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WATERSHED MANAGEMENT A PEOPLE CENTRIC ALTERNATIVE STRATEGY

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***Abstract**: Policy makers and managers of resources strive to arrive at a strategy and functional models of development that may be diffused to the mass of people. Numerous models and strategies have been discussed, adopted and implemented. Some models emphasize economic growth based on a doctrine of multiplier effects on consumption through propensity, to be the instrument of development by accepting market forces guided either by free competition or with Government intervention. They, however, are found to have been leading to greater concentration of wealth and control of resources just the opposite of what protagonists of development have been suggesting. They are also found to go against the broader limits set by the natural environment and being counter productive. A development plan based on the resource bases of watershed units representing homogeneity of environmental characteristics may just provide an alternative to the sponsored strategies by active participation of the local inhabitants and who are considered to be the best judges of their own resource endowments and who seek social and economic empowerment. The present paper following a field study is an attempt to highlight the significance of watershed as a planning unit especially in hill terrains where mobility of people, commodity and resource utilization are controlled and directed by the topographical attributes hence level of their development.*

Introduction

Watersheds represent the spatial variations in geo-bio-chemical dispositions and accordant adjustment by the communities living therein. It is exhibited in the quality of life in the area.

A reasonably comprehensive and rational plan for the management of the watersheds is aimed at social and spatial policies aimed at reducing interpersonal/interregional inequalities because watershed management plans are supposed to be self supporting, integrated and holistic.

Watershed management plans envisage involvement and active participation of local communities in resource management hence evolution of development plans from the grassroots level.

It, therefore, is expected and is capable of providing an alternative strategy for the well-being of mankind not only within the watersheds but also beyond, at state and na-

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tional level.

Advantage of watershed planning lies in the fact that hierarchic system of smaller basins (micro watersheds) fits exactly in the next larger basin and care has to be taken to safeguard the interest of the people living down stream (next micro watershed).

Watershed management strategies are expected to be eco-friendly and labor intensive involving primarily local manpower, available technology and resources.

The very concept of capital intensive concentrated large (and very often wasteful) operations is against the concept of watershed management as they have been found to direct the people in selection of vocations, more often than not, against their choice, sentiment and values.

Why alternative strategy is needed?

* Evaluation of the out come of the development strategies under prevailing paradigm appears to suggest an increase in interpersonal/ inter-regional disparities.
* Success of the strategies as propagated rests upon the optimization of cost effectiveness of resources by way of 'mass production' and its management that are centered on creation of demand, competitive market, capital-output ratio, doctrine of consumption through propensity and accelerator effect on investment as well as global regulations directed by the rich, developed and powerful economies/ persons/ administrative functionaries.
* Accepted strategies having been developed on the basis of 'Post Industrial Revolution' mercantilist theories are primarily based on the use of inanimate but capital/ investment intensive exhaustible sources of energy, efficiency of which is doubtful. It also thrives on sectored investments in scarce resources and accordant value independent economic growth and development of infrastructure which by necessity lead to concentration of activities.
* 'Profit motive' has been replacing 'labor motive' as the reigning economic philosophy. It is reinforced by ever enlarging 'monopolistic metropolis-satellite structure'.
* Common men are duped by eye catching and awe generating edifices that are meant to distract them from their own exploitation.
* Mass production and induced consumer behavior are found to be wasteful on the part of those few who are privy to it – creating a sense of deprivation and destitution in an aggravating environment of exploitation and oppression.
* Marginalization and/or underutilization of labor cause decrease in purchasing capacity of the larger mass and lead to a sense of insecurity and powerlessness.
* Governments (elected or otherwise) also suffer from a sense of insecurity and powerlessness and easily succumb to the demands of evolved economy and become sub

servient to the powerful and organized persons/groups.

* Interdependency of regions is compromised in favor of dependency at the cost of human dignity, equity, freedom of choice and participatory benefits. Common sense of people evolving out of their experience of their milieu is disregarded as it is perceived to challenge the system of existing political economy.
* Human institutions appear to have failed to keep pace with unprecedented time-space compression that characterizes the contemporary global operations.
* Development processes, more often than not, go against the principles of ecology and homoeostatic environment.
* Welfare of common man continues to be a political rhetoric and divisive.
* Disproportionately differential benefits to select group(s) is found to lead to 'development of under development'

Case of Mizoram

Mizoram born out of dissatisfaction of partisan attitude of earlier system of governance and its investment policy hardly appears to have met the aspirations of all its people. Deprivation appears to be growing and dissatisfaction brewing against growingly increasing and domineering elitism and evolution of class structure in a traditionally classless society. Adopted models of development appear to have generated unemployment/ under employment and marginality of workforce leading to reduction in purchasing capacity of the area (Table-1).

Table: 1 - Workforce composition in Mizoram (1991 and 2001)

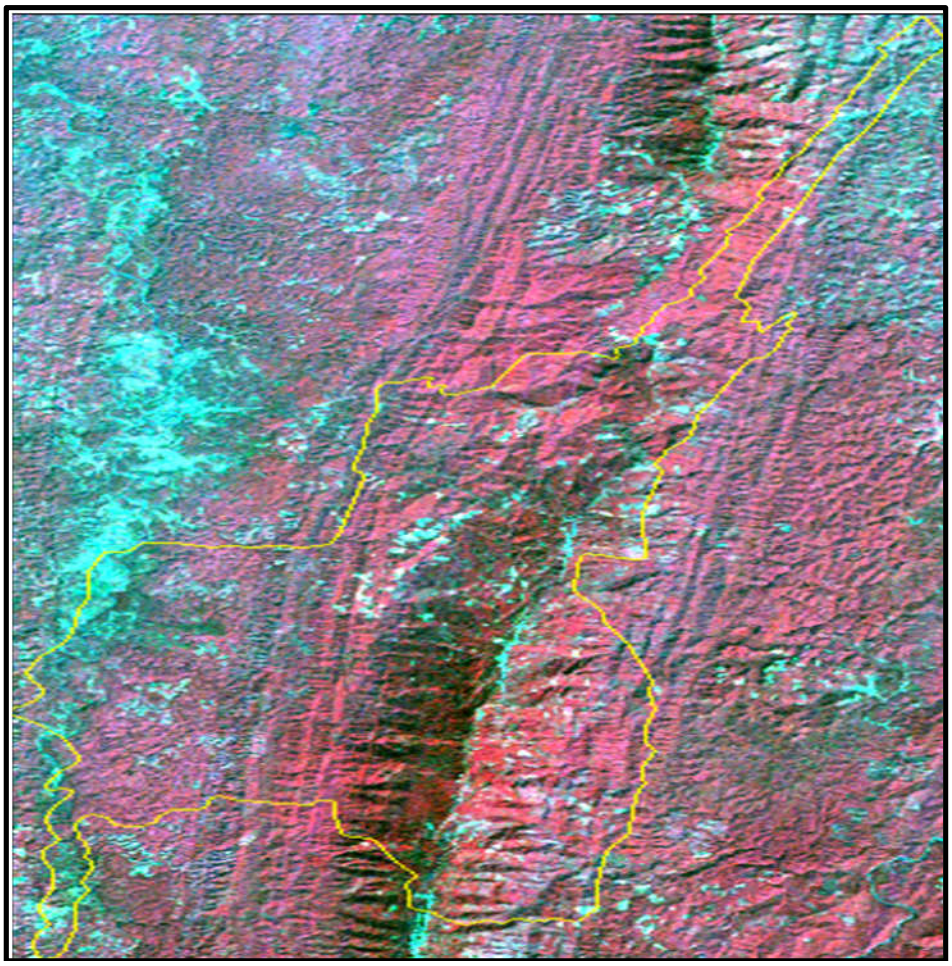
Workforce	1991	2001
Total Workers	**48.9**	**52.57**
Main Workers	**42.1**	**40.79**
Marginal Workers	**6.8**	**11.78**
Primary Sector	65.8	59.76
Secondary Sector	7.1	11.00
Tertiary Sector	29.1	30.24

The problem is aggravated as almost 50% of the total population (having a very large proportion of workers) is concentrated only in 3.14 of the state's area in its 22 urban centers. Resources spread over almost 97% of its area of and await judicious use. Mizoram with a broadly homogenous traditions and culture, unifying language, a very high literacy and people's capacity to adapt to new situations is capable of successfully implementing

strategically significant alternative plan for their own as well as community's welfare based on traditional value of co-operation.

Case of the Study Area

The study area falls broadly under the Tuichhuahen watershed occupying the space in Kolasib District. The River Tuichhahen originates near Kawnpui and travels a distance of about 31.68 km. towards north and discharges its cumulative volume of 15197.1490 m^3 in Barak river of Cachar district of Assam. The watershed extends over an area of about 26071 hactares. The average annual precipitation in the watershed is about 240 cm. (mostly received during the period of SW monsoon. Highest intensity of rainfall is received during the months of May to September.



The watershed like most part of the state of Mizoram is characterized by rough terrain wherein 27% of the area falls in the slope group of 50% and above followed by 45% under the slope group of 21% to 50%, 3% of the area has a slope ranging between 9% to21% and rest 25% below 8% of slope i.e. almost 6518 hactares. As compared to other watersheds as recognized by IRDAS, Hydrabad, Tuichhuahen watershed has proportionately the largest area under the slope category which may be maneuvered for different kind of land uses. However, the watershed is also exposed, because of injudicious use to a very high degree of soil erosion and stands 3rd on erosion index amongst all the watersheds of Mizoram. It, therefore, requires consideration and judicious planning on priority basis before the problem becomes insurmountable.

The soils under the watershed have developed mostly from tertiary deposits belonging to Surma group of rocks. They vary in their characteristics on account of differential elevation and slope.

The watershed has a relatively good cover of evergreen and mixed forest where natural and luxuriant growth of bamboo dominates, more on the lower elevations. Bamboo, therefore, may provide, if judiciously used and transformed with labor motive instead of profit motive, a supplementary resource base for the local communities who then may refrain from misusing the forest resources due to realization of higher productivity. This may require more of a best regulatory role for forest and civil servants instead of traditional path administrative governance and which have been found flawed at different levels. Taking communities/ people in good faith may also discourage the people to continue, arguably, the wasteful practice of jhum cultivation. At the same time, people/ villages must be made responsible to maintain and expand the facilities in tune with the changing population characteristics within their lawful territory once any kind of productive plans are initiated and undertaken with the initial financial help of either the governments or institutions or any funding agency. This may help people to break away from their dependency on extraterritorial agencies and help them regain self respect and dignity instead of subservience that the political economy perpetuates.

Suggestion

* The village communities based on division of labor may be encouraged to collect the seasonal crops of herbs, fruits and flowers like sunflowers as well as usable leaves from the forests without disturbing the tree stands. It is successfully practiced in Orissa where villagers have taken responsibility to protect the forest in lieu of their right to collect seasonal resources from the forests. This, it is reported, has reduced the burden of the forest managers as the villagers have been able to recognize the symbiotic relationship between their livelihood and the forest resources that is found to have

encouraged protection of forests in general.

* Labor intensive small processing units semi processing based on the specialized collection from the forests may be encouraged to be set up by the villagers either on community basis or on the basis of individual entrepreneurship in each village.
* Semi processed products after reduction in volume may then be collected at a settlement of higher order having greater accessibility and where processing unit of higher order may be set up to produce the final product ready to be transported to the market.

It is visualized that the division of unskilled labor in collection, skilled and semi skilled in processing and specialized skill of packaging and storage may discourage the local labor force to migrate. This is also believed to encourage the unified spatial relationship between rural and urban milieu which most of the contemporary models of development due to their urban bias appear to be overlooking.

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UNEVEN DEVELOPMENT AMONG URBAN CENTRES IN MIZORAM AND ITS SOCIO-POLITICAL IMPLICATIONS

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Abstract : *Urbanization in Mizoram is highly distorted. The emergence of Aizawl as a primate city has been retarding the growth of other towns. Limited opportunities for growth of urban economy, absence of decentralization and unequal distribution of urban amenities resulted into underdevelopment of smaller towns. Consequently, notions of relative deprivation and marginalization develop within certain towns that resulted into social movement for creation of new districts. The article inquires into the relationship between urban social movement and uneven development in a transitional economy. It is structured into three main parts. The first section deals with introduction and theoretical framework for the study. The second section comprises a quantitative analysis of disparity in development among urban centres and an exploration into the relationship between uneven development and social movement. The final section is conclusion.*

Introduction

Urbanization in Mizoram started during the colonial period. The British established some geographically favourable sites like Aizawl and Lunglei as administrative centre-cum-military outposts. They became the biggest urban centres in the state. By 2001, Mizoram became the most urbanized state in India with 49.65 per cent of the total population living in urban areas. This rapid growth rate of urban population have been explained as a result of grouping of villages during the Mizo National Front (MNF) rebellion (Guhathakurta, 1999; Kumar, 1998), expansion of areas of existing towns (Pachuau, 2009), high rural-urban migration as well as the notification of as many as twenty (20) villages to towns during 1971-1991[1]. It may, however, be noted that growth rate of urban population in the state is still high if we exclude these new towns, mainly due to the tremendous growth of the State's administrative capital i.e Aizawl. Therefore, in the absence of any other productive sectors, it seems that urbanization turns out to be the most important growth inducer.

