

**A
COUNTRY
REPORT**

***PROGRESS IN
INDIAN GEOGRAPHY***

2004-2008

31st International Geographical Congress
Tunis, Tunisia
August 12-15

Edited by
Debendra Kumar Nayak

**Indian National Science Academy
Bahadur Shah Zafar Marg, New Delhi 110 002
India**

Progress in
INDIAN GEOGRAPHY

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Edited by
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CONTENTS

Preface

Acknowledgements

Abstract of the Report

Introduction: State of the Art

A Geographical Mosaic of Incredible India

Indian Contribution

Resource and Environment

Geomorphology

Climatology, Soil Geography and Bio-Geography

Agriculture

Industry

Population

Population Change and Migration

Settlement

Urbanisation

Regional Development and Planning

Historical Geography

Social Geography

Cultural Geography

Gender Issues in Geography

Geography of Health

Social Transformation and Wellbeing

Political Geography

Administrative Geography

Remote Sensing and Geographical Information System

Bibliographical References

Contributors

PREFACE

This report on progress in Indian Geography is a modest attempt at projecting the state of the art as perceived by a group of scholars who have collaborated with me in this venture. Needless to mention, opinions tend to vary, depending upon who is writing the report on the state of affairs in a particular branch of study. Some have been quite happy and optimistic about the efforts made in a particular branch of study in geography; others feel disappointed and look forward to more concerted efforts to be made by geographers in India to bring the branch of study to a desired level of international standard. No attempt however has been made in this report to raise controversial issues or project the image of a certain school of thought. The report was designed to focus on the most productive areas of research in different branches of geography and to find out emerging areas of research in the light of the changes taking place in global as well as in Indian physical, economic, social and political space. Effort was made to be as comprehensive as possible, but despite best efforts some areas could not be covered due to lack of response.

The various sections of the report have been authored by professional colleagues who were extremely kind to spare their valuable time in writing the essays in spite of paucity of time and other nagging responsibilities. These contributions are given below:

Section	Author
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Agriculture	: Abani K.Bhagabati
Industry	: Praveen G. Saptarshi
Population	: N.C. Jana and Sudesh Nangia
Population Change and Migration	: Bimal K.Kar
Settlement	: Surendra Singh
Urbanisation	: H.N.Misra
Regional Development and Planning	: A.C.Mohapatra and Nabanita Kanungo
Historical Geography	: Rana P.B. Singh and Ravi S. Singh
Social Geography	: Debendra Kumar Nayak
Cultural Geography	: Rana P.B. Singh and Ravi S. Singh
Gender	: Anindita Datta
Health	: Jayashree De
Social Transformation and Wellbeing	: Niladri Ranjan Dash
Political Geography	: Sudepta Adhikari
Administrative Geography	: Surya Kant
Application of Remote Sensing Techniques and GIS	: R.B.Singh

The Report has been organized into nine broad themes apart from an introductory section on Geographical Mosaic of India: The Lithosphere, Hydrosphere and the Atmosphere; Interpretation of Economic Phenomena; Interpretation of Demographic Phenomena; Urbanisation; Regional Development and Planning; Historical Geography; Interpretation of Social Phenomena; Interpretation of Political Phenomena and Methodological Issues. Reviews of research may occasionally reflect individual viewpoints or likes and dislikes. These were unavoidable. These aberrations however do not in any manner undermine the basic thrust of getting an overall impression about the progress that Indian Geography has made during the past four years.

Shillong
July 10, 2008

Debendra Kumar Nayak
Member, National Committee of the IUGG and IGU

ACKNOWLEDGEMENTS

This research overview of the Indian contribution to geography since the 30th International Geographical Congress, held in Glasgow in 2004 is the product of contributions made by a team of scholars working at different universities in the country. I owe a debt of gratitude to each one of them for the services rendered by them in a short span of time. Understandably, this was a daunting task and cannot be expected to be exhaustive in coverage in spite of best efforts to collect as much information as possible. Given the constraints, all the contributors have achieved a measure of success in providing the much needed trends in Indian contribution to geography in various field and sub-fields of the discipline. I place on record my deep appreciation of the services rendered by my professional colleagues who have made this report possible well in time. I am particularly grateful to Dr. R.B.Singh, my friend and colleague from Delhi University who has been a constant source of help right from the beginning. I had to depend on him not only as one of the contributors to this status report, but also in helping me identify, even persuade some of the colleagues who have been contributors to this report. He has been instrumental in providing me with much of the valuable inputs so essential for reporting to the International community of geographers. The cooperation I received from Prof. Surya Kant, Panjab University, Chandigarh; Prof. Jayashree De and Dr. N.R.Das from M.S.University, Vadodra; Prof. S.R. Jog, University of Pune; Prof. H.N.Misra, University of Allahabad and Prof. Sudeepta Adhikari, Patna University is warmly acknowledged. I am also grateful to my colleagues in the Department of geography, North-Eastern Hill University who with their ungrudging support and help made my task relatively easy. I place on record my deep appreciation of the services rendered by each one of them, especially Dr. Zahid Husain Qureshi, Prof. A.C. Mohapatra, Prof. Surendra Singh, Prof. B.S. Mipun and my doctoral student KC.Lalmalsawmzauva in this connection.

The Status Report could be brought out only because I received full cooperation and funding support from the Indian National Science Academy (INSA). Special thanks are due to the President and the foreign Secretary of INSA for their unstinted support. I am especially grateful to Dr. Alok Moitra, deputy executive secretary and Dr. Brotati Chattopadhyay, assistant executive secretary, INSA who were a bridge between me and INSA.

I also place on record my sincere gratitude to Prof. Harsh Gupta, Chair, National Committee, IUGG and IGU for his constant encouragement and advice.

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Member
IUGG-IGU National Committee of India

ABSTRACT OF THE REPORT

This overview of research in Indian Geography covers the period between the 30th and 31st Congresses of the International Geographical Union. The Indian contribution to geography has been broadly reviewed by grouping it into the following clusters of research:

The Lithosphere, Hydrosphere and Atmosphere; Interpretation of Economic Phenomena; Interpretation of Demographic Phenomena; Urbanization; Regional Development and Planning; Historical Geography; Interpretation of Socio-cultural Phenomena; Interpretation of Political Phenomena and Methodological Issues.

Each cluster has been further divided into sections depending upon the multiplicity of issues inherent. The classical division of the discipline between physical and human was not considered meaningful while presenting this overview. The report begins with an opening section on A Geographical Mosaic of Incredible India introducing the natural and cultural heritage of India. The section is aimed at providing an overview of the baffling geographical diversity that India represents both in its physical setting and in its cultural make up.

Most if not all, sections indicate gaps in research, recommendations and future research agenda. All references to bibliography have been placed at the end, according to the sections. Broadly, the following important areas of concern may be identified which appear to be significant from the overview of research in Indian Geography presented in detail in subsequent sections:

Resource and Environment

Environmental issues now occupy a significant place in academic discourse and activism alike. Situation of India with regard to environmental crisis and resource depletion is deepening in the wake of rapid changes brought about by the new regime of economic liberalization and penetration of transnationals. However, few geographers have been able to take a holistic view of environment. Vulnerability is the key to our understanding that attempts to break from all-too technocratic agenda that have characterised relationship between human societies and their environments over previous centuries. There is a serious lack of integrated techniques and approaches to study vulnerable environment. There is a need to identify challenges and opportunities for improving human well-being through vulnerability analysis of different ecosystems and community groups. While application of GIS and remotely sensed data can make a world of difference, few seem to have undertaken meaningful research using this important tool. There is a dearth of empirical studies evaluating the impact of the current phase of liberalization and globalization on the environment and resources both at national and local levels.

Geomorphology

With growing awareness towards environmental problems the role of the geomorphologists is increasingly recognized as pre-eminently necessary. Geomorphology is being considered as a science contributing towards the natural resource and environmental management. Problems like stability of coastal structures, desertification,

land resource appraisal etc. are emerging as major topics of research being handled or expected to be handled by the geomorphologists. As a result micro studies are gaining importance. "Use of remote sensing technique and GIS" appears as a favoured suffix in many titles. The techniques and tools of research gain importance in such attempts and at times one wonders if the original topic of research is getting camouflaged in the description of these tools and techniques.

Climatology, Soil Geography and Bio-Geography

As these fields of geography thrive on links with disciplines like meteorology, soil science and life sciences, the range of non-geographers' contributions to the study of climate, soil and bioresources is considerable compared to that of the geographers. Although Climatology traditionally occupies an important position in Physical Geography considering the renewed interest world over on the topic of climate change, study of climate, finds little proportionate weightage in the hands of Indian geographers. Apart from a few purely pedological studies, contributions from geographers in the area of soil geography leave much to be desired. Biogeography continues to be less emphasized despite its growing importance in the field of environmental studies.

Agricultural Geography

Agriculture continues to be the backbone of Indian economy and rightly remains a major thrust area in geography. Agricultural geographers in India have diversified their interests and have ventured into significant areas of analysis such as land capability classification, agro-ecological concerns, crop diversification and diffusion, problems of food security and vulnerability, dairy farming apart from social and institutional framework of agriculture.

Industrial Geography

In spite of tremendous potential in this field of research, particularly in the post liberalization phase, not much work appears to have been made. Very few papers have been published in this branch of geography in leading journals of India. As industry along with agriculture is the backbone of the nation's economy, the geographers can neglect this field of inquiry only at their own peril. This is particularly true in the context of a vibrant trend of research in this field during the eighties and nineties.

Population Geography

Population related issues remained central to geographical discourse during the period under review. Issues that have caught geographers' attention include population distribution; density and growth; population composition; fertility and reproductive health; mortality and morbidity, migration and human development. Migration, both internal and international, appears to be one of the major focuses of researches. Besides; migration from across the international borders, which has led to conflicts and political unrest in the frontier states has attracted attention from population geographers. Concern for a better quality of life, reduction of poverty, gender equity and equality has led to several studies in Human Development, management of human resources and sustainable development. However, continued dependence on census based data has been a limiting factor. There is an urgent need to go beyond census based data to an understanding of

poverty, inter-ethnic differentials in population and characteristics of displaced populations.

Population Change and Migration

Regarded as a special area of interest within population geography, studies undertaken in this area are a mix of both general and contemporary-specific population issues relating to population growth/change and migration. There is little change in the focus of research during the period under review. It is necessary that studies pertaining to the impact of rapid population growth, migration, population pressure, ageing and globalization etc. need to be taken up with urgency for their important role in population change.

Settlement Geography

This is a traditionally important area of research that has attracted good number of researches. Moving away from the conventional analysis of size, form and location of settlements, Indian geographers have made important contribution to studies on functional aspects and locational characteristics of human activities as well as spatio-functional organization of economic landscape. Issue pertaining to the impacts emanating from hyper-urbanization and diversified urban systems are recommended as important areas for future research.

Urbanization

Urban geography is one of the most dynamic sub-disciplines of geography. It has been moving forward in its philosophical perspectives and thematic contents. However, the urban process as is viewed by geographers has been perceived more as a demographic phenomenon drawing largely on data available from successive census operations. Nevertheless, Indian urban geography has been unfolding several new dimensions including environmental issues of the built environment and sustainability of the present urban systems. More intensive research is recommended for studies on ecological implications of urban fringe, the natural and human induced hazards and disasters in the urban context and alternative models of indigenous city which is energy efficient, eco-friendly and sustainable.

Regional Development and Planning

Economic reforms initiated in India in the nineties and its regional impacts-both apparent and likely-have dominated researches in this field of study. The review however reflects a vast range of interests and research areas covered by geographers in relation to issues of regional development. The studies indicate that the shackles of a centralised planning perspective has largely become unrecognisable and on the other hand, a more local based concern, grass-root based issues but not entirely discounting the broader canvass, have come to stay in the subject as it has been evolving in India over a decade or so.

Historical Geography

Historical geography has never been a priority area in Indian geography, though its importance can hardly be overemphasized. Most of the studies cited in the review do

not come from geographers, nor can they strictly be considered as historical-geographical researches. Nevertheless, acceptance and emergence of new notions, ways, perspectives, subaltern views, oral history, biographical resources, heritage ecology, etc. are some of the recent concerns enriching the field of historical geography of India. All such studies can provide essential raw material for a meaningful historical-geographical interpretation.

Social Geography

Though this specialism is characterized by a more than desirable dose of eclecticism, the sub-discipline has received adequate attention by a number of geographers during the period under review. The most important feature of the growth of the sub-discipline has been an accent on theory impinging more on epistemological issues at the cost of empirical research. More contributions have come in the form of chapters in edited volumes rather than articles in leading journals. This cannot be taken as a healthy development. The immediate cause for a shift in interest in socio-geographical research appears to be the post-modern discourse that has caught the attention of Indian geographers following their western counterparts. A few geographers have however continued with studies of caste and morphology of rural settlements, spatial aspects of language and shifts in language and ethnic conflicts and the like.

Cultural Geography

The post-modern discourse has certainly given a new meaning to studies in cultural geography and cultural geography in India has become a shadow of its western incarnation. But, this branch has mostly been used as a way and approach narrating or analyzing landscape and culture, putting aside the theoretical construction and critique of the philosophical ideas as popular in the West. More western scholars than Indian have evinced interest in cultural forms, mostly of its mythical dimension. The geographical implication of cultural pluralism has hardly received any attention. While ancient Indian traditions have been overemphasized, few talk about contemporary cultural development including globalization of culture and its impact.

Gender Issues in Geography

Integrating gender issues into geographical research has been a formidable exercise. In spite of serious efforts made by a few enthusiastic geographers in India, gender in geography has not achieved the heights it deserves. This is despite instances of inclusion gender studies in the syllabi offered by a few universities. Most works in the sub-field continue to be descriptive rather than analytical. The engagement of space with gender and *vice versa* remains largely glossed over by geographers. The larger research input into these themes has come not from geographers but sociologists or economists. Most geographers equate site with space and sex with gender. Conspicuous by their paucity are studies which engage directly with the themes of gendered experience of space, gendered spaces and spatiality's of gender. Limitations in the current level of research notwithstanding, gender issues in geography holds an important social position in understanding larger issues of female subordination and deprivation.

Geography of Health

As a branch, Geography of Health has made significant strides in the period under review. It has progressed from studies in ecological associations of diseases and attempts at disease mapping, to investigations into a wider perspective of health and health care with a focus on human welfare. Cultural and the structural approaches to address the problems of health and place are dimensions that distinguishes this field of enquiry from its past. However, many, if not all studies stop at a cartographic representation of diseases showing inter-state or inter-district variation in the prevalence pattern and hardly move beyond the level of description.

Social Wellbeing and Transformation

Studies pertaining to health dominate in this field while issues concerning housing and social pathology remain neglected. Most studies continue to rely on cartographic representation of facts without placing the issues in a proper theoretical context. Recent impacts of globalization, liberalization and economic restructuring which are bound to have immense effects on the process of social transformation and social well-being find rare mention by Indian geographers.

Political Geography

Political geography in India has been a neglected field of inquiry in the past, and continues to be marginalized even at present. This is in spite of tremendous potential of the sub discipline in contributing to varied political problems directly linked to geographical backgrounds and territorial identification as well as external space-relations. Unfortunately barring a few notable exceptions, much of the interest is centred on electoral geography. The field needs to shed its conventional mould and concentrate on issues of urgent national importance such as political implications of social and cultural pluralism and related issues of conflict as well as integration, problems of nation building, federalism and above all the political geography of underdevelopment.

Administrative Geography

There has been world over, a significant increase in the expression of concern for the neglect of policy-relevant research in human geography. Only a few geographers in India have evinced interest in this vitally important area in which geographers should contribute significantly with their skills of understanding the 'natural' and 'human' in synthesis rather than in isolation.

Remote Sensing and Geographical Information System

During the last decade urgency has been shown by geographers for an increased application of remote sensing techniques and GIS not only as part of the curriculum but also in the researches conducted mostly confined, though not restricted to physical geography. Such techniques are crucially dependent on computer as a tool. Only a few elitist centres have been able to introduce such courses and are increasingly using these techniques in their researches.

INTRODUCTION

State of the Art

Indian geography claims a substantial segment of the national academic space. If one goes by the numerical strength of the geographical community in terms of students admitted to various geography programmes in different universities and colleges and the strength of the faculty, Indian geography has certainly made impressive gains during the past eight decades. More geographers now attend summits, workshops, seminars symposia and conferences in geography both at national and international level. Yet, Indian Geography does not feature prominently in the international arena. This is despite attempts to include every possible change in the development of the subject into the geography curriculum. Geographers in India have been alive to every new tool and technique that has appeared on its door step. Yet, the geographical enterprise has failed to reap dividends nationally or internationally.

Teaching and research in Geography is channelized through a large number of geography departments spread all over the country. The period under review has witnessed establishment of many new departments of geography particularly in the North-Eastern region of India. But the inherent dichotomy in nature of geography continues to affect its position in the highly structured university system that treats the subject either as a natural science or as a social science. The placement of geography in the university system continues to baffle generations of students. Geography continues to be placed under the faculty of sciences in many universities enabling them to procure funds and projects from funding agencies as well as to establish laboratories. On the other hand departments which are placed under arts/social sciences continue to be eternally starved of funds for their minimal needs. This has created not only inequality between departments of geography, but also affects the quality of teaching and research. Private universities which have come up in large numbers in recent years have largely ignored geography as a serious area of teaching and research. Even some of the traditional departments of geography which have made significant contribution in geography teaching and research have (or are in the process of) begun to cultivate new techniques such as geo-informatics on the wake of advances made in GIS and Remote Sensing technology. A number of geography departments now proudly display on their websites courses on GIS, Remote Sensing and Geo-informatics. There is nothing wrong in this trend except that an impression has gathered about a new image of geography as cultivation of these techniques. Many researchers now find it prestigious to add suffix-using GIS techniques- to the title of their research papers. Geography teaching and research is transforming in many departments to aggressively accommodate itself to this new trend. Yet there are many geography departments in universities and colleges which lack even computers to do word processing. Such is the state of affairs in geography that occupies a substantial segment of the national academic space.

Table 1-3 give an idea of the organizational set-up of Indian geography. There are many associations of geographers in the country-some very old and some relatively new-but there is no national council of geographers to coordinate their affairs. There are equally large numbers of journals published in geography, but few publish refereed research. This has seriously hampered maintenance of quality. The University Grants Commission made some effort in developing a Geography curriculum but it has not met

with much success. There is an urgent need to reorient the curricular programme in geography keeping in view the spirit of the changing times.

IGU Activities in India

The following major events concerning IGU in India took place during 2004-2008:

1. IGU Commission Session on LUCC and Biogeography and Biodiversity during Indian Geography Congress at Bangalore University, Bangalore November 2005.
2. 1st International Indian Geography Congress and IGU Initiatives on Culture, Civilization and Human Development, Osmania University, Hyderabad October 5-7, 2006.
3. IGU Seminar on Biogeography and Biodiversity at H.N.B.Garhwal University, Srinagar May 3-4, 2007.
4. IGU Seminar on Land Use and Land Cover Change and Agro-biodiversity, Lucknow University, March 7-8, 2008
5. Future Meeting: IGU Conference on Land Use Change, Biodiversity, and Climate Change at Marthandam, Kanya Kumari District, Tamil Nadu during October 6-7, 2008.

Indian Geographers working on IGU Commissions/Commonwealth Bureau

The following members are currently working as members of the IGU Commissions/commonwealth bureau.

1. Dr. R.B.Singh, University of Delhi, Member-IGU Commission on Land Use and Cover Change (LUCC) and South Asian Focal Point-IGU Initiative-Culture and Civilisations for Human Development.
2. Dr. T.Vasanthakumaran, University of Madras, Member-IGU Commission on Geographical Information Systems.
3. Dr.S.K.Agarwal, University of Delhi, Member IGU Commission on Health and Environment.
4. Dr. M.M.Das, Member (South Asia), Managing Committee of the Commonwealth Geographical Bureau.

Collaborative Programmes

The period under review is marked by an accelerated pace of collaboration between different departments of Geography located in India and in other countries. A brief account is presented below though the list could be bigger:

University of Delhi

Members of the faculty, Department of Geography, University of Delhi have collaborated with different international institutions, notably (a) on Shastri Applied Research Project (SHARP) on Role of Public, Private and Civil Sectors in Sustainable Environment Management in collaboration with University of Manitoba and the University of Winnipeg, Winnipeg, Canada (b) ICSSR -Indo-Dutch Programme on Alternative in Development (IDPAD) on Environmental Implications and its Socio-Economic Implications in Rural-Urban Fringe with University of Groningen, The Netherlands (c) CIDA-SICI Partnership Project-II on Urban Development and Environmental Impacts in Mountain Context, with University of Manitoba, Canada (d) DFID Research Project on Enhancing Food Chain Integrity...Pollution Impact on Vegetable System in Peri-Urban Areas, Collaboration with Imperial College, London, UK. And (e) A Research Project on Water in Delhi with the University of Koln, Germany.

Gauhati University

International Collaboration with (i) Centre for South East Asia Studies, Kyoto University, Japan and (ii) Graduate School of Asian and African Studies, Kyoto University, Japan in the field of 'Agro-Ecosystem and Sustainable Development in the Brahmaputra Valley, Assam'.

Jawaharlal Nehru University

The Centre for the Study of Regional Development has developed collaboration with (a) York University Toronto, Canada, on a CIDA-SICI Project on Development Induced Displacement (b) Institute of Social Sciences, Paris, France on Urbanisation and (c) Austria on Spatial Information Technology

University of Madras

An Adaptive Ecosystem Approach to Managing Urban Environments for Human Health (a Study of Toronto and Hamilton in Canada and Chennai in India), funded by the Social Sciences and Humanities Research Council of Canada.

North-Eastern Hill University

Indo-Polish Collaborative Research Program under DST (New Delhi)-and KBN (Warsaw, Poland) to investigate Run off, Rainfall and Soil Loss in Cherrapunji Area, Meghalaya Plateau (III Phase)

Panjab University

The Department has an academic exchange with University of Pecs, Hungary spanning over two decades. The Department is also starting two new courses namely One-Year Diploma in Geoinformatics and a Two-year Masters degree course in Geographic Information Systems and Science in collaboration with Centre for Geoinformatics, University of Salzburg, Austria.

University of Pune

MOU signed between Department of Geography, University of Pune and Center for spatial Information science, University of Tokyo, Japan in 2005.

Tripura University

Innovative research methods and technologies for the multispatial/multitemporal analysis of landslides in mountain regions, the prevention and awareness of related natural hazards and risks" with Prof. Marco Giardino of The University of Torino, Italy.

Table 1
Major Departments of Geography

Aligarh Muslim University, Aligarh	University of Allahabad
Banaras Hindu University, Varanasi	University of Calcutta
Bangalore University	University of Madras
University of Bombay	University of Burdwan
University of Delhi	Sri Krishna Devaraya University
University of Gorakhpur	Utkal University, Bhubaneswar
Magadha University	Panjab University, Chandigarh
Karnataka University	Gauhati University, Guwahati
Govt. M.L.B. (PG) College, Jiwaji University, Gwalior	Kurukshetra University
University of Sagar, Sagar	Jamia Millia Islamia, New Delhi
Rajasthan University, Jaipur	Ranchi University
Patna University, Patna	Sri Venkateswara University, Tirupathi
Gujarat University, Ahmedabad	Kashmir University, Srinagar
Punjabi University, Patiala	Shivaji University, Kolhapur
Madurai-Kamaraj University, Madurai	M.D. University, Rohtak
Himachal University, Shimla	M.L. Sukhadia University, Udaipur
JNV University, Jodhpur	North-Bengal University
Dharwad University	Nagaland University, Kohima
North Eastern Hill University, Shillong	Centre for the Study of Regional Development, Jawaharlal Nehru University, New Delhi
University of Jammu	Rajiv Gandhi University, Itanagar
Tripura University, Agartala	Manipur University, Imphal
Mizoram University, Aizawl	

Table 2
Major Geographical Societies

The Indian Geographical Society, Madras (F-1926)
Geographical Society of India, Calcutta (F-1936)
The Aligarh Muslim University Geographical Society, (F-1948)
The National Geographical Society of India, Varanasi (F-1955)
Allahabad Geographical Society (F-1958)
The Deccan Geographical Society, Secunderabad (F-1962)
National Association of Geographers, India, Delhi (F-1978)
Rajasthan Geographers' Association
The Association of North Bengal Geographers
The Association of Panjab Geographers, Chandigarh
Geographical Society of the North-Eastern Hill Region, India; Shillong
North-East India Geographical Society, Guwahati

Table 3
Major Geographical Journals Published from India

The Geographer Department of Geography, Aligarh Muslim University Aligarh-202002
Geographical Review of India University of Calcutta Ballygunge Circular Road Calcutta-700019
Annals of the National Association of Geographers, India (NAGI), Department of Geography, Delhi School of Economics, University of Delhi Delhi-110007
Indian Geographical Journal Department of Geography University of Madras Chepauk Madras-600005
Transactions of the Institute of Indian Geographers Department of Geography University of Poona Pune-411007
The Deccan Geographer Subhadra Bgavan 120/A NehruNagar East Secunderabad-500026
National Geographical Journal of India Department of Geography Banaras Hindu University Varanasi-221005
The Hill Geographer Department of Geography North Eastern Hill University, Shillong-793022
The North-Eastern Geographer Department of Geography Guwahati University Guwahati-781014
The Panjab Geographer, Department of Geography, Panjab University, Sector 14, Chandigarh - 160 014

A Geographical Mosaic of Incredible India

Introducing Natural and Cultural Heritage

R.B.Singh

India is a country with amazing geographical diversity together with plurality in language, religion, culture and ethnicity. It is a country of second largest human resources of the world with a population of more than 1027 million people supporting nearly 16.8 per cent of world's population. From the mountains of the Himalaya in Kashmir to the sea coasts of Kanyakumari and from the *Thar* deserts of Rajasthan to the humid forests of the north-east, India displays her wealth of diversity in cultures, religions fairs and festivals. Indeed, India is a unity in diversity. The country extends up to 3200 km from south to north and 3000km from east to west covering 32, 87,263 sq.km. Geographical mosaics of India include:

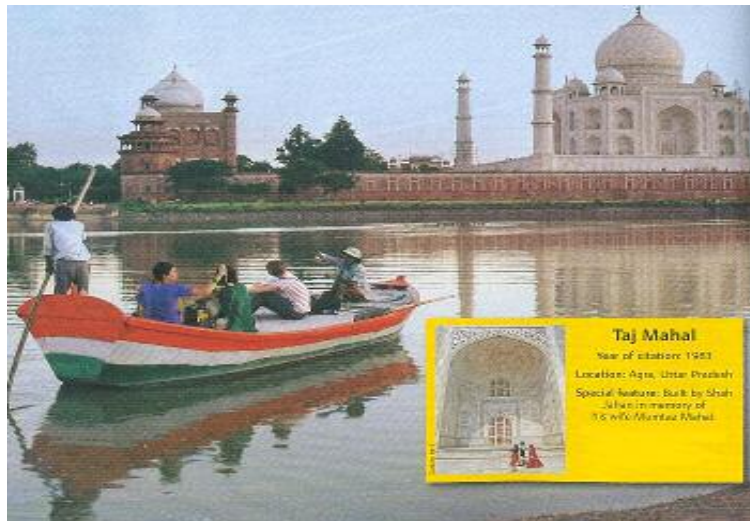
- i. Northern Himalayan Mountain incorporates typical land use *Jhum* and unique trans-humance practice together with varied cultural groups including a variety of tribes.



- ii. Two coasts of the Peninsula with rich biodiversity, estuaries and backwater ecosystem and dependent social groups like fishing communities.



- iii. Diverse humid to arid climates, varied rainfall and related production system, crop calendar and life cycles.
- iv. Extensive Indus-Ganga-Brahmputra alluvial plains in the north exhibiting continuation of traditional unique socio-economic interaction such as *Jajmani* system.
- v. Rising million-cities like Delhi, Agra, Kolkata, Mumbai and Bangalore containing within them most modern to cultural heritage and most traditional land uses together with worst form of visible poverty in the form of slums.



- vi. Plateau characterized by steppe to savanna and humid meso-thermic forests and dependent indigenous people on minor forest products.



- vii. Delta in the coastal regions of the eastern sea with typical mangroves and wetlands.

Historical Development and Civilization

The Name India is derived from *Sindhu* (Indus), the great river in the north-west. In traditional and legendary Hindu literature, India is called *Bharatkhandā*; and sometimes called *Jambudvipa*- one of the seven concentric legendary islands comprising

the earth. The earliest traces of history in India, so far discovered, go to the second Inter-Glacial period between 400,000 B.C. and 200,000 B.C. and there followed a long period of slow evolution, which gathered momentum during the spectacular Indus Valley Civilization excavated in the sites of Harappa and Mohenjo-Daro. These two sites bear testimony to the magnificent urban development dating back to 3000 B.C. The Harappan culture had declined by about 1700 B.C. and a vigorous incursion of the Indo-Aryan speaking people from the Middle East in about 1500 B.C. transformed the cultural landscape of the north-western India. The great Hindu epics, the *Ramayana* and the *Mahabharata* depict these historical events that took place between 1000-700 B.C. The *Aryavarta* –the homeland of the *Aryans*- was ruled by the Mauryan Kings and others in the Ancient period (321-185 B.C.) and the Mughals in the medieval period (1526-1712 A.D.) followed by the British rule until 15th August 1947. Urbanisation received a major spurt during the medieval and the modern period which witnessed the emergence of a large number of towns and cities as eminent centres of economic, cultural, social and religious diffusion.

Physical Landscape

The geological history of India started with geological evolution nearly 4.57 billion years ago. Indian geological formations consist of the Deccan trap, the Gondwana and the Vindhyan and those that originated in Pleistocene, Tertiary and Pre-Cambrian periods. Conventionally the country is divided into three physiographic regions *viz.*, the Himalaya and associated mountain chain, the Indus-Ganga-Brahmaputra plains and the Peninsular plateau including the coasts and the islands. The Himalayan Mountain covers about 5, 00,000 sq kms of land and extends over 2500 kms from the Karakoram in the west to the Myanmar in the east. Its width is about 240 kms. World's 14 highest peaks and few large rivers are located in the Himalaya. Indus-Ganga-Brahmaputra plains located in the northern part of the country, extends for 3200 kms from the River Indus in the west to Brahmaputra in the east. Its width varies between 150-300 kms. The senile peninsular plateau in the south is triangular in shape and has some of the oldest mountains of world with elevation varying between 600 and 800 mts. The Islands include the Lakshwadeep (36 coral Islands) and the Andaman (200 Islands) and Nikobar (19 Islands). The soils in India fall into seven categories, namely the alluvial soils, Black soils, Red soils, Laterite soils, Forests soils, Mountain soils and Desert soils.

Climate and Water Resources

India is situated in the Northern hemisphere and the tropic of cancer divides the country into roughly two equal parts. The southern part enjoys a low temperature range while the North is cold in winters and warm for greater part of the year exhibiting much greater range in its temperature. Though generally described as a tropical country, India experiences varied climatic conditions in different regions. The north is more affected by a continental climate while the south has more maritime influence (Arabian Sea, Bay of Bengal and Indian Ocean). Much of the rain is a gift of the monsoon and is primarily orographic. The annual rainfall of 116 cms is only marginally higher than the global mean of 99 cms. Spatial distribution of rainfall in India is characterized by great unevenness. While Mawsynram, located in the southern face of Meghalaya plateau receives the highest annual rainfall in world, India also has one of the driest regions of

world *i.e.* Jaisalmer located in the western part of the country. Generally rainfall decreases from east to west.

India has 4 per cent of the freshwater reserve of the world. The annually 'replenishable' groundwater has been estimated at 432 billion cubic meters (BCM). The Ganga basin has the highest potential followed by the Godavari and the Brahmaputra. The Indo-Gangetic alluvial plain with an area of around 25,000 km² is one of the largest groundwater reservoirs in the world. Of the total groundwater of India, only 30 per cent has been harnessed. Overuse of groundwater in almost all the states of India has led to ground water depletion in large parts of the country. In certain areas, like Punjab, the level of groundwater exploitation is over 98 per cent.

India is rich in terms of surface water wealth. It has some of the largest rivers of world *e.g.* the Brahmaputra (2900 Kms), the Indus (2810kms) and the Ganga (2525 Kms). Besides, there are many other large river basins, with basin area of more than 20,000 km². Some of its lakes are internationally known *e.g.* Chilka, Wular, Sambhar etc. Rainfall is the main source of surface water in India. It receives about 4000 BCM of water from precipitation. Of this, monsoon rainfall accounts for about 3000 BCM. The total utilizable water is about 690 BCM in the country.

India is one of the most disaster prone areas of world. Nearly 57 per cent of the country's land is prone to earthquakes included in the seismic zones III-IV. About 8 per cent of the land is vulnerable to cyclones of varying intensity. About 68 per cent of the net sown area and 5 per cent of the total land are vulnerable to droughts and floods (40 million ha). India alone accounts for 20 per cent of the deaths caused by floods in the world.

Forests, Biodiversity and Land Use

Great variation in climatic conditions has given appearance to variety of forest types including tropical and sub-tropical forests in the Western Ghats and eastern Himalaya, temperate and alpine forests in central and western Himalaya and desert forests in the arid and semi-arid regions of the country. According to Forests Survey of India (2003), about 6, 78,333 km², constituting 20.64 per cent of its geographical area is under forest cover in the country. Very dense forest (VDF) however accounts for only 1.56 per cent while the moderately dense forest (MDF) and open forest account for 10.32 per cent and 8.76 per cent respectively. The total forest and tree cover of the country is estimated to account for 23.68 per cent of the country's land.

