Resource Ownership and Demarcation of Village Boundaries in Hill Terrains : Tuichhuahen Watershed in Mizoram, A Case Study

G. Kumar

Abstract *: There are enough evidences from all over the world that suggest that development rarely seems to 'work' at least in respect of the consequences intended or the outcomes predicted. Yet the existing thrust under prevailing paradigms of unworkable development does not only persist but seems, to be continuously expanding its reach and scope. Despite severe criticism from both the modernists and post modernists the notion and practice of 'global development industry, therefore, flourishes. It is no where clearer than the regions which under governing thrusts of the existing politico-economic systems either willingly or unwillingly are forced to adopt the accordant models. It is found increasingly to have brought discordant notes amongst the communities and the regions not only on global level but also at national and sub-national levels. The powerful cartel obtained from the close nexus of politician, businessmen and administrators more often than not take the system for a ride - the system which is supposed to be the raison'de tre of their existence. It is done under the garb of legal sub-system that they are empowered to induce. The common man, in the process is made subservient with no choice and self respect even in a much touted system of democratic governance - of the people, for the people, by the people. The world regions in miniscule proportion are characterized by over consumption whereas disproportionately large group of people continue to remain undernourished or with little access to the resources to meet their minimum requirement that may enable them to survive.*

Present paper is based on the experiences obtained from directed resource uses and growing interpersonal/ interregional disparities. Failure of the existing system to combat and control such a problem necessitates understanding on the part of the common people and their active participation in taking the responsibility for resource management and control uses of natural endowments. It requires dissemination of objective information in which academicians can play a vital role and governments may assume a better role as regulator rather than governance in democratic system.

Introduction

Community resources, in the name of development and better management, are getting increasingly beyond the reach of the common men. Unilateral administrative decisions given legitimacy by a promise of compensation through uncertain welfare measures are found to limit, many times obstruct, the use of conventional resources within their command. There are enough evidences from all over the world suggesting that development rarely seems to 'work' at least in respect of the consequences intended or the outcomes predicted. Development is made out to be a 'fixed and concerted process' having, as Lumis (1993) puts it, 'predetermined results' in reduction of poverty, inequality and unemployment. Thrust under prevailing paradigms of development in utter disregard of the spatial characteristics leading

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to unattainable results does not only persist but seems, as Crush (1995: 4) finds, to be continuously expanding its reach and scope. Despite severe criticism from both the modernists and post modernists the notion and practice of 'global development industry resists development to be a process of equity for and accessibility to the poor- urban and rural alike.

It continues with the perception as a process of growth (economic) and modernization on which it flourishes. It persists with the notions and adopted definitions of national income, poverty, inequality and employment (Seers, 1979) unemployment and a shift from agrarian occupation to secondary and/or tertiary sectors (Hettne, 1990) . The conflict is no where clearer than the regions which under governing ideology of the existing politico-economic systems are forced (willingly or unwillingly) to adopt the accordant models. It is found increasingly to have brought discordant notes amongst the communities and the regions not only on global level but also at national and sub national levels.

As a result states at sub-national levels like that of Mizoram with weak economic base under prevailing concept of development though might appear to have done well on various social parameters under governing philosophy of the state they continue to be at the lowest level of economic regeneration hence choice of their development. It is in this light that an attempt has been made in the present paper to absolve people (under the adopted legal frame work) of their dependence on external agencies including the governments to seek their own path of development in order to enlarge their freedom of choice and what Amartya sen suggests dignity and self respect.

Statement of the Problems

The people, in the state of Mizoram generally face difficulty in identifying personal and community resources mostly because the concept of personal land property till recently has been alien to the people of Mizoram. They traditionally have been using the assigned resources by the village authority without any definite legal boundary (an attempt is now being made to establish the legal boundaries of the villages). As a result, the state does not have any cadastral survey of the villages. Dominant practice of shifting cultivation is found to be leading to less efficient agricultural productivity hence less economic returns. Besides degradation of one of the most valuable regional resource- the forest the practice is found to be enhancing agriculturally the most significant soil erosion. In addition, there is

growing conflict with the government departments about the ownership of the resources. Interdepartmental feuds in respect of ownership and management does not bid well for the needy people of the area. This is found to be forcing the people to migrate looking for better economic opportunities. This is also found to cause underutilization or no utilization of widely distributed natural resources. This also provides an opening for the powerful members of the society to muscle in their claim in remote areas.

Objective

* To identify agriculturally suitable slopes in the vicinity of the settlements.
* To provide a basis for demarcation of settlement boundaries.
* To suggest measures for enhancement of community resources and their sustainable use.

Study Area

The study area is located in northern part of the state of Mizoram. It forms the north western part of the Serlui sub-watershed in Kolasib District of Mizoram. It is identified to be the part of higher order sub-basin dominated by the Cachar Plains of Assam. Broadly it occupies an area between 24^{0}15' & 24^{0}30' N. Lats. and 92^{0}40' & 94^{0}45' E. Long. It covers an area of about, 3 272,20 hectares distributed between altitudes a little over 600m and a little below 100m. This small watershed contains 10 villages with 711 household and two urban centers.

The watershed houses a mixed population of the Mizo and Riang tribes. The number of people who depend on the watershed resources is about 3708 as per the mid census estimate in 2006. Population is predominantly agrarian and depends, for large part of their sustenance, on land and forest resources developed over the soils primarily obtained from Surma series of rocks. Though the watershed has small patches suitable for permanent cultivation, large area is given to shifting cultivation that is believed to have brought substantial changes in land cover of the area. In order to support their meager agricultural income substantial number of the inhabitants indulges in livestock rearing, and petty business. In absence of certainty of economic returns many of them migrate or tend to migrate to the places of perceived economic potentials.

Research Issues

The state of Mizoram with a predominantly tribal population has been facing a wide range of complex changes under the prevailing paradigms of development - a

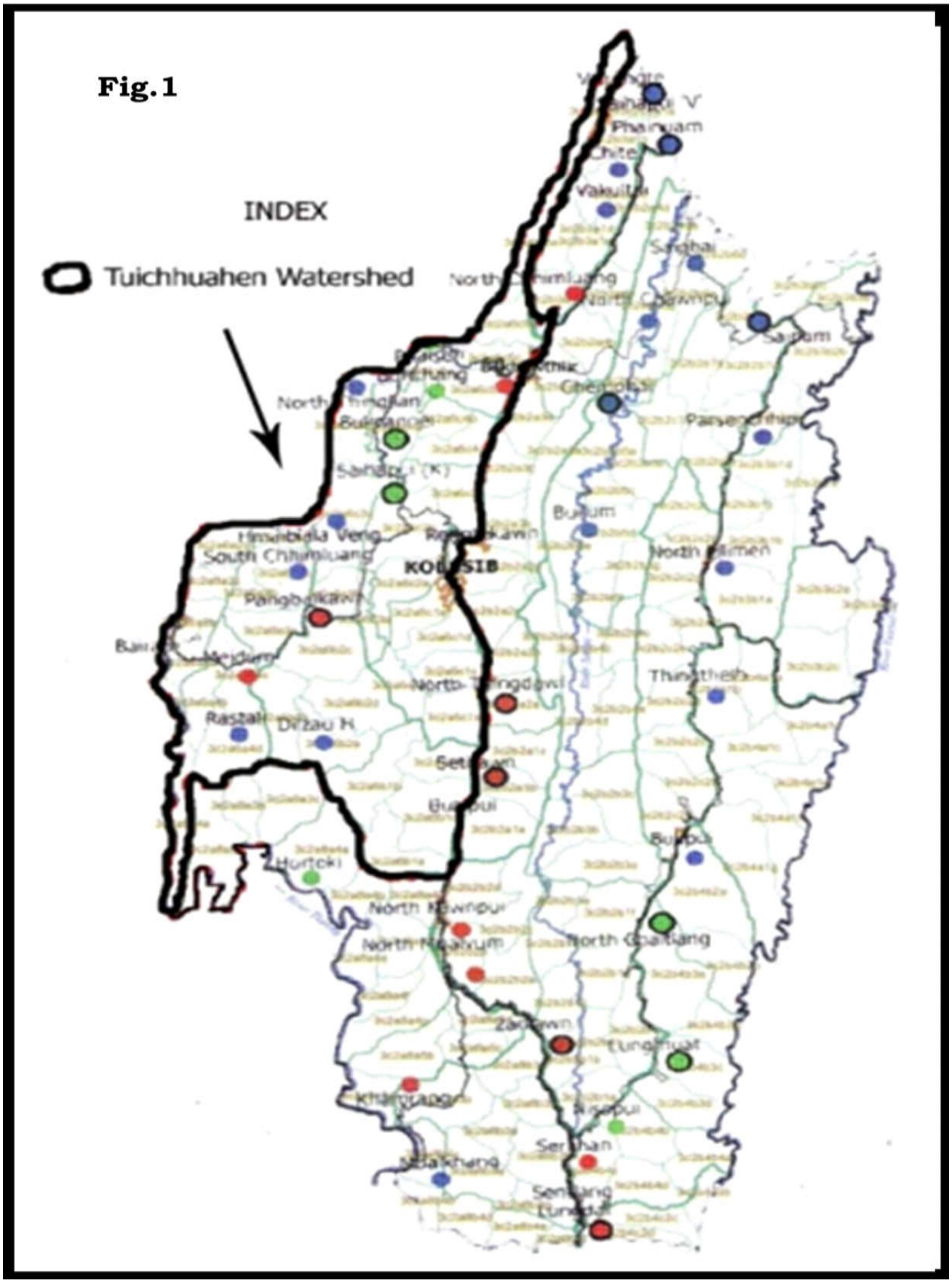

Fig.1

paradigm that appears to have induced increasingly interpersona/ interregional disparities. Though the managers of resources and the governments in power are ever busy in publicizing their achievements they are found to depend on partisan selection of development parameters suggested and approved by the powerful cartels at international, national and regional levels. The fact continues to remain that a large proportion of population is continually and increasingly deprived of its access to basic and common resources, more so in developing regions of the world.

Development is found to be leading to underdevelopment of regions. Mizoram is no exception. The state like any part of the world is strewn apparently with consumerism driven urban pockets of opulence. People under induced perception of development compete to come to such pockets to stake their claim on benefits of national/ statal macro resources. In the process, rural resources are either unutilized or underutilized. It is obvious from the fact that following the pattern at global level an area of 3.14% in the state is found to accommodate almost 50% of the population (Kumar, 2012). It, though might have brought changes in life styles, is not necessarily found to have led to better living condition. It is reflected in increasing rate of crime, violence, shabby housing, shortage of usable water and unbearable pressure on available urban infrastructure. The rural populace, in the mean time is exposed to exploitation and worsening living condition and decision making capacity. They are, thus, caught in the web to adopt Gunnar Myrdal's phrase of causative causation leading to growing underdevelopment.

It is, therefore, necessary to evaluate an alternative strategy of development particularly for an agrarian society based on the concept of diffusion of resources against that of concentration and in which people are made responsible for their own economic wellbeing and development against present attempts of encouraging dependency on external agencies including the governments.

Methodology

The study involves information broadly on two aspects - (1) the natural organization of the physical components, and (2) the distributional aspects of human organization of the space.

For the purpose of the study, therefore, the watershed area of Tuichhuahen has firstly been delineated from the topographical map nos. 83D/11 and 83D/12 available on a scale of 1:50,000. A relief map then has been prepared

on the basis of a contour interval of 20 meters to identify the workable slope categories in different parts of the study area. Slope categorization has been arrived at by using Wentworth's method of slope analysis wherein it has been assumed following McGregor (1957) that the slopes under 12o may be considered suitable for different kinds of agricultural uses. Almost the same suggestion is made by ICAR in respect of slope usability. An attempt then has been made to delineate the village boundaries keeping in view the local conditions to define the area of legal operation with varying slopes.

Findings & Discussion

Topographic lay out of the Tuichhuahen watershed as shown in fig.2 reveals that a large part of the area is characterized by low relief except along the eastern and intermittently along the western boundaries where relief is relatively more pronounced.

Relief, however, is hardly an indicator of agricultural usability of land. It, though may be influencing farming by modifying the climate and affecting the ease and degree of cultivation (Singh, 1976:34) it is the availability of usable slope in total landscape analysis that are more relevant to the directions which development is intended to follow (Thomas, 1969:103). Slope categorization of the study area (fig.3) on the basis of slope zones suggests that if made aware of their environs the villagers will develop a capacity to optimize the use of available resources in their own interest. It may also combat the menace of local degradation of environment propagated being caused by injudicious use of land for jhum cultivation.

Tabulation of area under different categories of slope (table: 1) reveals that the study area is endowed with a very large area under agriculturally suitable slope. It is proportionately the highest in the state with about 25% of the area below 8% of slope that will have an angular variation below 6o. The following table gives an idea about the availability of slope under different slope categories in Tuichhuahen watershed.

Table: 1
Slope categories in Tuichhuahen Watershed

Sl.No	Slope categpry in degree	Slope category in per cent	Percentage of land area
1	<6°		25
2	6° - 12°	9%- 21%	3
3	12° - 18°	21%- 50%	45
4	>18°	50% above	27

It may be seen from the table: 1 that quite a substantial area in the watershed is found to be suitable for agricultural activities. As a matter of fact, the watershed appears to have highest percentage of land on cultivable slope in the state. It is certainly much higher

Fig.2 - Relief

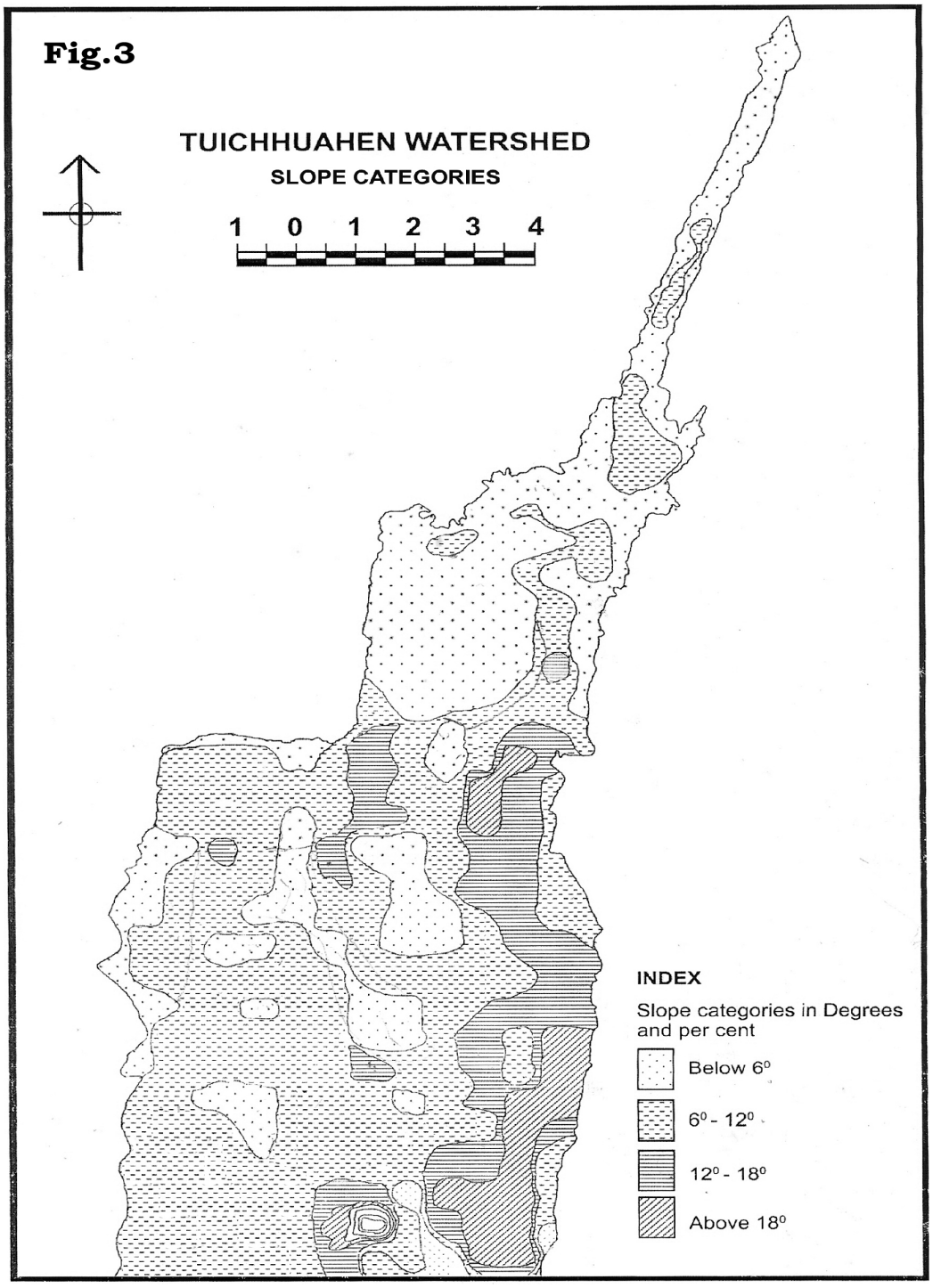
Fig.3
TUICHHUAHEN WATERSHED
SLOPE CATEGORIES
1 0 1 2 3 4
INDEX
Slope categories in Degrees and per cent
Below 6°
6° - 12°
12° - 18°
Above 18°

than the state average of about 2.9% (Kumar, 2012). It is, therefore, natural that people vie to own the land and associated resources in the area without having proportionate production.

Table -2

Name of the Village	Available area for agricultural use in hectares slopes categories		
	<6°	6°-12°	Total
N. Thinglian	7200	-	7200
Buhchang	6300	1220	7520
Bukvannei	9700	-	9720
Saihapui	16700	4500	21200
Hmaibial Veng	2100	5450	7550
S. Chhimluang	4970	13020	17990
Pangbalkawn	11080	18850	29930
Meidum	9170	14552	21990
Rastoli	5770	16220	21990
Dilzau H	6620	5970	12590
	79610	79780	157680

They, however, are found to have been caught in the conflict in respect of ownership and their access to common resources. The problem is aggravated by inter government departmental clash of interest which fails the people to allow their legitimate need based access to widely spread natural resources which many times are seasonal in nature.

Thus, a map (fig. 4) has been prepared to reflect the possible method of delineation of village area keeping in view the ease of mobility and land use.

The following table outlines the proposed area of the villages under different slope categories.

It may be seen from the table that the area under different slope categories is not equitably distributed due to local physical constraints. It is believed to have limited the population as well as infrastructural development of the villages. It may also be noted that against the total area of 3, 272, 20 hectares these villages at most can claim only 316990 hectares. Rest of the area may be directly controlled and managed by the government institutions. This may also help in promoting state-people partnership in larger and harmonious interest of the people and the state government.

Conclusion

Significance of the present study lies in the realization of obtained socio-economic conditions during more than 250 years of the adopted strategies for development and economic growth which is found to have contributed more towards increasing disparities rather than enabling the common mass of the people to realize better harmonious living condition. As a matter of fact the models that have been developed by the industrialized West is clearly based on the concept of exploitation in terms of natural as well as human resources. It has been thriving on the concept that development cannot take place without resorting to exploitation and underdevelopment

Fig.4


TUICHHUAHEN WATERSHED
Proposed Village Area & Land Use
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of certain regions. Concept of growth and development has been reinforced by the propagated productive efficiency of power driven new technologies. Little is realized that they are designed to disproportionately and wastefully consume natural resources. In developing regions superiority of such concept is established by the propagation of consumer industries and induced change in the consumer behavior of the targeted groups. In the process, labor (manual) intensive activities which are generally consumption neutral are looked upon. This is found to have led to abhorrence amongst the common mass of people for labor intensive basic activities/ industries. In absence of aptitude and proper training as well as limited openings offered by secondary and tertiary sectors of economy a large proportion of human resource is found either to be unutilized or underutilized (disguised unemployment). In the process people start beholding to and becoming dependent on the government which changes its role from being facilitator to that of ruler and administrator. Governance becomes an end unto itself. People are commoditized like any other inert commodity. Thus, it becomes imperative that the people take initiative and reestablish the dignity of labor in their own interest. With small population and closely knit social organization with still simple life style particularly in the rural areas, Mizoram may show the path to rest of the country in respect of regional organization of economic activities based on mutual dependence of settlements.

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Reproductive Healthcare in India: Does Road Accessibility Matters?

K.C. Lalmalsawmzauva

Abstract : *In the policy of reproductive healthcare in India, the geographical factor like accessibility has been neglected. Present paper tests the role of surface road connection on mother's health seeking behaviour in India. By classifying the country into several surface road density zones an attempt has been made to examine the varying impact of accessibility on reproductive health in different road density zones. Road networks in the country are denser in the plains of the north while it is moderately dense in the southern plateau region with poor road connectivity characterizing the hills. Based on the data available in NFHS-III (2005-2006) on reproductive health in India, this study tests the hypothesis that better road connectivity influence performance of reproductive healthcare.*

Key words: *surface road density, antenatal care, health facility, delivery, postnatal care, region, relationship.*

Introduction

"*Reproductive Health is a state of complete physical, mental and social well-being, and not merely absence of disease or infirmity, in all matter relating to the reproductive system and its functions and processes. Reproductive health therefore implies that people are able to have a satisfying and safe sex life and that they have the capability to reproduce and the freedom to decide if, when and how often to do so*" (ICDP Programme of Action para.7.2). It includes *Antenatal Care* (ANC) which refers to pregnancy-related healthcare provided by a [1]doctor or a health worker in a medical facility or at home. Ideally, antenatal care should monitor a pregnancy for signs of complications, detect and treat pre-existing and concurrent problems of pregnancy, delivery care and provide advice and counselling on preventive care, diet during pregnancy, and postnatal care and related issues. Another important thrust of reproductive health is *Delivery Care*. Place of delivery is extremely important- deliveries under proper hygienic conditions under supervision of trained health professionals and improper treatment during delivery makes a difference. Postnatal Care is also one important components of reproductive health. The health of the mother and her new born child depends not only on the healthcare she receives during her pregnancy and delivery, but also on the care she and the infant receive during the first few weeks after

[1]*The title of this paper is slightly changed. The same content under the titled: Maternal Health Care Utilization in India: Role of Surface Road Networks had presented at XXVI IUSSP International Population Conference held in Marrakech, Morocco during 27 September - 2 October 2009.* *The author gratefully acknowledge with thanks to IUSSP, Paris, France for providing full financial support to attend the seminar. Thanks are also due to the Dr. DK Nayak, NEHU for his guidance and unfailing help.*

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delivery. Postpartum check-up usually indicates medical check-up received by mother during the first two months after delivery.

Background

The amazing diversity of ethnic and racial characteristics evident in India has its roots in the manner the sub-continent has been peopled. The geography has played a significant role in all aspects of life of the people. The physical landscape and the magnitude of spatial variations are likely to contribute for differentiations of reproductive health status. In India the rates of infant mortality and reproductive mortality are alarming. Seven of every 100 children born in India die before reaching age one and approximately five of every 1,000 women who become pregnant die of causes related to pregnancy and childbirth. Worldwide, India accounts for more than one-fifth of all reproductive deaths from causes related to pregnancy and childbirth (Sugarthi, Mishra, and Retherford 2001). According to National Family Health Survey-3(2005-2006) more than 50 percent of pregnant mother attend at least three antenatal cares for their last birth. Only 48.3 percent received professional assistance during their last birth while around 36 percent get postnatal care from health professional. It is highly expected that diversify topography with its associations of road networks connection played substantial role in the process of reproductive health as distance to the nearest health centre, lack of transportation, and perceived quality of services are all thought to be associated with the use of modern healthcare and seeking assistance from trained medical personnel (Noor Ali et al., 1999; Paul, 1992; Paul and Rumsey, 2002; Sundari, 1992). Paul and Rumsey (2002) note that lack of access to healthcare facilities refers to economic and socio-cultural distance as well as physical distance. It is likely to be found an association between frequency of reproductive healthcare use and region of residence in Kenya, Magadi et al.(2000). Glei et al (2003) also found large differences in the likelihood of obtaining pregnancy care across region in Guatemala, perhaps due to regional variations socially and geographically. It is likely true that access to skilled assistance and well equipped health institutions during delivery can reduce reproductive mortality and morbidity and improve pregnancy out comes. Geographical barriers such as mountainous terrain or poor road conditions also delay access to reproductive healthcare. In Haiti road conditions and geography constrain access to both prenatal care and delivery care for women living in rural areas (Guttmacher

Institute, 2007). In the line of the above conceptual literatures pertaining reproductive health an attempt has been made to explore role of surface road network connection on reproductive health in India. (table-1)

Objectives

Analyse and compare surface road density regions on utilization of reproductive healthcare to find out the relationship between accessibility and reproductive healthcare indicators

Data and Methods

The study is based on the data from India's National Family Health Survey-3 (NFHS-3) conducted during 2005-2006, Census of India and Yearbooks-1995. NFHS-3 collected information from a nationally representative sample of 124,385 ever- married women of age 15-49 years. The survey covered 99 in all twenty-eight states. This survey has been conducted by International Institute of Population Studies (IIPS), Mumbai. Road density data is available from India year book-1998 and other substantial in formations from census of India-2001.

