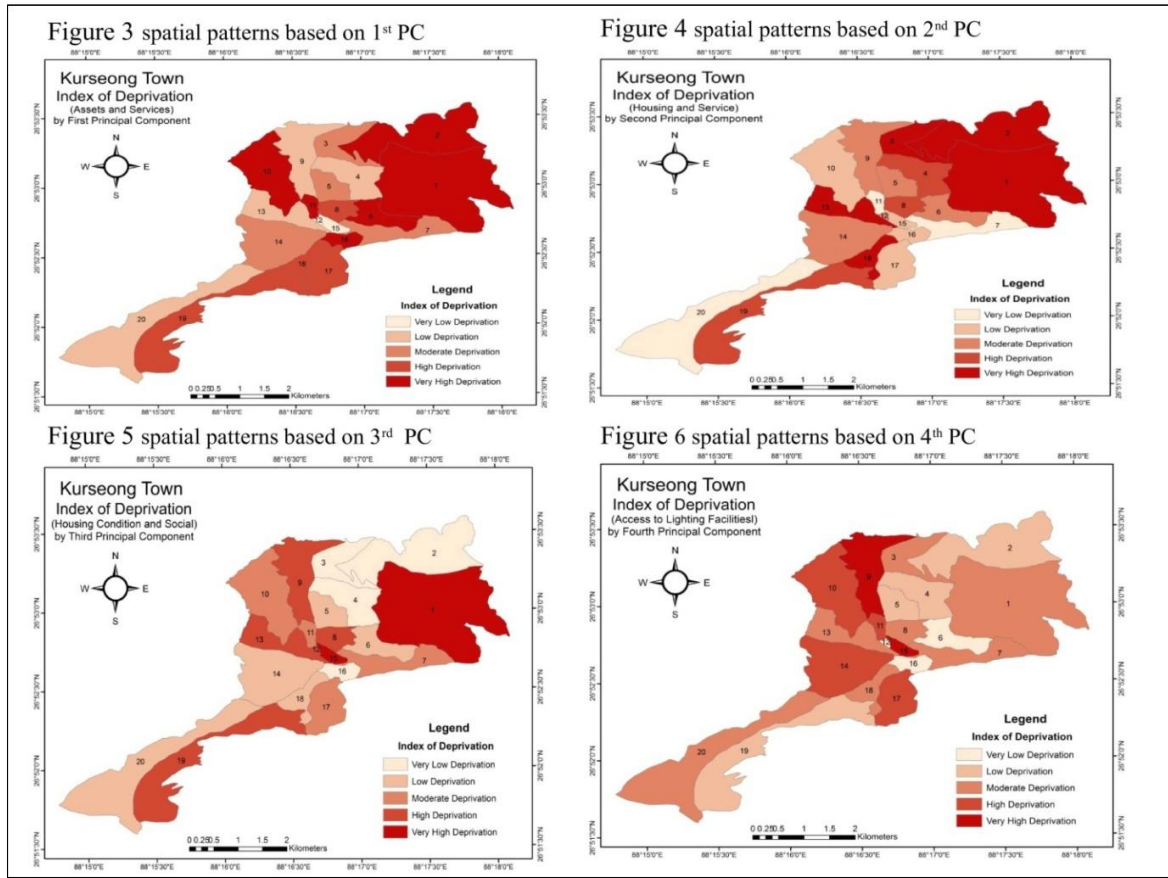
4.3 Index of deprivation (housing condition and social)

The third principal component explains 18.924% of variance with an Eigen value of 2.091 as per Table 3. The percentage of households having one room house, the percentage of households having dilapidated census house and the percentage of Female literates have high positive factor loadings with this component in Table 5. These three indicators are related to housing and social conditions, therefore it measures deprivation based on housing and social factors. Quality housing is crucial for the wellbeing of the people. Therefore determination of housing condition is important for determining the wellbeing of the people. Similarly, female literacy is also important for overall well-being of the households, as literacy among the females have positive correlation with the health indicators like decreased child mortality and fertility rates (Robinson 2008). This domain is the measure of the wellbeing of the households of the area.

Figure 5 shows the spatial variation of the index of deprivation based on housing condition and social (gender). Five categories of deprivation have been obtained by diving the factor scores. Very high deprivation (1.65 to 2.83) is found in ward numbers of 1 and 15; high deprivation index (0.28 to 1.30) values are found over ward numbers 8, 9, 13 and 19; moderate deprivation (0.12 to 0.23) levels exists over ward numbers 7, 10, 11 and 17; low deprivation (-0.78 to -0.51) can be observed among the wards of 5, 6, 14, 18 and 20 while ward numbers 2, 3, 4 and 16 have very low deprivation (-1.39 to -1.02). Very high deprivations are again observed in ward number 1 as the rapid growth of population has pushed the poor to occupy steep slopes of the Mahaldiram-Senchel ridge. Since, this ward lacks gentle slopes to build houses therefore as mentioned earlier multi-storied semi-pucca and kutchha houses have been built by few and rooms have been rented out to the migrants. The geographical condition of the area and the socio-economic conditions of the people have led to prevalence of very high levels of deprivation in the area. The reason for ward number 15 showing very high levels of deprivation in relation to housing and social conditions is chiefly social attitude and prejudice. Ward number 15 mainly being a muslim neighborhood although has performed fairly well in the previously two indices related to housing and assets; and housing and services, performs poorly in this index of deprivation mainly due to the presence of a social indicator that takes into account the % of female literates in the area. It is generally found that, in India the muslims are educationally the most backward among all the communities and muslim women lag far behind their male counterparts. The low educational status among the muslim men have created a barrier for the muslim women to attain education due patriarchal attitude of the community towards the womenfolk (Hassan and Menon 2005; Kirmani 2009). This pattern is also observed among the muslim community in Kurseong town.