India contains a great wealth of biodiversity in its forests, wetlands and marine areas. The country has 7 per cent of the mammals, 12.6 per cent birds, 6.2 per cent reptiles, 4.4 per cent amphibians, 11.7 per cent fishes and 6 per cent flowering plants of the world. Among plants, endemism is estimated as 33 per cent. India contains 172 species (2.9 per cent of world's total) of animals considered globally threatened species. The Western Ghats and eastern Himalaya are biodiversity hotspots. The faunal species of India is estimated to be about 81,000, representing about 6.4 per cent world's fauna. Besides other invertebrates, there are about 2546 fish species, 204 amphibians, 428 reptiles, 1228 birds and 372 mammals. About 4,900 species of flowering plants are endemic to the Indian subcontinent. Among the endemic species, 2532 species are found in the Himalaya and adjoining areas, followed by 1782 species in Peninsular India. About 1500 endemic flowering species are facing varying degree of threats of extinction. The

number of plant species in India is estimated to be over 45,000 representing about 7 per cent of world's flora. India is home to 14 biosphere reserves, of which 3 are in the world network of biosphere reserve viz. Sundarban, Gulf of Mannar, and Nilgiri.

Agriculture is the backbone of Indian economy. Agriculture and allied sectors like forestry, logging and fishing accounted for about 16 per cent of GDP and employed about 60 per cent of India's population. About 43 per cent of total geographical area of the country is used for the agricultural practices. Despite a steady decline of its share in the GDP, agriculture remains largest economic sector and plays a significant role in the overall socio-economic development of India. Indian agriculture is dependent on monsoon and is called "Gamble of Monsoon". Among the non-food crops, oilseeds, fiber crops, several plantation crops and forage crops are important. Rice and wheat are the principal food crops grown over the large tract (about 70 per cent of agricultural land) of the country.

Economy and Development

According to 2001 Census, a little over 27 per cent of India's population lives in 5161 urban centres. Going by the world average of 47 per cent living in urban areas, the share of urban dwellers is rather small, but in terms of total size, the urban population is huge by any measure. At least three cities namely Mumbai (16.37 million), Kolkata (13.22 million) and Delhi (12.79 million) contain a population size of over ten million persons. More than a million people reside in as many as 35 cities of India. The cities of India are a paradox in themselves displaying urban features comparable to any developed country and simultaneously retaining poverty and squalor as evident in the presence of slums supporting over 40 million people.

The country however has made strenuous strides in achieving rapid development of its industrial base from traditional iron & steel, cotton, jute and sugar to engineering, computer, information technology, communication and biotech industries. However, poverty continues to be a major hurdle in faster socio-economic transformation. The National Sample Survey for 2004-05 estimates rural poor at 28.3 per cent and urban poor at 25.7 per cent of the respective population. The Five Year Plans and several other developmental schemes are geared to the upliftment of the poor and weaker sections of the society. Since 1991, the liberalization of the economy and the increasing integration of India with the global economy have helped GDP to grow at 9 per cent or more at the present. India in 2000 announced the introduction of Special Economic Zones (SEZs) for enhancing foreign investments and to promote exports. More than 500 SEZs have been proposed, 220 of which have been created until 2007.

Human development has become an important agenda in the development paradigm in India. Growth and development in literacy have been accorded primacy for such an agenda. According to Census of India (2001), 64.8 per cent of Indian population is literate. There exists however a huge disparity in literacy attainment between the sexes as also among other social groups particularly the scheduled castes and the scheduled tribes. Various programmes such as National Literacy Mission, *Sarva Shiksha Abhiyan* and non-formal education etc. have been launched with a view to achieving total literacy in the years to come. Improvement in health has been an important agenda in overall strategy through the planning period. Sustained effort at improving the health of the people has borne some results in bringing down the crude death rate to 8 per thousand and life expectancy has substantially moved up to 64 years.

Improvement in transport and communication in a vast country like India has been recognized as an important sector of development. Total length of roads in India is over 3.0 million kms including both metalled and unmetalled roads. In terms of road length, India has one of the largest road networks in the world. The National Highways account for less than 2 per cent of the total road network but carry 40 per cent of the movement of goods and passengers. The total rail route length is about 0.063 million kms and of this 0.013 million kms is electrified. The railways carry over 11 million passengers and 1.1 million tones of goods every day. There are 14,500 kms of waterways and 346 airports in India. Communication facilities show a phenomenal growth during the recent years. Public phone booths, mobile phones, internet facility have grown rapidly in India. The landline telephones have expanded from about 0.084 million connections at the time of independence to about 40 million by the year 2007. In addition, there are about 217 million mobile phones in India in 2007.

Culture, Ethics and Unity in Diversity

A grand synthesis of cultures, religions and languages of the people belonging to different castes and communities has upheld its unity and cohesiveness. It is this synthesis which made India a unique mosaic of cultures. People belonging to several faiths-Hinduism, Jainism, Buddhism, Islam, Sikhism and Christianity have coexisted for centuries in a shared space. Diversity in India is not merely confined to racial, religious and linguistic distinctions but also permeates deep into patterns of living, life styles, land tenure systems, occupational pursuits, inheritance and succession law, together with local practices, rites and rituals related to social norms and values. The Indian cultural tradition is unique. The notions of *dharma* (normative order), *karma* (personal moral commitment) and *jati* (caste) as the hierarchical principle of social stratification are basic to Indian society. Twenty three Indian languages are listed in our constitution and more than 544 dialects are spoken in the country. Pali language was prominent in ancient India. Sanskrit enjoyed the status of carrying Hindu *Sanskritic* culture throughout the country. These were followed by the modern Indo-Aryan languages. The institutional basis of social order and socio-economic interaction among communities like *Jajmani* system remained unchanged to a large extent. A plural and multi-ethnic society like India would have an overlapping of ethnic, caste and class groupings. There are more than 285 ethnic tribal communities in India accounting for over 8 per cent of her population. The tribes themselves are not a homogenous group, but display remarkable heterogeneity in their racial, linguistic, religious composition as also in their modes of living and levels of development as well as in the level of socio-cultural integration. In spite of this great diversity, India continues to swear by its commitment to secularism and practices democratic form of governance. The federal principle of governance has provided a sense of identity to most people.

LITHOSPHERE, HYDROSPHERE AND ATMOSPHERE

Resource and Environment

R.B.Singh

Rapid environmental changes like climate change, environmental degradation, loss of biodiversity, and declining natural resources are threatening our life support system and these issues cut across administrative boundaries. Rural poor are the worst victims of environmental degradation and deserve a better deal (Singh, 2007).

Indian environment and ecosystem regions are stressed due to rapid population growth, underdevelopment and careless application of developmental technology. Major drivers of resource use include population growth dynamics, demand for food and incidence of poverty, stress on water, desertification, deforestation, soil erosion, climatic change, pollution, and land use/cover change. Case studies include land, water, forests, coastal and marine resources. There is a lack of integrated techniques and approaches to sustainable resource use in the vulnerable environment (Samant and Joshi, 2005; Sathyakumar, 2004). Integrated Watershed Management in recent years is emerging as an important tool for resource management. Integrating complex resource-environmental interactions within space provides an important base for sustainable environmental planning and management. The physical settings like mountains, deserts, valleys, coastal and marine life and their resources influence people, but on the other, they transform their surrounding into different cultural landscapes and resources (Singh, 2004; Singh, 2006).

Regions are units for studying and developing environment. As the seventh largest country in the world, India is a challenge for the researchers to locate viable natural resources. The enormous variety of ecosystems in India ranges from alpine zones in the Northern Himalayas to sandy coastal beaches at the southern peninsular tip. To the west lies, an arid expanse of desert and on the east a flood prone delta. Between the Northern - Southern and Eastern - Western extremes are fertile agricultural lands, free flowing rivers and groundwater, a myriad of dense forests, and minerals and natural gases. Entrusted with the monumental task of surveying the land for these four types of resources are four respective agencies: the Botanical Survey of India (BSI), the Central Water Commission (CWC), the Forest Survey of India (FSI), and the Mineral Exploration Corporation Limited (MECL). Each agency is the initial step towards the transformation of a natural resource into a useable product. Geographical education is facing serious crisis both in terms of quantitative and qualitative aspects in order to face national and regional resource degradation.

Drivers of Environmental Change and Development

According to World Commission on Environment and Development, the environment is where we live; and development is what we do to improve our well-beings. Both are inseparable. Major human driving forces of environmental use include

(a) Demographic change of environment in which there is relationship between population growth and other demographic factors such as migration; (b) Land use and land cover change includes biophysical and social dimensions of rapidly changing land use, human settlement and land cover patterns; (c) Urbanisation and industrialisation transformation highlights the linkage between dimensions covering environmental services and infrastructures for regulating the environment; (d) attitude and behaviour and their role in driving environmental responses and the potential role of alternative development paths; (e) decentralised decision making process promoting the linkages between national, regional and local skills and the constraints to the transfer of policy instruments from one region to another. In recent years, dimensions of environmental change has encompassed a full range of social sciences disciplines necessary to analyze and understand people's role as both the possible cause and target of environmental change as well as recognising the local issues and use of local field based geographical studies supplemented by national and regional data. This should provide an indispensable contribution to analyze the key driving forces of land use maintenance and change and especially reflects the wide diversity of economic, social, cultural and institutional practices and traditional knowledge at the local level (Phutego and Chanda, 2004).

This promotes interaction between local and regional communities, conflict prevention and resolution in critical environmental situations. This has direct implications for policy development and implementation in order to develop strong links between research community, policy makers and environmental management experts.

Resource Survey and Inventory of Vulnerable Environment

Vulnerability provides a basis for analyzing resource and environmental pressure. Vulnerability depends on exposure and sensitivity to impacts and the ability to cope or adapt. The Resource Information System (Mohammad *et al.*, 2007) has to be considered as multidimensional *i.e.* attribute dimension, spatial dimension and temporal dimension. Indian geographic education offers such capabilities as they integrate multi-sector, multi-space, and multi-period perspective. Vulnerable environment is highly sensitive and responds rapidly to anthropogenic intervention. Its restoration needs a long time, especially if the vulnerable environment is degraded or stressed beyond a certain point (Singh, 2007; Blaikie, 2005). Observations using remote sensing and GIS, such environmental changes allow identification of major processes for change and by inference, the characterisation of ecosystem dynamics. Empirical diagnostic models of environmental change can be developed from these observations. New technology applications for safeguarding the environment have increased dramatically in recent years (Singh, 2007; Ajai, 2004; Thangamani and Rao, 2007). The development of regional and global models can simulate both the socio-economic and biophysical driving forces, interactions, feedbacks and their responses to environmental change.

Forest and Biodiversity

Biodiversity loss restricts our future development options (Singh, 2008). India is rich in flora. Considering that agriculture employs 64 per cent of the labor force, it is agriculture which is the mainstay in almost every state in India. Forests in India constitutes 22 per cent, land not available for cultivation is 14 per cent, permanent pastures are only 4 per cent, whereas land under miscellaneous tree crops etc. are only 1

per cent. Total cultivable wasteland in India is 5 per cent, fallow land is 8 per cent and net area sown is 46 per cent (Forest Survey of India, 2005; Government of India, 2004, 2007). Currently available data place India in the tenth position in the world and fourth in Asia in plant diversity. From about 70 per cent geographical area surveyed so far, the Botanical Survey of India has described 47,000 species of plants. Indian Geography, which integrates physical and social aspects of surrounding, can play effective role in environmental management (Bisht *et al.*, 2004; UNEP, 2007). In assessing environmental change and prediction of future of that environment in an integrated and holistic manner, there is a number of emerging research areas relating to environmental changes which require geographical enquiry in Indian context. The understanding of global environmental change requires integrated emphasis on some promising geographical tasks, i.e. reconstruction of landscape processes, environmental history for ecosystem, state of environment and resource use, modeling of the dynamics of present day landscapes, analysis of causes and consequences of anthropogenic changes. This is possible with enhanced Geographic Information System (GIS) supported by detailed site studies (Singh and Mishra, 2005).

Urban Environment and Climate Change

Energy, industrial development, air pollution and climate change are critical to human security. In Mega cities, urban heat islands phenomena is emerging due to land use change, building materials, industrial development and transport congestions (Singh, 2006, 2007). Much of the urbanisation in India is taking place in metropolitan cities, and is accompanied by major changes in the social, economic and technological arenas. Many of these global trends are also apparent in India. Delhi metropolitan region has faced even more rapid rate of urbanisation and environmental change than the average for India. This accelerated urbanisation trend has environmental costs. This includes air and water quality problems, waste removal and disposal; and the metropolis and the development corridor (Singh and Singh, 2007) in which it is located have an impact on the surrounding country side through the depletion of resources such as food, portable water, and aggregated building materials. This is causing immense change in land use patterns as well as human response from the surrounding rural areas. The land use change is primarily from agriculture to residential/industry or brick kilns. In this process the region faces severe problems of land degradation (Goel and Singh, 2006; Singh, 2007).

Resource degradation, specifically land and water degradation, in the rural-urban fringe of Delhi, are the core issues. In this regard, the critical issues are (a) environmental criticality (b) environmental endangerment (c) environmental impoverishment and (d) environmental sustainability. Land mining, quarrying and resulting soil erosion due to excessive excavation is the major environmental concerns. Apart from agricultural land, common land used for cattle grazing and pastures have also degraded. Sectoral areas are moving to non-farm activities such as brick kiln, warehouses, factories, farmhouses and nurseries.

Urbanisation is a major anthropogenic force in transforming landscape, energy use, environmental quality and human populations. Inadequate access to urban basic services and infrastructure facilities pose serious problems to metropolitan resource base. Keeping these cities functional and sustainable is an environmental challenge in spite of investment requirements and constraints of administrative and regulatory controls. In

spite of higher investments on a per capita basis, even relatively privileged urban population has not been able to meet its needs. An effective urban planning policy and practice could help urban planners and decision makers to prioritize environmental problems and other policy options in order to meet environmental challenges (Jha and Parihar, 2007).

Certain aspects of the urban planning have received attention in the five-year plans, such as finance for housing, slum clearance and improvement, water supply and sewerage, transportation, preparation of city master plans. However, funds allocated are indeed meager and a lions' share is allocated to a few major projects in some states. Thus, urban planning and environmental management strategies should ensure how the problems of urbanisation are to be integrated into the larger issues of regional development.

The role of the oceans in shaping the global environment needs to be understood and the key interaction linking ocean process and the climate change needs to be highlighted. This is further supplemented by incorporating changes in past global environment. The ice-cores, ocean and lake sediments, tree rings, pollen and coral deposits are considered as natural archives for understanding past global environment. Indian Geography is trying to reorient the approaches in above context.

Land and Agricultural Resources

With rapid population growth demand on land resources is increasing. Subsequently, risk to land resource sustainability is also intensifying. Considering that agriculture employs 64 per cent of the labor force, it is not surprising that agriculture is the predominant mainstay in nearly every state. Agricultural geography has been the subject of intensive research and monitoring during the post independence period. Considerable data already exists at national, state and district level. But, agro ecosystem research and education are being preferred by geographers in order to provide particularly a strong base for detecting responses to global climatic change and preferred differentiating effects of climates, pollution and land use (Singh and Shah, 2004, Singh and Shah, 2007). The impact of increasing CO₂ concentration in the atmosphere will have enormous effect on agriculture and vegetation. It is important to understand processes relating to changes in land use affecting the resources of the river basin and coastal zone. A focus on agro ecosystem in Indian geography is highly imperative, highlighting different agriculture ecosystems of India, agricultural input environment, ecologically based pest management and eco-farming (Jha and Singh, 2008).

Water Resources

Fresh water availability and conservation of surface water resources are basic to human survival. The hydrological cycle is greatly influenced by changing land use and land cover in India. The large-scale deforestation may cause significant changes in regional and global climate. The rainfall variability in both time and space makes water availability and plant productivity quite uncertain. India has more than 60 per cent of its land under rainfed areas, difficult to manage in a sustainable manner. With growing urban impact on groundwater, supply of fresh water is getting contaminated. Recent studies indicate degradation of the water resource in the Himalaya resulting from erosion, flooding (Singh and Singh, 2007), and scarcity of water and degrading water quality

(Singh, 2004). In geography, monitoring and manipulating experiments are required to study *in situ* for understanding of the hydrological processes and their interaction. Literature related to watershed management, micro-watershed, integrated water resource management and different tools and techniques related to water conservation have been reviewed (Mushir and Khan, 2007; Singh and Bortamuly, 2005).

Wetlands Resources and Mangroves

Wetlands and mangroves are considered rich in biomass productivity. However, these are under serious threat for development of aquaculture, ponds, roads and ports. India has a wealth of wetland eco-systems distributed in different geographical regions from the cold arid zone of Ladakh in the North to the wet humid climate of Imphal in the East, the warm arid zone of Rajasthan in the West to the tropical monsoon Central India and the wet and humid zone of Southern Peninsula. Most of the wetlands in India are directly or indirectly linked with major river systems such as Ganga, Brahmaputra, Narmada, Tapti, Godavari, Krishna, Cauveri, etc. Significantly, a directory on wetlands in India, recently published provides adequate information on location, area and ecological categorisation of wetlands. India is signatory to the Convention on Wetlands of international importance, especially as Waterfowl Habitat (Ramsar Convention).

Mangroves are salt-tolerant forest ecosystems found mainly in the tropical and sub-tropical inter-tidal regions of the world. India harbours some of the best mangroves in the world and these occur all along the Indian coastline in sheltered estuary, tidal creeks, backwaters, salt marshes and mud flats. As per the State of Forest Report, 1997 the total area covered by mangroves in India is estimated at about 6,000 sq km (Paul, 2006; Rajput and Srivastava, 2007). The importance of mangroves in retaining biodiversity, capacity for salt tolerance and stabilizing the shoreline can hardly be minimised.

Mountain Environment

Mountain resources are getting enormous stress due to snow melting and glacial retreat (Bhattacharya *et al.*, 2006; Dobhal *et al.*, 2004). The scope of altitudinal gradient studies *i.e.* large change in altitude over short distance associated with significant change in climatic gradient varies from local studies at micro ecosystem to temperate and alpine region. Notable contribution from geographers in this context have come in studies related to assessment and modeling of the interactive influence of topography and land surface heterogeneity on the spatial pattern of soil moisture evapo-transpiration, runoff generation and erosion (Mishra, 2007; Sen Roy and Singh, 2007).

Disasters, be they natural or man-made, are the real constraints to development and are a threat to our environment. The enormous economic losses from natural disasters and the massive relief expenditure make disaster reduction a condition for sustainable development. Development programmes can be so designed as to decrease susceptibility to disasters. Disaster mitigation will have to become a part of national development. Environmental protection is also an essential input in the prevention and mitigation of disasters. The complex cause and effect relationship of disasters and the environment and its impact on development are being carefully understood in recent years as evident in a few studies related to these (Singh, 1998, Singh, 2005, Singh, 2006).

Mountain regions make up one-fifth of the Earth's land surface, and they have a considerable role and global importance as environmental resources. Mountains are home

to a substantial portion of the planet's diversity of species and ecosystems. Ironically, all over the world expanding economic pressures are degrading mountain eco-systems while confronting mountain peoples with increasing poverty, cultural assimilation, and political disempowerment (Joshi and Gairola, 2004; Silori, 2004, Singh and Anand, 2006).

Wasteland Resources

The National Wasteland Development Board (NWDB), New Delhi, 1986, describes wastelands as 'degraded land' which can be brought under vegetative cover, with reasonable efforts and which is currently under utilized and land which is deteriorating for lack of appropriate water and soil management or on account of natural causes. According to a report on soil conservation in the country, every year 12,000 million tones of fertile land cover is directly and indirectly destroyed due to the natural calamities. Because of such causes every year about 3 thousand ha land converts into the wastelands in the country (Singh and Singh, 2007).

Development of wastelands and their sustainable management has become one of the important and major ecological issues of concern for the national policy makers. Land resources being limited in arid and semi-arid regions of Rajasthan these very resources are depleting at an alarming rate rendering vast areas to the status of degraded land converting into wastelands (Convention on Biological Diversity, 2006). Because of the continuous exploitation of these resources the existing environment has become unbalanced, resulting expansions in wastelands (Kothari, 2006).

Resource Conservation and Environment Management

In recent years, India is becoming one of the important countries encouraging non-governmental initiatives for resource management, environmental and developmental capacity building with a view to achieving sustainable development. These attracted greater attention after 73rd and 74th Amendment in the Indian Constitution encouraging participatory decision-making and empowerment of the people. The effectiveness of such participatory approach has been particularly profitable in areas of disaster management (Singh, 2007). The NGOs have also been quite successful in conducting training, education programme and the management of health delivery system during emergency (Trivedi, 2004).

As biophysical and the social processes are integrated in an ecosystem, there is an interactive linkage and connection between human impacts on the environment and environmental impact on human. Geographers are better placed to understand such location specific and time specific interaction. In India, environmental impact assessment is emerging as a major tool for ensuring environmental quality as an essential component of decision-making processes of any developmental programme. In this context, it is suggested that environmental and social approaches should be linked and established for better understanding of Indian environment (Joshi and Joshi, 2004).

Concluding Remarks

The degree of environmental changes differs with differences in policy perspectives and community choices. Resource and Environmental issues are multi-disciplinary by nature involving assimilation and interaction between basic services on matters pertaining to the environment integrating conventional and modern techniques

and approaches. To have a better understanding of vulnerable environment, Indian Geographers focus on how physical and human ecosystems operate and interact. However, there is a lack of integrated techniques and approaches to vulnerable environment. In recent years, Integrated Watershed Management is emerging as an important tool for resource management. Understanding complex resource-environmental interactions in space provides an important base for sustainable environmental planning and management. Their physical settings and resources influence people. There is a need to identify challenges and opportunities for improving human well- beings through vulnerability analysis of different ecosystems and community groups.

Geomorphology

Suresh Jog

Process studies in post-Daviesian era have been largely responsible for major shifts in the subject matter and have provided methodological revolution in the subject and made the subject more applied than ever before. In recent past with a growing awareness towards the environmental problems and the imbalances leading to hazardous situations, the role of the geomorphologists is being increasingly recognized as pre-eminently necessary. Geomorphology of late is being considered as a science contributing towards the natural resource management mainly in terms of management of land, water and soil resources. Problems like stability of coastal structures, desertification, land resource appraisal etc. are emerging as major topics of research being handled or expected to be handled by the geomorphologists. As a result micro studies are gaining importance all over the world and the same is slowly getting reflected in a number of research articles appearing in the journals.

In the Indian context the trend is not very different from what is seen on a global scale. "Use of remote sensing technique and GIS" appears as a favoured suffix in many titles. The techniques and tools of research gain importance in such attempts and at times one wonders if the original topic of research is getting camouflaged in the description of these tools and techniques. Nonetheless it appears that using this suffix is gaining more popularity.

During the period under consideration– 2004 to 2008, most of the research articles appearing in Indian journals devoted to geographical research on the theme, this trend is well reflected. The following Indian journals have been referred to for a quick survey of this trend report on geomorphological researches.

Indian Journal of Geomorphology - Allahabad

Indian Journal of Landscape Systems and Ecological Studies – Kolkata

Transactions of the Institute of Indian Geographers – Pune

Geographical Review – Kolkata

Deccan Geographer – Pune.

Although not quite exhaustive, research articles which have found their entry in these journals provide a fair idea as to the state of the art in this segment of study. Amongst these the Indian Journal of Geomorphology, Published by the Indian Institute of Geomorphologists, Allahabad is the only journal fully devoted to geomorphology. Other journals include papers of different branches of geography and hence the number of articles on geomorphological research is quite limited. The only other journal wherein the number of articles is fairly high is the Indian Journal of Landscape Systems and Ecological studies from Kolkata. Some 60 plus articles, appearing in the above mentioned journals, have been referred for preparing this report.

The articles cover a wide range of topics from fluvial to coastal or from regional accounts to specific processes. Understandably the articles on fluvial landscape and processes outnumber other branches. Amongst the articles related to fluvial geomorphology explain the morphometry of drainage network and quantifying various aspects of basin characteristics. There are some articles that deal with the processes and provide some methodological components. In this context a mention may be made of the

article dealing with high magnitude floods. Soil erosion, degradation of soil resources is another area where geomorphologists are showing concern. About 8 per cent of the articles are devoted to this aspect. Another area of research concern wherein the geomorphic enquires are more frequent pertain to hydro-geomorphic studies. Most of the authors have made use of remote sensing data for demarcating the potential zones and through this they are also targeting the appraisal of water resources along with the land resources. Articles mainly devoted to land resource appraisal are dealing with the problems of resource management and various processes such as gully erosion, ravine development and slope wash processes etc. However, the quantification of the processes and exact nature of degradation that is taking place needs to be incorporated in such researches.

The coastal landforms and processes is the next important group that emerges out of this review. The vulnerability of the coast to erosive action, threat to the fragile mangrove ecosystems and the place deposits along the beaches are some of the topics covered in this section. The articles on morphodynamics of tidal inlets, slumping of sea cliff are largely devoted to coastal processes whereas articles on mud beach or lagoon describe the morphological aspect of the given forms.

The aeolian landforms and processes are dealt with in the articles on dune formation and desertification. However there are relatively fewer articles in this section.

In articles on geochronological classification or river dynamics, the spatial scales are somewhat enhanced. These relate to larger regions. One wonders why regional geomorphic studies are relatively few. With the tools of remote sensing, regional studies are becoming possible and it is precisely this area that appears to be getting neglected in Indian context.

There are some interesting studies like identification of seismic gap or ground tilt due to uplift. However these are not necessarily dealing with the geomorphology of the region. Nonetheless they provide good information and interesting interpretation.

Climatology, Soil Geography and Bio-Geography

A.K.Bora

The sub discipline of Geomorphology continues to dominate in terms of the volume of publications in Physical Geography. In comparison to preponderance of published works in this field, fewer works pertaining to the fields of Climatology, Soil Geography and Biogeography are noticeable. As these fields of geography have traditionally good links with disciplines like Meteorology, Soil Science and Life Sciences, the range of non-geographers' contributions to the study of climate, soil and bioresources is considerable compared to that of the geographers. A perusal of Indian geographers' works in the fields of Climatology, Soil Geography and Biogeography suggests much more strengthening of research endeavour in these fields.

Climatology

Traditionally Climatology occupies an important position in Physical Geography. But, in proportion to its potential significance and relevance, the study of climate, in fact, finds no due weightage in the works of geographers (Bora, 2004). Geographers' works on climatology have become generally limited and it is more so in the case of Indian geographers.

Climate being a dynamic entity changes in time and over space. The changes in climate have their resultant impact on global environment. Climatic changes and their consequences have become an important theme in climatological study. Sharma and Khan (2004) give a well-organized discussion on ozone depletion and its possible environmental consequences. Sharma *et al.* (2008) have analyzed the role of climatic controls in desertification process in the semi-arid region of Rajasthan. Geomorphological indicators of climate change have been studied at length by Singh (2005). On the basis of a wide range of indicators chosen the author provides vital clues to climate change detection. Akhtar and Hironi (2005) have discussed the problem of acid rain and its potential threat on plant communities. The study in general carries an analysis on the impact of acid rain on forest, crops and other vegetations. Incidence of malaria in Assam has been discussed by Bora (2004) by an evaluation of the geo-ecological base, especially the climatic determinants using remote sensing technique.

The role of monsoon in Indian life has been a favourite topic for geographers working on Climate. There are a few important contributions on behavior of monsoon in India. A hydro-meteorological study carried out by Sarkar (2004) on high intensity rainstorms in the Upper Tista basin provides adequate understanding of basin hydrology and runoff characteristics. Working on a popular theme *i.e.* extreme events, that has attracted international attention on the wake of the consequences of global warming and climate change, Starkel and Singh (2004) made a serious attempt to understand the intimate relationship between rainfall, runoff and soil erosion in the globally extreme humid Cherrapunji region of India. In another important study Singh (2007) studied the rainfall– runoff conditions in Meghalaya Plateau of India. This study primarily deals with the analysis of geo-hydrological characteristics and runoff pattern in the plateau. The rainfall distribution pattern caused by orographic effects in North–East India has been discussed by Syiemlieh and Das (2004). This study analyses the distributional pattern of rainfall on a SW-NE axis from Cherrapunjee at the edge of the Meghalaya Plateau to

Majbat at the foothills of Arunachal Pradesh. It has been found that the influence of orography on rainfall variation is most visible in rain-shadow and hilly areas where rainfall variability is moderate to high.

Monsoon floods are common in Indian rivers, which are governed directly by the effect of monsoon rhythm. Large monsoon floods bear substantial potentials for effective geomorphic work. Using quantitative techniques of measuring the total energy generated during the floods during the monsoon in the Narmada River, Kale (2008) demonstrated that large-magnitude floods are effective geomorphic agents in monsoon-dominated rivers. Besides, there are a few micro-climatic studies on regional climatic patterns. For example Sahariah and Bora (2005-06) using GIS technique studied the pattern of micro-climatic variations in and around the wetland system of the floodplain of Darrang District, Assam and found that such micro-level variations in climatic parameters may provide significant insight into the management and conservation of the wetlands. In an analysis of the impact of topo-meteorological factors on industrial siting in Musi river basin of Andhra Pradesh, Padmaja *et al.* (2005-06) emphasized on the quality of air while selecting a site for industrial expansion. In this study air pollution due to industrial siting is highlighted, which is greatly influenced by topo-meteorological factors. Barthakur (2004) has discussed at length the weather and climate of the Brahmaputra valley of India by classifying the climatic types and characteristics. While providing an elaborate description of the geophysical basis and physiographic framework of the SAARC nations, Bora (2007) presented an analysis of the prevailing climates and their variations separately for each of the SAARC nations.

The coastal zone of India is subject to various cyclic and random natural processes and extreme events both natural and man-made, which continuously modify the region. A study (Panda *et al.*, 2007) using remote sensing and GIS techniques of tracking, monitoring and forecasting of cyclones, assessed the damages and necessary protective measures. Dikshit (2006) also discussed the genesis, development impacts of a devastating cyclone along the Mississippi coast in 2005. Koul (2008) analyzed the impact of extreme climatic conditions leading to geomorphic hazards in the Himalayan domain.

Soil Geography

Studies on land resources with special focus on soil quality analysis and evaluation are attaining prominence in recent years in India, especially in view of the growing demand of food grain production. Needless to mention that soil geography has direct relationship with geomorphology and biogeography. However, apart from purely pedological studies carried out in various soil research laboratories and institutes, contributions from geographers in these areas of study leaves much to be desired. The few studies reviewed here are associated with geomorphological, biogeographical and land resource related studies.

Considering the soil characteristics as one of the criteria, the land capability of the Palar river basin has been evaluated by Thangamani *et al.* (2007). Shashikala and Padmaja (2005-06) using GIS techniques made an attempt at preparing a sustainable land resource development and management plan for Nampally Mandal in Nalgonda District in Andhra Pradesh.

Some of the studies in soil geography lay emphasis on soil characteristics as essential ingredients for agricultural productivity, land management and landuse

planning. In this context the study conducted by Ram *et al.* (2006) on evaluation of soil suitability for *rabi* crops in the semi - arid zone of Haryana using visual and monoscopic interpretation of Landsat TM-FCC data along with India topographical sheets is noteworthy. The impact of brick making on soil fertility and agricultural productivity was carried out by Singh and Asgher (2004) based on field surveys and the study clearly brings out the negative impact of brick manufacturing on land capability, loss of soil fertility and declining agricultural productivity. Panda (2007) examined the landuse potential with special reference to soil analysis in different geomorphic divisions of the Taraphini–Bhairabanki river basin. The study conducted by Bhattacharya and Dey (2007) concluded that there is a close relationship between soil and crop types and suggested that crop rotation and mixed farming in the study area should be practiced to maintain the soil quality. Bora (2007) too discussed the soil characteristics of the SAARC countries while examining their geo-physical bases and physiographic framework. Severe soil erosion leading to land degradation has been discussed by Patra and Thakur (2005) in the work relating to study on spatial pattern of land degradation in the northern highlands of Orissa. Doi (2005) assessed intensification in spatial extent of ravine land with respect to sub-watershed areas.

Biogeography

Biogeography continues to be a less emphasized branch of physical geography despite its growing importance in the field of environmental studies. This is notwithstanding geographers' view of it as a vital link between physical and human geography. Man's role as a dominant ecological agent has been emphasized in many biogeographical works (Bora, 2004). Most of the works of Indian geographers in the field of biogeography are found to follow this trend. In view of the recently emerging environmental problems, most of the biogeographic works primarily aim at examining the spatio-temporal dimensions of various environmental issues, *viz.* changing man-environment relationship, habitat ecology and its destruction, deforestation, landslides, loss of biodiversity and bio-depletion processes.

Gurjar (2004) for example, discussed the provisions of Convention on Biological Diversity (CBD) adopted in the Rio Earth Summit in 1992. The author took stock of the status of biodiversity in India and the imminent challenges. A detailed discussion and systematic analysis of biodiversity in the state of Assam (India) has been carried out by Bhagabati, Kalita and Baruah (2006). A study by Pagare (2007) examined geographical dimension of medicinal plant resources in forested regions of Betul Plateau, Madhya Pradesh. The study of Andhale (2004), confined to the riparian vegetation of Upper Nira and Kanand Basins of Maharashtra advocated the significance of vegetation as a factor of fluvial geomorphology in the upper reaches of the basins. Ahmed *et al.* (2005) studied the problems of wetland degradation, identified as a serious threat to biodiversity. Studying the dimensions of tiger straying hazards in Sundarban Das (2005), found that scarcity of prey in the forest areas of Sundarban is not the cause for tiger straying. Working on a similar focus, Saikia (2007) concludes that tiger habitat in Assam does not seem to be under threat from future climatic factors though human agent will be a critical factor. The Desert National Park of Rajasthan has been rightly identified by Meena (2005) as a unique biosphere reserve for conservation and development of biodiversity in India. Das *et al.* (2006) have examined the conservation priority for Black-breasted Parrotbill,

Marsh Babbler and Jerdon's Babbler in the Dibru Saikhowa Biosphere Reserve of Assam. The work has identified priority issues for conservation of some bird species in the study area.

Taking a case study of Ukhrul district of Manipur, Singh and Shah (2004) have established how *jhum* cultivation has put a threat to biodiversity of the region. It is suggested in the study that only the economic development of the tribal people would enable them to overcome the compulsions of overexploiting the living natural resources of the region. Environmental aspects of mining in Meghalaya have been discussed by Rai (2005). This work examines the various dimensions of impact of mining on the bioresources of the region.

