



LITERATURE SURVEY AND REVIEW ON TERRAIN, TERRAIN CLASSIFICATION, TERRAIN EVALUATION, AGRICULTURE LANDUSE, AND LANDUSE PLANNING IN THE EASTCENTRAL RAJMAHAL HIGHLANDS, JHARKHAND, INDIA

DR. MILAN MONDAL

Assistant Professor of Geography,
Department of Geography,
M.U.C.Women's College, Burdwan

Abstract:

The purpose of this paper is to identify the research gaps and fulfill the voids of the Eastcentral Rajmahal Highlands in Jharkhand, India. The research aims to understand what type of research work has actually been done previously about the geology, terrain, terrain classification, terrain evaluation, agriculture landuse, and landuse planning and try to develop research framework. The study area has not yet been assessed in terms of terrain capability and agricultural landuse purpose. The entire literature survey and review has been attempted on all the main parts of the topic. Many authors, experts and researchers are eager to explain the findings of their studies either at district, state or national level, no attempt has previously been made to go for terrain evaluation for agricultural landuse and planning of the study area.

Keywords: Eastcentral, Terrain, Literature Survey, Review, Agricultural Landuse

I. INTRODUCTION

In actuality, no separate work on terrain, terrain classification, terrain evaluation, agriculture landuse, and landuse planning on applied geomorphology in the study area was done previously. Some common ideas can be preoccupied from the books, theses and research articles, *etc.*, dealing with the Eastcentral Rajmahal Highlands of Chotanagpur. It is an attempt to understand what type of research work has been done previously and what type of methods and techniques has been used or has not been used on terrain evaluation and agricultural landuse. On the basis of previous literature, research gaps have been identified and efforts are made to solve the voids.

II. MAIN OBJECTIVES

The main objectives may be noted as follows:

- a) to identify the key issues,
- b) to identify the research gaps and fulfill the voids,
- c) to understand what type of research work has actually been done previously, and
- d) try to develop research framework

III. STUDY AREA

Extending from 23° 55'15"N to 24° 10'15" N latitudes and 86°56'00" E to 87° 30'00" E longitudes, the Eastcentral Rajmahal Highlands covering three blocks of Dumka district *viz*: Dumka, Raniswar and Shikaripara in the State of Jharkhand, India is a portion of the Chotanagpur Highlands (Fig.1). Occupying an area of 1164.6 sq. kilometres, the study area comprises the entire portion of Dumka, Ranishwar and Shikaripara administrative blocks of Dumka district of Jharkhand and lies in the Eastcentral Rajmahal highlands. It includes 753 villages as well as one municipal area of Dumka Town. The study area is mainly characterised by undulating and rugged terrains dotted with residual hills and hillocks. Therefore, the area is one of the backward regions of the State of Jharkhand.

IV.SOURCES AND METHODS

Georeferencing and mosaicking all the three C.D. block maps (Dumka, Ranishwar and Shikaripara) have been done (Fig. 1). Maps have been prepared by the researcher from the Survey of India Topographical sheets (1969-72), Department of Science and Technology, Government of India. These maps have been georeferenced, digitised and calculated the area of through 21st Century GIS Professional 2012 software (Fig. 1).

