Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 3, Issue, 12, pp.260-264, December, 2011

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

IMPACT OF CHANGES IN LANDUSE ON ENVIRONMENT: A REVIEW

[1]Nageshwar Prasad and [2]Smt. Tanusree Ghosh

[1]Professor, P.G. Department of Geography, The University of Burdwan, Burdwan-713104
[2]Assistant Professor, Department of Geography, Sailajananda Falguni Smriti Mahavidyalaya, Khoyrasole, Birbhum

ARTICLE INFO

Article History:
Received 29th August, 2011
Received in revised form
18th October, 2011
Accepted 17th November, 2011
Published online 31th December, 2011

Key words:
Landuse/Land cover, Landuse change, Environmental impact.

ABSTRACT

The main objective of the present paper is to get a vivid idea about the methods and techniques of the previous work related to 'Impact of Changes in Landuse on Environment in Southwest Birbhum Distrct, West Bengal' on international, national and regional level. Finally based on previous literature research gaps have been identified and an attempt has been taken to fill up the voids. The present work has been divided into three parts. The first part tries to analyze the conceptual aspect by explaining the term environment, landuse/land cover, changing landuse/land cover,and environmental impact. The second part deals with previous literature and the concluding part identifies the research gaps and provides probable solutions to fill up the voids.

INTRODUCTION

Land is the container of natural ecosystem. Land is active and dynamic, *i.e.* it evolves naturally with time. However, since the advent of human beings the evolutionary processes of land are no longer purely natural *i.e.* driven by geophysical or biochemical fluctuations and events, rather it is controlled by human action. Landuse is the manipulation of natural ecosystem by men for their own benefit. The process of landuse is as old as the advent of hunting and gathering human communities on the earth's surface. At that time the rate of landuse change was extremely slow and the impact was almost imperceptible. However, with socio-cultural evolution and with exponential growth of human population, both the qualitative and quantitative demand of human population has been increasing. Moreover, scientific and technological development makes it possible to extract maximum amount of resources with minimum time and minimum effort. All these result in rapid rate of landuse land cover change with more serious impact. Broad landuse categories across the state remain relatively stable over time. However, there are small scale changes evident in some regions and for some particular types of landuse that shows distinctive trend. Therefore, micro-level study is essential so that area-specific management plan is taken to maintain the quality of land as a habitat. The main objectives of the present paper are: to explain the conceptual aspects; to analyse the previous literature at international, national and regional level and to find out the research gaps and to suggest probable solutions.

***Corresponding author:** nprasad1947@gmail.com, tanusreegeo@gmail.com

CONCEPTUAL ASPECTS

Land use and land cover

Land is a broad term which embodying the total natural environmental areas of the earth. It includes relief, soil, climate, hydrology and vegetation. Landuse is the systematic utilization of land resources to satisfy human needs. The spatial and temporal variability of land in terms of its productivity is one of the main causes of systematic landuse. The broad landuse categories include:

1. Rural landuse, including agriculture, forestry as well as wild life conservation and the development and management of recreation grounds.
2. Urban and industrial landuse, including towns, industrial complexes, highways ans mining activities.

Land cover implies the tract of land covered by physical (such as forest, water body *etc*.) and/or cultural (agricultural field, building, roads *etc*.) attributes of land. Land cover is the areal aspect whereas land use is the functional aspect of land. Thus, it can be said that both the term landuse and land cover are closely interrelated and are not mutually exclusive.

CHANGING LAND USE AND LAND COVER

Both landuse and land cover is dynamic concept. Use of land in a rudimentary form started in pre-historic period by nomadic man. Change was almost imperceptible. Later on some sort of systematic pattern of change in land cover emerged conspicuously. Growing human population and consequent increase in demand made land as a scarce resource.

To meet these diversified demand there emerge newer and newer resource harnessing techniques. All these result in rapid, drastic and in many cases irrational and haphazard changes in landuse and land cover all over the world. Such changes include large scale deforestation, emergence of industrial units and complexes, growth of towns, cities, metropolitans, roads and high ways, mining areas, intensive and extensive farms, sanctuaries and parks and others.

