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From the Director

I and my colleagues at the SAARC Forestry Centre (SFC) have the pleasure in bringing out the volume II of the SAARC Forestry Journal 2013.

We would like to thank all the authors and co-authors for their contribution of articles in this journal. We appreciated your effort to write the articles and incorporating our suggestions on formatting and filling up the missing information.

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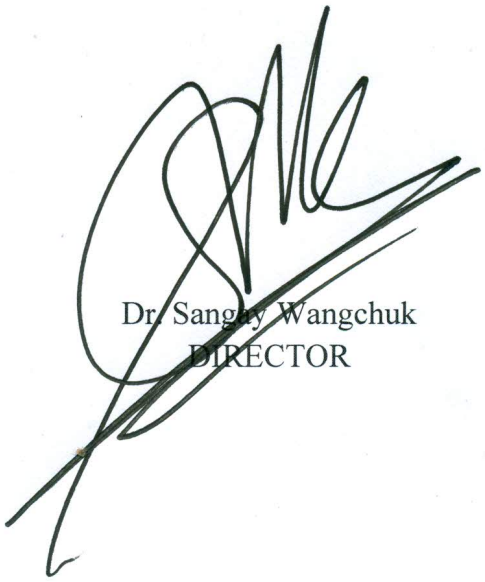

Dr. Sangay Wangchuk
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Community Forests: An Inclusive Innovation to Household Income Generation in Western Bhutan

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Abstract
This study evaluated the contribution from inclusive innovation such as community forests to the household income in Punakha district, Western Bhutan. The study also investigated the participation of community forest management groups in conservation and community forest protection activities. Data were collected using semi-structured questionnaires from 180 household members of the community forests. Descriptive analysis using market price technique for valuation was employed Four community forests, Waku Damchi, Lumsum, Yargay and Mangizingkha, all established in 2005 under Punakha district, western Bhutan were selected. The district has the oldest and highest numbers of approved community forests in the country. There was strong support from community forest members for forest conservation and protection activities mainly through labor contribution. The benefits derived from the inclusive innovations (community forests) were distributed among members both in-kind and as cash. The contribution from forest resources to each household per annum were Nu.1,501 in Waku Damchi, Nu. 377 in Lumsum and Nu. 681 in Mangizinkha. Households in Yargay received no cash income from the forest resources due to its early stage of plantation. The first three community forests contributed an average about 0.3% to the total household income of the members, which was relatively low compared to that of neighboring countries. There is a policy

challenge in terms of meeting both the goals of environmental sustainability and of income generation simultaneously. The policymakers should revisit restriction on the use of forest resources and explore opportunities to generate more benefits from them, alongside the environmental sustainability outcome. The Government should continue to provide supports for forest conservation activities and also promote wider participation through more education programs and awareness campaigns.

Keywords: *Inclusive, innovation, community forest, management, participation, income, Punakha*

1. Introduction

Forests cover 30% of the global land area with rich terrestrial biodiversity. Forests contribute enormously to the global energy supply as well as providing food, fodder, medicines, building materials, paper products etc. Furthermore, forests have cultural, spiritual and recreational value. They are also vital for climate mitigation and soil and water protection. In fact, 1.6 billion people worldwide, rely on forest resources for their livelihoods (FAO, 2012). Globally about 70% of rural communities live in extreme poverty (World Bank, 2009). These people lack the basic necessities to maintain a decent standard of living such as sufficient and nutritious food, adequate shelter, and access to health services, energy sources, safe drinking water, adequate education and a healthy environment.

Bhutan has abundant forest resources with forest covering a total of 26,826 square kilometers which constitutes 73% of the total land area (Food and Agriculture Organization [FAO, 2012]). About 69% of the total Bhutanese population lives in rural areas (Temphel & Beukeboom, 2006). It is also known that rural communities are directly or indirectly dependent on natural resources for their livelihood. The reduction of poverty is a theme of the development program in Bhutan. The Poverty Analysis Report of 2007 revealed that almost about 23% of the Bhutanese population lives below the national poverty line of about Nu 1,100 per person per month. Thus, enormous potential lies in inclusive innovation by exploration of natural resources to improve the livelihoods of the rural poor.

The inclusive innovation in the vein of community forest program is one of the regimes for forest management in Bhutan (Wangchuk, 2011). The Social Forestry Division (SFD) under the Department of Forest and Parks Services, Ministry of Agriculture and Forests, is the main government agency responsible for supporting the community forestry programs in all 20 *dzongkhags* (districts) of Bhutan. A community forest (CF) is managed by local people who are the traditional users of the forest, called the Community Forest Management Group (CFMG). On approval of a community forest management plan, the Royal Government provides CFMG members the right to utilize forest products from their designated community forest in return for

taking responsibility for its management and protection. The management plans, which are formulated by the CFMG with the help of District Forestry Sector staff and approved by the Department of Forest Park Services, form the basis for execution. This management plan act as an agreement between the CFMG and the Royal Government of Bhutan.

Punakha district is situated in western Bhutan. The altitude of the district ranges from 1,200 meters to 4,800 meters above sea level. As stated in Schindele & Dheki (1996), Punakha has forest cover of about 819 square kilometers accounting for 84% of the total area. The same report reveals that about 50% of the total forest in Punakha district is accessible and usable for forest management. Broad-leaved forest is the main vegetation type in the forest of Punakha and accounts for 89% of the total forest cover. The rest is chir pine forest.

However, how CF members contribute to the viability and sustainability of CFs through conservation and protection activities as well as how inclusive innovation for instance community forest resources contributes to household income of CF members in Punakha district is not fully explored. Taking this into consideration, this study aimed to investigate the participation of CF group members in conservation and protection activities, and the benefits if any, derived by CF members from the forest resources under their management.

2. Literature Review

2.1 Benefits of forest ecosystem

Forest ecosystem services are defined as services provided by the natural environment that benefit people. While there is no single, agreed method of categorizing all ecosystem services, the Millennium Assessment framework is widely accepted and is seen as a useful starting point. Some of these forest ecosystem services are well known, including food, fiber and fuel provision and the cultural services that provide benefit to people through recreation and appreciation of nature. Other services provided by ecosystems are not so well known. These include the regulation of the climate, purification of air and water, flood protection, soil formation and nutrient cycling. These are not generally considered within policy appraisal at present and represent an

area where a greater and more systematic focus would be very useful (DEFRA, 2007).

2.2 Total Economic Value

TEEB (2009) stated that the functioning of ecosystems and their services affect many aspects of human welfare, and hence a broad set of indicators should be used to measure the magnitude ('value') of their impact. All the aggregate values as defined in Total Economic Value (TEV) are integral for derivation of actual worth of the biodiversity and ecosystem services as these are important to humans for many reasons. Total Economic Value is comprised of both use values (including direct use such as resource use of timbers and NTFPs, recreation, tourism and indirect use from regulating forest services such as protection of watersheds and carbon storage) and non-use values, e.g. the value people place on protecting nature for future use (option values) or for ethical reasons (bequest and existence values).

The forest has non-use economic values in the benefits from the existence of and leaving of resource shares for future generations. The bequest value is the value of rights to the benefits of natural resources now and in the future. Non-use value is further categorized as option value and existence value. The option value represents the benefits due to uncertainty and estimates the potential future benefits of avoiding irreversible damage to resources. Existence value represents the benefits derived from forests existence regardless of actual uses, such as cultural, aesthetic and spiritual values as shown in Figure 1.

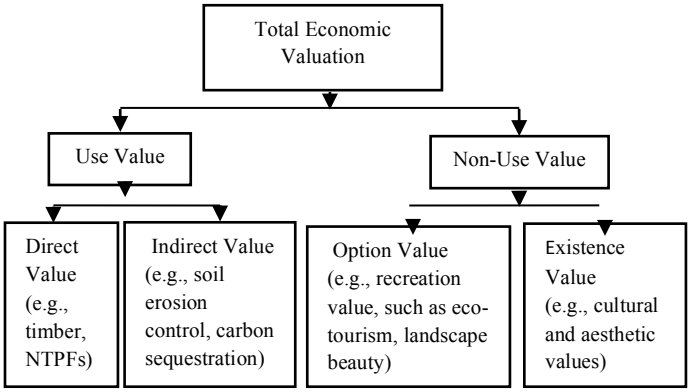

FIGURE 1 TOTAL ECONOMIC VALUE OF FOREST ECOSYSTEM FRAMEWORK.
Source: Adapted from MA (2005)

2.3 Community forest and rural poverty

According to RECOFTC (2004) community forestry involves governance and management of forest resources by communities for commercial and non-commercial purposes, including for subsistence, timber production and collection of non-timber forest products, wildlife protection and conservation of biodiversity and environment, as well as for social and religious significance. It also incorporates the practices, art, science, policies, institutions and processes necessary to promote and support all aspects of community based forest management. Vyas (2000) defines community forestry as forestry by the people of the people, for the people. Utilization and management of forests by the local community is not a recent inclusive innovation but it is rather a new attempt to enhance sustainable supply of forest and natural resources by involving local people aiming towards meeting their own objectives. It is also perceived as first meeting the people's objectives and later aiming to fulfill the conservation policy of the government.