In this context, it is highly necessary to inquire deeper into the urban social movement

[1] *All towns in Mizoram are Notified Towns (NT). The Census of India automatically accepted those towns which were notified by the State Government and classified as Notified Towns. Notified Towns are listed as Statutory Towns under the two-fold categorization of 'Statutory' and 'Census' towns in India.*

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that arose from certain towns demanding creation of new districts. Shortly before the State's Legislative Assembly election in 2009, there was a massive movement for creation of three new districts in Mizoram. The origins of this movement were three middle class towns viz. Hnahthial, Khawzawl and Saitual. After persuading the state government through road blocking, strikes, destruction of government buildings and processions towards Aizawl, the State government created three new districts with the above towns as district headquarters. This was not, however, the first of its kind. Similar movement, but smaller in intensity, was also witnessed before the Mizoram Legislative Assembly election in 1999. The then incumbent government, also allegedly trying to appease the voters, created five new districts viz. Champhai, Kolasib, Mamit, Serchhip, Saiha and Lawngtlai. Interestingly, all these district demand movements arose from those towns which were expecting to become district headquarters.

Theoretical Framework

Disparity in development is well known to have much political implications. Economic backwardness has often been resulted into wars, separatist movements and ethnic conflicts. It has also been observed from number of cases that regionalism and regional consciousness are deeply intertwined with underdevelopment.

Number of existing literatures suggested that disparities in development have been largely due to imbalance relationship between urban centres in the form of core and periphery. Introducing the concept of Primate City, Jafferson (1939) argued that in the early stages of a country's urban development, primate city exists, which, over time, attracts economic and political functions to the extent that it dominates the national urban system. McGee (1982) also argued that urbanization in the Third World countries is not as experienced in western countries but pseudo-urbanization in which city grows as a result of peripheral underdevelopment. In India, urban geographers have been fiercely suggesting that large cities are detrimental to the growth of other towns and villages (see Moonis Raza et. al., 1981; Kundu, 1983; Habeeb, 1987). They have argued that the regional structure of urbanisation in the country is highly distorted and the primate and metropolitan cities have grown at the cost of lower size class towns as a result of which "economic surplus gets geographically concentrated" through patterns directed by movement of goods and services (Habeeb, 1987). They considered this highly concentrated pattern unhealthy for balanced regional development and pleaded for active government intervention to correct the lopsided development.

In the context of social movement, most researches on urban social movements concentrated on movements within the city. However, urban social movement may encompass all sections of the local population. This kind of movements may be due to domina-

tion and subjugation of smaller urban centres by bigger cities as a result of geography (topography, distance, density etc) and/or the role of the state in differential distribution of political and economic functions. This may likely to happen in backward regions where one or two cities is/are large enough to inhibit growth of other towns and villages.

Deviating from most empirical researches on social movements that 'frequently attempts to extrapolate a movement's locationally-specific experience to a general theory of social movement practice without due consideration of a particular spatial and cultural context' (Routledge, 1992), the present paper focuses on the effects of differential allocation of amenities and of the reasons why particular movements arise in particular places.

Objective of the study

The present analysis attempts to answer the following questions:

1. To study spatial disparity in socio-economic development of urban centres in Mizoram.
2. To explain the relationship between disparity in development and the emergence of socio-political movements within certain urban centres.

Research variables

Selection of variables largely depends on the reliability and availability of data. Some important variables could not be included due to unavailability and unreliability. Variables included in the analysis are-

* Percentage of population engaged in non-agricultural sectors (WPR)
* Percentage household availing LPG (LPG)
* No. of hospital beds per 1000 population (HB)
* Percentage household having water closet latrine (WC)
* No. of banks per 1000 population (BANK)
* Percentage household having Electric connection (HE)
* Female literacy rate (FL)
* Percentage household having permanent house (PH)
* Population Growth Rate (GR)
* Percentage household having closed drainage (CD)

Data Base and Methodology

Data are secondary data taken from the following sources-

* Census of India - 2001
* Statistical Handbook of Mizoram (SHM)-2002
* Handbook of Health and Family Welfare Department, Mizoram - 2002

To study spatial disparity, principal component method (PCA) is used. To calculate PCA, firstly, raw data are normalized with the following formula:

$N_{ij} = 1 - [\text{best } X_{ij} - \text{observed } X_{ij}] / R$

where R = best X_{ij} - worst X_{ij}, I = i^{th} observation and j = j^{th} town. The normalized values are given in Table 1.

Secondly, factor loadings and weights are to be assign to these normalized values. For this, Statistical Package for Social Sciences (SPSS) is employed to obtain initial eigen values which is more than one. They are 3.617, 2.195 and 1.813. These eigen values are used to obtain weights of the variables. The weights of the indicators are given in Table 3.

Thirdly, after weights are assigned to each indicator, an index is determined with the help of the following formula:

$$I = \sum X_i (\sum | L_{ij} | .E_j) / \sum (\sum | L_{ij} | .E_j)$$

Where I is the index, X_i is the i^{th} indicator, L_{ij} is the factor loading of the i^{th} variable on the j^{th} factor; E_j is the eigen value of the j^{th} factor.

Table 1: Normalised Values of the IndicatorsFindings

TOWN	WPR	LPG	HB	WC	BANK	HE	FL	PH	GR	CD
Aizawl	1.000	1.000	0.182	1.000	0.090	0.913	0.898	0.924	0.888	0.618
Bairabi	0.288	0.184	0.167	0.301	0.367	0.000	0.269	0.000	0.723	0.306
Biate	0.046	0.000	0.991	0.070	0.000	1.000	0.750	0.817	0.086	0.137
Champhai	0.419	0.637	0.107	0.313	0.092	0.669	0.435	0.657	0.577	0.141
Darlawn	0.317	0.381	0.133	0.161	0.313	0.960	0.435	0.536	0.263	0.523
Hnahthial	0.485	0.420	0.260	0.259	0.339	0.957	0.481	0.818	0.600	0.004
Khawhai	0.000	0.037	0.051	0.405	0.504	0.855	0.528	0.500	0.501	0.000
Khawzawl	0.492	0.352	0.257	0.208	0.111	0.785	0.287	0.649	0.376	0.036
Kolasib	0.593	0.828	0.000	0.341	0.191	0.637	0.704	0.439	1.000	1.000
Lengpui	0.316	0.341	0.119	0.185	1.000	0.548	0.426	0.226	0.793	0.276
Lunglei	0.813	0.675	0.254	0.575	0.129	0.918	0.861	1.000	0.684	0.484
Mamit	0.389	0.306	0.430	0.111	0.237	0.513	0.750	0.483	0.659	0.006
N.Kawnpui	0.307	0.495	0.391	0.042	0.187	0.565	0.759	0.258	0.842	0.075
N.Vanlaiphai	0.240	0.515	0.169	0.153	0.370	0.929	0.713	0.636	0.415	0.065
Saiha	0.772	0.702	0.211	0.000	0.175	0.274	0.343	0.451	0.857	0.391
Sairang	0.610	0.580	0.085	0.258	0.241	0.446	0.657	0.142	0.821	0.291
Saitual	0.366	0.392	0.144	0.154	0.221	0.814	0.741	0.498	0.630	0.157
Serchhip	0.422	0.709	0.122	0.369	0.213	0.800	0.639	0.758	0.542	0.173
Thenzawl	0.243	0.552	0.358	0.043	0.220	0.482	0.815	0.613	0.501	0.165
Tlabung	0.675	0.057	1.000	0.086	0.000	0.045	1.000	0.059	0.476	0.053
Vairengte	0.472	0.473	0.235	0.122	0.314	0.327	0.176	0.128	0.740	0.111
Zawlnuam	0.361	0.172	0.182	0.178	0.777	0.682	0.000	0.007	0.000	0.054

Findings

Analysis of principal component reveals that district headquarters like Aizawl, Lunglei, Kolasib, Serchhip etc are better off are than other towns. These towns are also the biggest urban centres in terms of population. Allocations of district headquarters might have multiplier effects leading to socio-economic development and increase in population. It may also reflect the importance of public administration in the regional economy in the absence of other productive sectors.

Table 2: Ranking of Towns by Level of Development on the basis of Principal Component Analysis (PCA)

Rank	Town	Class	District	Index
1	Aizawl **	I	Aizawl	0.763
2	Lunglei*	III	Lunglei	0.639
3	Kolasib*	IV	Kolasib	0.578
4	Serchhip*	IV	Serchhip	0.472
5	Hnahthial	V	Lunglei	0.455
6	Saiha*	IV	Saiha	0.438
7	Sairang	V	Aizawl	0.419
8	Champhai*	III	Champhai	0.410
9	Lengpui	VI	Mamit	0.405
10	N.Vanlaiphai	VI	Serchhip	0.403
12	N.Kawnpui	V	Kolasib	0.396
13	Thenzawl	V	Serchhip	0.395
14	Mamit*	V	Mamit	0.386
15	Darlawn	VI	Aizawl	0.384
16	Biate	VI	Champhai	0.373
17	Tlabung	VI	Lunglei	0.357
18	Khawzawl	IV	Champhai	0.355
19	Vairengte	V	Kolasib	0.323
20	Khawhai	VI	Champhai	0.311
21	Bairabi	VI	Kolasib	0.267
22	Zawlnuam	VI	Mamit	0.221

*** corresponds to administrative capital*

** correspond to district headquarters*

From Table 3, it may be seen that Liquefied Petroleum Gas (LPG) plays an important role in disparity in development. LPG may be taken as a proxy for per capita income. Higher income groups may avail to LPG while lower income groups still depending upon firewoods and kerosene. Other variables like Population Growth rate (Gr), Number of Hospital Beds per 1000 population (HB) and Work Participation Rate (WPR) also play important roles. Decadal Population growth rate (Gr) shows the size and attractiveness of a particular town. Higher HB value signifies the importance of basic amenities for growth and development of towns. WPR is also an important indicator of urbanization as it relates to a shift from agriculture to non-agriculture activities.

Table 3: Weights of Variables estimated by using Principal Component Aalysis

Sl. No.	Variables	Weight	Sl. No.	Variables	Weight
1	LPG	3.789	**6**	PH	3.081
2	GR	3.663	**7**	CD	2.994
3	HB	3.661	**8**	HE	2.61
4	WPR	3.465	**9**	FL	2.557
5	WC	3.314	**10**	BANK	2.409

Although the above statistical analysis could not directly explain the relationship between socio-political movement and uneven development, it clearly shows that acute disparity in development exists among towns of Mizoram. Therefore, it may not be surprising to see certain bigger towns demanding district headquarters since expansion of administrative sector and concomitant urbanization are the only options that could induce growth. Certain settlements are growing more rapidly mainly due to allocation of administrative functions and comparative locational advantages. Therefore, disparity in growth of population and development increases and that resulted into movements for demand of districts.

Uneven Development and Urban Social Movement

One of the most crucial factors of popular grievances that turn into demand of districts was disparity in development among towns and particularly, the increasing polarization between Aizawl and other towns. The primate-capital city, Aizawl has been growing very fast in comparison to other towns. Founded only in 1890, the population of Aizawl increases from less than 7,000 persons to more than 2.2 lakh persons during 1951-2001. Presently, it comprises 49 per cent of the state's urban population. On the other hand, the second biggest town i.e. Lunglei comprises only 10.78 per cent of the total urban popula-

tion (SHM-2008). The accumulation of capital, human and infrastructural resources in the State's capital has been one of the main reasons of popular discontent like demand of creation of districts. Aizawl has been highly favoured and has been growing at the cost of depriving other towns. Other towns are deprived of urban infrastructures and basic amenities and are not able to attract migrants. Therefore, most of the notified 'development' towns failed to induce migration as they are not in a position to deliver basic infrastructural amenities.

Apart from spatial imbalance in development, Mizoram model of development is characterized by sectoral imbalance with relatively high level of social development and low economic growth. In a highly mobile and network society with relatively high literacy rate and high urbanization rate, there are greater concerns about growth and development. However, due to inhibition of structural constraints, economic development hardly occurs. At this juncture, when there is unequal distribution of growth inducing amenities, poorer towns persuaded the state to develop them. Obviously, the feeling of relative deprivation or marginalization built up social solidarity that fosters social movement. It is argued that 'place based solidarities motivate people to join and stick to social movement even when risks to life, liberty and property' (Nicholls, 2009).

Conclusion

Centralization of power and resources as well as structural flaw of the economy contribute to the primate-city formation in Mizoram. The capital city emerges as both 'parasitic city' and 'theatre of accumulation' at the cost of other towns and villages exemplifying the process of how capital operates, producing uneven development and capitalize space, especially of the largest cities. Marginalization of the peripheries resulted into acute form of demand politics.

The above discussion tries to show that development discontents in specific places are the result of the interplay of structural constraints, geography and role of the state. It may also be seen that this type of social movement may be classified within the new social movements which are 'frequently autonomous of political parties but locally-based and single-oriented issue' (Routledge, 1992). The district demand movement in Mizoram is also a local-based movement that aims to liberate poorer places from the processes of domination and exploitation by richer places.