INTERPRETATION OF ECONOMIC PHENOMENA

Agricultural Geography

Abani Kumar Bhagabati

By contributing nearly one-fourth of the GDP and providing livelihood to around 70 per cent of the population, agriculture continues to be the backbone of the Indian economy. Spatially it is the most widespread economic pursuit claiming more than 40 per cent of the country's total area. It is also equally important that the diverse cultural landscapes that rural India manifests are basically the product of peoples' judicious response to the available land and other environmental resources for raising crops and livestock. Not surprisingly therefore Indian geographers have been paying serious attention to the study of agriculture and associated issues during last several decades.

Landuse/Landcover and Land Capability Studies

Landuse/landcover and land capability studies have got a renewed emphasis as the process of agricultural use of land has been in a flux in the wake of fast changing national economy under the new global order. A number of studies on landuse/landcover and land capability using both conventional and modern techniques appeared during the last four years. Tribedi and Dubey (2006) using satellite imageries and aerial photographs delineated various landuse categories in Damoh area of Madhya Pradesh for planning purposes. They determined the changes in forest area, urban area, agricultural land, etc. and suggested measures for improvement in the landuse condition. Das (2006) analyzed the changes in landuse pattern in Assam and its implications for sustainable economic development in the state. The study carried out by Narayanakumar and Kumaraswamy (2006) using remote sensing techniques pointed to the fact that the agricultural practice along the fringe of the lake Oussudu contributes both nutrients and contaminants to degrade the natural aquatic environment. While discussing the causes of landuse/landcover changes in Ukhrul district of Manipur, Singh and Shah (2007) held the traditional practice of *jhuming* responsible for rapid shrinkage of forest cover. Thangamani and Rao (2007) on the other hand, evaluated the land capability of the Polar basin of Andhra Pradesh on the basis of physical characteristics. The study suggested cultivation of certain crops suitable for each of the land units. Joji and Nair (2004) dealt with problems associated with the wetland ecosystem, deforestation and landuse/landcover for sustainable management of environment in Vamanapuram river basin of Kerala. Most of these studies represent continuation of earlier attempts using similar methods and techniques.

Shifting Cultivation

Among the agricultural systems, shifting cultivation has a long history of its association with the tribal communities living in the tropical hilly tracts. Continuation of this primitive practice, defying changes through modernization witnessed in the adjoining plains, has been attracting the attention of agricultural geographers since long. A vast

fund of research wealth has accumulated by Indian geographers on various issues concerning shifting cultivation.

An attempt by Dikshit *et al.* (2004) to probe into the historical background, persistence and modification of shifting cultivation in course of time in an area like the Konya valley, Western Ghat is quite refreshing in this context. They discussed the evolution, spatial extent, crops cultivated, yield, suitability level and other aspects of this type of agriculture which may be helpful in exploring better alternatives. Bora and Saikia (2007) in a similar study suggested measures and a workable landuse model for viable and eco-friendly control and management of *jhumming* (shifting cultivation) practiced in the hills of Assam. Other works in this line include those of Singh and Shah (2004), Panda (2004) and Bhattacharyya (2005).

Agro-Ecological Concern

Till recently, the agro-ecosystems in most parts of India were almost in tune with local natural environment. Cropping pattern and farming methods practiced were largely determined by the prevalent ecological conditions and socio-cultural traditions (Bhagabati, 2007). But rapid population growth, technological development and growing market forces have recently encouraged the farmers to opt for cropping intensification using modern infrastructure, techniques and inputs. These changes are responsible for deterioration of the agro-ecosystems in different regions of the country, especially in the drier areas.

The study conducted by Mohammad and Sekhri (2006) on agricultural modernization and groundwater depletion in Ludhiana district, Punjab is worth mentioning in this context. The authors concluded that unless a balance between technology application and groundwater use is maintained, the sustainability of agriculture in the region would be jeopardized. In a similar attempt, Shashikala and Padmaja (2005) concluded that moisture adequacy becomes an important parameter in estimating the need for irrigation and exploring alternative crop combination to make agriculture more sustainable. Bhattacharyya (2007) observed that the net influence on agricultural landuse manifests itself through variability of farming as the rural society in Medinipur in West Bengal is shaped by the interplay of local environmental hazards, landuse pattern and peoples' initiatives. Singh (2004) in an interesting study in Bahraich U.P. indicated at disturbance to food-chain due to excessive use of chemical based insecticides, pesticides and fertilizers. He advocated for safer practices in this regard. Studies made by Singh and Shah (2004), Yadav (2004), Singh and Asghar (2004), Soundaram and Venkateswari (2005), Ram (2006), Swaminathan and Subramanyan (2006) and Bhattacharya and Dey (2007) are also worth noting in this regard.

Diversification and Diffusion of Crops

Diversification, diffusion, concentration, intensification of crops is some of the concepts/measures often involved in studies of agricultural geography. Dynamics and spatial characteristics of agriculture in an area may be well assessed using these concepts and measures. During the period under review several studies on such themes appeared (Hurakadli, 2006; Gupta, 2005; Kaur and Kaur, 2006; Singh, 2006). Using crop diversification index of Bhatia and Singh; Hurakadli and Singh analyzed crop diversification pattern in Belgaum district, Karnataka and Haryana respectively. Both the

authors stressed on the importance of such studies in micro-area planning for agricultural development. Gupta (2005) examined the status of crop diversification in Panchkula district of Haryana. The study concluded that application of modern technology has been an important factor in diversified crop pattern, though strong physical control in some areas limited the cropping practice simply to monoculture.

A study conducted by Kaur and Kaur (2006) analyzed the process of diffusion of apple in Himachal Pradesh during the period 1951-95.

Agricultural Productivity, Efficiency and Development

These three interrelated aspects of agricultural performance have always been at the core of studies covered under agricultural geography in India. Various measures and analytical frame have been evolved by Indian geographers to study these aspects from different perspectives. Achievements of agricultural geographers in these fields of study are noteworthy.

In a study by Singh (2006), the characteristic features of agricultural development in different agricultural systems prevalent in North-East India were examined. The case of Assam and Nagaland representing two distinct systems—the hills and the plains— was taken up to present the variation in the level of agricultural development. Mishra and Mishra (2004) measured the spatial pattern as well as the general level of agricultural development in Jaunpur district, U.P. by transforming and combining the variables using the Z-score method. The study provides valuable inputs for micro-level agricultural planning in the district.

Mipun and Das (2004) and Taufique (2004) in their studies on agricultural production in the Brahmaputra valley and North Bihar Plain respectively attempted to address various aspects of population and crop production. Taufique applied the method evolved by W.Y. Yang for determining agricultural productivity in North Bihar at district level. In a similar study on agricultural efficiency in North Bihar Plain, Rahman and Hussain (2005) analyzed inter-district variation in agricultural efficiency by applying composite rank scores. It is a pity that most works on productivity and efficiency of agriculture generally avoid important socio-cultural variables, not easily quantifiable but extremely significant in determining performance of agriculture at micro-spatial context.

Food Security

Problems associated with food security in recent years have drawn serious attention of agricultural geographers in India in line with social scientists throughout the globe. It is now agreed that carefully planned agricultural progress with a view to saving rural livelihoods can only ensure availability of more food, jobs and income. As opposed to modern industries which promote jobless growth, agriculture including animal husbandry, forestry and agro-processing can promote job-led economic growth. Importantly, geographers of India have not neglected this vital issue. Studies made by Choudhury (2006) and others are significant in this regard. Choudhury made an attempt to discuss issues relating to agriculture and food security in Sikkim and observed that the state suffers from acute food shortage resulting from dearth of cropland on the one hand and traditional practice of agriculture on the other. Jha (2006) elucidated the concepts of vulnerability and food insecurity and tried to develop a theoretical framework to analyze the issues of food insecurity. He emphasized on the impact of population on food security

and vulnerability in Bangladesh, a problem-ridden developing country of South Asia. Das and Dutta (2006) investigated the problem of population growth and food availability scenario of the states of North-East India and suggested measures to reduce food scarcity and malnutrition in the region. Gatade (2004) assessed the carrying capacity of land in Satara district of Maharashtra on the basis of the standard nutrition units of both production and consumption to analyze the population–food balance in the district.

Dairy Farming

Like many other countries of the world, India has a long history of peoples' association with domesticated animals, especially cattle. Each farming family in the country used to possess some cattle for the purposes of ploughing, pulling carts and producing milk. Interestingly, among others, dairy farming provided sustenance to millions of Indian farmers, particularly the rural poor. However, this important sector of economy has been largely neglected by agricultural geographers. A recent study by Khandelwal and Khandelwal (2005) is significant in this context. They carried out a survey in Jaipur district, Rajasthan around a hypothesis that as dairying is a major source of income for marginal farmers, landless persons and other rural poor, it is a major factor in socio-economic changes experienced by the area. According to them dairying and allied activities may open up great possibilities for jobs for the rural poor, particularly women. In another work, Deka and Bhagabati (2006) made an attempt to identify locations of dairy farms in and around the city of Guwahati, Assam and to delimit the areas of their major concentration. They tested the validity of the Thunenian model with respect to location of the dairy farms.

Society, Culture and Agriculture

In the country report – *Progress in Indian Geography, 2000-04*, Sohal, Munir and Singh (2004) rightly observed the role of dynamic agricultural geography in regional planning and development. Needless to emphasize, the role of socio-cultural factors on crop diversity and dynamics, and reflection of socio-cultural fabrics in agricultural practice and perception is extremely significant. Sadly few studies address such issues.

Exploring the place of rice farming in the life and culture of the Assamese people Dutta and Bhagabati (2007) found inextricable link between rice farming and various aspects of Assamese culture including food habit, folk behaviour and local festivals. Singh (2005) made an attempt to study the agricultural situation in a village of Bihar in relation to certain demographic and cultural attributes. While studying the relationship between farm size, type of agriculture and social status of the farming communities in Nellore district of Andhra Pradesh, Neeraja, *et al.* (2006) observed that the farmers' choice for crops, inputs and crop-sequences are conditioned primarily by socio-economic variables and size of landholdings. Datta (2007) examined the pressure of human population on the land resources of Assam and emphasized on the human resource development and mobilization of other natural resources so that poverty, social unrest, degradation of environment may be reduced. In a similar attempt, Barah (2004) discussed the impact of the factor of population on agricultural development and suggested strategy for improving the condition of agriculture in Jorhat district of Assam in the light of certain demographic and social variables.

Industrial Geography

Praveen G. Saptarshi

The studies in economic geography in the period under review have been mainly devoted to the areas like agricultural patterns, agro-based activities, impact of changing agricultural scenario etc. The work in the field of locational aspects of industry, impact of industrial development etc has not attracted much attention unlike earlier years. However, this statement is based on a quick survey of published researches easily available and a detailed survey of published as well as unpublished work may be at variance with what is stated.

The appraisal of industrial growth at Ludhiana (Singh and Nayyar, 2005) has concluded that connectivity, advantage of early start, availability of low cost labour, easily available capital etc., have been the significant factors. The study has presented a good account of working population in different types of industries. The process of concentration of industries has been considered as the major cause of regional disparity as stated by Ghosh and Narayana (2005), Kumar (2005), Muzumdar (2005), Nayyar (2005) etc. Tiwari and Mishra (2006) have suggested that dispersal of socio-economic activities, mainly industrial, should be taken into account while integrating spatial system with process of planning and development. Similar type of regional and applied studies has been carried out by Bhagat and Saptarshi (2004), Hangaragi (2005), Krishna Kumari *et al.* (2006), Tiwari and Misra (2006), Tiwari (2006), Kant (2006), Singh (2006), etc.

While presenting vision and action plan for the next two decades Dash (2004) has outlined a set of desirable objectives for geographical studies in future. Of these, identification, recognition and presentation of spatial dimensions of development processes can be useful to enhance the relevance of Industrial geography. His idea of promoting field based and applied research to bridge the gap between developed and less developed regions and between the privileged and lagging sections of the populations may be useful guideline for development of Industrial Geography. For strong economic foundation of any country it is necessary to achieve sustainable industrial development as pointed out by Singh (2007). He has also stated that poverty in India would have been far more than what is present today if the country had not adopted a policy of developing strong industrial base. A note of caution has been placed that sustainability in industrial sector needs both environmental and social audit (Saptarshi 2006). There is a need to stick to the principle of intergenerational equity while using natural resources. Geographers are uniquely placed to address these issues as they deal with space and resources- both natural and cultural.

A cursory review of available literatures suggests that industrial geography has not attracted the attention of scholars in geography as it used to in the past. This may be largely due to lack of availability of reliable data. However, there is an urgent need to undertake far more vigorous research in industrial geography by adopting interdisciplinary approach and to acquire necessary skills to procure data from secondary as well as primary sources. The annual surveys and reports of companies, environmental reports, financial balance sheets, reports of the public and private sector organizations, etc. provide valuable wealth of data now than ever before which can be profitably utilized to get a coherent picture of how the space is being constantly transformed by the process of industrialization in modern times more as a fallout of new industrial policies affecting

geographically differentiated space in the post liberalization phase. For primary surveys, it is necessary to develop innovative skills like rapid urban appraisal (RUA), questionnaire designing, preparation of checklist for impact assessment, procuring information through group discussions, etc.

It may not be out of context to suggest few points for future studies in industrial geography. These are listed below:

- 1) Sustainable industrial growth,
- 2) Social impact of Industrial development,
- 3) Environmental Impact Assessment,
- 4) Impact of space creation like Special Economic Zone (SEZ), Estates developed by Industrial Development Corporations etc,
- 5) Globalization and industrial growth of macro and micro regions and
- 6) Interface between industrial development and urbanization and associated issues.

The list may be extended by adding applied studies. This is just to suggest some of the thrust areas in the subject especially in the context of Indian industrial scenario which needs to be addressed in the next few years.

INTERPRETATION OF DEMOGRAPHIC PHENOMENA

Population Geography

N. C. Jana
Sudesh Nangia

In this status report, the research publications in Population Geography between 2004-2008 have been grouped into popular sub-themes of the Discipline *viz.* Population distribution, density and growth; Population composition; Fertility and Reproductive Health; Mortality and morbidity, Migration and the Human Development. The basic issues highlighted in the text relate to the areas/regions under discussion, data base and methodology, the scientific observations and the future implications of research/s.

Concept, Theories, Models and Principles

The *charlands* (river islands) may often be temporary pieces of land, their existence dependent on the rise and fall of the river. The inhabitants of *chars* have been dispossessed and are the poorest and most disadvantaged members of society; they are often migrants from other parts of the country or those who have illegally crossed the international border. Lahiri-Dutt and Samanta (2005) report how the *chouras* or *char* inhabitants have adapted to this marginal and highly dynamic environment, and have developed effective livelihood strategies to ensure their survival.

Problems of the middle level towns or regional urban centres in India are of a different nature and are often related to the inefficient removal of solid and other forms of waste, intra-urban transport, and local industries. Lahiri-Dutt *et al.* (2006) examine gender-specific awareness of the environment and examine women's participation in local governance in such urban environments using a case study approach to an urban centre of West Bengal in eastern India. The study explodes the 'myths' of women as the natural 'carer' of the environment.

Poverty is synonymous with poor quality of life, food insecurity, under nutrition, illiteracy, low levels of income, deprivations in various forms and low human resource development. Parveen's (2004) study of urban poverty reflects on these very issues and goes beyond. The study goes on to identify factors affecting the incidence of urban poverty and the regional variations on the basis of 2001 urban poverty data. Some of the suggestions for effectively tackling with the problem of urban poverty problem in India, according to the author include more inclusive governance, development and strengthening of community based organization of the poor, encouraging public private partnership, improvement and amendment in planning strategies and regulations to incorporate the needs of the poor in existing urban environment. In yet another study Majumdar (2005) analyzed the status of urban development in Jammu & Kashmir in the context of planning for formulating a state urban policy for sustainable development with a particular emphasis on optimizing the size of urban population.

Rajput's study (2005) of Population focuses upon the relationship between population, development and environment in South Asia. The study finds high population

growth in South Asia responsible for poverty, which has high correlation with various environmental issues. There exists also a positive relationship between industrial sectoral share to GDP and per capita GDP and energy consumption per head.

Delivering G. B. Simmons Memorial Oration, Nanda (2005) discussed the implementability, feasibility and future prospects of the new Reproductive and Child Health regime post-IPCD in India and elsewhere and the rationale behind the evolution of stand-alone “population control” mind set leading to unintended negative consequences. According to him, in the present complex socio-economic set up, quantitative data and analysis at micro-level along with ethnographic research can give more compelling explanations of population phenomena like female infanticide and foeticide. He emphasized on the broadening of ‘Demography’ to ‘Demology’ in the interest of attuning research to the needs of the hour towards better understanding of people constituting population.

On the basis of a review of 2001 Census Hassan and Daspattanayak (2004) commented that India’s population is first approaching the completion of the third stage of demographic transition. Analyzing the nature of fertility transition overtaking Orissa, a state of India which ranks rather poor in economic development the authors are of the view that if Orissa’s experience is applied in other ‘demographically vulnerable’ states, the problem of rapid population growth can be checked to a considerable extent. In an interesting paper Das Gupta (2005) outlines in a short compass the universal role of motherhood in the schemata of natural environment on the earth at the mundane level, presented here in the light of the basic tenets of the ‘Sāṅkhya Yoga’-an ancient Indian doctrine.

Distribution, Density and Growth

In a study of population pressure and changing pattern of agricultural production, Mipun and Das (2004) examined the agricultural land use and productivity pattern in the lower Brahmaputra Valley of Assam in the context of excessive population pressure. Taking into account indices like growth rate of population and in food grains, cultivated land and food grains availability per head Ramotra *et al.* (2005) examined the role of population pressure and magnitude of the problem in the context of Maharashtra state.

Composition

Using multiple regression modeling Das and Betal (2005) studied the literacy rate in different categories of educational institutions in Hugli district in West Bengal state. The study after labourious statistical analysis concludes that government and private sectors should take more initiative to balance the number of different categories of educational institutions at lower aggregative level than the district to improve the literacy rate, which in turn will strengthen the overall socio-economic culture.

Nangia and Kumar (2005) examined the spatio-temporal changes in the age-sex structure of India’s population through detailed study of shift in each age-cohort during 1881-2001. The study compared some of the economically lagging states with four southern states with diverse demographic profiles. Significantly the study revealed that the change in the India’s age structure has been rather slow over long range; the spatial pattern of change in age-sex structure is at variance; the southern states have experienced faster change in age-sex structure than their northern counter parts, and that the cohort-

wise change is more visible in the age group of 0-14 and 60+ than the productive age group.

In an analysis, primarily based on state level data generated by the Census, Chandna (2005) found certain discerning trend in demographic behavior of major religious groups in India warranting immediate attention. Notable among them are, consolidation in fertility decline among the Hindus; enhancement in the urge for individual well being among the Muslims especially in North India; acceleration in the literacy transition specifically in the North among both Hindus and Muslims alike and arresting the menace of female foeticide especially among the Sikhs.

With a refreshingly different approach- social ecology approach- Dash (2006) interrogated the interrelations between the impacts of altitude and the demographic structure of the Bhotia tribal society in Kumaon Himalaya of Uttaranchal.

Fertility, Mortality, Morbidity and Reproductive Health

In recent years, population geographers as much as the demographers have turned their attention to processes inherent in demographic transition, particularly to issues pertaining to fertility and reproductive health. Shukla (2005), based on field survey conducted in Sagar district in Madhya Pradesh, tries to explain the level, trend, age pattern of fertility and reproductive behaviour among the population and warns of an impending danger of exploding population.

Through a regional analysis undertaken for West Bengal, Banerjee and Das (2006) focus on the use of reproductive health care services associated with pregnancy and child delivery by women in Indian households. The study reiterates the need to channelize efforts in the effective and efficient utilization of the MCH services in order to reduce the incidence of infant mortality. Chaudhari's study (2005) of nutritional status among the tribal population in the Satpura region finds nutritional deficiency as a major problem leading to various deficiency diseases in the region.

Migration

Migration studies occupy a prominent place in all population studies. Studying the migration of the Telugu Community to Andaman and Nicobar Islands Murthy (2005) traced the origin and settlements of the Telugus and the factors that impelled the community to migrate to Andaman & Nicobar Islands. The study found that in the last two decades, the community has been virtually eliminated from the political, economic, social and cultural life of the Islands and there has been a continuous decline in their socio-economic and political position. In another study involving the migration of the Bangladeshi women Lahiri-Dutt and Samanta(2004a) narrate the life experiences of these migrant women based on field surveys among very poor migrants living in the *Charlands* (River islands) of the Damodar River in southern West Bengal. Social construction of the *char* environment through the eyes of women was a particularly interesting exercise. Specificity of the environment and its construction by women assume significant roles. In yet another interesting account of the migrant rickshaw pullers these (Lahiri-Dutt and Samant, 2004b) examine the relation between urban informal economy of Burdwan town and poverty-induced rural-urban migration from the surrounding regions. The study reveals that the rickshaw-pullers live a reality that straddles both 'rural' and 'urban', and creates a new form of synthesis of these two forms of economy. They also represent how

over generations the rural migrants struggle to survive in a radically different environment.

Human Development

Issues pertaining to human development have attracted quite a few studies in the recent years. Das and Datta (2006) assessed the impact of increasing population pressure on food availability in the North-East. Government's recent policy to reduce subsidy on food supplied through PDS and to limit the number of beneficiaries only to those who fall below poverty line (BPL), has made a large section of population in the region vulnerable to food insecurity, malnutrition and under-nutrition. Eswaremma *et al.* (2006) studied the socio-economic dimensions of slum households of Tirupati town based upon primary data and concluded that, because of poverty and altruism the society is secular and people live in harmony with each other. Yet the social ethos is such that the slums are a repository of people with bad habits and practices and is thus a place where socially acceptable behaviour is not always the rule.

In a study of the correlates of education in Western Uttar Pradesh, Naseer *et al.* (2005) observed glaring disparity in the distribution of educational infrastructure. In another study that attempted to measure poverty index in Rajasthan based on UNDP methodology, Joshi (2005) found that the level increases mainly from the North-East and Central Rajasthan to the South, West and North-West Rajasthan. Ingale and Pauer too measured regional disparities in levels of human resource development in south plateau region of Maharashtra using data at lower level of spatial aggregation. Human resource development was found to be positively associated with urbanization and industrialization and negatively related to drought-prone areas.

The success of the group approach in rural micro-finance among women has inspired the tendency to looking at all networking as essentially good and desirable in rural community development, without acknowledging the entrenched caste, class, ethnic and religious hierarchies that lead to diversities among women. Lahiri-Dutt and Samanta (2006) demonstrated that whilst the broader contexts of cooperative and household labour allocations continue to remain enigmatic, schemes take for granted that women exercise agency in creating development outcomes and this agency is embedded in cultural understandings of what development is and how it operates.

Jenamani (2005) by correlating the physical and environmental factors analyzed the institutional and social relation of production in understanding the persistent poverty in Kalahandi district of Orissa. The relationship between population and sustainable development forms the core problematic in a book authored by Haq and Singh (2006) broadly dealing with the twin problems of overpopulation and underdevelopment to which most developing societies are confronted with. Mapping poverty (Bansil, 2006) by emphasizing the spatiality dimension of the poor in Rajasthan signifies an attempt to understand poverty in micro level and local contexts.

Concluding Remarks

The content analysis of the publications indicates a trend towards inclusive approach. Not only the themes are being discussed in depth, their inter-relationship with the allied problems, but also are being investigated. Migration, both internal and international, appears to be one of the major focuses of researches during this period. Increasing urbanization, urban density and growth and their associated problems of

environmental degradation and scarcity of living space and basic services could be some of the compelling factors for the choice of this theme. Besides illegal migration from across the international borders, which has led to conflicts and political unrest in the frontier states has attracted attention from population geographers. Concern for a better quality of life, reduction of poverty, gender equity and equality has led to several studies in Human Development, management of human resources and sustainable development.

Population Change and Migration

Bimal K. Kar

India, with an ever increasing population, ethno-linguistic-religious diversity, strong historical legacies, and political undercurrents has contributed significantly towards emergence of a highly varied and complex character of population including its dimensions of changes and migration. It is in view of this population change and migration studies have been able to constitute a large chunk of works in the field of Indian Population Geography. This is also clearly reflected in the reviews done by Mehta and Ram (1996), Gill (2000, 2004) and Kar (2004) for the country as a whole, and Bhagabati and Kar (1999) for North East India. In fact, population growth/change and migration studies alone constitute more than one-third of the total works done in the field of population geography in the country. The distinctiveness of Indian population geography lies in addressing the issues in scales ranging from local/micro to macro focusing on local/regional specifics, and rural-urban and socio-spatial differentials based on data from the Census of India and other relevant sources and field survey.

For the purpose of the present survey, available literatures have been classified into the following broad themes, though with a certain degree of arbitrariness:

Population Growth

Growth of population and associated issues both at national and sub-national or local level continue to draw the attention of Indian geographers. Such studies based on Census data try to focus the overall trend in population growth and also the decennial variation in relation to the prevailing fertility behaviour. In one of such studies, Sharma (2006) tried to present the trend of population growth in India during the last century and to understand the major determinants of varied growth rates of population including fertility in the state of Madhya Pradesh as a case study through correlation analysis. He concludes that in spite of a slightly declining trend in recent times, considerably high fertility rate continues to be a major concern due largely to low status of women.

In a state level study, Rao (2006) analyzed the trend of population growth during 1901-2001 in Andhra Pradesh in comparison to the country as a whole and observed that in the coastal areas, the growth rate has even gone below the replacement level. In another state level study Kar (2007) focused on the prevailing regional and inter-community variations in population growth in Assam.

Population Growth in the Urban Context

In spite of a relatively low level of urbanization, its study bears immense significance in understanding the prevailing rural-urban differential in population growth. In this context Datta's (2007) contribution on the pattern of urbanization in India based on Census data for the period 1901-2001 dealing with tempo and degree of urbanization, urban problems and related policy implications may be considered quite significant. In another study Chatterjee (2004) presented the trend of population growth in Kolkata metropolitan city based on Census data for the period 1891-2001 and estimated the contribution of both internal and international migration towards rapid increase of population in the city. Almost on the similar line, Begum and Kar (2007) analyzed the pattern of population growth in Guwahati city of Assam in relation to the city's land area

and estimated the role played by migration and boundary expansion of the city in contributing to its rapid increase in population during 1971-2001.

Changing Fertility Behaviour

Studies relating to fertility behaviour in different socio-spatial contexts contribute significantly towards understanding the phenomenon of population growth and associated demographic issues. Towards this end in view, Shukla (2005) in a case study of Sagar district of Madhya Pradesh examined the pattern of fertility in terms of its various measures and correlated with factors like age composition and female age at marriage.

Consequences of Population Growth

Change in population, whether due to biological factor or migration, influences the overall character of population in any region. Rapid growth of population in backward areas often results in a host of problems of varied dimensions. In a study on similar line Jha (2006) developed a theoretical framework to understand the underlying complex relationship among population, foodgrain production, poverty, natural hazards and vulnerability with a case for Bangladesh. He concluded that the poor landless and women-headed households who contribute significantly to rapid growth of population in the country appear to be the worst sufferers due to lack of desired level of accessibility to food. In two different works relating to implications of population growth Datta (2006) and Das and Datta (2006) analyzed the consequences of the rapidly growing population in North-East India on its development fronts and food production. On the other hand, while discussing the growth of population in Assam during 1901-2001 Kar (2007) focused on the changing demographic structure of population in the state as a result of migration and the prevalence of varied fertility behaviour among different ethno-religious groups of population.

Changing Socio-Economic Dimensions

Changing socio-economic dimensions of population very well reflect the level of development of an area. The contributions made by the Indian geographers in this particular area have not been less significant. Among such studies, the one by Kar (2007) focused on socio-economic diversity and rapidly increasing population in South Asian Region as an emerging region with great potential for socio-economic growth and development in the context of Look East Policy of the government and strengthening of economic relations with ASEAN countries. Lakshmana and Eswarappa (2006) described the changing pattern of sex ratio at *taluka* level in the state of Karnataka using Census data in order to explore the demographic and socio-economic factors for the prevailing imbalances. In a micro-level study Barman and Kar (2004) assessed the pattern of demographic and socio-economic conditions and their changes among the different ethno-religious groups in Barpeta district of Assam using both primary and secondary data. In another micro-level study Das and Das (2007) brought out the significance of occupational mobility as a consequence of increasing population pressure and near stagnating agricultural production in rural areas of Hajo in Kamrup district of Assam.

Population Pressure

The problems arising out of increasing pressure of population and the adverse impacts on environment, society and economy in a country like India need no elaboration irrespective of ecological and regional variations. The scope of handling such issues has significantly increased due largely to the use of modern techniques like remote sensing, GIS and GPS. Unfortunately, few Indian geographers have taken advantage of these powerful tools. Ramotra, Vadiyar and Pawar (2005) in a study in the state of Maharashtra assessed the growing pressure of population on agricultural land for the period 1971-1991. They also developed a method of measuring population pressure with respect to availability of food grains. In another almost similar study done at district level, Datta (2007) analyzed the impact of increasing population pressure upon the available agricultural land and other associated problems in the state of Assam. In yet another interesting study Bhagabati (2007) focused on the impact of rapidly increasing population pressure in degrading the riverine environment in the Brahmaputra valley of Assam with a threat to sustainability. On the other hand, Saikia and Sahariah (2007) studied significant changes in land-use along with a variety of environmental problems in the city of Guwahati and the role of migration in effecting such changes.

Population-Environment-Development

The underlying relationship among population, environment and development has been a theme that has attracted the attention of geographers. The complex nexus among these rather provide a platform for a debate towards attaining the most delicate goal of sustainability. It is in this perspective Rajput (2005), Sharma (2006), Singh (2006) and Bhattacharyya (2004) have evaluated the nature of relationship among population, environment and development drawing examples from the contemporary situation. Among these works, Rajput examines the relationship in south Asian context, Sharma in global context, Singh in Indian context, and Bhattacharyya with reference to the metropolitan scenario in India.

Pattern of Migration

Only a few studies have appeared on the theme of International migration, growing rural-urban migration and various issues associated with these. A notable contribution worthy of mention is that of Murthy (2005) dealing with the historical background of Telugu migration to Andaman and Nicobar islands and its contribution to population growth and changing demographic structure during 1951-2001.

Implications of Migration

Many a times, developmental intervention in the marginal areas results in displacement of population, causing serious hardship to the displaced people. Such a theme which used to be popular in the past does not find many citations in the period of this review. Saikia (2005) in a study of Bangladeshi migration to North-East India has analyzed its possible implications in demographic, socio-economic and political fronts. Chatterjee (2004) and Kumar (2007) studied the contribution of migration towards rapid increase of population in urban areas like Kolkata metropolitan city and Ara town of Bihar, and examined the likely future impacts in this respect.

Migrants and Behaviour

The migrants coming from different places behave differently in changing situations. This provides an important area of research in the field of population geography. In a work of slum area in Delhi, Joshi (2005) discussed the character of marriage-induced female migration and its impact in the labour market.

Concluding Remarks

This quick survey leads to the conclusion that there has been little change in this segment of research compared to the earlier review period. The studies undertaken are a mix of both general and contemporary-specific population issues relating to population growth/change and migration. Barring a few notable exceptions, most studies continue with approaches and methods which are repetitive and mere cartographic representation of census data. Generation of relevant database through scientific field survey is highly essential. Studies addressing issues pertaining to the impact of rapid population growth, migration, population pressure, ageing and globalization as witnessed in different parts of the country are limited. In any case, considering the overall trend of research, a bright future of this field of geography may be foreseen. All these, however, would depend largely on the commitment of the geographers to the subject, society and nation, and their urge for the newness which carries much relevance in present context.

Settlement Geography

Surendra Singh

Confining the survey to the Indian geographic literature on settlement geography, it is obvious that physical as well as functional aspects of settlement systems of different parts of the country were first interpreted by the geographers associated with the International Centre for Rural Habitat Studies established in Banaras Hindu University at Varanasi in the late 1970s. The publications and seminars/symposia related to the theme of rural habitat of which settlements are considered as an integral part, were activities of International Centre for Rural Habitat Studies as well as the National Geographical Society of India, Varanasi during the last 30 years of the last century (Singh 1972, Singh 1975, Singh 1994). However, during the beginning of the present century, the physical aspects of settlement systems have not been taken up seriously by Indian Geographers. Most of the studies in settlement geography are confined to functional aspects and locational characteristics of human activities in the studies of spatio-functional organization of economic landscape.

For the purposes of the present review, the material has been organized under the following broad themes, namely, the size, spacing and forms of settlements; locational characteristics of settlements; settlements as socio-economic nodes; settlements as actors in spatio-functional organization of landscape, and urban settlements as centres of functional diversity and diverse land uses.

Size, Spacing and Forms

There are only a few studies on this aspect of settlement geography. This is understandable in a situation where the geographers are concerned more about economic landscape that considers settlements merely as the location of social and economic activities. This explains the neglect of the physical dimensions of settlement geography. Nevertheless, there are a few studies on the physical characteristics of settlement in relation to different environmental conditions of the landscape. A notable contribution in this context relates to the impact of shifting of the course of rivers on types, pattern and spacing of settlement in the lower Brahmaputra plains (Barman, 2007) changing their morphology and pattern. Sarma (2007) too studied similar aspects in Morigaon district of Assam.

Locational Characteristics

Location of a settlement in terms of its geographical surroundings is quite significant in spatial decision making. Settlement surroundings and its impact on growth and changing demography of settlements is an important dimension of settlement geography. There are however, very limited papers on such themes. Sarma (2007) analyzed the locational characteristics of periodic settlements taking into account the physical environment. Kumari and Haroon (2007) on the other hand analyzed the location of urban centres in the central part of the great plains of India by considering the distances among them.