In Bhutan community forestry began as an attempt by the government and aid agencies to provide an alternative way for forest department to manage forests, that is, by including local people (Gilmour and Fisher, 1991). The development of community forestry was also partly motivated by a desire to allow forest dependent people to obtain legitimate access to a major source of their livelihoods, as well as by the recognition that forests could not be properly managed without some level of active support from local people. Behind this, there was also increasing pressure on forest departments to become more efficient in their uses of government funded resources.

According to Dhakal and Masuda (2008), the community forests supply the basic needs of forest-products such as firewood, fodder/grass and timber to local people on a regular basis. The proper management of a community fund is crucial for sustainable community forest management and livelihood, where forest resources have higher economic potential.

3. Study Methods

3.1 Sampling

There are 23 CFs in Punakha. The four oldest CFs, namely *Lumsum*, *Yargay* CF under Lingmukha block, *Waku Damchi* CF under Kabjisa block and *Mangizingkha* CF under *Talo* block(Figure 2), were selected as the samples for the study using purposive sampling method. Punakha district was selected for the study because Punakha district has the oldest and second highest numbers of CF established in Bhutan.

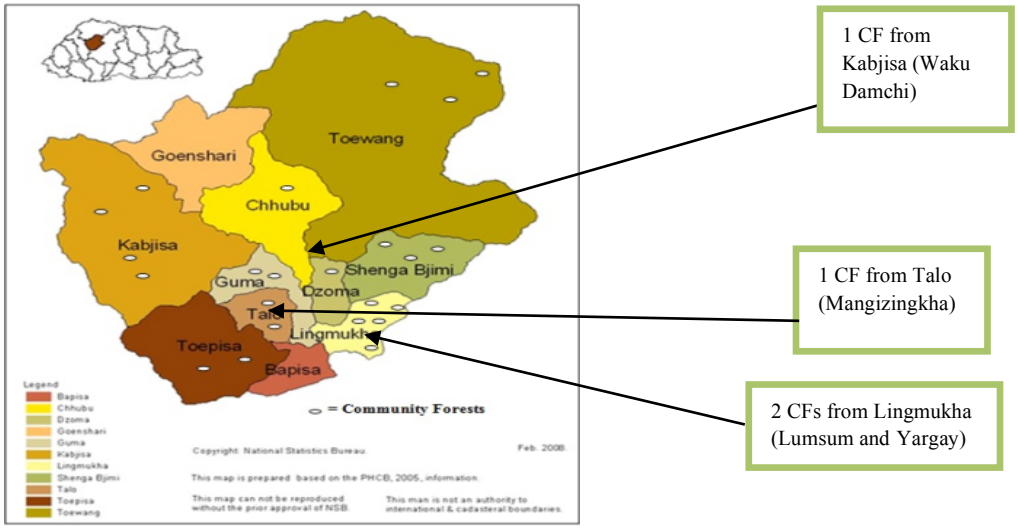

FIGURE 2: THE ADMINISTRATIVE MAP OF PUNAKHA DISTRICT WITH COMMUNITY FORESTS

Source: National Statistic Bureau (NSB) (2009)

3.2 Source of the data

Interviews with the members of the CFs, their leaders and the executive committee members were conducted. Structured and semi-structured questionnaires were pre-tested and revised making changes where it was felt necessary. Other sources of information for this case study included the following: existing literature and plans of the Social Forestry and Extension Division of the Department of Nature and Park Services under the Ministry of Agriculture and Forests. Data were also retrieved from office

records and reports of the District Forest Office, Block Forest Offices, and the Forest Division, Punakha District.

3.3 Data analysis

The data were analyzed after error correction and data editing from each questionnaire. Microsoft Excel was used for data entry in order to perform descriptive analysis. Microsoft Excel was also used for quantitative data analysis. For economic valuation of forest resources, the data obtained was converted to monetary terms for all tangible goods by using market price. The unit used for the monetary terms was in Bhutanese Ngultrum (Nu). At the time of valuation, one US$ was equivalent to Nu 45.

3.4 Economic analysis

Calculation of direct use values

'Direct use values' refers to values derived from actual use of particular goods either for direct consumption or the production of other commodities. Market prices are used for goods that are traded. In the case of forests, direct use values would include the direct value of timber being extracted and NTFP collected. The value of timber and non-timber forest products for both domestic purposes and sale in the market was estimated. The study did not capture indirect values as the estimation of indirect values was difficult because most products and services cannot be traded in the market, and hence they do not possess market prices. Net income was valued in units of Nu/household/year. The direct use value at the household level is explained as follows:

$$DUV^T = \sum_i^n \sum_j^m \left[R_j - C_j\right]_i \qquad (1)$$

Where: DUV^T are the direct use values accrued to the total households in the CF using resources in activity j of forest utilization in i^{th} household, in the time period of annual contribution. T is for the time period of one year.

R is the gross return from timber, poles, post, fuel wood and NTFP both for domestic purposes and for sale per year: (amount of forest products collected from forest (Kg) **x** price (Nu/Kg)/household/year.

C is the cost incurred during the collection of forest resources, such as transportation and cost of hired labour: (hour/time **x** amount of time/month **x** amount of people)/household/year. The data were collected in 2011.

4. Results And Discussion

4.1 Socio-demographic profile of the households

The background information of household respondents (gender and education level) is presented in Table 1. About 38% of the household respondents were female. Regarding the educational status of the respondents, about 73% of the total households were illiterate. About 11% of the respondents had completed high school, 9% completed secondary school and 6% completed primary school. Only 1% of the respondents reported having attended non-formal education. The average age of the respondents was 44 years old.

TABLE 1: GENERAL SOCIO-DEMOGRAPHIC PROFILE OF THE RESPONDENTS IN THE STUDY SITES (PERCENTAGE)

Criteria	Waku Damchi	Lumsum	Yargay	Mangizing kha	Average
Gender (female)	48	5	35	24	38
Education					
-None	67	69		82	73
High school	12	14		6	11
-Sec. high school	5	10		6	9
-Primary	14	3		6	6
-Non-formal	2	3		0	1

4.2 Community forest management

An inclusive innovation program community forest is managed by a group of local people, including the traditional users of the forest, called the

Community Forest Management Group. On approval of a Community Forest Management Plan, the Royal Government gives CFMG members the right to use and benefit from their designated community forest in return for taking responsibility for its management and protection. A CFMG elects representatives to function as their CFMG management committee. Each CF committee comprises a chairperson, a secretary, a treasurer and normally has five to eight members. Committees are selected bearing in mind that there are considerable responsibilities involved, and the committee members are expected to attend meetings and implement tasks on a regular basis. The CFMG members raise their funds through different CF activities, such as the sale of timber and non-timber forest products. The amounts received from organization or government, other grants, donations or funds received from any person contribute to CFMG funds In accordance with the CF rule, fines/penalties for the violation of rules and regulations are also collected and all funds are deposited in the CFMG account. The committee decides on the use of funds, which is normally for community development activities such as rural road construction.

4.3 Community forest conservation and protection activities

During the household survey, the respondents were asked about their participation in various community management activities regarding natural resource conservation and CF protection (Table 2). Forests fire control, protection against illegal logging and NTFP collection, fresh water protection and re-plantation showed full participation. Committee members mostly attended conservation meetings with 92% of respondents' participation. The participation in patrolling CFs was shown at 90%. The participation in wildlife conservation was about 65%. The lowest level of participation of the households was in wildlife conservation because wildlife causes damage to agricultural crops.