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LAND USE LAND COVER CHANGE IN TUICHHUAHEN WATERSHED, KOLASIB DISTRICT OF MIZORAM

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Abstract : *Land and forest are an important component of natural resources. Though humans have been modifying land resources to obtain food and other essentials for thousands of years, current rates, extents and intensities of land use land cover changes are far greater than ever in history, driving unprecedented changes in ecosystems and environmental processes at local, regional and global scales. The forest ecosystem provide watershed services and its modification results in multidimensional changes in watershed processes. Tuichhuahen watershed harbor good forest ecosystem services, but the changes in land use land cover due to anthropogenic activity disturb these services even beyond the watershed Therefore, it is an imperative for planner, researcher and policy maker to analyse land use land cover changes at the watershed level.*

Introduction

The term land use land cover is a general term for the human modification of Earth's terrestrial surface. It can be broadly understand as the alteration and the manner in which human beings employ the land and its resources and also implies changes in physical or natural state of the earth surface. While land cover and land use are often assumed to be identical, they are rather quite different. Land cover may be defined as the biophysical earth surface, while land use is often shaped by human, socioeconomic and political influences on the land. (Nagendra, *et al*, 2003) Though humans have been modifying land resources to obtain food and other essentials for thousands of years, current rates, extents and intensities of land use land cover changes (LULCC) are far greater than ever in history, driving unprecedented changes in ecosystems and environmental processes at local, regional and global scales.

The LULCC are mainly anthropogenic and are being increasingly recognized as critical factors influencing global environmental changes. (Helmut, *et al,* 2002, Nagendra, *et al*, 2004) The LULCC is primarily and largely confined to tropical countries (Myers, 1994). It is a complex and dynamic process which draw attention to scientific and academic community across the globe. Though, India is among the least witnessing the LULCC in tropical countries, the land and forest resources are not commensurate with its human and

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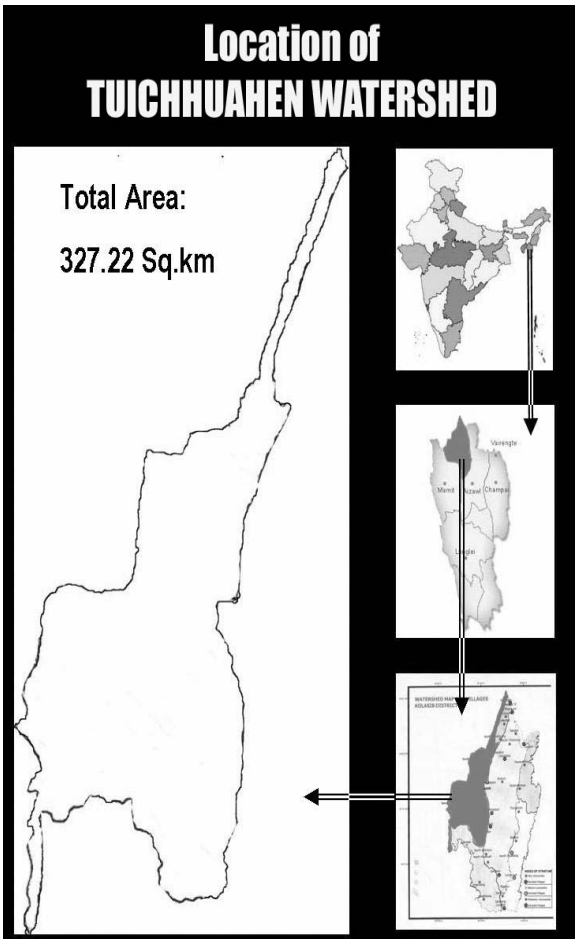
livestock population (Pachuau Rintluanga, 2009). However, conversion of forest to other agricultural land use, mainly shifting agriculture are common in Eastern Himalaya and the North East (Singh, *et al*, 1984, Rai, *et al*, 1994, Ramakrishna, *et al*, 1994, Schweik, *et al*, 1997, Sen, *et al*, 2002) as it continue to be the main source of livelihood for majority of the people. Therefore, it results in multi-dimensional changes in watershed services, future ecological balance and the livelihood of millions of rural community are at stake.

Study Area:



Tuichhuahen watershed is located in the western flank of Kolasib district in Mizoram having an extended total area of 26071 hectares. It harbor 10 census villages with a total population of 3523 and two urban centres with a population of 3981 in 2001 respectively (Appendix). The community of villages is composed of Mizo and Reang tribes with other negligible tribal community. Majority of the families directly depends on shifting agriculture and minor forest produces. The River Tuichhahen originates near Kawnpui and travels a distance of about 31.68 km. towards north and discharges its cumulative volume of 15197.1490 m^3 in Barak river of Cachar district of Assam. The average annual precipitation in the watershed is about 240 cm. (mostly received during the period of SW monsoon. Highest intensity of rainfall is received during the months of May to September.)

The watershed like most part of the state of Mizoram is characterized by rough terrain wherein 27 per cent of the area falls in the slope group of 50% followed by 45 per cent under the slope group of 21 % to 50%, 3 per cent of the area has a slope ranging between 9% to 21 % and rest 25 per cent below 8% of slope i.e. almost 6518 hectares. As compared to other watersheds as recognized by IRDAS, Hyderabad, Tuichhuahen watershed has proportionately the largest area under the slope category which may be maneuvered for different kind of land uses. However, the watershed is also exposed, due

to injudicious use, to a very high degree of soil erosion and stands 3rd (third) on erosion index amongst all the watersheds of Mizoram. It, therefore, requires consideration and judicious planning on priority basis before the problem becomes insurmountable.

The soils under the watershed have developed mostly from tertiary deposits belonging to Surma group of rocks. They vary in their characteristics on account of differential elevation and slope. The watershed has a relatively good cover of evergreen and mixed forest where natural and luxuriant growth of bamboo dominates, more on the lower elevations. Bamboo, therefore, may provide, if judiciously used and transformed with labor motive instead of profit motive, a supplementary resource base for the local communities who then may refrain from misusing the forest resources due to realization of higher productivity.

Data Source

An Aerial photo 1987 and LISS-IV images 2007 were used for change assessment by using Geographical Information System (GIS). Primary data and other necessary information were collected by using structured questionnaire with the help of the community in respective villages. Interview was conducted representing various local body and field level Forest Department staff to know the causes and path of changes. LISS-III Remote Sensing image (2002) IRS-IC/ID (Digital) is also used to highlight trends in Land use land cover during field work. Reports on Census of India 2001 are also used for population and household data

Change Assessment (1987 -2007)

The analysis of two dates satellite data remarks the level and intensity of LULCC. The empirical evidences show that the changes are anthropogenic. The rate of changes within twenty years in .Shifting Agriculture is from 21 to 27 per cent. Another remarkable change is the increase in Bamboo Brake from 15 to 19 per cent. However, the area of Non Forest is also doubled from 6 to 12 per cent. There is also a huge reduction of evergreen miscellaneous forest mixed with bamboo from 58 to 42 per cent. This miscellaneous evergreen mixed forest is compact and dominate the land use during the 1980's.

Discussion and Conclusion

The communities in Tuichhuahen watershed largely depends on land and forest resources for livelihood necessity. These occupational activities modify and change the Tuichhuahen watershed landscape. The in-migrants of the Reang community and the policy to accommodate temporarily by the state government during the late 1980's increase the pressure on land and forest resources. This Reang community lead a nomadic life and solely bank on jhum cultivation for their livelihood. Conversion of forest land for shifting

agriculture purpose and encroachment of notified reserved forest was common in Tuichhuahen watershed. Forest with a mixture of Bamboo was the dominant land use/ cover with an extensive shifting agriculture land use during the last two decades. After a decades of extensive exploitation, the land is highly degraded and the remaining forest cover is also highly fragmented. The high rate of increase in Bamboo Brake and Non-Forest seems to be the result of an excessive use of forest and leads to land degradation.

Table : Change Assessment using Aerial Photo and LISS IV Images

Imagery	LISS IV Imagery 2007 in km sq & (5)					
AERIAL PHOTOGRAPH 1987 (in sq.km & (%)	Vegetation Types	SA	BB	MB	NF	Total 1987
	SA	14.6	17.7	0	1.9	34.2 (21)
	BB	5.4	6.2	11.3	1.5	24.4 (15)
	MB	22.7	6.6	55.5	7.5	92.3 (58)
	NF	0	0.4	0	8.7	9.1 (6)
	Total 2007	42.7 (27)	30.9 (19)	66.8 (42)	19.6 (12)	160 (100) -100

Note :
SA = Shifting Agriculture; BB = Bamboo Brake
MB = Misc. Forest with Bamboo; NF = Non Forest

The alteration and modification of land use/cover due to anthropogenic activity signifies a serious concern to environment and ecological balance for the entire watershed. It also threaten the future livelihood of the communities. The intensity of forest fragmentation after twenty years also signifies a high degree of habitat loss. Moreover, it shows lack of proper planning and management of land and forest by the community and the concerned department. Which, in the long run is detrimental for balance ecosystem services and livelihood of the community in the entire watershed. The continuing increase in Bamboo Brake could lead to grass dominated land cover with soil fertility loss if the trend is not reversed. Therefore, it is important for all the stakeholder to conserve and manage these resources on a sustainable basis in order to maintain future valuable ecosystem services of the watershed and the livelihood security of the community.

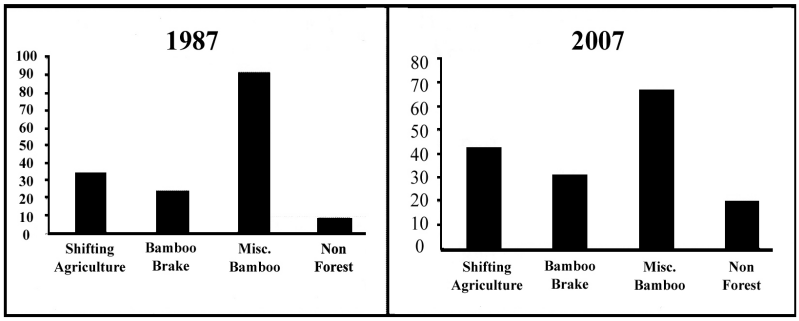


Figure : Comparative Graph of Land Use cover change in Tuichhuahen Watershed (1987-2007)

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Appendix :

Table

List of Village and Urban Centre in Tuichhuahen Watershed

Name of Villages	Population	Household	Literacy (%)
Bukvannei	158	31	62.80
Saihapui 'K'	311	70	63.80
Panqbalkawn	587	113	60.80
Meidum	773	144	59.30
N.Thinglian	258	43	10.60
Hmaibialaveng	423	71	86.20
Phaisen	412	85	89.10
S. Chhimluang	355	62	30.50
Rastali	159	34	68.30
Dilzau H	87	15	72.10
	3523	668	
Name of urban centre	**Population**	**Household**	**Literacy (%)**
Buhchang	677	117	82.80
Bairabi	3304	639	93.10
	3981	756	

Source : Census 2001, Final Population, Mizoram

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DETERMINANTS OF RICE PRODUCTIVITY AND PERFORMANCE ANALYSIS OF ALTERNATIVE VARIETIES IN MIZORAM: A CASE STUDY OF WRC

Dr. James L.T. Thanga

Abstract : *The declining trend in rice productivity in Mizoram has become a major concern since rice holds the key to food security. An attempt is made here to examine the main determinants of rice productivity in Mizoram with special reference to wet rice cultivation by estimating production function. It also examines the productivities of alternative varieties of rice using ANOVA technique and Principal Component Analysis. Irrigation and fertilizer are found to be the main determinants of rice productivity and NDR-359 variety is found to be the most productive rice variety.*

Introduction

Deterioration of agricultural productivity has become a serious problem facing the state of Mizoram since almost half of the people solely depend on agriculture for livelihood by practicing Jhumming. It is known that Jhum cultivation is subjected to deteriorating state of productivity due to the erosion of top fertile soil. The change in the system of cultivation from Jhum to a more sustainable one has become an urgent need of the state (Thanga, 2009)[1]. Rice, being the main food item in Mizoram, will continue to hold the key to sustained food security for the state. With the decreasing trend in rice yield per hectare under Jhum cultivation, the system of Wet Rice Cultivation (WRC) appears to be the best alternative which ensures sustainability. At the same time, unfavorable topography limits the expansion of area for WRC necessitating more productive system of cultivation through the application of modern technology. Use of modern technology comprised the adoption of modern varieties (e.g. hybrid seeds) and efficient application of chemical fertilizers along with the improvement of irrigation system. It is felt necessary to ascertain the main determinants of rice production in WRC areas of Mizoram. This paper attempts to establish functional relationship between rice production (yield) per hectare and the factors like area, fertilizers, irrigation, total rainfall and rainfall uncertainties in order to identify the major determinants of production.

A number of attempts has been made to fit the agriculture production function in

[1] Thanga, L.T, James (2009), 'A Time Series Study of Agricultural Productivity in Mizoram', *Geographic,* Vol.4 (July), pp.1-9.

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India by Rajkrishna (1964)[2], Parikh (1966)[3], Abraham and Raheja (1967)[4], Rao (1965)[5], Venkateshwarlu (1965)[6], Shetty (1969)[7]. One common conclusion that emerged from these studies was that fertilizers and irrigation had made a major contribution to the total output.