ENVIRONMENTAL IMPACT

The term 'environment' etymologically means 'surrounding'. It represents the surrounding conditions and or forces that influence or modify:

a) The whole complex of climatic, edaphic, and biotic factors that act upon an organism or ecological community and ultimately determine its form and survival – the physical environment.
b) The aggregate of social and cultural conditions that influence the life of a community – the cultural environment.

Land is the container of all physical, biological and cultural component of the environment. Landuse is the universal instrument of modification of the environmental component. Environmental impact is the response of environment to this modification.

Ecologically it can be said that environment has a rather delicate balance of inputs and outputs, but this balance is often not sufficient to avoid instability.

Based on impact, environment is of two types:

1. Inherently stable environment/resilient environment: it has an ability to revert their original form after stress from a given land use regime is discontinued.
2. Fragile environment: this is susceptible to change.

PAST STUDIES

The concept of "Impact of Changes in Landuse on Environment" has attracted the attention of many earth scientists, climatologists, biologists, geographers, anthropologists as well as environmentalists. For convenience the following brief review of literature has been divided into three sections:

I. International status
II. National status and
III. Regional status

INTERNATIONAL STATUS

Internationally the first attempt to conserve land and its resources were concerned mainly with the protection of forest. Decrees aimed at protecting forest were issued in China as early as 1122 B.C. (Eidsvik, 1980). The same notion was manifested in Britain and in other northwest European countries in the medieval and in subsequent centuries. In the eighteenth century, the concept of land use change and environment became more mature by the practical scientists who began to give emphasis on the relationship between deforestation and erosion. An attempt was made to stabilize the coastal sand dunes along parts of the Atlantic, North Sea and Baltic coasts (Glacken,C., 1956). In the later part of eighteenth century and early nineteenth century a new attitude to nature emerged through the writings of Rousseau, Wordsworth and other members of the Romantic Movement.

In the later part of the nineteenth century the causal relationship of deforestation was reinforced by equating with climatic phenomenon. Marsh,G. ((1864, p. 182) travelled extensively in Europe and the Near East and observed the obvious sign of soil erosion and other environmental damage around parts of the Mediterranean. He believed that vegetation and precipitation are reciprocally necessary to each other. He quoted the following:

Afric's barren sand,
Where nought can grow, because it raineth not,
And where no rain can fall to bless the land,
Because nought grows there.

In United States the same notion was manifested by the enactment of the Timber Culture Act in 1873. The act was passed in the belief that, plantation in the Great Plain and the Prairie states would be increased rainfall sufficiently to eliminate the climatic hazards to agriculture (Thornthwaite, C., 1936, p. 209). Aughey,S., (1880, p. 44-45) in his writing of Nebraska attributed increased rainfall to the consequence of spread of cultivation. He said:

'Thus year by year as cultivation of the soil is extended, more of the rain that falls is absorbed and retained to be given off by evaporation or to produce springs. This of course, must give increasing moisture and rainfall.'

Man's role in changing the face of the earth, edited by W.L. Thomas, Jr. (1956) typifies the twentieth century geographers' and/or environmentalists' viewpoints regarding man-nature relationship. This book is actually the collection of valuable articles relating to man-nature relationship. During this period the resurgence of man-environment study was motivated by several practical phenomena. For example, Dust Bowl of U.S.A. was an indication of land use induced damage of land resources. Several measures were taken in U.S.A. to protect soil erosion. Soil erosion was also a matter of great concern in policy making in various other countries including Australia (Knowles,G., 1978), New Zealand (Mather,A.,1982) and Kenya (Moore,T., 1979). Thus up to 1960s the study of 'Land Use and Environment' was mainly concerned with the measurement of change of physical parameters of the environment. The study was motivated by short term solution of maintaining the flow of resources to meet the demand of existing population.