4.4 Index of deprivation (access to lighting facilities)

The fourth principal component explains 10.219% of the total variance and has an Eigen value of 1.328. Two indicators related to main source of lighting such as the percentage of households using kerosene as source of lighting and the percentage of households lacking electricity connection load high and positively with this component. This component can be called as an index of deprivation based on access to lighting facilities. The use of electricity as the major source of lighting among the households of the town is generally low, only 13.05% of the households use electricity and 96.62% of the households depend on kerosene along with electricity for lighting purposes (Census Report 2011). The spatial variation of the index of deprivation based on access to lighting facilities as shown by Figure 6, reveal that certain wards of the town are more deprived than the others. The factor score has been divided into five grades of very high deprivation (1.14 to 1.65), high deprivation (0.61 to 1.00), moderate deprivation (-0.04 to 0.57), low deprivation (-0.80 to -0.07) and very low deprivation (-2.5 to -1.04). The Figure 6 shows that very high deprivation index scores are found in wards 9 and 15; high deprivation index scores over ward numbers of 10, 14 and 17; moderate deprivation levels prevails over ward numbers of 1, 3, 7, 8, 13, 18 and 20; low deprivation is found in the wards of 2, 4, 5 and 19 and very low deprivations index can be found over ward numbers 6, 12 and 16.



4.5 Composite Index of Deprivation (CI_d)

Composite Index of Deprivation (CI_d) has been formulated to assess the level of deprivation that exists in Kurseong town. In Table 6, the CI_d value of the different wards have been calculated as a simple average of the four principal component scores, further these wards has been ranked on the basis of their CI_d score from the highest to the lowest rank. The higher the CI_d value, higher will be the level of deprivation and vice versa. The CI_d has been classified into five zones of deprivation i.e. very high deprivation (0.73 to 1.26), high deprivation (0.24 to 0.73), moderate deprivation (-0.24 to 0.24), low deprivation (-0.73 to -0.24) and very low deprivation (-0.84 to -0.73). 5% of the total number of wards falls in the zone of very high deprivation. The zone of high deprivation has 30% of the wards, while moderate deprivation zone and zone of low deprivation have 35% and 25% of the total wards respectively and only 5% of the total wards have very low deprivation levels. This indicates that the intra-urban variation in the levels of deprivation is high and still 35% of the wards under the Municipality of Kurseong suffer from very high to high levels of deprivation in one form or the other. The municipal authorities can take steps to reduce deprivations in the different wards of the town by prioritizing each important indicator considered by the study.

Table 6 Standardized factor scores of indexes of deprivation along with the composite index of deprivation

| Ward numbers | Ranks | PC1 | PC2 | PC3 | PC4 | CI _d | Zones of deprivation | % of frequency in each class |
|--------------|-------|-------|-------|-------|-------|-----------------|-----------------------|------------------------------|
| 1 | 1 | 0.63 | 1.03 | 2.83 | 0.58 | 1.26 | Very high deprivation | 5 |
| 13 | 2 | -0.09 | 0.88 | 1.18 | 0.18 | 0.54 | | |
| 8 | 3 | 0.45 | 0.62 | 0.47 | 0.47 | 0.50 | High deprivation | 30 |
| 18 | 4 | 0.39 | 1.25 | -0.65 | 0.32 | 0.33 | | |
| 9 | 5 | -0.39 | 0.11 | 0.31 | 1.14 | 0.30 | | |
| 17 | 6 | 0.35 | -0.24 | 0.14 | 0.90 | 0.28 | | |
| 10 | 7 | 0.90 | -0.59 | 0.20 | 0.60 | 0.27 | | |
| 19 | 8 | 0.38 | 0.46 | 0.28 | -0.24 | 0.22 | | |
| 14 | 9 | 0.10 | 0.38 | -0.79 | 0.68 | 0.09 | | |
| 11 | 10 | 0.76 | -1.26 | 0.12 | 0.62 | 0.06 | | |

| | | | | | | | | |
|----|----|-------|-------|-------|-------|-------|----------------------|----|
| 2 | 11 | 0.68 | 0.10 | -1.05 | -0.46 | 0.04 | Moderate deprivation | 35 |
| 3 | 12 | 0.27 | 0.72 | -1.29 | 0.16 | -0.03 | | |
| 5 | 13 | 0.16 | 0.13 | -0.66 | -0.14 | -0.13 | | |
| 16 | 14 | 0.52 | -0.93 | 0.60 | -1.15 | -0.24 | | |
| 4 | 15 | -0.33 | 0.58 | -1.31 | -0.80 | -0.46 | Low deprivation | 25 |
| 6 | 16 | 0.58 | 0.04 | -0.62 | -1.99 | -0.50 | | |
| 20 | 17 | -0.16 | -1.14 | -0.75 | -0.04 | -0.52 | | |
| 15 | 18 | -3.17 | -0.18 | -0.50 | 1.65 | -0.55 | | |
| 7 | 19 | 0.23 | -2.96 | 0.23 | 0.00 | -0.62 | | |
| 12 | 20 | -2.24 | 0.11 | 1.25 | -2.46 | -0.84 | Very low deprivation | 5 |