TABLE 2 : PERCENTAGE OF PARTICIPATION IN CONSERVATION AND PROTECTION ACTIVITIES BY CF MEMBERS

Activities	Waku Damchi	Lumsum	Yargay	Mangizingkha	Average
Protection against illegal harvesting	100	100	100	100	100
Forest fire control	100	100	100	100	100
Protection of fresh water	100	100	100	100	100
Re-plantation	100	100	100	100	100
Attending CF meetings	90	90	100	88	92
Patrolling of CF	0	86	85	100	90
Wildlife conservation	60	52	70	76	65

4.4 Household's income earning

About 90% of the rural communities in study area depended on farming, such as crops and livestock for their livelihood in the study area. Other off-farm sources of household income include weavings, earning wage labour, money remittances and pensions. The net annual family income from various activities ranges from Nu.101,748 to 489,200 per household (Table 3). The incomes from crops and livestock were estimated to Nu.1,217,175 and Nu.145,289 respectively. The estimated net farm income was Nu.1,362,464 per household per year. The other sources of income came from non-farm activities such as salary, remittances, weaving and small household business, which were estimated non-farm income was Nu.15,891 per household per year. The annual income from forest resources (timber and NTFPs) was estimated at Nu.2,559 per household. The other household cash expenditure such as on food, education, health, cultural events, house rents, electricity and telephones were calculated and amounted to Nu.352,865 per household per year.

TABLE 3: NET HOUSEHOLD INCOME AND EXPENDITURE IN STUDY AREA (NU/HOUSEHOLD/YEAR)

Items	Waku Damchi	Lumsum	Yargay	Mangizingkha	Average
Farm income Crops Livestock	578,822 563,413 15,409	189,755 174,209 15,546	251,400 159,342 92,058	342,487 320,211 22,276	340,616 304,294 36,322
Non-farm income	4,810	5,821	510	4,750	3,973
Forest income	1,501	377	0	681	640
Household expenditure	95,932	94,204	120,918	41,811	88,216
Net family income	489,200	101,748	130,992	306,107	257,012

4.5 Household benefits from community forests

In this study, forest income includes the income derived from the use and sale of forest products from a community forest, the monetary value of the products consumed and sold by the users (Table 4). Among the four CFs, Waku Damchi CF had the highest annual net income from forest resources of Nu.1,501 which was estimated at Nu.36 per household and Nu.20 per hectare. The net annual income of Mangizingkha CF was Nu.681 which accounted to Nu.40 per household and Nu.17 per hectare. The lowest annual income was that of Lumsum CF with net income of Nu.377 which was estimated to Nu.13 per household and Nu.6 per hectare. Yargay CF was not been included as Yargay CF had not made any contribution from its forest products as it is still at the plantation stage.

TABLE 4:NET INCOME FROM FOREST RESOURCES IN THE STUDY AREA (NU/HOUSEHOLD/YEAR)

Items	Waku Damchi	Lumsum	Mangizingkha	Average
Timber	152	154	373	189
NTFP	591	38	20	289
Poles	353	65	139	210
Fuel wood	260	38	112	153
Posts	145	81	38	100
Forest income (Nu/year)	1,501	377	681	941
Forest income (Nu/household/year)	36	13	40	10
Forest income (Nu/hectare/year)	20	6	17	5

***Note**: NTFP include mushrooms, bamboo shoot, orchids, ferns and bettels*

5. Discussion

5.1 Management and participation in conservation activities of community forest in Punakha district

One of the purposes of the inclusive innovation for instance CF program is to generate income and reduce rural poverty through the sustainable management of the forest. The CFMG has given rights to manage the CF in its own area and the benefits derived from the CF were distributed among members. The failure of some community-based management systems can be traced to a number of problems, such as the inability to truly develop power at local levels. This happens when local communities are given rights to forest use but decisions are usually made by forest or other officials outside the community. For example, CFMGs are responsible for forest protection but have limited rights to access forest resources. For a CF program to capture this untapped potential, wide ranging and phased reforms are required at both local and national levels. As stated by Shyamsundar & Ghate (2011), a good part of the success of CF in Nepal was attributed to local foresters banding around the concept, and community institutions being more accountable locally. Communities with more secure rights over their

forest are able to use funds raised from forest-related activities with less interference from the state.

The National 10th Five Year Plan states that it will adopt an effective inclusive innovation strategy in which the communities and the prospects of the forest complement each other in such a way that communities are closely and gainfully involved in all of the CF activities relating to regeneration, afforestation, protection and management of forest areas and other CF programs. When it comes to forest conservation and protection, the compromise within the research and policy communities is generally positive (Shyamsundar & Ghate, 2011). The results of the four CFs in the Punakha district are shown in Table 2. It was found that a majority of households contribute to forest regeneration and fresh water protection. The vigorous patrolling and awareness campaign has resulted in decline of forest fires, illegal logging and NTFP collection.

5.2 Contribution of CF to community's household income

The present study indicated that forest plays a good role in contributing to rural household incomes. Most of the communities in the study areas, however, did not depend solely on the forest and its products as sources of sustenance and income. The greater proportion of their livelihood derived from agriculture but also depend on the forest for certain products. The study revealed that the principle sources of income for the majority of households were from agriculture. Forest utilization is a supplementary source of income to agriculture. This result was similar to what one would expect: free forest utilization by households are additional sources of income in rural areas and fuel woods were the main source of energy (Kaale et al., 2002). The communities were aware of the economic potential of CFs but do not optimally benefit from them economically at least as of now. Some small-scale timber harvesting does occur at the local level for construction of houses, but any profit from timber extraction has been strictly forbidden until there is a surplus timber available (Temphel & Beukeboom, 2006).

It was found that forest resources contributed about 0.3% to the total household income of the members. It is relatively very low compared to other countries (Chhetri, 2005). This may be because communities depend

mainly on forest products which are restricted by regulations imposed by CFMGs. The impact of CFs is limited, particularly with respect to the income because of restrictions on timber harvesting; the returns from timber and non-timber forest products are small.

Tshering, (2009) stated that the annual harvesting limit did not allow the harvesting of any timber if the basal area was below 10 square meters per hectare because it was classified as degraded forest. However, it was found that the resources were under-utilized. In a protected forest, the challenges were higher as harvesting was restricted and local benefits were minimal (Zahabu., Malimbwi., & Ngaga. 2006).

Further, Wangchuk and Back (2008) argued that the area ceiling of 2.5 hectare per household is a limiting factor as the maximum area for a CF program failed to take into account the large differences in the growth and yield potential of different forest types in the country. The area ceiling also severely limits the ability of communities to manage their forests to produce an excess of timber that can be sold to generate income.

6. Conclusion and Recommendations

The rural communities heavily rely on forest, and good management can play a crucial role in poverty reduction. The CFMGs were given rights to manage community forest in their own areas and the benefits derived from the community forest were distributed among the members. There is strong support for conservation and protection activities in CF. It offers a degree of confidence about the long-term positive impact of a inclusive innovation such as CF program on the environment. The net family income for households ranges from Nu.101,748 to Nu.489,200 per year. The contribution from forest resources were Nu.2,559 per year, accounting for 0.3% of total household income. It is relatively low compared to that of other countries. At the time of this study, the contribution from CF activities to household income was marginal.

There is a policy challenge in achieving the goals of both environmental sustainability and poverty reduction at the same time. Therefore, the challenge needs to be acknowledged. The policymakers should rethink the restriction on the use of forest resources and explore opportunities to capture

more benefits from forest alongside the environmental sustainability outcome. The government could help by supporting small-scale processing plants to diversify and add value to CF products, such as making timber into furniture and by providing relevant and timely information to help households' access local and regional markets for their CF products. The government should continue to support conservation activities and promote wider participation through more education and awareness campaigns. Further this study didn't attempt to consider the indirect value of the forest, such as biodiversity, which should be further researched.

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Wild Plants As Non Wood Forest Products Used by the Rural Community of Dagana, A Southern Foothill District of Bhutan

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Abstract

Wild plants and edible fungi are the potential resource of the Non Wood Forest Products (NWFP) that provides rural poor people with food and cash during the lean agricultural farming season leading to ensure the food security. Bhutan stands at one of the fragile mountain ecosystems of the world which need much attention to the conservation of ecosphere for maintaining its biodiversity. People residing in High Mountain or in the foothills of Bhutan have immense knowledge and skill on ethno-plants resources. Hence, the wild plant survey was conducted to reveal the traditional knowledge and documentation of available NWFP species that are locally used by the remote community people of Dagana district.