Settlements as Socio-economic Nodes

Diffusion of economic as well as social innovations, radiation of the effects of development and social interaction through nodes are functional dimensions of settlement geography. Nature and characteristics of socio-economic nodes conventionally termed as 'growth foci' emerging in the arid landscape of *Marusthali* located in the Thar Desert of India were studied by Mishra and Sharma (2003). Singh and Singh (2007) presented a geographical interpretation of emerging service centres by distinguishing functional hierarchy in the middle Ganga Plains. Pathak and Pathak (2007) identified service centres in Ballia district of Uttar Pradesh using conventional techniques. Distributional pattern of educational as well as infrastructural facilities for area development was analyzed by Samvanshi (2007) through the use of Rn value in order to test the validity of distributional characteristics of facility locations.

Settlements as Actors in Spatio-functional Organization

Evolution and creation of diverse functional spaces at higher order settlements in its functional hierarchy regulates activities/functions in spatio-functional organization. Transport accessibility, allocation of activity locations and market regulations are major issues of area development and are the main components of spatio-functional organization in which settlements act as catalytic agents. In this context, relationship between the levels of nodal accessibility (distance-based criteria) and spatial pattern of non- primary activities was established to show disparities in spatio-functional organization in semi-urban landscape of the outer periphery of National Capital Region (Mandal 2004). Ahmad and Shamim (2004) studied location of health facilities in the developed rural economy of Meerut district in Western Uttar Pradesh.

A case of market centres and their spatial arrangements in the rural hinterland of historical twin cities of Orissa (Cuttack- Bhubaneswar) was taken up by Dash (2005) in the context of the periodicity of markets and also in the BARPETA district (earlier the part of Kamrup district) of Middle Brahmaputra plains by Sarma (2007). Periodicity and status of market activities determine the level of development of rural landscape while the regulation of market activities provides common infrastructure of development of socio economic, industrial and transport activities which evolve diverse functional structure and create imbalances in spacing, patterning and population concentration at market centres as noted by Pawar and Lokhande (2004) in their study of Kolhapur district (Maharashtra). Effect of diverse types of developmental measures on environment that results in a distortion of population-environment relationship has been the core issue of analysis by Sharma (2005).

Urban Settlements as Centres of Functional Diversity

Dynamics of urban settlements has been implicitly influenced by changing forms and patterns. Fast morphological changes of towns, Rustonian model of location-allocation of activities within town, space-reduction by the revolution of information technology, human rationality and social relation/isolation in city life, increasing socio-economic disparities in the urban Households, urban sprawl and degradation of city environment are major issues of urban settlements. For examples, after examining the functional nature of 222 towns of Rajasthan, Mishra and Sharma (2007) found that the economy of higher order towns has been aligned with the policies of globalization and

liberalization with its adverse effects on local city environment. The urban morphology of medium size towns too is changing as part of the same town system (Malik, *et al.* 2007). Problems of urbanization of a historical town, Patna located in the Middle Ganga plains were highlighted by Kumar (2007) largely as an effect of environmental degradation. Likewise, functional morphology of Sultanpur town was analyzed in the same manner by Singh and Mahrajdeen (2007).

Contemporary growth trends (hyper-urbanization with faster population growth than the growth of urban infrastructure) and diverse urban system (that are aligned with external forces of globalization rather than regional or national feeders) have been continuous forces that have been responsible for distortion in the spatial arrangements and forms of urban space in India. Such issues are important to study in future in settlement geography of India.

URBANISATION

H. N. Misra

Urban geography is one of the most dynamic sub-disciplines of geography. It has been moving forward seemingly continuously in its philosophical perspectives and thematic contents. It has not merely captured the prevailing paradigms of geography; it has also succeeded in injecting new paradigms (Misra, 1990). This is rightly so because cities play critical role in spatial organization and modernization processes by contributing to regional and global economy. They, thus, recharge the human life and accelerate the rhythm of exchange. The fact that cities occupy 2 per cent of the world's land surface but use over 75 percent of the natural resources (Girardet, 1992) clearly brings out the importance of urban centers in shaping the world economic order. According to White and Whitney (1992) most modern cities have spread far beyond their carrying capacity and draw resources from far a field and naturally, therefore, they have far reaching implications.

A survey of literature reveals that Indian urban geography has been unfolding several new dimensions (Misra, 2004). The works published during 2004-2008 may be put into the following sub-themes:

Trends and Patterns

Contemporary trends of urbanization have been so massive that several geographers have been attracted to explain its implications in different locales and at different scales. Dayal (2004), while drawing the attention of trends and challenges of world urbanization, points out how the developed world is highly urbanized and the less developed world is likely to experience the major growth of urbanization. The challenge to manage urban population in less developing countries is, thus, likely to be more formidable than more developed countries. Dayal suggests that the developed countries should provide financial and technical support to developing countries to manage the newly emerging problems of urbanization because their squander and squalors of third world cannot coexist. Tripathi (2005) points out that urbanization in developed world is culminating into suburbanization, megalopolitanization, counter urbanization and finally re-urbanization which are a new trend of movement of people from periphery towards core. The rapid growth of urbanization suggests that future of South Asia lies in its cities. This is clearly evident from the paper written by Dutt and Noble (2008). Large scale rural-urban push of working age people has enhanced the process of urbanization which is highest in Pakistan, India and Maldives and lowest in Bhutan and Nepal. Countries like Bangladesh and Sri Lanka occupy the middle ground. They notice the rise of motion pictures in Mumbai as the most fascinating cultural and economic development. Yet another phenomenon of increasing significance is the emergence of urban dual economics where modern industry compliments, and also competes with traditional bazaar economy or informal sector. Bangalore and Karachi provide very good example of this development.

With the availability of the 2001 census data, a few meso and micro level studies have also appeared. Majumdar (2005) has examined the growth and development of urbanization in Jammu and Kashmir and Kumar (2007) has attempted to analyze the urbanization in Mizoram by relating it with the human organizational change. He notices that most of the towns are very small and have little chance of being diversified. They are, thus, not able to induce any change in the organization of space. Ahmad *et al.* (2006) and Ali *et al.* (2007) have also tried to measure the level of urbanization in West Bengal and North Bengal respectively. Both the studies attempt to portray the spatio-temporal changes in the pattern of urbanization in the respective regions. Both the studies are data based and not much inference can be drawn. Based on location quotient, Tigga and Malini (2004) have tried to map the pattern of urbanization in the Jharkhand state; they conclude that availability of mineral resources has had great impact on urbanization of the state. The urban centers which have emerged due to administrative process are not able to influence the growth of urbanization. Munir *et al.* (2006) have attempted to see the pattern of urbanization at the micro level by taking the case of Dehradun district.

Mega and Million Cities

The major segment of urban population lives in mega and million cities and they have been continuously increasing and rapidly expanding. Globalization has further intensified the process. This situation, therefore, calls for their separate treatment as they have their own dynamics.

The book edited by Misra (2008) makes an excellent contribution to the understanding of urbanization in general and mega cities of the South Asia in particular. Mega cities constitute major driving forces in economic resurgence of the region. At the same time, exhibit the problems this region faces rather glaringly. The book includes chapters each on nine mega cities of the region: Mumbai, Kolkata, Delhi, Chennai, Bangalore, Hyderabad (India), Karachi, and Lahore (Pakistan), and Dhaka (Bangladesh) contributed by well-known authorities of respective countries.

To see the above mentioned within the national and regional contexts the book begins with a brief survey of each country of the region (chap. 1). Chapter 2 traces the history of urbanization in the region, while chapter 3 discusses the role mega cities of the region play in national development; the challenges they face, and the opportunities they have to move forward. The last three chapters (18-20) focus on Urban Governance and Empowerment of Communities, SAARC, and a new urban Future of South Asia. The book is addressed first and foremost to people of the region who have pinned their hopes in their mega cities for a better future, and who bear the brunt of urban chaos South Asia is known for.

The Million Cities of India edited by Misra (2008) has 71 chapters organized in two volumes. It is perhaps the most comprehensive publication on urbanization in India in general and on large (million plus) cities of India, in particular. Volume I has three parts. Part I consists of 10 chapters on urbanization in India, all the way from urban history to urban planning. And Part II has 7 chapters on the Mega Cities of India: Mumbai, Delhi, Kolkata, Chennai, Bengaluru, Hyderabad and Ahmedabad and Part III has 7 chapters on Mega Cities in Making i.e. Pune, Surat, Nagpur, Jaipur, Kanpur and Lucknow. Volume Two has two parts. Part I has chapters on each of 21 million plus

cities not covered in volume One; and Part II has 12 chapters on million cities in making i.e. the cities which are likely to become million plus cities by 2011.

The message of the book is that India needs strategies at rural-urban integration; de-elitization of physical and social development planning; and environmental protection. It calls upon policy makers not to neglect rural areas lest the country is back on the food crisis of 1950s; and the cities are over-crowded by migrants.

Small and Intermediate cities

The future of urbanization lies in small and intermediate cities as they are likely to serve as strong links between big cities and rural areas. These are also being developed as alternative strategy of development. However, geographers have not paid much attention to study them as growth engines. A comparative study of intermediate towns in Haryana and Gujrat by Dalal (2007) reveals that population growth has strong links with the growth of infrastructural facilities. The transportation and medical facilities appear to be the most dominant variables influencing population growth. The financial receipts play major role in improving the infrastructure in Haryana. The stepwise regression analysis reveals that medical facility contributes very significantly in the population growth of medium size towns of Gujrat. The government policies can play critical role in improving infrastructure. Das and Samanta (2007) have also studied the expansion and growth related problems of Jhargram which is a small town with a population of about 50,000 in West Bengal. The authors have drawn attention towards problems such as short supply of water, growth of slums and traffic congestions being faced by this town. The work of Prasad and Mahto (2008) explains how impact of Ranchi city has changed the socio-demographic structure of Borea, a rural centre. Now this is destined to be an important urban centre of Jharkhand and likely to merge with Ranchi.

Urban Migration Dynamics

Migration could be identified as a separate theme as it has its own dynamics. The paper by Kaur (2004) deals with migration pattern in Ludhiana city and concludes that it is basically urban- urban migration which plays significant role in swelling the population of city. The fact that migration can be a source of conflict has been pointed out by Hazarika *et al.* (2004). They have raised the issue of urban labour market by portraying the political economy of labour immigration in Jorhat (Assam). The problem of alienation of local labourers due to migrant labourers is assuming serious proportions and needs to be tackled carefully. The famous dictum that there is an inverse relationship between movement of people and distance has once again been demonstrated by Khairnar (2006) by studying the migration pattern in Pune city which is growing fast due to increasing industrialization. In the context of mega cities of Asia, Mukherji (2008) refers to distressed migration which is a quantum jump of people from poverty stricken rural areas to urban areas which is already in the state of decay and involution. The polarized growth of economy has further worsened the situation by way of promoting the dualistic mode of urban economy. The three strategies suggested by him to overcome these problems are: urban development, rural development and regional development.

Socio-Economic Dimensions

Basically this pertains to the study of vulnerable groups which has assumed importance in view of increasing urban poverty, emergence and expansion of slums, and growth of informal sector in the urban economy. Eswarama *et al.* (2004), while studying the people living in slums in Tirupati, have used factor analysis to identify the socio-economic dimensions. They find education is the most important dimension to explain the slum households. Sahay (2006) has also tried to study the quality of life of 25 families living in Bind Toli slum of Patna by using composite index method. The high fertility among Muslims of Sagar city is attributed to lack of education and poor socio-economic conditions (Shukla, 2005). Gupta and Baghel (2008) have similar findings in case of Bhilai city which is a little more modern and highly industrialized. The increasing number of child labour in lock factories in Aligarh city is again explained by poverty, illiteracy and economic insecurity at the family level. The issue of social vulnerability has been raised by Sarkar (2006) taking the example of waste pickers involved in the solid waste management of Delhi. She recommends institutionalization of the activities of waste pickers and the formation of cooperatives as these would enhance the scope of their work and at the same time provide better working conditions.

Transport System

This is yet another issue that has caught the attention of urban geographers because growing traffic within a city and movement of goods and people among cities is assuming new dimension. Problems associated with urban transportation have been taken up by Adhikari (2005), Nasser (2005) and Ashraf (2007). The urban transportation problems and prospects in India have been highlighted by Adhikari. Nasser has tried to test road accident prediction model in Mysore city and found that the simulated model of decision support system helps in controlling the accidents and managing the traffic. The vehicular traffic problems of Aligarh and Vardhman have been dealt by Ashraf and Bhattacharya *et al.* (2006) respectively.

Environmental Problems of Built Environments

This is perhaps the most popular theme among urban geographers as most of the cities are plagued by environmental problems. The environmental problems may be domestic such as water supply, sanitation and overcrowding, and city environment such as air pollution, water pollution, toxic wastes and natural and human induced hazards. There are several scholars who have attempted to explain the causes and consequences of these problems and suggested measures to redress these problems. Devavarathanam *et al.* (2004) have explained how the urban sprawl of Thiruvananthapuram has adversely affected the wetland ecology of the countryside and thereby paddy cultivation and water table. Narayan and Kumra (2005) have explained the sources and existence of heavy metals in Kanpur metropolis and Ramkrishna (2005) have analyzed how Hyderabad, the Pearl City has turned into polluted city due to air pollution caused by heavy vehicular traffic congestion. Rao (2005) has also very meticulously analyzed the air pollution level in Hyderabad urban region and suggested the integration of land use changes with transportation besides the greenery to overcome the problem of air pollution. Likewise Ahmad *et al.* (2006) have also tried to see the impact of air pollution on the habitat of Lucknow, the capital city of Uttar Pradesh. Faridabad, yet another metropolis of Haryana,

is under the state of ambience air pollution due to industrial units and Nasir and Khanam (2007) have attempted to make spatio-temporal analysis of air pollutants especially SPM and suggested a few control measures to lower the pollution level. De and Patel (2008) have focused on the air pollution and its impact on human health in Vadodra and suggested interdisciplinary approach to tackle problems of respiratory diseases and other related diseases borne out of air pollution.

Question of Urban Sustainability/Eco-Planning of Cities

This is the most captivating theme for urban geographers because the question of urban sustainability has become the key issue in cotemporary context. Sustainability has many variants and it is being approached differently by different scholars. Banerjee (2006), while tracing trend of urbanization in brief has tried to dwell upon the top heavy character of India's urbanization and its implications on physical, social and other environments and need for sustainable urban development. She has mentioned the need for effective implementation of mission mode approaches such as Jawaharlal Nehru National Urban Renewal Mission (JNNURM) for improvement of Basic Services to the Urban Poor (BSUP) and infrastructure and governance for 63 selected cities, and Integrated Housing and Slum Development Programme (IHSDP) and Urban Infrastructure Development for Small and Medium Towns. Gupta (2006) has expressed the importance of urban ecology in the planning of Rabindra Sarobar in Kolkata. The book edited by Singh (2007) contains several papers which focus on sustainable urban development. Increasing solid waste in cities is one of the major sources of urban decay and Choudhary (2007) has traced the growing menace of solid waste and its management of problem in Delhi. He suggests the principles of recovery, reuse and recycling to handle the problem of solid waste management. Misra's (2008) paper looks at growing ecological plains of cities and suggests eco-development planning as the only way to save it from decay. Taking the case of Shimla, the capital of Himachal Pradesh, Misra observes that urbanization process in India is marked with two trends: urban explosion and urban implosion. Increasing number of people is moving to the cities and it is larger ones with a million or more population that are growing fast. The larger cities are growing faster; the smaller too are growing but very slowly. Both are in distress, the larger ones because they cannot accommodate more people without huge investment in infrastructure and smaller ones because they have no infrastructure at all. The major consequences of massive urbanization in India are ecological degradation. He suggests greening of city, maintaining biodiversity, managing land degradation, infrastructure development and people's participation as the major steps of eco-planning for Shimla in particular and other cities in general.

Research Frontiers

The future of India is urban India. The first half of the 21st century is likely to be characterized by large scale urban development. This is quite evident from the current trend and therefore, Indian urban geographers should continue endeavoring to appreciate the causes and consequences of processes and patterns of urbanization in different geographical regions. Likewise, the future of urban geography lies in the future form of cities or cities of future. There are different types future cities envisaged such as Green City, Dispersed City, Compact City, Regional City, Informational City and Virtual City.

Our scholars have to continue endeavoring for alternative models of indigenous city which is energy efficient, eco-friendly and sustainable. This is difficult but not impossible. The methods such as ecological foot print and green accounting may be used to effectively apply the concept of eco-planning. In this process of clamouring for sustainable and smart city, the potentials of small and intermediate towns/cities may not be overlooked as they can serve as alternative forms of future cities. The urban environment and infrastructure development is yet another potential area of discussion. Our cities are the victim of *laissez faire* approach as far as the land use is concerned. The geographers have overlooked the problems of urban governance and management in spatial context which needs to be analyzed, modeled and experimented. Continuously expanding urban areas have been devouring ecologically sensitive lands of the surrounding countryside which is called urban fringe. The dynamics of urban fringe needs to be monitored. Likewise, the natural and human induced hazards and disasters in the urban context can also be the subject of research. These are only a few themes, even more can be thought of.

REGIONAL DEVELOPMENT AND PLANNING

A.C. Mohapatra
Nabanita Kanungo

From beginning of the 21st Century, India as a nation appears to have somewhat emerged from the shadows of “ex-colonial, developing basket case” to a reasonably confident nation, often clubbed with the Republic of China as the “New Frontier” of development. There may be some truth in it, but there is more euphoria about the “leap forward to the league of Developed Nations” than the reality is. India, despite its consistent GDP performance remains immensely un-developed, poverty-stricken, but certainly with some hope and a huge potential.

Despite the fact that economic deregulation to some extent has freed the stifled economic forces and thereby, in some way pushing the GDP performance, the same forces have also unleashed “forces of polarisation” in the economy, towards the middle and upper-middle-class on the one hand, and on the other, between the relatively industrialized metropolitan centres/regions and the huge backward country-side. Second, if not “centralized planning”, but planning itself has not lost its relevance in bringing out often the best results from limited resources within perhaps the shortest possible time. Those who advocate a “no planning” scenario, forget that in most market economies, though there may not be a central planning mechanism, there are indeed, great many plans and planning activities at local bodies level and by even the private sector without which the performance in those economies will falter. Indeed, planning schools are more popular and numerous in market economies as compared to the former CPEs (Centrally Planned Economies).

The difficulty is that, in the last decade, due to the deregulation ambience in the Indian economy and the general perception, ‘central planning did more harm than good’ to the economy, the planning profession and planning education has suffered. The process has got even more complex with shrinkage in employability of planning professionals in the government sectors. One has to view the professional and research contributions primarily from geographers into the field of Regional Development and Regional Planning studies keeping the above perspective in view.

The materials reviewed covers a broad spectrum drawn from publications in primarily Indian professional journals, some books and some Ph.D. level dissertation, with no claims whatsoever being comprehensive, rather is a small sample of the type of studies and research concerns in the field covered. The review can be grouped into the following sub-sections:

Reforms of the 1990s and Regional Disparities

India has witnessed tremendous economic growth, albeit in selected and forward centres, following the sea change in its economic relations post liberalization in the 1990s. Although it has enhanced India’s overall economic position in the global world of trade, there also has been a sharp increase in economic and social disparities on various scales, at local and regional levels. The tertiary sector has had quantum leaps in many developed states where the IT and the ITES sectors have changed the employment shares

in favour of the tertiary rather than secondary and primary sectors. The huge inflow of FDI following economic liberalization has opened up the Indian market to global transaction and this has singularly brought in the advantages as well as the host of fall-outs in the case of India. Mohapatra (2006) assesses the trends of regional development in India in terms of widespread growth of the service sector, especially the IT and ITES (BPO) sectors in the post reform period with special reference to employment generation and the ensuing regional disparities. His findings reveal that although the Eastern (Calcutta) and Western (Mumbai) regions were predominant in industries, mostly fordist enterprises, before 1951 (during which the southern region had no presence), by 1951-61, the Southern (Chennai) and Western regions' share of industries increased sharply. This, he maintains was a transitional phase that led to the dominance of post fordist enterprises in 1992-2002 which coincided with economic de-regulation and a giant growth of the Southern and Western regional tertiary enterprises by over 70 percent. Mohapatra and Dey (2007) further state the locational advantages enjoyed by the Western and Southern Indian state, in a comparative study of four South Asian countries namely, India, Pakistan, Sri Lanka and Bangladesh.

Mallikarjun (2007) used the Malmquist Productivity Index to assess aggregate productivity changes in terms of: (i) efficiency change and (ii) technological change to assess the growth in labour productivity in relation to Total Factor Productivity (TFP) across major Indian states. Thus it is empirically established that IT diffusion generates IT externalities which have positive effects on backward regions. He concludes that the 'digital gap' across regions is quite significant when the mean values of IT investments that are positively related to TFP across all categories and that IT diffusion enhances TFP.

Rao (2004) examines the regional disparities in the development of the tertiary sector for different periods across major states in India. The Composite Index of development of this sector has been estimated using the method of Principal Component (Koutsoyiannis, 1977). The findings reveal that regional disparities have increased. Generally, physical infrastructure has fared better than social infrastructure even in forward states like Gujarat, Haryana, Kerala, Maharashtra and Punjab whereas Assam, Bihar, Madhya Pradesh, Orissa and Uttar Pradesh rank low.

Nangia (2005) assessed the Work Participation Rate (WPR) in India using data from the Census 2001. The study reveals a decrease in male-female gap though WPR was clearly showed a change in favour of the urban areas.

Mukherjee (2004) analyzed the problems and prospects of the informal manufacturing sector (IMS) in the industrial city of Durgapur following economic recession caused by slackening of the factory sector. The author notes the marginalization of workers engaged in the manufacture of chemical products and fabricated metal due to increasing demand and low capacity. Potteries and paper packets are fighting a losing battle against cheap substitutes like plastic. Policy recommendations include strengthening formal-informal linkages of industries, ensuring cheap raw materials, exploring new markets and resource mobilization.

Rural and Regional Development

In the wake of rapid urbanization, the land-use patterns in India show progressive decline in the share of agricultural land. This has had adverse effects on agriculture, and

has set in motion a process of pressurizing agricultural land for yields for which it is unable, continued encroachment of the urban fringe on agriculturally productive land, peasant despondency and suicides following crop failures, incidences of large scale migration to urban agglomerations, disguised employment in the rural hinterlands and a host of other problems. The need for agricultural modernization, introduction of non-farm activities, and development of cooperatives are keenly voiced by many papers. Kaushik (2006) for example assessed the neo-urban situation in the development of farm houses in the peri-urban spaces of the National Capital Territory of Delhi and the consequent shifts in agricultural practices, changes in patterns of the sale of land and land values. He concludes that the growth of farm houses has links with the neo-rich urbanites whose hunger for land has increased. He correlates distance with land values wherein the latter is found to be declining away from the urban agglomerations.

Venkateswarlu (2005) examined the performance of Rural Non-Farm (non-crop production) Employment (RNFE) at state, regional and district levels in Andhra Pradesh that revealed that RNFE shares for both males and females positively related to the share in RNFE, as the share of food crops in Gross Cropped Area show significant positive correlation with the share of RNFE. Pradhan (2006) investigated the nature of rural non-farm sector in India and its contribution to rural employment and income. The author re-evaluated the history of shifts in employment restructuring from the 1960s to the 80s and 90s. Inter sectoral shift in employment composition recorded a sharp increase in the 1980s and the rural male workers' share was high in the primary sector. However it has been worsening in terms of female workers as their proportion in the primary sector has increased. The decline of rural workforce in the agricultural sector is particularly noticed in a few states. In contrast some other states record a higher shift among males from agricultural to non-agricultural activities during the 1980-1990s.

Kumari (2004) found that upper castes fared well in an investigation of the level of modernization among farmers and its spatial variation in the Nellore district of Andhra Pradesh in terms of nearness to towns, the influence of caste, income, age and education and their overall effect on agricultural modernization. Sharma (2007) noted the benefits that agro-based industries impart to rural employment provided they have a suitable labour base and market in a study of agro-based industries in Maharjganj, Uttar Pradesh. Kumar (2007) studied the behaviour of farmers in Uttar Pradesh (NSSO Reports) in obtaining information on modern technology for farming and noted that more than half of them (67 percent) had no access to information. Television and the radio appear to be the chief sources of information for the more progressive farmers.

Daimari and Mishra (2006) assessed the role of cultural differences in the differences they initiate in economic performance of rural households in the Udalguri sub-division of Assam. Their findings reveal that the indigenous population shows resistance in assimilation of modern techniques whereas (Bangladeshi) migrant out perform in the use of modern techniques as well as earnings of income through commercial and intensive farming. The proximity to towns is well utilized by the migrants. Subash (2004) assessed the technical efficiency of rice production in Kerala by applying the Stochastic Frontier Analysis and found that farming experience and education are significant contributors to efficiency. Singh (2004) examined the disguised employment, marginalization of rural labour and mass migration of farmers of the

Jamunia Kamal village of the Sailana block in the Ratlam district of Madhya Pradesh, following the droughts of 1996-97.

Urban Development and City Planning

The rural-urban migration is an enduring problem that has a two-way effect on the urban areas (congestion and pressure on civic governance and basic amenities) and rural areas (continued draining of labour from the hinterlands, migration to and the development of slums in the urban areas due to poor living conditions). Singh (2005) assessed the urbanization scenario highlighting such migrations, construction of new townships, rapid growth of metropolitan cities and decline in the number of small towns in the backdrop of economic growth. He focused on the growth of the Ludhiana city, Punjab as an urban industrial centre in terms of small, medium and large scale industries and the subsequent migration from surrounding rural areas.

Kundu (2006) analyzed the level of basic amenities across states and size class of urban centres and observed that the Urban Local Bodies (ULBs) will have to increasingly depend on financial intermediaries and credit rating agencies as increase in tax rates of municipalities often incurs the wrath of the electorates which elect them. Wide disparities in the ULB earnings are recorded.

Malik *et al.* (2007) examined the urban morphology of the Bolpur Municipal Town in the Birbhum District of West Bengal. The cause and effect chronology of morphogenesis of the *bazaar* (market) based area surrounded by rural country- side highlights the (i) road frontage land-use of nodal points, (ii) general land-use pattern and urban morphology, (iii) built-up fabric of the town and (iv) the socio-ecological and socio-pathological components. Haphazard urban growth has led to immigration from surrounding areas, development of urban sprawls and shanties. Rice fields at the peri-urban fringe are decreasing in size due to encroachment by built-up areas.

The problem of flooding in urban areas was acutely felt following the flooding in Mumbai on 26 July, 2005. Kewalramani (2006) highlighted this case of Mumbai to assess the event and its effects in urban areas due to the increases in built up areas and impervious surface cover (ISC). The recommendations include improvement of trunk drainage, banning of plastic bags below 80 microns thickness, construction of detention basins, to name a few. Mohapatra (2007), through a comparison of planning practices between Canada and India reason for a people-centric, participatory planning process rather than a top-down approach often practiced in Indian city and regional planning programmes.

Planning Social Sector and Economic Welfare

Adi (2004) analyzed how the expenditure on the social sector has changed from the pre to the post reforms period. The findings reveal that although public expenditure has increased in absolute terms, relatively the rate of increase during the reforms of 1990s has been at a declining rate (especially until 1997-98). Public expenditure on the social sector was however regarded as very low as most of the capital is disbursed as salaries or spent on establishments.

Kumari (2007) studied the gender disparity present in the literacy levels in Bihar using the Gender Related Educational Development Index (GEDI), formulated on the lines of HDI, UNDP. Adi and Patil (2007) examined the changes in the classification and

composition of women workers in India in terms of (i) educational composition of the women workforce, (ii) occupational structure of women workers, (iii) economic rewards in terms of salary/wages and (iv) representation of women in the governance of India.

Gulati and Sharma (2004) analyzed district level indices on Reproductive and Child Health (RCH) status using factor analytical techniques thereby highlighting socio-economic and cultural predictors of inter district variations (backward districts) of indices on RCH.

Radhakrishna and Rao (2006) evaluated trends in poverty in India and noted regional difference in its incidence across states from 1956 to 2001. Interstate variation in poverty reduction from 1957 to 1990 has been attributed to improvements in agricultural productivity, variations in the initial resource endowments and interstate variations in performance. Growth of the rural non-farm sector is indicated to be the most important factor in poverty alleviation in the rural areas.

Dixit and Chatterjee (2007) examined poverty and malnutrition in rural households in Jharkhand and West Bengal in the backdrop of seasonal unemployment and migration. Positive correlation between poverty and migration, migration and malnutrition, migration and nutritional security was established.

Malhotra and Shailja (2007) analyzed various indicators of gender bias and poverty vulnerability on a regional and temporal basis. Whereas sex ratio, female literacy and total fertility rates were chosen for gender vulnerability, poverty vulnerability has been measured by taking percentage of non-poor for various years and states.

Tiwari (2007) analyzed regional patterns in the levels of poverty in Niyamatabad, a Community Development Block (CBD) in the Chandauli district of Uttar Pradesh using a Composite Poverty Index in 14 sample villages. Findings show that high poverty areas coincide with concentration of depressed castes, illiteracy, low per capita income and low food grain availability. Low poverty areas show urban industrial impact.

Gogoi and Borah (2005-06) assessed urban poverty from the perspective of unplanned urban growth and the status of the urban poor in Guwahati city, Assam. It is found that most of the urban poor are indeed migrants from districts of Western Assam.

In a study of the vulnerability of waste pickers of Delhi with focus on the socio-economic and occupational health aspects Sarkar (2006) explored the commitments of the government towards them. Their occupational hazards were primarily malnutrition, anaemia, tuberculosis, allergic and respiratory disorders and bacterial and parasitic infections.

Devi, *et al.* (2006) studied malarial incidence in the Salem district of Tamil Nadu with the help of satellite (LISS III and IRS) and GIS data. The findings reveal that water bodies and the interaction of rainfall and forest cover play a major role in vector propagation. The high risk areas were identified in order to extend control programmes effectively. Choubey (2005) assessed the epidemic scenario of HIV/AIDS in India and its diffusion from high risk urban centres to rural hinterlands. *Population*

Lakshmana and Eswarappa (2006) analyzed the inter-district and inter-*taluk* variation in sex ratio in Karnataka from 1991 to 2001 to compare broader trends in population distribution. A decline is recorded in the inter-decadal sex ratio from 1991 to 2001. Sharma (2006) analyzed the total fertility and demographic attributes of states that have already reached replacement level and that of Madhya Pradesh. He isolated the principal determinants of population growth with data from NHFS (2). His findings show

that the Southern states record a lower growth rate. Fertility is positively related to mean age of marriage. Total fertility rate among illiterate women is found to be higher than those who have completed at least high school education.

Environment and Ecological Planning Approaches

Ramotra and Pakhare (2007) appraised the status of wind power generation in Maharashtra. The combined efforts of the Ministry of Non-Conventional Energy Source (MNES) and Centre for Wind Technology (C-WET) are evaluated in terms of infrastructural facilities as the Green Energy Fund, Approach Roads, encouragement to cooperative sector and Letter of Credit (LOC), also through private intervention.

Yadav and Yadav (2006) assessed the efforts of the Madhya Pradesh State Electricity Board (MPSEB) in providing energy to various sectors in the state. The findings are that the growth rate of consumption and consumers has increased exponentially at the aggregate level in all sectors over the past 30 years, with agriculture and the domestic sector claiming the lion's share. However, the industrial sector was found to rely more on captive power plants.

Mondal (2004) attempted to establish the relationship between transportation and non-primary activities with some variables indicating levels of nodal accessibility and spatial patterns of non-primary activities in the Mewat region. The findings show that the correlations between weighted road capacity and manufacturing, servicing, processing, transportation, storage and communication were strongly positive. Routray and Swain (2004) analyzed the level of participation by local people in land related project activities in a micro watershed of Orissa. It is found that participation is comparatively higher in the flat-land villages and those that are closer to the project site.

Sharma (2004) assessed the impact of floods on the quality of life in Assam through correlation of indicators of quality of life and those reflecting damages caused by floods. The districts with higher incidence of floods are found to be the same as those with lower values of variables showing quality of life. Saha (2005) described the major environmental problems that are directly related to mining operations in the Raniganj coalfields of West Bengal. The physical impacts are categorized as subsidence of land, its degradation, depletion of the water table, changes in forest cover and coal fires. Saikia and Dutta (2005-06) record the transformation of wetlands and its environmental degradation in both rural and urban areas of the Nagaon district of Assam. The shrinking of *Beels* (wetlands) and the hazards to fauna and flora due to increasing human interference are noted with concern.

Concluding Remarks

The studies cited and reviewed reflect a vast range of interests and research areas covered by geographers in relation to issues of regional development significance as well as those that can in some way be connected with planning issues and approaches. The studies themselves indicate that the shackles of a centralized planning perspective has largely become unrecognizable and on the other hand, a more local based concern, grass-root based issues but not entirely discounting the broader canvass, have come to stay in the subject as it has been evolving in India over a decade or so.

HISTORICAL GEOGRAPHY

Rana P. B. Singh
Ravi S. Singh

Review of over seventy papers in the turn of present century on the aspects of historical geography of India indicates that this branch has mostly been used as a way and approach in place of an established branch (Singh and Singh, 2004). The first pioneering magnum opus is Alexander Cunningham's *The Ancient Geography of India* (1871), which needs re-reading and re-research with the use of recent techniques and technology, orientation and objectivity, surety and subjectivity. By ignoring the past one loses the understanding of the rootedness of culture by which biotechnologies essential to human survival and health have progressed over the past 8,000 years in the ancient world like India, and the consequences of uncontrolled urban growth on food and health security (Hulse, 2007).

Spanning a range of topics- print culture and oral tales, drama and gender, library use and publishing history, theatre and audiences, detective fiction; a recent book has made appeal to historians, cultural theorists, sociologists and all interested in understanding the multiplicity of India's cultural traditions and literary histories (Blackburn and Dalmia, 2004). The collective or interdependent nature of Asian society is consistent with Asians' broad, contextual view of the world and their belief that events are highly complex and determined by many factors, including human and terrestrial. The individualistic or independent nature of Western society seems consistent with the Western focus on particular objects in isolation from their context and with Westerners' belief that they can know the rules governing objects and therefore can control the objects' behaviour. Nisbett adds: "I believe the twain shall meet by virtue of each moving in the direction of the other" (Nisbett, 2004); the historical process of development and transforming thoughts approve this now. Cartographic representation and mapping of historical attributes has recently got attention by NATMO, covering time series from Stone Age to Vedic India to Mughals and British with depiction of territories, kingdoms, centres, expansion, and routes (Nag, 2007).