When spatial variation of the CI_d is viewed, the levels of deprivation varies from very high to high in all those wards which are located in steep slopes, have experienced urban expansion post independence period and almost all the wards except ward number 8 are located far from the C.B.D or the market place.

Ward number 1 suffers from very high deprivation index value as it is located far from the C.B.D area on the very steep northern slopes on Mahaldiram-Senchel ridge and though it is one of the very old sections of the town it saw rapid population settlement only after independence when the town started experiencing very high immigration from the surrounding areas.

Ward numbers 13, 8, 18, 9, 17 and 10 have high levels of deprivation. They are low income neighborhoods situated on the steep slopes and except ward number 8 are located away from the market place. Meanwhile, ward numbers 19, 14, 11, 2, 3, 5 and 16 have moderate levels of deprivation and low levels of deprivation are found in ward numbers 4, 6, 20, 15 and 7. These are those wards which are located on moderate to steep slopes and are middle class and upper middle class areas. The only ward which has very low levels of deprivation is ward number 12, which is located on the gentle slope of the town and is the C.B.D. of the town. Figure 7 shows that deprivations are spatially concentrated in municipal wards 1, 13, 8, 18, 9, 17 and 10. In those wards CI_d is significantly higher but highest in ward no 1 (i.e. higher than mean + 1.5 standard deviation).

4.6 Detailed analysis of the deprived wards

When the components of deprivation is viewed across the seven most deprived wards of the municipality as shown in Figure 8, then it is found that in case of the deprivation index related to assets and service, ward number 10 is the most deprived area of the all, followed by 1, 8, 18 and 17. In fact, within this component ward number 9 and 13 are not at all deprived. Ward number 9 performs better in terms of presence of water and drainage facility and ward number 13 in respect to access to banking service and drainage as evident from Table 2. In case of housing and service, ward numbers 18, 13 and 1 are the most deprived wards and 10 and 17 perform very well in this component. When performance of the deprived wards are viewed in the background of housing condition and social component then ward number 1 scores very badly followed by ward number 13. Ward no 1 has performed very poorly especially in context of female literacy indicator. Ward number 10 is the only ward which is not deprived in this sector. When we observe the deprivation related to the access to lighting facility then all the wards are found to have been deprived.

When the individual municipal wards are examined to assess the type of deprivation then Figure 9 shows that ward number 1 is severely deprived across all the indices of deprivation in general and housing condition and social parameter in particular, ward number 8 also performs poorly across all the indices of deprivation, ward no 9 is more deprived in terms of access to lighting facilities but has done well in access to assets and service category, ward number 10 lacks in terms of assets and service but has good housing and social score, ward number 13 performs badly across almost all the indices except in index of deprivation related to access to assets and service, ward number 17 is deprived in context of access to lighting facilities while is less deprived in access to housing and service parameter and ward number 18 has good performance in terms of housing and social conditions (i.e. % of dilapidated houses is low and % of female literacy is high) but suffers from high deprivation related to housing and service parameter. It has been found that ward numbers 1 and 8 are the only two wards that are suffering from multiple deprivations on all four components and immediate interventions are needed from the concerned authorities to arrest further deterioration, ward number 13 is another area which has the tendency of entering that state if no concrete policy measures are implemented.