In the later part of the twentieth century, more specifically in 1970s, environmental movement took a definite shape. Publication of Rachel Carson's'Silent Spring', space shot photographs of the earth emphasized the finiteness of the earth at a time of unprecedented growth in human population. This has led to the emergence of the concept of resource scarcity. The 1970s marked a major shift in policy perception. The notion of resource scarcity motivated the planners'/ policy makers' as well as the academicians to think about the long term solution of maintaining the carrying capacity of the

environment to meet the demand of existing as well as future population. Thus the concept of 'sustainable development' came into existence. It has been rightly pointed out that, there must be a threshold beyond which further development will ultimately lead to biotic impoverishment. A.S. Mather proposed that environmental impacts vary with types and intensities of landuse and with management practices. He gave more importance to the perception of the land users about environmental damage. Since the last two decades of twentieth century specific emphasis was given on to identify the causal factors of environmental change. There was increasing recognition that landuse change is a major driver of global change through its interaction with climate, ecosystem process, biogeochemical cycles, biodiversity and even more important human activities. To understand these issues an important international project *i.e*. Land Use Land Cover Change (LUCC) – a joint initiative of IGBP and IHDP has been working since 1995 to address important global change questions on the local, regional and global level. Another important global initiative is Global Land Cover 2000 (GLC 2000) project by Joint Research Center (JRC) of European Commission.

Twentieth century also marked a paradigm shift in techniques of landuse land cover study. Application of R.S. and G.I.S. has introduced the new techniques of change detection which is not only labour and time saving but also provides accurate landuse land cover maps and monitor changes at regular interval of time. Thus since late 1970s onwards emphasis has been given on to study change detection by using R.S. and G.I.S. Macleod and Congation (1998) identified four aspects of change detection:

- detecting the change that have occurred
- identifying the nature of the change
- measuring the areal extent of the change
- assessing the spatial pattern of the change.

Plenty of works has been done by using this new technique and published all over the world.

NATIONAL STATUS

There have been rapid changes in landuse pattern and land use techniques in India for last several years. Diversified physical settings in the country result in diverse tolerance limit of the habitat. Some of the bio-physical settings are intensively utilized or over utilized whereas others are underutilized or unscientifically utilized. The ultimate result is gradual decline in the carrying capacity of the environment. At the same time tremendous increase of ever increasing population in the country has been causing relative decline in the fixed/limited land resources. Per capita availability of land declined from 0.9 ha in 1951 to 0.3 ha in 2001 and is projected to decrease to 0.1 ha by 2035. In this context, at present the study of landuse/land cover dynamics and their impact analysis is of prime importance. Plenty of work regarding this matter has been done all over the country. Brief review of some of the works, recorded by different observers under different geo-climatic as well as socio-economic settings, is as follows:

A. Singh (1991) has studied the environmental impact of landuse in flood prone areas of Bharatpur district, Rajasthan. He demarcated the study area into different flood frequency zones and selected 200 villages concentrated in above zones. Based on data collected from each of the villages he categorized the degraded land according to their quality. For each category he identified the specific causes of land degradation and offered some remedial measures.

Sharma, Gajja and Shah (2008) have discussed the issues related to causes of over exploitation of ground water resources and consequent environmental deterioration in Haryana region.

Abrol and Sehgal (1994) assessed the nature and extent of land degradation in India along with their impact on environment. They also described rehabilitation and conservation of resource base.

N. Prasad (2000) made an in depth analysis of the concept of environmental impact of changing landuse and land cover. He divided the time frame into three broad categories (pre-historic time, historic time and modern time) and then explained the nature of landuse and consequent environmental status in each of the above three time frames.

D. Kaur (1991) has identified the spatial pattern of change in agricultural landuse in Bist Doab, Panjab that have experienced between 1951 and 1980. He also analyzed the causal relationship of such change. In the last part of his book he analyzed the role of distance in spatial organization of agriculture. The study is comprehensive and objective. However, he did not analyze the impact of such change on environment.