The average yield of rice under WRC was 26.81 quintals per hectare in 2004-05; but it decreased drastically to 4.39 quintals per hectare in 2007-08. This sudden change in average yields may be due to the effect of bamboo flowering and its impacts. At the same time, a sudden change in productivity is a clear indication of the vulnerability of rice production in Mizoram. This situation calls for adoption of scientific methods of cultivation and diversification of cropping which ensures more productivity and less vulnerability to the changes in climatic conditions. An attempt is made in this paper (i) to examine the factors that determine the productivities (yield per hectare) of rice in Mizoram and to estimate production function, (ii) to analyze the productivities of alternative variety of rice in order to find out the suitable variety for replacement of existing local variety, and (iii) to suggest most productive varieties with short duration for double/triple cropping system in WRC areas of Mizoram.

Data used in the study

The required data have been collected from the State's Agriculture Department, Directorate of Economics and Statistics, Government of Mizoram. While we can have detailed WRC and rainfall statistics from 1980 till 2007-08; detailed data can not be obtained on the amount of fertilizer used in agriculture for a longer period, this study cover only the period from 1993-94 to 2001-02. The main variables included in the analysis are area, fertilizers, irrigation, total rainfall and rainfall uncertainties. Fertilizers applied in agricultural land include Nitrogen (N), Phosphorus (P) and Potassium (K). Fertilizer is the sum of three fertilizers – N, P and K – in Kg/Ha. Irrigation is the area (in Ha) covered under minor irrigation, and rainfall is the total rainfall recorded (in mm) in Mizoram. Since there is no direct measure for rainfall uncertainties, the monthly variability of rainfall as a

[2] Raj Krishna (1964), 'Some Productions for Punjab', *Indian Journal of Agricultural Economics,* 19 (3&4), July-December, pp.87-97.

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[6] Venkateshwarlu, V. (1965), 'Growth in Agricultural Output in Andhra Pradesh during the period 1952-53 to 1961-62', *Arthaniti*, 8(2), July, pp.157-170.

[7] Shetty, S.A (1969), *Long Term Trends in Farm Production in India*, PhD Thesis, Department of Economics, University of Bombay.

standard deviation has been used as proxy for rainfall uncertainties.

The analysis of the productivity performance of alternative varieties of rice is based on the observations of two of scientific experiments conducted by Department of Agriculture (Crop Husbandry), Government of Mizoram, at Champhai WRC area (leilet) for the years 2000 and 2001. Randomized Block Design with three replications was applied in each of the experiment. The treatments comprised 4 varieties of rice (paddy) each and fertilizers were applied at 80:40:40 NPK Kg/Ha in each of the experiments. Sowing of seeds in the first experiment was done on 27.05.2000 and transplanted on 08.07.2000 with a spacing at 20cm x 15cm (row to row and plant to plant). In the same way, sowing of seeds in the second experiments was done on 25.05.2001 and transplanted 27.06.2001 with a spacing at 20cm x 15cm. Thus, these two experiments comprised 8 varieties of rice, and hence the productivity performances of these varieties are analyzed in this study.

Methods of Analysis

i) Determinants of Productivity: To examine the determinants of productivity of rice (Kg/Ha) simple correlation coefficients have been calculated between productivity and other variables, viz, fertilizer, irrigation, rainfall and rainfall uncertainties. Variables which are significantly correlated with productivity of rice will be considered as significant determinants of rice productivity in Mizoram. To examine the joint influence of these factors/ determinants on rice productivity, the following production function, called Cobb-Douglas (1928)[8] production function, is estimated

$$Q = AF^{\alpha_1} I^{\alpha_2} R^{\alpha_3} V^{\alpha_3} e \qquad (1)$$

where Q = average yield per hectare, A = positive Constant, I = irrigation or total area under minor irrigation, R = total rainfall, V = variability of rainfall, and e = error which accounted for the effect of other variables which are not included in the model. Eq (1) can be transformed into

$$\log Q = \alpha_0 + \alpha_1 \log F + \alpha_2 \log I + \alpha_3 \log R + \alpha_4 \log V + v \qquad (2)$$

where $\alpha_0 = \log A$ and $v = \log e$. The estimated $\alpha's$ are the elasticities of yield per hectares or productivity on fertilizer, irrigation, total rainfall and rainfall uncertainties respectively.

ii) Performance analysis of 8 varieties of rice: The significance of the difference of variability of 8 varieties of rice is being analyzed using Analysis of Variance (ANOVA)

[8] Cobb, C.W and PH Douglas (1928), 'A Theory of Production function', *American Economic Review*, Vol.18 (March), pp.139-165.

technique. The sum of squares (SS) have been decomposed as follows:

$$\sum_{j=1}^{k}\sum_{i=1}^{n_j}(Y_{ij}-\overline{Y})^2=\sum_{j=1}^{k}n_j(\overline{Y_j}-\overline{Y})^2+\sum_{j=1}^{k}\sum_{i=1}^{n_j}(Y_{ij}-\overline{Y_j})^2 \qquad (3)$$

or Total (SS) = SS (Between) + SS (Error), with the corresponding degrees of freedom, $(N-1)=(k-1)+(N-k)$. To test the significance of difference between treatments (varieties), the statistic

$$F=\frac{SS(Between)/(k-1)}{SS(Error)/(N-k)}$$

follows Scenedor's F- distribution with *(k-1) (N-K)* degrees of freedom.

Significance of F-statistic associated with ANOVA indicates the variability differences are significant among the 8 varieties of rice being examined in the experiment. If the variability of the productivities of different varieties of rice is statistically significant, we can rank them on the basis of mean. However, it was found that mean differences for some local based varieties are not significant. In this case, we cannot give rank on the basis of mean because we cannot say productivity of one variety is higher than others if the difference is not significant. So, it was decided to extract Principal Components (p)[9] for all varieties to indicate the productivity performance of each of the variety in each of the replicate. Principal component takes into account not only means, but also the variability in each of the replicate.

The aim of the principal components method is to construct a new variable, called the principal component (p), out of a set of variables X's which is a linear combinations of the X's. The extracted principal component can be described as

$$p=a_1X_1+a_2X_2+a_3X_3 \qquad (3)$$

The loadings, *a's*, are worked from the correlation matrix so that the principal component so extracted accounted for maximum variance. The principal component is estimated from the correlation matrix of all seed and replications.

Determinants of Rice Productivity

The calculated correlations coefficients between yield of rice per hectare and each of the other variables have been recorded in Table 1. It is observed that rice productivity

[9]Due to limited space, we do not include the whole process of finding principal component. Interested readers are advised to read *Research Methodology: Methods and Techniques,* by C.R. Kothari (2004), New Age International (P) Limited, New Delhi, pp.315.

is significantly correlated to area, fertilizer and irrigation. Correlation of production per hectare with other variables, viz, total rainfall and rainfall variability, are not significant at 10 percent level. Judging from the relationship being measured by correlation coefficients, it is clear that area, fertilizers and irrigations are the significant determinants of rice productivity in Mizoram. It is worth noting that yield per hectare is negatively correlated with total area under WRC. It implies that expansion of areas tends to compromise the yield per hectare (productivity). This is a clear indication that a mere expansion of area without improvements in other variables like irrigation and fertilizers will reduce the productivity of rice.

Table 1 : Correlation Coefficients between each of the 6 Variables

	Area	Fertilizer	Irrigation	Production	Rainfall	Sd of Rainfall
Area	1.000	-.885* (-5.030	-.122 (-.32)	-.760* (-3.1)	.432 (.432)	-.005 (-.013)
Fertilizer		1.000	.469** (1.4)	.890* (5.16)	-.247 (-.67)	.211 (.57)
Irrigation			1.000	.629** (2.14)	.454 (1.14)	.018 (.05)
Production				1.000	-.159 (-.43)	.216 (.59)
Rainfall					1.000	-.093 (-.25)
Sd of Rainfall						1.000

Figures in the bracket indicate calculated t-value
* significant at 1 per cent level of significance
** significant at 5 per cent level of significance
** significant at 10 per cent level of significance

It can also be observed from Table 1 that (i) area is negatively correlated with fertilizer, and (ii) the amount of fertilizers applied is positively correlated with irrigation. Base on the above correlations, it may be inferred that the available supply of fertilizers is insufficient to support the expansion of area, and hence, amount of fertilizers being applied per hectare tends to decline with the expansion of area under wet rice cultivation. Since the correlation between irrigation and fertilizers is significant, with the increase in the area under minor irrigation there is more demand on fertilizer. In other words, increased application of fertilizers necessitates improved irrigation facilities and vice versa.

Production Function

Following the above discussion as the productivity of rice is significantly correlated to fertilizer, irrigation and area, the yield per hectare can be expressed as a function of fertilizer, irrigation and area. However, the inclusion of area among the explanatory variables resulted in the insignificance of individual estimates though R^2 is quite high. This is

clearly due to the problem of multicollinearity[10] in the regression as there are strong correlations among the explanatory variables. The individual estimates are still insignificant even after the removal of area from the model. To contain this problem, we add other exogenously determined variable, viz, rainfall, which is not significantly correlated with other explanatory variables. Then we get better estimate by including this variable in the regression. The production function, so estimated is reported in Table 2.

The estimated coefficients (or elasticities of productivity) with respect to fertilizer applied per hectare are significant at 10 percent level; while elasticity with respect to total rainfall is insignificant at this level. As the estimated coefficient of determination is 0.86, it can be concluded that 86 percent variation in productivity of rice depends on the joint influence of fertilizer and irrigation. As the estimated elasticities are higher in case of irrigation than fertilizer, the contribution of irrigation on the improvement of productivity is higher than the contribution of fertilizers. This result suggested that an increase in the area under irrigation along with the increasing use of fertilizer will result in the improvement of productivity of rice in WRC areas of Mizoram. Further, the sum of the significant elasticities is less than one indicating that there is decreasing returns to scale in rice production per hectare with the increase in fertilizer and irrigation. This is in line with the traditional theory of production which states after some points, output increase less than proportionately as inputs increased. This limitation can be broken only with the technological improvement in rice cultivation.

Table 2 : Estimated Production Function

Dependent Variable : LOG (Production per Hectare in Kg)
Sample : 1993-2001
Included observations

Explanatory Variables	Coefficient	Std. Error	t-statistic
Constant	4.58*	1.55	2.95
LOG (Fertilizers per Ha in Kg)	0.15**	0.07	2.15
LOG (Irrigation)	0.68**	0.30	2.29
LOG (Total Rainfall in mm)	-0.26	0.18	-1.42
R.Squared	0.86	F-statistic	
Adjusted R-Squared	0.78	Prob (F-statistic)	

* significant at 5 per cent level of significance
** significant at 10 per cent level of significance

[10]Multicollinearity means the existence of significant correlation between one or more explanatory variables. It seriously reduces the reliability of regression in which the individual estimates are insignificant.

Productivity Performance of Alternative Varieties of Rice (paddy)

The data of two experiments conducted by the state's Agriculture Department at Champhai Leilet (WRC) have been analyzed using Analysis of Variance (ANOVA) technique. The result of ANOVA on the variability of yields per hectare is reported in Table 3.

Table 3 : Results of the Analysis of Variance (ANOVA) to test the significance of the difference between the performance of 8 varieties of rice in three replications

Treatments	Sum of Squares	df	Mean square	F	Sig.
Between varieties	4479.17	7	639.88	7.68	0.000
Within varieties (error)	1333.33	16	83.33		
Total	5812.50	23			

The result given in Table 3 reveals the variability of productivity performances of 8 varieties being analyzed is significant as the calculated F-statistic is significant at all levels. It can be concluded that the experiments revealed that there is significant difference with respect to productivity among the 8 varieties being tested. As we have proved the significance of variability among the varieties, the 8 varieties of rice can be ranked according to their average yield per hectare. However, it is observed that the differences between some pairs of the average yields are not significant and hence we cannot rank them directly according to means. So, it is decided to rank these varieties on the basis of principal component extracted from each of the replication. The result is reported in Table 4.

Table 4 : Ranking of Paddy Yield (Qtl/Ha)

Varieties of Rice	Duration (days)	Mean	p-score
NDR-359	140-145	58.33	1.03
Local	150-160	56.67	0.93
Local (Manipur)	150-160	50.00	0.42
PNR-381	130-140	50.00	0.35
PNR-162	130-140	45.00	0.10
Manipur Tawi	150-160	43.33	-0.03
RC Maniphou-5	150-160	33.33	-0.75
MTU-7029	150-160	13.33	-2.05
Variance Accounted by the principal component = 82.4 per cent			

Table 4 reveals that the NDR-359 variety has the highest yield per hectare followed by local variety; while MTU-7029 variety has the lowest yield. This result suggests that the local variety requiring more than 5 months (150-160 days) can be substituted for with a shorter duration (140-145 days) and more productive variety of NDR-359. Due to the shorter length of duration by around 15 days and higher productivity, this variety may be chosen for double cropping rather than the local variety in WRC area of Champhai.