Figure 7 Zones of deprivation using CI_d

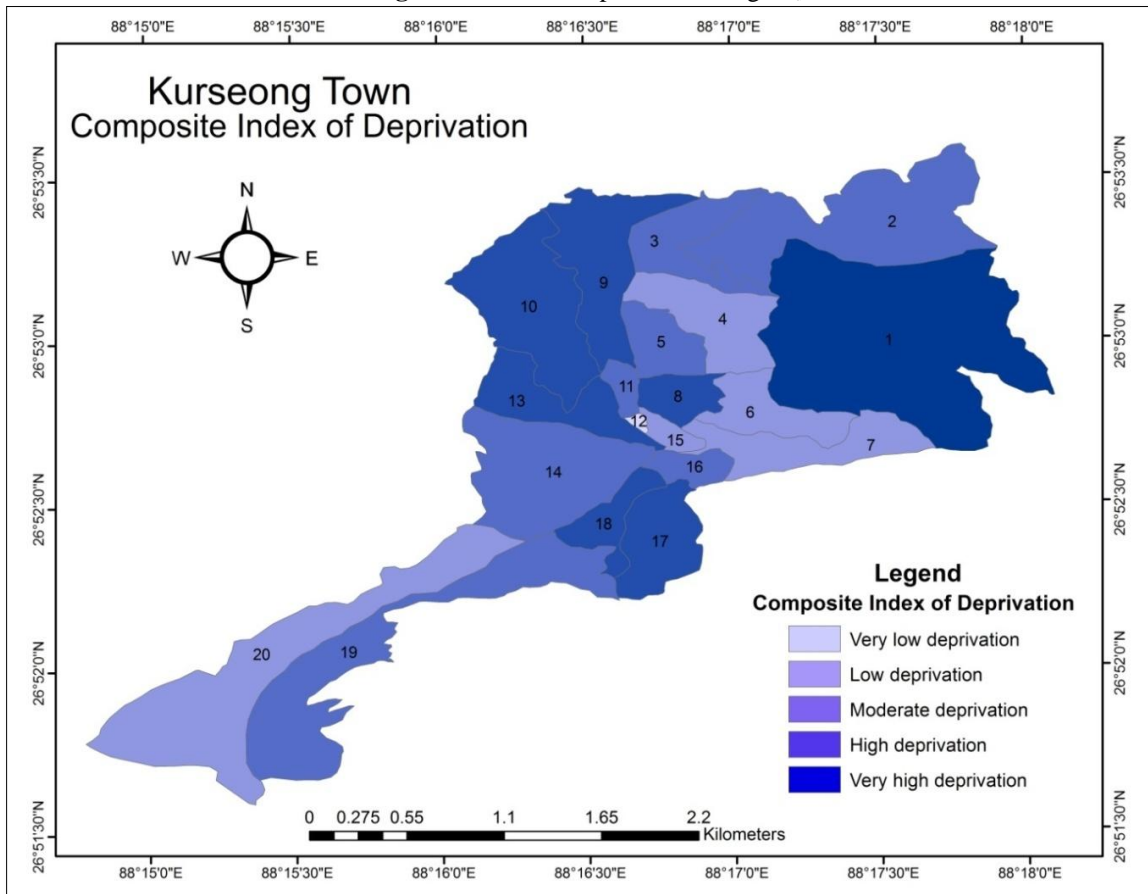


Figure 8 Individual deprivations

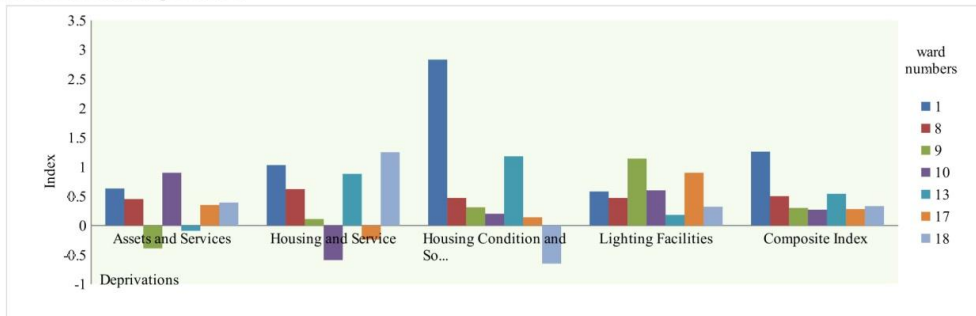
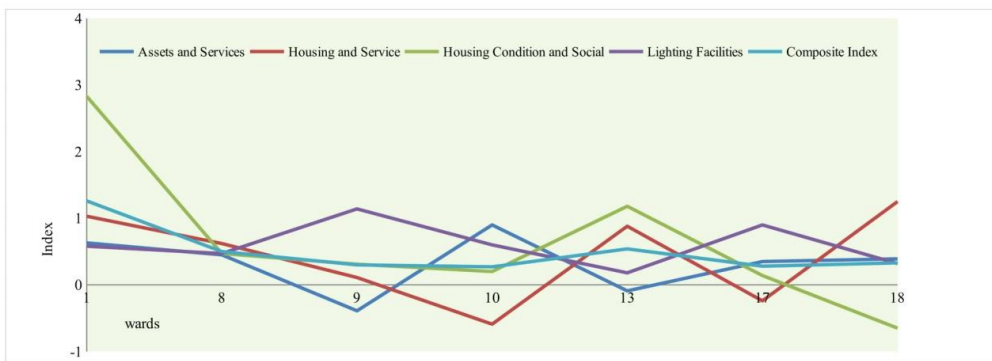


Figure 9 Deprivations in selected wards



4.6 Interrelationship among different indicators

The interrelationship between indicators has been shown by Figure 10. Karl Pearson’s correlation matrix indicates that percentage of households having motorcycle is positively related to percentage of households having own house, percentage of households having water (within the compound), percentage of households accessing banking service, percentage of households lacking drainage at 0.01 level and with percentage of female literates at 0.05 level of significance. The percentage of households having own house is positively correlated to percentage of households having water (within the compound) , with the percentage of households accessing banking service and with the percentage of households lacking drainage at 0.01 significance level at 0.05 significance level respectively. There is a high positive correlation between percentage of households having water (within the compound), percentage of households accessing banking service and percentage of households lacking drainage facility at a 0.05 level of significance. Percentage of households accessing Banking service is negatively correlated to percentage of households having dilapidated census house at a 0.05 significance level. Positive correlation exists between percentage of households having LPG connection and percentage of households having permanent structures at 0.01 significance level. There is a positive correlation between percentage of households having one room house and percentage of households having dilapidated census house at 0.05 significance level. This indicates that these relations have significantly contributed to the prevalence of deprivation in Kurseong municipality