It has been divided all India states into surface road density regions and analyze its relationship with utilization of reproductive healthcare services including - received all antenatal care during pregnancy, birth delivered in health facility, delivery assisted by health personnel & delivery with postnatal check-up, delivery with postnatal check-up within 2 days of birth; Therefore; India has been divided into five surface road density regions such as (see figure 1)-

(i) Very high surface road density region (>50km per

Table-1. Very High Density Surface Road Region (>50km per 100km² areas)

Name of States	Surface Road Density#	% Received all ANC@	%Institutional Delivery	Delivery assisted by health personnel	% Any postnatal check-up	% Postnatal check-up within 2 days of birth
Delhi	1006	29	58.9	64.1	60.9	58.4
Goa	123	55.7	92.3	94	82.8	75.5
Punjab	94	19.6	51.3	68.2	63.7	62
Tamil Nadu	91	34	87.8	90.6	91.3	87.2
Kerala	84	63.6	99.3	99.4	87.4	84.9
Haryana	60	14.7	35.7	48.9	57.6	55.9
Average	**243**	**36.1**	**70.88**	**77.53**	**73.95**	**70.65**

@For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Source: NFHS-3, and data given in India-1995 Year Book

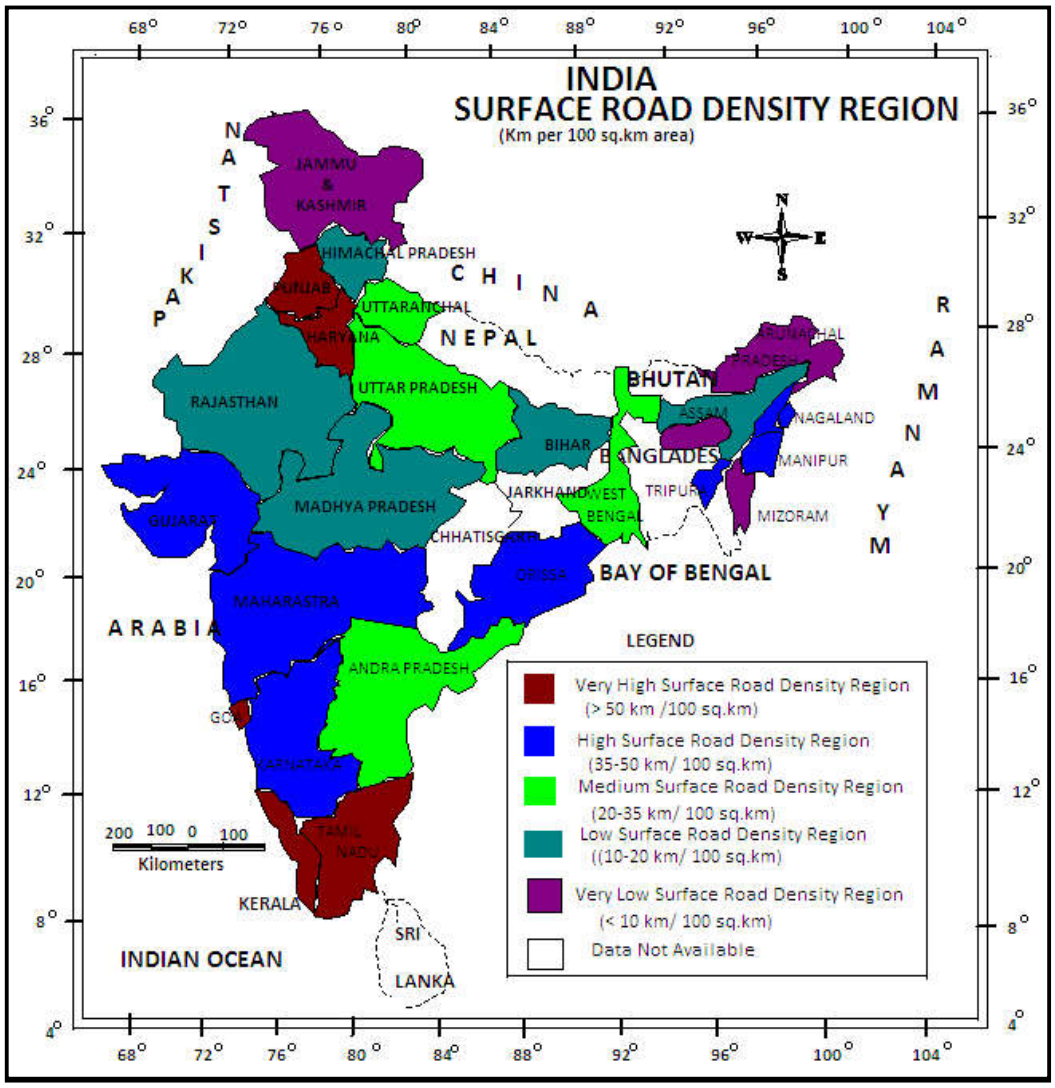
percent of India's population living

100km^2 areas) consists the states of Delhi, Punjab, Haryana, Kerala, Goa and Tamil Nadu.

(ii) High surface road density region (35-50 km per 100km^2 areas) includes the states of Manipur, Tripura, Orissa, Maharashtra, Karnataka, Gujarat and Nagaland

(iii) Medium surface road density (20-35km per 100km^2 area) region includes the states of Uttaranchal, Uttar Pradesh, West Bengal, Sikkim and Andhra Pradesh.

(iv) Low surface road density (10-20 km per 100km^2 areas) region consists of the states of Assam, Bihar, Madhya



Pradesh, Himachal Pradesh and Rajasthan.

(v) Very low surface road density region (< 10 km per 100km^2 areas) contains the states of Arunachal Pradesh, Meghalaya, Mizoram and Jammu & Kashmir.

Influence of road networks on reproductive healthcare utilization have been examined base on these road density regions. It is likely to be found the relationship of road density of particular regions with mother's health seeking behaviour throughout reproductive process. It is assumed that highly road density region provides better access for mother to visit healthcare facilities that will, in turn leads to greater utilization of healthcare facilities than those mothers who belong to low density road regions.

To test the relationship, statistical analysis is conducted between predictor variable- surface road density, and five response variables such as- (1) received all antenatal care, (2) birth delivered in health facility, (3) delivery assisted by health personnel, (4) delivery with postnatal check-up, and (5) delivery with postnatal check-up within 2 days of birth by using SPSS (Statistical Package for Social Sciences). Even though many factors can be responsible for mother's health seeking attitude present study is focus to surface road density and its impact on reproductive healthcare utilization. It is also well established from various studies that utilization of maternity services are influence by other factors like mother's education, mother's exposure to mass media, place of residence and background characteristics (G.Debarchana 2006, Retherford and Mishra, 1997, Mosley and Chan 1984; Monteith et al.1987). It appears that little research has been done so far in India about the important of accessibility factor on utilization of reproductive healthcare facilities.

Unfortunately, the NFHS does not include questions on road network connection or accessibility level in detail, data has been acquired from other sources like year books and planning commissions. This study stresses the magnitude of access to health services as accessibility variable effecting the utilization of healthcare services. Historically, improving access to services has been a primary strategy for increasing health service utilization in developing countries (Sartia and Touminen 1993; Kumar, Singh, and Kaur 1997). Studies by Elo (1992) and Sawhney (1993) have presented evidence that the effects of inadequate access to services on utilization are greater than the effects of socioeconomic factors.

Discussion and Results

1. Very High Density Surface Road Region (>50km per 100km² areas)

This region consists of six highest density of surface road states-three from the northern plain areas of Delhi, Punjab and Haryana, three from peninsular coastal region including Goa, Tamil Nadu and Kerala. (table-1). The region with overall average of 243 percent surface road density (243 km per 100 km² areas) achieved more than 36 percent of mother received all antenatal care (ANC) during pregnancy, 70.88 percent birth delivered in health facility, 77.53 percent delivery assisted by health personnel, 73.95 percent delivery received postnatal check-up and 70.65 percent received postnatal check-up within two days of birth. It is found that within this region there exist inter-states variations in several variables. The common characteristics, however, is that higher road density provides greater number of mother utilized health facility except in the case of country's capital Delhi, which showed a perplexing results may be due to the influence of other potential socioeconomic variables.

2. High Density Surface Road Region (35-50km per 100km² areas)

This region consists of seven Indian states in spatially diverse areas. From the Deccan plateau-Maharashtra, Orissa, Karnataka and Gujarat plain form high density surface road region in association with Manipur plain and Tripura plain in the North East India (table-2). As having average surface road density of 42.38 km/100sq.km, utilization of maternity health services are low compared with very high surface road density region. The relationship of road density and utilization of maternity

Table-2. High Density Surface Road Region (35-50km per 100km² areas)

Name of States	Surface Road Density#	% Received all ANC@	% Institutional Delivery	% Delivery assisted by health personnel	% Any postnatal check-up	% Postnatal check-up within 2 days of birth
Maharashtra	48	21.6	64.6	68.7	64	58.7
Manipur	46.7	10.5	45.9	59	50.1	46.4
Karnataka	45	29.6	64.7	69.7	66.9	58.5
Tripura	42	10.6	46.9	48.8	33.7	30.3
Nagaland	41	1.9	11.6	24.7	11.8	10.6
Gujarat	37	25.6	52.7	63	61.4	56.5
Orissa	37	18.4	35.6	44	40.9	33.3
Average	**42.38**	**17.1**	**40.94**	**52.11**	**48.24**	**42.57**

@For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Source: NFHS-3, and data given in India Year Book-1995

health services are not strong and disparities prevail when we looked at inter-states performances. This puzzling situation reveals that there are other determinant factors in the region. In overall, 17.1 percent of pregnant women received all antenatal care, 40.94 percent birth delivered in health facility, 52.11 percent delivery assisted by health personnel and 48.24 received postnatal care.

3. Medium Density Surface Road Region (20-35km per 100km² area)

It consists of northern plain states of Uttaranchal and Uttar Pradesh with Chhotanagpur belt of west Bengal states as well as the Himalayan foothill of Sikkim (table-3). The region has average surface road density of 30 km/100sq.km area revealed more or less same characters regarding utilization of maternity health services compared with high surface road density region. Around 17 percent of pregnant women received all types of recommended antenatal care, a slightly more than 41 percent delivered in health facility and 48.38 percent birth were assisted by health personnel while 44.14 percent and 39.08 percent received postnatal care at any time after delivery and received postnatal care within two days of delivery respectively.

4. Low Density Surface Road Region (10-20km per 100km² areas)

States having surface road density between 10-20km/100km² areas are falls under low density region that consists of Bihar plain, Assam plain, Rajasthan desert, Himachal Himalaya and Deccan plateau of Madhya Pradesh. It is interesting to note that while high and medium surface road density showed a weak relationship with utilization of maternity health services, low surface road density portrayed significant association

Table-3. Medium Density Surface Road Region (20-35km per 100km² area)

Name of States	Surface Road Density #	% Received all ANC@	% Institutional Delivery	Delivery assisted By health personnel	%Any postnatal check-up	% Postnatal check-up within 2 days of birth
West Bengal	32	12.3	42	47.6	44.3	40.7
Uttaranchal	31	16.1	32.6	38.5	35.8	32.4
Uttar Pradesh	31	4.1	20.6	27.2	14.9	13.3
Andhra Pradesh	30	28.2	64.4	74.9	73.3	64.1
Sikkim	26	27.2	47.2	53.7	52.4	44.9
Average	**30**	**17.58**	**41.36**	**48.38**	**44.14**	**39.08**

@For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Source: NFHS-3, and data given in India-1995 Year Book

with utilization of maternity health services. However, this relationships again, depicted differences from one states to another within the region.(table-4).This region has average surface road density of 16.6 percent and 9.72 percent of pregnant women received all antenatal care while a little over 28 percent delivered in health facility. More than 36 percent delivery were assisted by health personnel, 29.98 percent received postnatal care at any time after delivery and only 26.08 percent received postnatal care after two days of birth.

5. Very Low Density Surface Road Region (<10km per 100km² area)

Very low surface road density region consist of three Himalayan mountainous states of Jammu & Kashmir, Mizoram and Arunachal Pradesh including Meghalaya plateau (table 5). This region shows a peculiar and vague association between road network and utilization of maternity services. Variables of reproductive care indicators in the region generally depicted comparatively better results even though bad road network connections prevailed. While only 6.5km surface road density, antenatal receiving rate is 10.2 percent and institutional delivery is as high as 41.87 percent respectively, which are higher than medium and low density road regions. Besides, the region scores as high as 45.8 percent delivery assisted by health personnel and a high 40.5 percent postnatal care respectively, which are higher than low density surface road region. This may be due to the intervening effects of other socio-economic factors like mother education, mass media exposure and background characteristics which are varied widely within this

Table - 4. Low Density Surface Road Region (10-20km per 100km² areas)

Name of States	Surface Road Density #	% Received all ANC@	% Institutional Delivery	%Delivery assisted by health personnel	%Any postnatal check-up	% Postnatal check-up within 2 days of birth
Bihar	20	5.8	19.9	29.3	17.8	15.9
Rajasthan	18	8.6	29.6	41	31.8	28.9
Madhya Pradesh	18	7.2	26.2	32.7	33.8	28.5
Assam	14	9.6	22.4	31	15.9	13.9
Himachal Pradesh	13	17.4	43	47.8	50.6	43.2
Average	**16.6**	**9.72**	**28.22**	**36.36**	**29.98**	**26.08**

@For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Source: NFHS-3, and data given in India-1995 Year Book

region.

Relationship between Surface Road Density and Utilization of Reproductive Healthcare Services

The first part of this section deals with relationship of surface road density and utilization of maternity health services from the median outcomes of each region. Table.6 shows that surface road density has substantial influence on mother health seeking behaviours and utilization of health facilities. It reveals that better road network connection leads to greater utilization of health facilities (Fig-2) Very high surface road density region (243km/100 sq.km) has 36.1 percent women received all types of recommended antenatal care while high surface road density regions (42.38 km/100 sq.km) has 17 percent women received all type of recommended antenatal care. Medium and low surface road density regions show that more than 17 percent and 9 percent of women received all types of recommended antenatal care. While high and medium surface road density region display more or less similar results throughout the whole process of utilization of reproductive healthcare facility, very low surface road density, contradictorily, distinguishing itself by depicting higher utilization of maternity health services rather than low surface road density regions as a whole and medium density region in certain indicators.

Table.6 reveals that institutional delivery, professional assisted deliver and postnatal care are related with surface road density. While more than 70 percent recorded institutional delivery in very high surface road density region only a little over 52 percent and 48 percent institutional delivery occurred in high and medium surface road density regions respectively. Even though very low surface road density region show poor accessibility, institutional

Table - 5. Very Low Density Surface Road Region (<10km per 100km² area)

Name of States	Surface Road Density#	%Received all ANC@	%Institutional Delivery	%Delivery assisted by health personnel	%Any postnatal check-up	% Postnatal check-up within 2 days of birth
Meghalaya	13	8.1	29	31.1	33.2	28.8
Mizoram	6	8.7	59.8	65.4	53.5	50.6
Jammu& Kashmir	4	17.5	50.2	56.5	51.6	48.4
Arunachal Pradesh	3	6.5	28.5	30.2	23.7	22.7
Average	**6.5**	**10.2**	**41.87**	**45.8**	**40.5**	**37.62**

@For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Source: NFHS-3, and data given in India-1995 Year Book

delivery is as high as 41 percent while only about 28 percent in a better accessibility area of low surface road density region. These perplexing results are mainly due to intervention of multiple factors which can cause utilization of maternity services.

Besides, postnatal cares portrayed positive relationships with surface road network except in the very low surface road density region. Substantial positive relationship of higher surface road network connection with greater number of women received postnatal care found in all regions except very low surface road density region. This baffling result may be due to other intervening variables, most probably mother's education, income and unique background characteristics.

Correlation between surface road density and Reproductive health indicators of different

To concisely proves of the existence of the relationship of surface road and reproductive healthcare present paragraphs discuss detailed results of statistically test correlation between the surface road density (predictor) and response variables like mother who received full antenatal care, institutional delivery, delivery assisted by health personnel and number of postnatal cares.

Table.7 reveals that surface road density played critical role for reproductive health from pregnancy to lactating period. Full antenatal care and surface road density have a very high positive relationship (r=0.971) with 0.01significant level.

Table-6. Relationship between surface road density and utilization of reproductive health services

Road density regions(in average)	Surface Road Density#	% Received all ANC@	%Institutional Delivery	%Delivery assisted by health personnel	% Any postnatal check-up	% Postnatal check-up within 2 days of birth
Very high	243	36.1	70.88	77.53	73.95	70.65
High	42.38	17.1	40.94	52.11	48.24	42.57
Medium	30	17.58	41.36	48.38	44.14	39.08
Low	16.6	9.72	28.22	36.36	29.98	26.08
Very low	6.5	10.2	41.87	45.8	40.5	37.62

@For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Source: NFHS-3, and data given in India-1995 Year Book

There were positive correlations between surface road density and all the indicators of utilization of maternity services at a high 0.05significant level, which are ranges from(r=0.936) for institutional birth, (r=0.950) for delivery assisted by health personnel, (r=0.939) for any postnatal check-up and (r=0.947) for postnatal check-up within two days of birth.

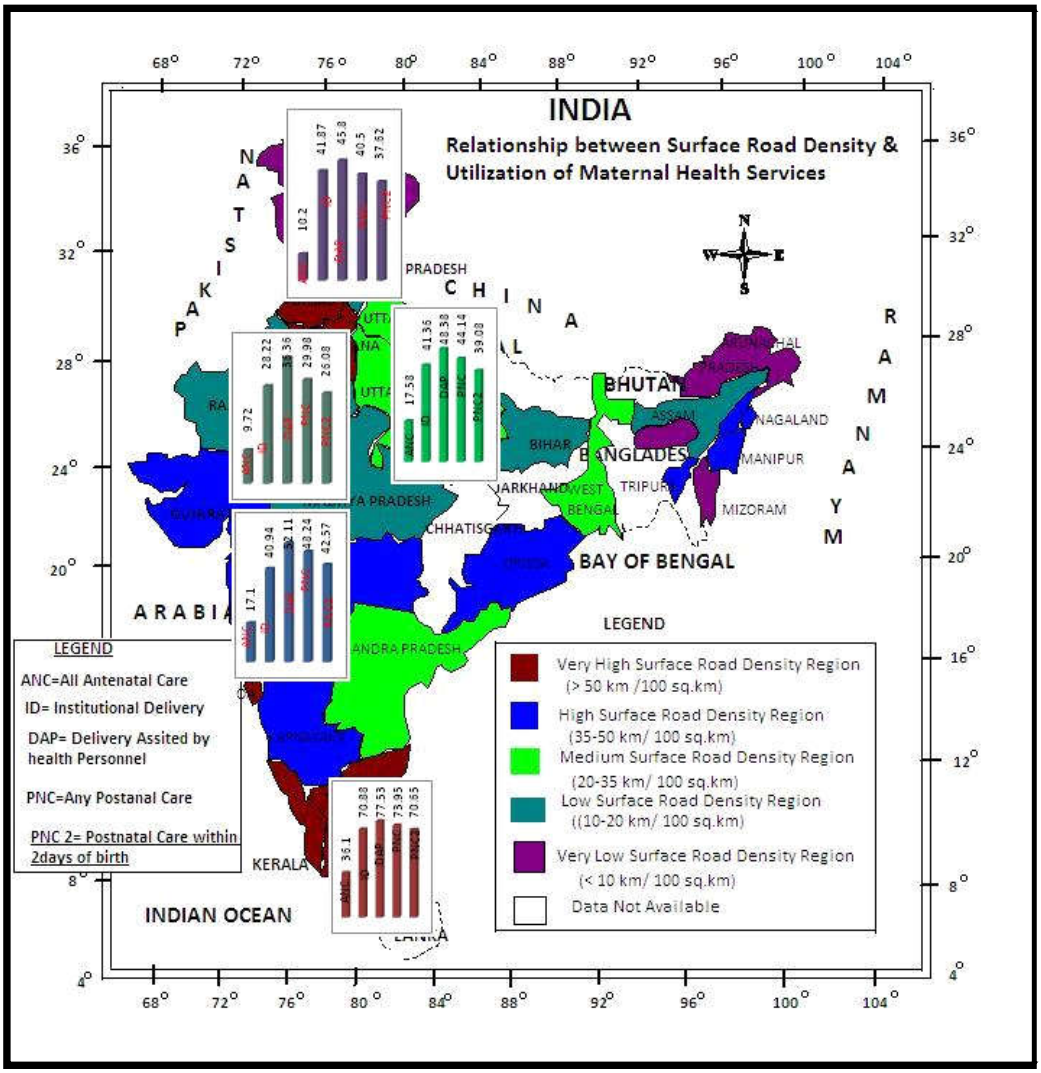


Fig 2 Accessibility and Reproductive healthcare indicators

Table-7. Correlation between Surface road density and reproductive health indicators of different regions

	Road Density #	% Received all ANC@	% Birth delivered in Health Facility	delivery assisted by health personnel	Delivery with postnatal check-up	% Delivery with postnatal check-up within 2 days of birth
Road Density	1	0.971**	0.936*	0.950*	0.939*	0.947*
% Received all ANC		1.000	0.946*	0.973**	0.972**	0.967**
% Birth delivered in Health Facility			1.000	0.986**	0.982**	0.992**
Delivery assisted by health personnel				1.000	0.999**	0.999**
Delivery with postnatal check-up					1.000	0.998**
% delivery with postnatal check-up within 2 days of birth						1

**Correlation is significant at the 0.01 level (2-tailed). *Correlation is significant at the 0.05 level (2-tailed). @For the last live birth in the five years preceding the survey, mother received three or more antenatal check-ups (with the first check-up within the first trimester of pregnancy), received two or more tetanus toxoid injections, and took iron and folic acid tablets or syrup for three or more months. #km per 100sq.km area

Another interesting observation is that full antenatal care is strongly associated with more institutional delivery (r=0.946) at 0.05 significant level as well as professional assisted delivery (r=0.972) and postnatal check- up (r=0.972) at a very high 0.01 significant level respectively. Table.7, again, portrayed that most of institutional delivery received professional help resulting more chance of postnatal check-ups. This statement clearly shows that there exist significant relations among institutional delivery, professional assistance and postnatal check-ups, in which surface road network plays important role and associated with them all.

Conclusions and policy implications

Present study shows that in spite of the Ministry of Health and Family Welfare's vigorous reproductive healthcare programme, which have been more than five decades; mother's utilization of healthcare facilities remains limited. According to NFHS-3 for only 15 percent pregnant women during the five years preceding the survey, received all types of recommended antenatal care in the country. Undoubtedly, in some areas of India the many benefits associated with full antenatal care services have not reached a considerable proportion of the population especially in regions where accessibility become a problem. The special programme for Reproductive and Child Health (RCH) has not achieved expected results. Though the country using uniform programme designed

throughout, present analysis reveals that there is considerable regional diversity in the utilization of maternity services.

Generally, higher density of surface road network associated with greater utilization of reproductive health services except in case of regions of extremely low density of surface road network. This is because accessibility alone is not the only factor responsible for mother's health seeking behaviour and each region has its own peculiar problem which is a factor that affects utilization of reproductive healthcare. Here the role of road networks becomes very important.

It is therefore concluded that there is an association between surface road density and reproductive healthcare utilization. It is observed that good road connection with higher number of antenatal care, institutional delivery and postnatal care in each region. It is also evident that mother who delivered in health facilities has more chance to received postnatal care than those who did not delivered in health facilities. It is common that assisted by health professional happened among mother who delivered in health facilities than who delivered in home.

Therefore, it is suggested that any healthcare programme should incorporated accessibility data or sufficiency of road network connection to enhance client satisfactions as well as for the success of programme implementations. This clearly indicates that understanding of spatial variations and geographical diversity is a must for the success of healthcare programme in India particularly for reproductive health.