Travelogue, Image Writing and Historical purview

In 1870, Nawab Sikandar Begum of Bhopal became the First Muslim Woman to publish an account of her Hajj Pilgrimage to Mecca. On her return to India she wrote her impressions of the visit. Her account is reproduced, "*A Pilgrimage to Mecca*" in the original English translation by the wife of a British Colonial officer, of an unpublished Urdu manuscript, and is accompanied by a critical introduction and afterword that make this offering a comprehensive resource on travel writing and encourage the reader to rethink established understanding on travel writing, colonialism and world history. Sikandar Begum's critical and often surprising description provides unique insight into the factors that went into writing this quintessentially Muslim journey in a colonial environment (Lambert-Hurley, 2008).

Majeed's essay focuses on the oppositional politics expressed in the historical geography of the Persian and Urdu poetry of Muhammad Iqbal (1877–1938), showing how it emerges from, and breaks with, Urdu and Persian travelogues and poetry of the nineteenth century, exploring the complex relationships between the politics of Muslim separatism in South Asia and European imperialist discourses. There are two defining tensions within this politics. The first is between territorial nationalism and the global imaginings of religious identity, and the second is between the homogenizing imperatives of nationalism and the subjectivity of individual selfhood. Iqbal's work contains three elements: a sacred space, a political territoriality and the interiority of subjectivity; however, these elements are in conflict with each other, particularly, the space of interiority in his poetry conflicts with the realm of politics in the external world (Majeed, 2007). The study of historical formation and the de-territorialization of the Muslim minority in India exemplify the emergence of spatial blocks and associated lifeworlds (Delage, 2007).

A book on 'partition' examines the context, execution and the aftermath of the Indian subcontinent's division, weaving together local politics and ordinary lives, focusing the obliviousness of the small elite driving division, as well as the activists on both sides, to what the partition would entail in practice, how it would affect the populace and how damaging its legacy would be (Khan, 2007). The proverbs and sayings refer to the cultural knowledge about the agrarian life and horticulture, as exemplified in the study of Assam (Bhagowati and Neog, 2006). Exploration of the concepts of boundaries and homes in partition fiction through a scholarly essay and interviews with six well-known novelists from India and Pakistan, narrating historical stories of their personal experiences and memories of the years around 1947, their families in pre-partition India, their Hindu, Muslim, or Sikh neighbours, their ideological shifts, their difficult days of survival amidst the carnage, and the impact of the partition on their writings provides the context and happenings of conditions (Bhalla, 2006).

Following the post-colonial approach and archival sources, a biographical analysis of Mary Curzon, Vicereine of India (1898–1905) is presented within the context of her family and friendship circle, presents the recent shifts in the method and theory of biography that have opened new avenues for geographers engaged with life writing (Thomas, 2004). Following an interdisciplinary path, a recent pioneer study of Hindu images in late 18th century portrays and projects the monumental achievements of Balthazar Solvyns (1760–1824), a Flemish artist from Antwerp who lived in Kolkata (formerly Calcutta) from 1791 to 1803. By analyzing life, work, creations and the interpretive and intuitive messages, a new dimension to historical geography and regional historiography has been added (Hardgrave, 2004).

Partly derived from South India, and partly from the northern Indian core of the Mughal empire, the materials related to South Asian xenology deal with the problem of the 'Franks', namely the Europeans-whether seen in the context of Asia or of Europe. Initially the Europeans appear as strange, wondrous and also largely untrustworthy interlocutors in the Indian Ocean. Then, with the passage of time, an image of Europe itself emerges, which is finally sealed in the later eighteenth century with the first travel accounts by Indians to Europe. However, these images are part and parcel of a more general xenological and geographical understanding of the areas that neighbour South Asia, and should hence be analyzed as such (Subrahmanyam, 2005).

Understanding the period of transition from ‘native’ to colonial rule, issues like the crisis of political-economy in transition, by contextualising certain civil cases and petitions to understand how people exploited the ambiguity between power and authority—between the ideology of ‘tradition’ and the ‘method’ of colonial institutions—to elevate their social and economic status have been comprehended. It is noted that while the colonial institutions could empower individuals and groups economically, only ‘traditional’ authority could legitimise their revision in social status. The strategy of social mobility and empowerment, undergirds the transformation in the agrarianscape, and contextualises the ascendance of religious orders/leaders that cut across caste and sectarian boundaries at the time when the state was in the process of transition (Sharma, 2006).

Through an anthology, the notion of photography as a globally disseminated and locally appropriated medium is established, and its importance in raising historical consciousness from many regional, cultural, and historical perspectives is also provoked (Pinney and Peterson, 2003). Changing political interests, a decreasing desire to fix identity and a broader popular visual culture is reflected through photographic portraiture which is indicative of the emergence of post-colonial Indian photographic practice (Pinney, 1997).

Science, Historical Context and Searching the Roots

Indo-Muslim medicine or the Unani tradition developed in South Asia alongside Mughal political culture. While it healed the body, it also had a profound bearing on the social fabric of the region. Alavi’s book shows the nature and extent of this Islamic healing tradition’s interaction with Indian society and politics. Without disprivileging the state, she demonstrates how an in-house struggle for hegemony can be as potent as external power during processes that define medical, social, and national modernity (Alavi, 2007). Epitomizing a lifetime of research on ancient India, a recent writing vividly captures all different articulations of sociological import from a whole body of traditional writings: both sacred and secular (Banerji, 2007).

The 19th century historiography of colonial India consciously projected modern science as a characteristic product of the Western civilization decoupled from and superior to its antecedents, with the implication that all material and ideological benefits arising from modern science were reserved for the West. In the present century when the East (oriental) and the West (occidental) are coming closer by a search of interconnectedness and multiculturalism, there is thus a need to construct a history of world astronomy that is truly universal and unselfconscious (Kochhar, 2006). Interest in science, technology and medicine of India under British rule has grown in recent years and has played an ever increasing part in the reinterpretation of modern South Asian history. Spanning a period from the establishment of the East India Company rule through to independence, a recent analytical survey demonstrates the importance of examining the role of science, technology and medicine in conjunction with the development of the British engagement in India and in the formation of Indian responses to western intervention, the impact of scientific and medical research and the dilemmas of nationalist science (Arnold, 2005). Under the East India Company the writing of records and historical documents were subject to variable regimes of transformation and stability

in relation to their own interest and motives that fulfill the objectives of the Company (Bowen, 2005).

Focusing on ideas and cultural attitudes toward science and technology, and more specifically toward scientists and engineers in British period, 1875-1927, a recent study (Weil, 2006) traces the trajectory of several self-reinforcing transitions in the culture of the Forest Service. Drawing on a rich collection of sources, Weil reconstructed the history of the forest communities in western India, while exploring questions of tribal identity and the environment; further also demonstrating how the ideology of indigenous cultures, developed out of the notion of a pure and untouched ethnicity, is in fact rooted in nineteenth-century racial and colonial anthropology. It is appealing to trace the processes by which the apparently immutable identities of South Asian populations took shape, and how these populations interacted politically, economically and socially with civilizations outside their immediate vicinity (Guha, 2005). A work on ecology and colonialism documents the impact that colonial commercialization had on the environment in a cattle rich region of central India called Berar when the traditional interdependency of agriculture, grazing lands and forest was broken under British colonial onslaught (Satya, 2004).

During the British period attempts have been made to develop forestry under the notion of modernizing nature and imperial purview of eco-development (Rajan, 2006), but unfortunately after independence less emphasis is laid. Tropical forestry in the nineteenth century consisted of at least two distinct approaches towards nature, resource, and people; and what won in the end was the Continental European forestry paradigm. The assessment and analysis of impact of Green Revolution in Bulandshahr is also an example of understanding agrarian change in modern history (Jewit and Baker, 2007). In the light of modern history transformation, growth and development have provided a substantive frame to understand the Indian condition after independence (Nayyar, 2006). The study of the *Rigveda*, myths based upon it and the Mycenaean names of land and people is also a new dimension in historical interpretation (Srinivasan, 2005). The historical analysis of environmental movement like Chipko has also been a subject of historical geography that refers to achievements, peoples' consciousness and awakening and also the pitfalls and marketization of such movements (Buryan, 2005).

Cultural History and Regional Historical Geography

It is being gradually realized today that the present civilization of India is not merely a development of the Aryan culture, as has so far been generally held. Indian culture is a composite product in which the contribution of the Sindhu (Indus) valley civilization has been significant. A recent book has explained the various strands of diverse cultures that have contributed to the emergence of Indian culture (D'Souza, 2007). Another study (Mohanty, 2008) examines the nineteenth-century cultural history of Orissa from the postcolonial angle by drawing primarily from literary sources. It focuses on issues such as feudalism and colonial modernity, language politics and the rhetoric of progress, westernization, nativity and border crossing.

The conventional modern history writings have mainly dealt with nationalist movements and leaders. However, recently there is a clear shift towards subordinated histories of regions and peoples. An anthology of six essays by well-acclaimed social scientists has established this tradition, and covered themes like caste and cricket,

autobiography of Indian women, calendar art and ‘unity & diversity’, etc. – reflecting new topics and new ways of looking at the issues (Menon, 2006). The decades of the 1950s and 1960s were a watershed in the writing of history. Narratives of the past continued to be written as they are to this day, and there continues to be a valuable gathering of new evidence. But the more challenging trend has been to pursue answers to questions that relate to why and how something happened rather than merely when and where. There is also a need to integrate a variety of facets in constructing a historical context. Historical explanation and understanding also have to be viewed as a process in time (Thapar, 2005).

Historical study proves that the establishment of the Mughal Empire and the advent of Europeans, particularly the English, had intertwined India’s history with larger, historical movements sweeping the world. The Mughals connected India to Persia and Central Asia through massive movements of people and goods, and by precipitating new encounters and accommodations between Muslims and Hindus. At about the same time, Europeans were establishing trading posts and forts throughout the Indian Ocean basin, challenging the Arab and Indian merchants who dominated these trade routes. Moreover, as time went on, the Europeans entered aggressively into the politics of the region, leading eventually to their colonial rule over the subcontinent. As a result of these, life in England was also transformed, in everyday matters like food and clothing, an incipient industrial revolution, increasing global competition with European rivals, and a new self-aggrandizing image as rulers of a global empire (Spodek and Louro, 2007). The Maratha Empire that was founded by Shivaji in the mid-seventeenth century, spread across most of India during the following century has been analyzed by regional historiography, based on administrative documents of the Maratha polity, family papers and histories of the Empire (Gordon, 2007).

In the debate about political unity and cultural diversity in India, representation of the past often has been the main battlefield. The frequent instances of violence against minorities in connection with disputes over the past give cause to reconsider the role of history in the emergence of the nation state in India. By inserting both the unifying model of the nation state and the diversity of cultural and social forms of life into an overarching perspective of temporal change, a modern form of unity can be accomplished that may be called unity in diversity (Gottlob, 2007).

An article dealing with configuration of the migrant self as located within the problematic of capital and colonial modernity explores the fashioning of the figure of the Kutiyettakkaran, a migrant, in the Malayalee unconscious by problematising the peasant migration from Travancore to Malabar during 1920–70. It is noted that the fashioning and circulation of a modernizing and heroic image endowed the migrant with a peculiar authority in the landscape and history of Malabar. However, such a mission is critiqued, often in absolute terms, by texts closer to our times (Varghese, 2006).

Orientalist research has most often been characterized as an integral element of the European will-to-power over the Asian world through the histories of knowledge – Sanskrit erudition and forms of legitimacy. Dodson’s study profusely seeks to nuance this view, and asserts that British Orientalism in India was also an inherently complex and unstable enterprise, predicated upon the cultural authority of the Sanskrit pundits, its principal Indian intermediaries. By revealing the unacknowledged roles which this ‘traditional’ intelligentsia played within elements of the colonial state apparatus, he traces

the conflicts within Orientalism, from the consolidation of Britain's fledgling Indian empire to its links with the emergence of early forms of Indian national identity and inherently anti-colonial cultural movements (Dodson, M. S. 2007a). Through establishment and expansion of English language the British succeeded to reorient and transform Indian culture towards the West. Similarly through translations and re-interpretation publishing in English, Indians became suspicious about their own root, of course in several ways that helped them to preserve several of their old literary traditions (Dodson, 2005 and 2007b).

Historical settlement geography

Computing the length of the 16-span rod, a measuring instrument used in the Kanchipuram region during the late Chola period, by combining information on land boundaries from a single inscription with fieldwork and map tools, attempt is made to reconstruct part of the geography of the city referring to long-term changes in land use. It is suggested that the application of this methodology to other epigraphic records may allow a detailed reconstruction of early agrarian and urban environments, and contribute to the quantitative evaluation of land holding or revenue systems (Heitzman and Rajagopal, 2004). Chamar (2005) has tried to analyze the evolution and history of rural settlements in Bhiwani district of Haryana with reference to succession of period and spatial expansion. The settlement pattern and cultural profile of an early historical city of Mathura is an additional example of historical settlement geography explaining the expansion, planning and the structural growth (Singh, V.L. 2005). In case of another holy city, geographical interpretation of the historical growth of Varanasi shows the impact of cultural forces and emergence of the sacredscapes (Singh, R.P.B. 2005). Since the emergence of myths and related literature (*Puranas*), starting from 2nd century BCE to 16th century CE, Varanasi has been the focus of attention for understanding cultural landscape, sacrality of space, time and functionalities, and above all the processes of spatial transposition through which the city has emerged as a sacred territory (*kshetra*) and pilgrimage place (*tirtha*). The critical edition of the 8-9th century text, *Skandapurana*, that has a special section on Varanasi refers to above aspects in detail and successfully justified its role as cultural capital (Bakker, and Isaacson, 2004). By use of power and patronage, the deserted city of Banaras was recreated, reinvested and re-established among the dwellers and pilgrims during the 18th and 19th centuries (Freitag, 2005).

In a significant contribution to the understanding of gender history, attempt is made to capture and document crucial turning points in the course of transformation of Indian women's consciousness from objects to subjects, especially referring to Punjab. (Mohan, 2007). A geographer turned activist observed that during the 2002 riots, some areas coped with violence better than the others through peace committees; processes of rehabilitation and restitution; and effective collaboration among local, regional, national, international relief, and human rights organizations (Ahmed, 2004). A study dealing with coming of the 'modernity' in Bombay in the first quarter of 20th century, offers an insight into the multi-layered relationships between modernity, colonialism, and the production of urban space (Hazareesingh, 2007).

Conservation of sacred groves is a cultural phenomenon of historical significance in conserving the nature. Carrying a strong tradition of landscape approach, historical

study of conservation of sacred groves in the Western Ghats of India presents a good example (Bhagwat, *et al.* 2005).

British Raj, Imperialism and Orientalism

An innovative remapping of empire offers broad-ranging view of the workings of the British Empire at a time when India of the Raj stood at the centre of a newly globalised system of trade, investment, and migration. A recent publication offers a refreshingly new perspective on how imperialism operates, emphasizes transcolonial interactions and webs of influence that advanced the interests of colonial India and Britain alike (Metcalf, 2007).

Constructed from original source material including confidential documents of some of the British Viceroys and Officers as well as some letters of Winston Churchill to Muhammad Ali Jinnah a work deals with the intricacies of the problems which overwhelmed the greatest men of India like inexorable forces of time (Das, 2004).

Tracing the history of the East India Company from its first tentative trading voyages in the seventeenth century to the foundation of an empire in Bengal, a pioneer study presents *tour de passage* into the scriptoria, ships, offices, print shops, coffeehouses, and palaces to investigate the forms of writing needed to exert power and extract profit in the mercantile and imperial worlds. Interpreting the making and use of a variety of forms of writing in script and print, the study argues that material and political circumstances always undermined attempts at domination through the power of the written word. Navigating the juncture of imperial history and the history of the book, *Indian Ink*, uncovers the intellectual and political legacies of early modern trade and empire and charts a new understanding of the geography of print culture (Ogborn, 2007). This study has been further enriched by historical geographical interpretations of travel and trade, geographical context of arts of commerce, collectivity and authority in India during 1600-1760 (Ogborn, 2004, 2006; Ogborn, and Withers, 2004). It is known that the industry entered into a declining phase in the third quarter of the nineteenth century. The hypothesis of discriminatory colonial policies as an explanation for the decline is not tenable; rather, the industry collapsed under the adverse impact of the market (Ray, 2005).

In a paper that examines the contested grounds of authorization for one important orientalist project 19th century India– translation of the ancient Sanskrit *Rig Veda*, it is argued that Europeans initially sought to validate their translations by adhering to Indian scholarly practices and, later, to a more “scientific” orientalist–philological practice. Indian Sanskrit scholars, rather than accepting such translations, instead engaged critically with them, reproducing a distinctive vision of Indian civilization through their own translations into English. This essay also suggests that intellectual histories of the colonial encounter in South Asia should move beyond debates about colonial knowledge to more explicitly examine the contexts of knowledgeable practices (Dodson, 2007). The historical passage to modernity, mediated by colonial authority and by nationalist resistance to it, has impacted all cultural disciplines (Ganesh, and Thakkar, 2005).

On the line of post-colonial studies in geography, some attempts have been made to re-analyse the colonial literature and archival materials. Challenging scholarly inquiries into communalism in South Asia that often exclusively focused on politically constructed religious and ethnic identity categories, it is argued that territoriality and the

designation of homelands played an important, but largely unrecognized, role in developing social and political boundaries in the region. By analyzing the writings of Bipin Chandra Pal, it is revealed that the territorialization of a Hindu-based version of the national homeland as a key process in the development of communal difference in Bengal and South Asia was more popular and operative. By implicitly excluding all other forms of social affiliations from the narrative of the homeland, it is argued that the stage was set for the contestation of territorial identity categories that played out through the 20th century Bengal (Jones, 2006).

Following the analysis of colonial urban governmentality, combining Foucauldian and (post-) colonial theory, recent interpretation of archival data are presented as re-interpretation of the politics of late colonial Indian urbanism, illustrating a comparative history of New and Old Delhi and taking into account problems of social and racial segregation, policing of the cities, and biopolitical needs in urban settings, and portraying the scenes of lived spaces (Legg, 2007). This is in continuation of earlier works dealing with nationalist struggle in colonial Delhi, postcolonial developmentalities and related aspects of congestion and calculation (Legg, 2005, 2006a, 2006b). The issue of governance and governmentality in India has also caught attention by contemporary geographers dealing with post-colonial critique (cf. Sharp, 2007). Similar perspective and constructs are also used by a geographer turned historian who has analyzed colonial governance and public culture and issue of poverty formation in Bombay (Kidambi, 2004a, 2004b, 2007). Historical study of imperialism, dark and light sides of public life and culture in the city of Madras (presently Chennai), and also the growth, consequences and impact of prostitution in city life have been critically examined by a historical geographer (Kumar, 2005, 2006a, 2008). A cross-cultural study of the census and women's work in Rangoon, 1872–1931, further reflects upon the expansion and influence of the colonial culture and the stress imposed by the British (Kumar, 2006b).

Reconsidering the policies applied by the colonial state with regard to European 'loafers' or vagrants in colonial India, a number of questions have been raised about the relationship between categories of 'race' and 'class' in colonial settings. Discussing the intellectual roots of the class prejudices towards working-class Europeans dating back to the Company era, on the basis of a brief survey of the economic and demographic developments in mid-nineteenth century which brought the issue of 'white poverty' to the foreground, it is noted that the 'reclamation' of European loafers can be regarded as an 'internal' civilizing mission which shared many features with the 'external' mission directed at the Indian population. It is noted that the colonial government's vagrancy policy was largely designed to protect the bluff of 'colonial difference' underlying the 'external' imperial civilizing project (Fischer-Tiné, 2005). The tale narrating the aftermath of partition for Lahore and Amritsar 1947-1957, presents the viscosity and disastrous situation of structural and cultural loss (Talbot, 2007).

Theories that explain the origins of communal violence in South Asia often point to the discursive creation of Hindu and Muslim identity categories at the beginning of the 20th century. These theories indeed overemphasize imagined social differences without adequately considering how these boundaries were territorialized in everyday life through performative place-making practices. It is argued that zones of tradition were established across British India symbolically and tangibly dividing the territory before it was officially partitioned (Jones, 2007). Similar case study of colonial agrarian policies in the

tribal areas of the Salem and Baramahal region of Madras Presidency (1872–1947), also concludes that those setting the colonial agrarian policy did not consider the economic disadvantages of the hill areas and forest-oriented tribal economy and treated them in line with the plains; mainly to extract maximum land revenue. It is also confirmed that colonial agrarian policy, from the late 19th century to the end of the colonial rule, contributed to the deterioration of the tribal economy in Madras Presidency due to restrictions on rights and access over land and forest (Saravanan, 2006). Western Himalayas however were politically, economically and socially distant from the civilizations and empires of the North during pre-colonial times; subjected to British interference much later that made them far removed from nature (Alam, 2007).

Society, Gender and Historical processes

British historian Nile Green has extensively analyzed the Islamic and Islamicate South Asia from the seventeenth to the twentieth centuries, in particular Sufi expressions of Islam. Given that Sufism as a category was itself in some sense a colonial invention, his recent work has concentrated on the interplay between Sufis and the colonial power in India. Following an approach of a historian trying to formulate ethnography his work aims at understanding the different ways in which Sufism has functioned in its changing historical and ethnographic contexts. The first monograph referring to Indian Sufism (Green, 2006), was a study of historical change in three Sufi traditions under the Mughal Empire. The followed book is a study of what he has termed ‘barracks Islam’. Based on wholly neglected small town Urdu lithographs which lend an entirely new insider perspective on the life of the Muslim sepoy under British command, the work also draws on colonial archives to address the roles of such new institutions as the ‘natives only’ asylum on the transformation of Islam in colonial India through the medium of the army (Green, 2008a). Another book presents the neglected but major role of Hyderabad in reforming the customary Islam of India’s many Muslim saints and shrines, emphasising the evolution of two reformist networks stretching between the towns and countryside of Hyderabad State to the industrial quarters of colonial Bombay and across the Indian Ocean to Natal in the wake of the export of Indian indentured labourers (Green, 2008b).

In the perspectives of history of landscape, culture, tradition, formation of narratives and social environment are examined; and at the same time, the localization of Islam and re-conceptualizing the interaction of Islam with other religions (particularly in India) has been taken seriously with an aim to see the harmonious interaction and community formation, e.g. Sufism and its ways in the formation of publics (cf. Green, 2004a, b, c, d, e, f, and 2005).

In historical context, analyzing everyday corruption in India, and the effects of the *Panchayat Raj* reforms, drawing examples from the states of Madhya Pradesh and Kerala, a major work shows how decentralization can be connected to social capital and corruption (Widmalm, 2008). Arguably, these systems are the product both of the colonial history of the Indian subcontinent, and of the poverty and inequalities still endemic in post-colonial India. Moreover, leaving aside the distracting influence of romantic or demonic myths of rurality, ethnographic and other accounts of village life should be read with an awareness of wider political, social and economic influences (Wardhaugh, 2005). According to popular belief, poverty and low standards of living have been characteristic of India for centuries. Examining the transformation of Indian

society and economy under British rule through the prism of the labouring classes, it is justifiably argued that their treatment by the early colonial state had no precedence in the pre-colonial past and that poverty and low wages were a product of colonial rule (Parthasarathi, 2007). Through the processes of agrarian change and supporting industries in South India, the provincializing capital get regional accumulation that changed the life and economy of people (Chari, S. 2004). The nature of sacred relationship between human and nature and interactions within that have shaped the ecosystem specifically of Maharashtra, were threatened and transformed into exploitative strategy under the British colonial rule, and followed up even after independence (Rao, 2007).

By integrating the histories of land and capital, the relationship between capitalist ‘development’ of the wider economy under colonial rule and agrarian continuity and change, a critical interpretation of agrarian change under British colonial rule, on the basis of the relationships between demography, commercialization, class structure and peasant resistance unfolding over the long term between 1770 and more recent times, is presented recently. Drawing most of the empirical evidence from rural Bengal, Bose’s study makes comparison with regional agrarian histories of other parts of South Asia, thus stands on its own in the field of modern Indian social and economic history in its chronological sweep and comparative context and makes the complex subject of India’s peasantry (Bose, 2007).

By using the case of the Baptist missionaries called the ‘Serampore Trio’—Rev. William Carey, Rev. William Ward and Rev. Joshua Marshman— it is urged that science and Christianity were intimately related in early nineteenth-century north India. Ward, in his important account of Hinduism, argued that true Hindu science had given way to empiricism, and that Hindus had confused nature with the divine. The trio sought to educate Indians with respect to both Sanskrit and European science, and utilized a range of scientific instruments and texts on science published in India, and aimed successfully to change the way its pupils saw the material world by urging experimentation rather than reverence of nature (Sivasundaram, 2007).

It is also noted that the colonial census was a bureaucratic device which provided an essential abstraction from social reality, a ‘statistical fix’ designed to map individual social groups in space, as exemplified with the contradictions associated with colonial knowledge systems as reflected in the census grafted onto Burmese society in the 19th and early 20th century similar to other areas of India (Kumar, 2006). The impact of cinema that turned its march from public awakening to common entertainment, it carried the basic pitfalls of the colonial period and in fact took a turn in more negative way, especially encouraging crime, loss of rich culture and dismantling social ties (Mankekar, 2004). Similarly, the legacy of the colonial India has not yet recovered even after passing more than five decades. While India succeeded at economic front but at social front and regional scale wide hierarchical gaps are visible (Goswami, 2004). Focusing on the role of the poor in caste, religious and nationalistic politics, and on their contribution to the urban economy, it is demonstrated how they emerged as a major social factor in South Asia during the interwar period, and illustrated with the case of Uttar Pradesh, focusing on urban social history, ethnic and sectarian conflict, nationalism, and the politics of poverty, labour and class relations (Gooptu, 2005).

Rather than waning in significance under globalization, nation-state is made the reference point by representatives of the state as well as by civil society actors of diverse

political persuasions, in an attempt to secure material and discursive control over identities. The anxiety with globalization is displaced onto gendered bodies, juxtaposing the scale of the body with the scale of the nation. These anxieties lead to efforts to police the boundaries of gendered behaviour, or conversely to displays of military strength. On these lines it is concluded that it is critical to interrogate the categories of identity mobilized by ‘local resistance’ to globalization before valorizing this resistance (Oza, 2006).

Epilogue

The increasing acceptance of critiques like post-colonialism, post-traditionalism, post-structuralism and postmodernism has opened a new avenue to understand the interpretive meanings, inherent messages and the projective mystical realities that are deeply rooted in the vast corpus of ancient Indian narrative, literature and mythologies. Re-reading, re-interpreting and re-projecting the contextuality of sources that are rich resources of the past would be helpful in tracing the backdrops of Indian crisis and to modify the image and identity. The issues of historical legacy and cultural downfall yet not fully analyzed from the viewpoint of “inside reality”— seeing the world through the eyes of its people. The acceptance and emergence of new notions, ways, perspectives, subaltern views, oral history, biographical resources, heritage ecology, etc. are some of the recent concerns enriching the field of historical geography of India. Even the historians are now frequently using geographical skills and resources; remember it is said: “geography without history is a mirror without frame” (cf. Mittal & Dua, 2005).

INTERPRETATION OF SOCIO-CULTURAL PHENOMENA

Social Geography

Debendra Kumar Nayak

Writing a review of research in social geography has always been a hazardous task. A major reason for this has been the very nature of this sub-discipline which 'actually lies on the periphery and not in the core area of Indian geographical tradition' (Ahmad, 2004). The pioneering effort in introducing this sub-field to Indian geography was made by the Centre for the study of Regional Development, Jawaharlal Nehru University in early 1970s. Even after four decades, courses on social geography form part of post graduate curriculum only in a handful of geography departments in the country. The themes selected for offering this course however differ drastically from one department to the other even among those few departments which offer this course. What constitutes 'social phenomena' as expressed in the spatial context is defined by individuals in their individualistic view (Ahmad, 2004). This has been one of the reasons for the stunted growth of this sub-discipline. Secondly as Sinha (1996) pointed out, the zeal for the study of local and regional dimensions of India's social structure by geographers in the formative period of this sub-discipline soon ran out of steam as geographers, instead of developing upon the theoretical and analytical tools provided by the 'pioneers' were found increasingly emulating the tools of the sociologists and social anthropologists. This has been another cause of the underdevelopment of this segment of study in India. Social geography as it developed in the Anglo-Saxon world was much in response to political happenings of contemporary social relevance. Unlike the western scholars, Indian social Geographers were not greatly attracted to the sociological theories, nor did the post colonial, post-modern discourses influenced them much- they remained aloof to the major developments in critical social theory (Ahmad, 2002).

Critical Social Theory and Globalization

It is heartening to note that the dearth of a critical discourse on social theory within geography has received welcome attention in an edited volume by Banerjee-Guha (2004) on Space, Society and Geography. The book explored the trend that has set in India in contemporary human geographical researches and built up a perspective of society-space convergence. Inevitably, the discourse goes beyond the disciplinary confine in understanding major shifts and developments in the discipline: the impact of globalization, post-Fordism, post modernism, the cultural turn of gender studies, studies on languages and communal strife, environment and social wellbeing, social infrastructure and social wellbeing. In a leading contribution Munshi (2004) opposed the idea of partitioning of the subject containing the twin gamut of physical and social sciences and strongly pleaded for a fusion of the two for a meaningful understanding of the impact of globalization in all spheres, sustainable development. Almost in similar vein, Ahmad (2004a) argued that human geography in India has to be re-positing and that

geographers have to explain their position in the wake of all round changes occurring due to globalization. He further argued that the logic of geography has got distorted by the current polarisation of the forces of world policy. In the context of recent changes, Sharma (2004) has sought to advance a threefold argument in relation to globalization and made an attempt to define its socio-cultural discontents. He issued a warning for drawing the socio-cultural safety nets well in time lest that giant globalization shark engulf the small fry before the process of deglobalization is even initiated.

Banerjee-Guha's (2004a) paper investigated the crisis of post modern urban space with an example of Mumbai revealing how the restructured urban space or the flexibilized economy of Mumbai epitomized the contradictions of globalizing spaces and economies and the manner in which they get embedded in urban plans and policies to a systematic segmentation of space and people. The contemporary discourses, Raju (2004) argued, need to take up the varying spatiality of patriarchal structures. In another study, Raju (2006) insisted that India's urban labour markets must be understood with reference to emerging global commodity chains. She places the 'local' in a complex web of intersecting subjectivities that furnishes spaces of exploitation and hope simultaneously. A study by the Jeffreys (2006) explored the social mobility of the lower castes achieved through education as influenced by globalizing forces though they might not have produced significant employment opportunities as yet as is the case in the Western Uttar Pradesh. Chattopadhyay (2004) made a strong case for integrating environment in socio-geographical analysis as space is continuously restructured by the changing production processes that affects environmental situations.

Social Change in Mega-Urban Regions

Mega cities in India are growing very fast with their inherent intra-urban inequalities and implications for social change. With the help of a case study of Mumbai Metropolitan region, Sita (2004) argues that the pace of settlement transition in terms of social attributes is resulting in the distinction between urban and rural forms getting blurred to an extent. But Mukherjee categorically asserts that rural urban migration in India continues to be essentially poverty induced, not likely therefore to induce any change in the economic or social status of the poor rural migrants. Phadke (2004) in his study of Mumbai Metropolitan Region identified glaring intra urban social gaps with respect to availability and/or provision of social infrastructure. In an important contribution to urban social geography, Desai and De (2004) contended that unlike in rural space where socio-economically dominant groups are accepted as a political power, the resistance offered by the non-Hindu minority and Hindu low caste segments in large urban areas has intensified and ethnic clashes have developed as a culture of post-modernism. This, in turn has strengthened the pattern of spatial segregation and the pattern undergoes little change even after migration to peripheral suburbs in Indian cities. Taking the case of Ahmedabad that experienced communal strife that fragmented, retrenched and reorganized the territorial structure, the authors find the social space in tact at the time of suburbanization.

Tribe, Displacement and Ethnic Conflict

The tribal segment of the population and their distribution in areas of diverse degrees of isolation has been a favourite topic of research among social geographers of

India. The pattern of their clustering and concentration in areas generally averse to settled intensive cultivation leading to their socio-economic stagnation has been noted by geographers working on the problems of tribes in India. There is a clear shift in the period of review from this identification of patterns to problems of displacement due to development initiatives or otherwise and ethnic conflicts arising out of a heightened assertion of tribal identity expressed in terms of a territorial identity. Continuing with the earlier tradition of examining the pattern of distribution of tribes Misra, Hassan and Daspattnayak (2006) described the pattern of Scheduled Tribe distribution in the state of Orissa in order to understand the degrees to which the tribal segment has been exposed to forces of development and modernization. Evidently, geographical factors have determined to a large extent the pace at which the tribal communities have been brought closer to the mainstream- the authors observed. Exploring the pattern at micro level, Sinha (2004) identified the morphology of tribal non-tribal boundary in the areas of *Bodo* concentration in the context of the demand of the *Bodo* tribal community for a separate state to be carved out of Assam. She found that the long drawn ethnic conflict in this region has substantively modified the morphology of tribal non-tribal boundary that changed from a gradual transition to abruptness. The demand for statehood by the *Bodo* tribal community and the violent inter ethnic conflict between the *Bodo* and the *Santhali* has unleashed an irreversible process of redistribution of population in the areas of *Bodo* concentration, changing the ethnic composition of the population that has serious repercussion for the polity (Patra, 2004). Singh, Singh, Singh and Juyal (2004) in their study of development induced displacement of ethnic population in Sonbhadra district have drawn attention to the plight of the tribes as project affected persons.

