Journal of Pharmacognosy and Phytochemistry
Available online at www.phytojournal.com

E-ISSN: 2278-4136
P-ISSN: 2349-8234
JPP 2018; SP1: 115-119

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Geoinformatics application in village level dynamic studies

Rana Mamta and Muskan

Abstract
In India, Indian villages are often described as "Cultural artifacts" or "reposition of culture" especially by those who are stands for residential planned unit development (RPUD) (zoning) of Indian heritage and culturally rich past. India still live in village three fourth population live in 5.8 lac village spread everywhere, in every nook and corner of the country-from the Himalaya to the Indo Gangateic plain to coastal area row south, and from an arid area of the western hot and humid area of north east. In order to provide spatial information to transform timely and cost effective manner, development of scientific planning process can be effectively met by remote sensing based geo spatial natural resources layer, spatial layers crated from databases, stakeholder department data linked to spatial framework, GIS and information system as Geographic information and communication Technology(GeoICT) tools. For this endeavor resources data on 10,000scale is essential for scientifically depicting village level spatial information. The existing village cadastral maps (hard copy or digital) will be converted into digital format and will be co-registered with the georeference, orthorectified satellite data and created revenue boundary of the village. The Eastern region of India is one of the most poverty–laden regions regarding both prevalence rates and total numbers. Reducing poverty in Eastern India has been a big challenge, and the successful implementation of this study is expected to contribute to our understanding of the complex poverty dynamism in the region. Our study focuses on three states of Eastern India, namely Bihar, Jharkhand, and Orissa.The Baghakole village of Patna district in Bihar, Sogar village Dhenkanal District in Orissa & Hesapiri village Ranchi District in Jharkhand. Before selection of sample households for continuous monitoring, the village census has been conducted in each selected village to understand the general and socio-economic profile of the village. This village profile is based on the village census carried out and qualitative information gathered by the project team.

Keywords: GIS, RS, GPS, Poor Village, Socio-economic profile

Introduction

1.1 Background

Poverty reduction is the central theme of almost schemes and policies of government at national and international level. Poverty alleviation is given special attention by World Bank and government of the respective country in developing countries like India, where according to estimates 41.6% of the total population falls below the International Poverty Line.

Poverty is a multidimensional problem which is best tackled using a multidisciplinary approach. It includes low income, low food consumption, ill-health, reduced life expectation, poor education, lack of assets, limited access to natural resources, low social status, poor access to social services and welfare facilities. With these dimensions closely related one to another, indicators rarely occur alone as the presence of one form of poverty appreciably increases the probability of occurrence of all others. The past two decades of experience, though reinforce the value of collecting health and education data, as well as other social indicators that describe broader conditions of poverty.

The present paper is emphasizing the estimation of best indicator for poverty alleviation with the focus on the application of Remote Sensing and GIS for spatial analysis of estimated indicators. Recent studies showing the importance of spatial variables in tackling poverty have promoted the use of poverty maps made within a Geographical Information System (GIS) environment to understand better who the poor are, where the poor are found and to some extent, why and how long they have been poor. Consequently, decision makers can better identify and understand from maps, the socio-economic and development variations among regions for planning purposes.

1.2 What is a GIS?

GIS is a computer-based tool for mapping and analyzing spatially referenced data. They are essentially database management systems that use geographic location as the reference for

each database record. Location can be used to integrate information from heterogeneous sources. A GIS can also generate information to test hypotheses about neighborhood relationships. For instance, we can examine whether neighboring farmers tend to share similar household characteristics, which may point to the other factors, diffusion processes or spatial spillovers. Finally, GIS provides powerful visualization tools that facilitate analysis of geographic data and improve communication of analysis results and policy recommendations.

2. Data Collection & Methodology

2.1 Study Area

The three villages of three different states of Eastern India were taken for the case study based on resource availability and same climatic conditions.