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Urban Land use Mapping and Site Suit Ability Analysis of Lunglei Town Using Remote Sensing and GIS Techniques

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Robert Lalchhanhima Sailo

Abstract *: Urban planning is increasingly important in today's context where natural resources needs optimum utilization and conservation. Urban areas are rapidly getting densely packed with human settlements and other infrastructures that increased population brings in with it. The challenge is to map and analyse the land use pattern of the urban settlement areas and its surroundings based on reliable land resource database which can project scenarios in how the town functions in economic, social, environmental terms, and guide to formulate scientifically sound plans for future development and expansion. The present study utilizes the techniques of remote sensing and GIS to map and analyse the urban land use pattern of Lunglei town using merged data of Cartosat-I and LISS-IV. As the town adapts to profound economic, social and technological shifts, new urban and environmental problems are emerging - mostly induced by human activities. The site suitability analysis gives a practical understanding of the land resources available and scope for developing processes and mechanism for strategic and scientific town planning. The study has proven the capability of delineating different urban land use features from fused high resolution satellite imagery and also site suitability analysis for future development in a GIS environment. The data generated can further be utilized in municipal/ zonal plans and utility/ infrastructure planning.*

Key words*: GIS; merged data; remote sensing; site suitability; urban land use.*

Introduction

The unprecedented and rapid growth and development of urban town areas has been a matter of concern to town planners and policy makers as they are faced with challenges of maintaining a balance between development and sustained utilization of natural resources. As with the case in other urban towns and cities, this urbanization has brought an increase in pressure on land, water and environment to an extent where it now requires the intervention of scientific planning to reduce the negative impacts. The pre-requisites are often the inventorying of available resources to assess the carrying capacity of towns and to analyse site suitability and formulate viable plans to enable the towns to develop in a sustained manner.

Data from Indian Remote Sensing (IRS) satellites have been extensively used for mapping and monitoring urban land use, urban sprawl, urban land use zoning, urban demographic studies and change detections by various remote sensing agencies in the

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country for different users involved in urban planning. Researches on suitable data for capturing urban land use features have shown that the best bandwidths suitable for urban feature discrimination is between 0.45 and 0.55 micron (blue region), and 0.69 and 0.80 micron (near infrared region) of the spectrum, based on spectral reflectance studies using spectro-radiometer (Subudhi & Mishra, 1989). These bands co-relates with IRS bands 1 and 4. In addition, techniques of fusing or merging satellite data of high resolutions has helped in effective urban feature delineation. This has also been proven with previous IRS LISS-II data, which when merged with high resolution data of SPOT PLA, increased the interpretability of urban features upto Level II with high confidence and Level III with the help of ground data (Murthy et. al., 1991). Likewise, earlier studies have proven the usefulness of visible and near infrared multispectral bands for urban feature identification and mapping (Raghavswamy et.al., 1994). Urban sprawl mapping for Aizawl city during 1975-2003 had also been done using Landsat MSS, and also IRS 1C LISS 1II and PAN merged data which utilized both visual and digital techniques along with field checks to study the physical growth of the city and analyse site suitability (NESAC & SRSC/ MIRSAC, 2004).

Materials & Methods

Study area

The study area - Lunglei town, is located in the southern part of Mizoram. It lies between 22°57'27.00" and 22°50'00.27"N latitudes and 92°42'08.80" and 92°50'42.60"E longitudes. The study area is centrally located within Lunglei district, Mizoram (Fig.I) and is also the administrative headquarter of the district. There are a number of villages scattered on the fringes of the town, sharing most of the resources - both environmentally and administratively. The study area is one of the 23 notified towns in Mizoram (Economics Fig I. Location map of study area & Statistics, 2010) and occupies an important administrative unit next to Aizawl, the capital city. The study area covers a geographical area of 87.80 sq km.

The study area experiences a humid tropical climate owing to its geographical location. It is observed that the average mean summer temperature is (April to June) 26.9°C and average mean winter temperature (November to February) is 20.7°C The study area receives heavy rainfall starting from Mayas it is under the influence of south-west monsoon. The average annual rainfall is 2618.6 mm (MIRSAC, 2012).

According to the 2011 census,

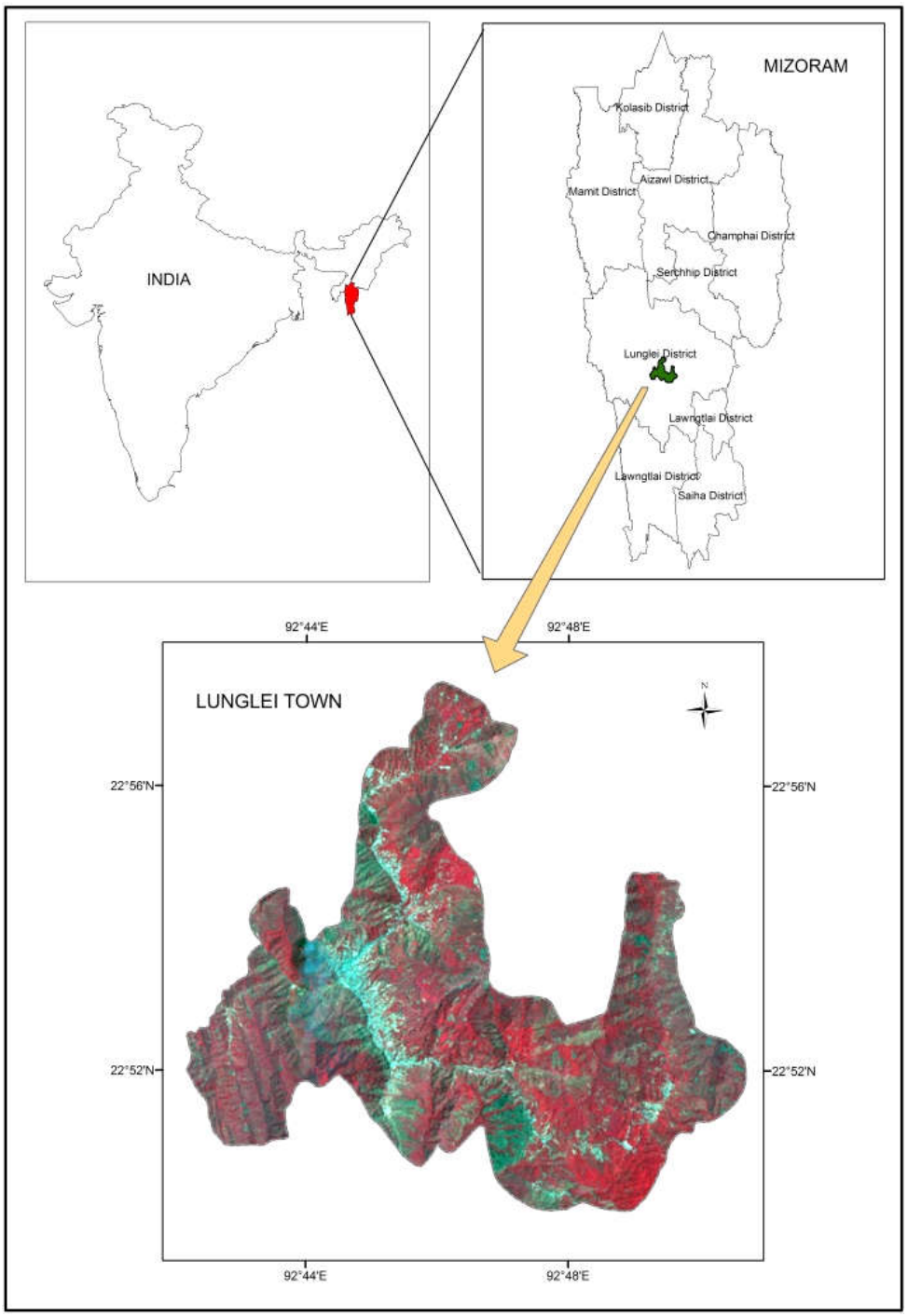

Fig. 1 Location Map of Study Area

the total population of the study area is 49871 (Census, 2011). It has a literacy percentage of 91.20 (MIRSAC, 2008). The study area is well connected by road and distance from the state capital, Aizawl via Serchhip (NH-54) is 235 km (NIC Lunglei). The forest type found in the study area is mainly tropical wet evergreen forest mixed with semi evergreen and tropical moist deciduous forests comprising mainly of bamboo (MIRSAC, 2007).

The physiography of the study area varies from small inter-montane valleys to hilly terrains without considerable plain areas. It is situated on one main ridgeline which runs approximately in north-west south-east direction and the drainage system are mostly flowing in a east-west direction. The longest river of the state - River Tlawng also has its origin within the study area. Elevation varies from 240 m MSL at the western part near Hauruang village, to 1300 m at the highest point of Theiriat tlang (MIRSAC, 2011). The eastern flanks of the study area is characterised by gently sloping topography where as the western side consist of more steep slopes as well as cliffs.. The hillside slopes are generally steep to very steep and escarpments are common. The soil is generally of lateritic type with loamy skeletal, fine loamy, and clayey textures. (MIRSAC, 2011).

Data Used

Satellite imagery (IRS-P6 LISS IV and Cartosat-I) was acquired from National Remote Sensing Centre (NRSC), Hyderabad. Other ancillary data like Survey of India Toposheets, existing land use/land cover, slope, drainage, roads, settlements, etc were also used for preparation of base layer. Administrative/town data and legacy data from Town & Country planning Department was also referred. Ground data collected for verification of doubtful areas arising during the pre-classification stage were used for correction of interpreted layers.

Method

The standard techniques of Remote sensing and Geographic Information System (GIS) was followed for mapping of the urban land use/land cover features. The spatial data consisting of satellite data, ground data, administrative/ town data and legacy thematic map data were processed for uniformity, consisteqcy and feature matching. Image fusion or merging technique was used to combine the two satellite data (USS IV and Cartosat-I) having complimentary information into one single composite image. This technique helps to enhance maximum information content or improves the interpretation in the fused or merged images, taking the advantage of complete information

in both multispectral (USS IV with 5.8m spatial resolution) and panchromatic (Cartosat-I with 2.5m spatial resolution) image. The process eventually produced a multispectral image with high spatial resolution. Further processes of image processing and enhancements was carried out using image processing system (Erdas Imagine) to increase the visual perceptibility of land use features.

The geo-referenced Cartosat-I and USS IV merged imagery were used to co-register the study area i.e, administrative (town) boundary shapefiles. The overlaid boundary on the merged satellite data conveys the spatial extent of the study area required to be mapped for thematic details. On-screen visual interpretation method was used for classifying and delineating the various urban land use/land cover classes from the satellite data at 1: 10,000 scale. The pattern of land use and extent of land cover was mapped focusing on the level at which features could be extracted at the given scale. Cartosat I having an enhanced spatial resolution with along track stereo viewing capability for large scale mapping applications was utilized to derive and generate other ancillary information (eg. roads, drainage) and also effectively used for generation of slope maps and DEM.

For analysing the site suitability in the study area, the thematic layers were integrated in a GIS environment and certain criteria were assigned for each of the layers. The site suitability, thus, derived are divided into three zones based on the systematic overlaying and giving weightage to different thematic layers.

Pre-field interpretations are then subjected to evaluation on-site. Various field information necessary for assessing and validating the accuracy of the maps prepared was collected during ground truth surveys. Data collected from these surveys were then incorporated during the final stages of map corrections and accuracy assessment at the mentioned mapping scale.

Results & Discussion

1. Land use / land cover

The major urban land use/land cover features in the study area were classified into built-up land, agricultural plantation, crop land, forests (dense, open & forest plantation), barren/rocky land, scrubland and water body. The urban land uselland cover statistics is given in Table No.1 and corresponding map is shown in Figure No.2.

Built-up land

This class of urban land use consist of human habitation developed due to high density of

population and which has a cover of buildings, connectivity by transport, communication and have utilities in association with water, vegetation and vacant lands. Within the study area, there are 22 wards having separate village council areas - namely, Pukpui, Zotlang, Serkawn, Zohnuai, Bazar veng, Venglai, Venghlun, College veng, Rahsi veng, Electric veng, Ramthar, Farm veng, Salem, Chanmari, Lunglawn, Luangmual, Sethlun, Theiriat, Hrangchalkawn, Zobawk, Lungpuizawl and Hauruang. Built-up land also includes residential areas (including villages falling within the study area), mixed built-up land, commercial areas, locations of communication facilities, recreational areas, public and semi-public areas. This class of urban land use covers 5.08 sq km, i.e, 5.79% of the study area.

Table I. Urban Land Use statistics of study area

Urban Land Use Class	Area (Sq. Km)	Percent (%)
Built-up land	5.08	5.79
Crop land	0.13	0.15
Agriculture/Horticulture plantation	0.01	0.01
Dense Forest	16.32	18.59
Open Forest	38.75	44.10
Forest Plantation	0.01	0.01
Barren/Rocky land	1.43	1.63
Scrubland	26.09	29.72
Water Body	0.01	0.01
Total	**87.80**	**100.00**

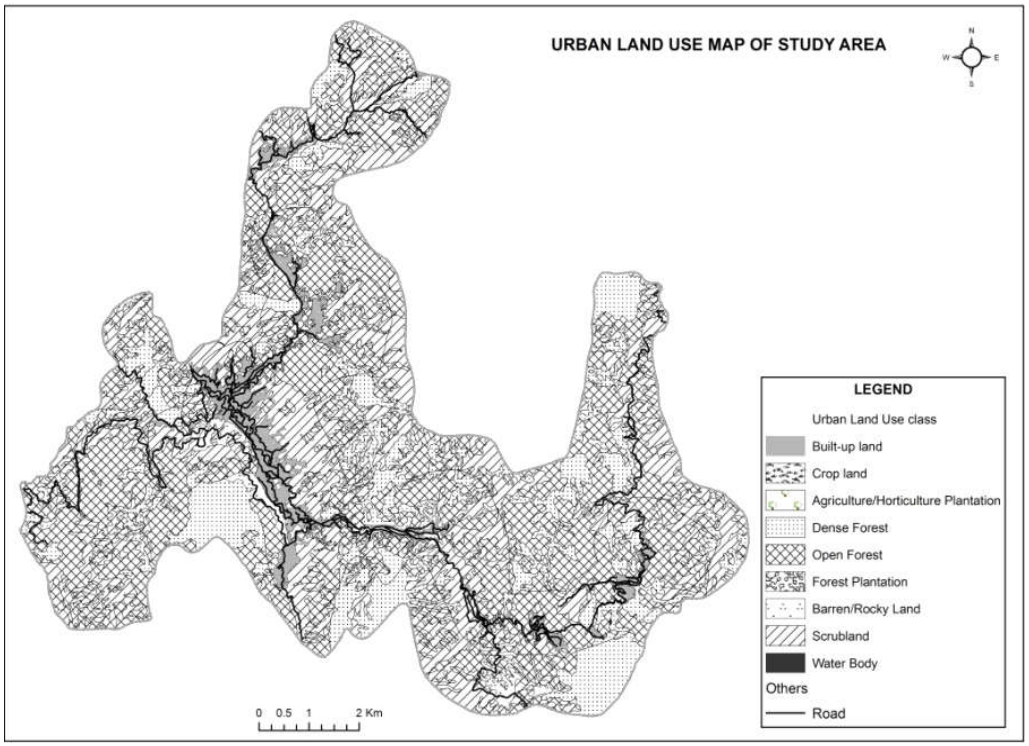

Fig.2 Urban Land Use Map of Study Area

Crop land

This class of land includes areas located in low-lying plains used for wet rice cultivation. These areas are mainly found along the valley plains of River Nghasih and covers a small area of 0.13 sq km, i.e, 0.15% of the study area.

Agriculture/Horticulture plantation

Plantation sites of agricultural and horticultural crops are the main constituents of this urban land use class. The inhabitants are engaged in cultivation of cash crops like passion fruit, orange, pineapple, banana, etc. Most of these plantations are found in small patches towards the eastern and western sides of the study area. These plantation sites occupy an area of 0.01 sq km, which is only 0.01% of the study area.

Forests (Dense, Openforest & Forest plantation)

Based on the crown density, the forests in the study area were further segregated into dense and open forests. This urban land cover category occupies a majority of the urban land use/land cover distribution. Open forest occupies a larger area with 38.75 sq km (44.1 0% of study area), while dense forest occupies 16.32 sq km (18.59% of study area). Forest plantations are also found scattered in the study area which mainly constitutes small areas of Pinus kesiya (Pine) and Tectona grandis (Teak) plantations. Other roadside plantations of Grevelia robusta, Eucalyptus globulus, Thuja oreintalis, Delonix regia, Caesalpinia pulcherrima, etc are also found. These forest plantations constitutes only a small fraction of the study area i.e, 0.1 sq km.

Barren/rocky land

Barren/rocky lands are mainly dominated by rock outcrops/ exposures, often barren and devoid of soil and vegetation. These exposed lands are usually located on steep hill slopes where soil erosion is maximum. They are distinctively recognizable from their rugged exposed textures. This class ofland cover constitutes 1.43 sq km, which is 1.63% of the study area.

Scrubland

Land cover with sparse vegetation/scrub with thin soil cover constitutes scrublands in the study area. They are generally exposed to erosion and found on moderate slopes and foot hills. These lands are found scattered in the study area and constitutes a large fraction of the urban land cover, i.e, 26.09 sq km (29.72% of study area).

Water body

This class comprises surface water in the form of rivers, lakes/

ponds, etc. River Nghasih is a prominent water body found within the study area. Although not prominent, there are a few ponds located in isolated patches. A network of other small streams and non-perennial rivers are also found spread throughout the study area. This class covers an area of 0.01 sq km which is only 0.01 % of the study area.

2. Other thematic layers

Slope

The study area comprise of very steep slopes to the western aspect extending from Luangmual to Rahsiveng via Chanmari and Lunglawn localities, and also to the western side of Serkawn and Zotlang localities with the southern aspect of Zohnuai locality. The eastern parts around Farm veng, Ramthar and their surroundings, on the other hand, are characterized by low and gentle slopes. A few plain areas of small coverage are found in the valley fills between hills and along Nghasih river, which is a prominent flatland in the study area. The slope has been divided into three broad facets as given in Table No.2 and corresponding map shown in Figure No.3.

Road network

The study area being one of the important towns in the state, is well connected by a network of roads along the main ridge line (Fig. 2). These road network consists of metalled and unmetalled roads spanning across the town and connecting the study area with neighboring villages. The total length of roads within the study area is 115.21 Km.

Table 2. Slope statistics of Study area

S.No.	Slope class	Area (Sqkm)
1	< 20°	6.48
2	20 - 40°	44.20
3	> 40°	37.12
	Total	**87.80**

3. Site suitability analysis

Site suitability analysis is the process of understanding existing site qualities and factors, which will determine the location of a particular activity (Kamal & Subbaiah, 2007). The study area shows a long stretch of habitation areas along a rugged topography which is characterised by steep slopes, elongated folding hills, deep valleys and gorges. The urban land use / land cover pattern also depicts that there are very limited plain areas and a majority of the land cover is occupied by wastelands and open forests. The present scenario shows that if planning for future urban development is not done based on scientific terms, the town area might suffer from various urban problems. A site suitability analysis for future growth of the study area is done with an objective to aid in planning and expansion of the

urban town.

The site suitability zones are achieved by overlaying the parameters and giving weightage according to their criteria (Table No.4).

Based on the criteria used and layers integrated for analysis, three suitability zones have been identified. The result of this analysis is presented in map form as shown in Figure No.4. The following are the description of each suitability zone -

Zone I (Highly suitable)

This zone is characterised by areas where slope percent is less than 20° and roads are within a buffered distance of less than 300 m. The prevailing land use / land

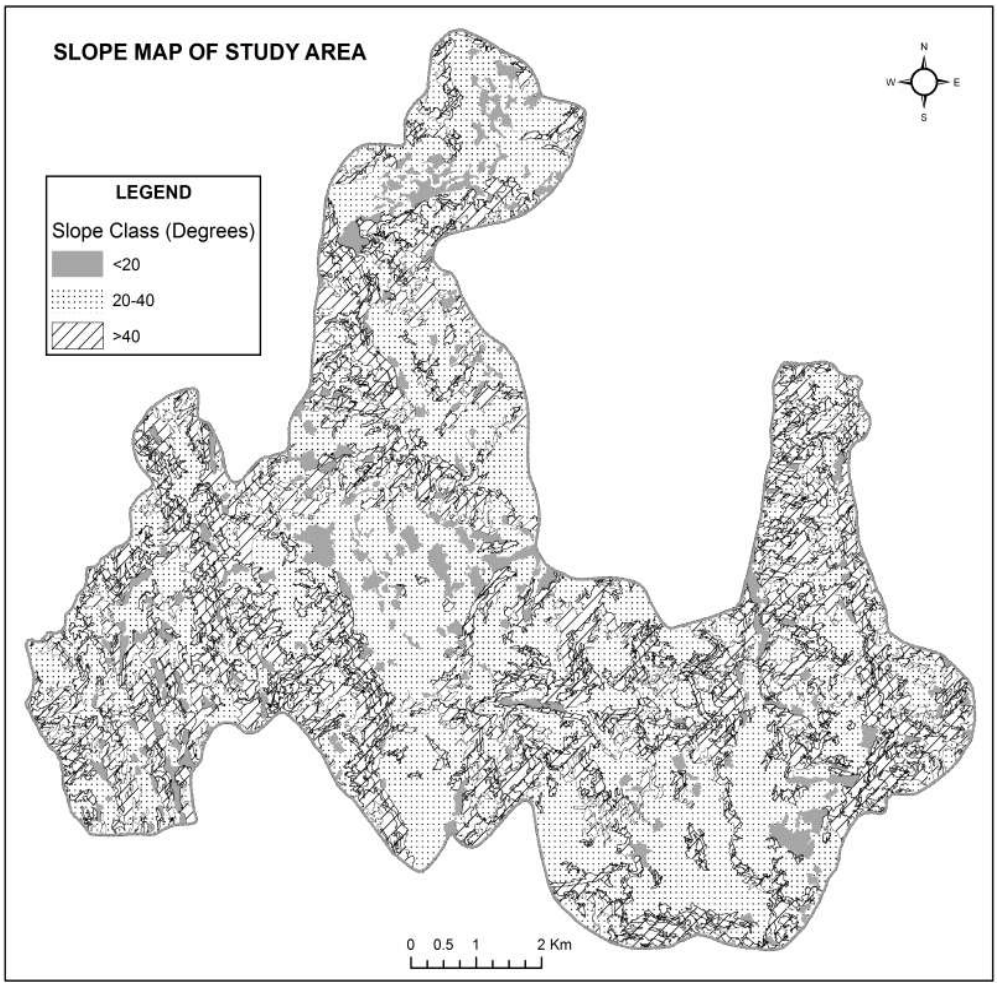

Fig. 3 Slope Map of Study Area

cover mainly consist of wastelands i.e, barren/rocky lands and scrublands. An area of 0.75 sq km falls under this zone.

Zone II (Moderately suitable)

This zone comprises of areas having slope percent between 20° to 40°. The accessibility to adjoining roads is between 300 to 600 m and the prominent land cover class is scrubland. This zone has an area of 3.73 sq km.

Zone III (Less suitable)

The areas falling within this zone are those where slope percent is more than 40°. This zone has no major roads beyond a distance of 600 m and the prevailing land cover is mainly open forests. Less suitable zone covers 7.45 sq.km of the study area.

As a whole, 11.93 sq.km ofland has been identified under the suitable zones for urban expansion and development. Further, the analysis has also found that, along with the existing built-up lands, the total area that can come under urban development is 17.01 sq.km which is 19.37% of the total study area.

Conclusion

The present study has highlighted the capability of using merged satellite data for mapping of urban land use features. As mapping is the pre-requisite of any further planning process, data created from reliable sources are often sought after. Space technology has brought in such base information from where accurate data can be extracted and put to further use like urban land use mapping. Compared to conventional mapping practices, the data acquisition of satellite borne sensors on a periodic routine over the same area is one of the strength in its effective use for mapping of urban land use or any other mapping exercise. Further, its digital form makes it possible for more objective analysis for mapping and detecting changes. The platform offered by GIS softwares have also enhanced the scope of mapping an urban landscape which can be put to a higher level of operation with value addition during the mapping process.