The 14 block administration that includes all in the district was accounted to conduct field survey. The survey tools included direct observation, semi-structured interviews, individual discussions, key informant interviews, focus group discussions, questionnaires, and participatory rural appraisal.

It was found that 241 species of NWFP are used by the local community. Some species does have potential for commercialization and it is being observed that low income group of the people benefitted monetarily the most. The NWFP farmer groups in Dagana have been getting good monetary advantage from the sale of matured spikes of *Piper longum* L. and *Piper peepuloides* Roxb. and the leaves of *Cinnamomum tamala* (Hamilton) Nees & Ebermaier.

Dagana has diverse NWFP species that provide subsistence livelihood to economically disadvantaged group of people. However, it was revealed that because of rural-urban migration, the transferring of indigenous knowledge from elderly people to younger generation is in the stage of oblivion. The flow of indigenous knowledge from generation to generation is at stake thus, it is very much necessary to have documentation of such knowledge before it gets depleted.

Key words: *Livelihood, biodiversity, subsistence diet, poverty, part-time employment, sustainable conservation, fragile ecosystem, ethno-plants*

1. Introduction

The creation of Convention on Biological Diversity (CBD) at the earth summit in Rio de Janeiro in 1992 gave a limelight to every nation in the world on conservation of biodiversity which include both the diversity of wild flora and fauna. CBD is an international treaty for the conservation and sustainable use and the equitable sharing of the multiple benefits of biodiversity. It has universal participation with 193 Parties (Salpekar *et.al*., 2010). In this article it is used Non Wood Forest Products (NWFPs) for the diversity of wild flora which has a great importance to the rural and semi-urban livelihood of any people communities in the world. The local community or indigenous people can be regarded as knowledgeable in terms of managing the biodiversity resources which includes NWFPs too.

Diversity of plants species has diverse uses at the local community level. Some plants are used for primary health care and to supplement subsistence diet, provide part-time employment and generate off-farm cash income, fodder for cattle and raw materials to construct green resilience infrastructures. In Bhutan quite many wild plants species uses as different type of NWFPs and has become a part and partial to the subsistence livelihood since time immemorial. According to NOP[1] 2012, about 64% of the Bhutan population depends on agricultural farming and NSB[2] 2013 stated that 12% of the country population are still poor as per the Bhutan Poverty Analysis (BPA) 2012, report which means this section of people lives below the total poverty line of Nu.1,704.84 per person per month. The highest poverty rates are observed in the districts viz. Dagana, Samtse, Lhuentse, Pemagatshel, and Zhemgang. Most of the rural communities in these districts are subsistence poor as the individual household lives with per capita consumption below the cost of subsistence diet food. These sections of the people are very much dependent on NWFPs of diverse plants species for their means of livelihood. Rural poor communities always live in adjacent to the forests. In amidst, every nation of the world has to give highest priority to the participation of people communities in order to uphold the ethno-biological value in concurrence to the principle of CBD so that diversity of in-situ plants are well conserved and avoids the depletion of natural

[1]National Organic Programme
[2]National Statistics Bureau

resources. The Royal Government of Bhutan (RGOB) always emphasized on the conservation of environment and forests which is one of the four pillars of the country's Gross National Happiness (GNH) and environmental conservation is also enshrined in Article 5 of the constitution of the country. LCMP (2010) depicted that the country has forests coverage of 80.89% including the shrubs cover.

This ensuing article endeavours to find out the uses of NWFPs for diverse purposes by the rural community of Dagana, which is one of the southern foothill districts of Bhutan. Almost everywhere in this article, the diversity of wild plants is referred as NWFPs since NWFPs is more accepted and well understood abbreviation in Bhutanese context.

2. Objectives

The broad objective of this article is to reveal the ethno-botany state of the district. Other specific goal is to:

1. Find out the numbers of NWFP plants species and their economic benefits
2. Find out whether ethno-biology can explain the floral diversity
3. Understand the trend of ethno-ecological plants resources

3. Study Area

Dagana is one of the southern foothill districts of Bhutan (Fig. 1). It has an area of 138,900 hectares with an average altitude ranging from 200 to 3,800 m a.s.l.[3] District has forests and shrubs cover of about 92% (LCMP, 2010). It is bordered by Thimphu and Chukha district in the West, Wangduephodrang district in the north, Tsirang district in the East and the Indian State of West Bengal in the South. The district lies

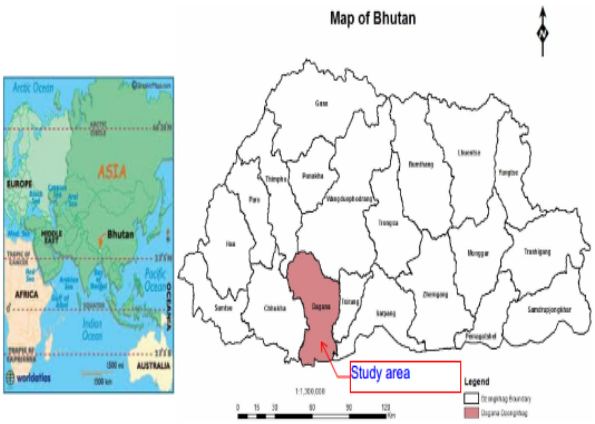

Figure 1: Location of study area

[3] Metres above sea level

within the zone of temperate and sub-tropical that experiences with hot and wet summer and dry cold winter.

The district is divided into 14 blocks viz. Dorona, Drujegang, Gesarling, Goshi, Kalidzingkha (Kana), Khipisa (Khebisa), Lajab, Tashiding, Tsendagang, Tsangkha, Tseza, Deorali, Lhamoizingkha and Nichula (Fig.2). It has a total projected population of 25,070, out of which 12,644 are male and 12,427 are female as of 2010. Settlements in the district are scattered and remote due to rugged terrain topographical feature. The dwellers consist of diverse social community. Before 1990s it was composed of the communities like Lhotshamp, Kheng and Ngalong. With the commencement of RGOB's resettlement programme after 1990s, the Dagana dwellers community was enriched by the addition of another Sharchop community. Presently, this district has 8 Basic Health Units (BHUs), 23 Schools complemented by outreach health clinics and extended education class rooms respectively (NSB, 2010).

Figure 2: Study area

Subsistence agriculture farming is practiced which is the major source of income for the district. Agro-ecological climate favours to grow varieties of crops like paddy, maize, millet, orange, cardamom, banana, passion fruit, pear, avocado, and vegetables such as broccoli, cauliflower, cabbage, potato, chilies, and tomatoes.

4. Materials and Methods

Before visiting the field, the programme for the NWFPs survey in the field was informed to the district administrator, district forest office and to territorial forest office. The field survey was carried throughout 14 blocks of the district in phase-wise. For the first 11 blocks the study was carried out in 2002 and for other 3 blocks in 2003. From each block, 25 households were randomly selected and asked from each household to take part in survey atleast by 2 household members irrespective of gender. All the respondents in the survey were of above 20 years of age. NWFPs data were collected

through different interview methods which include participatory rural appraisal (PRA), direct observation, semi-structured interviews, key informant interviews, individual discussions, focus group discussions, and questionnaires. The key informant group was comprised of local block administrator and forestry field officials.

The interview was conducted to gather pertinent information such as name of the informant, age, sex, occupation, available NWFP species local name and the useful part (s), purposes of the used part (s) and distribution within their locations. Wherever possible the informants were asked to collect and bring a plant sample which they used as NWFPs for easy identification. It was tried to identify the plants in field itself by observing their morphological characteristics, habit, and habitat. Further, several available related flora books were referred to identify the plants and get confirm of the scientific names and the family they belong to. Average elevations (in metres) of the plants species growing areas were also noted. Secondary data also obtained through reports and papers that are submitted from field to the head quarter offices. It was done to see the gain of ethno plants to the rural communities.

5. Data Analysis

The collected information on NWFPs and other related issues were checked thoroughly to avoid duplication of the data. After physical verification, all data were entered in the computer using MS Excel and MS Word spreadsheets. The data were then analyzed using descriptive statistic to deduce the mean plots of the data. Also inferential statistical tools like linear regression employed using SPSS to determine the models and regression coefficient of the NWFP resource distribution.