Caste and Language

Caste has been one of the most potent factors governing the hierarchical social organization in India. In spite of its extreme negative role, it continues to define distribution of resources amongst social groups as well as the pattern of social and spatial interaction, structures of political power and social authority. Geographers have been traditionally interested in studies of caste in terms of their spatial distribution, caste combination regions and the role of caste as a constraint in social transformation. Caste has historically played an important role in territorial organization of rural and/or urban space. In relocating space and society in rural Haryana, Sharma (2007) rediscovered clan based spatial organization at the territorial as well as village levels in a study of Rohtak district. Efremova (2004) identified and demarcated socio-cultural regions with the help of dissimilarity index of caste structures and found socio-cultural boundaries thus identified too often coincide with natural frontiers especially between varying relief zones. Narayan's study (2007) of caste and politics in Bihar reiterated the changing role of caste in modern Indian society as it has acquired a new and fresh lease of life.

The role of language in defining elements of regional identity in India has long been recognized. This character of language as it is expressed in space has been found to be a satisfactory basis for reorganization of states in Independent India. Ishtiaq (2004) traced the trends in the development in linguistic geography of India and identified crucial areas of social geographic research that study of languages is capable of throwing significant light on. Language has played an important role in not only identity formation but also "contextual coexistence" of various linguistic groups and thus is seen as a

significant component of social geography, it is not being paid enough attention by scholars especially geographers who can contribute a lot in developing the understanding of spatiality of languages and their explanation (Ishtiaq, 2005). Nayak (2005) studied the process of language retention and change among the immigrant tea garden labourers of Assam and found two distinct and separate processes - process of language shift among the minority groups and the second, the process of bilingualism or multi-lingualism among the majority groups. In any case, language change has been a single major outcome cutting across communities present in the tea gardens. With the territorial reorganization of the federation and the linguistic partitioning of the political space, according to Adhikari and Kumar (2007) good number of linguistic communities began to consider themselves as nations and sub-nations as the political organization of linguistic regions made them feel like historic entities. Kalra (2007), using dissimilarity matrices, on the other hand emphasized the association of Indian languages and dialects as they are distributed over space. Nath (2004) emphasizes the need for creating smaller states not at lower level of linguistic hierarchy, but on consideration of population size.

Education and Underdevelopment

Diffusion of literacy and education in India has never been uniform either in its spatial spread or in its social coverage. There are glaring regional disparities in the spread of education as the art of reading and writing has rarely filtered down the rigid social hierarchy that India inherited from its past. The depressed castes, the tribes and other marginalized sections of the society have taken little advantage of this important instrument of social change and transformation. A major reason for low level of literacy in certain regions among the marginalized social groups has been dropping out from schools. Ansari and Rajinder (2007) explained this factor as a cause for educational underdevelopment in an otherwise economically developed district of Rohtak in Haryana. The remedies suggested however do not address to structural problems, but a series of governmental measures which have not really produced desired effects elsewhere. Wide disparity in the level of literacy between the tribal and the non-tribal segment of the population has been a feature of social underdevelopment in the country as a whole barring the notable exception in the North-East. Prakash (2007) examined the differentials in Sikkim –a state where the non-tribal segment is lagging behind their tribal counterparts in responding to impulses of literacy and education. Writing on literacy patterns in the North-East region of India, Sharma (2007) observed that the region emerges as a social deep, although not without the scattered presence of certain social ridges. Social peaks apparent in the hilly areas seem to be hardly generative in character and therefore have contributed only marginally towards strengthening the educational base in such areas.

Concluding Remarks

The period under review is marked by a resurgence of interest among social geographers in epistemological issues. The ongoing process of globalization to which India is now firmly committed appear to have been the driving force behind a large number of geographers interrogating the spatial impact of the changes manifesting on the wake of these changes. The urban interest is inevitable in such a situation. Researches in social geography have also been alive to contemporary social problems of displacement,

redistribution and ethnic strife. The role of language and caste in Indian social geography has also attracted some interest. Likewise disparities in literacy and education too continue to be an important area of research within the sub-field. Issues of gender, health and wellbeing -important themes in social geographical studies are dealt with separately in this volume and important contributions have been made in each of these sub themes.

While the contribution made in this sub-field may be viewed with some satisfaction, it may be pertinent to note some of the regrettable gaps in addressing to issues of socio-geographic interest. Not much work has been done on spatial organization of Indian society and its social structure. The issue of religious identity remained least attended. The marginalized sections of the population; the tribes, the depressed castes, other backward castes and the minorities have been largely neglected in the researches undertaken by geographers in the period under review. The burden of globalization appears to have fallen on the people living in large metropolitan areas while social geographical researches are conspicuous by their absence in analyzing its manifold impacts on the peasants, the toiling masses and the socially marginalized segments living in rural as well as in urban areas.

Cultural Geography

Rana P. B. Singh
Ravi S. Singh

The diversities, distinctions and desperateness scattered all over India and at the other end unifying forces of traditions made this country a web of cultural whole. It is with these characteristics in studying cultural geography of India emerges a variety of topics. In the present review emphasis is placed on research that has been conducted in or about India. The first attempt to review the literature on cultural geography of India is presented by Wescoat *et al.* (2003). In the evolution and growth of geography in India since late 1990s a cultural turn took place through reinterpreting the ancient Indian classics using multidisciplinary approaches and illustrating them with field studies and contemporary contextuality (cf. Wescoat, *et al.* 2003). Examining 'Indianness' in geographical context is a subject of self-retrospection as well as re-assessment (Singh, R.P.B. 2008e). Presently, issues of conversation and contestation have received more attention, like fluidity and dynamics of tradition, lineages of art, inter-culturalism and the question of body, dimensions of woman power in India, legacy of Gandhian politics, the humanist perspective and the civilizing role of history, and the debate on science in post independence India. The long-standing and continuing debate on Indian culture and on what constitutes 'Indianness' manifests itself in many ways, some more subtle than others.

Since the turn of the 21st century, a review of good number of works published on cultural geography of India, mostly by scholars from abroad; indicate that this branch has mostly been used as a way and approach narrating or analyzing landscape and culture, putting aside the theoretical construction and critique of the philosophical ideas as popular in the West (Singh, R.P.B. and Singh, R.S. 2004). The acceptance of regional and territorial use of geographic skill in social sciences is now a common practice, yet in cultural context, territoriality is a prominent tool (Delage and Headley, 2008b). Mobilizing the metaphors of pregnancy and lactation to address the imperatives arising from British academic geography's postcolonial position has influenced geographers dealing with culture of India, especially fascinating to foreign scholars.

In recent debate geography as a discipline is considered 'pregnant' but 'in trouble' to illustrate the paradoxical struggle of the discipline to be a global discipline whilst at the same time marginalizing the voices and perspectives that make it global. Moreover, geography is also considered as a discipline whose 'milk is flowing'— suggesting ways that the discipline can acknowledge its global interconnectedness to produce a mutually responsible academic agency (Noxolo, *et al.* 2008). In cultural geography discourses in the West, critique of representational and non-representational context, expression and exposition are given more emphasis (Lorimer, 2007); however in India more emphasis is continues to be laid on descriptive-narrative and ethnological interpretation. Cartographic representation and mapping of attributes of cultural heritage has recently got attention by the NATMO, covering aspects like physical and cultural bases of ancient India, religions and philosophy, *Bhakti* movements, social reforms movements, art and culture, and performing arts, and also short introduction to each of the maps (Nag, 2007).

Cultural Journey: Pilgrimage and Sacred place

Started in 1970s by Surinder Bhardwaj through his pioneering publication on *Hindu Places of Pilgrimages* (1973), study of pilgrimages has not been popular in comparison to Indology. However, it has received attention recently in geography too. The tradition of Bhardwaj has been continued by Stoddard and his associates, though taking only numerical dimension (Foster and Stoddard, 2008). In a study of history of religions attribute of space has been taken prominently as a basic frame (Zeiler, 2008). As a cultural practice, pilgrimage and pilgrimage places are in continual transformation as the societal forces shaping them are changed. As with any cultural practice, pilgrimage is both a window and mirror, revealing and reflecting the effects of these forces in people's lives. This continues in modern India, and has become even more complex as Hinduism in the Diasporas has extended Hindu sacred horizons. Pilgrimage to such spirituo-magnetic nexus is an expression of the richness and variety of life and culture within India, and wherever else, Hindus are settled (Bhardwaj and Lochtefeld, 2004).

Use of theoretical frame of pilgrimage studies in a geographical perspective has attracted people even from religious studies, especially to emphasize Victor Turner's constructs, territorial context and emerging conflicts (cf. Delage, 2004, 2005, 2008; also Singh, R.P.B. 2006). The study of feminine divine and her association with different cults, traditions has proved the potential capacity of geographic skills in narrating the deeper spirits, as exemplified in the study of *Chhinnamasta* goddess at Rajarappa (Singh, R.S. 2008b). Study of the origin and growth, and the role of various active agents in the process of making a local goddess, indicates the locality in time frame converges into regionality through continuity and increasing pace of devotees and visitors and their supporting auxiliary functionaries (Singh, R.S. 2007). Conversely, the universality submerges into locality like in case of goddess shrine at Kamachcha (Singh, R.S. 2008a).

In pilgrimage studies using 'text' as a way to see the past and understanding 'context' is to see the contemporary situation receiving strong attention with reference to image worship that looks simple but it possesses the complex, fluid, and contested nature of religiosity and cultural underpinnings. The five essays in a recent anthology deal with these themes. The studies establish the notion of 'crossing the religious boundaries' from locality to universality (Granoff, and Shinohara, 2004a).

Essays included in the Proceedings of a Conference on 'Sacred Space and Sacred Biography in Asian Religious Traditions' explore the role of sacred place in creating a specific local religious identity (Granoff, P. and Shinohara, K.2004b).

Use of religion in public awakening and consciousness in the elections is also a field of enquiry in contemporary cultural geography by British scholars, e.g. in the context of feeling of nationalism and reformative frame for maintenance of identity and also as a 'show' (Oza, 2004). Additionally, the study of contrapuntal geographies of threat and security, while making comparison with USA and Israel has also been a new addition that reflects the similarities, transformations and changing life ways (Oza, 2007).

Studying the social and cultural issues as being the root cause of present political crises in Nagaland, Kibami (2004) propounds that ethno-linguistism is an important dimension to understand the present crisis, especially in providing a strong base not only to understand language dynamics but also to help in language planning in a multilingual country like India. It is noted that the in-group clashes among the Nagas have bearings on

their separate identities, but the mass conversion to Christianity in Nagaland has brought them together (Kibami, 2004).

A study of topographic symbolism of pilgrim landscapes offers an insight into aspects of the mother goddess' divinity. The study of Pavagadh Hill in Gujarat, notes that the primeval landscape of bare rock, ephemeral springs, and layered vegetation, has evolved into a cultural landscape of worship in temples and shrines, small communities that draw their sustenance from pilgrimage, and holy organizations that facilitate and manage it (Sinha, 2006b). A study of multiculturalism and integrative form of culture and built architecture has been undertaken by geographers-turned architects and their team, e.g. case study of the Yamuna riverfront (Sinha, Ruggles and Wescoat, 2004).

Study of sacred geography of Puri emphasizes the variety of existing religious centres and landscape that comprising temples, *maths*, *Sahis* inhabited by ritual functionaries, sacred tanks, holy trees and the auxiliary and supportive secular institutions and organizations (Patnaik, 2006). The study reveals the blending of sacred and profane, thus resulting to the 'wholeness' in the holy territory of Puri.

Ethno geographical study of Sun goddess festival in Bhojpur Region illustrates the interlinking chain from locality to universality (Singh, R.P.B. 2008d). Similarly, the applicability and contextuality of *Gaia* theory in Indian culture has been tested in a cross-cultural perspective, emphasizing the roots in Indian culture (Singh, R.P.B. 2008e). The most sacred month for Hindus, *i.e. Karttika*, records variety of festivals and celebrations that make the sacredscape a fantastic web of culture (Pintchman, 2005).

The conflation of the West with modernity is being challenged by new critical interventions on the themes of 'occidentalism' and 'plural modernities'. In this context an interesting study compares two important figures in the articulation and invention of the West, the Japanese 'Westerniser' Fukuzawa Yukichi and the Indian poet and advocate of spiritual Asia Rabindranath Tagore. Fukuzawa and Tagore developed contrasting narratives both of the West and of Asia, narratives which they employed to express novel and distinctive visions of the nature of modern life (Bonnett, 2005).

Cultural Notions and Changing Reflections

The literary images and fictive literature are rich cultural resource in explaining the roots of culture and traditions that developed in the past and continued as legacy and continuity of maintaining identity (cf. Dhussa, 2007). An attempt is made to recapture the past, relocate priorities, recover lost myths and unveil the process of nation construction, an effort to unfold a multi-layered reality (Jain, 2006). A recent study of Vikram Seth's *A Suitable Boy* is a good example that portrays the variety, distinctions and contrasts of Indian culture (Festino, 2005). Classical study of folk art in India, illustrated with Mithila art and painting, has also drawn special attention jointly by an expatriot Indian and an American geographers (Cotton and Karan, 2007).

A comment by Narayan on the "false geography" of his "imaginary town" provides the departure-point for a discussion of Malgudi, which argues against the frequently held view that it is a metonym for a quintessential India, or South India. Taking its cue from the cultural geographer Doreen Massey's assertion that "the identities of places are always unfixed, contested and multiple", the paper contends that Malgudi is a multifaceted and transitional site, an interface between older conceptions of "authentic" Indianness and contemporary views that stress the ubiquity and inescapability of change

in the face of modernity (Thieme, 2007). The mystical, erotic and metaphysical expression of Indian art has influenced the contemporary American art exemplified in a recent study where Indian deities, *mandala*, *chakra*, body-soul metaphor and cosmicised representations are given preference (Myers, 2005).

Examining class, gender, and work in Tiruppur, South India, where export of knitted garments has been led by a networked fraternity of owners of working-class and Gounder caste origins, it is noted that the class mobility is hinging on their “toil.” Chari (2004) very admirably portrays how history, geography, gender, and work practice shape local sites of global production. The issue of caste and land quality in Bihar has intricate relationship that led to hierarchy, dominance and the power relationship (Thakur and Sinha, 2007). Mapping the changing profile of reservation debates on caste, class and politics in India, a study has argued for developing new paradigms for the discussion of caste and interrogates the democratic and secular roles of caste in relation to class and politics (Pankaj, 2007).

The impact of cultural globalization with special reference to Kolkata (Calcutta), illustrates how the City-symbol of Bengali culture, is changing fast under the sway of globalization in which the traditionality of the culture is lost for the several ongoing processes—may it be called feminism or postmodernism! (Ray, 2005). Kashmir, as known internationally for proxy militias, Islamic terrorists, and human rights abuses by the Indian security forces, is reflected in its regionality called *Kashmiriyat*, the language of belonging as expressed by Kashmiris themselves, prior to foreign rulers, colonization, and the creation of national boundaries (Zutshi, 2004). Language has played an important role in not only identity formation but also “contextual coexistence” of various linguistic groups and understanding of spatiality of languages and their explanation is imperative (Ishtiaq, 2005).

The issue of women’s empowerment in India, with reference to socio-spatial disparities in regional and societal contexts is a good example of practicing modern cultural geography (Gupta and Yesudian, 2006). Gender concerns in coal mining displacement and rehabilitation in India emphasize the engendering mining communities (Ahmad, and Lahiri-Dutt, 2006). The journey of women’s struggles and their emotional and intellectual responses to patriarchal control and imposition has received a scholarly analysis (Jain, 2006a). Hindi cinema offers a means of examining the evolving geographies of the multi-sited, multi-national Indian diaspora and its relationship to the ‘homeland’. Mohammad’s paper (2007) seeks to elaborate an understanding of Bollywood’s visibility in the new Diaspora as a response to political, economic, and technological transformations that have taken place in India.

An overview of the Sufi traditions of South Asia emphasizes some emerging research angles on the problematic convergences between texts, territories and the transcendent elements in Sufism (Green, 2004). Islam as it is practiced by millions of Muslims in South Asia, has an empirical validity and is a dynamic process of adjustment and accommodation as well as conflict with other religions, with which it coexists’ (Ahmad and Reifeld, 2004).

Landscape, Cultural Heritage, Contestation and Context

In the frame of archetype the natural, spatial and design; attributes of landscape in India is studied and illustrated with examples from Braj, Pavagarh, village plans, and

pilgrimage centres and that landscape symbols express all that a culture holds dear and externalise deeply felt emotions. It is further observed that as Indian society modernizes; secular thinking in the workplace and public sphere replaces religiosity ordained tasks (Sinha, 2006a).

Within the time frame of the 12th through the 14th centuries, a particularly creative period in Gujarat, Islamic influence has been predominant that do not necessarily fall into specific sectarian categories. In fact, the local traditions formed its 'communities' as exemplified in the Arabic, Persian and Sanskrit inscriptions is illustrated in Maru-Gurjara style at Bhadrashvar as studied by Patel (2004). Using a case study of the sacred complex of Tirumala-Tirupati, a popular pilgrimage centre in south India, a paper explores causal linkages between different factors that shape the environment in a pilgrimage centre, and also notes the environmental effects *i.e.* seasonality on traditional pilgrimage to be limited over time and space. It is argued that significant changes in scale, frequency and character of such visitation over the past few decades reflect new pressures on the environment of sacred sites (Shinde, 2007).

The issue of heritage contestation has recently drawn attention of historical geographers, architects and conservators. Some of the UNESCO sites in India have been recently studied (Singh, R.P.B. 2008f). Champaner-Pavagarh, like other heritage sites in India, exhibits both the palimpsest of landscape layers inscribed over time and the juxtaposition of Hindu and Islam traditions in architecture and city planning (see Sinha, 2004). Both Hindu and Islamic cultures exploited the visual potentials of the topography. The concept of cultural landscape as a heritage resource is a recent development on the line of old idea of historic conservation and certainly did not guide monument-centric colonial efforts at restoration (Sinha and Harkness, 2006). On this line the Yamuna riverfront around the Taj Mahal is suggested as 'cultural heritage landscape'. This also raises the issue of suspicion of tension between the Hindus and the Muslims at some places (Sinha, 2005). Defining heritage territory under the strict control of heritage law will help avoiding conflicts and contestation together with active public participation. This can be exemplified with a case study of riverfront heritagescape of Varanasi where history, culture and the lifeways together resulted into evolution of a unique landscape, *i.e. faithscape* (Singh, R.P.B. 2004). Studies dealing with the historical processes involved in assessing the heritage area of Champaner-Pavagadh, Gujarat, India refer the failure of the mechanism and also prioritization of the concern for heritage preservation (Sinha *et al.*, 2004a, 2004b). Historical formation and the deterritorialisation of the Muslim minority in India, soon after independence have been noticed prominently resulting in diverse structure and forms of sacred landscape (Delage, R. 2007).

Following the scale of UNESCO World Heritage the riverfront of Varanasi is also considered as landscape of contestation, which needs critical appraisal for urban-regional development (Singh, R.P.B. 2004a, 2007b, 2008f; also Dar, 2005). Maintenance of cultural mosaic, religious multiculturalism and blending of diversification and distinctiveness of lifeworld make this city eternal (Singh, R.P.B. and Singh, R.S. 2008). Study of another UNESCO site of Khajuraho refers to re-establishment of the ancient glories by re-interpretation of the old literature together with conservational strategy to save it (Singh, R.P.B. 2006e).

Based on the aesthetical and conservational studies of water with reference to design themes, illustrated with South Asian examples from medieval history it is noted

that if history is any guide, water will not be a cause of war in the 21st century' (Wescoat, 2005). Inspired by the conservation work of Sir Bernard Feilden with a study of conserving Mughal Garden, it is concluded that historical waterworks help us rediscover traditional methods of water conservation that ultimately enhance human experiences and understanding (Wescoat, 2006). Metaphorically, Indian landscape was an icon of garden as in Mughal period (16th-17th centuries). Emperors realized and used it as political metaphor. This study indicates the historical ways to project environmental well-being (Wescoat, 2007a). Recent explorations are made to understand and navigate the spectrum of cultural conflicts associated with landscape heritage conservation. To link the case of Champaner–Pavagadh with the theme of human rights, the six types of conflict examined, may be viewed as progression from cultural to socio-economic and ultimately to human rights (Wescoat, 2007b).

Varanasi, the Holy city & Symbol of Indian Culture

Considered and mythologised as city of Shiva, Varanasi has been distinctively represented in the tradition of lithographs showing this city (Chakraverty, 2005). Since the last twenty the city is facing the problem of illegal encroachments and threats (Dar, 2005; also Doytchinov and Hohmann, 2004). Mahamaya temple is a representative of such a cultural symbol that is also a subject of threat (Dwivedi, 2005). The study of boatman and their role in the formation of life along the riverfront is itself a 'lifeworld' of its own and is considered to be a special feature (Doron, 2005a, 2005b). The riverfront of the Ganga at Varanasi is in itself a sacredscape where a unique *faithscape* emerged and constantly awakened by rituals performed there (Singh, R.P.B. 2007c, and 2007d).

The role of historicity and cultural patronage during 18th and 19th centuries has been a new wave of revitalizing the city's religious landscape and related architectural built-up; in fact in this period the city has been re-created to fit into the ancient panorama of its sacredscapes (Feitag, 2005). A monumental work that integrates architecture, photography, cosmology, culture and geography, illustrated with the pilgrimage routes and symbols in Banaras is an example of cultural geography of a city (Gutschow, 2005).

The Heidelberg University has completed its 3-years project dealing with *Visualised Space in Banaras: Images, Maps, and Representations* (Gaenzle, and Gengnagel, 2006). Many other associated attributes of codifying the maps and processional routes, field study based on the ancient maps and texts have also added new dimension (Gengnagel, 2005a, 2005b, 2006). The behavioural study of pilgrims and tourists in Varanasi further support the image of the city as 'holy centre' and place of pilgrimages for Hindus and also for others (Rana, P.S. and Singh, R.P.B. 2004). The study of life style and lifeways of Muslim communities shows space affinity and temporal consequences that influenced Hindus and reciprocally influenced by too, thus emerged the multiplicity of culture (cf. Lee, 2005; Showeb, 2004-2005). Another study of daily data for continuous two year of the tourists and visitors are used to test the theory of Self Organized Criticality that supports the pattern and ordering of chaos and fractals (Malville, 2004; Malville, and Singh, 2004; Singh and Malville, 2005a). The spatial structure of the goddesses' sites in Banaras forms many such patterns, where shapes like triangle, square, circle, pentagon, hexagram, and other meet (Singh and Singh 2008a, 2008b, 2008c). The detailed analysis of nine mother goddesses in Banaras also supports the same pattern (Wilke, 2006). Similarly in case of sites associated to *Shiva, Ganesha*

and *Surya* (sun god) in Banaras also form series of alignments that converge to various symbolic shapes (Singh, R.P.B. 2008a).

Even in the establishment and growth of the Banaras Hindu University, the archetypal cosmogonic design has been taken as a base for the basic plan (Singh, R.P.B. 2007a). The city has maintained its cultural image through the processes of spatial manifestation and set breathe of the Indian culture (Singh, R.P.B. 2007b). The study of various cultural attributes and variety of landscapes has presented the amalgamation of culture where multiplicity of religion and society converges into mosaic (cf. Mitchell and Singh 2005). Iconographic and cosmic design of goddesses in Varanasi reflected the deeper sense of cultural astronomy and positively corresponding alignments (Singh, and Singh, 2006). The role of goddess in Hindu society has a frame of consciousness that developed in the past and further emerged as a 'motherly' force, linking humanity to divinity (Stähle, 2004). To activate and re-energise such rituals many old healing trees and their products are still used (White, 2005). This study is further comparable and projected with the similarities and contrasts with the goddess territory of Vindhyachal, a neighbouring sacred territory which emerged in the frame of 'landscape as temple' and spatial manifestation of all the 52 *Shaktipithas* scattered all-over India (Singh, R.P.B. and Singh, R.S. 2008b, also 2008c)

Gandhi, a Cultural Symbol and a Vision

In the 21st century Mahatma Gandhi has been considered as 'icon' of India and as a way to make this world more humane, peaceful and harmonious; that is how in geographical debate emphasis has been laid on his contribution to understand development, human development, ecological and political practices (Singh, R.P.B. 2006c, 2007b).

The making of one of modern India's most enduring political symbols, *khadi*: a homespun, home-woven cloth has been explored with the background of image of Mahatma Gandhi who clothed simply in a loincloth and plying a spinning wheel as familiar around the world. Trivedi's work brings together social history and the study of visual culture to account for *khadi* as both symbol and commodity (Trivedi, 2007). Weber (2006) noted that it is difficult to understand Gandhi without understanding his spiritual quest. Gandhi's importance as an environmental thinker may be marked in terms of the strategies and vistas opened up by his pursuits, both public and private, towards a sustained animal and environmental liberation struggle. In fact, Gandhi's environmental thinking is rooted in his larger philosophical and moral thinking (Bilimoria, 2004).

Gandhi's thought on ethical and humanistic frame of political thought is of a state consisting of self-governing village communities small enough for 'love' to be a practical reality and for communal approval and disapproval to be effective moral forces without the need for routine and formalized coercion. The ends of such a state will be achieved not through threats and force, but through persuasion and consensus (Adams and Dyson, 2003). Against Nehru's high modernist vision, Gandhi's postmodern view of India's future has been more suited to India but it is tyranny that has never been used (Rudolph and Rudolph, 2006). These ideas have not yet examined in the field of geography.

Epilogue

Geography matters because it affects human life and the natural environment, and serves as force in the formation of landscape. In a country of such rich cultural traditions and ancient civilization there are ample areas, issues and objects of serious and comprehensive research in cultural geography, emphasizing the classical, traditional, transformational and futurist approaches to be used to understand and reinterpret the meaning, metaphor, symbols and the inherent messages that may help awakening and formation of new vision to serve the society better. With the emergence and acceptance of interdisciplinary approaches, study of cultural geography has acquired a renewed importance in the present than ever before. Recent philosophical constructs like Gaia theory, visioning spiritual tourism, sacralising space and time, interrelationships between mystical tradition and corresponding cultural astronomy, etc. are strengthening the corpus and field of cultural geography. Issues like changing nature of cultural adaptation, attitudinal and ethical, role of religious movement and pilgrimages, sacred places and message of peace, reinterpreting the old texts and their relevance today, India's message to the world order, and Diasporas etc. are yet waiting serious attention. The exposition of experiential feelings, like the novel, the meeting point of culture and technology, ecological order and conservation, saving and serving the humanity are the other areas where Indian geographers are lagging behind.

Claiming the Dawn Sky: Gender Issues in Indian Geography

Anindita Datta

The growth of the geography of gender in India is akin to the image of the swiftly expanding horizons of the dawn sky. The illustration is apt in more ways than one, particularly as this report of progress in the subfield goes to press. Continuity, innovation, originality and spread are the basis on which this analogy is drawn. The subfield represents a confident opening up that has successfully integrated gender as an analytical category to much of geographical research. Situated on the frontiers of the discipline, the subfield is uniquely positioned to allow an almost unparalleled scope to enlarge the realm and relevance of geographical enquiry.

From only a small trickle of research in the eighties, the subfield has witnessed a gradual yet cautious widening in the nineties. By the year 2000, the field had expanded enough to attempt to claim for itself its share of academic space in the discipline and to merit a separate chapter in the status report on the progress of geography in India(1). The current report is a continuation of the same and draws upon many of the arguments put forward in the former.

To begin with, the progress in the subfield must be sited within the general context of teaching and research in human geography in India. Within the present scenario, a large number of post graduate departments continue to be a part of the faculty of sciences, rather than social sciences. Further, mainstream praxis in much of human geography remains geared towards policy planning and analysis. Yet, it is extremely heartening to note that the field has witnessed an almost exponential expansion in the period under review. The introduction of new courses that interrogate spatial patterns with reference to gender and the incremental volume of geographical research using gender as a category of analysis are major milestones marking the development of the subfield.

As mentioned in the earlier report, a welcome development has been the inclusion of the geography of gender as a paper in the model curriculum for undergraduate courses proposed by the University Grants commission(2). At the time of writing it may be mentioned that two full fledged papers are currently on offer as part of the M.A and M. Phil programmes at the University of Delhi. Discourses on gender and the spatial find representation in at least five of the papers in the MA syllabus at JNU. The department of Geography of the SNTD University also lists a course on gender geography as part of its M.A. syllabus. Further, the subfield finds passing, often fleeting mention on the web pages of a number of geography departments/faculty profiles as a prospective research area (for example, Kurukshetra University, Jamia Millia, Gauhati University among others). The spatial spread is to be noted and is indicative of the acceptance and expansion of the field.

From being almost invisible, gender as an analytical category has seeped into almost every field of geographical enquiry. Research papers using gender include themes on health, development, workforce participation, food security, conflict, disaster management, environment issues, resources, micro credit, and policy planning among others (see list of works reviewed for details). In terms of sheer volume alone, this is definitely indicative of an expanding subfield. This development could perhaps be better

explained through a set of etic-exogenous factors, with the post Beijing concern for women's empowerment and the academic preoccupation with the millennium development goals (3) being the most prominent. Emic-endogenous factors that may have played a significant role could be the introduction of the new courses and overhaul of existing syllabi, among others. The two sets of factors are expected to continue to push further developments in the subfield.

Yet the widening of the field is not synonymous with its deepening. Most works continue to be descriptive rather than analytical. Barring a few studies, the engagement of space with gender and vice versa remains largely glossed over by geographers (4). The larger research input into these themes has come not from geographers but sociologists (Abraham 2007, Nair 2007, Phadke 2006, and Vishvanathan 2007, among others). Similarly, economists too have been tempted to interrogate place and space to explain status of women and implications of their work (see Kodoth 2005, Krishna 2005).

Among geographers, by and large, most works reflect equating of site with space and sex with gender (see for example, Gulati and Sharma 2004, Kapoor 2006, Kumar 2006, Laxmi Devi 2006, Sannashiddannanavar 2007 among others). Conspicuous by their paucity are studies which engage directly with the themes of gendered experience of space, gendered spaces and spatialities of gender. Ironically, the spatial turn in the social sciences places these themes firmly within the ambit of geographical enquiry, bringing space to the forefront of analysis, explanation and interrogation. It could be argued that in much of the Indian context, rigidity of disciplinary boundaries and a circumscription of the geographical understandings of space to include only a two dimensional tangible space has led to the greater appropriation of these spatial themes by sister disciplines (see Raju 2004, Datta and De 2008).

On a more optimistic note however, one must comment that the subfield is among the least hegemonic in its praxis. Innovativeness of themes and method distinguish it from the largely moribund mainstream. Perusal of list of dissertations submitted in at least two centres (5) reveals a steady stream of ongoing research using a healthy combination of qualitative methods along with the quantitative. (see Anand 2006, Chandramukhee 2004, Misra 2006, Moinuddin 2007 among others). The interrogation of space and sexuality is another optimistic development that deserves mention (Bhairannavar 2005, 2007). One can only foresee a furthering of this trend in the future.

Of critical importance for both the deepening as well as the widening of the field is the interrogation of colonial praxis, the search for post colonial alternatives in explanation and description, together with the inclusion of qualitative research methods as part of the post graduate training imparted(6). The innovativeness in method, willingness to combine the qualitative with the statistical, the emotional with the tangible will ultimately stand the field in good stead, placing it on a continuous trajectory of development. From not holding half the sky to claiming the dawn sky, the journey has been one of cautious (perhaps contentious) opening of the field. Today this subfield is firmly rooted and unabashed in its growth and development, constantly pushing at the disciplinary edge and enlarging the field of human geography.

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Notes

¹ Raju S and A Datta (2004) 'On Not Holding Half the Sky: Gender in Indian Geography', in H.N Sharma (ed) *Progress in Indian Geography: A Country Report, 30th International Geographical Congress, Glasgow*, Indian National Science Academy, 2004, Delhi. pp 131-134.

² University Grants Commission, (2001), 'UGC Model Curriculum in Geography, University Grants Commission, New Delhi.

³ See <http://www.undp.org/mdg/basics.shtml> and <http://www.undp.org/mdg/goallist.shtml> for details. At least four of these goals demand reference to and an enquiry of gender roles and relations within the local regional contexts.

⁴ Much work in this direction has been produced by PUKAR under their gender and space project with the city of Mumbai as the backdrop. Similarly Jagori (An NGO dealing with consciousness raising and awareness building on women's issues) in Delhi has produced interesting work on the way in which women engage with public spaces. See Ranade 2007, Phadke 2005, 2007, Vishvanathan et al 2007.

⁵ While dissertations submitted at the department of Geography, Delhi School of Economics are cited here, I am privy to the fact that this is true for other post graduate departments of geography as well, especially the CSRD, JNU, based on dissertations sent to me for evaluation and personal communication with faculty.

⁶ A dedicated journal or at least a working paper series, together with annual seminars and workshops are other inputs that would go a long way in sustaining the field. In the early nineties a newsletter of the gender and geography study group was initiated by Prof Saraswati Raju with inputs from students at the Centre for the Study of Regional Development, JNU. Many of these are now in teaching positions in different universities. It would be worthwhile to revive the newsletter or initiate a working paper series.

Geography of Health

Jayashree De

Geography of Health as a branch of study has been making significant strides in most of the universities in India where the subject is being taught. Over the years, it has progressed from studies in ecological associations of diseases and attempts at disease mapping, to investigations into a wider perspective of health and health care. Researches in India have been laying greater stress on changing environmental factors and its impact on health as a system and on health care. The focus of most research has been human welfare and various attempts have been made to adopt the cultural and the structural approaches to address the problems of health and place. Some of the publications that have been reviewed here may be divided into different categories based on the central theme of these studies.

Disease Ecology

It is interesting to note that disease ecology studies have shifted from the traditional communicable diseases to the more modern diseases such as SARS, Bird flu and HIV/AIDS. Hazra (2004) has highlighted the factors that contributed to the occurrence of SARS in China and has traced the diffusion of the disease from China to other parts of the world. She also examines the social and economic implications of the disease. In yet another study, Hazra has looked at the global threat of Bird 'flu (under publication).