Table 4. Site Suitability criteria

Range of weightage	Parameters	Zone I	Zone II	Zone III
Rank 1	Slope	< 20°	20°-40°	>40°
Rank 2	Road Distance	<200m	200-500m	>500m
Rank 3	Land use	barren/rocky land & scrubland	scrubland	Open forest

In the present study, satellite data of IRS P-6 LISS IV and Cartosat-I were utilized for mapping the urban land use patterns of Lunglei town. The level of mapping has focused on capturing a broad spectrum of urban land use and land cover at 1: 10,000 scale which proves to be effective in further use for town planning. The multispectral characteristics of LISS-IV and high spatial resolution characteristics of Cartosat-1 that was merged during this study has enhanced the delineating capability of urban land features like adjoining vegetations, residential areas, roads and drainage. Further segregation of vegetation components (forests, barren, scrub lands, etc) were also possible using this merged imagery as both spectral and textural features were enhanced in the image. This capability combined with ground surveys has further been useful in creating a database that can assist in preparing town levelland use maps. This systematic mapping of urban land uses can also serve as important data for proper planning,

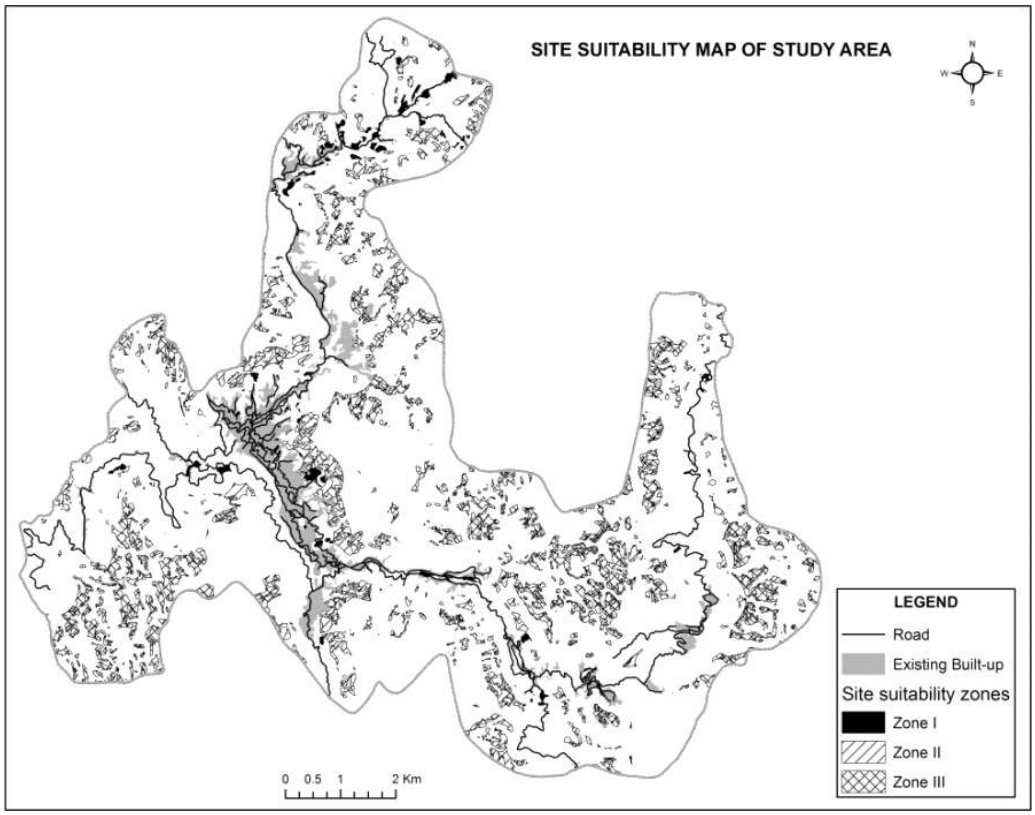

Fig. 4 Site Suitable Map of Study Area

management and policy making at operational levels.

The land use data along with other thematic data are pre-requisites for formulating and identifying sites that are suitable for further urban development taken up in the area. The study has also projected the capability of a GIS system in analysing suitable sites for urban development. The inherent flexibility of this system can also facilitate its use in further planning of other resources based on different criteria and inputs.

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An Overview on Jhum Cultivation in Wokha District, Nagaland

Wangshimenla
Renthungo Jungio

Abstract : *Jhum or shifting cultivation also known as slash and burn cultivation is an age old agricultural method practiced in the Tropics. Wokha district of Nagaland is inhabited by the Lotha Naga tribe who has been practicing Jhum cultivation since time immemorial which has been the basis of subsistence for many and it still continues to do so. Jhum cultivation plays a very important role in meeting the needs of the common men such as firewood, vegetables, food grains, etc. Inspite of its importance and dependency of the common men on jhum cultivation for subsistence, in the recent times it has been observed that the frequency and of jhum cultivation and land use has increased to a great extend due to various factors. This research paper presents an overview on jhum cultivation in Wokha district and its future prospect taking into consideration the various factors prevailing in the present time leading to changing trends in jhum cultivation in the region.*

Keywords : *Jhum/ shifting cultivation, Wokha, Fallow, Land-degradation, Logging*

Introduction

Shifting cultivation is a form of agriculture adapted to the uplands where slopes are steep and soils are poor, whereby the forest is cut and burned to release nutrients from the forest biomass to the soil. Shifting cultivation is a common agricultural practice that is the basis of subsistence for many rural populations throughout the tropics (Paul Grogan et al.2012). Estimates suggest that it is the basis of subsistence for at least half a billion people (Carswell et al.1997). Each year, village communities slash the vegetation on selected sites during winter, wait for it to dry and then burn it in situ before planting a variety of annual crops to coincide with the return of the rains (Toky & Ramakrishnan 1981).

Shifting cultivation was an economically and ecologically efficient agriculture practice in the former times when village population densities were low, and the fallow abandonment period matched or exceeded the time necessary for full recovery of the sides (Bruun et al.2009; Ramakrishnan 1992; Tanaka et al 2001 in Paul Grogan et al 2012). In many regions across the Globe, shifting cultivation systems are undergoing important changes, one of the most pervasive being the shortening of fallow cycle (Sarah Paule Dalle & Sylvie de Blois).When the population density is low and the area of forest relatively large shifting cultivation may be environmentally benign. But as population expands and the available forest area shrinks, this

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process can lead to a high level of habitat fragmentation and an insufficient time for cleared fields to recover before being cut again. The consequences of shorter fallow periods are deterioration of faunal and microbial organisms, lowered soil fertility, increased soil erosional loses during periods of heavy rainfall and reduced annual crop yield (Paul Grogan et al 2012). Shifting or Jhum cultivation has been the major life sustaining activity for majority of the hill people in the North-East India (P. Toiho Sema et al. 2010) and it also has high cultural importance among the people of North East India (R.S Tripathi & S.K Barik 2003).Numerous festivals are centered around agriculture and have their roots in cultivation practices. It was the main stay of the people of Nagaland during 1950s, when almost 96.5 percent of the population was dependent on agriculture. Though the dependency for employment on agriculture has declined to 70 percent in the 1970s and further to 65 percent by 2000, it continues to be the main source of livelihood (Nagaland State Human Development Report 2004 pp-73).

Methodology

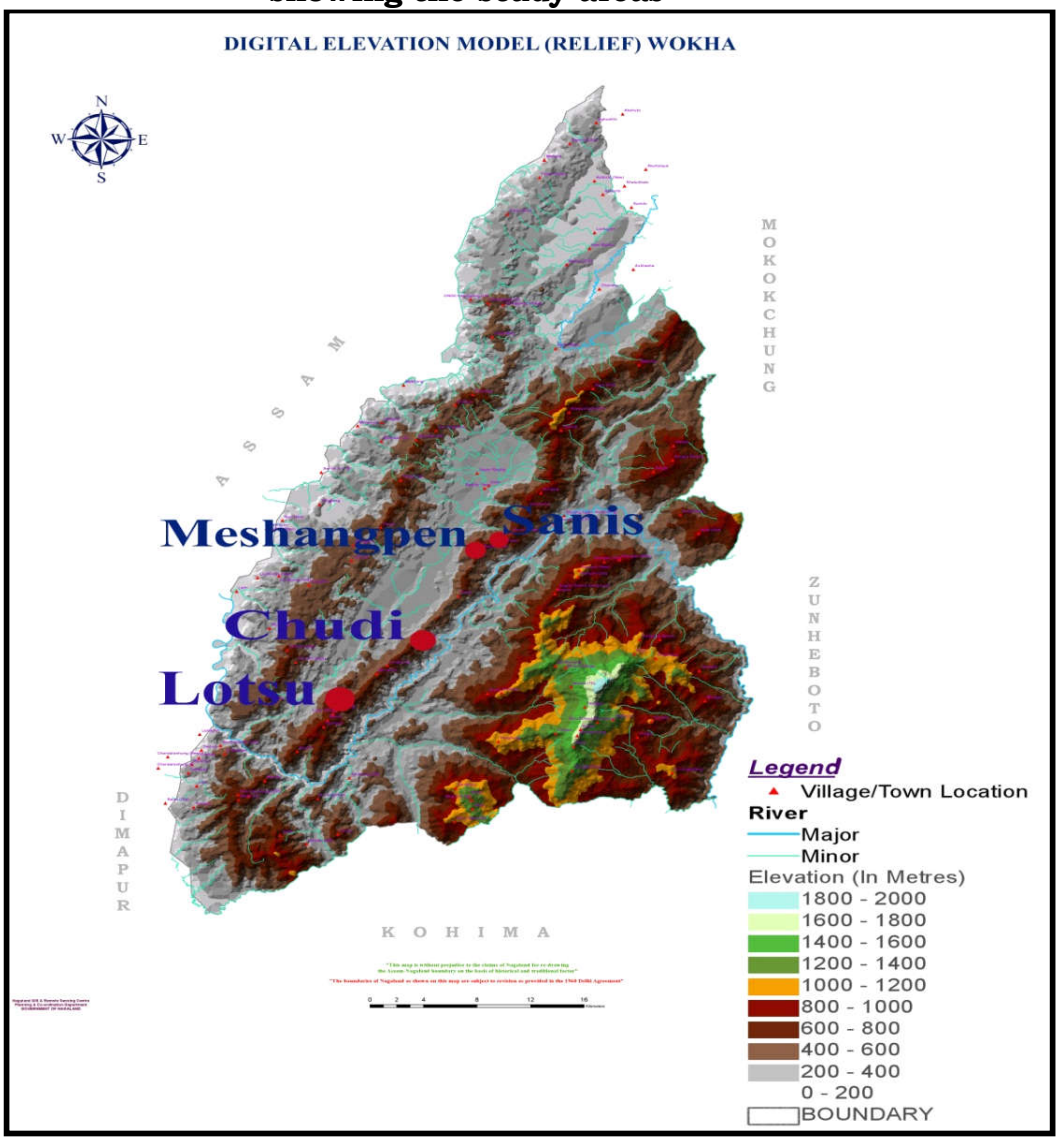
The study has been carried out basing on secondary datas and field trips. For acquiring the primary datas Field trips to the study area were undertaken from April to June 2012. Purposive sampling was adapted for selection of four villages within the study area basing on the fact that the villages in the range are separated from each other at an average of 3 to 4 KMS. Structured questionnaire was prepared and on the basis of which focused group interview was conducted with additional insight from the participants which included the village head man or Gaon Buras, the village council members and the other members of the village who represented 20 to 30 households in average in one sample village. During the study period in the field, observations were also done which complemented the information obtained during interviews. The secondary datas have been acquired from various sources such as the State Government Departments, libraries of Government and educational institutions, Government officials, local News papers etc.

Study area

Wokha district of Nagaland lies between 26°8' North Latitude and 94°18' East Longitude covering a geographical area of 1628 Sq.Km. It is the homeland of the Lotha Naga tribe and like the other districts of Nagaland the topography is hilly with ridges and ranges dissected by seasonal streams and rivers. As per the ground water resources estimation

of the state, out of a total area of 1,62,800 hectare, about 8,710 hectare is considered hilly area and about 1,500 hectare is earmarked as valley area like Baghty. The district can be divided into three ranges based on the topography, namely the Wokha or

Fig.1. Digital elevation model (relief) of Wokha District showing the study areas



Source : Nagaland GIS & Remote sensing centre, Planning & Co-Ordination Department, Govt. of Nagaland.

upper range, the Sanis or middle range and the Bhandari or lower range (District census handbook, Wokha 2001) Fig-I shows the Digital elevation model (relief) of Wokha District and the sample villages.

The study has been conducted in the Sanis or middle range which is distinctly bounded by the Doyang River in the east and a fertile stretch of land called the Baghty valley in the west. Four villages namely Sanis, Meshangpen, Chudi and Lotsu were selected based on purposive sampling basing on the fact that the villages in the range are located not very far from each other and also they possess similar physiographic, socio-cultural and economic features. The physiography of the region is mostly hilly terrain with some belt of gentle slopes where the elevation ranges from 200 to 850 meters above mean sea level. The climate in the region varies from sub-tropical type in Sanis village to sub-temperate in the other three sample villages with annual range of rainfall between 200 to 250 Cms and annual temperature range between 10°C to 30°C.The soil type prominently found in the study area are of red-loamy and brown forest soil or sub-montane soil with high organic matter content where the PH of the soil vary from 4 to 6.5 (Detail project report IWMP Wokha II 2009-2014 Department of Land Resources, Govt. of Nagaland). Some important information of the sample villages are given in Table I.

Though the hilly terrain dominates the topography of the study area yet because of the favorable climatic conditions varieties of indigenous plants grow here, which in turn forms the basis of sustenance for many species of wild animals and birds. The people residing within that region have also been benefited by the favorable climatic conditions as they are able to cultivate varieties of agricultural products such as paddy, maize, millets, beans, tomato, ginger, cucumber, black sesame.etc whose productivity mostly depends on the climate.

Table: I- Important information of the sample villages

Sl No	Village	Elevation in meters	Distance from district Hqrs	Climate	Rainfall in Cms	Temperature in ° Celsius
1	Sanis	330-820	45 KM	Sub-tropical	200-250	10°C-27°C
2	Meshangpen	210-830	46 KM	Sub-temperate	200-250	10°C-27°C
3	Chudi	240-750	55 KM	Sub-temperate	200-250	10°C-30°C
4	Lotsu	230-840	65 KM	Sub-temperate	200-250	10°C-30°C

Source: Detail project report IWMP Wokha II 2009-2014 Published by Department of Land Resources, Govt. of Nagaland. (http://www.lrdgon.com/index.php/iwmp-dpr)

Shifting cultivation in the study area

Agriculture is the main source of livelihood for the people of this region. Jhum or shifting cultivation which is an age old agriculture method has evolved over the years and it still forms the basis of economy and livelihood of the people. Due to many reasons such as the hilly terrain which dominates the landscape, unavailability of proper water source for practicing terrace cultivation, less investment of money, lack of scientific knowledge and modern farming equipments, etc. the inhabitants of this region has to resort to jhum or shifting cultivation for survival. Shifting cultivation is not just another method of agricultural practice but it is deeply rooted in the customs, beliefs and folklore of the people. It influences the cultural ethos and social fabrics of this agrarian society. In fact, 'Tokhu Emong' the most important festival of the Lotha Naga tribe is also centered around agriculture and is celebrated after the harvest.

As per the data published in the Wasteland Atlas of India 2011 by National Remote Sensing Centre, Hyderabad, out of the total geographical area of 1628 sq.km in Wokha district the jhum cultivated area in 2008-2009 was 75.42 sq. km. A similar survey of jhum cultivated area was also conducted by the Department of Soil and Water Conservation, Government of Nagaland in 2005-2006, according to which the jhum area of the sample villages are given in hectares and sq.km in table II.

Table II- Area under jhum cultivation in the sample villages

Sl No.	Village	Area in Hectare	Area in sq.km
1	Sanis	143	1.43
2	Meshangpen	77	0.77
3	Chudi	117	1.77
4	Lotsu	98	0.98

Source: State jhum land survey report 2005-06, Department of soil & water conservation, Govt. of Nagaland.

During the forefathers' time most of the land was property of the village and shifting cultivation begun with the selection of site called 'Liphi' in local dialect by the village elders and the cultivable size of the land or 'Liphi' depended on the number of households or families involved but in the recent times it has been observed through the interviews conducted during the field work that the land ownership in the study area is mostly owned by families and individuals hence it is the elders of the family or the individuals who select the land for the purpose of cultivation. After the site is selected clearing of the jungle locally known as 'Ntssoli ejon' is done mostly towards the end of December and continues till January. The cleared jungle is left in situ to dry which is then burned

during the month of March. The sowing of seeds is carried out in the month of April and finally the harvesting is done in the month of August and September depending on the varieties of rice sown. Two local varieties of rice are mostly used in the study area which are locally called mesa moro which gets harvested in August and motso harvested in September.

Table: III-Different stages involved in jhum cultivation are as follows:

Month	Activity(local name)	Activity(English)
December to January	Ntssoli ejon	Clearing of the jungle is done during these months
March	Oli rüchü yüta	Burning of the cut and dried vegetation
April	Oli echen yuta	Sowing of seed is done during this month
August to september	Lirü yuta	Harvesting of the paddy is done during these months

Source: Field work

Apart from the cultivation of rice/paddy, other agricultural products are also grown which includes maize, millets, soyabeans, beans, yam, tobioca, ginger, pumkin, gourd, brinjal, chilly, peas, cucumber, tomato, etc.

Shifting cultivation and environment

Majority of the people in the study area depend on shifting cultivation for their livelihood, as per the response obtained from the interviews more than 90% of the total population in all the four sample villages practice shifting cultivation. Since time immemorial shifting cultivation has been the main agricultural practice and has played an important role in the socio-economic life of the people and it still continues to do so. With the passage of time there has been an increase in population which has triggered the need for more land for cultivation and infrastructural development purposes leading to various environmental problems such as land-degradation, climate change, soil erosion, loss of biodiversity, etc.

In the recent years the increase in population and implementation of infrastructural development projects coupled with various problems such as man-elephant conflict and the hilly and rugged terrain, etc. the availability of cultivable land has reduced drastically and as a result the fallow period has also reduced to a great extend which has led to land-degradation. The recent strong trend towards shorter fallow periods has led to widespread concerns about decline in soil fertility, crop yields, and food security. For instance the respondents in Chudi village stated that the traditional jhum cultivation practice integrates a relatively short cropping phase and relatively long fallowing period of about 9-10 years but in the recent time it has come down to 4-5 years. Likewise, the fallow period has shortened in all the sample villages

Fig. 2 - A couple engaged in jhum cultivation in Meshangpen village

Fig. 3- Jhum cultivation on a steep slope

resulting in the loss of top soil and low yield of paddy and other agricultural products by about 50% since the past 10 to 15 years.

Shifting cultivation is considered as a major driver of deforestation globally, until the year 1991, shifting cultivation had accounted for 61% of overall tropical forest destruction (Telgalapalli Karthik et al., 2009). There have also been reports from the respondents about change in the climate which they have started experiencing since some 15-20 years back. The respondents have stated that the heat produced by the sun has become unbearable and the rainfall and other climatic conditions have become erratic and unpredictable. For instance, the respondents from Lotsu village stated that the area where the Government high school is located, it used to be a cold place surrounded by trees and many varieties of birds used to flock and cross that place, ice and mists were a regular sight in that area but in the recent years these are no longer visible. The most important factor resulting in climate change is the clearing of forest for the purpose of shifting cultivation, implementation of developmental projects, logging and in the recent years increase in practice of plantation. The respondents stated that the forest is mostly cleared for jhum cultivation and plantation apart from logging which some years back was practiced at a large scale but in the recent years logging has reduced due to the ban imposed by the Government. The random practice of logging prior to implementation of the ban has led to cutting down of large number of trees, in some cases these trees were as old as 60 to 70 years and more. The cutting down of trees have resulted in vast clearing of forest cover and due to the extensive practice of shifting cultivation and the introduction of plantation of tree species such as rubber, teak, kamari, etc. in the recent years, the secondary forest do not get adequate time to regenerate leading to less natural or primary forest cover.

Indigenous biodiversity has also been affected to a large extend due to shifting cultivation, logging, random destruction of forest and its resources by fire, etc. as the natural forest gets destroyed leading to disappearance of local species of flora and fauna. One good example worth mentioning is the disappearance of the hornbill apart from other species of plants and animals from the area which all the respondents confirmed during the interviews.

Changing trend of shifting cultivation

Shifting cultivation, no doubt has played an important role in

Fig. 4 - -Fallow land on the way to chudi village

Fig.5-Portion of Baghty valley as seen from Meshangpen vilage

meeting the needs of the people of the study area for many centuries. Though, in the recent years developments have been taking place in all fields around the world due to the advancement in science and technology, yet coming to the context of the study area the practice of shifting cultivation continues to remain primitive and crude. The various methods applied in shifting cultivation such as burning of the cut vegetation for derivation of nutrients, use of crude implements, post harvest management,etc. which were practiced by the forefathers and passed on through generations are still practiced by the people.

The study area is a rugged and hilly terrain bounded by the Doyang River in the East and the Baghty valley in the West. Many years back the Baghty valley used to be the centre of agricultural practices, this valley also has the potential for wet rice cultivation with proper water source for irrigation from the Baghty River and other small tributaries but after the occupation of the wild elephants in the Baghty valley the people in the region were unable to cultivate in the valley due to men - elephant conflict. The respondents from the study area stated that whenever cultivations are carried out in the valley most of the crops are destroyed by the wild elephants and as a result the villagers suffer from shortage of food grains and other agricultural products on which they depend for survival. It is because of these reasons that the villagers have stopped cultivating in the valley area since some 20 to 30 years back.

The introduction of labour intensive rubber plantation through individuals and Government organizations such as the Department of Land Resources, rubber plantation has become very popular in the study area apart from the plantation of other tree species. Since the past three to four years most of the families have started practicing the plantation of rubber which according to the respondents is the second most important occupation after jhum cultivation. Almost all the families have taken up plantation of rubber because of the potential it has to benefit and improve the economic conditions of the rural population and more over according to the survey conducted by the department of Land Resources, Government of Nagaland out of the total geographical area of 1,62,800 Hectares rubber can be successively cultivated in 1,16,546 Hectares i.e 71.54% of the total area along the foothills and valley lands of Wokha District (Morung Express 29th may 2012). The rush for plantation of rubber in the recent years has led to the fragmentation of land for

agricultural practice as well as plantation and division of labour as both the practices are labour intensive. Since most of the cultivable land located in the Baghty valley are inaccessible due to the occupation of the wild elephants, the little land available are confined towards the Doyang river and this land which was used only for cultivation purpose are in the recent years utilized for both jhum cultivation and rubber plantation. The respondents stated that the introduction of rubber has reduced the availability of land for jhum cultivation and increased the frequency and intensity of land-use.

Till the early 1970s there was maximum involvement of persons in jhum cultivation but with the passage of time increasing number of rural population started migrating to the urban areas for higher and better education, employment opportunities and better standard of living. During the field work it was observed that migration of the rural population to the urban has resulted in fewer hands for the hard work on jhum fields, rendering it less attractive and lucrative. Since most of the families in the study area are engaged in more than one occupation such as jhum cultivation and rubber plantation which has become very popular in the recent years, both are labour intensive and with the limited availability of accessible land coupled with limited man power and time and the requirement to give equal importance to both the occupations, the jhum cultivated area has shrunk. For instance in Chudi village most of the households are involved in jhum cultivation as well as rubber plantation which are both labour intensive. As a result the cultivable land capable of accommodating 4 to 5 tins (rice grain seeds are measured in tin or tina, a container made of tin) of rice seeds was cultivated by one family in the past but in the recent years due to shortage of man power, land and time that particular land is distributed among 3 to 4 families for cultivation.

Taking into consideration the various factors such as man-elephant conflict, decrease in availability of accessible and cultivable land, decrease in involvement of persons in labour intensive jhum cultivation and growing interest and popular practice of plantation of rubber in particular and other tree species in general, it has been observed that the practice of jhum cultivation is slowly declining and if this trend continues there is high chance that other occupational practice will one day suppress or overtake the practice of jhum cultivation. The frequency and intensity of land use has also increased greatly due to the factors mentioned above and if no

preventive methods are adapted than the pressure exerted on the land will reach its limit and will ultimately become degraded waste lands which will have adverse effect on the human population in future.

Conclusion

The survival and livelihood of the rural populations are dependent on the utilization of land mainly for agricultural purpose but with the changing scenario of economic growth affecting all the sections of the society, the people have become aware of the fact that they cannot depend on jhum cultivation alone for sustenance, hence they have started adapting and practicing other occupations through individual initiatives and assistances from the Government along with jhum cultivation. Though jhum cultivation is the primary occupation which accounts for about 90% of total involvement of people yet because of the introduction of other labour intensive allied agriculture practices, lack of availability of accessible and cultivable land, decrease in involvement of persons, etc. the dependency on jhum cultivation is seen to be gradually declining and if this trend continues there is high chance that the jhum cultivation may no longer be practiced by the people and their dependency for survival may shift to some other occupation in the near future. Nevertheless, practice of jhum cultivation still persists as it provides subsistence livelihood and it is intricately linked to cultural, ecological and economic aspects of the people (Telgalapalli Karthik et al., 2009).