Figure 10 Pearson’s correlation matrix for 13 indicators of deprivation

| | | | | | | | | | | | | | | |
|-----------------|----------------|----------------|----------------------------------------------------------|-----------------------------------------------------------|----------------|----------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|--|
| X ₁ | X ₁ | | | | | | | | | | | | | |
| X ₂ | .805** | X ₂ | *Correlation is significant at the 0.05 level (2-tailed) | | | | | | | | | | | |
| X ₃ | .793** | .769** | X ₃ | **Correlation is significant at the 0.01 level (2-tailed) | | | | | | | | | | |
| X ₄ | .748** | .670** | .492* | X ₄ | | | | | | | | | | |
| X ₅ | .607** | .507* | .472* | .423 | X ₅ | | | | | | | | | |
| X ₆ | .076 | .024 | -.110 | .216 | .092 | X ₆ | | | | | | | | |
| X ₇ | .126 | .121 | .045 | .316 | -.176 | .733** | X ₇ | | | | | | | |
| X ₈ | -.370 | -.414 | -.374 | -.113 | -.316 | .707** | .565** | X ₈ | | | | | | |
| X ₉ | .014 | -.005 | -.012 | -.190 | .365 | .290 | -.080 | .082 | X ₉ | | | | | |
| X ₁₀ | -.312 | -.162 | -.175 | -.479* | .259 | -.016 | -.274 | -.141 | .557* | X ₁₀ | | | | |
| X ₁₁ | .457* | .347 | .477* | .422 | .164 | -.049 | .203 | -.211 | -.187 | -.169 | X ₁₁ | | | |
| X ₁₂ | .047 | -.024 | -.096 | .107 | .057 | .061 | .122 | .051 | -.047 | -.174 | -.033 | X ₁₂ | | |
| X ₁₃ | .432 | .403 | .338 | .657** | .149 | -.057 | .038 | -.103 | -.219 | -.441 | .424 | .327 | X ₁₃ | |

V. STRATEGIES AND INTERVENTION PROGRAMS FOR THE SELECTED WARDS

As mentioned earlier, the town of Kurseong was developed during the colonial period as a supplementary hill resort for the middle class Indians by the Britishers and the Indian elites; however, many Europeans had settled in this area much earlier and had established cottages, hotels, schools and *Dak* bungalows (rest house) in the town (Malley 1907). Later, many of the Indian elites like Maharaja of Burdwan, Raja of Chanchal, Raja of Kakina Arvind Shankar Bam, etc realized the value of the real estate in the town and started heavily procuring and investing in it (Kurseong Municipality 2011). The location of the town on the steep slopes of the Darjeeling Himalaya surrounded by the tea plantations have always led to the dearth of gentle slopes for construction of houses and have limited urban expansion. Moreover, the colonial legacy of the area resulted in the occupancy of all the favorable sites within the town by Europeans and the Indian elites leaving very little for the lower middle

and the lower classes. After Independence, The Darjeeling hill areas started suffering from severe economic slowdowns; the tea gardens which used to employ large number of people began to close and low productivity in the functional gardens could not generate further employment opportunities (Chettri 2013), small landholding sizes owing to physical and social factors caused the hill agriculture to be unsustainable (Subba 1992), the decentralization of the social infrastructures like schools and hospitals from the urban areas into the rural and tea garden areas failed to occur, etc. All these factors have caused the people to migrate from the surrounding rural and tea garden areas into the hill towns. The rapid increase of population in the Kurseong town due to migration of the people from the surrounding rural and tea garden areas and the lack of space for construction of houses within and outside the town due to the geographical and historical reasons have led to construction of houses of the urban poor on the steep slopes as well as within the overcrowded areas of the town. Moreover, the complex politico-administrative setup of the Darjeeling hill areas further complicates the matters. The areas of Darjeeling hills have witnessed mass movements for creation of a state of Gorkhaland within the union of India. Following the mass movements of 1980-88 and 2007-10, two hill bodies namely Darjeeling Gorkha Hill Council (D.G.H.C) and Gorkhaland Territorial Administration (G.T.A) respectively were formed after the tripartite agreements. These two semi-autonomous bodies enjoyed certain executive and financial powers but lacked legislative powers and the main objective for the formation of such bodies was to devolve power at the regional level for the development of the area and to empower the people by including them in the governance. Generally, the strong regional parties that have led the mass movements against the state government like the Gorkha National Liberation Front (G.N.L.F.) (1988-2007) and Gorkha Jan Mukti Morcha (G.J.M.M) (2007 onwards) have dominated the semi-autonomous bodies as well as the Urban Local Bodies (ULBs) in the hill areas. The state government and the regional parties running the hill areas have not shared very amiable relationships for most of the time and this in turn has created a situation of administrative backlogs. The hill parties have always labeled allegations of administrative and political interference from the state government. Smooth functioning of both the D.G.H.C and the G.T.A were hampered due to non transfer of the departments from the state and non release of the adequate funds as stipulated by the tripartite agreements. Due to the political exigencies that exist between the state and the hill areas, the ULBs of the hill areas have suffered the most. The ULBs on the one hand, have often suffered from the disdainful treatment by the state government as they belong to the opposition parties resulting in acute shortages of funds and grants and on the other hand suffer from interference from the semi-autonomous body in their decision making process. As these ULBs are controlled by the parties running the erstwhile D.G.H.C and now G.T.A their policies and decisions are always dictated by them, which often results in violation of municipal bye laws and regulations. Moreover, due to single party domination of the hill politics, the allegations of corruption, nepotism and lack of accountability have always been labeled against the people running the ULBs and the G.T.A by the public. This single party domination in the hills has often led to such situations where developmental works have been stopped from being carried out in the areas where other political parties are active. In urban areas, this leads to the exclusion of certain households within the municipal wards from accessing the different municipal facilities and services if they seem to be from the opposition parties. The geographical location of the town, the colonial legacy and complex politico-administrative set-up coupled with the lack of decentralized development in the surrounding rural and tea garden areas have aggravated the problems of Kurseong town.