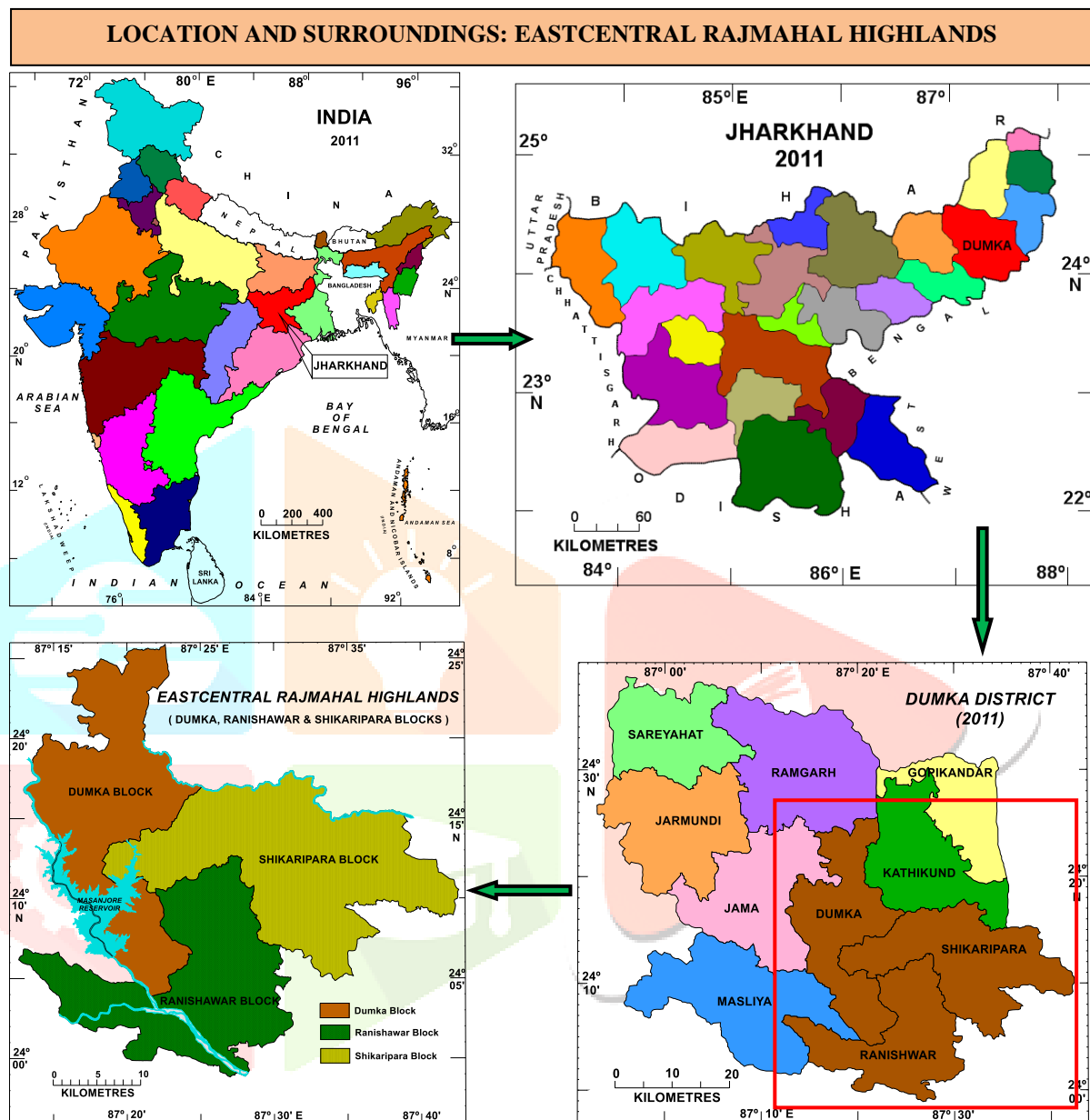


Fig. 1: Location of the Study Area (Eastcentral Rajmahal Highlands)

V.GEOLOGICAL STUDY

Oldham (1893), Dunn (1942), S. C. Chatterji (1949), Pascoe (1950), Krishnan (1953) E. Ahmad (1958, pp.16-22), and Wadia (1961) have presented an excellent record of the geology of India and these records have been treated as fundamentals of geological description for such type of research work.

R. P. Singh (1969), studied, the “*Geomorphological Evolution of Chotanagpur Highlands-India*” in detail. This book has been enriched with several maps and diagrams about Chotanagpur. Regarding the physiographic evolution of Chotanagpur, he has taken into account diastrophic events and changing sea-level to make an analysis of its surface history. This book itself is a document of laboratory and field mapping to portray its landscape cycles.

A. Kumar (1985) in his research article on “*The Chotanagpur Highlands: A Study in Synchronicity*” elaborately discussed about Chotanagpur highlands and their distribution, surface configuration, phases of solidification, erosion, sedimentation, emissions, intrusions and diastrophism. He revealed that the highlands consists of three plateaus, the highest in the west (900 m.), extensive in the middle (600 m.) and lower in the north, east and south (345 m.). The Rajmahal hills break the monotony of the undulating surface of the lower plateau in the north-eastern section. He also studied the concept of synchronicity and stratigraphical time-scale on Chotanagpur highlands.