Concluding Remarks

The preceding discussion revealed that enhancement of the productivity of rice in the areas under WRC in Mizoram is attributed to fertilizer and irrigation. The productivities can be raised by increasing the area under minor irrigation (since major irrigation projects may not be feasible in most of the WRC areas) along with the increasing application of fertilizers. Since the estimated production function suggested diminishing returns to scale, Green Revolution can be achieved in Mizoram only through technological breakthrough in seeds management, treatment of land with chemical fertilizers along with the development of sustainable system of irrigation. So, this study suggests further research in order to chalk out more sustainable and productive methods of applying chemical fertilizers as well as governmental initiatives to undertake comprehensive irrigation projects. During 2007-08, total area under WRC was 9594 hectares, of which minor irrigation covered only 14.95 percent; while the remaining 85.05 percent was supported by seasonal rain. As irrigation has played a significant role to increase rice production, this study suggests production of rice can be increased significantly with the successful implementation of irrigation project in the State.

As it is pointed out earlier, the foreign variety (NDR-359) perform better than local varieties of paddy in respect of productivity in Champhai area. Further research is suggested to find the most suitable and productive with a shorter duration. In addition, as this is the result of the experiments made in high altitude (5505 ft above sea level), it is suggested to conduct varietal experiments on the low altitude areas like Kolasib, Mamit, Thenzawl, Zawlnuam and Bairabi.

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EVOLUTION OF SETTLEMENTS IN MIZORAM : A SPATIO-TEMPORAL ANALYSIS

Rintluanga Pachuau

Abstract *: It is not easy to trace the history of the tribals of the north eastern states where written records are not available and where researchers have to depend mainly on folk tales, folk songs and oral history. In fact, the history of the Mizos, the present inhabitants of the state of Mizoram, prior to 1700 is vague, and calls further researches. The present paper is a humble attempt in tracing the origin of the Mizos, focusing their early route of migration and the subsequent settlements in the present state. In doing this, attempt have been made to examine how far the geographical factors have exert influence upon the ultimate phenomena in time and space. It is interesting to be seen that despite the harsh physical constraints, the cultural factors also weighed a large degree in the decision making among the Mizos of the recent past.*

Introduction

Man by nature is a social animal and lives in a gregarious manner. He lives in communities, in a single collection of houses that form the settlement. Yet one can see various types and patterns of settlements as reflected by its environs. Settlements have gradually evolved over a long period of time and by analyzing their sites, types, spatial pattern and functions; one could decipher the history of man's exploitation of the surrounding environment and resources.[1]

The analysis of early migration, rural population and rural settlement of Mizoram is of immense importance in the present context because of its dynamism and the fast transformation, which is experienced in the study area during the last three decades especially after 1967. The development and transformation is fairly at a progressive pace due to socio-political enlightenment and urbanization. A number of rural settlements originally associated with traditional jhuming and forests are undergoing change towards urbanization.

The study of population and settlements in Mizoram has its distinct characteristics. The study and growth of rural population, its distributional pattern, process and other distinctive characteristics and spatial pattern of settlements depends upon the scale of observation[2]. The present analysis attempts to examine the influence of physical and cultural environments and socio-economic as well as political factors affecting the selection of

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sites for settlement in Mizoram.

Early Stream of Migration

It is a very difficult task to trace the origin and of settlements in Mizoram. This is mainly due to the fact that there is no integrated historical account of the region as it is occupied by ignorant tribals who have lived for a long time in physical isolation and have no scripts of their own. There is no evidence of pre-historic settlement in this region.

Before the advent of the British in this region, the Mizo people were isolated from each other due to difficult terrain, dense forest and lack of transport network. The lack of interaction with the outside world coupled with inaccessibility of the land left them comparatively untouched and, therefore, they remain primitive in character for long period of time.

Traditionally, the Mizo claim themselves the descendants from CHHINLUNG[3], a mythical rock, east of Shan State in Burma bordering China. Migration of tribal groups seems to have had taken place as early as the beginning of the 15th century. This migration of different groups was retarded by several ha1tages at certain locations for longer and lesser periods through Shan State, Chindwin Valley and Chin Hills in Burma.

According to Zaw1a (1964)[4], the Mizo migration to the hills began; in 1463, whilst Professor Luce estimates the Mizo migration took place during the 16th Century[5]. Thanga (1978)[6] writes about the settlement of Lusei in the *Kabaw* valley around *Khampat*: "That the Mizos belong to the Mongoloid stock is not disputed. That they came from the east is also not disputed. That their original home was in Mekong Valley and that they once lived in the *Hukawng* Valley was further corroborated by many including an old Burmese priest at Mandalay to Mizo historians who had visited Manda1ay to trace the history of their origin and migration. According to him, the ancestors of the Mizos came from Shanghai, possibly in tenth century. By which route they came, and how long they took to reach *Hukawng* Valley in Burma is now lost in obscurity". According to Zawla (1964)" ... they carne to the *Chindwin* belt about 996 A.D."[7]

Evolution of Settlements in Mizoram

Liangkhaia (1938)[8] wrote that the first large-scale migration of the Mizos started from the Chin Hills by crossing over hill ranges bordering south-west Manipur. The Mizo tribes entered the present Mizoram in successive bands and the Hmars, a Mizo sub-tribe, were first to enter. As to the date of their migration from Chin Hills to Mizoram, Soppit (1976)[9] believes that the first batch of the Mizo tribes after crossing *Tiau* river settled in Mizoram some time in the middle of the 16th Century. Liangkhaia (1938)[10] also supports this view and agrees that a section of Hmars entered the Manipur plain about the middle of

the 16th Century and the beginning of the 17th Century A.D.

According to Songate (1977)[11] the Mizos entered Mizoram in four successive batches. The first batch included the sub-clans of Hmar such as Hrangkhaw1, Pang, Mualthuam and Chhunthang under their chief Chawnhmang who eventually migrated to Tripura. They were followed by Hrangchal, Ngurte, Darngawn, Lungtau, Leiri and Changsen.

Since each clan followed a particular route and built their own villages, the villages are to be known by the clan is name. To this day, many of these villages are in existence under such names like *Biate, Chhungte, Darngawn, Khawbung, Khawzawl, Ngur, Thiak, Vankal, Zote* and so forth[12].

The Mizo after reaching the present Mizoram, found the land to be very healthy and embracing climate and thought that it was the land which nature has provided for them. They were predominantly agriculturists in the form of shifting cultivation. They settled usually in a single collection of houses, situated on the hilltops than on low level ground with a view to secure easy defense organization. It is important to note that before the advent of the British in the present Mizoram, the Mizo were headhunting tribes. The selection of sites for settlements was on the hilltops where they could have a better defense for the villages.

Each village was ruled by the Chief who looked after the welfare of its citizens and was the supreme head in matter of handling village administration and disputes, distribution of land, etc. With a view to enlarge their territorial possession, the inter -village and inter-clan wars were the order of the day. This eventually resulted to dispersion and micro-regional migration.

In short, as a result of the wars among the clans and villages, certain clans of the Mizo origin have later migrated to different parts of northeast India. The sub-clans of Hmars fled to north and west to Manipur, Cachar, Sylhet and Tripura. A section of Biate entered Cachar district between 1730 and 1780 A.D. and some of them went up to North Cachar Hills and Meghalaya[13].

Thus, it may be summed up that the Mizo are racially Mongoloid stock in origin, who migrated towards the present habitat somewhere from China during the 15th to 16th Century, following different routes by each clan period between the middle of 16th Century and the at different stages with several haltages at different places. It appears that the first batch (of successive batches of migrants) entered the present Mizoram in the beginning of the 17th Century. They were content to settle there as far as geographical environment was concerned. But certain minority clans (sub-tribes) were forced out of the land as a result of inter-clan and inter-village wars. The advent of the British and the eventual attainment of Indian independence changed the way of living to a surmount extent that the Mizo started to adopt modern way of and living have settled down permanently till date,

and the inter-village or inter-clan wars are no more experienced but form a part of history.

Although the prime factors in selection of sites and development of settlements might have lost most of its significance at present, but it is imperative to trace the evolution of settlement in this region.

The first settlers in a new and virtually untouched environment have to exist in a self sufficient manner[14]. This was true of the early and isolated settlers of the present Mizoram. The first inhabitants, with their necessary limited knowledge, made more or less rational judgment concerning choice of sites for their villages. Important to them was the availability of cultivable land and close supply of water. In addition, building materials and fuel were also important.

The Mizo have always been particular about their place of residence, and a considerable thought was given to the subject of village sites. The highest hill top started as favorite and the site subsequently chosen would be that with proximity to cultivable lands, water supply and other positive hygienic considerations. A compact pattern of settlement was most common in the early development of villages. Houses were constructed close to each other with some sense of regularity arranged usually in two lanes, the front of the houses all facing towards each other and separated by a space treated as a village street. The physical configuration was responsible for the built up of the village structure; it determined the pattern and direction of houses or village street.

Nevertheless, the first settlers in a place must often have made false start and sometimes settled down permanently on a less good site even with a better site close by. In a similar way, mistakes might have been made which could be seen clearly in the light of later development. Thus, we find some areas in a division of the original settlements into two with the prefix 'old' and 'new' attached to the original is name.[15]. Although we say that shifting of village sites as a consequence of development in respect of economic and social amenities in the region.

Factors Influencing the Location and Growth of Settlement

The factors of affect that spatial aspects settlements are as complex and varied as are the patterns of distribution. Not only the physical environment is operative in determining location of settlement, but cultural environment and socio-economic and political factors also play a vital in determining the role establishment of the physical climate, settlement. Among environment, topography, geology, terrain, drainage, forest and soil are the significant factors.

In Mizoram settlements are mainly governed by the configuration of land surface, climate, water availability and proximity to arable land. The ethno-genetic factors like

tradition, necessity of defense and security, and availability of land for traditional *jhum* practices have also exerted much influence on the sites of settlement.

Most of the settlements in Mizoram are located on the hill top or crest, that only a very few settlements are found located on the lower valleys or river banks. An attributable reason for the selection of hill top settlement is readiness for defense purpose. The early Mizo were involved in conflict and constant war for territorial possession, as is found in most of the tribal history. The ruggedness of the topography gives no alternative place other than hilt top as the existing small patches of level lands (river banks) can support only a few settlements.

Climatic condition is another important factor that influence the settlement in Mizoram. The hillcrest have pleasant climate with good sunshine, while the low-lying valleys are marked by humid, warm and sultry weather. Hence, the hilltops and crests offer the only alternative base for human habitation.

Another factor that helped in selection of settlement sites and growth is the availability of resource potentials and development of infrastructures. Despite the unpleasant climatic condition prevailing on the low valleys or along the riverbanks, certain settlements exist mainly because of availability of fertile land. The process of economic development, especially infrastructure like road development has led to the establishment of new settlement with a new function suited to its location.

Types of Settlements

Depending upon the location of settlements above mentioned in Mizoram can the be factors, broadly described as follows :

i) Settlement on the hill top and hill slope
ii) Settlement along the watershed
iii) Settlement along the main road
iv) Settlement along the river

i) Settlement on the Hill Top and Hill Slope

The location of settlement on flat hill top and gentle hill slope terrain was the marked characteristic feature of the hills as defense in the Pre-British period was the most decisive factor in selection of sites for settlement. This choice is also favored by congenial climatic condition. A numerous settlements, both large and small are situated on the hill tops and hill slopes of the State. The researcher who conducted an extensive field work had no doubt that about 50 per cent of the total settlements in Mizoram are situated on hill top and hill slopes. The remarkable mountain ranges which support settlements of this type are *Hachhek* Range in the north- western part, *Chalfilh-Ratu* Range in the north central,

Sialkal Range in the north-east, *Zopui-Tan-Lurh* Ranges in the east, etc. All these ranges are characterized by high degree of slopes and rugged topography that compels the inhabitants to occupy the. hill top and hill slopes. The hill top and hill slope settlements are a common feature in Mizoram and are found numerously throughout the region.

ii) Settlement along the Watershed

A large number of settlements are found located along and between the watersheds, and their distribution varies from place to place. The study of topographical maps reveals that quite a number of settlements are located along the watershed formed by numerous tributaries of different river systems or basins. For instance, North Vanlaiphai, East Lungdar and Khawbung are conspicuous example covered by Toposheet No.84E/4, issued by Survey of India.[16]

iii) Settlement along the Main Road

The of route has development also transport affected the feature of settlement in Mizoram. It has been mentioned that most of the villages in the region are situated on top of the hills. But when motorable road cannot connect them due engineering reasons, various the villagers are tempted to come down to settle along the main road. By this process, villages like Rengdil, Dampui, New Vervek, Baktawng, Khawhai, etc. have come down from their original hill top location to the road sides. This phenomena is seen taking place in all along the roads constructed by B.R.T.F. and P.W.D.

iv) Settlement along the River

This type of settlement is found on the low lying valleys of perennial rivers where agriculture or horticulture is practicable. The availability of fertile soil is the main factor for the growth of valley settlements. So that the adjoining areas of certain important rivers such as Tut, Teirei, Tlawng, Langkaih, Chhimtuipui, Khawthlangtuipui and Tuichawng are intervened by a number of settlements.