In order to redress the deprivations prevalent in Kurseong town both macro level and micro level planning and intervention programmes are necessary. Firstly, one has to understand that the urban area has experienced massive inflow of the people from the surrounding areas that has led to sharp increase in the urban population. Therefore, a generalized macro level development plans have to be made for the whole of Darjeeling hill area to dissuade rural-urban migrations. Secondly, micro level plans and intervention programmes have to be suggested to remove deprivations at the local ward level within the urban area. For the efficient implementation and functioning of these recommendations it is important that the G.T.A and the State Government should coordinate with each other, should maintain a very cordial relationship and should frequently be engaged in confidence building measures through discussions, meetings and reviews at both political as well as at the bureaucratic levels.

1.1 Macro level recommendations

With the lack of economic growth in the rural and tea garden areas and due to the concentration of facilities and opportunities only in the urban areas, the areas of Darjeeling Himalaya falling under the administrative jurisdiction of G.T.A suffers from acute inter-regional imbalances. This inter-regional imbalance between the urban and the rural including the tea garden areas had in the past led to huge migration of the people from the latter to the former during the decades following the independence. This influx of the people into the urban areas have overburdened the existing infrastructures of the urban areas of the hills, this has led to the creation of multifarious problems like emergence of slums, shortages of water supply, traffic congestion, problems of waste disposal, etc. among the urban areas of the Darjeeling Himalaya (Chhetri and Tamang 2013). Therefore, efforts

must be made to retain the population within the rural and tea garden areas by introducing various schemes for economic empowerment and for enhancement of the services. There is an urgent need for livelihood diversification in the rural and tea garden areas under the G.T.A, the diversification of livelihood among the people will generate either alternative sources of income or will supplement the existing income source thereby reducing risks associated with the current livelihood structures which will enable the households to move out of the poverty. The recently most successful form of rural tourism in the Darjeeling Himalaya has been the homestays, these homestays have done a phenomenal work in not only strengthening economic status of the rural people but has also served as a vehicle of gender equality (Help Tourism 2014). Kannegieser (2015) in her study of the homestays located at Tumling, Lepchajagat, Lamahatta and Maneydara found out that these homestays which were run by women had generated not only socio-economic benefits for the womenfolk but those benefits had also trickled down at the familial and community levels. However this form of rural tourism is of very recent phenomenon and needs to be vigorously promoted in the other rural and tea garden areas too. The tourism department of the G.T.A. along with the state government and other stakeholders including the tea garden management, N.G.Os and the community members should co-ordinate and form committees to promote, manage and regulate homestay tourism in the different rural and tea garden areas of the region. Organic farming whose products demand higher prices should be encouraged in the rural areas and should be marketed in the nearby urban areas through farmer cooperatives and S.H.Gs. Poultry farming along with livestock and dairy should be given more emphasis as this can supplement the meager income from the agriculture and tea gardens. Traditional crafts and cottage industries like bamboo basket weaving, *khada* (traditional silk scarf) making, noodle manufacturing, cheese making, paper making, etc should be promoted and micro financing should be done in collaboration with various banking and non-banking institutions. The diversification in the livelihood should be achieved by;

- Establishing various formal and vocational institutions in the tea gardens and rural areas. The lack of educational institutions in these areas has been a major push factor for people to migrate to towns in case of Darjeeling Himalaya. Therefore institutions of formal as informal education like schools, rural colleges and vocational training centers should be established, these institutions will not only help in improving the literacy status of the people but will enhance their skills in the number of areas like plumbing, repair work, electric work, painting, carpentry, production of handicraft etc., which will eventually help in improving the human capital of the rural and tea garden areas.
- Developing and strengthening the rural-urban linkages in the form of efficient transport and communication networks. The tea garden areas and rural areas should be more integrated with the urban areas by constructing efficient roads which will help in two way flow of goods and services with great efficiency, as well as, it will narrow down the producer-consumer gap that exists between the villages and towns due to the absence of efficient transport linkages.
- Encouraging different agencies to establish micro-financing networks in the rural and tea garden areas. The various small scale group lending schemes through SHGs, NGOs, banking and non-banking institutions should be started in order to provide sufficient capital to the enterprising individuals to start homestays, rear livestock, establish cottage industries, etc. this micro financing policy should be achieved by involving the womenfolk and the respective *samaj* (a traditional community based organizations) of the area.