Table 1: List of Selected Villages

State	District	Village
Bihar	Patna	Baghakole
Jharkhand	Ranchi	Hesapiri
Orissa	Dhenkanal	Sogar

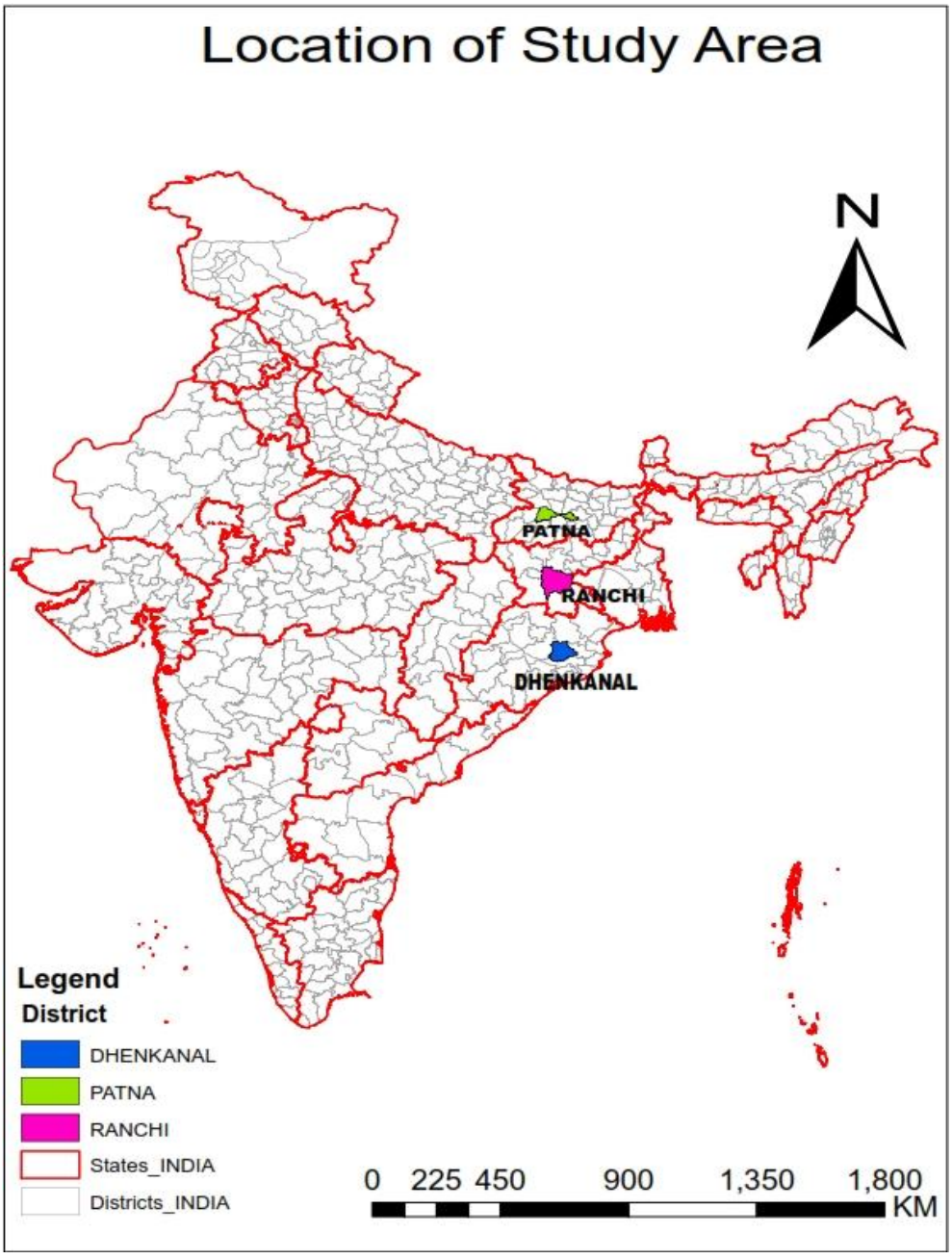


Fig 1: Location of Study Area

2.2 Data

In this study, both primary and secondary data were used for statistical and spatial analysis. Satellite images of selected villages were downloaded from Google Earth server on 15 May 2012. These images were mosaicked using Arc GIS 10 and then projected in the same software. The household level information related to population and household size, land use, type of housing, electricity, telephone facility, sanitation conditions of houses, the occupation of households was collected during field visit using questionnaire method and afterward, transferred on the map.