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Levels of Natural Resource Development

Lalrinmawia

Abstract : *Studies of natural resources have been made largely by the economist and geographers as it deals with man, searching for means to attain given ends (such as the satisfaction of individual wants and the attainment of group or social activities) and nature. Mizoram located in the corner of North Eastern part of the state has also been endowed by certain natural resources. However, within this tiny state also there are wide regional disparities in the level of natural resources endowment. The accessible areas that lie close to the national highways are better off - those away in the interiors are cut-off most of the year and lack even the basic amenities of life. The main purpose of this study is to identify the level of natural resource development and to seek out the problem that may help in formulating effective public policies in the state. The first section deals with the introduction and theoretical framework. The second section deals with the quantitative analysis for the resource association regions and the levels of natural resource development in Mizoram. The third section is the conclusion.*

Introduction

Natural resources like land, water, and forests, mineral etc. provide a comparative advantage to a region in what people can do- an advantage over other regions in terms of abundance of factors inputs in the process of creating wealth. If a region has abundance of certain natural resources, then their supply make them cheaper as factors inputs and close availability makes the transport cost cheaper vis-à-vis another region that has to import them over long distances (Lalrinmawia, 1999). Natural resources is anything needed by an organism or group of organism (Trivedi, 2004).It includes all materials that are obtained by human beings from the physical and environment of this planet for fulfilling its needs (Khoshoo and Manju Sharma, 1992). In this light, natural resources may be defined as those aspects of man's physical world, which have been influencing the days of his evolution and on what man depended to draw support and maintenance of his life. Zimmermann also observes almost the same thing when he says "those aspect of nature which man can utilize in the satisfaction of his creature wants (without contribution made by man) may be called natural resources" (Zimmermann, 1946). Broek though gives little wider meaning to natural resources also defined it as "an element or property of the earth that is useful to man" (Broek, 1973: 33). His definitions which point out the 'Property of the earth' clearly suggest that there is a complex interaction between human need and level of his technology. Thus he does not assign any individuality of natural resources.

All the natural resources in their totality similarly are difficult to be evaluated on a regional level,

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as most often information are not available for smaller units. Therefore, some critical and representative components of natural resources should be selected for appraisal and evaluation. Thus, for the purpose of the present study slopes of the land, hydrography, forest, livestock and agriculture in that order, have been taken as critical parameters for evaluating the natural resources of the state of Mizoram.

The elements of natural resources may, however, be classified in three categories : (a). Physical resources including slopes of the land and hydrology; (b). biotic resources consisting of forest and livestock; and (c). agricultural resources representing cultivated land, intensity of productivity, cropping intensity and irrigation intensity.

In Mizoram topography definitely plays a dominant role in all facets of life. Therefore a study of topography, especially with regard to the slope, is of utmost significance. "Slope represents one of the most important elements of land surface. Analysis of slope is a prerequisite for land classification on the basis of land use capability. Any good use of land needs the knowledge of slope characteristics of the terrain. Slope plays an important role in the evolution of a particular land use pattern thereby representing the direct relationship between slope characteristics and land use components" (Sarmah and A.K. Bora, 1995:13). Out of the total geographical area of 2108.700 thousand hectares. The slope category of 0- 3 per cent account for 0.08 per cent from the total land area of Mizoram. The slope category of 3- 10 per cent slope cover 0.46 percent and 10- 15 per cent cover 1.80 per cent from the total land area of the state. Rainfall of the state is a direct reflection of climatic conditions and is not equally distributed which may be attributed to physiography as well as its location. The average annual rainfall in the state is 354 cm.

The state of Mizoram despite indiscriminate felling of trees is still richly endowed with forest cover. Out of the total geographical area of 21,087 Sq.km forest and tree cover 17456.63 Sq.km which account for 82.39 per cent (Environment and Forest Department, 2006). On a broad scale, the forest of Mizoram can simply be described as wooded forests in the higher altitudes and bamboo forests in the lower ridges (Rintluanga, 2009: 49) Animal husbandry which has been found to be closely interwoven with agriculture played a very important role in the rural economy. It is an integral part of crop farming and contributes substantially to household nutritional security and poverty alleviation through

increased household income (Kumar and T.Sudarkar, 2004). According to Livestock Census of 2003, the total livestock population in Mizoram was 3.17 lakhs. It was 2.57 lakhs in the earlier Livestock Census of 1997. Thus within a period of five years, livestock population has registered a phenomenal growth of 23.3 per cent.

The economy of the state essentially remains agriculture despite implementation of different developmental scheme. About 66 percent of the total working population is still engage in agriculture and allied activities. The share of cultivated land to total land area is only 3.97 per cent which is very low. The intensity of cropping in the state is 26.76 percent whereas the intensity of cropping is only 130.92 per cent which is low as compared to the highest state Punjab (160%) but higher than the dry region of Rajasthan (116%). The intensity of irrigation for the whole state is only 0.12 which is very low comparing to other state.

Aims and Objectives

In the context of development, the concept of backward region, its identification and measure of the extent of backwardness needs to be understood carefully. Any strategy for the development of a backward region has to begin with the identification of regional units, mapping it in all possible details like its resource base, prevalent culture and value systems etc. Therefore, in order to achieve the objectives of promoting growth and to reduce regional disparities it is essential to identify regions according to their level of development.

The main objectives of the study are as follows:

1. To identify the level of natural resource development.
2. To explain the causes of regional disparities.
3. To characterize the nature of regional disparities.

Methodology

In order to arrive at a composite natural resource development index, Z-Score method has been adopted.

Z-Score is defined as the deviation of observation from its mean divided by the corresponding standard deviation. Symbolically, it represent:

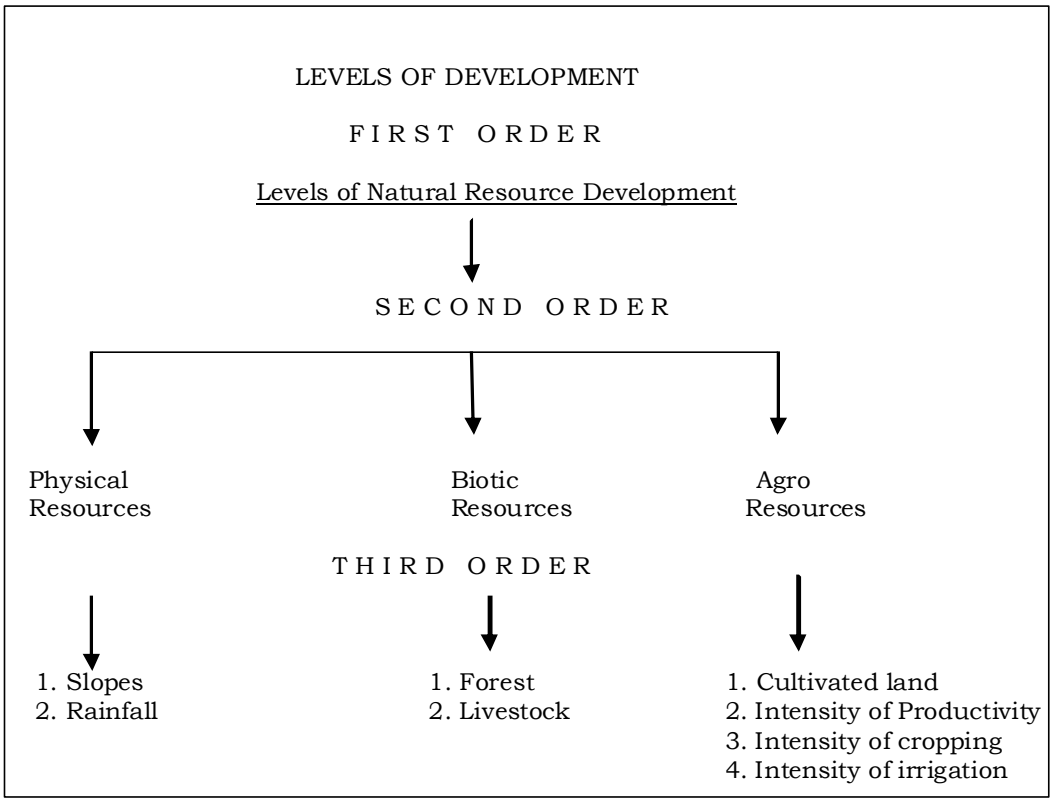
$$Z = \frac{X - \mu}{\sigma} \qquad (1)$$

Where μ is the mean and σ is the standard deviation. Z-score, by definition, is a pure number, which can be used for the comparison of different variables with different measurement units. After calculating Z-score for two or more variables, one, further, needs composite score to evaluate the overall performance.

In this case, it is suggested to add scores on different variables to obtain composite score (Jeromy Anglim's Blog. 2009). In this study, thus the sum of z-score from different variables represent the overall performance of different RD blocks in Mizoram.

The steps under the study (following Kumar, 1981) may, thus, be charted as below.

After computation of Z- score, blocks have been ranked on each parameter. Thereafter, percentage of each category in relation to total of that resource has been calculated. For example, if the average rankings for physical, biotic and agro resources in Tlangnuam block are 10, 11 and 14 respectively, a total of these rankings i.e., 35 is assumed to represent 100 per cent natural resources in the block. After their percentage values have been calculated, they have been plotted on a triangular graph. Advantage of plotting the three variables on triangular graph lies in the fact that they can proportionately be represented by only one point. The same process has been followed for all the blocks. When plotted on a triangular graph, the standing of different units with regard to



different resource categories and also in relation to each other is obtained.

It also reflects the association of different components of resource in each unit under study. After resource association regions of second order has been obtained, a quartile class has been worked out to find out the level of development for each block on the basis of Z-score. Quartile classes have been identified by using mean and standard deviation. Thus, the blocks having above mean + 1SD have been classified as Developed followed by between mean + (1SD) as developing and below mean as underdeveloped.

Natural resources

All the natural resources in their totality similarly are difficult to be evaluated on a regional level, as most often information are not available for smaller units. Therefore, some critical and representative components of natural resources should be selected for appraisal and evaluation. Thus, for the purpose of the present study slopes of the land, hydrography, forest, livestock and agriculture in that order, have been taken as critical parameters for evaluating the natural resources of the state of Mizoram.

Natural Resource Association Regions

The main objective is to study the level of regional development. In this regard, attempts have been made to study the natural resource region to give the clear picture of each of the blocks the natural resource that it possessed for development. In order to assess the regional significance of the different categories of the natural resource region as they exist, they have been plotted on a triangular graph and then natural resource regions have been obtained. In order to obtain integrated natural resource region, various natural resources have been sub grouped into three categories. Thus the elements of the natural resources have been grouped as:

1. Physical resources including physiography and hydrography.
2. Biotic resources including forest and livestock
3. Agro resources comprising cultivated land, intensity of productivity, intensity of cropping and intensity of irrigation.

While assessing on physical resource only available of cultivable land on the slope, rainfall has been taken into consideration. Similarly in the evaluation of biotic resources distribution of forest in each block in percentage and livestock units have been considered. In the evaluation of agricultural resources share of cultivated land to total land area of each block, intensity of productivity, cropping intensity and irrigational facilities has been

taken for evaluation.

In order to assess the regional significance of the different categories of the natural resources as they exist, they have been plotted on a triangular graph and then natural resource regions have been obtained.

Region of Equitably Distributed Natural Resources

The composite triangle showing natural resources reflect that there are three blocks where natural resources are evenly distributed. These three blocks are located in the northern part of the state. These blocks are Thingdawl, Zawlnuam and Tlangnuam.

Region of Two Evenly (Physical and Agro) Resources dominate one resource

There are two blocks dominated by equitably distributed physical and agricultural resources. These blocks are Lawngtlai and Serchhip blocks.

Region of Two Evenly (biotic and Agro) Resources dominate one resource

Darlawn is the only block dominated by biotic and agro resources.

Region of One Predominant (Physical Resources) and two evenly distributed resources

There is only one block of Aibawk that has marginally predominant physical resources and wherein two resources are found to be evenly distributed. Though biotic resources are significantly low when compared to agricultural resources.

Region of One Predominant (Biotic Resources) and two evenly distributed resources

There are four blocks which are found to have predominance of biotic resources over physical and agricultural resources. They are Khawzawl,W.Phaileng, Thingsulthliah and Hnahthial.

Region of One Predominant (Physical) Natural Resource

Blocks dominated by physical resources are Reiek, Sangau, Tuipang and Chawngte.

Region of One Predominant (Biotic) Resource

There are three blocks that are dominated by biotic resources. These blocks are Lunglei, Lungsen and Bunghmun.

Region of One Predominant (Agro) Resource

There are four blocks that has been dominated by agro resources. These blocks are Phullen, Ngopa and Khawbung and E.Lungdar.

As it is obvious from the analysis that there is no regular pattern of natural resource distribution in the state. This may be attributed due to the physical nature of the state. Blocks which have all components of the natural

resources equitably distributed may be considered to have greater potential for development without depending on supply of resources from other areas. Blocks which have two evenly distributed and blocks that have one predominate natural resources for one reason or the other have a problem with regard to development. In this regard, planner must keep in mind that any development programmes do not bring irrational destruction to one resource or the other.

Level of Natural Resource Development Based on Z-Score the level of natural resource development has been categorized into three divisions such as above Developed above 3.71, developing between -0.12 - 3.71 and Underdeveloped below -0.12. On the basis of the result a composite map has been prepared. On the basis of the given map it may be assumed that there are three blocks which may be identified as having more developed natural resource. There are seven blocks which have been put in the category of developing regions with regard to natural resource development. Similarly, there are twelve blocks which are found to be lagging in natural resource development.

Developed Natural Resource Region.

There are three blocks that are identified as natural resource wise developed. These blocks are Thingdawl, Tlangnuam and Khawzawl.

Developing Natural Resource Region

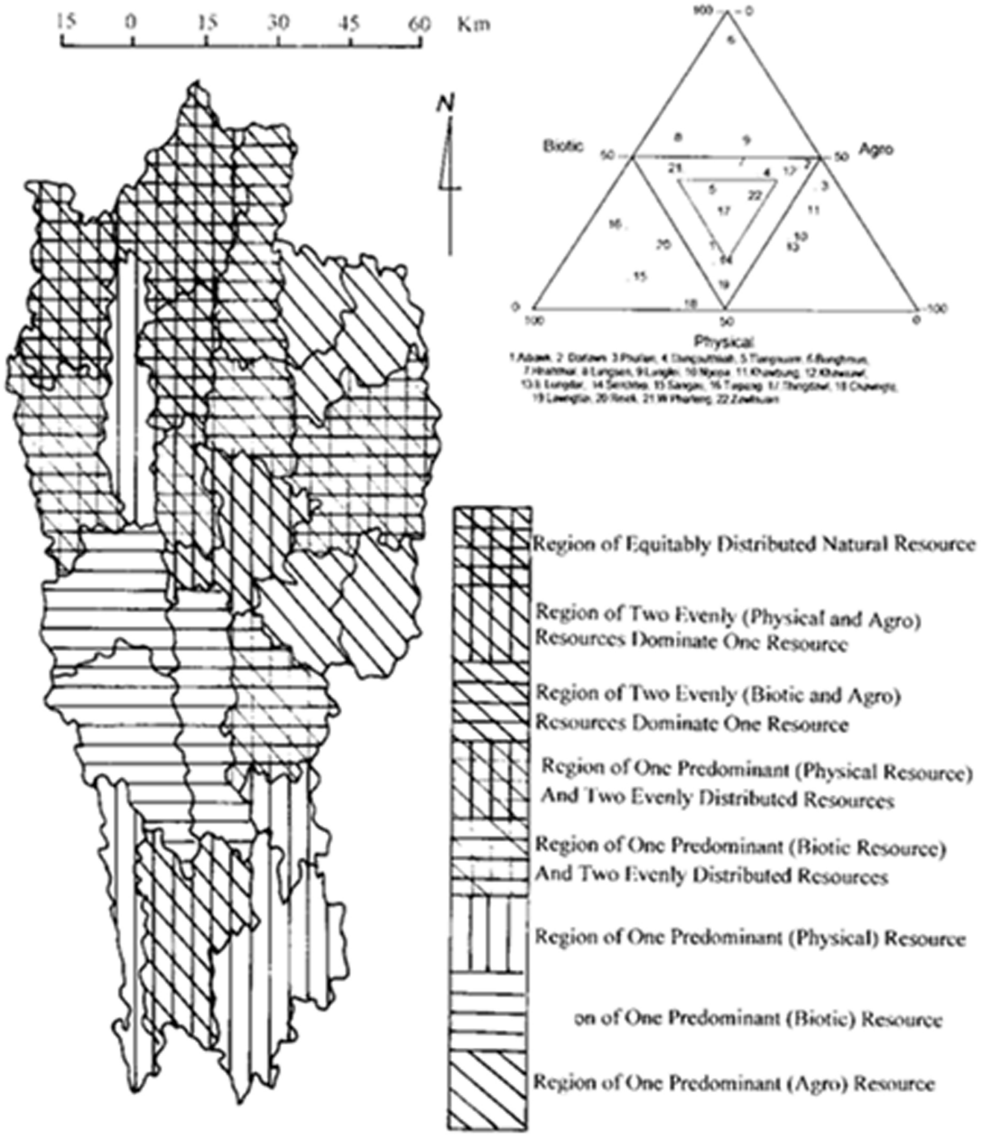
The overall natural resource evaluation reveals that Zawlnuam, Lawngtlai, Reiek, Serchhip, Khawbung, Ngopa and Aibawk blocks fall under developing region.

Underdeveloped Natural Resource Region

The least developed blocks that fall in underdeveloped categories are Darlawn, Phullen, Thingsulthliah, Lunglei W.Phaileng, Bunghmun, Lungsen, E.Lungdar, Hnahthial, Chawngte, Sangau and Tuipang. Thingsulthliah ranks 11th on the composite index of natural resources, Phullen 12th, Lunglei 13th, Chawngte 14th, Darlawn 15th, W.Phaileng 16th, Tuipang 17th, Lungsen 18th, Hnahthial 19th, E.Lungdar 20th, Sangau 21st and Bunghmun the least developed ranks 22nd.

It is obvious from the composite triangle (Fig.1) and overall composite development of natural resource (Fig. 2) that, blocks that have all the three components of natural resources equitably distributed are more developed than the other blocks. Blocks such as Thingdawl, Tlangnuam, and Zawlnuam have all the natural resources equitably distributed. The exclusion of Zawlnuam block from the developed category may be attributed to low

Fig.1. Mizoram
Natural Resource Association Regions



value score of the biotic resources. Khawzawl block which ranks third on overall natural resource development index is dominated by biotic and two other resources equitably distributed. But Thingsulthliah, Darlawn, W.Phaileng and Hnahthial that have been dominated by the same resources have been categorized in underdeveloped blocks as their Z-Score is found to be very low. This shows that some block that have been dominated by one resource lack in other resources. This suggests that physical resources such as cultivable slope and rainfall play very important in the natural resource development of any region. Because land resource forms the most important wealth of any regions and its potential, proper utilization and management as well as its role in development is a matter of utmost concern to its people.

It is however, believed that promotion of terraced cultivation along the river valleys in different parts of the state will reduce disparities in natural resource endowments. In order to reduce the area of shifting cultivation terracing on cultivable slope will help intensification of cultivation by way of increased productivity, cropping intensity as well as irrigation intensity. This will help to reduce soil erosion as well as it will increase area under forest. Thus, despite, physical constraints, efforts can be made to change the physical setting by way of leveling down the small hills near the river banks and reclamation of forest land destroyed by shifting cultivation on the lower slopes of the mountains. They may be used to promote livestock rearing particularly dairy stocks, which are gaining new economic importance in the state.

In this connection. Government is attempting to bring the jhum land under terrace cultivation by financing the farmers who intend to convert their jhum lands into terraced fields. But so far it has met with little success. What is required at the initial stage of such efforts is convincing the local people of the advantages of terraced cultivation and train them in new technique of cultivation.

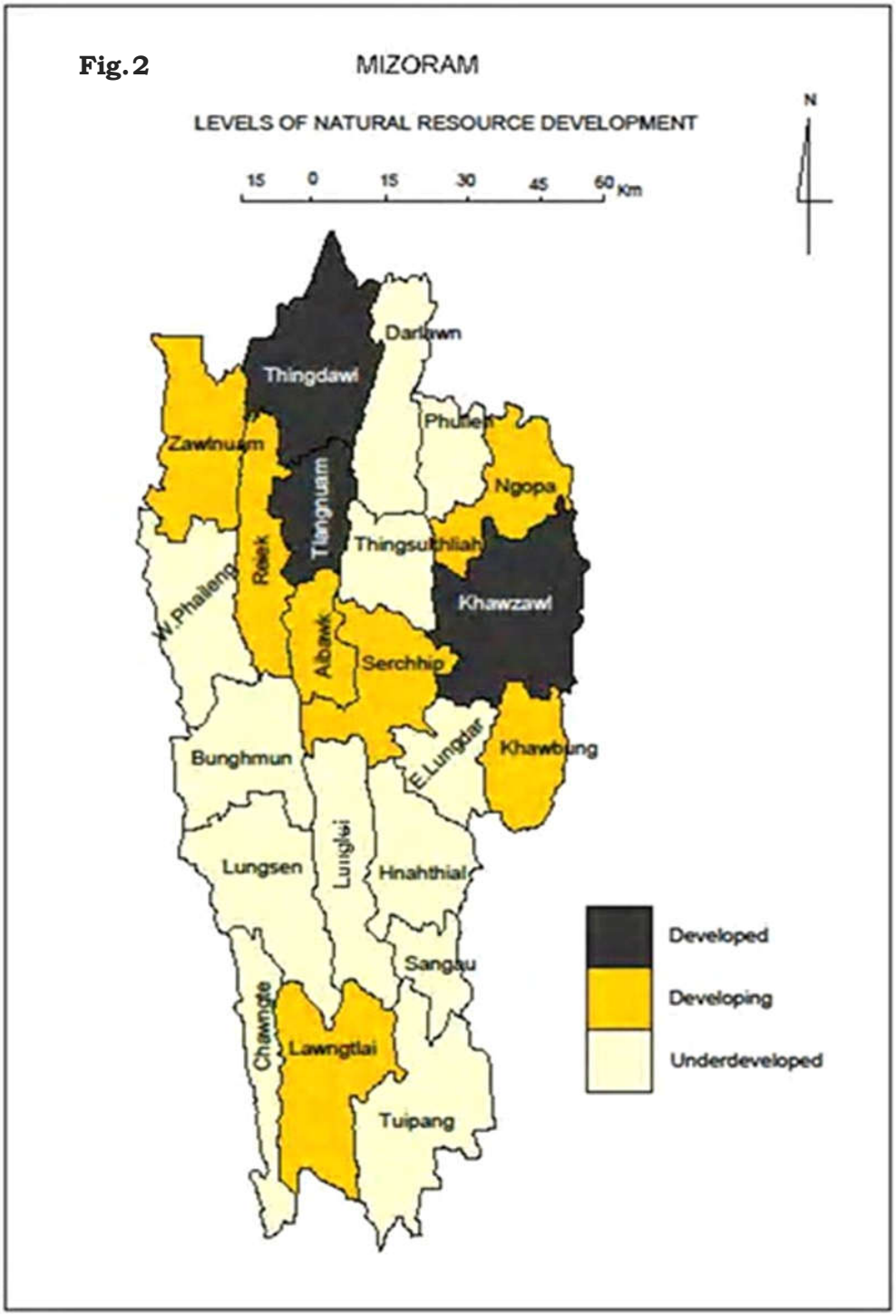


Fig. 2
MIZORAM
LEVELS OF NATURAL RESOURCE DEVELOPMENT
15 0 15 30 45 60 Km
N
Thingdawl
Darlawn
Phullen
Zawlnuam
Tlangnuam
Ngopa
Thingsulthliah
Raiek
W.Phaileng
Khawzawl
Albawk
Serchhip
Khawbung
E.Lungdar
Bunghmun
Lungsen
Lunglei
Hnahthial
Sangau
Chawngte
Lawngtlai
Tuipang
Developed
Developing
Underdeveloped