1.2 Micro level recommendations

The municipal authorities of Kurseong town can implement following recommendations to redress the deprivations prevalent in the town and to achieve more inclusiveness in the development strategy.

- The municipal authorities have to establish various ward level committees in each electoral ward for proposing, implementing and monitoring the various development projects undertaken by the municipality. This will safeguard against the exclusion of the households in accessing the services and facilities provided by the municipality on the grounds of political affiliations and will encourage more public participation in urban governance.
- Building bye laws have to be strictly followed and functional zoning of the urban area has to be done. Construction of multistoried buildings exceeding the recommended height as per the bye law should be banned and penalties be imposed on those who have failed to comply; construction of the houses on the steep slopes should be stopped as those slopes are more susceptible to landslides.
- Kurseong town suffers from acute scarcity of water and this problem intensifies during the summer months, in order to tackle the crisis of water the municipality can adopt three prong strategies. Firstly, the municipality needs to construct additional reservoirs to collect, store and distribute water on the upper ridge of the town; the upper forested areas of Ward number 1 and 2 lying on the Mahaldiram-Senchel ridge would be suitable location for this. The ridge line areas of Ward number 1 and 2 have relatively gentle slopes, are less inhabited and surrounded by the forests from which numerous small streams flow down the

slope. The water from these streams can be channelized and stored in these reservoirs and from there it can be piped and be distributed to the different wards located below with the help of the gravity. Secondly, the municipality should make rain water harvesting mandatory in the building plans for any new constructions, the water from the roof tops can be collected at the basement tanks. The various institutions like schools, hospitals, offices, etc should be asked to incorporate rain water harvesting system within their sites for localized uses and lastly, the C.B.Os should be involved at the ward levels to construct tanks for storing rain water in the poorer neighborhoods where the individuals lack financial capabilities to construct storage tanks. Various N.G.Os, public sector units and government departments can be approached for financial and technical assistance in this regard.

- The municipal authorities should collaborate with various agencies like the N.G.Os, private enterprises, educational institutions, etc. in the skill development exercises of the urban poor. They can be given trainings and financial helps to develop their skills and to start small scale businesses. They can be given computer education to enhance their knowledge, should be provided with vocational trainings in masonry, carpentry, electrical fittings, plumbing, etc. to develop their skill sets and especially the women folk should be trained in stitching, tailoring work and pickle making to make them gainfully employed and should be provided with small capitals to help them start small scale businesses.
- The municipality should establish a very healthy working relationship with the state government and the central government to implement various national level and state level schemes in the needy areas of the town. The schemes that can be implemented which have been framed by the Government of India at the national level to provide basic facilities and amenities to the urban dwellers as well as to create a sustainable livelihood for the urban poor are Pradhan Mantri Awas Yozna- Housing for All (PMAY), Atal Mission for Rejuvenation and Urban Transformation (AMRUT), Swachh Bharat Mission (Urban), Deen Dayal Antodaya Yojana – National Urban Livelihood Mission (DAY – NULM) and other important schemes which is not urban specific but serves as an important tool for empowering women and the urban poor are Pradhan Mantri Ujjwala Yojana (PMUY), Pradhan Mantri Jan Dhan Yojana (PMJDY) and Beti Bachao, Beti Padhao Yojana (BBBP).

Pradhan Mantri Awas Yozna- Housing for All (PMAY) was implemented in 2015 and seeks to provide housing for all by year 2022. The beneficiaries include economically weaker section (EWS), low income groups (LIG) and middle income groups (MIG) who lack any good and permanent census house. This scheme can be implemented as the following options; as in situ programme or as a credit linked subsidy programme or as a partnership programme or as a subsidy for beneficiary linked programme. The in situ option has been used for slum redevelopment where land is used as a resource with private participation. The credit linked subsidy programme gives subsidies in the interests accrued against loans sanctioned for construction of a new house or for incremental housing especially to EWS and LIG but also has been extended to MIG from 2017 onwards. The partnership programme allows financial assistance to be given to any private sector or public sector partners for the construction of houses for the EWS, LIG, MIG and high income groups (HIG); provided that 35% of the houses are meant for the EWS category. The subsidy for beneficiary linked programme empowers the state to prepare a project for the beneficiaries and the central assistance is provided directly to the individual families for the construction of new house or for incremental housing. Ward numbers 1, 8, 9 and 13 have all show higher deprivations on both the indices related to housing therefore these wards should be the target areas for the implementation of PMAY scheme. Various households residing within these four wards who are lacking house ownership and are living in dilapidated census houses or in slums should be identified and subsidies can be provided under any of the available four options as applicable.