Traditional Chieftainship as an Affecting Factor of Population and Settlement in Mizoram

The Mizo society as it exists today is indeed very different from what it was about fifty years back. Changes have swept over the region in an extremely rapid manner. Till the early fifties or so, the Mizo chief was the real center of authority in Mizoram. It is said that the people had adopted the chief system so that they could be guided and governed in all activities of life. In due course of time the chief became hereditary, and the benefit of becoming a chief went to the eldest son. The chiefs used to be the protectors of village life and property. The entire land and villages belonged to them and it was them who distributed the jhum lands for cultivation to the villagers. Besides disposing of land for cultivation

the chief also used to administer justice according to the customary laws of the Mizo..They saved men from revenge and took them under their protection. A chief also have his cabinets called *upa* to assist him in the day to day administration of the villages under his jurisdiction.

The Chief was usually called *Lal* which means a Chief in Mizo language. He maintained his position more through his personal qualities than hereditary rights, even though under normal circumstances the sons of the chief were provided by him with ample opportunity to build themselves up as Chiefs. Thus, as soon as a Chief's son attained maturity, the Chief would set up a separate village with the mature son as its Chief and a few of the households from his village transferred to the new village. He was not supposed to pay any tribute to his father-Chief and was left to himself to establish his position as a Chief through his personal ability.[17]

The Chief's position in the village was indeed that of a benevolent ruler. All those who lived in the village were looked upon as his own children. He was bound to help them in their adversities, counsel them in their difficulties, reward them in their achievements and punish them found when they of misdeeds guilty were or infringement of established customs. The villagers, in their turn, were to obey his orders implicitly, carry out errands assigned to them individually and collectively, and help the Chief in all possible ways. It must, however, be mentioned that the Chief was not an autocrat, and in fact, could not afford to be so if he desired to retain his chieftainship, as they would leave him and take shelter under different chief in another village if they found him tyrannical or indifferent to their needs and conveniences.[18]

Just as the Chief had the right to banish from his domain any person who incurred his displeasure or whom he considered, undesirable, had the villager also corresponding right to migrate from one Chief's village to another if the latter agreed. In fact, a strong good chief who administered according to customary law could get away with almost anything, while a weak chief, indulging in petty tyranny was likely soon to find himself a king without any subjects.

Conclusion

From the above text, it can rightly be perceived that existence of large size village was not applicable in the past Mizo society as a village was to remain under the rule of a Chief. It is important to note here that not only traditional chieftainship is responsible for small population size of the village, but want of cultivable land for jhuming has always been a key factor restricting the village size. Large population in a village would reflect in long distance to jhum lands which would give less time for the villagers to attend their jhuming, leading to a resultant reduction of *jhum* harvests.

Consequent upon these factors, the settlements in Mizoram has remained scattered here and there, containing only very few population. Of course, the society and the region has gone through the inevitable wind of change. There has certainly been a lot of improvement in various direction. The recent developmental programmes and modernization has shaped the typical village structure and population quality into transitory stage with better living condition of the population. However, it appears that the emotional and sentimental attachment to traditional and societal village life of the past still linger in the mind of elderly Mizos.

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ECOTOURISM AS A MEANS FOR CONSERVING WETLAND ECOLOGY - A CASE STUDY OF DEEPAR BEEL (RAMSAR SITE) IN GUWAHATI, ASSAM

Niranjan Das and Sujata Deori

Abstract :*The United Nations General Assembly recognized the global importance of Ecotourism, its benefits as well as its impact with the lunching of the year, 2002 as the international year of Ecotourism (IYE). The IYE offers opportunities to review Ecotourism experiences worldwide. In order to consolidated tolls and institutional frameworks that ensures its sustainable development in future.*

Ecotourism in simple words means management of tourism and conservation of nature in a way so as to maintain a fine balance between the requirements of tourism and ecology on one hand. Well-planned Ecotourism can benefit both protected areas and residents of surrounding communities by linking long term Biodiversity conservation with local social and economic development.

Assam in fact is a part of global Bio-diversity hot spot (Myers, 1988; 1991) and has a rich cultural Heritage. It also forms part of two Endemic Bird areas, viz. - Eastern Himalayan and Assam plain. (Coller, 1994). Assam plain comprises a good number of Wetlands (Beels) in the Brahmaputra valley abounds in Bio-diversity and Productivity. These wetlands maintain ecosystem diversity, as they are the natural storehouse of valuable flora and fauna of an area. Besides these, they are also used for various economic purposes by the people living in and around it through Ecotourism activities like Bird watching, Angling, Boating etc. The wetlands are of great Value for both man and environment for long term financial sustainability by the surrounding communities as well as conservation of Nature. Through the paper the author tries to highlight such possibilities on the basis of assessment of potential ecotourism resources of the Deepar Beel (Wetland) of Guwahati through field experience gained different parts of the Area.

Key Words - Ecotone, Conservation Status, Ecotourism for Sustainability

Introduction

Tourism is currently the world's largest industry ($ 3.4 trillion annually) and ecotoutism represents the fastest growing segments of this market. The term "Ecotourism "was coined

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by "Hector Ceballos Lascurain" in 1983, and was initially used to describe the nature-based travel to relatively undisturbed area with an emphasis on education. The concept of ecotourism is new one, and the state has tremendous potentiality for sustainable development of its potential nature based tourist resources (Seace, et al., 1992).

Ecotourism involves education and interpretation of natural environment and to manage it in an ecologically sustainable way. Here "Natural Environmental" includes cultural components and the term "Ecologically Sustainable" involves an appropriate returnees to the local community and long term conservation of resources (Grant, 1995).Ecotourism is already the largest source of foreign exchange in countries like Costa Rica and Belize; in Guatemala, it is second.

Assam has tremendous potentiality for growth and development of ecotourism. In fact, Assam forms a part of global biodiversity hot spot, with varieties of flora and fauna, which can provide a sound base to start with ecotourism venture. In fact, such ventures can be used for advocating environmental awareness, long term conservation measures and economic benefit of the local people (Bhattacharya, 2002). The ecotourism elements of the park is given below-

Ecotourism Elements in Deepar Beel Wild Life Sancturies:

- Scenery and natural landscape
- Wild life viewing.
- Bird watching
- Water sports
- Trekking nearby the Area
- Angling in Selected points. (Catches and release basis)

Source: Authors Field Observations-2008

Wetlands of Assam

Brahmaputra Valley in Assam, a part of Eastern Himalayas Global Hotspot of Bio-diversity harbors a no of globally important wetland ecosystems. Wetland ecosystems are integral part of the Valley supporting the major portion of Life forms in the state (Abbasi, 1997). Most of the permanent natural wetlands *(Beels)* are situated about 10 kms from both the bank of river Brahmaputra (Baruah, et.al.1998). During winter the feeding channels get cut off and water bodies remain as ecotonal wetlands (Chatrath, 1992).

The state of Assam holds around 430 registered *Beels,* 1192 swaps and low lying areas and 185825 tanks covering about 134134.12ha (Anon, 1993) other than lotic system involving rivers. According to ARSAC (Assam Remote Sensing Application Centre)

report, about 10123 sq km area in Assam has been occupied by wetland out 78438 sq km, which is the total area of the state. As per the survey conducted by Assam remote sensing application center, there are about 5213 nos of wetlands in Assam distributed in its 23 Districts (Deka, et. al.1993). The wetlands of Brahmaputra Valley are considered as an internationally important wetland habitat for wetland bird (Choudhury, 2000).

Deepar Beel Wetlands (Ramsar Site)

Deepar Beel, a riverine wetland ecosystem is a highly valued ecosystem situated about 5 kms from Guwahti, the capital city of Assam. It is the largest wetland in the Kamrup District of Guwahati covering an area of 40.14 sq. km. Because of its rich bio-diversity, Ramsar Committee has recently declared this wetland as Ramsar site. Since the wetland has fulfilled the three out of four IBA (International Bird Area) criteria, Important Bird Area Programme of Bird Life International has selected the wetland as an important IBA site. Because of rich bio-diversity value and other ecological value the Government of Assam has proposed this wetland ecosystem as wildlife sanctuary through a notice dated 12th January 1989 under wildlife protection Act, 1972 (Forest Reports, Govt. of Assam, 1992). Deepar *Beel* provides home to a good population of endangered rare residential as well migratory avifauna. Three globally important birds namely Greater Adjutant Stork (*Leptoptilos dubius*), Lesser Adjutant Stork (*Leptoptilos javanieus*) and Spotted Billed Pelican (*Pelecanus philippensis*) find this wetland as one of the major habitat. Graylag Goose (*Branta ruficollis*), White Eyed Pochard or Ferruginous Duck (*Aythya nyroca*), Bar Headed Goose (*Aythya basri*), Asiatic Golden Plover (*Vanellus cinereus*) etc are the globally important migratory flyways which congregates in Deepar *Beel* This wetland also serves as an additional habitat of a good population of endangered Mega-fauna like Asiatic elephant (*Elephus maximus*) residing in the adjoining Rani-Garbhanga Hill Reserve (Choudhury, 1998). A number of aquatic vegetation forms the habitat as a biodiversity rich wetland. The ecosystem is also a major fish breeding ground.

Objectives

1. defining the role of ecotourism in the frame work of sustainable development strategy for Deepar Beel Wild life Sanctuary;
2. identifying the best practices of ecotourism in Deepar Beel Wild life Sanctuary
3. developing a source of long term financial, sustainability for the conservation of the wet land

Methodology

The paper entitled Ecotourism as Means for Conserving the Wetland Ecology-A Case Study of Deepar Beel (Ramsar Site) in Guwahati, Assam is a simple descriptive case study; data and information were obtained on the spot observation of ecotourism resources

by the author supported by secondary information sources like books, papers, reports, maps and information from local people. For this study, data related with tourist flow from govt. tourist Dept. of Forest, field survey for primary information and different tourism promotion organization is used.

Study Area

Deepar *Beel* (26°05′26″N to 26°09′26″N and 90°36′39″E to 91°41′25″E), a riverine wetland ecosystem situated 5 kms from the river Brahmaputra, is one of the most biodiversity rich ecosystem of the valley. The Beel (*wetland*) is located on the 3 kms south of river Brahmaputra and surrounded by Bharalu basin on the east, Kalmani River on the west, Jalukbari Hills on the North and Rani and Garbhanga Reserve forest on the South. It is a permanent freshwater lake in a former channel of the Brahmaputra River, with great biological importance and also essential as the only major storm water storage basin for the city of Guwahati. The *Beel* is a major fish breeding ground for a large number of fish and supply fish stocks to other nearby wetlands and rivers (Saharia, 1999). So far about 50 species of fish has been identified in this wetland. The *Bee*l is a staging site on migratory flyways of the migratory birds and some of the largest concentrations of aquatic birds in Assam that can be seen in winter (Collar, et. al 1994).

Apart from the above-mentioned ecological value, the wetland shows its importance from geographical point of view. This ecosystem serves as storm water reservoir of the Guwahati City. According to reports, it can hold up to 42 million cubic mt. of storm water during peak monsoon (Gogoi, et al. 1998).

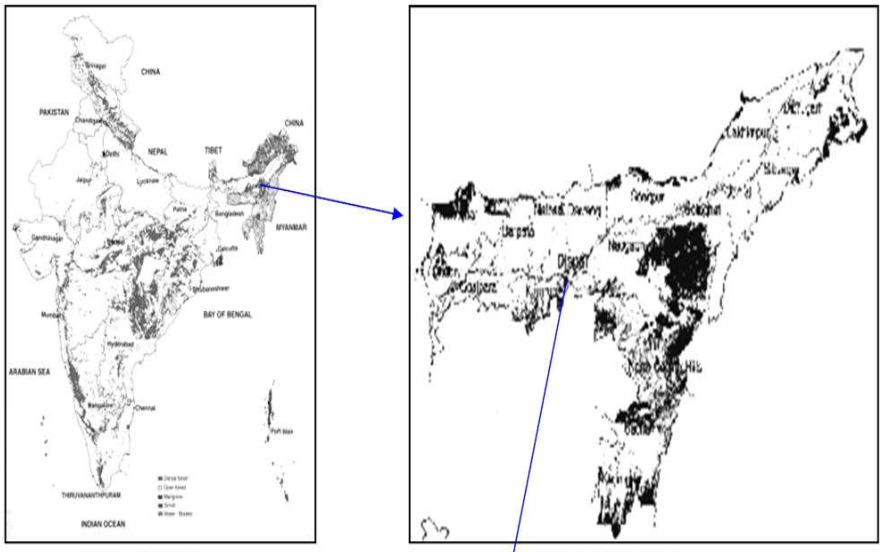
The value of bio-diversity that has been supported by Deepar *Beel* is enormous. For conservation of this bio-diversity conservation of Deepar *Beel* is must (Choudhury, 2000) Conservation process should initiate activities to uplift the economics of the villagers through various developmental processes to reduce their dependency on this wetland and should follow a sustainable process of conservation (Mehlhop, et. al.1994).