2.2 Construction of Poverty Indices

The data were collected from 40 households. The sample size was taken by farm holding size group. The questionnaire was constructed namely General Endowment Schedule (GES) that

includes the following Information:

1. Household Information
2. Landholding
3. Livestock
4. Farm Implements
5. Building and Consumer Durables
6. Stock Inventory
7. Debit and Credit Schedule
8. Role of Gender
9. Source of Marketing and other information
10. Coping Mechanism.

The conceptual framework was made for schedule mentioned above and collected data according to the weighting scheme. Then, the units of data were standardized according to accepted norms like Livestock Units standardization by FAO. Afterward, dimensional Index was constructed for homogeneity. These dimensions were given weightage. All weighted dimensions indices were added and then divided by the total number of indices. Thus the construction of dimensional index through weights and score statistical method provide us with a tool to analyze the poverty dimensions in the study area.

2.3 Mapping of Indices using GIS

Arc GIS software was used for creating maps (to the scale) and for creating the GIS based information system. The selected villages map was opened for further processing. As our main emphasis was to derive such indices which reflect the indicators of poverty of each village, therefore a theme was made. The overlap maps were prepared using farm holding and different indicators datasets.

GIS allows the linkage of spatial and non-spatial data based upon defined relationship. A one to one relationship can be defined for each of the spatial entity with the non-spatial data. Therefore, tables of both spatial village map and non-spatial data were opened and joined, with the help of user defined ids, using table-join functions.