Table- 1

Ranking of Blocks based on Different Components of Natural Resources

Natural Resource Evaluation							
Sl.No	Blocks	Physical		Biotic		Agro	
		Total	Rank	Total	Rank	Total	Rank
1	Aibawk	2.03	19	-0.15	10.5	1.25	17
2	Darlawn	-1.93	3	-0.05	13	-0.09	11
3	Phullen	-1.95	2	-0.21	8	0.61	14
4	Thingsulthliah	-1.08	9	0.12	17	0.48	13
5	Tlangnuam	1.56	17	2.63	21	0.69	15
6	Bunghmun	-2.12	1	-0.02	14	-2.67	1
7	Hnahthial	-1.41	5	-0.16	9	-2.19	5
8	Lungsen	-0.78	11	0.06	16	-2.64	2
9	Lunglei	-1.26	7	0.79	19	-1.28	8
10	Ngopa	-1.24	8	-0.23	6	1.52	18
11	Khawbung	-1.29	6	-0.15	10.5	2.64	20
12	Khawzawl	-0.94	10	2.22	20	2.56	19
13	E.Lungdar	-1.86	4	-1.22	3	-1.21	9
14	Serchhip	1.49	16	-0.72	5	-0.06	12
15	Sangau	-0.6	13	-1.84	2	-2.28	4
16	Tuipang	0.13	15	-0.22	7	-2.51	3
17	Thingdawl	3.06	22	3.22	22	4.84	22
18	Chawngte	2.11	20	-3.53	1	-0.35	10
19	Lawngtlai	1.88	18	-1	4	1.22	16
20	Reiek	2.53	21	-0.09	12	-2	6
21	W.Phaileng	-0.59	12	0.04	15	-1.93	7

Table -2

RANKING OF BLOCKS BASED ON Z- SCORE OF NATURAL RESOURCE

		Z-Score of natural resource evaluation									
Sl.No	**Blocks**	**X1**	**X2**	**X3**	**X4**	**X5**	**X6**	**X7**	**X8**	**Total**	**Rank**
1	Aibawk	-0.28	2.31	0.64	-0.79	-0.34	1.53	-0.54	0.6	3.13	5
2	Darlawn	-0.73	-1.2	0.65	-0.69	-0.61	1.54	-0.54	-0.48	-2.06	15
3	Phullen	-1.03	-0.92	0.64	-0.85	-0.23	1.54	-0.54	-0.16	-1.55	12
4	Thingsulthliah	-1.01	-0.07	0.64	-0.54	-0.07	1.54	-0.54	-0.45	-0.5	11
5	Tlangnuam	0.64	0.92	0.66	1.97	0.04	1.54	-0.54	-0.35	4.88	2
6	Bunghmun	-0.61	-1.51	0.76	-0.78	-1.18	-0.84	-0.11	-0.54	-4.81	22
7	Hnahthial	-1.11	-0.3	0.43	-0.59	-1.14	-0.83	-0.1	-0.12	-3.76	19
8	Lungsen	-0.09	-0.69	0.6	-0.54	-1.15	-0.83	-0.11	-0.55	-3.36	18
9	Lunglei	-0.99	-0.27	0.64	0.15	-0.42	-0.83	-0.11	0.08	-1.75	13
10	Ngopa	-0.61	-0.63	-0.07	-0.16	-0.01	0.02	2.06	-0.55	0.05	10
11	Khawbung	-0.7	-0.59	-0.07	-0.08	0.28	0.08	2.08	0.2	1.2	7
12	Khawzawl	-0.27	-0.67	-0.07	2.29	0.8	0.07	2.07	-0.38	3.84	3
13	E.Lungdar	-0.84	-1.02	-0.73	-0.49	1.13	-1.02	-0.8	-0.52	-4.29	20
14	Serchhip	0.16	1.33	-0.73	0.01	2.18	-1.02	-0.8	-0.42	0.71	8
15	Sangau	-1.11	0.51	-1.54	-0.3	-0.6	-0.92	-0.81	0.05	-4.72	21
16	Tuipang	-0.64	0.77	-1.54	1.32	-0.3	-0.93	-0.82	-0.46	-2.6	17
17	Thingdawl	2.84	0.22	1.01	2.31	2.84	1.13	1.06	-0.19	11.22	1
18	Chawngte	1.11	1	-3.04	-0.49	0.22	-0.79	0.72	-0.5	-1.77	14
19	Lawngtlai	0.64	1.24	-0.68	-0.32	-0.27	-0.79	0.71	1.57	2.1	6
20	Reiek	1.5	1.03	0.55	-0.64	-0.73	-0.03	-0.78	-0.46	0.44	9
21	W.Phaileng	0.26	-0.85	0.54	-0.5	-0.53	-0.13	-0.79	-0.48	-2.48	16
22	Zawlnuam	0.65	-0.62	0.55	-0.31	0.02	-0.02	-0.78	3.97	3.46	4

X1: Slopes, X2: Rainfall, X3: Forest, X4: Livestock, X5: Cultivated land, X6: Intensity of productivity, X7 Intensity of cropping, X8 Intensity of irrigation.

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Shifting Cultivation and Land Degradation in Teirei Watershed, Mizoram

R. Zonunsanga
Ch. Udaya Bhaskara Rao

Abstract : *Shifting cultivation appears to be one of the prime causes of land degradation and depletion of forest resources in the hilly tract of Mizoram. Clearing of natural vegetation for agriculture leads to severe soil erosion in Mizoram due to the fragile nature of the terrain which is composed of unconsolidated sedimentary rocks with steep slopes aided by heavy monsoon rainfall. The Teirei watershed in the northwestern Mizoram has good potential for agricultural development due to the presence of flat to gently sloping lands, particularly in its middle and lower reaches unlike other parts of this region in the northeast India. A comparative analysis of multi-date topographic maps and satellite images made towards identification of the zones of soil erosion and the quantification of soil loss in Teirei watershed, however, revealed that about 390 km2 (60%) area is under the threat of moderate to very severe soil erosion even in this gently sloping land, apparently due to unplanned agricultural practices.*

Key words *: shifting cultivation, soil erosion, land degradation, deforestation*

Introduction

The tribal populations of the hilly regions such as in Mizoram have remained 'victims of environmental degradation' due to unfavourable physical conditions coupled with certain anthropogenic activities. The land degradation problems in the hilly areas probably due to fragile ecosystems along with unsupportive production functions of landscape (Vink, 1975). About 60% of the total area of the state is facing the threat of land degradation mostly due to practice of massive shifting agriculture over steep slopes in addition to certain soil problems like high soil acidity, low base status, landslides and subsequent soil loss (Maji et. al., 2001). In most of the cases, shifting cultivation has been attributed to be the root-cause for the degradation of land and forest resources. The traditional agricultural practices in these regions have led to deforestation and subsequent land degradation. However, considering the need for sustenance and socio-economic development of the forest dwellers, abolition of shifting cultivation may not be viable as it is the age-old tradition and more importantly the only primary source of livelihood in these regions. Being under such compulsion to carry on agricultural activities in this highly rugged hilly terrain, where scarcity of land

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resources pose a serious threat to food security, farmers are compelled to continue this type of traditional land use practices along the steep hill slopes. The efforts made by various agencies in this area in trying to do away with, or implement alternatives to, the shifting cultivation, in most cases, have proved futile.

The shifting cultivation prevalent in the region involves forest clearance for tilling the land leading to soil erosion and land degradation. Removal of top soil in turn reduces fertility and moisture retention capacity of the soil thereby rendering the soil unsuitable for crop growth anymore. Hence, farmers have to shift their agricultural activities to other areas where they start clearing the natural vegetation to grow crops. This type of what is known as shifting cultivation leads to overall depletion of forest cover and soil loss in the region. The best way to curb shifting of agricultural activities from one area to the other is to arrest soil erosion through appropriate methods.

Background of the Study area

The present study has been carried out in Teirei watershed covering an area of 680 km^2 located in Mamit district in the northwestern part of the Mizoram state. Geographically, the watershed lies between $23^0$34' 48" - $24^0$11'12" north latitudes and $92^0$21'07"- $92^0$32'15" east longitudes (Fig.1). The area is composed of several linear to arcuate-shaped narrow to broad crested hill ranges separated by narrow and deep structural valleys exhibiting high relief ranging between 24m and 1261m above the mean sea level.

Geologically, the rock formations in the area are composed of Tertiary sandstones, siltstones and shales of the Surma group in varying thicknesses. It is found that a majority of the tributaries and main course of the river Teirei are controlled by major faults and fractures probably due to on-going tectonic activity. The area experiences humid tropical climate. The average annual rainfall during 1987 - 2012 was 2882 mm. The mean minimum and maximum temperatures are 15^0C and 32^0C respectively, with an average annual relative humidity of 70%. Rainfall occurs in this area mostly during the southwest monsoon (June-September).

The watershed accommodates a total of 34 settlements with a total population of 33,000 persons living in 6,900 households. About 73% of the population in the watershed area is estimated to be the Jhummia tribe. It is observed that about 5% of the total area has been brought every year under shifting cultivation allotted generally from the lands owned by the village community. This type of traditional cultivation system

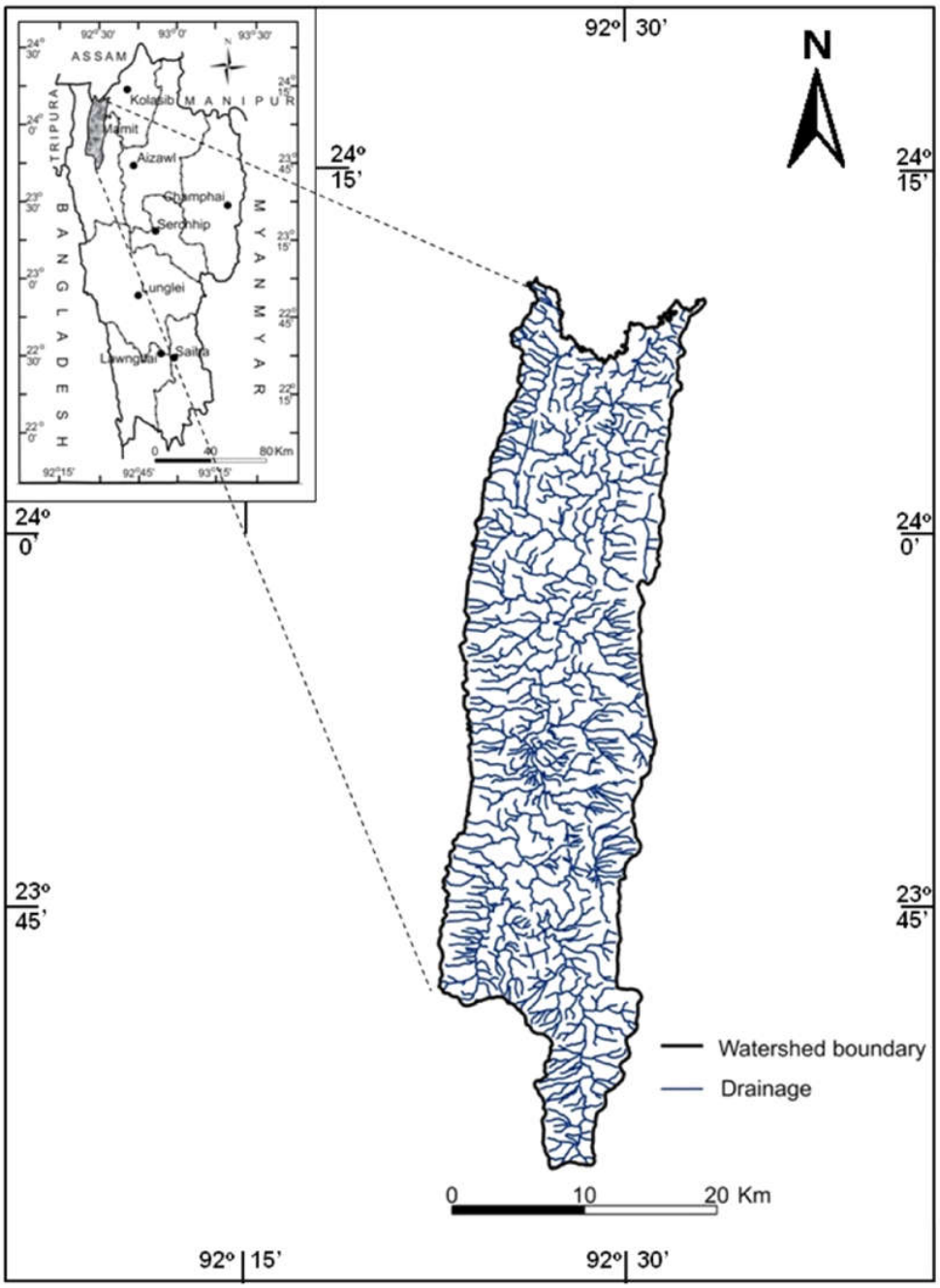


Fig.1 - Location and drainage network of the Teirei Watershed in northwestern part of Mizoram

which is still being practiced widely in the area is economically and ecologically, the most unsustainable system of cultivation, as already mentioned above leading to destruction of valuable natural forest through the processes of slashing, burning and subsequent abandonment of the cultivated lands as the soil is depleted by erosion after a few years of crop growth. The extensive practice of this primitive agricultural system in order to meet the basic needs of ever increasing population has been exerting tremendous pressure on the available natural resources and their deterioration.

Materials and Methods

Survey of India toposheets and IRS P6 LISS III FCC geocoded satellite imagery have been used to delineate the boundary of the Teirei Watershed, its drainage network, land use /land cover features and other relevant topographic information. The rate of soil loss from each spatial unit in the study area has been estimated through integration of thematic data layers such as rainfall erosivity, soil erodibility, slope length and steepness, land use and vegetation/canopy cover and anthropogenic management practices in GIS environment. The data of digital elevation model acquired by Shuttle Radar Topographic Mission RADAR pertaining to the study area downloaded from the United States Geological Survey website (www.cgiar.csi.org) has been used to compute the slope length and steepness parameters. Special attention has been given to shifting cultivation with regard to its areal extent and its contribution towards soil erosion. The Revised Universal Soil Loss Equation proposed by Renard et.al. (1994) with minor modifications has been applied to quantify the metrological loss of soil within the study area by computing the value of each factor causing the erosion to derive the quantifiable soil loss in a unit area. Normalized Difference Vegetation Index (NDVI) technique (Rouse, 1973) has been adopted to find out the vegetation vigor and density in the area using ERDAS Imagine Image processing software.

Soil Erosion and Land Degradation

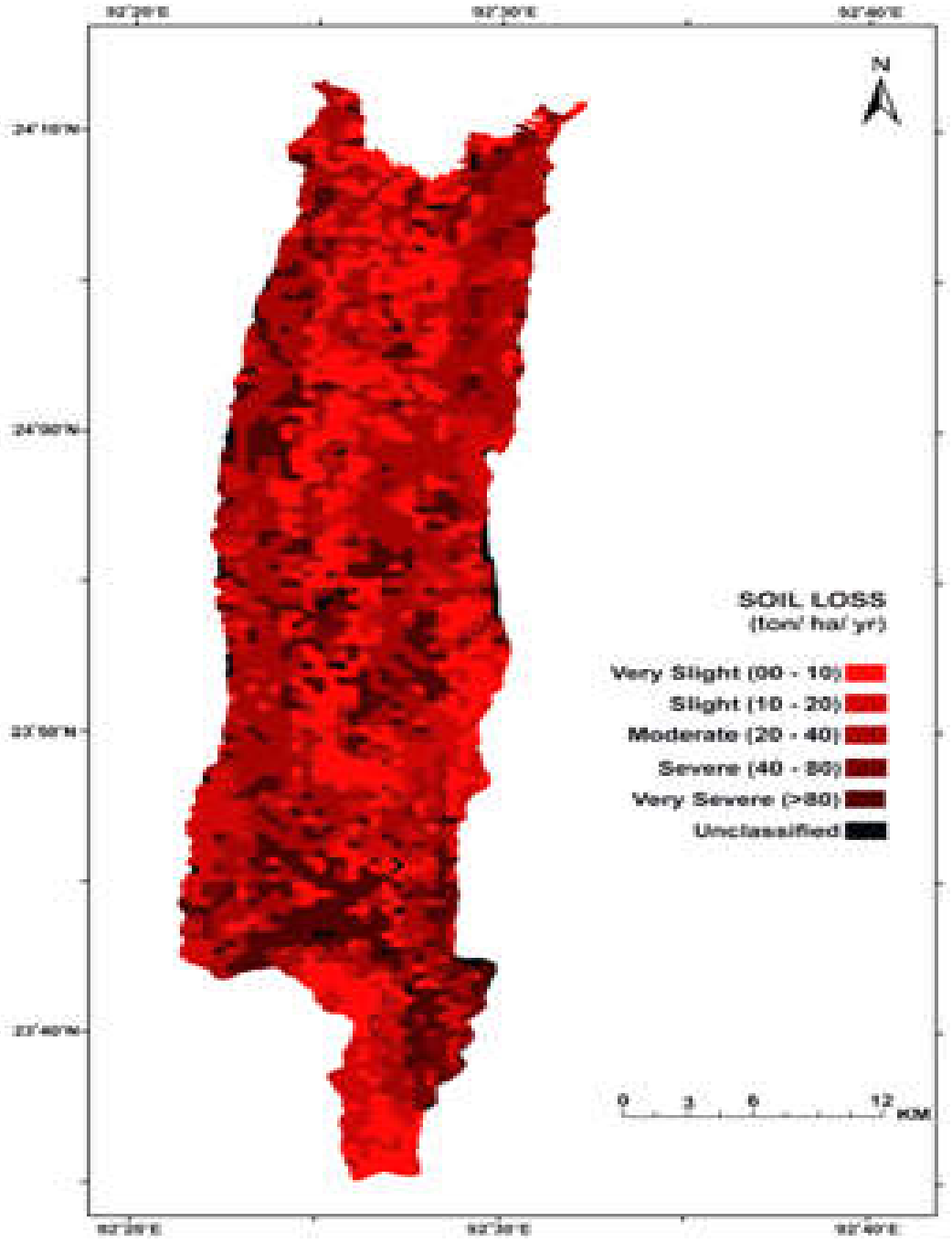
Soil erosion is a complex and dynamic process by which soil particles are detached, transported and accumulated in a down-slope location. Erosion induced land degradation is found to be the major global issue as it affects adversely the agricultural productivity thereby sustainability (Lal et al., 1998). Similarly, soil erosion also affects the environment of downstream sections by siltation, thereby decrease the carrying capacity of water bodies. Particularly, in Mizoram cutting of

hill slopes appears to be one of the major causes of landslides with increased intensity and subsequent soil erosion. One of the most unsustainable agricultural systems like shifting cultivation has also been attributed as the outcome of severe soil erosion whereby the farmers have been compelled to shift their agricultural activities to another area due to intensive loss of the fertile topsoil. Of all the World's land degradation problems, soil erosion is the first order category (Hitzhusen, 1993). Conservation and management practices of land resources should therefore consider the ways and means for minimizing soil erosion. Water erosion is considered to be the most effective first order category of land degradation in India (Venkataratnam and Ravishankar, 2004). The entire study area is afflicted with a serious problem of soil loss as a consequence of its high relief with steep slopes, highly erodible nature of its soil and rocks and removal of vegetation cover and more importantly absence of any sort of soil management practices. The area had indeed been ranked in the category of the topmost priority areas for conservation of soil in the state of Mizoram (Anonymous, 1994). Based on the estimated annual soil loss per hectare, the watershed of the river Teirei has been classified into six erosion intensity units in this study. The delineation of soil erosion intensity zones and estimation of total soil loss has been carried out based on the pattern of slope distribution and more significantly the pattern of vegetation density (Fig.2).

This shows that the rate of soil erosion in hilly terrain is determined by the protective services of vegetation. The soil erosion intensity zones, soil loss and the subsequent risk of land degradation are presented in Table 1.

Out of the total 680 km^2 (or 68000 ha) area of the watershed, about 14225 hectares (21%) of area falls under very low intensity zone of soil erosion with a minimum soil loss of 0 to 10 tons ha^{-1} $year^{-1}$ which is associated with dense and open forest cover over moderately steep to steep slopes (Fig.2). The zone with slight intensity of soil erosion with 10 to 20 t ha^{-1} $year^{-1}$ of soil loss covers an area of about 13300 hectares (19.5%) of the watershed mostly associated with dense and open forest areas over steep to very steep slopes. These two zones cover an area of about 40% of the total watershed fall under the category where erosion-induced land degradation risk is low. As the soil cover being deep to very deep and the vegetative cover being thick in these zones, chances exist for soil resilience and capability to regain their degraded energy.

Fig.2 - Soil erosion intensity zones



The area with the largest areal extent falls in moderate intensity zone of soil erosion at a rate of 20 to 40 t ha^{-1} $year^{-1}$ of total soil loss. This zone occupies about 37.65% of the total geographical area of the watershed mostly associated with open forest over steep to very steep slopes and shifting cultivation existing on nearly flat lands. The zone of severe intensity with soil loss rate of 40 to 80 t ha^{-1} $year^{-1}$ shares approximately 4.9% of the total area on the flat lands where wet rice cultivation is practiced and also open forest lands of above 50% of slope. The erosion intensity zone with soil loss above 80 tons ha^{-1} $year^{-1}$, which is designated as 'very severe' category covers an area of about 14.9% (10125 ha) is in about 3% of the area in the watershed. The combined area of the three zones experiencing 'moderate', 'severe' and 'very severe' rates of soil loss account for about 60% of the total area of the Teirei watershed and fall under the high risk category of land degradation and loss of biodiversity.

Shifting Cultivation and Degradation of Resources

Shifting cultivation is largely a subsistence activity practiced in the area where few alternative options exist due to physico-socio-economic constraints and its practice is therefore likely to continue. The paraphrasing of the term 'shifting cultivation a necessary evil' has great demonstrative value for policy framers (Das, 2006) because the system is considered as the root-cause of degradation of resources. This agricultural system extends over an area of about 5% of the total area annually and the abandoned lands devoid of proper vegetation cover account for approximately 15% every year.

Table 1 Soil erosion intensity zones and associated land degradation risk

Erosion Intensity Class	Soil Loss Class (ton ha^{-1} yr^{-1})	Erosion-Induced Land Degradation Risk	Land use/ land cover	Slope	Area (ha)	Area (%)
Very Slight	00 – 10	Very Low	Dense forest	25-35%	14225	20.90
			Open forest	0-10%		
Slight	10 – 20	Low	Dense and	35-50%	13300	19.56
			Open forest	15-25%		
Moderate	20 – 40	High	Open forest	0-1%	25600	37.65
			Shifting cultivation	25-50%		
Severe	40 – 80	High to Very high	Open forest	> 50%	3325	04.89
			Wet rice cultivation	0-1%		
Very Severe	80 Above	Very high to Severe	Shifting cultivation	>3%	10125	14.89
Unclassified	Dynamic	-	Built-up Lands	-	1425	02.10

After a few years, these abandoned lands are generally regenerated by the growth of less dense forest dominated by bamboo whose areal extent now stands at about 56% of the watershed. This has revealed that absolute deforestation or complete degradation of forest resources due to shifting cultivation has been experienced in 5% of the total area annually and that the absolute but temporal degradation of forests resources has been witnessed on 20%. These rates at which spatial reduction in forest cover occurs are quite detrimental to the fragile ecosystem and biodiversity of the region.

Taking into account the very severe intensity zone where annual loss of soil cover per hectare exceeds 80 tons, soil erosion continues to occur regardless of the soil types, slope and rainfall but depending on the nature vegetation cover only. As high as 96.3% of the area in this category of very severe erosion comes under shifting cultivation thereby manipulating the chances of biodiversity loss is minimal. In most cases, jhumming is largely associated with moderate to steep slopes. But in areas jhumming is in association with very steep slopes, soil loss is very severe. Under such conditions, depletion of soil nutrients and reduction of moisture retention capacity and fertility of soils is imminent as no soil conservation measure is implemented. Therefore, the subsistence farmers are compelled to shift their agricultural activities to fresh forested lands in order to maintain their annual food production.

Thus, the prevalent shifting cultivation system, as attributed to the causes of degradation to biodiversity, land and forest resources, remains only a secondary factor whereas soil erosion is the primary cause. The best way to manage and reduce the system of shifting cultivation is therefore prevention of soil loss from the farmland which in turn avoids the compulsion of shifting the agricultural lands, instead of trying to curb the practice of shifting cultivation especially keeping in view failure of several attempts made earlier to do away with this age-old traditional agricultural system in the region. Since no mechanical and or technical measures appear to be affordable or viable to control or abolish the so called shifting cultivation due to the prevailing physico-socio-economic conditions in the region. The only alternative measure is the modification and improvement of agricultural practices by avoiding felling of trees with large crown and contour bunding by vegetation predominantly with bamboo. Such measures can reduce

run-off and check erosion effectively.

Conclusions

The fragile ecosystem of hilly terrain in the northeast India has been experiencing a threat of high risk of land degradation due to soil erosion which is estimated to be about 60% of the area under investigation. The very high rate of deforestation as a part of shifting cultivation in the area has worsened the situation leading to degradation of forest resources and loss of biodiversity. Shifting cultivation is therefore attributed as the major contributor towards the three negative scenarios, i.e. soil erosion-induced land degradation, forest degradation and loss of biodiversity. It is, however, to be documented that the system of shifting cultivation cannot be simply paraphrased as "necessary evil" for it is the age-old and blood-bonded traditional practice that occupies the heart of tribal culture which is, arguably, one of the most eco-friendly practices. Besides, any attempt to do away with the system is fraught with serious constraints. Therefore, the only viable solution to this environmental problem is to control degradation of biodiversity, and land and forest resources is through implementation of improvement measures to shifting cultivation system in such a way that farmers retain the soil nutrients in their farmland and avoid shifting from one plot to another.