6. Results and Discussion

The rural settlement in Dagana is very close to the natural forest areas (*see above paragraph: study area*). Traditionally the rural folks are too intact with the forest areas from where people used to derive some basic necessities for their everyday livelihood. For instance, farmers collect fodder from forest to feed their livestock, instant medicine for the minor injury and sickness. Likewise during lean agriculture farming season, people used to gather wild edible tuber, wild medicinal spike (that of piper plant) and get sold in available market for cash income. But people stated, these days depending

on forest are being declined due to the advent development taking place in the district as compared to two decades ago. Even then as per the survey, it was identified a total of 89 plant families that are being used as diverse sources of NWFPs. It was found; the community used a total of 241 different NWFP species (Annex 1) which includes fungi (wild edible mushrooms), bamboos, rattans, climbers, lichens, ferns, small plants, shrubs, and trees. Out of that total NWFPs, 213 were identified scientifically that comprised of 13 bamboo, 6 rattan, 6 wild edible tuber, 7 wild edible mushroom and 4 piper species. About 22 wild edible mushrooms and 6 other plants and climbers species were identified using only local names that used by the local community of Dagana district.

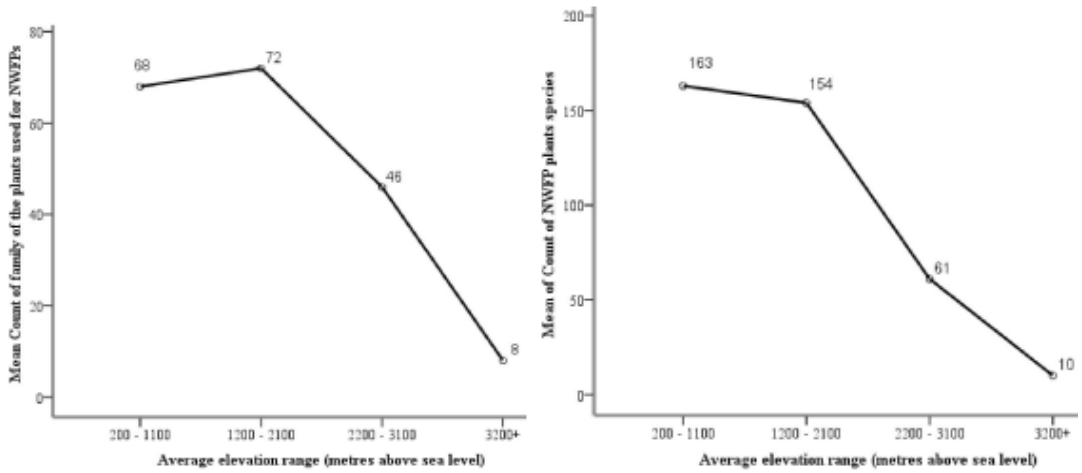

Figure 3 Mean count of family and species occurrence

It was noted that the people residing in the lower altitude (elevation) enjoys bigger diversity of NWFP resources as compared to the people those dwells in higher elevation places (Fig. 3).

Figure 3 above shows that greater number of family and plant species occurred in the lower elevation places. In higher elevation topography, the diversity of plants species decreases. It might be, because of ecological phenomena in which biophysical factors like land topography, aspects, soil type, climate (micro and macro conditions), rainfall and land gradients influences growth of the floral diversity.

The effect of average elevation of the physical topography will be the casual factor to the occurrence of the family of the plants that are used as NWFP resources. This is predicted by the model (Fig.4) of regression coefficient where R^2 = 0.8230 and y = -20.60*x + 100. This model has indicated that family of the vascular plants diversity will significantly decreases as the land topography ascended. Similarly figure 5 also shows the model regression coefficient for the NWFP plants species diversity against the range of topographic elevation. This model has deduced R^2 = 0.9250 and y = -55.20*x + 235. This regression relationship is too significant which predicted that 92.50% of the casual factor for decrease of plant diversity is explained by average elevation of the land topography as figure 5 illustrated that, the increased altitude results lesser or fewer number of floral diversity available.

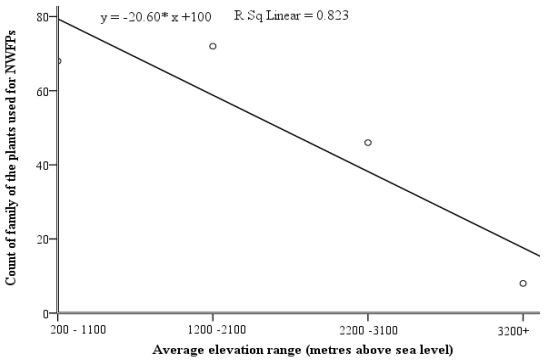

Figure 4: Availability of family of the plants used for NWFPs

It is being observed that marginal section of people in rural community depend much on the nearby forest for the requirement of subsistence living as compare to well established people or community of the particular remote area. This section of people knows more about the ecology of NWFP species and ethno-management aspect of the resources. In 2008, farmers of Lhamoizingkha came forward with an innovative idea of forming farmers group to manage the NWFP resources. In 2009 with the intervention of Social Forestry and Extension Division, setup

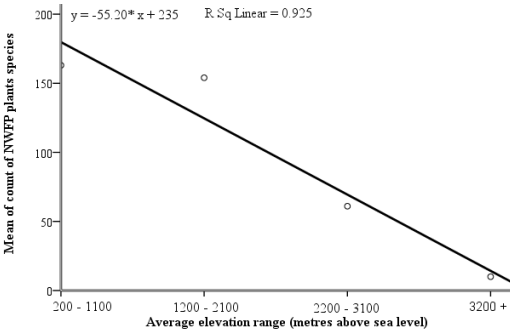

Figure 5: Occurrence of mean NWFP plants species diversity

NWFP Farmer Group in Lhamoizingkha, a first of its kind in the country to manage and commercialize the NWFPs sustainably. Table 1 shows the benefit from NWFP ethno plants to the rural community of Lhamoizingkha. This demonstrated the management of wild plants by the rural community is crucial for the betterment of the community's social and economic lives.

Table 1: Cash earned by NWFP Farmer Group

NWFP species	Products	Quantity sold (Kg)	Earned cash (Nu.) in year		Total cash earned (Nu.)
			2010	2011	
Piper peepuloides Roxb.	Spike / fruit	240 & 755	19200.00	113250.00	**132450.00**
Piper longum L.	Spike / fruit	7 & 21.50	1050.00	3655.00	**4705.00**
Cinnamomum tamala (Hamilton) Nees & Ebermaier	Leaves	0 & 887	0.00	19514.00	**19514.00**
Grand Total Earned Nu.			**20250.00**	**136419.00**	**156669.00**

Source: Social Forestry and Extension Division, Thimphu.

Note: USD 1 ⇔ Nu.55

Apart from financial benefits, maximum numbers of plants species are used for various purposes by the people of Dagana. As a paradigm, for minor injuries and sickness people don't usually visit the nearby clinic instead they used their surrounding plants species for the immediate remedy (Annex 1). Bhattarai *et.al,* 2009 stated that the healthcare system in remote villages would be a very basic so wild ethno plants (traditional medicines) becomes the primary source of healthcare. Remote people are more intact with traditions, culture customs, and beliefs; hence many people depend on wild medicinal plants as they have in-depth skills on the use of such plants species for their basic healthcare.

In agriculture off-season, many rural people collect vegetables, mushrooms, oil seeds, dye plants, bamboos, and rattans from the adjacent forest for the purpose of their survival livelihood (Annex 1). Ju, *et al,* 2013 also ascribed that wild edible plants are the sources for local people, particularly to inhabitants of remote rural areas to derive mineral elements and vitamins and several such plants have great potential for commercialization. However, Ju cautioned that the knowledge related to the utilization of wild edible plants

are fast depleting especially in the areas where it is convenient of transportation and thriving tourism culture.

7. Conclusions

The survey shows that the wild plants are the significant sources of various NWFPs for rural people of Dagana as they have intimate association with the wild plant communities since time immemorial. Various parts of the plants are used by the local people and most often used are leaves as fodder for livestock, tender leaves, shoots and fronds as wild edible vegetable, bamboos and rattans for every-day livelihood, wild edible tubers as substitute to food in off-crops period and fruits or spikes and even leaves for commercial purposes. It is observed that the lower income section of people get some financial benefits by selling some of the potentials NWFPs. Economically disadvantaged group of people have yet strong belief on the quick remedy for the minor sickness, diseases and wound from the use of wild plants that are available within the fringe of their close environment. Conversely, it is noted that there is deficiency of persistence flow of such ethno knowledge from elderly people to the younger generation because of rural-urban migration.