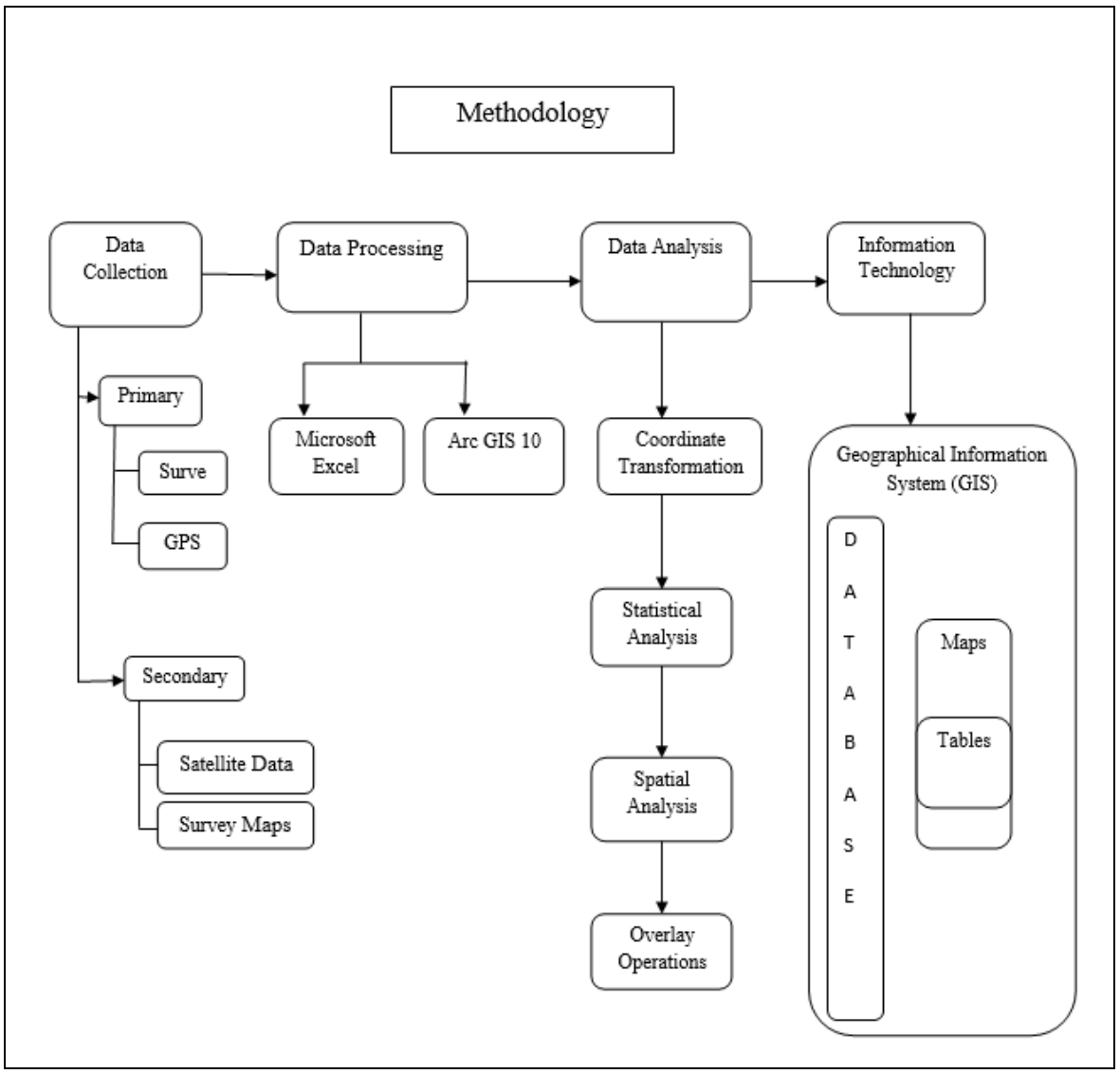


Fig 2: Methodology Flow Chart

3. Results and Discussions

The first step is the estimation of indicators. Although monetary indicators - consumption and income - are widely considered as the most reliable measures of poverty, social and structural indicators describe facets of human well-being that are not easily captured by purely economic measures. One approach is to create an index of well being as a weighted sum of the values of relevant variables. Alternatively, instead of the actual value of indicators, the observations rank in each indicator dimension is aggregated. These combine, for example, information on access to safe water, sanitation, and housing conditions into a single

indicator.

The diagram (shown below) shows different indicators choose for this study. The Housing Sanitation Index (HSI) describes the condition of a person or household. Examples are their income level concerning a chosen benchmark on whether the household has access to basic services such as safe drinking water. Other indicators, in contrast, focus on the consequences of achieving or failing to achieve a secure or sufficient welfare status in one or more indicator dimensions. Examples are anthropometric measure such as low weight –for-age measure which is a consequence of insufficient caloric intake. The distinction between status and economic indicators is not always clear-cut; since there are strong interdependencies between different aspects of welfare for e.g., low income can be both a cause and an effect of low education and poor health.

The Aggregate Endowment Index is the weighted sum of the indices of different dimensions, while most often used as a country level can also be used at the sub national level using sufficiently detailed survey and census data. The composite indicators recognize the multidimensional nature of poverty; their weakness is that there is often no objective basis for selecting the weighting or ranking schemes on which aggregation is based. This makes basic needs and human development indicators difficult to interpret.

The most promising route is therefore to recognize the multiple dimensions of deprivation but to describe these dimensions separately. For example, spatial maps are used in this paper, to overlap farm holding size group-poverty indicators, and access maps to access joint correlations and disparities to fulfill the objectives of this study. Also, Overlaying indicator maps atop size of farm holdings in each village shed more light on the possible constraints of growth and poverty setting, impact assessment and policy. Thus, an information system has been generated showing the village maps (given in annexure) with relevant information containing eco-socio-economic dimensions.