Pradhan Mantri Ujjwala Yojana (PMUY) and Beti Bachao, Beti Padhao Yojana (BBBP) was launched as women specific schemes. PMUY was launched in 2016 to provide LPG connections to the women of below poverty line families while BBBP was launched in 2015 to create equal value for the girl child and promote her education. Place the issue of decline in child sex ratio at birth in public discourse and to focus on gender critical districts and cities. In addition to these two schemes, the state government of West Bengal has also launched its own scheme for improving the status and well being of the girl child called as Kanyashree Prakalpa. This scheme gives monetary incentives to the girl child to complete their secondary or higher secondary education or equivalent technical or vocational education. The benefits are directly deposited in the bank account of the beneficiary thereby facilitating financial inclusion of the girl child. These schemes need to be implemented in all the wards having high CI_d values and should be monitored by the municipal authorities with the help of citizen's charters and NGOs. Figure 8 shows that ward number 1 has highest deprivation in terms of deprivation index which has female literacy as an indicator. Therefore ward number 1 along with ward number 15 which has fared very badly in terms of female literacy should be given special status and self help groups, female cooperatives be formed and capacity building programmes for the

female be conducted. Access to micro credits for livelihood security and enhancement of skills through Deen Dayal Antodaya Yojana – National Urban Livelihood Mission (DAY – NULM) can be done. DAY – NULM aims at enhancing and expanding existing livelihoods by building skills for market based employments and setting up of self employment ventures. Moreover, school going girl child should be brought under BBBP and Kanyashree Prakalpa schemes and various support and counseling networks comprising of female teachers, female politicians, social workers, civil servants and mothers be setup in the area.

Pradhan Mantri Jan Dhan Yojana (PMJDY) aims to give universal access to banking facilities with at least one basic banking account for every household. It also serves as a platform to provide social security schemes such as Pradhan Mantri Jeevan Jyoti Bima Yojana (PMJJBY), Pradhan Mantri Suraksha Bima Yojana (PMSBY), Atal Pension Yojana (APY) and Pradhan Mantri Mudra Yojana (PMMY) to the beneficiaries. This scheme can be launched vigorously in those wards which lack access to banking facilities. Since all the selected wards are suffering from deprivations related to access to lighting facilities, they can be brought under the Saubhagya scheme also called as Pradhan Mantri Sahaj Bijli Har Ghar Yojana. This scheme was launched in 2017 to provide free electricity connections to BPL households in both rural and urban areas and if implemented properly it will help the deprived households to get access to electricity service in Kurseong town. Moreover, implementation alone cannot help to eradicate deprivations which exist in the town; it should be followed up by strict monitoring and assessment process. Therefore, a feedback mechanism has to be setup where any scheme which is being implemented will be monitored by a cell consisting of municipal authorities, planners, academics, civil societies and local people and opinions from the beneficiaries themselves have to be collected and reviewed. Public participation in all such programmes and schemes should be encouraged and policies should be framed in consultation with the concerned public as they know what is best for them.

VI. CONCLUSION

The objective of this paper was to construct an index of deprivation using the census of India data of 2011. The main drawback of using such data is that it does not have an income component in it (Marsh 1993; Dorling 1999; Boyle and Dorling 2004; Norman 2010) and since it is conducted after every ten years and takes a minimum of two years to release the report, the data rapidly becomes outdated (Noble et al. 2006). However the census of India report is considered to be highly reliable (Baud 2008) and it tends to incorporate a lot of non monetary information which can be used as an indirect measure of deprivation. The study has used PCA to develop indices of deprivation. PCA is most preferred statistical method than other statistical alternatives as it is very easy to calculate and takes into account all the variables during dimensional reduction of the data. The component scores derived from the statistical process have been used to construct the single index of deprivation known as the Composite Index of Deprivation. The deprivations prevalent in the different wards of Kurseong town was studied and mapped with the help of ArcGis 10.2.1 software on the basis of this composite index score. It has been found that, out of the total 20 municipal wards, very high to high levels of deprivations exists in seven wards only. There is diversity in the types of deprivations that are prevalent in these seven wards. The presence of such diverse kind of deprivations in the different wards empowers the concerned authorities and policy makers to understand the nature and characteristics of deprivation and designate target areas where intervention programmes specific to the areas can be implemented. The study sheds light into a very interesting fact, that out of the seven wards which had higher CI_d scores only two wards suffered from deprivations across all the four indices, one was on the verge of experiencing deprivation on all the four indices if no proper timely interventions were made and the rest four remaining wards suffered from three different indices of deprivations. GIS serves as an important tool to identify the target areas where intervention programmes and schemes can be prioritized. The municipality can implement many national level schemes which can remove such deprivations in the identified target areas, these intervention programmes need to be strictly monitored and their effectiveness should be frequently assessed. Moreover, the authorities should take the local people, planners, academics and NGOs into confidence and seek cooperation from all the stakeholders while implementing policies and programmes and should monitor the progress of such programmes.

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