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Ecotourism as a Means od Community Livelihood and Women Empowerment in Nameri National Park of Assam

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Abstract : *Tourism is currently the world largest industry ($ 3.4 trillion annually) and ecotourism represents the fastest growing sector of this market. The term 'Ecotourism' was first coined by Hector Ceballos Lascurain in 1983, and was initially used to describe nature-based travel to relatively undisturbed destination with an emphasis on education.*

In many parts of the world the number of women seeking involvement in ecotourism ventures has soared in the past decade. A cogent concern, from a development perspective, is that many such ventures have progressed with scant regard for the changes they may provoke in gender roles, gender relations and access to resources. As with other development initiatives which profess to be 'gender neutral', ecotourism runs the risk of disadvantaging and marginalizing local women. The research considers both positive and negative ways in which women are engaging with ecotourism enterprises in Nameri National Park. Such examples could help to guide agencies which wish to find ways of facilitating local level empowerment of women through ecotourism in the future.

Key Words*: Tourist Resources, Ecotourism, Women Empowerment, Facilities and Services and Community Livelihood.*

Introduction

Tourism was declared an industry in 1992 by the Government of Assam to encourage private investment particularly in creating required infrastructure facilities. For such a highly dynamic and sensitive sector of economy, an appropriate and reliable information base is indispensable.

Ecotourism as an enlightening natural travel experiences that contributes to the conservation of ecosystem while representing the integrity of host community Seace et al (1992). This definition reflects a value and resource based perspective, by highlighting a balance scenario of benefit among tourist, tourism industry and local community. As the very idea of Ecotourism is based on the sustainable use of resource, there should be some guideline, both general and specific that to be followed ill such operations. The ethic-based perspectives, put forwarded by Wight (1993), encompasses those principles, which are proved to be fundamental for sustainable tourism practice.

Empowerment is defined as a critical aspect of gender equality implies a society in which women and men enjoy the same opportunities, outcomes, rights and

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obligations in all spheres of life. A critical aspect of promoting gender equality is the empowerment of women, with a focus on identifying and redressing power imbalances and giving women more autonomy to manage their own lives. Women's empowerment is vital to sustainable development and the realization of human right for all. Tourism is a tool to empower women from various aspects. Tourism could assist women to increase power and control over natural resources; economic empowerment; educational empowerment and political empowerment.

Micro analyses were done in the study area where general background of the regional development and tourism, women position in the society and empowerment through tourism were discussed. Examples were collected to reflect clearly the connection between tourism and women empowerment addressing examples and provide answers to questions such as why the empowerment is successful and how is the empowerment implemented? Despite of general indicators which are quite revealing by making it easy to grasp the disparities, the cases give a detailed and in-depth process of women empowerment through tourism which cannot be grasped by general indicators.

It has only been in the last few years that woman empowerment has attracted the interest of on ecotourism; those who do discuss it fervently support the concept (Drake 1991; Theophile, 1995). Akama (1996) stresses that 'there is a need for the initiation of alternative wildlife conservation and tourism programmers aimed at the social and economic empowerment of women, while Gauthier (1993), goes further, claiming that 'empowerment of woman within the context of environmental protection is one of the tenets of ecotourism'. Wearing and Larsen (1996) are positive about the potential of ecotourism to promote community development, stating that ecotourism can empower women by giving them a sense of pride in and awareness of the importance of their natural resources and control over their own development. Similarly, Swain (1995) posits that 'environmental issues in tourism development are a distinct area of research ripe for gender analyses. While a dearth of gender analysis on ecotourism initiatives is notable in the academic literature, such as the impacts of tourism on village women (Wilkinson & Pratiwi 1995) and women's involvement in ethnic tourism (Swain 1993). In addition, examples of 'good practice' which show that women are participating equitably in sustainable tourism initiatives have recently been compiled in a report for the United Nations' Commission on Sustainable Development (Hemmati 1999).

Study Area

The study region covers Nameri National Parks of Assam and its adjoining areas located in 26°50'48"N to 27°03'43"N Latitudes and 92°39' E to 92°59' E Longitudes covering an approximate area of 600 km^2. The park extends up to east and south west bank of the river Bor-Dikorai from interstate boundary at Sijussa to left bank of Jia-Bharali River along the north of Sikam basti, up to the south bank of Balipara Reserve Forest. Rangapara-Balipara area in the west, Tezpur in south, Jamuguri and Bishwanath Chariali located in the eastern corner are the adjoining areas of Nameri National Park. Nameri is covered by of Tropical evergreen, semi-evergreen, moist deciduous forest with cane and bamboo brakes and narrow stripes of open grassland along rivers. Orchids include Dendrobium, Cymbidium, Ladies sleeper etc. tree fern, lianas; creepers are some of the specialties of this forest. The areas are influenced by the tropical monsoon regime (Barthakur 1986). There are several ethnic communities viz. Mishing, Garo, Nepali, Nishi, Bodo, Ex-Tea Garden Labour inhabiting in the periphery of the park and they are trying to promote ecotourism through their unique cultural identity.

Objectives of the study

The study is to be carried in the Nameri National Park and adjoining areas on the following major objectives:-

i) to highlight how the existing resource base of the area can be an attraction for tourists;
ii) to study the of tourist-flow pattern and their preferred destinations and needs; and
iii) to evaluate the status of existing tourism infrastructure to promoting women empowerment and needs including community participation.

Research Question

i) How far will ecotourism be an attraction for tourists at Nameri National Park?
ii) Nameri National park is a govt. owned area, how and to what extent the govt. is willing to share the responsibility and give the women their due share of profits? and
iii) If ecotourism is promoted, long term economic gain will be a desired goal. How can sustainability (for the park and women) be achieved when degradation of ecotourism resources taking place?

Data Base Methodology and Research Design

To understand the problem at hand a good understanding of the local conditions is required. More consultation has done in the libraries of different universities and institutions. Data input would

be of immense importance and collected through fieldwork, topographical maps, journals, govt. reports and websites.

Empirico-descriptive method of analysis has used in this work. As there is dearth of basic information regarding tourist and tourist resources in promoting women empowerment in the study region, primary data of various important fields through physical survey has generated.

Discussion

In this study both qualitative and quantitative methods were employed for data collection from a wide range of concerned stakeholders and beneficiaries. All relevant secondary data on socio-economic, demographic, geographical and natural conditions as well as current planning, management policy, and project implementation of responsible government agencies, NGOs, international development communities and donors has collected. The primary data were collected through various applicable methods. The qualitative methods involved participatory rural appraisal (transact walk and cognitive mapping, group meeting and discussion and social mapping) with 79 local women participants, semi-structured interviews with 120 local household representatives, in-depth interviews with seven local communities and authorities and executing semi-governmental officers, expert interviews with Indian and foreign personal, and participant observation. Quantitatively, formal interviews with 9 travel agencies and tour operators and contingent valuation methods (survey-based analyses by using SPSS program interviews) with 315 domestic and 100 international tourists were conducted during the fieldwork period. Concerning the sampling techniques, purposive samplings were used to select the sample populations for the qualitative investigation, whereas convenience and stratification samplings were followed to identify relevant respondents for quantitative data collection.

In this study, the women empowerment referred to both supply and demand sides. For the supply side study, four major aspects were encapsulated in the research plans. These included: (1) vulnerability context (shocks, trends and seasonality) of local communities; (2) existing livelihood capital assets near by the park and the interaction between each substantial capital for development and conservation; (3) carrying capacity assessment and other challenges for ecotourism development; and (4) community perceptions of and other concerned stakeholders' attitudes towards ecotourism development in the areas. The research fundamentals of supply side investigation allowed

the application of sustainable livelihood approach (SLA) to help analyze the context of local livelihood system and problems and related underlying causes. It was also used to help analyze the complexity of internal and external factors and the evolution of development and conservation processes in influence community livelihoods and capabilities as well as the effects of local livelihood strategies on the existence of natural resources in the areas. The application of the sustainable livelihood approach provided a foundation of concrete analysis upon the effectiveness and applicability of ecotourism as an integrated conservation and development approach and how it could address social and environmental problems in the areas.

The demand side study encompassed the demands of tourists and private business sector for ecotourism development and their perceived possible local economic activities and businesses.

Possible effects of ecotourism on the natural and human environments of the area were investigated through environmental impact assessment by considering different scenarios of its development. This involved the extent to which ecotourism could possibly contribute to local economic stimulation, appropriate human and resource capacity development, biodiversity conservation and sustainable use of primary resources, and to suitable regional planning for development The creation of guiding principles for planning and management of ecotourism development in Nameri and adjoining area was done through the analysis of data obtained from different methods, especially from the expert interviews.

The study shows that the main occupation of the local people in the areas is collection of resources followed by other economic activities, such as livestock rearing, seasonal crop farming, local tour guide, boatman, and women are involve in local handicraft, working in eco-camp, restaurant etc. Despite living in natural resource rich areas disparity in income generation is prominent among local populace. Most of the collectors which represent the majority of the total population are facing many livelihood problems. Poverty and social complexity are attributable to various critical factors, which have caused livelihood conditions of the local communities worse, while biodiversity conservation remains more challenging due to its close relationship with local livelihood options. These factors include: rapid population growth;

inadequate local economic opportunities; constant decline in fish catch and other essential natural resources; lack of public services and infrastructure; lack of ownership right and access to fishery resources and other common property resources; low capacities; insecurity; social inequality and exclusion;

The study has found that local community livelihoods are becoming more vulnerable due to both internal and external reasons. Internally, people's vulnerabilities are caused by their limited education, inadequate knowledge and skills and seasonal health problems, local informal rules (social capital) and social system, spatial condition and complication of the areas, and community attitudes towards protected area management laws and law enforcement. External problems affecting local livelihoods include: ideological conflicts of management plans and responsibilities among executing agencies; politics of the concerned state (inter-ministries and semi-governmental agencies) and non-state actors (developmental and conservational NGOs, international communities and funding agencies); interaction between insiders and outside communities and attitudes of the newcomers (i.e. seasonal in-migrants) towards natural resource use and management in the areas; and current national and global environmental issues and movement.

The study reveals that there is a strong interaction and interdependency between local livelihoods or poverty and the status and effectiveness of natural resource management in the area. Challenges to the management and protection of biodiversity resources and natural environment in these core areas are:- insecure and inadequate financial support; increasing population pressure; demands on energy sources; economic growth oriented concession policies; unclear legal and institutional frameworks; lack of community support and participation; insufficient local economic alternatives; client-patron relationship; lack of knowledge, skill and capacity among the locals and responsible government staffs; inadequate support infrastructural services; geographical condition of the areas; social organization and local network; conflicts of interest over resource consumption and access; overlapped management mandates between responsible agencies; lack of adaptation and respect of local knowledge; unclear definition of the land boundaries; and lack of local empowerment and external coordination. In other words, it is difficult to achieve natural resource management and conservation goals because of six major constraints i.e. theoretical,

policy, legal, institutional, structural and implementation.

The study indicates that the areas have plenty of potential natural and cultural resources. These resources signify three fundamental elements for ecotouristic destination-quantity, quality, and fascination. The natural attractions consist of vital and sensitive biological and scenic values of the destination areas, including undisturbed habitats, richness in biodiversity and ecosystem, unique ecological and geological formations, remote and beautiful natural landscapes, unique hydrology of the river and its creek system, etc. These area are home to abundant natural resources, encompassing endemic and illustrious fauna and flora species, some of which are environmentally global significant. The matchlessness and ecological value of these areas can be further connoted through the presence of mammal, reptile, and amphibious species. The natural setting, distinctive ecosystem and loaded biodiversity, rare freshwater natural habitats, and reversed hydrological fluctuation of the park are also of great interest for visitation. In addition, it has an amalgam resource base of historic and cultural attractions that can be perceived as distinctive by tourism developers, tourism industry sector, and tourists. Different cultural-historic resources have evolved in different parts of the park as a result of local diverse settlements, livelihood options, varied social organizations and adaptive strategies of people to their surrounding natural and physical environment, different histories and styles of political and economic development. Cultural attractions comprise cultural events, objects, and activities. Possible tourist activities can be established through both primary and secondary natural and cultural attractions of the places.

The study demonstrates that local communities have positive perceptions towards ecotourism development, but they are cautious whether it could be brought in as an alternative economic option for the region not at the expense of the community. Other stakeholders' attitudes are also positive but varied depending on their interests, perceived benefits from their involvements, and current socio-economic and political status in the areas. In addition, these attitudes are clearly defined and distinguished between concerned NGOs and line departments of the government sector, which hold different states of the art, know-how, and accountabilities in the areas.

The impact assessment of ecotourism development shows that there are possible positive and

negative impacts on human, natural and cultural environments, local livelihood approaches, and natural resource management. The potential positive consequences of ecotourism are: improve people's quality of life; increase and diversify village-based economic activities; increase the supply of public and infrastructural services; protect spiritual and cultural significance and improve the recognition of local communities on the value and pride of their resources as well as their capacities; enhance local empowerment and ownership right; increase community's roles / responsibility / awareness and voluntary works; increase local involvement in decentralization practices and in conservation process; and increase community-driven and outreach programs. Prospective ecotourism benefits for natural resource management and protection include: reduce natural resource depletion and decrease in environmental quality; improve protection and management through economic incentives of ecotourism; increase understanding of tourists and local communities about symbiosis between human and natural environment; increase environmental research and education programs; and increase conservation programs and activities initiated by both inside developers and external forces.

The possible negative effects of ecotourism are: conflict of interest; disparity in income generation and distribution; economic leakage; overcrowded environment; disturbance of natural habitats, water birds and wildlife species caused by tourist activities; population booming; land speculation and encroachment; environmental degradation and pollution; change of village landscapes; cultural alienation and modification of culture and nature; increased dependency of local communities on outside developers and planners; and, increased pressure on local community livelihoods caused by environmental strengthening and biodiversity conservation which restrict their access and use over natural resources.

Providing economic alternatives and diversification for the local communities to cope with their livelihood loss and current threats to natural resources is regarded as one of the most desired remedies. It is optimistic that ecotourism development in park and adjoining area will give a lot of benefits to the local people. Nevertheless, they will be prone to its negative consequences as well provided a number of critical issues are overlooked. The study also reveals that ecotourism has the potential to help reduce the amount of natural resource depletion and the growing decline of the environmental quality in the areas. Therefore, six guiding

principles are needed to be followed through the entire ecotourism process. These include: (1) integrated and collaborative planning and policy development; (2) systematic management plans; (3) community involvement and community-based approach; (4) awareness raising among concerned stakeholders; (5) stakeholder partnership building and participation; and, (6) government support programs.

This study eventually suggests several approaches for sustainable biodiversity conservation, livelihood improvement and women empowerment in buffer and core areas of the park. These include: (1) good collaboration and coordination among all concerned stakeholders; (2) local empowerment and respect of local knowledge; (3) harmonization and integration of development policies and programs; (4) adaptive management and effective integrated natural resource management and community development strategies; (5) suitable and clear policies and laws on environmental management, boundary designation, land use planning and business operations in the areas; (6) improvement of capacities of the locals and executing government and project implementation staffs; (7) appropriate law enforcement; (8) supply of technical and financial assistances to implementing staffs and community organizations; (9) provision of necessary public and infrastructural services; (10) effective control over population growth and its pressure on natural environment; (11) promotion of sustainable rural community livelihoods via appropriate small and medium scale enterprises while building a culture of sustainable use of natural resources; and, (12) establishment of well-preserved biodiversity and ecosystem zones in core and buffer areas.

The study shows that areas could be developed as a single ecotourism destination due to abundance and great variety of resources. The development of ecotourism on community-based level will provide more direct and indirect employment to the areas. A wide range of local industries will be revitalized, established and enhanced. These include accommodation, food, handicraft, and other service businesses. However, a number of challenges could hinder the success of ecotourism as a tool for conservation and development in the areas. These challenges range from technique to politics including: capacities of the locals and responsible government institutions to sustain ecotourism process; participation and structural barriers; and community vs. market's competing interests. Although ecotourism could contribute to the success of the

three major principles of development, it is not the only remedy for current socio-economic and environmental problems in the areas.

The current challenges facing the areas are to enhance local economic viability based on current livelihood activities, reduce poverty, and foster the implementation and succession of reform policies. These entail institutional and administrative reform, environment reform, structural reform, etc. To overcome these problems will require effective economic and environmental management and external assistance in order to support the completion of local economic self-sufficiency and conservation priorities. Considerable structural development frameworks to improve the quality of life of the locals (particularly vulnerable and marginal groups) and sustainable use of natural resources should be introduced into the areas.

Development mechanisms should start from addressing local survival groundwork to medium and long-term strategic plans for rapid adjustment, local economic development and conservation supported by good micro and sectoral policies. In the medium term, developers and conservationists should aim to: eliminate illegal and destructive activities to natural resources by strengthening institutional and legal framework; ensure equal access to resources and fair economic distribution of benefits of development; promote and diversify local livelihood activities with less impact on human and natural environment; improve infrastructural and social services; and sustain growth within a stable microeconomic framework in core areas. In the long term, local communities and the government should aim to achieve: poverty alleviation defined in the Millennium Development Goals; the improvement of people's well-beings and quality of life; community development goals; and environmental governance in these core areas.

Development of ecotourism cannot be seen in isolation from the overall development of the state. Ecotourism can play a major role in developing the economic condition of the Nameri National Park and upgrading the economy of the surrounding communities.

Though the Department of Tourism played an important role in boosting up ecotourism activity in the stage at the initial stage, at present its role is quite insignificant. The appeal of the time is to make 'ecotourism for the people, of the people and by the people'. Thus people's participation

and privatization of the ecotourism sector are some of the urgent needs.

Conclusion

As tourist flow to Nameri National Park is quite meager, the probability of environmental threat from ecotourism is negligible. However, difference of tourist flow in the areas of fragile wilderness of the park will create problem in near future. What matters is not the numbers of visitors, but the type of visitors and the nature of resource use. Increasing vehicular pollution, associated with the rising number of visitors, is certainly matter of great concern. So, increasing pressure from tourism will be one of the causes to threaten the fragile ecosystem, unless ecotourism and associated activities are managed in sustainable ways. The pressure from tourism can also be minimized by diverting tourist flow to the other areas of Assam having similar nature of tourist attraction and by adopting sustainable ecotourism strategy.

Assessment of women empowerment of destinations reveals that there are as many as two very high empowered areas and three high empowered areas for ecotourism development and there are also as many as three moderate empowered areas for ecotourism venture. Hence, there is ample scope for decentralized development by using ecotourism as means of economic development of the area.

Sound community development and sustainable management and conservation mechanisms of natural resources in the area should take place alongside nation-wide micro and macro-economic frameworks in localities around Nameri National Park. This would help to women nearby the park to attain long term financial sustainability in near future.

It may also be noted that development of ecotourism in Nameri National Park cannot be thought without considering women involvement in this interventions. Hence an integrated approach for ecotourism development is an urgent need to exploit the tourist potentiality of the area. Nameri National Park being a centrally located in Assam has a key role to play in this regard.

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Regional Development in Patkai Hills : A District Level Analysis

Benjamin L. Saitluanga
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Abstract *: Regional development concerns with development of regions and reduction of regional inequality for balanced and inclusive development. Throughout the world, the process of development has been accompanied by inequality at various scales but with unequal intensity. In this paper, an attempt has been made to study pattern of intra-regional inequality in various dimensions of development in Manipur, Mizoram and Nagaland at district level. With the help of Z-score method, composite indices have been developed to measure levels of development. It has been found out that capital districts were more developed while peripheral and border districts were less developed in various dimensions of development. There were three (3) clusters of relatively more developed districts viz. Imphal cluster, Aizawl cluster and Kohima-Dimapur cluster.*

Keywords*: Regional Development, Patkai Hills, Z-Score Method, Spatial Inequality*

Introduction

Geographers have maintained that the main themes of geographies of development are about relationships between people, environment and places in different locations and at variety of scales (Potter et. al., 2004). After the emergence of radical geography during the 1970s, regional development has been associated with uneven development and features of regions has been seen as economic and highly structured if not even materially determined (Baerrnholdt, 2009). Regional development, therefore, is about balanced development at a regional scale with sustainable relationship between human and the environment. Although the term 'sustainability' remains problematic both analytically and practically, it may define the process of regional development because of the changing paradigm of development that inclines towards the progress of humanity. The United Nations also stressed the need of policies for sustainable regional development for attaining balanced development between urban and rural habitats (UN-Habitat II, 1996).

Regional problems are most complicated and acute in former colonial and dependent colonies (Lavrov & Sdasyuk, 1988). Development process failed to provide adequate benefits to all people across a region or space. Certain spaces are deprived and neglected while certain regions are favoured. Thus, one of the biggest challenges of development is reduction of increasing social and spatial inequalities. Northeast India is one of the most problematic regions in the country. The region

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is a dependent territory where capital has been funneled from the central government which in turn has been appropriated and accumulated at major towns and cities. Therefore, it may be presupposed that there are regions within the region that vary among themselves in levels of dimensions of development. An inquiry into the problems of development of 'regions' is thus needed which, however, does not necessarily involved the traditional descriptive method as advocated by regional geographers. In this paper, an attempt has been made to study pattern of intra-regional inequality in various dimensions of development at district level in Manipur, Mizoram and Nagaland collectively known as the Patka Hills in geographical terminology. From the available data, pattern of spatial development was found out by measuring levels of economic, health, education, infrastructural developments as well as development of basic household amenities. An attempt has also been made to inter-correlate the indices of development.

Sources of Data

One of the main problems of quantitative study on Northeast India is lack of data. Data were collected from a number of reliable sources. The main sources of data are:

1. Census of India 2001.
2. Reproductive and Child Health-Rapid Household Survey 1998-1999.
3. Nagaland Statistical Handbook-2004.
4. Statistical Abstract of Manipur-2002, 2004.
5. Mizoram Statistical Handbook-2004, 2006.
6. Indian States at a Glance 2006-07: The North-East and Sikkim.
7. District Elementary Education Report Card-2005-06.
8. North East Development Finance Corporation (NEDFi) Databank

Methodology

Firstly, a composite index called Z-score was calculated to measure levels of various dimensions of development. The method used to find out the composite index may be explained as-

(i) Data obtained from secondary sources were transformed into variables to be used as indicators.

(ii) To transform data matrix into scale free matrix, indicators were standardised by subtracting the mean from each individual variables and divided by their standard deviation as-

$$Z_i = (X_{ij} - X_j)/ SD_j$$

Where Z_i is the Z-score for the i^{th} unit, X_{ij} is the X variable in the i^{th} unit and j^{th} variable, X_j is the mean of j^{th} variable and SD_j is the

standard deviation of the j^{th} variable

(iii) After obtaining Z-score for every indicators, composite score was obtained by adding up of all individual Z-score or standardised data as-

$C = \sum Z$

Where C_i is the composite score and $\sum Z$ is the summation of Z-scores.

Secondly, coefficient of variation (C.V.) was employed to find out disparity in index of urbanisation and other indices of development. The formula of Coefficient of Variation is

$C.V. = SD_j \times 100/X_j$

Where SD_j and X_j are the standard deviation and mean of the j^{th} variable respectively.

Thirdly, Pearson's product moment correlation was used to test the relationship between urbanisation and regional development. Pearson's coefficient of correlation tells us the degree and magnitude of the association between two or more variables. Theoretically, the formula for Pearson's coefficient of correlation(r) can be given as-

r =dx.dy/N$x.$y

Where, dx and dy are the deviations from the mean of x and y variables respectively. $x and $y are the standard deviations of x and y variables respectively and N is the number of districts. A computer-based programme called Statistical Package for Social Scientists (SPSS) was employed to find out the correlation coefficients.