Punyatoya Patra (2006) has provided a well researched account about land degradation of tropical highland, Orissa. It is a comprehensive and critical account of all the issues related to types and causes of degradation of tropical highland of northern Orissa. The study is the outcome of amalgamation of traditional as well as modern techniques. An important observation in the study is: the rate of land degradation over time is closely related to land use factors. The research findings have practical implication in natural policy making for management of rural land resources in a diversified terrain of northern Orissa. However, the study is lacking in incorporating the social, economic, and political issues which affect land degradation.

G. Sastry and Jayal (1994) have discussed the impact of developmental activities (e.g. construction of roads, mining activities, overgrazing, deforestation etc.) on environment. Various measures of mass erosion control have been discussed.

A.N. Singh (2003) in his paper has also identified the causal relationship between landuse and land degradation in Uttar Pradesh. The study captures the past and looks into the future. He identified three main types of land degradation in Uttar Pradesh *viz*. soil erosion by water, salinization and alkalization and water logging.

The volume 'LandUse' edited by M.M. Jha and R.B. Singh (2008) reflect the intellectual caliber of the contributors belonging to diverse field having common interface with land use. The book provides a vivid account of land use dynamics

of India. The book also provides an account of agricultural scenario of Nepal, Bangladesh and Laos. Thus, to some extent, the book provides a comparative base for agro-economic analysis on an international level. No doubt, there are some important issues which need to be deliberated at greater length while there are others which should not have been neglected. But, on the whole, the statistics of land use dynamicity derived by using spatial information system at different level (macro, meso, and micro) has definitely provided a framework for making development plan.

The volume is divided into four sections, viz. application of spatial informatics in land use studies; agricultural land use and development; urban influence and land use dynamics; and socio-economic development linked with landuse. J.L. Jain provided deep insight into how the geological and geomorphological parameters influence landuse dynamics in Narmada valley and adjoining hills and plateaus. However, the result is partial in the sense that landuse dynamics is the outcome of both physical and socio-economic factors. Kaushal K. Sharma brings out the picture of dynamicity of agricultural transformation in terms of crop combination regieons in Himachal Pradesh.

K.Sharma, Lahkar *et.al*. (2008) assessed the future implication of anthropogenic changes in landuse in Manas National Park, Assam which falls in the bio-physical settings of bhabar and flood plain ecosystem of north east India. They integrated the satellite data of 1977, 1998, and 2006 and superimposed them to identify the impact of natural and anthropogenic changes in the last 30 years. They divided the entire study area into six broad landuse categories in terms of their areal coverage and finally suggested some area specific recommendation ns for proper management.

K. Puri (1992) explained the need for an Indian landuse policy which seeks to draw attention to the impact of growing population, industrialization and farming on the land degradation.

REGIONAL STATUS

There is no substantial wok on environmental impact of landuse change in south west Birbhum district. However, some studies related to physical constraints behind land utilaization or faulty land use practices or land use dynamics of the Birbhum district as a whole or part of the district have been completed.

O'Mally (1910) has provided a detailed account of the history, antiquities, crops, castes, sects, marriage customs, land tenures, soil and occupation of the district as a whole. The District Gazetteers has, thus, provided a vivid picture of the physical and socio-economic characteristics of the Birbhum district as a whole. District resource map published by GSI has provided a broad outline of the geo-lithological framework of the study area. Wadia, D.N.(1975), Dey, A.K.(1968), Pascoe, E.H.(1973) *et.al*. have provided a detailed account of geo-lithological characteristics of each unit and subunit of the study area. The soil survey report published by NBSS and LUP provided a comprehensive account of different physical attributes of land related to soil development of the district of Birbhum as a whole. The report also provides a detail account of different physical and chemical properties of soil as well as the susceptibility of soil to different land use practices of the Birbhum district.

Subramanyam,V.P. (1983) has divided India into climatic zones. This study provides information to identify the nature of micro-climate of the study area.