Deepar Beel as the Ecotourism Destination

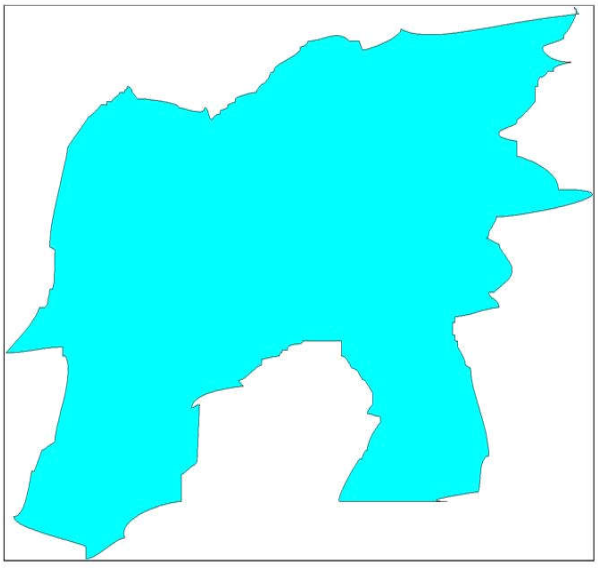
Deepar Beel wild life sanctuary also is considered as the Bird sanctuaries because of habitability of both local and migrant bird species. Birdlife International recognizes this sanctuary as the Important Bird Area sites. In terms of productivity, species diversity, breeding ground, food chain supporter it has immense importance in this regards. Deepar *Beel* harbors a good no of commercially important plant species. Being a major source of fish resource it has become the backbone of income source of a huge population residing nearby.

There is a tremendous scope for special areas of ecotourism like bird watching

Fig. 1 Map of Study Area



Map of India **Map of Assam**

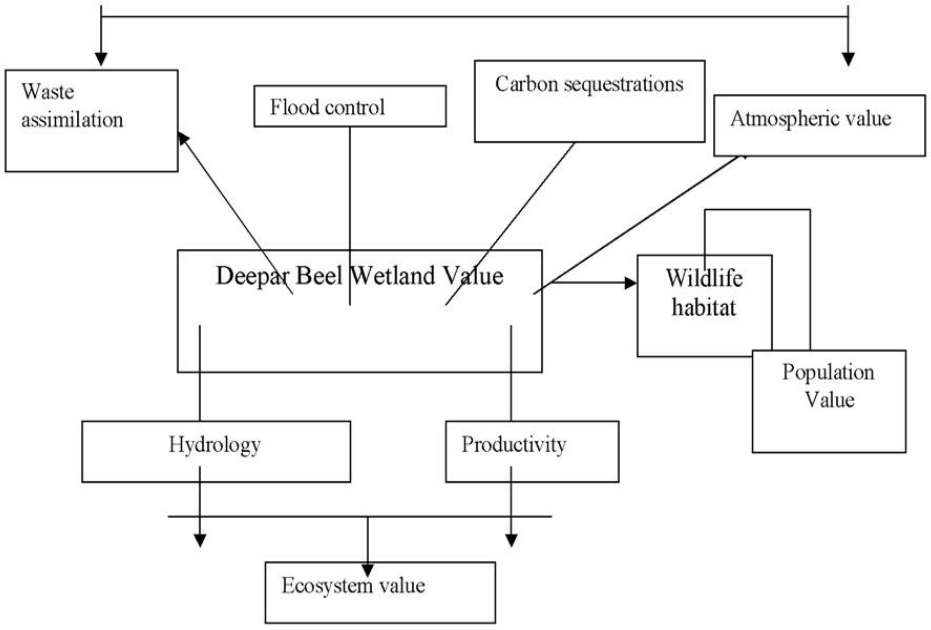


Map of Deepar Beel Wild Life Sanctuary

ventures. Deepar Beel wild life sanctuaries are the ultimate habitat of both aquatic and migratory bird. The sanctuaries can also offer ideal site of its scenic beauty and for bird watching to the tourist (Department of Tourism, 1994).

Conventional tourism always offers diverse effect to environment increasing vehicular and garbage pollution both air and sound, hence priority should be given to ecotourism ventures like elephant safari, trekking, walking etc. at the initiative of the nature tour operators or by forest department. Alternative eco-friendly accommodations like tented accommodation; thatch bamboo houses, etc. may go a long way, especially in exploiting ecotourism resources in the natural, wilderness area of the state (Bhattacharya, 2002).

Fig. 2 Ecological values of Deepar *Beel* Wildlife Sanctuary.



Source: Odum, 1978: Wildlife, Environmental and Socioeconomic value of Wetland

Conclusion

Ecotourism is a field of human activity where observation and development can wisely effectively be balanced to achieve a mutual goal to the benefit of the people in the community. It can be developed effectively only when there is consent and active involvement of the local people, who should become partner in this process. Ecotourism is possibly is one of the meaningful sources of economic development and job creation. Cross

country evidence demonstrates that tourism is labour Intensive and offers a variety of small scale opportunities creating jobs for poor, women, and young people, and jobs for indigenous community.

So, community based ecotourism is the best option in such areas which is owned and managed by a community and takes care of their natural resources in order to gain income through operating a tourism enterprise and using that income to better their lives. It involves conservation, business enterprise and community development and there will be direct and indirect participants and direct and indirect beneficiaries (Das, N, 2003).

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AN ECONOMIC APPROACH TO BIODIVERSITY, POVERTY REDUCTION AND DEVELOPMENT

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Abstract : *Poverty alleviation and biodiversity conservation are basic social goals and part of the policy agenda of postcolonial states and international agencies. It is not surprising therefore that a large number of programmatic interventions have aimed to achieve the two goals at the same time. This paper, examines the conceptual discussion around poverty and biodiversity. The discussion shows that the literature on these programmatic interventions depends on relatively simplified understandings of poverty and biodiversity in stark contrast to the theoretical literature on the two concepts. This paper also highlighted the importance of forest for the livelihood of mankind.*

Keywords: biodiversity, economic development, agriculture, environmental policy, poverty, research.

1. Introduction

Biological diversity - or biodiversity - is the term given to the variety of life on earth and the natural patterns it forms. This diversity is often understood in terms of the wide variety of plants, animals and micro-organisms. Yet another aspect of biodiversity is the variety of ecosystems such as those that occur in deserts, forests, wetlands, mountains, lakes, rivers, and agricultural landscapes. In each ecosystem, living creatures, including humans, form a community, interacting with one another and with the air, water, and soil around them. Improving the quality of life for the people of a country is perhaps the most important duty of Government. There are various sets of measurable indicators across the whole range of issues that matter most to people, and are likely to matter to future generations too. That means measuring how we perform on the big, important things such as people's health, the state of the economy, employment, transport, crime and the environment.

The Biodiversity for Development initiative was established by the Secretariat of the Convention on Biological Diversity (SCBD). The main goal of this initiative is to promote the integration of biodiversity considerations into sectoral policies or cross-sectoral strategies (e.g. Poverty Reduction Strategy Papers (PRSPs) or Sustainable Development Strategies) as well as ensuring the development dimension in National Biodiversity Strategies and Action Plans (NBSAPs).

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As human societies become more and more complex and technologically advanced, it is easy to gain the impression that we no longer depend on natural systems. A steadily increasing proportion of people live in cities, in environments dominated by human-built structures and machinery. Even in rural areas, conservation of natural spaces is often seen as a luxury that has little to do with the well-being of local people. Effective protection of the environment not only requires protection of species and habitats, but also management and aftercare of areas that are to be retained, enhanced or created. We should hand on to the next generation an environment no less rich than the one we ourselves inherited.

2. Biobiversity and the Millenium Development Goals (MDGs)

A major challenge currently facing the international community is finding ways to transform these precarious living conditions for the poorest of the poor. One global initiative that intends to do this is the campaign to achieve the Millennium Development Goals (MDGs). These time-bound and measurable goals and targets for combating disease, illiteracy, environmental degradation and discrimination against women – with the overarching aim of halving extreme poverty and hunger – were agreed in September 2000 by world leaders at the UN Millennium Summit in New York. The goals were explicitly reaffirmed at the 2002 World Summit for Sustainable Development in Johannesburg, placing them at the heart of a broader vision to integrate global development priorities with environmental protection. Biodiversity is dealt with explicitly under the seventh MDG, which is a commitment to ensure environmental sustainability. It is clear that the conservation and sustainable use of biological diversity is also central to achieving many of the other goals.

The first goal of eradicating hunger, for example, depends on sustainable and productive agriculture. And that in turn relies on conserving and maintaining agricultural soils, water, genetic resources and ecological processes. The capacity of fisheries to supply hundreds of millions of the world's people with the bulk of their animal protein intake, for example, depends on maintaining ecosystems (such as mangroves and coral reefs) that provide fish with habitats and sustenance.

2(a) *What does biodiversity has to do with poverty and development? And why should it concern an organization such as the United Nations Development Programme (UNDP), whose principal mandate is to improve the lives of the poor?*

The answers to both questions lay in the fact that biodiversity, far from being optional or a luxury restricted to the rich countries, is a key development issue. Indeed, it frequently provides the 'welfare system of last resort' for poor people and communities.

Unfortunately, however, it is the wealthy that control access to a greater share of these services than the poor. They also consume them at a higher rate, and are buffered from changes in their availability by being able to purchase services that are scarce, or

replace them with substitutes. When a degraded river basin, for example, no longer purifies water effectively, the wealthy can afford to build water treatment facilities – but the poor cannot. Similarly, the depletion of fisheries does not disrupt supplies of fish for the wealthy. But for poor fishing communities in developing countries, it can mean the loss of precious livelihoods. Indeed, for poor communities, losing the insurance afforded by healthy, intact ecosystems can literally be a matter of life and death. The impacts of floods, landslides, drought, crop failure and disease, for example, are each intensified whenever ecosystems are already degraded. It was poor communities living in such conditions, who were the most severely affected, for example - Hurricane Mitch of the catastrophic storm that caused more than 6,000 deaths.

3. Overcoming Conflicts with Agriculture

Achieving the various MDGs could, however, throw up potential conflicts; and these obviously need to be avoided. Take the goal to halve world hunger before 2015. One way of meeting this could be to dramatically expanding agriculture by clearing natural forest. But we know that the side-effects of deforestation – such as increased soil erosion, the silting up of rivers leading to reduced fish stocks downstream, and the degradation of water quality – whether planned or unintentional, may actually significantly reduce the benefits to society of that land over the long and even short term.

A more innovative and sustainable approach is to incorporate biodiversity conservation into food production practices, a strategy that is increasingly referred to as 'ecoagriculture'. This refers to the many different ways in which land can be used to produce food, while also supporting the maintenance of biodiversity and other critical ecosystem services. There is a range of methods for promoting such 'dual-use' of land, from reducing the amount of chemicals used, to providing more wildlife breeding sites on farms. There are also a growing number of practical examples showing how this approach can be applied. Take, for example, the 'Campesino to Campesino' (CaC) programme in Nicaragua. CaC was a finalist in UNDP's 2002 Equator Initiative Awards, which recognize outstanding community success in reducing poverty through biodiversity conservation. Founded in 1992, the CaC project is aimed at controlling the rapid spread of agriculture over valued natural areas, achieving food security, and restoring deforested. It does this by, for example, promoting the use of leguminous plants and green fertilizers as cover crops that stabilize the soil and lead the way for crop diversification and improved land use planning.

Through UNDP's work and the Small Grants Programme funded through the Global Environment Facility (GEF), we have become aware of literally thousands of other examples of such 'win-win' initiatives all over the world. We need to learn from these inno-

vative communities, and to help other communities learn from them and follow their example. This is a focus of UNDP's work in biodiversity.

4. An Opportunity for the Poor

In fact, there is a silver lining to all this. Most of the world's biodiversity exists in the economically poorest countries. This provides the poor with opportunities to enhance their income by entering emerging markets for sustainably produced, certified forest and agricultural products, as well as ecotourism.

Poor rural communities even have a chance to compete in the global economy via payment for ecosystem services by those who benefit the most from them. Such arrangements might include watershed protection contracts (where, for example, users of the water or hydroelectricity dependent on these watersheds make payments to communities for protecting the forests), as well as many other market-based mechanisms. Such an approach would of course rely on those communities not being excluded by insecure land tenure, high transaction costs or unfair subsidies. Globally, we are seeing a real opportunity to advance all the Millennium Development Goals without undermining our ecological capital. But this will happen only when we recognize that poor communities have an urgent stake in safeguarding their own ecosystems at the same time as meeting their basic human needs. In other words, we need to go down a path that recognizes that for rural people living in poverty, development cannot happen without the conservation of biodiversity. The real key to a sustainable future is to remember that our efforts towards poverty reduction and conservation are mutually reinforcing. In other words, our programmes should focus on 'biodiversity *for* development' not 'biodiversity *or* development.'

Biodiversity contributes directly to poverty reduction in at least five key areas: food security, health improvements, income generation, reduced vulnerability, and ecosystem services. Conservation is therefore a key to achieving the Millennium Development Goals (MDGs). It does not only link to MDG 7, the "environmental sustainability goal", but also provides a strong source of support to the development and poverty reduction targets that are outlined in the other MDGs concerned with hunger, education, gender, child mortality, maternal health and disease. At the same time the degradation of biodiversity and natural ecosystems poses a significant barrier to the achievement of the MDG targets for 2015 and may actually undermine progress that is made towards meeting them. Although biodiversity underpins socio-economic wellbeing — and despite the fact that ensuring sustainability will bring large payoffs in development and poverty reduction terms, the linkages between biodiversity, poverty reduction and economic development are often overlooked. In all too many cases "conservation" goals are seen as being distinct from (and sometimes even as being in conflict with) "development" goals. A choice or a trade-

off is posed between investing in biodiversity and investing in poverty reduction.