T. M. Mahadevan (2002), in his book “*Geology of Bihar & Jharkhand*” provided new and emerging vistas of crustal evolution through time of one of the most classical terrains in the Indian Shields. This book comprises in all 22 chapters. Geomorphic studies have led to identification of several palaeo-surfaces in the south Bihar plateau region, and characterization of

the Himalayan rivers. The author has also discussed Rajmahal Volcanism in the light of the recent concept of Hot Spot tectonics and magmatism and the Cretaceous Plate Tectonic reconstructions.

A. Tripathi and A. Ray (2006), presented an excellent record on "*Palynostratigraphy of the Dubrajpur Formation (Early Triassic to Early Cretaceous) of the Rajmahal Basin, India*". The authors discussed comprehensive review of the lithology, megaflores and palynology of the Dubrajpur Formation of the Rajmahal Basin. They mentioned that the Dubrajpur Formation includes strata of Early Triassic to Early Cretaceous, thereby indicating that this unit is profoundly diachronous.

N. Bhattacharjee, J. Ray, S. Ganguly and A. Saha (2012), in their research paper on "*Mineralogical Study of Gabbro-Anorthosite from Dumka, Chhotanagpur Gneissic Complex, Eastern Indian Shield*" discussed the country rocks of Dumka have suffered three phases of deformation and the gabbro-anorthosite intrusive maintained a sharp contact with the host rocks, deformed and metamorphosed. The authors present new field, petrographic and mineral-chemical data of Dumka gabbro-anorthosite to evaluate the P-T conditions of constituent mineral phases and crystallization history of these rocks.

R. De, S. N. Chowdhury, P. R. Rao and N. C. Sahoo (1999), in their report on "*Seismotectonic Study of the East Margin Fault (Munger Saharsha Ridge) at the contact of Rajmahal Trap and Chhotanagpur Gneiss*" mentioned that a four-station micro earthquake (MEQ) network was established for a period of four months in the Rampurhat and Dumka district area at the contact zone of the Chhotanagpur granite gneiss and Rampurhat Traps. The MEQ survey has shown that a number of earthquakes are recorded at the northern extension of the East Margin Fault (EMF), which is confirmed to be seismically active.

VI. TERRAIN AND TERRAIN EVALUATION

Ollier (1977), Mitchell (1977), Verstappen (1983), Desai (1968), Mahto (1985), Chatterjee (1987), Kumar & Pandey (1989), Douglas (1976) and Prasad (1979, 1980, 2003) have studied very few work about terrain and their different purposes. All these research works are specifically different from each other.

Douglas S. Way (1973) in his book entitled '*Terrain Analysis*' emphasized on utilizing aerial photographic analysis as a technique for the identification and interpretation of landforms.

C. W. Mitchell (1991) in his book '*Terrain Evaluation*' discussed the principles of terrain evaluation, practical systems of terrain evaluation, methods in terrain evaluation and the prospect of terrain evaluation. A logical structure pervades the book, starting with sections on the history and principles of terrain evaluation, an account of the components that encompass terrain (geomorphology, geology, vegetation, and so on), methods for collection and analysis of data (including remote sensing and GIS), display and mapping of such data and finishing with an overview of the range of applications. A detailed discussion of the potential use of digital elevation models (DEM) in morphological assessment would have been useful. There is an extensive bibliography of over 600 references. Technical weaknesses which is outdated and should have been left out but this book is very useful to understand terrain.

S. Mukhopadhyay (1992) in her book "*Terrain Analysis and Its Impact on Landuse (Kangsabati River Basin)*" elaborately discussed the development of distinct patterns in landforms suites, soil groups, slope types, rainfall types, geomorphic processes, agro-crops pattern, irrigation, settlement types etc. Modern statistical tools and techniques such as Multivariate analysis, Kolmogorov-Smirnov tests, Linear correlation coefficient, 't' test etc. has discussed in details. The entire Kangsabati basin has been divided into six terrain divisions are made with the geomorphic as well as land use patterns.