V.C. Jha (2009) provided a vivid account on rill and gully erosion risk at south west Birbhum district. He divided the entire study area into 45 micro watersheds of the Kopai, Bakreshwar, Dwarka and Hingla basins. He then quantitatively measured the rill and gully erosion risk at different micro watersheds. Finally, he divided the entire study area into three broad (least, moderate and severe erosion) rill and gully erosion risk zones.

A Biswas (1978) critically examined the role of physiography in determining the spatial distribution of agriculture in Birbhum.

D. Das was more specific in identifying the impact of canal irrigation in Ajay-Kopai inter-riverine tract of Birbhum district. The study was essentially a micro-level study and based on intensive field investigation of 360 households of 15 villages. He rightly pointed out the evil effect of unscientific land use practices.

A. Mukhopadhaya (2006) has extensively studied the role of physical and cultural parameters in shaping the agricultural scenario of Dubrajpur block. Finally she suggested some remedial measures which can provide sustenance to the local environment and can improve the economic condition of the local inhabitants.

S. Guchhait and M. Sen (2009) provided a vivid account of spatio-temporal dimention of landuse in Birbhum district. They overemphasized the role of physiography and soil in determining the land use dynamics of the district.

D. Chakraborty (2009) made a comparative analysis of the spatio-temporal change in agricultural efficiency of Birbhum district. He regionalized the district into five agricultural efficiency zones (very high, high, moderate, low and very low). He also analyzed the probable causes responsible for variability in agricultural efficiency of the district.

RESEARCH GAPS

The detailed account of the literature review has provided the scope to sum up the following methodological and technical shortcomings of the previous works:

1. There is no substantial work on impact analysis of landuse change of Southwest Birbhum District. Earlier researchers, except few, focused their attention on the district as a whole. The present study deals exclusively with the Southwest Birbhum District, comprising three C.D. blocks of Dubrajpur, Khoyrasole and Rajnagar. The study aims to investigate landuse dynamics at both meso (block) and micro (*mouza*) level.
2. The previous studies gave emphasis either on physical land attributes or on socio-economic land

attributes. However, both the physical and socio-economic land attributes are complimentary to each other. The present study tries to integrate terrain, economy and society into one framework.

3. Most of the studies related to impact assessment of landuse change were mainly related to analysis of the changing pattern of landuse categories and their impact on physical environment. The present study is more comprehensive in the sense that it aims to explore the cumulative impact of changing landuse categories/techniques on both physical and social environment.
4. No attempt has yet been taken to identify the landuse potential of the particular bio-physical settings in analyzing the impact of landuse change. However, land capability assessment is one of the pre-requisite to scientifically identify the area-specific landuse categories or landuse techniques. For the present study, the researcher at first quantitatively determine the land capability of Southwest Birbhum District and finally suggest area-specific landuse to sustain the carrying capacity of study area on a long term basis.
5. The previous workers related to Southwest Birbhum District focused their thrust only on agricultural landuse. The planning proposal based only on agricultural landuse definitely provides a partial result. The present study has wider horizon as it incorporates all the landuse categories and their spatio-temporal interchange in a single framework.

An attempt has been taken to fill up these research voids to make the present study more exhaustive, up-to-date and need-oriented.

REFERENCES

Aughey, S. (1880). *Sketches of the physical geography and geology of Nebraska.* Daily Republican Book and Job Office

Biswas, A. (1978). Physiographic determinism in Birbhum agriculture. *Geographical review of India , 40*

Chakraborty, D. (2009). Spatio-temporal change of agricultural efficiency in Birbhum district, West Bengal. *Practicing geographer ,* Vol13, Summer 2009

Das, D. (n.d.). Canal irrigation and environmental degradation in Ajay-Kopai interriverine tract of Birbhum district, environmental degradation and development strategies in India

Dey, A.K., (1968). *Geology of India*. National Book Trust, New Delhi

Dutta, R. (2003). Coal resources of West Bengal. *V* , 23-96. (A. Dutt, Ed.) Kolkata: Director General GSI.