Failing to understand that biodiversity offers a basic tool for reducing poverty, strengthening livelihoods and sustaining economic growth leads to the risk of incurring far-reaching economic and development costs — especially for the poorest sectors of the world's population.

5. Link Between Household Poverty and Biodiversity Dependence

There are notable differences in socio-economic status between the richer households generally having higher levels of food self-sufficiency, benefiting from a much greater range (and level) of subsistence items and income-earning opportunities, and being able to access more and better quality farm lands. There is a corresponding variation in the types, overall values and relative importance of forest product use between households. In particular, there is a clear relationship between socio-economic status and the relative wealth or poverty of individual households, level and value of forest use, and livelihood dependence on bio. According to all of these socio-economic and poverty indicators, both the richest and the poorest households consistently harvest forest products to a much higher annual value than other sectors of the population diversity. Yet whereas richer households focus primarily on higher-value and market commodities, the high forest values accruing to poorer households reflects their reliance on forest products for subsistence and home consumption due to the absence of alternative sources of income.

Although valuable in absolute terms, forest resources do not form the main component of richer households' production. As poverty levels rise, so forest products make a progressively greater economic contribution to livelihoods. Security of the country's population is forced to deal with many of the social and economic effects of biodiversity degradation – such as falling income, declining production and livelihood insecurity.

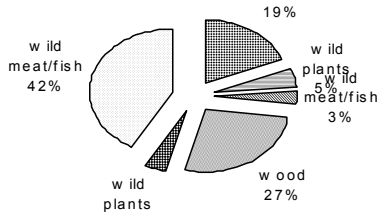
Biological resources support a high level of industry, commerce and trade, add value through processing, and have major multiplier effects on national employment, services and industrial output. Biodiversity degradation and loss has the potential to impact heavily on trade, commerce and industrial output, and on the jobs, earnings, exports and revenues that these sectors generate for the economy. There is a risk and effects that biodiversity loss will undermine much of the progress achieved in national economic growth over the last decades. Effects include a slowdown in national income and growth, macroeconomic instability, and declining foreign exchange earnings, trade, employment and output. Many of the areas of the economy that have been targeted for growth over the current planning period depend on biodiversity goods and services, including hydropower, irrigated agriculture, tourism and other service industries.

Poverty alleviation and biodiversity conservation are basic social goals and part of the policy agenda of postcolonial states and international agencies. It is not surprising therefore that a large number of programmatic interventions have aimed to achieve the two goals at the same time. These interventions are funded by governments, conservation NGOs, bilateral and multilateral donor agencies, and private sector organizations.

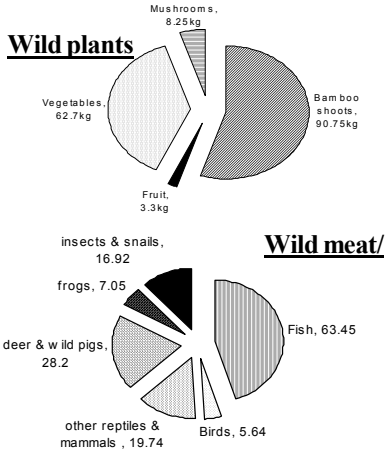
6. The Role of Forest in Local in Local Livelihoods : An Example from Lao

Lao PDR is one of the most forested countries in Asia, and in biodiversity terms ranks as one of the richest in the region. It is estimated that almost half of Lao's land area, or 11.6 million hectares is under forest. The human population of Lao PDR is also characterized by their extremely high economic dependence on biodiversity. Alongside rice farming, biological resources underpin the majority of Laotians' livelihoods ? more than 80% of the country's 5.5 million people live in rural areas, and depend largely on harvesting wild plant and animal products for their day-to-day subsistence and income.

Cash income $84/household/year



Home consumption $229/household/year



Forest biodiversity use is worth an average of $313 a year for households living around the Protected Area (PA)

Lao's resources provide a wide range of products that are used for income and subsistence by the households in Viengthong District., who together include more than 24,000 people. Forest use includes harvesting wild products for food, medicines, fodder, house construction and handicrafts production. Over 40 species of trees, 15 bamboos, 6 palms, 34 wild vegetables, 12 wild fruits, 7 grasses, 4 vines, 56 medicinal plants and 13 mushrooms have been identified as being used by local villagers, and birds, snakes, frogs, fish, porcupine, barking deer and wild pigs are all regularly consumed as food. In total, it is estimated that 165 kg of wild plant products and 141 kg of wild meat are consumed each year at the household level18, that almost all of domestic energy and construction needs are sourced from the Protected Area, as well as the bulk of livestock fodder and pasture, human medicines and raw materials for crafts and utility items. Unsurprisingly, the economic value of forest product utilization for villages in Viengthong District is significant. It is estimated to be worth more than $1.12 million a year overall, or $313 per household. Subsistence-level consumption (mainly for food, medicines and building) accounts for almost three quarters of this value, while approximately a quarter is earned as cash income from selling forest products. Annual values range from $160 per household living outside the Protected Area, through $270 for those bordering the Protected Area, to an average of $500 in villages that are located inside the Protected Area. (Emerton, L., O. Philavong and K. Thanthatep. 2002).

Relating forest value and forest dependence to socioeconomic differences and relative poverty levels as measured by other indicators gives a similar picture. Households can be differentiated according to access to productive assets which can be taken as proxies for wealth, including rice surplus/deficit, cropped area, and livestock numbers. According to socio-economic and poverty indicators, both the richest and the poorest households consistently harvest forest products to a much higher annual value than other sectors of the population. Yet whereas richer households focus primarily on higher-value and market commodities, the high forest values accruing to poorer households reflects their reliance on forest products for subsistence and home consumption due to the absence of alternative sources of income. Although valuable in absolute terms, forest resources do not form the main component of richer households' production. As poverty levels rise, so forest products make a progressively greater economic contribution to livelihoods. Poorer households who have access to both a smaller range and a lower amount of cash earnings depend far more on forest products to generate income than do richer households — even though the latter are able to tap a far higher value of earnings from the sale of forest products. From this example it can be clearly seen that biodiversity plays an important economic role in providing livelihood for mankind.

7. Why Biodiversity Matters for Poverty Reduction

The close linkages that exist between biodiversity conservation, poverty reduction and socioeconomic development also hold in many other parts of the world. Other countries also face similar constraints to conservation. Economic and development decision-makers frequently undervalue biodiversity, both in terms of its overall economic worth as well as in the way that it contributes to national and local development processes. Not only do they underpin local subsistence and income but they also fill the gap between the goods and services that a poor and rapidly growing human population require to survive, and that which the government is currently able to afford to provide. At the macroeconomic level, biodiversity forms a foundation for generating national income, employment, foreign exchange earnings, public sector revenues and inflows of investment funds.

The under-valuation of biodiversity benefits is however not just an accounting problem. In many cases it has acted to the detriment of conservation, and of sustainable local livelihoods.

Unfortunately, few studies examine how biodiversity conservation and poverty alleviation are related (cf. Campbell 1998, Marks 2001), let alone how tradeoffs between the two goals are shaped by the social and ecological context. Indeed, more than half the studies do not even indicate the poverty-related results of the implemented programs despite the use of consistent indicators of poverty. An exceptionally small number of studies situate results in relation to findings from similar studies in other parts of the world and there is little indication of how the programs in question affected poverty over time. These oversights are especially difficult to understand since nearly all the studies highlight potential conflicts between the goals of poverty alleviation and biodiversity conservation. Certainly, they cite this potential tension as a justification for the need to undertake (and study) community-based wildlife management. to assess biodiversity and conservation-related impacts contrasts with the greater number and type of criteria used to assess poverty and development-related impacts. The number of criteria for poverty is nearly doubles that for biodiversity. There is also greater consistency across the studies in the use of different criteria.

8. When Economic Policy Instruments Undermine Biodiversity

The aim of using economic instruments is to promote and encourage behavior that will meet particular socio-economic targets. In some cases, however, they may actually have the opposite effect, because they undermine these goals. Instruments that cause biodiversity loss largely act against poverty reduction and socio-economic development. Even though there exist some positive economic incentives for conservation (such as reduced land taxes on stabilized land use and reforestation, exemptions on turnover tax for

forestation activities, and release from the reforestation component of timber tax against replanting), biodiversity continues to be marginalized by some of the economic policy instruments that are being used to support other sectors. For example a wide range of implicit subsidies favor land clearance for farming, including the provision of preferential credit to agriculture, minimum farm gate prices, relatively lower tax rates and reduced trade duties on agricultural products and inputs. Sustainable biodiversity –based activities are not subject to such special treatment. The relative profitability of agriculture vis-àvis conservation is enhanced still further by exemptions on agricultural land tax for newly cleared land in both mountain and lowland areas, and on newly-established industrial orchards. Within the logging sector below-market royalties are also thought to promote excessive demand, and tax variation between different timber products encourage the use of only premium quality logs and encourage wastage in harvesting.

9. Conclusions

The approaches discussed in this paper are all founded on the general assumption that it is possible simultaneously to achieve two seemingly incompatible goals — biodiversity conservation and poverty alleviation. Indeed, was it possible to identify a transcendent mechanism that could accomplish the integration of these two goals, one might speculate that it would be widely adopted? Such a magic bullet would unite diverse camps of social thinkers, environmentalists and dogmatic believers in development-at-any-cost, and permit the politics that bedevils all collective decision-making to be set aside. The evidence and discussion in the paper suggest, however, that optimism on the subject needs to be tempered with great caution and substantial new thinking.

The evidence from the examined case studies suggests that it may even be inappropriate to pose a question such as "What is the relationship between biodiversity and poverty?" The theoretical literature on the concept of biodiversity and poverty demonstrates their multiple referents and meanings, and how attempts to alleviate one aspect of poverty may undermine efforts to alleviate another. For example, it may well be possible to reduce the headcount ratio on which most official measures of poverty are based, at the same time as the intensity and volatility of poverty increases. Similarly, genetic, species, and ecosystem components of biodiversity bear no necessary, monolithic relationship to each other so that efforts to conserve one component may well hurt another. If one cannot make definitive statements about whether a particular policy measure can alleviate all aspects of poverty or conserve all components of biodiversity, surely it is foolhardy to hazard that a particular policy can simultaneously alleviate poverty per se and conserve biodiversity. We suggest that particular policy efforts and programmatic interventions, when they are successful, likely alleviate only some aspects of poverty even while they successfully maintain different components and attributes of biodiversity. The balance of such tradeoffs has

been neither documented nor theorized in any general way. Such massive ignorance about tradeoffs makes it all the more ironic that we inhabit a world where shaky assumptions about this tradeoff are the grounding logic of most policies that aim at positive outcomes related to poverty and biodiversity. The question going forward is how to identify settings and create landscapes with diverse trade-offs so that even while some aspects of poverty are alleviated, different components and attributes of biodiversity can be conserved. Only through additional systematic investigation will we come to know which aspects of biodiversity can co-prosper with alleviation of different aspects of poverty.

Analysts and policy makers begin to think much more precisely about exactly which aspects of biodiversity and poverty are addressed by their favorite approaches, there will be little or no progress in understanding why people remain poor in certain ways (but perhaps not others), what makes (certain aspects of) biodiversity decline, and how to slow and even reverse such declines. Without greater nuance in thinking about poverty and biodiversity, future studies that take these terms to be their compass may provide greater understanding of specific programs in specific places, but will not advance the agenda of a more general understanding or more effective policy. What is even more troubling is that if the most widespread and frequently used analytical approaches to understand and document the relationship between poverty alleviation and biodiversity conservation continue to be used, it may not be possible to throw greater light on this relationship. Case study approaches based on evidence that is collected from a single time period and without careful and systematic consideration of the causal mechanisms at play are ill suited to generate policy-relevant insights into the tradeoffs between poverty alleviation and biodiversity conservation.

Perhaps the most critical aspect of a new research agenda would be to explicitly document and test the likely tradeoffs involved in pursuing specific poverty alleviation and biodiversity conservation goals. It is necessary to understand how efforts to conserve particular components and attributes of biodiversity affect different aspects of poverty in particular contexts, and vice versa. Research efforts need to focus on the contextual details that makes a particular outcome more likely instead of trying to find the 'silver bullet' that will provide a quick and universal solution to the problems of poverty and biodiversity loss. Further, for research to be policy-relevant, new studies need to focus on the dynamics of the relationship between various measures of poverty and biodiversity, and on how these dynamics are affected by macro-social and political variables such as education, demographic change, levels of unemployment, and technological change among others. Without greater attention to change over time, the goal of policy-relevant understanding of the relationship between biodiversity conservation and poverty alleviation is likely to remain chimerical.

If it is necessary to reconfigure the analytical lens to focus more insistently on tradeoffs in the relationship between poverty alleviation and biodiversity conservation, it is equally important to rethink the methods that have hitherto been adopted to study this relationship. Better research design, based on careful specification of the relevant hypotheses, will likely require panel data from a suite of sites and households to allow systematic comparison across cases and regions. Where possible, researchers would need to collaborate with policy makers to identify potential natural experiments so that the impacts of particular interventions can be studied more authoritatively.

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