The ethno plants survey ensures the resource analysis of the diverse NWFP species used by the people of the remote community. As the study has found out that the use of wild plants in Dagana is an age old tradition. Therefore, instantaneous efforts for conservation and management of some valuable NWFP plants species in participation with local people community will persuade the sustainable conservation of ethno-plants, social and cultural diversity. The regression model demonstrated in this survey can be used to prioritize and develop the criteria for sustainable conservation of ethno-plants diversity in the selected region identifying the fragile ecosystem altitudinal-wise. Ultimately such approaches will lead to the preservation of local indigenous ethno-plants knowledge of the brink community.

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Two Decades of People Centered Conservation in Kalakadu-Mundanthurai Tiger Reserve of Southern Western Ghat Mountains in Tamil Nadu, India

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Abstract

Kalakadu Mundanthurai Tiger Reserve, the first tiger reserve in Tamil Nadu occurs in the southern Western Ghat mountains. Declared as one of the 18 global biodiversity hotspots, Western Ghats is known for its extremely rich floral and faunal diversity and endemism. KMTR faced severe conservation problems among other things, from resource dependency on the forests by the fringe communities from about 241 villages lying in the buffer zone of the reserve. With an object of achieving ecological development of forests of the area through economic development of the people by promoting participatory planning and implementation, World Bank funded Forestry Research, Extension and Education Project was implemented for a period of seven years from 1995-96 to 2001-02 at an outlay of Rs. 118.2 million at KMTR. Besides Entry Point Activities, the Project has three essential components viz., biomass regeneration in and around the target villages, provision of substitute energy materials and methods to reduce dependence on wood biomass energy, and alternate employment opportunities for the forest dependents. With a unique approach including transparent, consultative implementation process, the Project brought many benefits to the area by way of reduction of forest dependency, positive impacts on forest and wildlife protection and on the local economy through micro credit management of revolving fund linked to micro enterprises by the village institutions like Village Forest Committees and Self Help Groups. The post project impact assessment strongly indicates ecological, institutional, financial and social sustainability of the outcomes. Independent evaluation by various agencies points towards the huge success of the eco development pilot project in KMTR, suggesting that it is a well accomplished model replicable to different protected areas across India and Southern Asia.

Key words: *Western Ghat mountains- Kalakkad-Mundanthurai Tiger Reserve- World Bank's Eco development Project- Process approach in planning-Participatory implementation-Project outcomes and impacts-sustainability of benefits- External evaluation*.

1. Introduction

The Western Ghats Setting

Western Ghats, one of the ten biogeographic zones of India has its throw as a long hill range, running almost parallel to the country's West Coast of to a length of 1,600 km from south of Tapti river to Kanniyakumari. Spread over six State provinces, the Ghats is a continuous escarpment, except for a gap in Goa and a 40 km long Palghat gap in Tamil Nadu-Kerala border. The range rises from near sea level at its foot in Goa to a maximum of 2,695 metres (m) above Mean Sea Level (MSL) as Anaimudi peak in Kerala. The topographic reliefs and the directional aspects contribute to three major climatic gradients, with their local topographic variations. These are the West-East gradient in the progress of monsoon from the coast towards interior, the South-North gradient with regard to length of dry season and the temperature-altitude gradient[12]. The climatic and edaphic variations within different reaches of the Ghats result in distribution of diverse vegetation types, their associated floristic composition and structure of the forest stands. The Ghats possess nine of the 16 major forest types in the country as per Champion and Seth's classification and support many sub groups, edaphic and serial groups within these nine forest types.

Though the Western Ghats cover only5% of India's land area, it is a rich repository of floral assemblage accounting for about 27% (4,000) of its flowering plant species. Various botanical explorations bring out the fact that high degree of endemism is one of the interesting aspects of the floristic of the Western Ghats. Nearly 63% of the country's arborescent evergreen taxa are endemic to the Western Ghats[11]. High level of diversity and endemism in the Western Ghats has conferred on it the status of one of the 18 global biodiversity hotspots. Western Ghats directly or indirectly support the livelihood of millions of people, besides innumerable ecological services. The economic valuation and contribution of Western Ghats to GDP remain to be assessed.

Tamil Nadu Part Of The Western Ghats

The State's part of the Western Ghats, constituting its southernmost segment holds diverse forest types and is rich in terms of biodiversity abundance. Considering the ecological uniqueness of the region, the Ghats portion in the Nilgiris of Tamil Nadu, combined with the Ghats in Wayanad area of Kerala and Bandipur area of Karnataka came to be notified as the first Biosphere Reserve of the country in 1986 under the aegis of UNESCO's Man and Biosphere Programme (MAB). Eight of the 10 sanctuaries and three of the five National Parks of the State lie in the Ghats, thus providing enhanced legal status of protection to these forests as Protected Areas (PA) under the Indian Wildlife (Protection) Act 1972. In view of its outstanding universal values, 39 sites in the Western Ghats, proposed as serial nomination were declared as UNESCO's World Natural Heritage Site during 2012. Of them, six sites including Kalakadu-Mundanthurai Tiger Reserve (KMTR) are located in Tamil Nadu.

Kalakadu-Mundanthurai Tiger Reserve

Within the Western Ghat region of Tamil Nadu, Mundanthurai sanctuary (558.57 km^2) was formed in 1962 for the protection of tiger, a flagship species and Kalakadu sanctuary (221.07 km^2) was notified as a Protected Area in 1976 for the conservation of endangered primate species, the Lion Tailed Macaque (LTM)[13]. These two sanctuaries were together declared as KMTR, the first tiger reserve of the State in 1988 and presently include part of adjacent Kanniyakumari sanctuary. KMTR with an extent of 895 km^2 (8º 25'N to 8º 53'N and 77º 10'E to 77º 35'E) is part of Agasthiarmalai landscape **(Add Map 1).**

KMTR falls in the province 5B as per the Rodgers and Pawar's biogeographic classification. Comprising of three major watersheds viz., Kodayar, Manimuthar and Tamirabarani, KMTR protects the catchment of numerous streams and rivers and is rightly called a 'River Sanctuary'. The river and canal systems together support the agricultural economy of three districts viz., Tirunelveli, Thoothukudi and Kanyakumari. Spread over a diverse terrain ranging from about 60 m to 1,866 m above MSL, KMTR hosts vegetation type ranging from thorn scrub to montane temperate

evergreen forests. Topographically, the reserve comprises of three distinct units viz., low Mundanthurai plateau, the steep hilly terrain and high altitude Upper Kodayar plateau.

The floral diversity is impressive with 2,255 species of angiosperms. This region has about 150 localized plant endemics and is a rich reservoir of relatives of cultivated plants such as cardamom, mango, banana, rice, jack and turmeric[5]. With regard to faunal diversity, 77 species of mammals have been recorded in KMTR and many of the charismatic, endangered mammals like elephant, tiger, leopard, Indian gaur, Nilgiri tahr are found here. Entire KMTR has been declared as a critical habitat area for tiger conservation. It is one of the five places in the peninsular India, where all the five primates- LTM, Nilgiri langur, common langur, bonnet macaque and slender loris- occur. Of the 215 amphibian species recorded in India, 45 species are reported in KMTR and 27 of them are endemic to Western Ghats. 480 species of reptiles have been recorded in India, of which 197 are found in the Western Ghats. KMTR has 88 species of reptiles. Number of bird species recorded here is 337 and of the 16 Western Ghats endemic birds, 14 species are recorded in KMTR[15]. It is recognized as one of the sixCentres of Plant Diversity (CPD) and one of the 24 micro centres of endemism in India[3]. IUCN has recognized Agasthiamalai, core area of KMTR as 'super hotspot of biodiversity' and identified the reserve as among the Level-1 tiger conservation units (TCU), representing the tropical Wet Evergreen forests worldwide. Ramesh et al. [11] reported that there is ca. 440 $km^2$of contiguous extent of non-equatorial rainforest in KMTR and the adjacent hills. In view of global level prominence of it unique biodiversity assemblage, KMTR along with adjacent Tamil Nadu and Kerala portions of Western Ghats over an extent of 1672.4 km^2 was declared as Agasthiamalai Biosphere Reserve (ABR) in 2005.Many of the plant species find place in the global Red List of IUCN and the red listed animal species are either placed in the critically endangered, endangered, vulnerable or near threatened category.