Eidsvik, H. (1980). *National parks and other protected areas: some reflection on the past and prescriptions for the future* (Vols. Environ. Conserv., 7)

G. Sastry, a. J. (1994). Mass erosion and its control. *Indian Journal of soil conservstion , 22(1-2)*, 145-153

Glacken, C. (1956). *The origins of conservation philisophy* (Vol. Soil water conservation)

Guchhait, S. & Sen,M. (2009). Spatio-temporal DFimensions of Land Use in Birbhum District*, Practicing geographer ,V* ol 13, Summer 2009

Jain, J. (2008). Land use interpretation from satellite imagery: Geomorphic controls on land use and settlement in Normada valley and adjoining hills and plateaus. In M. j. Singh (Ed.), *Land use.* New Delhi: Concept publishing company

Jha,M.M. & Singh,R.B. (2008) (Ed.). *Land Use*. New Delhi: Concept publishing company

Jha, V. (2009). Rill and gully erosion risk of lateritic terrain in southwest Birbhum district, West Bengal, India. *Sociedade & Natureza, Uberlandia , 21(2)*, 141-158

Kaur, D. (1991). *Changing patterns of agricultural land use.* Jaipur: Rawat publication

Knowles, G. (1978). Erosion assessment and control techniques in Australia. *Erosion assessment and control in New Zealand*, (pp. 349-362)

Macleod & Congation (1998) A Quantitative Comparison of Change detection, algorithims for Monitoring Eelgrass from Remotely Sensed Data. Photogrammetric Engineering & Remote Sensing. Vol. 64. No. 3 P.207-216

Marsh, G. (1864). *Man and Nature.* London: Stampson, Low and Son

Mather, A. (1982). The changing perception of soil erosion in New Zealand. *Geog. J. , 148*, 207-218

Moore, T. (1979). Land use and erosion in the Machakos Hills. *Annala of Association of American Geographers , 69*, 419-431

Mukherjee, A. (2006). Riverine morphology and agricultural characteristic of DPSA of Birbhum district, West Bengal. (Unpublished thesis)

O'Mally, L.S.S., 1910. Bengal District Gazetteers Birbhum, Calcutta

Optimising land use of Birbhum district (2007). NBSS & LUP. NBSS publisher 130

Pascoe, H.E., (1973). *A Manual of Geology of India and Burma*, Vol.1, Geological Survey of India

Patra, P. (2006). *Land degradation in tropical highlands.* New Delhi: Rajesh publication

Prasad, N. (2000). Environmental impact of changing land use and land cover: an assessment. *Environment:Science & Thoughts* (Ed. A.K.Das) acb Publication p.152

Puri, K. (1992). *Dimensions of land use policy in India.* New Delhi: Oxford book and stationaries

Rachel Carson (1991). *Silent Spring*. Great Britain: Penguin Books

Sehgal, I. A. (1994). Dedraded land and their rehabilitation in India. *Workshop on the Ecological foundations of sustainable agriculture (WEFSA II)*, (pp. 129-144)

Sen, S. G. (2009). Spatio-temporal dimensions of land use in Birbhum district, West Bengal. *Practicing geographers , 13*

Sharma, K. (2008). Agricultural transformation and crop combination regions in Himachal pradesh. In M. M Jha & R.B. Singh (Ed.), *Land use.* New Delhi: Concept publishing company

Singh, A. N.(2003). Drivers of land degradation in Uttar Pradesh. In N. G. Raghavswamy (Ed.), *Land use/ Land cover management practices in India.* B.S. Publication

Singh, A. (1991). *Environmental degradation in flood prone areas, jaipur.* Pointers Publishers

Thornthwaite, C. (1936). *The Great Plains*. University of Pensylvania Press

V.P. Sharma, B. G. (1995). Managing land and water resources for sustainable agricultural development: issues and options. *Artha- Vijnana, 37:1* , 46-65

Wadia, D. N. (1975). *Geology of India.* New Delhi: Tata McGraw-Hill

****