B. K. Patnaik (1993) in his Ph.D thesis on "*Terrain evaluation for Agricultural Land Utilisation in the Chhatrapur Subdivision, Orissa: A Study in Applied Geomorphology*" discussed the importance of terrain evaluation for agricultural landuse or utilization for a particular area. The main objective of this thesis was to evaluate the terrains of the Chhatrapur Subdivision for agricultural land utilization. It has a great contribution to the field of applied geomorphology. It is based on a detailed field survey and intimate knowledge of the area.

M. Basu (1998) in her "*Terrains and the development of Agriculture in the Madhupur Erosion surface in Bihar*" studied the concepts of terrain, methods of terrain classification and principles of terrain evaluation of the Madhupur erosion surface. The author has given a detailed information about geology, surface elevation and forms, drainage conditions. A detailed and critical study of the relief measures such as relative relief, absolute relief, dissection index, ruggedness index etc. has been made here.

J. P. Wilson and J. C. Gallant (2000) in their edited book "*Terrain Analysis: Principles and Applications*" incorporated the concept of digital terrain analysis and their principles and application, digital elevation data sources and structures, digital terrain analysis methods, digital elevation model, DEM interpolation method, etc. In this book contributors describe how TAPES (Terrain Analysis Programs for Environmental Sciences) are applied to specific geomorphologic problems, explain the algorithms used in current terrain analysis software, examine the interpretation and use of terrain attributes in predictive models.

N. H. Khadse (2003) in his Ph.D thesis entitled "*Evaluation of Terrain and Human Resources for the development of Agriculture in Akola district, Maharashtra*" attempted to evaluate the terrain and human resources for agricultural development and to suggest planning for appropriate utilisation of terrains of Akola district, Maharashtra. He recognized, identified, classified and delineated the terrains with the help of aerial photographs. The author has applied both landscape method and parametric method for evaluation and classification of terrain. Temporal as well as spatial distributions of population and landuse categories have been discussed.

A. Bhattacharjee (2004) emphasized on "*Terrain and Agriculture in the Deoghar Subdivision, Jharkhand*". He recognized and evaluated the terrain of the Deoghar subdivision for agricultural landuse. He presented a detailed information about geology, surface elevation and forms, drainage conditions, soils, etc. An effort has also been made to present the existing pattern of terrain utilization and planning proposals for betterment.

A. Mahto (2006) in his book '*Changes in Terrains and Socio-Economic Profile of an Oraon Dominated Rurban Centre in Chotanagpur*' discussed the Boreya's terrain for economic purposes, and also to show the important social, economic and landuse changes within the context of urban influence of Ranchi. The author emphasized the changes and development from 1969 to 1984. It is a model work and is a contribution to the field of geography.

N. Prasad and A. Mahto (2009, pp.45-80) in their paper '*Terrain Evaluation: Concept, Method and Application*' discussed the terrain, their classification, objectives of terrain evaluation, methods of terrain evaluation. This paper is an excellent work of village level study. The authors applied this concept and methods of terrain evaluation to Boreya, a sample study area and classified into terrain units and terrain capability classes for agriculture.

S. Mukhopadhyay (2010) in her thesis on “*Terrain and its Impacts on Landuse of East Singhbhum District-Jharkhand*” attempted to evaluate the terrain characteristics and their impact on land use, including land use planning with reference to the land potentials of the area. The researcher has also ascertain the impact of terrain on the pattern of land use and to identify the root causes of the related problems. It is an applied geomorphological study with quantitative and qualitative analysis of landform.

R. Sarkar (2012) in her Ph.D thesis on “*Terrain evaluation for Agricultural Landuse and Planning in the Burdwan Upland, West Bengal*” attempted to evaluate the terrain for agricultural landuse in the coal mining and an industrialised urban area. The author has used both topographical maps and satellite images for terrain evaluation and landuse change detection. She has used some statistical techniques and calculated Village Development Index (VDI) to identify developed and underdeveloped villages. The author tries to developed landuse model and gives planning proposal to improve the economy and sustainable landuse on a subsidence prone coal mining area.