The exemplary ecological richness of the area attracted many international and national scientists to the area for in depth investigations, which has enhanced our understanding of the biological values of the area. About 60 new species have been reported from this region since 1957 out of the

botanical explorations in the last four decades [4]. In terms of its cultural richness, the reserve supports a single tribal population group of Kanis in five enclaves, who primarily depend on sustenance agriculture and collection of NTFP. In short, KMTR possesses global, national, regional values in terms of its natural heritage and ecological distinction and adds much to the socio-cultural, economic values to the State and to the local communities.

Lost Woods And The Pressures From Within

A survey by Indian Institute of Public Administration revealed that human population live inside 69% of the surveyed PAs and community rights, leases or other customary concessions exist in 64 % of them[8]. KMTR is no exception. The twin sanctuaries of Kalakadu and Mundanthurai were administered as like other forest divisions of the State till it was declared as a tiger reserve. The major focus was on protection of forests and wildlife by solely relying on the strength of the forest and wildlife laws. In the lower elevation outer hill slopes, the anthropogenic pressures were intense. Five groups of key stressors were affecting the biodiversity conservation in KMTR in the past.

Non forestry land use

Though KMTR boasts one of the contiguous forest ecosystems, it holds for long many private forest enclosures totaling 21.92 km^2 and a major leasehold area with tea plantation on it (33.99km^2) within its core area. The reserve also lost its natural woods and the associated vegetation in the period between 1960 and 1990 to various forms of non-forestry land uses including the development of reservoirs (36.4km^2), lease to the State Electricity Board and Public Works Department (2.88 km^2), village enclosure (0.60 km^2), religious enclaves (0.38 km^2) and encroachments (0.40km^2) [2]. All these diversions within the forests had led to the removal of invaluable biodiversity, besides posing some threat by the large human presence and their associated activities.

Resource utilization as part of forest management

Organized utilization of tree resources by way of extraction of mature wood through selection felling, removal of dead and wind fallen timber trees in the natural forests, clear felling in fuel coupes and rotational harvest of

plantations in managed forests had been in vogue till mid 1980s, when these activities ceased. These practices have caused considerable alteration in forest structure, composition and extent, reducing the late-seral stages and old-growth forests, particularly wherever clear felling was practiced. Another important economic management activity was seasonal removal of Non-Timber Forest Produce (NTFP), which was mainly through contract system awarded by annual auction. Timber harvest and collection of NTFP abated since the declaration of the area as tiger reserve.

Resource dependence by fringe population

The natural resource rich terrestrial areas of KMTR have always been under immense anthropological pressures. The Reserve on its northern, southern and the western boundaries share the forests of Kanniyakumari district or of Kerala and therefore, free of any human-induced threats. However, along its eastern perimeter of ca.110 km and within 5 km distance from this boundary, it has about 145 villages and a few medium townships with about 30,000 households and a population of over one lakh[10]. People of these villages practice traditional rain-fed agriculture, which is their single most important source of livelihood. These villagers along with their cattle were heavily dependent on the reserve for its bio resources. These forests experienced intense pressure from head loading of firewood, small and large timber, grazing, removal of fodder and green manure, unauthorized collection of NTFP and occasional hunting of prey animals. Fall out of these activities was annual incendiary fires in dry deciduous, thorn forests, savannahs and the scrubs, which was largely man-made. Organized forest crimes like cannabis cultivation, illicit distillation of arrack (country liquor) and gem stone mining were a problem in few pockets **(Add Map 2).**

Unsustainable tourism

Many places of religious and tourism value occur within the reserve. Though by extent, the pilgrimage sites occupy much smaller area (0.38 km^2) in four locations in all) impact of visitation by pilgrims and tourists, largely from far-off areas to these places are undesirable in terms of their ecological, aesthetic and pollution impacts. The Sorimuthaianar koil in the Mundanthurai plateau receives nearly one lakh visitors in a short span of one week for the seasonal festival during the Tamil month of *Aadi* (July) and the

spillover effect of such a congregation could be easily understood. Water falls in the reserve and the reservoirs attract tourists in connection with bathing and boating, besides for nature and wildlife viewing. All these uses were impinging upon the biological value of the KMTR.
Other activities

Transportation infrastructure, mainly the roads passing through the reserve acts as a barrier for movement of wildlife, cause mortality and disturbance and as movement routes (corridors) for the spread of invasive alien species. Wide ranging herbivores like elephant, Indian gaur and carnivores like tiger, leopard are disturbed hugely due to fragmentation of forest habitats and due to the presence and movement of people and their vehicles. Tribal presence in the five forest enclaves is also a management concern, albeit in small measure. Deprivation of traditional livelihood of tribal with the stoppage of grazing and cessation of all harvest and removal of forest produce from the reserve is also a source of anthropogenic disturbance by way of illicit NTFP collection, grazing, fire etc. by the local people.

Era Of Management Plans And Eco Development In Kmtr

National Wildlife Action Plan (1983) recognized the need for eco development to support PA management. Union Planning Commission for the first time included eco development scheme in the country's Eighth Five Year Plan (1992-1997). When the early management plan for KMTR was written[7], it had outlined many management priorities in its plan in tune with the Project Tiger guidelines. Since then, the prescriptions for reserve management are written in the five-yearly management plans. The key management objectives have been to conserve the ecosystem, species and genetic diversity and evolve recovery strategies for the red-listed plant and animal species by reducing the adverse impact of people's activities on the reserve. It envisages maintenance and restoration of the catchment capability of the watersheds and ensuring security of water regime in the region. People's participation in reserve management by developing stake in nature conservation is also aimed to be achieved.

Guidelines of Ministry of Environment and Forests (MoEF) describes eco development 'as a package of programmes that will demonstrate the concern of the PA manager for the socio economic development of the fringe or

buffer zone villages and will result in greater cooperation of the residents of the villages in conservation and management of wildlife'. Thus, corner stone of eco development strategy is involvement of people living in and around PAs in planning and implementation of proposed conservation measures and livelihood activities. As the impact of fringe population on the forests of KMTR was intense, the reserve managers and officials of the Tamil Nadu Forest Department felt an imminent need to initiate an eco development programme with the view to create an enabling environment and mechanisms to reduce the dependency of people on forest resources.

2. Programme Objectives

The Forestry Research, Education and Extension Project (FREEP) preparation document prepared for World Bank funding (1993) defined eco development 'as a strategy for protecting ecologically valuable areas from unsustainable or otherwise unacceptable pressures resulting from the needs and activities of people living in around such areas'. Two representative mountain ecosystems of the country's northern (Great Himalayan National Park, Himachal Pradesh) and the southern (KMTR) region, representing unique biodiversity assemblages, with differing levels of peoples' dependency on forests were chosen to undertake the pilot project to foster people participation in biodiversity conservation. The basic philosophy of the KMTR initiative was 'ecological development of the forests through the economic development of the forest fringe communities'. The project introduced eco development approach for poverty alleviation along with conservation goals of PAs on a systematic basis for the first time in India. FREEP was launched in KMTR during 1994-1995 as a five year project, which got extended by two years (1999-2001) with the total outlay of Rs. 118.2 million. This scheme envisaged to generate valuable experience and information on causes, concerns and outcome of local people's involvement in conservation of biodiversity. The project has the following broad objectives:

- ✓ To establish committed grass root level organizations viz., Village Forest Committees (VFC) concerned with conservation by educating, motivating and eliciting participation in the eco development villages
- ✓ To achieve reduction in resource dependency on the forests of the reserve by providing alternative employment opportunities for sustainable livelihood, thereby reducing the adverse impacts of local

people on biodiversity leading to habitat improvement and conservation

- ✓ To promote awareness among the target villages about the values of the reserve and the need for conserving it using different media
- ✓ To enhance the capacity among local people in needed skills and knowledge by way of organizing training courses, workshops and field visits
- ✓ To provide opportunities for local peoples' participation in PA management activities.