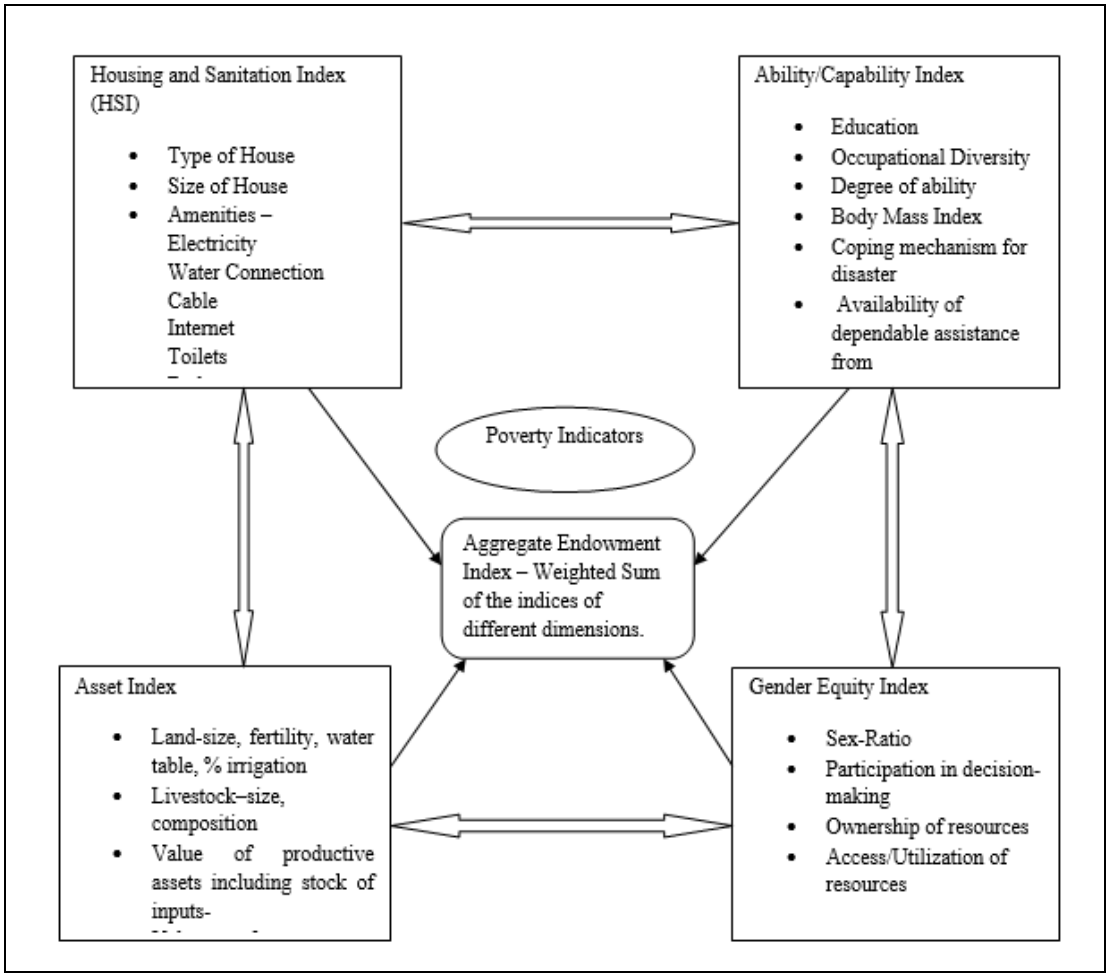
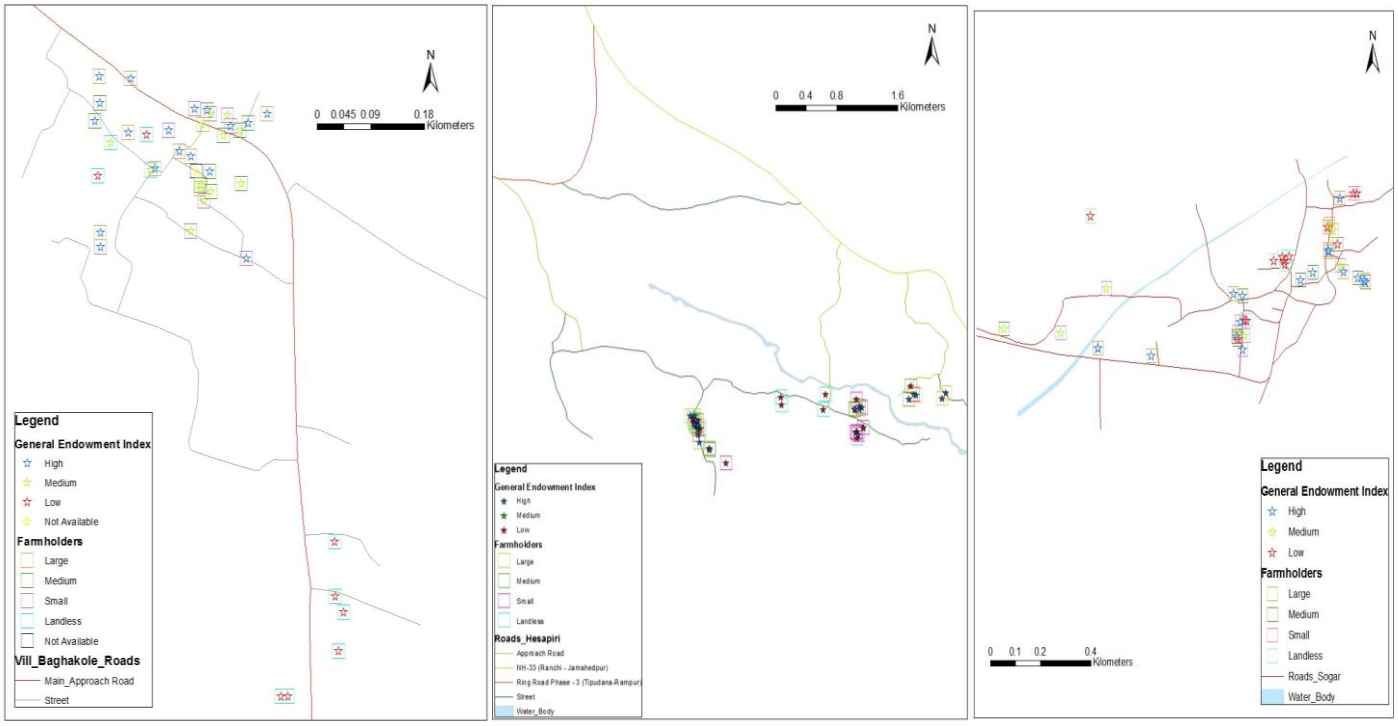