A. M. Ågren, W. Lidberg, M. Strömngren, J. Ogilvie and P. A. Arp (2014), in their article on “Evaluating digital terrain indices for soil wetness mapping– a Swedish case study” reported on several digital terrain indices to predict soil wetness by wet-area locations. They varied the resolution of these indices to test what scale produces the best possible wet-areas mapping conformance and found that topographic wetness index (TWI) and the newly developed cartographic depth-to-water index (DTW) were the best soil wetness predictors.

VII. AGRICULTURAL LANDUSE AND PLANNING

A. P. A. Vink (1975) in his book “*Land Use in Advancing Agriculture*” discussed the different aspects of landuse, landuse surveys, land utilization types, land resources, landscape ecology, land conditions, land evaluation and development of landuse in advancing agriculture.

D. K. Khan (2000) in his paper “*Landscape Ecology and Landuse Planning*” discussed the concepts of landscape ecology and their importance, landscape sustainability, landscape hierarchy, landscape gradients, biodiversity of landscapes and their future prospects. He mentioned that the interaction between spatial and temporal components in a landscape and landuse planning is the ecological knowledge of any region.

S. Kapat (2000) in her paper ‘*Dumka Subdivision: A Study in Geomorphic Processes and Hillslope*’ studied the relationship between the hillslope with its various forms and the geomorphological processes, with a special reference to weathering, mass wasting and regolith or soil. She also emphasized on the soil erosion

C. Duhamel (2001) in his paper “*Land Use and Land Cover, Including Their Classification*” stated that land use and land cover are two ways of observing Earth’s surface. Classification system of land use and land cover should be built some rules – a) They should be able to classify all possible objectives and arrange them in nested categories, b) They should provide a system for naming and describing the groups of objects and c) They should allow the discussion of membership of one object into the classification.

N. Bhattacharjee (2002) in her Ph.D thesis entitled “*Geomorphology and Agricultural Landuse in the Jayanti River Basin, Jharkhand*” discussed the geomorphic aspects of the basin in detail and to evaluate the relationship of all these aspects with potential and development of agriculture on the other.

M. Chattopadhyay (2003) emphasized on “*Morphogenetic Processes and Landuse - A Geoecological Impact Assessment in the Ittikara River Basin, South Kerala*”. It is an excellent work on applied geomorphology. She analysed the landuse pattern and its changing trend over the years and impact assessment of morphogenetic processes on landuse pattern.

P. D. Wit and W. Verheye (2003) in their paper “*Land use planning for sustainable development*” mentioned the parallel development of different perceptions on land use planning and new perceptions on planning and management of land resources. In this new context sustainable development involved economic, environmental, social and institutional challenges. This paper deals with past and present thinking on land resource management in the context of sustainable development.

S. Gopichand Patil (2012) in his Ph.D thesis entitled “*Spatio-Temporal Analysis of Agricultural landuse Pattern in Pune District*” discussed the physical background of the study area as well as identified crop combination and diversification regions in the study area. The author has used the data for general landuse and agricultural landuse for the year 1980-81, 1985-86, 1990-91, 1995-96, 2000-2001 and 2005-2006. He has studied in detailed six sample villages in Jiroft watershed.

Y. Saleh, A. M. Badr, F. El Banna and A. Shahata (2014) in their research paper on “*Agricultural Land-Use Change and Disappearance of Farmlands in Kaduna-Metropolis Nigeria*” studied the use of remote sensing and geographic information system (GIS) application to ascertain the rate of agricultural land-use change from 1980 to 2012 time period. They find that the study area experienced a significant reduction in agricultural land and these leads to continued disappearance of farmlands and loss of livelihood, reduction in food supply and increase poverty.

VIII. RESEARCH GAPS

The specific research gaps are -

- Eastcentral Rajmahal Highlands has not been classified and judged for agricultural landuse purpose.
- It has not yet been identified how a particular portion of land of the study area can be utilised potentially.
- No attempt has been taken to assess the landuse potentials for analysing the impact of landuse change.
- The study area has not yet been assessed in terms of terrain capability.

VIII. CONCLUSION

It may be concluded that many authors, experts, observers and researchers are eager to explain the findings of their studies either at district, state or national level, no attempt has previously been made to go for terrain evaluation for agricultural landuse and planning of the study area. This area has not been studied in detail by any person. So, it may be considered as new venture of the present researcher.

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