Since India has the largest number of HIV/AIDS cases in the world, the disease continues to attract the attention of Indian geographers. Choubey (2007a & b) has highlighted the distribution pattern of the disease in India and has shown to what extent it is associated with sex workers in Greater Mumbai. Hazra (2007b) too, identifies the environmental factors that are causatively associated with the occurrence of the disease.

Nutrition and Health

The period under review has witnessed a surge of interest in studies establishing the relation between nutrition and health. Choubey (2004a) has studied the nutritional status among different tribal communities of Madhya Pradesh and has quantified the extent of deficiency of the required nutrients within the community. A significant contribution in this area has been the publication of a book (Ashraf, 2006) which stresses the link between environmental factors, agricultural practices, nutrition levels, health and disease.

Maternal and Child Health

Maternal and child health has been another emerging area of concern of a number of geographers in the recent years. The need, availability and utilization of Maternal and Child Health (MCH) care services have been the main focus of these studies. Banerjee and Das (2006) have analyzed how the use of MCH services has played a significant role in reducing infant mortality rates in different states of India with special reference to West Bengal. Choubey (2005) and Dubey (2005) have carried out investigations into the reproductive and child health care status in different parts of the state of Madhya Pradesh.

Women's Health

The environment, including physical, biological and socio-cultural conditions, plays a dominant role in determining the health status of women. This has been highlighted by De (2005). Malnutrition, anaemia, low birth weight of children, vulnerability to infectious diseases due to under-nutrition, increasing incidences of tuberculosis, bronchial asthma, lung and breast cancer due to exposure to air pollution, skin diseases due to contact with polluted water and soil, urinary tract infection due to poor sanitary conditions, and stresses and strains of the physical and social environment leaving their imprint on the mental health are some of the problems faced by women that have been highlighted in this paper.

Health Care Planning

Location of health care facilities has been a significant area of study by medical geographers. Availability of modern tools and quantitative techniques have further facilitated such studies and enabled geographers to contribute towards the planning of health care services. Ahmad and Shamim (2004) have used quantitative techniques to reveal the gap between distribution of settlements and settlements having health facilities. Rubeena and Kumaran (under publication) have assessed the possibilities of employing geo-informatics in promoting the use of Local Health Traditions and thereby provide affordable health care options within the reach of the common man. Using a participatory approach, in another study, Rubeena and Kumaran (under publication) have looked into the problems faced by local health practitioners in Kerala. They have tried to examine the viability of complementing the modern system of medicine with Local Health Traditions. Choubey (2004) has pointed out the paucity of allopathic health care facilities in tribal areas of Madhya Pradesh and the factors that inhibit provision of health care in such areas (Choubey, 2006).

Health and Social Well-being

A number of papers have been published within the last four years concerning the close link between health and social well-being. Mukhopadhyay (2007) seeks clarification of the concept of well-being from an interdisciplinary perspective and demonstrates its relevance with respect to the changing mode of the discipline of geography. De (2004) establishes the link between health and social well-being and identifies the role of geographers, vis-à-vis other scientists, in the domain of health. Aliar (2007) has broken new ground by dealing with issues pertaining to the rights of the community and traditional medicine for Local Health Traditions as an intellectual property.

Environment and Health

Increasing environmental pollution, resulting from industrialization and technological developments, has become a matter of global concern. Therefore, the impact of air, noise, water and land pollution on human health has become an important area of study by geographers. Bhatt *et al.* (2005) have tried to identify the health impacts of air and noise pollution on the health of the population. Bhatt *et al.* (under publication) have also highlighted the increasing incidence of skin diseases, cancers and other

ailments among farming communities that use effluents from the Central Effluent Channel in the Vadodara industrial belt to irrigate their fields.

The possible impacts of climatic change on human health are one of the burning issues that have also been addressed by Indian geographers. Akhtar (2007a) has observed the changes in climate in Kashmir and the consequent impact on the local population. He has highlighted the possible increase in malaria that may result from the ongoing changes in climate. Akhtar (2007b) has also looked into the historical perspective of the relationship between rainfall and malaria incidence in India as well as the increased deaths due to heat wave conditions resulting from global warming. The growing threat of diseases arising due to various natural hazards has been a focus of the study. Akhtar (2007c) has emphasized on the various health problems that can result from a tsunami strike, and has outlined a holistic framework of study of health and disease that needs to be adopted under the circumstances.

Urban Environment and Health

The fast changing urban environment and associated health problems have attracted the attention of Indian geographers in the period under review. De (2007) has identified the factors of the urban environment that are causatively related to disease and death in urban areas in India. The increasing incidence of non-communicable diseases associated with changing lifestyles in the cities and the resultant epidemiological transition have also been illustrated by De (2007). The need for developing a holistic health system has also been pointed out as the remedy.

Taking sample households in different income groups, Rahman (2004) studied the household environmental condition in Aligarh city. Using correlational techniques between household environmental conditions with the occurrence of a number of communicable diseases he has concluded that there exists a significant positive relationship between income level and household environmental conditions, and also between income and various diseases among sampled households. Similar socio-economic and poor environmental conditions were found to be related to the occurrence of malaria in Aligarh city (Rahman, 2005). Drainage system, as well as permanent, seasonal and occasional water logging areas was mapped in order to assess potential breeding sites of malarial mosquitoes. Predisposing factors for the large number of cases of malaria in poor households have been identified in the study. Commitment both by the Government and local residents has been suggested as a necessity for improving the environmental conditions to eradicate malaria from Indian cities.

Application of Remote Sensing & Geographic Information System

Use of remote sensing and GIS techniques in researches in the field of geography of health has been increasing in recent studies. One of the contributions made is by Prashanthi Devi *et al.* (2006). The researchers have used the Geographic Information System to explore the model relationship between malarial incidence and mosquito habitat. They have used remotely sensed and other spatial data on incidence of malaria, humidity, temperature, rainfall and the presence of vegetation and water bodies to develop a predictive model for malarial incidence.

Social Transformation and Social Wellbeing

Niladri Ranjan Dash

A perusal of the contemporary literature in social transformation and social wellbeing during the period under review (2004-2008) reveals significant shift in the interest of geographers towards particular issues. While on the one extreme, issues pertaining to disease, health and health care have been accorded primacy, issues pertaining to social pathology and housing have received scant attention.

Social change and transformation in Indian society has been analyzed by geographers in various contexts. Singh's study (2005) of several social and economic parameters of change in a village of Bihar displays inertia. Notwithstanding the present situation, however, the study indicates optimistic prospects of change through new aspirations generated in the minds of the younger generation. In this context, higher education and migration are considered as the vehicles of change. Role of formal institutions in social change has been assessed by Rath (2006) in the context of rural areas of Goa. Change and transformation among the tribes of India has always remained an attractive field of research for geographers. Misra and others (2006) highlight the role of geographical factors in bringing the tribal communities closer to the mainstream. Tribal communities living in somewhat less hospitable areas have witnessed a faster pace of change in comparison to others living in completely isolated areas. The authors believe that detailed study based on primary survey would further shed light on the association between ecological factors and the pace with which tribal communities are undergoing change in their material culture and mode of living. Depletion of economic resource base of the tribal areas, particularly forests, due to the contemporary processes of development are not only affecting the economic but also the social spheres of tribal life. A study on the effect of deforestation on the tribes of Gujarat by Dash (2005) stresses upon milieu specific approach, wherein planning measures designed based on the locally available resources and local participation is envisaged. Even in the contest of the Resettlement and Rehabilitation (R&R) of the forcibly migrated groups, the contemporary concept of development recognizes the principle of participation of the different stakeholders as the guiding principle. A study by Dash and Kumar (2006) of the displaced tribes from the Narmada catchment area reveals economic biasness in the R&R policy, wherein the socio-psychological aspects of the affected population remains completely unattended.

Studies pertaining to disease, health and health care seem to be favourite area of research by Indian geographers. Contemporary processes of globalization, industrialization and commercialization have brought irreversible changes in the physical and social environment of postmodern societies and have exposed human population to a variety of health hazards. The epidemiological transition has brought humankind at a stage in time where the health problems have become more complex and difficult to understand. Geographers with their interdisciplinary background seem to be in a better position to comprehend these issues.

Studies during the concerned period depict wider thematic coverage. Apart from analyzing basic health care facilities, geographers have attempted to incorporate under the sub-field, studies of linkages of environment and health. Drinking water has attracted greater attention as one of the crucial factors related to outbreaks of water borne diseases

especially in urban environment. Considering the serious health hazard posed by water contamination, Lomate and Kumar (2006) conducted a study on the seasonal variation in the number of Coliform bacteria in different ground water samples collected from various wards of Kolhapur city. Significantly, the study revealed faecal pollution even in deep tube-wells, indicating sewage contamination that had badly affected the city groundwater profile posing serious health hazard. Desai and Prajapati (2004) too had a similar observation in their study of Ahmedabad. Hazra (2004) noted with concern the increasing level of arsenic content and seawater intrusion into groundwater in some of the coastal regions of India exposing the coastal people to serious health threats. Utilization of ground water for drinking purposes in the absence of proper portable water supply sources in many parts of the country has been found to be dangerous for human life by several studies. Studies on northwest Bankura (Prasad and Sinha, 2006) and Murshidabad districts (Kanchan, 2007) of West Bengal and on Kolhapur city (Lomate and Kumar, 2006) reveal severe contamination posing great threat to human health.

Andaman Haemorrhagic Fever (AHF) is mainly due to the climatic conditions of the region, as indicated by Anand (2004). Deteriorating environment as well as malnutrition in some parts of the country has also posed serious threats to the health status of the people. Lack of awareness and empowerment has been considered the root cause of the sufferings from both common diseases and women specific illness among the rural women (Singh & Asgher, 2007). Increasing the level of awareness of the inhabitants in general in the context of waste disposal and human health has been stressed by Singh (2005). A few geographers have analyzed the spatial distribution of specific diseases like Goiter in Kashmir valley (Mayer, 2004) and HIV/AIDS in India (Choubey, 2005).

Spatial pattern of health care infrastructure in different parts of the country has been analyzed by geographers using appropriate techniques. Kanchan (2004) analyzed the adequacy and accessibility of primary health services in Vadodara district. Singh (2004) provided the basis of planning strategy for basic medical facilities taking Bhind district of Madhya Pradesh as an example. Surywanshi and Chaudhuri (2007) noted the inadequacy of the facilities available in primary health centers of Western Satpura region. In a study of the spatial variation of medical centers in Haryana, Singh (2004) identified glaring regional disparities in location of the facility. Besides, the ratio between population and doctors, indoor beds and distance traveled etc. portrays poor quality of health care facilities in the state. In a similar attempt Nayak's study (2004) reveals glaring regional disparities in availability of health care facility in Khasi Hills of Meghalaya plateau. The study clearly brings out the lack of locational perspective in the planning of health care centers in the region. Sinha (2006) addressed the issue of health status and health care among the tribes of Jharkhand. Misra and Misra (2004) related the degradation of ecosystem particularly due to deforestation, with the health conditions of the tribal population. The authors strongly believe that alienation from the forests, lack of awareness and insufficient health care facilities in the tribal areas of Orissa are factors responsible for the deterioration of the eco-health of the tribal population.

Indian geographers continue to neglect a very important area of research concerning social pathology. Butola's study (2004) on crimes against women is the only contribution which is noteworthy. Based on the National Crime Record Bureau (NCRB) data on legal crimes, Butola analyzed the spatial patterns of the intensity of violence

against women in 594 districts of India. The author envisages remedy of such a great social evil in building proper democratic consciousness in the society, initiating movements among the masses along with a change in the mind-set of the society in general and males in particular.

Literacy and education are important instruments of social change and transformation. Geographers have contributed significantly towards the analysis of the spatial and temporal dimensions of literacy and educational levels in the country from time to time. The work of Sawant and Charmaine (2004) is one such example. Mahapatra and Panda (2004) provided a detailed regional account of literacy disparities between male/female, rural/urban and scheduled tribe and general population of Meghalaya state. Spatial dimensions of literacy and education have also been analyzed by Bhole and Bhangale (2006) in relation to differences in the environmental conditions. Regional variation in the levels of literacy and education in areas having heterogeneous environmental conditions seem to follow a zonal pattern, with interior, isolated and rugged terrain areas lagging much behind the foothills or the open plain areas. The historical roots of regional disparities in educational development in India have been studied by Sinha (2004).

Geographers' concern towards issues pertaining to infrastructure and quality of life seems to be on the rise in recent years. Analysis of quality of life in relation to infrastructure of health, education, transport and water supply has helped to generate valuable application oriented suggestions and remedial measures. Aspects pertaining to utilization of health infrastructure too have received significant attention. Krishna Kumari *et al.* (2006) in a study of health care delivery system in Kurnool district of Andhra Pradesh observed that type of medicine used and visiting a private doctor is independent of social status, level of education and income whereas, rating/grading of health centres, preferences to go to health centre for treatment and satisfaction of medicines given by health centres are dependent upon social status, education and income. In another study, Saravanalavan *et al.* (2006) investigated the efficacy of the existing distribution pattern of the healthcare centres with reference to travel behaviour of patients of different age-sex groups. The authors have drawn 'desire line maps' using GIS software, which illustrates the spatial manifestation of the behaviour to avail distance-based services. The study makes it clear that centres located far off from mean average distance are less efficient in catering to the health services. Based on their study of Maternal and Child Health (MCH) Care Services in India and West Bengal in particular, Banerjee and Das (2006) argued that immunization alone cannot improve the Infant Mortality Rate. Rather, the MCH services should include steps towards improving nutritional status of the mother, quality of care during pregnancy and delivery as well as nutritional and care given to the child.

Inequality in quality of life is one of the new domains of geographical investigation whose spatial pattern and temporal changes with an emphasis on the poorer section of the society, have been studied by geographers from the welfare and development perspective. A micro-level study by Sahay (2006) exhibits low and very low quality of life in Bindtoli slum of Patna city. Singh and Singh (2005) find significant spatial variation in quality of life in Kushinagar district of Eastern Uttar Pradesh. Population pressure, low family income, lack of awareness of health programme and ill-served social infrastructures, and tradition and beliefs are considered reasons behind deficiencies, diseases and ill health in the district. Manhas (2005) elaborated upon the

socio-economic development strategies for the Jammu district by highlighting the provision of infrastructure for education, transport and communication, medical facilities, rural electrification and drinking water.

Similarly, strategy for the development of educational infrastructure in Rohtak district of Haryana has been developed by Ansari and Rajendra (2006) by identifying settlements where new schools need to be established based on settlement size.

Importance of road connectivity as infrastructure has also been recognized by geographers. Studies of Kayamkhani (2006) on Rajasthan and Despande (2007) on Maharashtra highlight the same in their studies.

Overall, studies pertaining to health dominates in the field of wellbeing while issues concerning housing and social pathology continue to remain neglected. Sadly, most of the studies continue to rely on cartographic representation of facts without placing the issues in a proper theoretical context. Strangely, the recent impacts of globalization, liberalization and economic restructuring which are bound to have immense effects on the process of social transformation and social well-being find rare mention by Indian geographers who seem quite satisfied with churning old materials time and again.

INTERPRETATION OF POLITICAL PHENOMENA

Political Geography

Sudeepta Adhikari

Even after a little more than sixty years of research in various fields of human geography in India, little seems to have changed when it concerns political geography. The contemporary 'state' of political geography in India is a mere reflection of a legacy, or a heritage that the founding fathers of modern Indian geography, trained in the western philosophy, methodology of geography, had laid down soon after their arrival in the country after obtaining higher professional degree in the discipline. There was no scope for political geography to be put into the curricula of geography that they prepared for their respective departments where they were posted.

Political geography in the 40s of the last century had remained a 'discredited' sub-branch of human geography in the Anglo-Saxon world because of the havoc '*Geopolitik*' created during 1939-1945. Together with '*Geopolitik*', political geography was, also bundled out from the under-graduate, and post-graduate curricula of the European and the American universities soon after the cessation of the World War II. In post World War British Geography, particularly, political geography had ceased to be a lively field of research, training and study. Incidentally, it was during this period that the Indian geographers had gone to various universities of Great Britain for doctoral research and higher studies, and underwent training under the contemporary pedagogy of British geography sans political geography. They had no other option but to study agricultural geography, land-use, industrial geography, economic geography etc.

On returning to India, in late 40s and early 50s, these Indian geographers, whom I call with respect, the founding fathers of modern Indian geography, laid the foundation of geography departments in various states, and framed the under-graduate and post-graduate curricula on geography, patterned on the British curricula. It is no accident that political geography did not find a place in the curricula. Ironically, politicians and bureaucrats, and political scientists of the period often talked about 'political geography' of the emerging Indian State, since it was the period of accession, integration, and consolidation of the new Indian State. Prof. N. Srinivasa in his '*Democratic Government of India*', published in 1954 had remarked: "after independence the political geography of India was rationalized by the merger or the consolidation and integration of the states.....India was unified as never before in her history.....". Even V. P. Menon in his '*The Story of the Integration of the Indian States*', published in 1956 mentioned about '*the changing 'political geography' of the Indian state following the accession of the Princely States*'. Contemporary Indian geographers however were silent on political geography of India. The subject suffered neglect from the very start as there was no conscious effort to include it in the university curricula or to reveal its applied relevance in dealing with territorial problems confronted soon after independence. This is despite the fact that India has been a 'veritable' field, a laboratory, for politico-geographical

research due to varied political problems directly linked to geographical backgrounds and territorial identification as well as external space-relation that necessarily concerned with federal weakness and federal rivalry, ethnicity, communalism, state-idea and the *raison d'être* and conflictual relations with the neighboring States. But, unfortunately, these problems remained, largely unaddressed.

In contrast, Israel has a rich heritage of political geography because people there, at the helm of geography teaching, research and training, had long realized the applied relevance of political geography to address political problems of geographical relevance, arising out of its creation in 1948, in the Palestine. Some of the problems indeed were quite identical for both India and Israel, particularly concerned with integration, consolidation, state-idea and the *raison d'être* etc. Political geography also developed in Israel as it was made a part of the curriculum at the under-graduate and post-graduate levels. At doctoral and post-doctoral levels too there was an urge to work in the field of political geography.

Nevertheless, since the 90s of the last century at least some have come forward to show deep interest in political geography, and in the geography of political *choice*, *i.e.* electoral geography. Since, India is a participatory-democracy; electoral geography holds a special relevance in politico-geographical research. Development of electoral geography in India in the 80s and 90s merely reflected the tendency to incorporate the techniques of statistical procedures in the study of the geography of political *choice*. Application of such techniques, however, in most of the cases did not yield desired results. Most of the recent works in political geography in India, except those in the field of electoral geography, are 'idiographic' in nature, though they appear to have been sustained by systematic analysis.

During 2004-2008, however, very few works have been done in the field of political geography in India, and indeed shows a disappointing trend. The works reviewed here, are of two kinds: *traditional and regional*, concerning with nation, nationalism, nation-state, unity and integrity, political stability and instability, geopolitical code, changes in federal boundaries, open boundaries and their relevance with neighbours, recent phenomena like insurgency, cross-border terrorism, and war and conflicts etc. and *analytical and systematic*, concerning electoral geography.

Adhikari (2004) raises a question that given the criteria of a nation-state in the contemporary literatures of political geography, should all 'such' federating units, in the Union of India, whose boundaries underwent re-structuring along the linguistic-nationalistic patterns, be called 'nation-states'? The cultural federation that emerged over the Indian State, following the territorial changes of the state boundaries along the cultural-linguistic patterns in 1956, appeared to have conceptualized the national characteristics of the dominant linguistic community with territorial identification, into nationhood. Each linguistic state in the Union is an 'ideal' state, with the situation where all the inhabitants mostly belong to one linguistic nation, whereas each linguistic state in the Union has recognizable linguistic minority group outside the dominant linguistic nation. Since each linguistic state is territorially organized in such a way so as to correspond to the 'nation' with that of the 'state' the author finds no reason as to why these linguistic states should not be called 'nation-states'?

Adhikari (2004) identifies various spatial and geographical factors which have greatly influenced India's foreign policy. India's non-aligned geopolitical code (the

operating code of a government's foreign policy that evaluates places beyond its boundaries) appears, according to the author, to have been destined by its geographical location on the threshold of the High Asia and the South Asia on the one hand, and at the cross-roads of the South Asia and the Indian Ocean. In another contribution, Adhikari (2005) identifies the processes leading to the partitioning of the political space of the Union on the basis of 'iconography', and 'movement or circulation'. The author is of the opinion that the social construction of India's political space is a continuous process that would continue to partition the political space of the Union. Significantly as Adhikari (2007) argues; nationalism, regionalism and federalism in Indian context are at variance with each other, and each appears to be not epistemologically inclusive, and has developed its own political concept in a way so as to create epistemological conflicts along the geo-political philosophical plane. Contemporary political geography of India with emphasis on changing political map of India, the *raison d'être* and state-idea of the federation, a new approach to resolve the Kashmir conflict, and host of other aspects, concerning the politico-geographical realities of India is what constitutes the content of a book authored by Adhikari (2008).

Bhardwaj (2005) attempts to distinguish between borderless region and liberalization of borders, in the light of the prevalent 'open Indo-Nepalese border', and studies the emerging politico-territorial problems in the terai region of border areas of both India and Nepal, particularly, that concern with human trafficking and illegal trade. The author emphasize on making the Indo-Nepal boundary 'a restricted one'. In another significant contribution Bhardwaj and Bhardwaj (2006) identify major consequences of trans-border migration into the terai border areas along the Indo-Nepal boundary-an area subject to Muslim migration from India during the early 90s of the last century, into the Nepalese side which, according to the authors, experienced demographic transformation with the Muslims having grown into a majority community. Conversely, the Indian side of the terai, also, experienced Nepalese migration. The entire terai border area along the Indo-Nepal boundary has, thus, emerged into a potential hotspot of political instability and may have serious impact on the Indo-Nepalese bilateral relations. In yet another contribution Bhardwaj and Sharma (2007) analyzed the geopolitical viability of the prevalent 'open Indo-Nepalese boundary' in the light of the emerging problems of terrorism, human trafficking and illegal trades across the boundary. The authors call for a review of the functionality of the open border in the light of the security and national interests of both India and Nepal despite people's opinion to the contrary.

Jalan (2006) investigated the changing voters' hues in the north-eastern part of Rajasthan with respect to the Indian National Congress party for the period between 1991 and 1998. On the basis of electoral performance of the party for the two successive Lok Sabha and assembly elections, the study identifies spatial patterns of electoral support and delineates areas of significant contrast at the two levels of election. The study reveals that the socio-economic base of the Indian National Congress is more clearly defined during the Lok Sabha election rather than in the assembly ones. In another study of similar content, Jalan (2006), with an areal-ecological approach examined differential electoral behavior in Lok Sabha vis-à-vis Assembly elections with respect to the Bhartiya Janata Party in the same region. The study revealed lower and more unevenly distributed support base for the party in the region during the Assembly elections rather than the Lok Sabha elections. The Party commanded a fairly identifiable socio-economic base in the

region. The influence of the ecological context was found to be higher in the Lok Sabha elections as compared to the assembly elections.

Measuring consistency in the electoral patterns of the Congress and The Bharatiya Janata Party in Himachal Pradesh with the help of Principal Component Analysis, Sharma (2004) found that six elections held during the study period generated two components with Eigen values higher than 1 for the Congress and one component for the Bharatiya Janata Party. However, the performances of these parties during 1977 to 1998 have not shown reversal in spatial patterns of support. In another study Sharma (2005) interpreted the 'mismatch' in per cent votes polled and per cent seats won by political parties in the Assembly elections in Himachal Pradesh by attributing the mismatch to 'electoral bias'- malapportionment and gerrymandering- typically geographical in nature. However, the study identified unintentional gerrymandering as the major cause. Using factor analysis to compress a number of socio-economic variables into four broad 'contexts' Sharma (2005) made an ecological analysis of the Bharatiya Janata Party's electoral performance over five elections held during the last two decades of the twentieth century. The study revealed that the party received higher support in relatively urbanized and developed areas. Using identical method of analysis Sharma (2006) also assessed similarities and differences in spatial patterns of support for the Congress and the Akali Dal in the Assembly elections held during 1977 to 2002. The study revealed that major political events cast their shadows on electoral politics of Punjab to which the spatial patterns of support for both the parties underwent changes. The support pattern of the Akali Dal was found to be more stable over time than that of Congress.

Human development plays a very significant role, according to a study by Mohammad (2005) in maintaining peace and prosperity in the world. Development with social justice is desirable and its absence will result in various levels of social and political chaos to the extent as to threaten the peace at different geopolitical scales: international, national, regional and local.

Insurgency and cross-border terrorism that the Indian State is awfully confronted with constituted the theme of analysis by Mookherjee (2005). Insurgency in peripheral areas of the country in general and in the north-eastern region in particular has intensified since independence. According to the author, various terrorist activities in the border regions of the north-west and the north-east are endemic as the breaking-up of the sub-continent, and subsequent partition of India along the communal lines created 'hardened' cleavages among the multi-religious communities to the extent as to make them mutually exclusive, forever. In yet another study Mookherjee (2007) holds sub-nationalism in the distant peripheral areas, ethno-religious, ethno-cultural, ethno-tribal, and ethno-linguistic identities with territorial specification and dynamism responsible for the contemporary spatial patterns of disintegrating forces that necessarily sustain insurgency in the north-east India on the one hand, and cross-border terrorism in Kashmir and Punjab. These forces of disintegrating tendencies largely restrict the expansion of the 'effective national territory' across the length and breadth of India, weakening the historical forces of integrating tendencies.

Prakash (2005) identified major ethnic communities of the mountain state of Sikkim of the Union of India, and measured the 'ethnic-distance' between them with the object of identifying the spatial conflictual pattern of relationships between them. The

author also enumerated the impacts of these conflictual ethnic relationships on the diverse internal political structure of the state vis-à-vis internal space relationships.

Prakash (2007) examined the theoretical aspects of the inter-state water disputes from a chronological perspective. The author identified various types of territorial water disputes between the federating constituent units of the Union of India in the light of the constitutional provisions and acts. According to the author, these disputes are a manifestation of 'federal weakness, and rivalry', and needs immediate resolution; as any delay in resolving may substantially weaken Indian federalism.

In a descriptive study Sharma (2007) discussed of the need for a negotiable demarcation of the territorial water and exclusive economic zone. Gradual exhaustion of continental resources, and the unchecked growth of population in peripheries of the world-systems have drawn the attention of both the developed and the depressed nations towards the marine resources, and a fierce competition for the control of marine resources, between the nations, could not be ruled out, and, that may, in the near future, convert the oceans, and seas into potential zones of war and conflict with horrendous implications for the world peace.

Singh (2005) observed that much of the contemporary political crises and conflicts- international, national, regional or local- are due to consistent increase in population, because more and more living-space (*Ratzellean heritage of 'lebensraum'*) is required and needed to accommodate the growing population, and for that nations are fighting among themselves. Increasing population notes the author, appears to be a threat to world peace and prosperity.

Srivastava (2007) in a chronological study of the changing map of India since independence analyzed various processes over years that have led to territorial changes in the federal boundaries of the constituent units of the Union of India, and, at the same time, made an attempt to measure the impact of the territorial changes on the economic and political landscapes of the Union.

Surya Kant (2006) examined challenges thrown by the processes of globalization before the Indian State in the context of internal political stability by looking at the spatially differential impacts of various reforms and policies. According to him, the recent upsurge in democratic participation of the *dalits* and backward castes, growing demand for new states on the basis regional identities, tension in urban-rural economic interest, language and ethnic divide, and the crisis of governance in the periphery are the symptoms of growing instability, being the reflections and/or manifestation of negative impacts of globalization, causing concern to the geography of political stability of India.

In an overall assessment, political geography in India is yet to be developed to the extent the other sub-branches of human geography have done over the years since independence. Quantitatively, the research output in Indian political geography, during 2004-2008, is meager by any standard but is quite encouraging in terms of quality. There is an urgent need for conscious efforts to promote research and training India's political geography with the object of making the application of its applied principles relevant to study practical political problems with geographical and/or spatial background.

Administrative Geography

Surya Kant

In the previous review of the progress in the field of Administrative Geography in India during 2000-2004, presented at 30th International Geography Congress (IGU), the reviewer stated that this branch of our discipline has remained “a neglected field” (Krishan, 2004, p. 113). In his views, the situation is not much different even at the international level. In support, he quoted from Rob Martin’s article on “Geography and public policy: the case of missing agenda”, published in *Progress in Human Geography*. Martin, highly critical of research in geography, wrote: “Much of what is now regarded as front-line research in the subject has little practical relevance for policy: in fact, in some cases, one might even say little social relevance at all” (Martin, 2001, p.191).

Looking at the progress made during the period 2004-2008, the present reviewer finds hardly any discernable change in the situation. Nonetheless, there has been, world over, a significant increase in the expression of concern for the neglect of policy-relevant research in human geography, and I quote here. (Notably, the public policy related research is one of the most important components of research and teaching both in Administrative Geography).

We would argue that many, if not most geographers are focused neither on achieving political change nor on communicating with the world “out there” (Dorling and Shaw, 2002; p.632).

The reality is that the policy-making of one kind or another is a prominent and pervasive feature of modern society, affecting the daily lives of us all. As geographers, we should be striving to inform and shape the process and improve the outcome (Martin, 2002, p.190).

(R)arely is policy change a question of simply providing technically correct answers.... What is always at issue- and this one of the reasons why it is important to work more widely- is political will (Massey, 2002, p.646).

My point is that policy research is a legitimate, non-trivial and potentially creative aspect of the work of academic geographers, but one that we are currently neglecting and/or undervaluing (Peck, 1999, p.131).

Evidently, there is now a larger concern among the geographers for policy-relevant research in our discipline. In a recent article, prepared as the progress report on *Geography and Public Policy* for *Progress in Human Geography*, Ward (2005) diagnoses the issue of policy-relevant research in geography from various angles. While agreeing with the fact that there is an urgent need to produce policy-relevant works in geography, he doubted the existence of any straightforward answer to the question of policy-relevant research. Fixing a starting point, defining what is meant by this term (i.e., policy-relevant), is harder than might at first be thought of. Ward also went on to explain the other ways that the geographers can think of ‘policy relevant’ geographic works. The ‘other ways’ can include public seminars, popular writings in the newspapers or journals and working with activists.

According to Ward the number of geographers, seeking to move beyond the academic-activist dualism to argue for the role of action-research has grown in recent years. Hence, the need is to 'reconceptualize how it (human geography) can engage and (participate) with marginalized populations, opening new alternative routes for "doing" geography'. Ward pointed out dilemmas or contradictions in the argument of those supporting 'policy-relevant' research. In the beginning of the progress report, Ward listed the conditions under which geographers may or may not be engaged in 'policy-relevant' research. Briefly, the main thrust of Ward's argument is neither to minimize the importance of policy-relevant research in geography nor to speak against those expressing concern for the neglect of policy research vociferously, but to initiate a discussion for having a greater clarity on the concept of policy-relevant research and to contextualize it.

Studies in Administrative Geography in India: 2004-2008

An examination of the research articles, published in geographical journals and related literature during the period under reference only reveals the paucity of studies related to Administrative Geography in India. Indian Council of Social Science Research, New Delhi received only one single project proposal during these years entitled "Challenges of Globalization and Federalism in India"- a theme relating to Administrative Geography. The University Grants Commission, New Delhi did not even receive any proposal on Administrative Geography of India during this period. Only a few articles, which could be located in journals, have been described in the following.

In the backdrop of the alarming number of deaths and damage to infrastructure caused by different types of disasters in India during the past 100 years, Kapur (2005) attempted to trace the concern for disaster in the government, media and the academia in the country. With utter surprise and dismay, the author lamented that the official structures dealing with disasters are not only recent in origin but are also highly fragmented in nature. The study reveals that none of the ten plan documents so meticulously prepared since the beginning of the plan period considered earthquakes, cyclones, landslides, weather anomalies or industrial disasters. The planning commission never thought it important to have a unit exclusively for disasters among its 29 divisions and 3 special units. The methodology, used by the Centre to allocate funds to states to deal with natural disasters, is frequently changed. She is equally critical of the implementation of laws and information base on disasters in the country. The administrative machinery lacks adequate and reliable database for disaster. The academia and the media, according to the author too have remained by and large insensitive to the phenomenon of Disasters and management in spite of record increase in the occurrence of disasters.

While Kapur is worried over India's sensitiveness to disaster mitigation and management, Krishan (2006) is surprised over the lack of cooperation among the states in India, while fulfilling their development agenda. This is contrary not only to the nature of Indian federalism and the vision of our constitution framers but also to reaping the full benefits out of the new economic policy adopted in 1991. After examining the available constitutional provisions and the mechanisms evolved in India to make inter-state cooperation a fruitful exercise, Krishan is of the opinion that the formal arrangements made to foster cooperation has proved fragile. The new economic policy, which explicitly

favours competition, has made the task more difficult. States are now adopting divergent policies to attract private investment, invite foreign capital and seek central funds.

Krishan attributes lack of inter-state cooperation in India to the mode of their formation and consequent disputes over territory and sharing of assets and resources. Nevertheless inter-state cooperation is unavoidable in the management of ecology, upgradation of infrastructure, fighting floods and droughts, laying out irrigation systems, rationalization of cropping patterns, designing of transport networks, and generation and distribution of power, matters of development and law and security and disaster management. The author suggested a number of mechanisms for a better and effective cooperation among the states through administrative reforms. The author also cited some examples of success stories pertaining to inter-country cooperation including that of the European Union, as an inspiring message.