Fig 3: Dimensions of poverty and indicators

3.1: Analysis of Spatial Village Maps

The interpretation of overlap maps indicates that poor households tend to be concentrated in specific areas. They fall in the category of landless and small farm holding size and low classes of selected indicators for each selected village. Also, these houses are located at a distant from the main road. There exist a causal link between geography and the level of well being. Mobility is seen as limited and structural differences between regions regarding natural resource endowments, infrastructure and access to services, therefore, tend to persist and intensify.

Aggregate, endowment index give the impression that condition within each selected village is not uniform. Significant variation in the incidences rates of poverty may be due to differences in resource endowments, education and a host of reasons mentioned earlier. As a consequence, inequality exists between regions as it does between individuals, as we map indicators for higher resolution administration units, geographic viability that was hidden in the aggregate data becomes apparent. This is illustrated in map given below:



4. Conclusions

It can be concluded from the findings of the study, that an important benefit of mapping survey sample data is the measures of well being can be linked to other spatially defined information. At the same time, mapping survey sample data that help in identifying general geographic trends, these maps should therefore not be used to conclude the status at a specific location in the country. But the importance of GIS of can't be overlooked. With the aid of a geographic information system (GIS), knowing where a sample cluster is located allows aggregation of survey data for regions other than administrative units. The geographic location of the sample of sample survey points also serves as an indexing system. This allows us to extract auxiliary indicators that were not included in the survey instrument, but that may provide important clues about the distribution of poverty. Also, the generation of information about the village, called Village Information System (VIS), comprises of all information related to facilities, infrastructure, population, building type, etc. give planning and development a more effective and meaningful direction.

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