Selected Indicators of Development

A. Indicators of Economic Development

1. Yield of paddy (Kg/hectare) (Yield)
2. Percentage of settled (paddy cultivation and terrace farming) cultivated area to total geographical area (PerAgri)
3. Percentage of net sown area to total geographical area (Netsown)
4. Percentage of workers in secondary sector (Popsec)
5. Percentage of workers in tertiary sector (Popser)
6. No. of Small scale industrial units/100 km2 (SSI)
7. Per capita income (PCI)
8. Per capita amount of bank deposit (PCB)
9. Average annual growth rate of employment (1991-2001) (GrEmploy)

B. Indicators of Educational Development

1. Percentage of graduate to total population within the age group

of 20-35 years (Graduate)
2. Female literacy rate (Femlit)
3. Percentage of female teachers in primary school (Femteach)
4. No. of high schools and higher secondary schools/1000 population (SSchool)
5. No. of colleges/ lakh population (College)

C. Indicators of Health Development:

1. Number of hospital/1000 population (Hospital)
2. Number of Hospital beds/1000 population (Hosbed)
3. Percentage of fully immunised infants (age group 12-25 months) (Imunised)
4. Under-5 survival rate (Infsurviv)
5. Percentage of women aware of AIDS/HIV (Aids)
6. Percentage of birth delivered in government hospitals to total birth (Delivery)

D. Indicators of Infrastructural Development:

1. No of post office/1000 population (Post)
2. No. of hotels and tourist lodges/ 1000 households (Hotels)
3. Percentage of village connected by paved approach road (PvRoad)
4. No. of Banks/1000 Population (Bank)
5. Road density (km/km2) (RdDensity)

E. Indicators of Development in Household Amenities:

1. Percentage of households using Liquefied Petroleum Gas (LPG)
2. Percentage of households having drinking water facilities (DrinkingWater)
3. Percentage of households having electric connection (Electric)
4. Percentage of households having permanent house (House)

Limitations of the Study

The present study is based on secondary data collected from government publications and other reliable sources. Unlike other parts of the country, micro-level secondary data on Northeast India are inadequate and temporal data are particularly unavailable due to constraints of capital and human resources. Moreover, apart from the Census of India 2001 data, most of the variables used as indicators of development in the present study were collected during 1998-2006 and, having no other alternatives, we took the liberty to put the year of the study as 2001.

Findings and Analysis

Economic Development

Economic development in the region is largely determined by geo-spatial attributes including topography, transportation network and distance from market centers. It was observed that coefficients of variations (CVs) were relatively high for indicators like number of SSI

units per 100 sq. km, percentage of settled cultivated area to total geographical area and per capita bank deposit as shown in Table 1 below. SSI units and settled cultivated area were highly concentrated in certain districts like Imphal West and Imphal East. However, non-agricultural activities were not highly productive as indicated by lower disparity in per capita income.

As shown in Table 2, Imphal West in Manipur was the most developed district in Patkai Hills in terms of economic development followed by Imphal East, Dimapur, Thoubal and Bishnupur. All of these districts are located in plain areas. The plains were economically more developed due to their advantageous location for carrying out industrial establishments, availability of agricultural surplus, lower transportation costs and higher population concentration. On the other hand, hill districts have performed lower in comparison to plain districts. Absence of large-scale industries, unproductive agriculture, hostile environment, higher transportation cost and higher labour cost are the main problems of hill areas.

It may be mentioned that a few medium and large-scale industries were established in Nagaland and Manipur. But, they were either sick or non-functioning mainly because of scarcity of raw materials and small size of local markets, non-inculcation of geographical factors in localisation (Yumnum, 2005), inadequate management as well as lower technology to compete with industries in other parts of the country. In the absence of manufacturing sector, employment opportunities as well as investment alternatives were limited.

Handloom and handicraft

Table 1. Descriptive Statistics of Economic Development Indicators

Sl. No.	Indicators	Mean	Std. Dev.	CV	Min.	Max.
1	Yield	2023.11	1023.07	50.57	1126.26	5125.09
2	PerAgri	8.26	12.95	156.82	0.14	43.07
3	Netsown	11.89	12	100.94	2.19	43.07
4	Popsec	4.78	4.42	92.51	1.37	16.56
5	Popser	28.39	12.82	45.13	9.8	52.82
6	SSI	0.66	1.94	292.5	0.01	9.92
7	PCI	25885.9	14473.9	55.91	9172	74669.8
8	PCB	6978.75	10069.8	144.29	511.59	26484.91
9	GrEmploy	3.46	2.22	64.3	-4	7.57

industries are the main traditional industries in the region. However, in spite of the long occupation with cotton and cotton products, handloom and handicraft industries have hardly developed in the region. In a survey taken by the Registrar General of India during the 1980s, it was reported that handloom weaving in Nagaland was seriously underdeveloped and non-lucrative mainly due to less demand and low price. more than 50 per cent of the sample Naga households have taken up the industry only to preserve customary heritage and not a single non-practising household like to take up weaving as occupation (Census of India, 1981a), Similar problems were also found in the survey of handicrafts in Mizoram during the same period. It was reported that in Mizoram, more than 82 per cent of households engaged in handicraft reported Jhum as their main occupation due to small size scale of the handicraft industry as well as less demand and low price of their products (Census of India,1981b).

Educational Development

Disparity in educational development was relatively less acute in comparison to economic development as indicated by lower values of coefficients of variation. Table 3 shows that the highest variation was found in number of colleges per lakh population. Percentage or graduate population and female literacy rate have shown relatively lesser variations. However, the region has shown higher disparity in hard educational infrastructures like schools and colleges in comparison to soft educational infrastructures like literacy rate, percentage graduate population to total population etc.

Table 2. Levels of Economic Development, Patkai Hills, 2001

Index	Level	District
5.83 to 17.11	Very High	Imphal West, Dimapur, Imphal East
-0.73 to 5.82	High	Thoubal, Bishnupur, Aizawl, Kohima, Kolasib
-3.86 to -0.74	Medium	Zunheboto, Wokha, Mokukchung, Champhai, Lunglei, Serchhip, Churachandpur, Phek
-5.56 to -3.87	Low	Mon, Saiha, Ukhrul, Chandel, Tuensang
-6.7 to -5.57	Very Low	Lawngtlai, Mamit, Tamenglong, Senapati

Level of educational development was very high in Aizawl and Imphal West districts as indicate in Table 4. These two districts comprised Aizawl city and Imphal city which are the administrative capitals as well as the main educational centers of Mizoram and Manipur respectively. Being a location of the biggest town in Nagaland i.e Dimapur town, Dimapur district has done well in educational sector. In fact, the district contained the largest number of colleges in terms of per population among the districts under studied.

Female educational status was assumed to be higher in Manipur plains due to higher incidence of number of girl's school in comparison to other parts of the region. However, our data shows that gender gaps in literacy rate were relatively higher in these districts. On the other hand, districts like Aizawl, Serchhip, Kolasib, Champhai and Mokukchung have shown relatively higher equality in male and female literacy rates. These districts were also the most literate districts in terms of percentage of literate to total population. Therefore, it can be said that total literacy rate and female literacy rate are closely related to each other. However, gender gap was also relatively low in the least literate districts like Mon and Tuensang. As a result, it may be posited that low gender gap in literacy rate in hill tribal areas indicates absence of gender discrimination in education.

Health Development

Health is a crucial social component of development. It

Table 3. Descriptive Statistics of Educational Development Indicators

Sl. No.	Indicators	Mean	Std. Dev.	CV	Min.	Max.
1	Graduate	24.43	4.94	20.24	1.21	23.02
2	Femlit	67.53	15.62	23.14	36.4	96.3
3	Femteach	41.15	10.86	26.39	23.9	65.7
4	SSchool	2.83	1.23	43.45	0.81	5.17
5	College	2.73	1.41	51.91	0.38	6.79

Table 4. Levels of Educational Development, Patkai Hills, 2001

Index	Level	District
2.86 to 6.52	Very High	Imphal West, Aizawl, Dimapur, Champhai, Serchhip
0.77 to 2.85	High	Kohima, Kolasib, Lunglei, Saiha, Mamit, Mokukchung
-1.60 to 0.76	Medium	Zunheboto, Bishnupur, Imphal East, Wokha
-4.54 to -1.61	Low	Thoubal, Ukhrul, Phek, Churachandpur, Chandel, Lawngtlai, Senapati
-8.33 to -4.55	Very Low	Tamenglong, Tuensang, Mon

determines the productivity and longevity of a person. Health of a person largely depends on the availability of medical facilities and knowledge of health.

As shown in Table 5, Age Under-5 survival rate has shown relatively low value of coefficient of variation indicating less inequality in infant mortality rate. On the other hand, relatively higher inequalities were found among children in terms of place of delivery and immunisation. This may indicates lower incidence of health centers and problems of accessibility in certain peripheral districts like Mon, Tuensang, Chandel etc.

From Table 6, it may be observed that districts like Serchhip, Kolasib, Imphal West, Saiha and Imphal East have performed better in health sector. The pattern is slightly different from other development indices since Serchhip and Kolasib districts have topped the list of districts. In Serchhip district, hospitals per 1000 population and hospital beds per 1000 population were relatively high. This may be due to small size of the population in a highly compact settlement

Table 5. Descriptive Statistics of Health Development Indicators

Sl. No.	Indicators	Mean	Std. Dev.	CV	Min.	Max.
1	Hospital	0.07	0.03	45.07	0.01	0.14
2	Hosbed	1.33	0.76	57.44	0.19	2.82
3	Imunised	26.68	19.57	73.36	0	57.8
4	Infsurviv	903.51	25.01	2.769	853	943.3
5	Aids	85.17	13.35	15.68	45.79	99.6
6	Delivery	28.8	22.19	77.03	1.83	84.34

Table 6. Levels of Health Development, Patkai Hills, 2001

Index	Level	Districts
4.54 to 6.91	Very High	Serchhip, Kolasib, Imphal West, Saiha, Imphal East
0.91 to 4.53	High	Champhai, Mamit, Aizawl, Bishnupur
-1.66 to 0.90	Medium	Phek, Lunglei, Thoubal, Kohima
-4.45 to -1.67	Low	Dimapur, Churachandpur, Tamenglong, Wokha, Ukhrul, Mokukchung, Zunheboto
-6.17 to -4.46	Very Low	Senapati, Chandel, Mon, Tuensang, Lawngtlai

pattern found in the district. Besides, the district has the highest score in percentage of fully immunised children between 12-35 months. As a result, the district has also scored very high in age under-5 survival rate. Percentage of women with knowledge regarding AIDS to total female population was also relatively high. Imphal West and Imphal East districts have relatively higher percentage of fully immunised children and delivery of birth in government hospitals. Due to prevalence of AIDS, awareness of AIDS among women was also very high in these districts.

On the other hand, relatively low levels of health development were found in districts like Senapati and Chandel in Manipur, Mon and Tuensang in Nagaland and Lawngtlai in Mizoram. These districts were particularly underdeveloped in knowledge regarding health as shown by low immunisation ratio and delivery of birth in government hospitals. As a result, under-5 survival rates were low in these districts. In a survey taken at Mon district by PRATHAM (2006), more than 70 per cent of pregnant mother do not take iron tablets and perform pre-natal check up even once during pregnancy.

Problems of health development in these remote districts are lack of infrastructures and ineffective management of the existing infrastructures. It may be noticed that availability of hospital and hospital beds per thousand populations were very low since rural populations were dispersedly distributed in numbers of small villages. As a result, the only hospitals, most of which are found in district capitals are relatively less accessible for villagers. Many villages were not connected by paved approach road and villagers have to traverse rugged hill roads by foot to avail medical facilities in towns. For instance, only 12 per cent of total villages in Lawngtlai district in Mizoram had been connected by paved approach road. All these problems were reflected in low immunisation rates, lower percentages of birth delivered in hospitals and lower survival rates for age group under-5 population.

Infrastructural Development

Infrastructural services mainly include public utilities and public works like power, roads, telecommunication, irrigation, dams, sanitation and sewerages and others (World Bank, 1994). The study area is known as one of the least developed regions in terms of infrastructural development. The Twelfth Finance Commission Report (2004) has categorised the entire Northeast region under low infrastructural development category.

As shown in Table 7, peripheral districts like Mon, Tuensang and Lawngtlai with single directed

transport route towards their capital cities have low levels of hotels/ lodges per 1000 households. Density of roads and availability of bank per 1000 population has shown relatively higher variation among the infrastructural indicators. On the other hand, villages having paved approach roads did not show comparable disparity with density of road.

As shown in Table 8, Imphal West district was the most developed district in terms of infrastructural development. The district excelled in indicators like percentage of village connected by paved approach road, incidence of bank per 1000 population and has also done fairly in number of hotels and tourist lodges. Imphal West was followed by other plain districts like Thoubal, Imphal East and Bishnupur. All hill districts were ranked lower than plain districts. Hill areas have geographical disadvantages that limit allocation of infrastructural services. It may also be maintained that plain districts were smaller in geographical size and their villages were more clustered. This problem

Table 7. Descriptive Statistics of Infrastructural Development Indicators

Sl. No.	Indicators	Mean	Std. Dev.	CV	Min.	Max.
1	Post	0.486	0.328	67.55	0.096	1.425
2	Hotels	4.01	1.977	49.22	1.19	9.38
3	PvRoad	46.93	21.76	46.36	12.95	92.11
4	Bank	0.725	0.598	82.4	0.113	1.994
5	RdDensity	0.592	0.479	80.94	0.104	1.75

Table 8. Levels of Infrastructural Development, Patkai Hills, 2001

Index	Level	Districts
2.72 to 6.02	Very High	Thoubal, Imphal West, Bishnupur, Imphal East
-4.03 to 2.71	High	Ukhrul, Senapati, Mokukchung, Tamenglong, Saiha, Phek, Zunheboto
-1.78 to -4.04	Medium	Dimapur, Kohima, Churachandpur, Mamit
-3.81 to -1.79	Low	Tuensang, Chandel, Champhai, Kolasib, Serchhip, Aizawl, Lunglei, Wokha
-4.99 to -3.82	Very Low	Mon, Lawngtlai

of comparison of incompatible spatial units, known as "ecological fallacy" is inherent in regionalisation process.

In Mizoram, level of infrastructural development was low in comparison to other dimensions of development. Interestingly, relatively less developed districts like Saiha and Mamit have done better in comparison to relatively more developed districts like Aizawl, Serchhip and Kolasib which, may possibly due to low population base. Similar pattern was also observed in Nagaland. Less developed districts like Phek, Tamenglong and Mokukchung were ranked higher than more developed districts like Dimapur and Kohima. However, since some of the less developed districts have comparable sizes of population with more developed districts, it may also be due to the presence a number of small settlements scattered in these districts. These villages were provided with basic infrastructural facilities like post offices, paved roads and other facilities and services.

Development of Household Amenities

Household amenities are also infrastructures but pertaining to households. A separate index has been constructed for household amenities because it shows not only the regional allocation of these amenities but also reflects the average household income. In fact, household amenities may be employed as a proxy for income (Filmer & Pritchett, 2001; Rutstein & Johnson, 2004). Allocation and development of household amenities depend on both the State government and the income level of a particular household.

In the study area, percentages of households having LPG and permanent houses were unequally distributed. The reason is that these two amenities were costly and not easily accessible for poorer section of the people as indicated by the lower percentages of households having these two amenities. It can also be seen that relatively less developed and urbanised districts like Tamenglong, Phek, Mon, and Tuensang have the lowest

Table 9. Descriptive Statistics of Indicators of Household Amenities

Sl. No.	Indicators	Mean	Std. Dev.	CV	Min.	Max.
1	LPG	16.76	16.46	98.24	0.68	66.02
2	Drinking Water	36.85	15.42	41.85	5.56	77.28
3	Electric	59.61	18.6	31.21	30.55	90.18
4	House	21.02	19.92	94.79	1.63	71.83

percentages of households having these amenities.

Aizawl and Serchhip districts were the most developed districts in terms of household amenities followed by Imphal West, Kolasib and Lunglei districts (Table 10). Except Imphal West, all the high ranking districts were found in Mizoram. As usual, remote districts like Tamenglong, Lawngtlai, Chandel and Mamit were the least developed districts.

Provision of drinking water is a big problem in the Patkai Hills and is intertwined with its geography and political economy. Out of 25 districts in the study area, only four districts have more than 50 per cent household availing to drinking water facilities, the highest district is Phek (77%) while the lowest district is Mamit (5.5%). It may also be noted that about 50 per cent of the total household in average could avail drinking water even in the most developed districts like Aizawl, Serchhip and Imphal West. It has been argued that household having access to safe drinking water in the region is low because people are taking water from springs and rivers (Kundu, et al., 1999). This is particularly true in villages but in large and medium cities, springs and rivers are either polluted or not adequate to supply the burgeoning population.

Electricity is another infrastructural backlog of the region. Although, the region has huge untapped hydro-power resource, the installed capacity in each state is very low. In terms of access, while more developed districts like Aizawl and Serchhip have more than 90 per cent of total household accessing electricity, districts like Mon, Mamit and Saiha have only about 30 per cent households having electric connection. It may however be mentioned that regional variation in electricity may be best measured in terms of power consumption rather than mere physical connectivity for which data is not available at district level.

Table 10. Levels of Development in Household Amenities, Patkai Hills, 2001

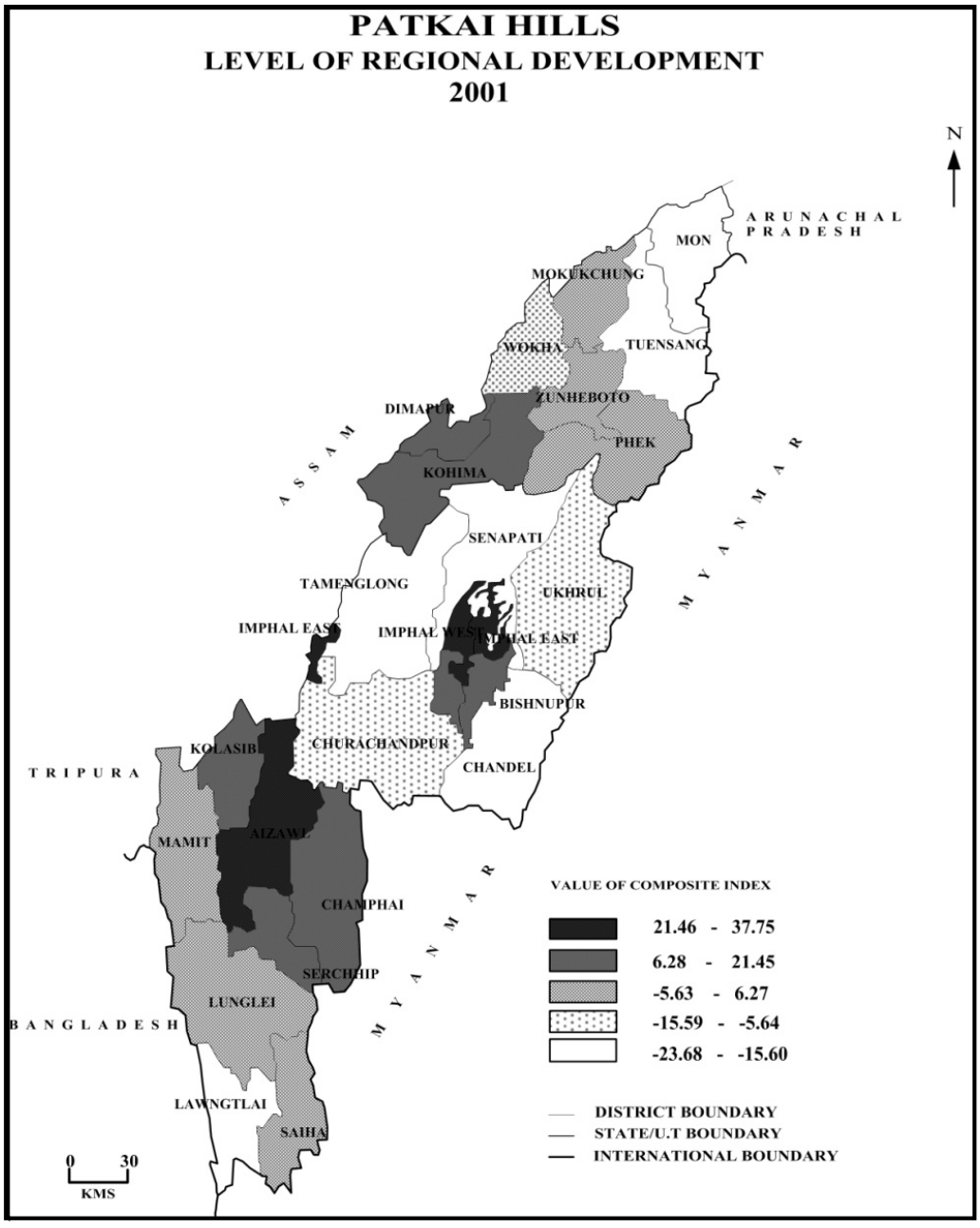
Index	Level	Districts
3.09 to 7.84	Very High	Aizawl, Serchhip, Imphal West
0.39 to 3.08	High	Kolasib, Lunglei, Phek, Kohima, Dimapur, Imphal East, Mokukchung, Champhai
-1.43 to 0.38	Medium	Bishnupur, Zunheboto, Saiha,Wokha
-3.23 to -1.44	Low	Tuensang, Mon, Ukhrul, Churachandpur, Thoubal, Senapati
-4.4 to -3.24	Very Low	Mamit, Chandel, Lawngtlai, Tamenglong

Regional Pattern of Development

As shown in Figure 1, Imphal West was the most developed district in the region followed by Aizawl, Imphal East, Dimapur, Kolasib, Serchhip and Bishnupur. The relatively higher level of development of Imphal West district may be attributed to its long history of occupancy by the Meitei kings and the city was the seat of the Meitei kingdom which can be traced back to as early as in 33 A.D. (Kabui, 1973). During the colonial period, Imphal city became the British administrative headquarters and in 1901, Imphal was already an urban center with a population of 71.342. At this time, there were only 3000 population in Kohima in Nagaland which was the second biggest settlement in the region. With its more advantageous location on the central plain of Manipur, Imphal city and the district has been growing proportionately in the post-independence period. Settlements tended to concentrate around the Imphal city, mainly along transportation routes. Till today, the former seat of the Meitei kingdom is the primate city mainly due to centralisation of all government machineries and public institutions. Aizawl district in Mizoram was the second most developed district in the region mainly due to the presence of Aizawl city. Like Imphal city in Manipur, the city has been accumulating all administrative offices, public institutions and Church machineries. Development impulses from the city have been reaped by the outlying villages as well as those districts located at major transport routes linking to the city like Kolasib and Serchhip as already explained in the previous sections. On the other hand, other districts located at remote distances from the capital city were the least developed ones.

On the other hand, Mon, Lawngtlai, Tuensang and Senapati were the least developed districts in the study area. These districts are mainly peripheral districts located far away from the major cities. The relative backwardness of Mon and Tuensang districts in Nagaland may be attributed to the long absence of formal administration. During the colonial regime, these areas were declared 'unadministered areas' and came under effective administration only after formation of the Naga Hills-Tuensang Area (NHTA) in 1957. The relative backwardness of these districts in terms of educational development may also be attributed to the late arrival of the Christian missionaries (Nagaland Human Development Report, 2004). During the colonial period, Lawngtlai district was one of the two gateways of the whole Mizoram but grossly neglected after Independence due to the formation of Bangladesh thereby closing the traditional route

Figure 1. Level of Regional Development, Patkai Hills, 2001



of interaction with the outside world.

Conclusion

From the above discussion, it may be observed that the region denies the conventional notion of lower chance of inequality in a small region (Kuznetz, 1960) as a considerable extent of spatial inequality has been found in the region. Moreover, spatial pattern of development follows Tobler's first law of geography which states that, 'everything is related to everything else but nearby things are more related than distant things' (Tobler (1970). A closer look at the above Figure 1 reveals that there were three (3) clusters of relatively higher developed districts viz. Imphal cluster, Aizawl cluster and Kohima-Dimapur cluster. On the other hand, peripheral districts were relatively less developed due to fewer spillovers from the cores of these clusters. The most discernable pattern of development, however, is the underdevelopment of those districts adjacent to international and inter-state borders but without any interconnectivity due to absence of transport routes. Most of these districts are located in the eastern and western parts of the region.

The relative backwardness of the Patkai Hills may be attributed to the complex outcome of the region's history, geography, culture and political-economy. These interrelated barriers of development did help to accentuate intra-regional inequalities in various sectors of development. The spatial and sectoral imbalances started during the colonial period were not rectified after the Independence. National Highways have evolved on the former colonial expedition routes which connect only the administrative towns. Districts lying on National Highways have initial advantage to other districts. On the other hand, absence of good transport network has created peripheries in this peripheral region. International border districts like Lawngtlai, Saiha and Mamit in Mizoram; Mon, Tuensang and Phek in Nagaland; Ukhrul and Tamenglong in Manipur were opened inwards but closed from the neighbouring countries. Secondly, those former colonial outposts became important administrative-cum-market centers thereby creating avenues for government and private informal jobs and induced rural-urban migration. As a result, capital districts like Imphal West, Aizawl and Kohima are the most developed districts in their respective states. However, these capital cities could not trickle down development impulses to rural and peripheral areas since they also suffer from serious lack of infrastructural facilities.

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