Administrative areas reform is one of the very importance themes in Administrative Geography. In this context, the contribution of Singh (2008) on reorganization of states in India is quite significant. Undoubtedly, the current political map of India is considerably reorganized, yet the federal union continues to be marked by a great deal of inter and intra-state asymmetries relating to demography, territorial size, culture, ethnicity, and economic development. This sort of multicultural diversity and federal segmentation create majoritarian states for minorities within a nation of a different majority overall. Federalism, according to Singh, as a political mechanism has been more successful in protecting the identity and interests of major national minorities that happens to be state or provincial majorities (e.g., Muslims in Jammu and Kashmir, Sikhs in Punjab, Nagas in Nagaland, etc) than of internal minorities and 'discrepant' majorities, by which is meant the national majority community that happens to be a provincial minority in some states. The author stressed the need for setting a second states' reorganization commission in India, because the short-sighted creation of newer states in recent years has given birth to new problems without offering systematic solutions for existing ones. The author outlined the likely major problems and challenges in the way of reorganizing states in India in the decades ahead. As the author suggests, any further reorganization of states in India should be based on a 'cosmopolitan model of democracy' and should be anchored in theories of constitutionalism and the rule of law, consociationalism, and multiculturalism.

Kant (2008) examined the role of agricultural policy vis-à-vis environmental challenges and sustainable development in India. He made a detailed examination of policies pertaining to pricing of agricultural commodities, farm-inputs subsidies and land reforms and land re-distribution. Agricultural pricing policy, according to Kant has hurt not only the regional equity in agricultural development in the country and the interests of the buyers of food and agricultural raw materials but has also created pockets of capitalist farming and farm lobby as a pressure group to influence pricing and other related policies. Besides, a time tested ecology friendly cropping pattern has also been disturbed. All this has contributed implicitly or explicitly to the intensification of ecological and environmental degradation in rural areas". The traditional harmony existing in cropping pattern, regional equity in agricultural development and the interests of the net buyers of food and agricultural raw materials have been badly hurt in the process. Beside, the decline in soil fertility, fast depletion in underground water levels, water logging and soil salinity, alkalinity, loss of tree cover and host of other problems leading to eco-

environmental degradation in the rural environment has placed a question mark on the very sustainability of Indian agricultural as well as rural environs. Such problems are going to intensify further under the new economic policy, initiated since 1991.

Krishan (2006a, 2006b and 2006c) has initiated an interesting 'map series', published regularly in a research journal, *Man & Development*, to map districts having high incidence of mental disability, the 100 poorest districts and higher age longevity districts in India at 2001 Census. The maps and a brief write up in each case provide good insights into issues having important policy implications.

Research Agenda for the Future

It seems that the public policy is emerging as the focal research agenda in Administrative Geography in the world as a whole. In this context, the five themes identified in the previous review of Progress in Administrative Geography, published in Progress in Indian Geography, 2000-2004, are still quite relevant. We recapitulate these briefly, as follows: (i) study of variations in quality of governance at the level of local government, encompassing not only the government organization and institution but also those of non-government, cooperative, private and household sectors, (ii) study of inter-state differentials in devolution of powers to the local bodies, a highly commendable reform in Indian polity and governance following the 73rd and 74th Constitutional Amendments, effected in 1992, (iii) administrative area reforms, especially the reorganization of states and districts in India, (iv) an examination of public policies in terms of their formulation, implementation, and impact, and (v) study of territorial administrative units organized by private organizations, especially the private corporate sector. In addition, the nature and working of inter-state cooperation in India, especially after the implementation of 'market' policies, freezing of the delimitation of Parliamentary constituencies till 2026 and the functioning of federalism in India, sufferings of national majority communities in provinces where national minorities are the ruling class or vice versa, recent decision of the government of India to extend 27 per cent reservation to 'Other backward Castes' (OBC) are themes of great interest, needing geographical treatment.

METHODOLOGICAL ISSUES

Remote Sensing and Geographical Information System

R.B.Singh

The combined use of Geographic Information Systems (GIS) and Digital Image Processing (DIP) provide better prospects of spatial analysis, environmental monitoring and forecasting over wider areas within limited time-span. Such geographical technology provides the spatial database of natural resources and basis for formulating development plans. It would be easy to develop predictive model capabilities in order to achieve effective public policy in years to come (Singh, 2004). This has direct implications for local, regional and national development. With the advent of Remote Sensing, a major technological breakthrough has taken place in the method of acquisition of information about environment and natural resources in India. Remote sensing with its unique characteristics of synoptic view, repetitive coverage and reliability has opened immense possibilities for spatial mapping together with planning and management to achieve optimization of resource utilization and conservation. Development of modern information technology and use of electronics has certainly opened new possibilities of data storage and exchange.

Satellite remote sensing plays an effective role in natural resource inventory, desertification and drought monitoring, geological, geomorphologic and environmental hazard mapping (NNRMS, etc.). It provides vast scope to explore and analyze resources of underdeveloped regions. Scientists are making use of the features of different bands for soil and radar waves for hydrological studies. Optimal management of resources has become a critical requirement in these days of increased industrial development and growing population.

In recent years, there has been significant development in GIS technology and its applications especially on the research front. Use of the GIS has been widespread with the advent of computer application and to meet the necessity of integrating data generated through various modes like field data, thematic map data, attribute data and remote sensing data (Singh and Kumar, 2004). Use of the GIS in India began towards the end of the Sixth Five Year Plan, when the Department of Science and Technology launched a project on Natural Resource Data Management System (NRDMS). The expertise available at different leading institutions and departments were pooled to conceptualize, create and implement a system for better management of resources.

Historical Development

With the launching of operational remote-sensing satellites IRS-1A (1988) and 1B (1991) and setting up of information systems like National Natural Resources Management System, National Resources Information System, Regional Remote Sensing Service Centres and Natural Resources Data Management System, about 350 national / regional-level remote sensing centres and launch of second-generation and indigenously built IRS-1C satellite on 28 December 1995 and IRS-1D (ISRO, 2005; 2006) in India has

provided tremendous opportunities for applying space informatics in areas of environmental monitoring and natural resources management. Browsing data for Panchromatic Camera and Linear Imaging and Self Scanning III and IV are being generated for users.

The IRS-1C marks a major milestone in India's satellite remote sensing programme by contributing to the National Natural Resources Management System with better resolution, coverage and revisit in order to provide valuable data on environmental resources. The IRS-1C satellite has three types of advanced imaging sensors. The Panchromatic Camera (PAN) provides very high spatial resolution data of 5.8 m and a ground swath of 70 km. The PAN camera can be steered to ± 26 degree which in turn increases revisit capability to 5 days. Linear Imaging and Self Scanning (LISS-III and IV) Sensor provides multi-spectral data collected in four bands. All the three cameras are operating in real time over the Indian ground station visibility circle two or three times a day (National Remote Sensing Agency, 1996; ISRO, 2005). Keeping these requirements in mind, the Department of Space (DOS), Govt. of India has launched a few other satellites like IRS-P3, IRS-P4 (OCEANSAT), Technology Experiment Satellite (TES) and RESOURCESAT-1 has LISS-IV as which is a high resolution multi-spectral sensor operating in three spectral bands (B2 0.52-0.59, B3 0.62-0.68, B4 0.77-0.86). CARTOSAT-1 and 2 are the new addition in the India's space programme (Table 1).

Table 1: Indian remote sensing satellite system

Satellite	Launch date	Launch Vehicle	Status
IRS-1A	Mar 17, 1988	Vostok (USSR)	Successfully completed
IRS-1B	Aug 29, 1991	Vostok (USSR)	Successfully completed
IRS-P2	Oct 15, 1994	PSLV-D2	Successfully completed
IRS-1C	Dec 28, 1995	Molniya (Russia)	In Service
IRS-P3	Mar 21, 1996	PSLV-D3	In Service
IRS-1D	Sep 29, 1997	PSLV-C1	In Service
OCEANSAT-1	May 26, 1999	PSLV-C2	In Service
TES	Oct 22, 2001	PSLV-C3	In Service
RESOURCESAT-1	Oct 17, 2003	PSLV-C5	In Service
CARTOSAT-1	May 5, 2005	PSLV-C6	In Service
CARTOSAT-2	Jan10,2007	PSLV-C7	In Service

Source: www.isro.gov.in

Trends of Research in India

Weather and Climate Change

New developments are taking place in estimating sea surface temperature and modeling the methane emission using MODIS (Agarwal, Reshu and Garg, 2007). The multipurpose INSAT 3A sends information half-hourly, in the infrared band, and imageries of the weather systems over India and adjoining areas. This provides vital information for a detailed monitoring of the weather and an accurate forecasting. It also relays information sent by 100 unmanned Data Collection Platforms (DCPS). These DCPS have been installed in remote and uninhabited areas from where they keep transmitting meteorological data. The regular reception of the imageries of data has vastly improved weather forecasting (Singh, 2006).

In the cyclone prone areas of coastal Andhra Pradesh and Tamil Nadu, Disaster Warning Systems (DWSs) have been installed. When a cyclone is detected heading for the coast, the satellite relays a signal from the Area Cyclone Warning Centre's in Madras to DWSs in the villages in its path. The DWSs emit a siren, which warns the villagers to go for shelters. Similarly, flood forecasting has become much easier. The Satellite Microwave Radiometer (SAMIR) has been functioning to provide water vapor content of atmosphere, rainfall rate over oceanic regions, and surface winds over oceans. Abnormal composition of atmosphere, cloud cover and location of depressions can be detected well in time.

According to a study that examines the impact of global climate change on forest biodiversity (Singh, 2007); increase in global temperature projected by scientific data on climate trends could bring about significant changes to the world we know. Biodiversity is considered important as it ensures continued possibilities for adaptation of species in a changing and uncertain world climate. The impact of climate change may be particularly severe when critical thresholds are crossed with additional stress on ecosystems and species that are, often, already under stress from other pressures like habitat change, land use change, overharvesting, pollution etc. A policy aimed at current level of deforestation and forest degradation combat should be of high priority. Afforestation and reforestation initiatives should be accompanied by policies and programme designed to ensure the health of both plantation and natural forests. A policy on partial replacement of fossil energy source by wood and other bio-fuels is also worthy of considerations.

Geomorphology

Space Application Centre is continuously monitoring glaciers in order to observe climate change impacts. Remote sensing data is being used for mapping potential glacier lake outburst floods (GLOF) in the greater Himalayas. It is further used for estimating flooding in low land based on snow run-off. In this context use of remote sensing and GIS may be very helpful in understanding the hydrometric features and geomorphic features in any region (Borse and Patil, 2006). The most frequent applied area of remote sensing in India is the study of earth's subsurface and surface features. Aerial photographs are an effective tool for geological, geomorphological, relief and hydrological studies and land use mapping. Geomorphic units have been identified based on interpretation of the aerial photographs and the Survey of India's Topo-sheets and the LANSAT imageries in the various regions like Pali district, Jodhpur District, Luni basin and Tripura state. These geomorphic units have different physical potential and provide a sound base for land use planning. Other application includes like remote sensing study in identifying wind erosion areas (Swaminathan and Chandrasekharan, 2007).

The potential of ground water has been investigated with reference to the geomorphic units, and relevant geological aspects (Sundaram and Nagarathiman, 2005). The occurrence and potential has been evaluated for the five major geomorphic units as river built plains, broad valleys with infilled sediments, narrow valleys, active pediment and piedmont zone which have been recognized and delineated on aerial photographs and landsat imagery. Several abandoned channels provide good aquifers for the accumulation of sub-surface water.

In understanding the land use, soil texture and morphological characteristic, remote sensing and GIS is very important (Dubunde, 2005). Based on aerial photographs,

a study of Hiran catchment (Jabalpur district) highlights the physical and hydrological characteristics of the area, using quantitative analysis for land resource development and management. GIS has been used for soil productivity assessment and mapping.

Based on irrigation, cropping pattern and physical attributes namely watersheds, slope, landforms, lithology, soils, land use and hydrogeomorphic units, the land suitability of agricultural use are identified. The SAC of ISRO and the Kerala State Land Use Board jointly carried out an integrated resource survey aimed at making a comprehensive survey of land and water resources in Idukki district of Kerala. Large number of maps on 1:15,000 scales has been prepared on land use, geomorphology and structural geology.

The National Remote Sensing Agency (NRSA) carried out a survey for soil association mapping, land degradation and ground water exploration to aid drought relief in Bundelkhand region of Uttar Pradesh. On the basis of maps prepared, further geophysical exploration was taken up to suggest areas suitable for tube wells and dug-wells, etc. Broad landuse types were delineated for the entire Himalayan region in different seasons of the year (Singh, 2007).

A pilot project on Geological Information System was initiated by the Geological Survey of India (GSI) working on new projects i.e. Singhbhum and Bhusampada (on lines similar to project “Vasundhara”) in eastern and Northern region respectively. Some of its achievements have been in delineating the bauxite-capped plateau in the Eastern Ghats of Andhra Pradesh and Orissa and location of buried deposits of calcareous nodules in the alluvial tracts of Uttar Pradesh and desert terrain of Rajasthan. Similarly, airborne multispectral scanner data are being used in locating zones of geothermal energy like hot springs, hot spots etc. Another aerial survey of geology of Maner-Godavari valley (Andhra Pradesh) was conducted covering an area of 2900 km². Photo interpretation helped in delineating formational boundaries on the basis of photo recognition elements, tones and textures, etc. Construction of 56.58 m. high composite dam across the Tapi River, downstream of its confluence to the Sipra was studied extensively through aerial photography. LANDSAT and other Indian satellite imageries of Precambrian hard rock and desert terrains of Rajasthan were visually analyzed and compared with ground data compiled on similar scale to determine their potentiality for regional geological interpretation and feasibility for preparing small-scale geological and tectonic maps of the region.

Hydrology and Water Resources

Targeting the ground water in hard rock area using remote sensing and GIS is a recent phenomenon in hydrological science (Pathak, Subun and Chandrasekhar, 2006). The first category of ongoing projects comprise ground water potential zone mapping, national drought monitoring, irrigated command area monitoring, irrigation infrastructure monitoring and prioritization of watershed and flood plain management for major river basins. Other projects refer to water management in command area, environmental studies of major river valley projects. It includes snow melt run-off model development, microwave remote sensing, digital terrain models, etc. Monitoring of water is done mainly through infrared scanning, for instance, warm water emits more energy thus, appearing brighter than cool water and it becomes easy to record the temperature of water bodies. In India, remote sensing is used for monitoring the aspects such as measurement

of evapo-transpiration, measurement of water surface roughness, rainfall distribution and infiltration pattern, ground water discharge and salt content of water and light absorption. Other application like estimating the courses of rivers can also be done with the help of remote sensing and GIS, Run-off Modeling in a watershed and changes in river courses (Govindraju, Lakshmanan and Nagarathinem, 2005).

Aerial photographs are utilized to get information regarding regional water storage, season and long term fluctuation of lake and river surface aerial extent, assessment of underground and soil moisture, flood coverage and damage, etc. Mapping of hydro geomorphic feature and estimation of Glacial Variation and Fresh water assessments, watershed development are another advantage of Remote Sensing (Thakur and Dhiman, 2007). Estimation of surface temperature of snow is assessed through GIS technology (Negi, Thakur and Mishra, 2007).

The weather satellite imagery is used to monitor ice and snow cover conditions providing important inputs for water management and flood prediction. The Central Water Commission (CWC) has deployed in DCPs in the Yamuna catchment area for flood forecasting. Even within a week the inundated areas can be mapped. Many such flood maps were already prepared for the many river basins. Such technology is being used for environmental and management of hydropower and river valley projects, mapping of water logged area by optical remote sensing (Panda and Ray, 2005). In recent years micro wave sensor data is being used for flood monitoring during cloud cover conditions.

Conventional aerial photographs and topographic sheets do not lend as adequate support for effective mapping of dynamic relief features, e.g. in case of flood plain. For quick appraisal of the dynamic nature of flood plain, it is necessary to use remote sensing data either in the visual interpretation or digital data for correct estimates in order to make environmental assessment in an effective way (Singh and Kumar, 2004).

The emerging technique of image Bathymetry is very useful in the areas of mobile seabed and in the studies of coastal erosion where no recent hydrographic surveys are available. With the help of image Bathymetry, coastal features and depths coastline, low water line reefs and islands are delineated particularly using observed spectral reflectance by the sensors as recorded in Landsat Imagery especially in bands 4 and 5 (Sathe and Muraleedharan, 2007). Another study describes the lineaments in the coastal area of Goa identified on aerial photographs.

India is one of the largest coastline countries and derives substantial socio-economic benefits from its coastal marine resources. The sustainable benefits require considerable improvement from application of remote sensing to improve both utilization and management of these resources. The launching of the OCEANSAT-I satellite has brought significant improvement in the ocean monitoring. Other issues include marine fisheries and brackish water, Potential Fishing Zones (PFZ) etc.

Forest and Biodiversity

Assessment of grassland and their changes with time has been greatly facilitated by using remote sensing and GIS technology (Suresh et al., 2006). India's forest areas have been decreasing rapidly, and a system of continuous operational monitoring is necessary. It is through remote sensing that the actual forest covers of India was known through findings of satellite data analysis in India as highlighted by the Forest Survey of

India. In the last 40 years, as much as 4.32 million ha of forest land has been lost, 0.7 million ha has been encroached upon and the rest subjected to shifting cultivation (Singh, 2004). Deforestation has increased because of large-scale consumption of fuel wood.

Identification of vegetation in any region through NDVI technique may be possible (Pandya, Singh and Chaudhri, 2007). The first attempt to categorize forest cover types by computer analysis of Landsat digital data was done in 1978 for Nagaland. In this study, a colour-coded categorized map delineated the broad forest cover types. In a study conducted by NRSA, the satellite digital image covering entire Periyar-Thodupuzha drainage basin was analyzed. Multistage approach is being adopted by the Indian Remote Sensing, which gives information like timber volume using stratification of imageries. Apart from forestland classification, stock mapping and volume estimation, remote sensing is also used for damage assessment and fire detection, which is a common feature of Indian forests. GIS is also used in biodiversity conservation plan. Recent development includes forest fire mapping using satellite data.

The Forest Survey of India prepared forest cover type and land-use maps on 1:50,000 and 1:63,360 scale by interpreting medium to small-scale panchromatic aerial photographs for about 4,20,000 km² in India (Government of India, 2005). The main application of remote sensing in forest management has been for timber harvest planning and monitoring of logging and deforestation.

There exists a map atlas on biodiversity characterization (Sarika, 2006). This is a multi-institutional programme on bio prospecting of biological wealth jointly supported by Department of Space and Department of Biotechnology. The Atlas identifies gaps in the conservation planning by setting priority in decision-making and at management level for conservation of biodiversity. Digital Elevation Model (DEM) was used to prepare terrain complexity map. The resultant map is the biological richness.

Creation of biosphere reserves is one of the important programmes of Government of India. UNSECO-MAB initiated programme as an integral part of wide spectrum of complementary and transverse scale observations. Such a vast task can be largely assisted by recent advances in computer-based GIS. In the wildlife census, the fish counts, migratory bird numbering, their resting spots, etc. could be photographed through thermal infra-red light imagery, this would provide a considerable management input to the protected areas and biodiversity (Singh and Mishra, 2005). Potential fishing zones are being mapped from the data collected through satellites.

Land Use / Land Cover Mapping

Land use and cover change (LUCC) study is very important aspect of the natural resources data base study. Land information system plays a vital role in managing the land resources of any area (Bhatt, 2007). Using IRS-LISS - 1 data in 274 districts through visual interpretation and 168 selected districts through digital techniques, agro-climatic zones of India are being analyzed. For the first time, two season satellite data both for *Kharif* and *Rabi* are used to precisely estimate the agricultural land in *Kharif* and *Rabi* season. Landsat data has been used intensively for mapping. Recently under this programme one of the projects refers to changes on land use because of urban spread, while another project emphasizes on industrialization in Ahmedabad-Vapi region and Chindwara District, M.P etc. (Trivedi and Dubey, 2006).

The salient features of the programme are agricultural crop inventory, crop acreage and production estimation, watershed prioritization, command area, crop inventory, surface water monitoring for Rabi crops, etc. The recent action plan includes preparation of remote sensing methodology manuals and crop acreage and production estimation for multiple dry land crop regions. Area under wheat is relayed by the season even before it is harvested in the states of Punjab, Haryana, Western Uttar Pradesh and parts of Madhya Pradesh and Rajasthan (Doi, 2005). The Department of Space is also working out ways to accurately forecast crop yields from a variety of remotely sensed parameters.

A detailed land capability classification is being conducted using remote sensing and GIS technology, especially for the highlands and the Himalaya region prone to land degradation to be used for the formulation of integrated land use plan. The arid zone monitoring includes agricultural improvement and desertification study. Data on vegetation index may also be used from NOAA weather satellites. India should join in worldwide initiatives to have first 8-km resolution global data sets of AVHRR products and subsequently 1-km database. The land use land cover change through GIS technique is very significant in analyzing the dynamics of land use change (Das, Dutta and Saraf, 2007; Singh, Fox and Himiyama, 2001). In pest and locust management the GIS technique may also be significant (Dutta *et al.*, 2004).

Urban Development

Urban infrastructure planning is getting attention in recent years. Cities are now emerging as centers of domestic and international investments in an era of economic reforms, liberalization and globalization (Singh, 2007). Efficient urban information system is a vital pre-requisite for planned development. Increasing demands in urban planning and management sectors call for coordinate application of Remote Sensing and GIS for sustainable development of urban area (Tyagi, 2005 and Hanjagi, 2006). Availability of high-resolution data from IRS-1C and 1D satellite has revolutionized the process of thematic mapping and spatial data base creation especially in the context of urban sprawl and regional planning (Sarika, 2008). Other application includes remote sensing in infrastructure development, Urban Sprawl Mapping, Regional Planning for Air and Noise Monitoring Network, Development of Road Monitoring and Management System and Silting Sanitary Landfills etc. (Kshirsagar and Rutt, 2007). Various remote sensing and GIS layers are also being used for mapping urban heat islands.

Natural Hazards and Disasters

Assessment of vulnerability of any region to disaster has been made easy by using the remote sensing and GIS (Singh, 2005). One of the most devastating natural disasters is an earthquake. However, security to the people all over the world from the calamities of earthquake is still in danger since these are very difficult to predict over space and time. Several researches have pleaded for improving our understanding using Remote Sensing and GIS. Considerable efforts have been made to understand the causes and location of frequent earthquakes, but unfortunately scientific knowledge is not adequate enough to predict the time and precise space where they will strike (Singh, Tejpal and Viridi, 2007). Hence there is a need to monitor the indicators or processors. In remote sensing the monitoring of these processors is done through geodetic changes measured by

very long base inter-frometry (VLBI) satellites, laser beams etc. Other studies include a new algorithm to retrieve aerosol over the Gulf of Cambay in India. Many foreign scientists are working on applicability of SAR sensor for earthquake prediction.

Drought monitoring is an important aspect of satellite monitoring in Maharashtra state. The study for the period 1986-1989 provides a valuable database to study annual biomass production, agro-climatic zoning and rain-use efficiency in addition to its use in drought monitoring. In the year 1986, the NRSA completed the survey and mapping of wastelands in India using Landsat satellite data. Flood plain zonation is a key tool in managing the disaster various parts of India. Satellite imageries are also being used for assessing the impact of flood on bio-diversity particularly in Kaziranga national park (Singh and Bortanmuly, 2005).

Government Initiatives in Remote Sensing and GIS

During the seventies, India undertook demonstration of space applications for communication, broadcasting and remote sensing; designing and building experimental satellites- Aryabhat, Bhaskara, APPLE and Rohini- and experimental Satellite Launch Vehicles, SLV-3 and ASLV (ISRO, 2005). The comprehensive space research programme for the future integrates satellite remote sensing within six areas of studies of the land: ice and atmosphere, theoretical and modeling studies, and laboratory - based analytical programme. Space use technology requires instrumental development like multi-channel imaging spectrometers, SAR, Lidar, Laser altimeter, Radar and high resolution Images. The new generation of satellites like polar orbiting platforms provided impetus to such activities. The recent programmes address problems relating to data continuity, access, and acquisition and information systems. It is being realized that remote sensing by itself could not satisfy all information requirements of application and that it should be supplemented with data from various sources; thus GIS is stated as warehouse of remote sensing data merging with geo-referenced data sets. Data from newly launched satellites have helped in the areas of Integrated Mission for sustainable development (IMSD), National Level Crop Acreage and Production Estimation (CAPE), wasteland inventory, landslides hazard zonation and forest inventory mapping etc.

Satellite based thermal imagery offer data to study urban heat islands regarding energy and water conservation, human health and comfort, air pollution dispersion and total air circulation. The National Remote Sensing Agency conducted study for characterization of urban heat islands in Hyderabad using MODIS data of TERRA satellite. Recently, Space Application Centre (SAC), Ahmedabad have used imagery from the IRS satellite to measure loss in glacier ice. For the first time they have gathered concrete evidence that four glaciers in the basin of river Baspa in Himachal Pradesh are facing “terminal retreat” and they are disappearing. Fifteen more glaciers in the same basin also face extinction. All of them are showing negative mass balance.

Spatial Information Technology and Database Development

(a) Natural Resources Data Management Systems (NRDMS)

The Department of Science and Technology launched a comprehensive programme in 1982 on the development of multidisciplinary NRDMS by setting up computerised data bases at micro-level, taking the district as the unit. The main objective

of the NRDMS is to integrate the natural resources and socio-economic data base in order to facilitate monitoring exercises by providing information on different spatial units-village, block and district. Conventional land-bases and remotely sensed data are integrated so as to develop comprehensive database in a particular area that can be used for micro-level planning. The system involves two distinct tasks: (i) development of interface technology to link satellite remote sensing to district databases, and (ii) adoption of a grid-based geo-coded integrated data system for macro and micro-level analysis as well as planning. During the pilot phase of the project, nine case studies were carried out in order to test the capability of the entire system by 11 participating institutions.

(b) National Natural Resources Management System (NNRMS)

The Planning Commission of the Government of India has set up the NNRMS in 1983 in order to achieve optimum utilisation of natural resources through a proper and systematic inventory of resource availability. The Department of Space has been identified as the nodal agency for establishing NNRMS in the country. Taking into account of the recommendations and suggestions by the task forces, six standing committees have been set up to cover (i) agriculture and soils, (ii) bio-resources and the environment, (iii) geology and mineral resources, (iv) ocean resources, (v) water resources, and (vi) remote-sensing technology and training sectors. The various ongoing projects include crop-acreage and production estimation; soil moistures estimation using ERS-1, SAR; marine fisheries, coastal zone mapping; brackish water aquaculture, and wet-lands mapping; grasslands of the Banni area in Kachchha, watershed prioritisation, environmental impact studies for the Narmada and Tehri projects; land use/land cover mapping and damage assessment; wasteland mapping and snow-melt run-off forecasting (Department of Space, 2005). Recently NNRMS has approved the projects launched at the initiative of the Ministry of the Environment and Forests and Natural Resources Audit as part of UNCED's Agenda 21 recommendations. The conservation of soil could be done by zonation of soil salinity through remote sensing and GIS (Sharma and Mandal, 2006).

(c) National (Natural) Resources Information System (NRIS)

Since a comprehensive system is essential for policy makers to ensure the optimum utilization of natural resources, development of a NRIS has been conceived as a major component under NNRMS (Mohammad, Singh and Dutta, 2007). The information system would provide up-dated and systematic information on natural resources related to land, water, forest, minerals, soils and oceans etc., which are, in turn, being integrated with the socio-economic data. A computer system based on a Geographical Information System (GIS) is being developed with capabilities for data integration and easy retrieval. The NRIS has advanced capability and is proposed as an integrated information system with linkages with the other existing systems; such an integrated information system of spatial (maps) and non-spatial (socio-economic) data at the districts, state and country levels to provide an efficient and powerful tool for resource managers and policy makers.

(d) Integrated Mission for Sustainable Development (Department of Space)

The Integrated Mission for sustainable Development is a new initiative by the Government of India for generating thematic maps covering arid and semi-arid regions is

India in 157 districts, on a 1:50,000 scale. These districts cover 45 per cent of India's geographical area perennially affected by drought and floods and are located in hilly and tribal areas. Using data from Indian Remote Sensing Satellites, the study involves generation of thematic maps showing current land use/land cover, types of wastelands, forest cover/types, surface water resources, drainage patterns, potential groundwater zones, landforms (geomorphology), geology (rock types, structural features, mineral occurrence), soil types, etc (Sharma and Thakur, 2007).

(e) Nation-wide Land Use/ Land Cover Mapping for Agro-Climatic Zone Mapping

The Indian experience in use of remotely sensed data for land use/land cover analysis, gained over past 20 years of implementation of various projects, especially "Nation-Wide Land Use/Land Cover Mapping for Agro Climatic Zone Planning" and "National Wasteland Inventory Project" are commendable. The former was sponsored by Planning Commission of India and later by Ministry of Rural Development (MRD). Two season (*Kharif and Rabi*) Indian Remote Sensing Data were used to generate district wise composite land use/land cover maps on 1:250,000 scale. The reconciliation of area statistics generated by remote sensing and ground based techniques established that the better accuracy maps/data is possible to generate through remotely sensed data. The outputs of the project provided the actual cropped area in two different seasons and the area left fallow (without crop) separately to enable planning for increasing the agricultural production. Realizing the importance of spatial land use/cover information at multiple national scales with synergistic use of all information sources is expected to be soon implemented under National Natural Resource Information System (NNRMS) programme. A systematic study was carried out to identify 13 different types of wastelands on 1:50,000 scale up to village and micro watershed level. A digital data with standard codification system in four different layers were generated for the entire country. Various watershed programmes are being implemented in the country consulting this database. Other applications include Coastal Landform Mapping.

(f) Himalayan Snow Cover Monitoring System, NCMRWF, DST, New Delhi

HIMSIS-Himalayan Snow cover Information System has been initiated by NRSA from 1980 onwards (present overview is enclosed). Various database like Hydro meteorological, Digital Terrain Models etc. has already been designed with emphasis on water resource management. HIMSIS was considered useful for other activities e.g. weather forecasting, snow-avalanche studies, agricultural production and other climatic investigations. NCMRWF is issuing operational snow and temperature weather forecasts up to 3 days in advance.

Future Development

Indian space programme is in the process of tackling global challenges by focusing future missions: gravity and magnetic field studies, polar ice cap studies, cloud properties and climate links, radiation budget and hyperspectral observations.

To pursue global change studies in the context of India, a variety of satellite data will be required. The data may be received and achieved in the country or by agencies outside India. In either case it is critical that such satellite data be available in a timely and affordable manner. Proper archival provisions are essential to ensure preservation

and retrieval for an essentially indefinite period. This implies permanency of the storage, medium and upward compatibility of data storage and retrieval technology in the future. Since data archiving involves large numbers, selective archival storage should be resorted to. Updated information on satellite data availability is essential to determine where and what data are available, and to obtain the required data from the database. Access from remote terminals will facilitate information retrieval. The information system should have the capability of providing on-line data with characteristics which will determine whether data should be acquired; the capability to transfer or place an order for a subset of data base; capability to combine various data or different formats on a geographical framework and also capability on a geographical framework; and also capability to manipulate elements of integrated data set into descriptive and predictive models. Department of Space is in process of launching OCEANSAT-2 and RESOURCESAT-2 for better spatial monitoring and RISAT-1 for monitoring both during night and days as well as in cloudy condition. In the field of meteorology, future launch of INSAT-3D and MEGHA-TROPIQUES will bring revolution in atmospheric and climatic studies.

Though the ISRO's vision for the decade 2000-2010 laid stress on promotion and development of space technology for applications in socio-economic development, one of its important plans was to commercialize the technological capability and space application potential in the global market in an attempt to harness the benefits accruing from the national space efforts. Future application will focus on detailed digital terrain models, digital cartographic database, NRIS/GIS, and permanent GPS station network etc. The IGBP-DIS suggests that substantial effort is required in the pre-processes of the data sets (radiometric calibration, atmospheric correction, geometric correction and temporal compositing) with several aspects requiring additional research before standard procedures can be established. Coping with global change scenarios, pilot studies concentrate on land cover vegetation index, inter comparison study of surface temperature and data directory study. It is important to link the Indian researches with Global Mapping Forum. Recent initiative in the form of Geo Spatial Data Infrastructure (GSDI) is a welcome step.

There is a need to establish multi-disciplinary framework involving various organizations in order to promote technology transfer and exchange of data at national level. As data is very critical for any research, there is a need to evolve a mechanism to accelerate supply of data and topographical maps in order to maintain availability of information and sharing with every institution/person engaged in national endeavor. For avoiding duplication of efforts, a central agency like a Referral Data Centre needs to be created in order to play the role of Data Clearing House. An information book should be published incorporating various types of data to be provided by each national institution describing various levels of information available. A format should be sent to various agencies for getting responses. At macro-level, existing databases available at various institutions should be taken into consideration and standardized, identifying key sectors like meteorology, geology, biosphere, land uses, and anthropogenic and socio-cultural aspects. Satellite and geo-spatial data of low cost, as well as user-friendly formats should be provided to various users. High-resolution satellite data and low-resolution satellite data should be compiled in multi-temporal database to support regional and local projects. Micro-level database projects should be established selecting geosphere-biosphere observatories in various regions. Appropriate geoinformatics technology and

its hardware and software requirements should be identified on the basis of the experiences of several institutions. Institutions should be provided the latest information about products and systems in the fields of space technology image processing, Geographical information System, Global Positioning System and expert systems. In the electronic age, there is a need to strengthen existing institutions, particularly universities, policy making bodies and NGOs by encouraging networking.

Concluding Remarks

India is in the process of linking its space and remote sensing programme with emerging trends in Sensor Systems include imaging microwave radars; Lidars, Radar altimeters: Scatterometers, geodynamic instruments, imaging multispectral radiometers, earth radiation budget radiometers, rain radars, atmospheric temperature and humidity sounders. Global experience shows that remote sensing and GIS can be very effective tools for problems of natural resource management when carefully evaluated and applied within an appropriate conceptual framework. The new age of micro-computers and increased potential for information exchange would aid in assembling these new programmes.

Links between the scientific communities and the space agencies need to be improved. Close collaboration between academic institutions and central/state government departments will further improve remote sensing education. Various remote-sensing sources should also be extended at various disciplines like geo-sciences, hydrology, marine science, agriculture, urban planning and engineering, etc. Young scientists will require appropriate training in GIS technology, access to data and opportunities for regional and inter-regional collaboration.

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