3. Process Approach In Eco Development Planning

The selection criteria for implementation areas were that the sites are representative of variety of conservation problems that are affecting the PA and that there should be a real chance of measurable and demonstrable success in the project life time. 113 villages consisting of a population of 80,317 people participated in the project to begin with. From among the 20,020 families in these villages, 15,298 families joined as members of the Village Forest Committees (VFCs) during the first phase of the project.

Process approach in planning adopted the following stages:

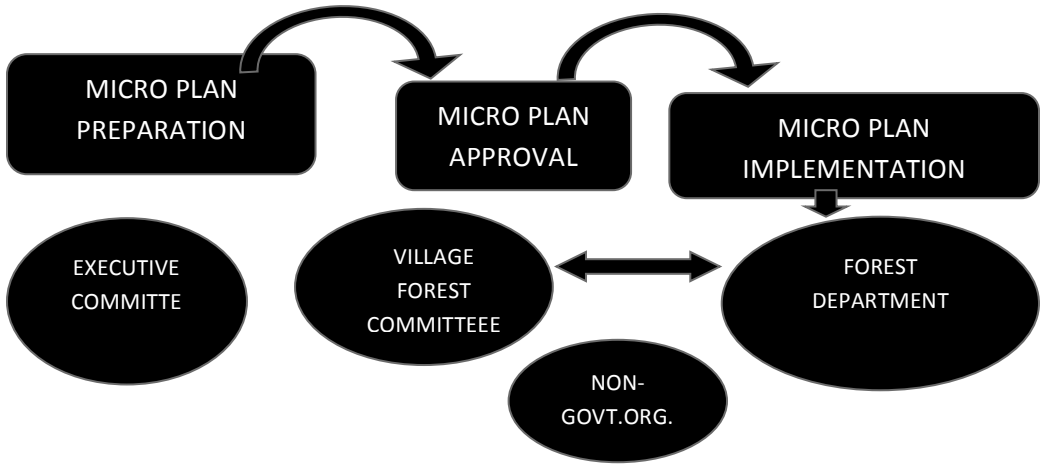
a. Developing relationship with people of the programme village to achieve the desired involvement by providing preliminary project investment for building various community assets as Entry Point Activities (EPA) like repair of a village road, drinking water supply etc. Allocation of Rs.50,000/- for a village comes as an 'ice breaking' effort and is accompanied with peoples' contribution to the tune of 25% of the cost of works.

b. Facilitating the enrollment of members for establishing the VFC by the project team comprising of the project staff, local Non-Government Organization (NGO) representatives (52 of them from nine local NGOs had been working in the area) by sitting with the villagers. Membership is open to all households with one male and female member representing each household at a nominal membership fee of Rs.1 per person per month. Members then select six executive members (with at least 50% of them being women), who among themselves select a chairperson with a tenure of one year. Eco development Forester of the area is nominated as the Member Secretary of the VFC.

c. Undertaking the participatory micro planning so as to i) assess the resources or income derived by members of a community from the PA, location and distribution of such resources and the seasonality of supply and demand, ii) determine the negative impacts of the community on the reserve and vice-versa (wild animals depredation for instance) iii) consolidate community suggestions on felt needs and for creating alternative ways of accessing resources or earning income, iv) present cost proposals for the implementation of agreed alternatives together with an implementation schedule, v) identify the institutional arrangement, community responsibilities and those of the reserve management. For prioritizing the devolution of project benefits, the households are grouped into three categories of 'Red', 'Yellow' and 'Green' based on the family's economic status and relative dependence on the forest for livelihood. Red group families are the poorest, which have maximum dependence on forest for livelihood for a greater part of the year. Green group conversely are the least dependent.

d. This consultative planning process adopts a highly evolved protocol of Participatory Rural Appraisal (PRA) methods and leads to the preparation of a mutually agreed eco-development micro-plan, which is then duly approved by the Reserve Field Director.

Figure 1: Flow Chart Showing Process Approach In Eco-Development



4. Programme Activities

The micro plan, besides the EPAs, contains three major components viz., provision for biomass regeneration in and around the target village, substitute energy materials and methods in order to reduce dependence on wood biomass energy, and alternate employment opportunities for the forest dependents. On the basis of approved micro plan, Eco development Support Fund (EDSF) is transferred to the VFC bank account, which is jointly operated by the Chairman and Member Secretary of the Committee for implementing the component wise identified micro plan activities in each project village as below:

Sl.No	Expenditure Head	Expenditure (Rs in million)	%
1	Civil Works	20.522	17.8
2	E.D. Support Fund*	47.712	41.4
3	Support activities: Awareness, Training and Workshop, Studies and Consultancies, Research and monitoring	25.976	22.5
4	Staff, Equipments, Vehicles	15.292	13.3
5	Operation and Maintenance	2.450	2.2
6	Unallocated	3.253	2.8
	Grand Total	**115.205**	**100.0**

* Preliminary investment (for EPA) – Rs. 6.6 million. ED investment- Rs. 41.112 (Loan component- Rs. 33.5 million including Alternate Income Generation- Rs. 26.7 million, Energy conservation-Rs.6.8 million and Non loan component (Biomass generation) Rs. 5.973 million.

i) Different strategies were adopted to create alternative biomass production and augment fuel, fodder and other resources. Individual beneficiary oriented biomass creation benefitted 10,749 families through the supply of 0.143 million fruit seedlings for homestead planting and about 0.063 million miscellaneous seedlings for patta land planting. For community benefit, 171.75km of road avenue, 182.65 ha of poramboke plantations and 18. 25ha of fodder plots were raised.

ii) Part of the support fund has gone as loan component to supply energy conservation and alternative energy use devices to ease out pressure on forests. The project enabled supply of husk chullah (2,048), hot-point stove (1,048), LPG stove (956) and biogas plant (348) to a total of 4,400 families. Switch over to alternate forms of energy has reduced fuel wood consumption in the project area by 7,216 tones per annum[2].

iii) Rest of the loan component served as seed money for providing micro credit to individual forest dependents and also to the Self Help Groups (SHGs), formed of such dependents for pursuing various livelihood and alternate income generating activities. For this purpose, the Project identified over 60 odd micro enterprises for the project villagers to choose from, according to the suitability for individual household.

iv) With a view to improve the skills of the people for choosing their livelihood, various training programmes including tailoring, embroidery, driving, computer trainings etc. were conducted. About 2281 members benefitted from such trainings.

v) Awareness programmes in the form of traditional folk theatre / street play (*oyilattam, kummi, karagam* etc.)were planned simultaneously and the task of undertaking the awareness activities was assigned to the local N.G.Os.

4.1 How Kmtr Eco Development Model Is Distinct From Other Jfm Programme In Tamil Nadu

Certain new initiatives have been made for the first time in the project, salient features of which are summarized as follows.

- ✓ To provide statutory backing to VFCs, they have been registered under the Tamil Nadu Societies Act 1975.
- ✓ Institutional sustainability has been ingrained in the project itself with an objective of continuing the participatory momentum in the co-management of forests. Exclusive eco development staff was sanctioned for carrying out the project activities for ensuring continuum.
- ✓ Government of Tamil Nadu ordered for implementation of various identified activities including civil works as envisaged in the micro-plan by the VFC. Government's decision in permitting direct disbursement of funds to VFCs for implementing the micro plan is

first of its kind and now stands out as a replicable model. With this decentralized fund management, the project staff and the NGOs function as facilitators for the micro plan implementation.

- ✓ All activities carried out in the project have a built in provision for beneficiary contribution to the tune of 25% of the cost, which comes in form of kind, if not in cash. As such, no activity comes completely free. This infuses greater involvement of the members in the works by bringing a sense of attachment to the activities.
- ✓ Micro credit advanced from the project fund and from the revolving fund for alternate income avenues carries a simple annual interest of 12%. Prompt recovery is ensured to build up the corpus through proper selection of economic activity and beneficiary. The recovered loan amount with interest forms the revolving fund, facilitating further assistance to other needy members for their economic upliftment.
- ✓ The seed money disbursed from the project and Project tiger fund allocation during the period of implementation was Rs.68.40 million, which has grown to a corpus of Rs 96.90 million as on March 2013.
- ✓ Transparency in the fund flow mechanism is assured by mandating the release of funds from the VFC account to eligible loan applicants only with the approval of two-third majority of the VFC members.
- ✓ KMTR experience proved that effective eco development can be fostered without having the need for benefit sharing that provides for consumptive use of bio resources as in conventional JFM areas.

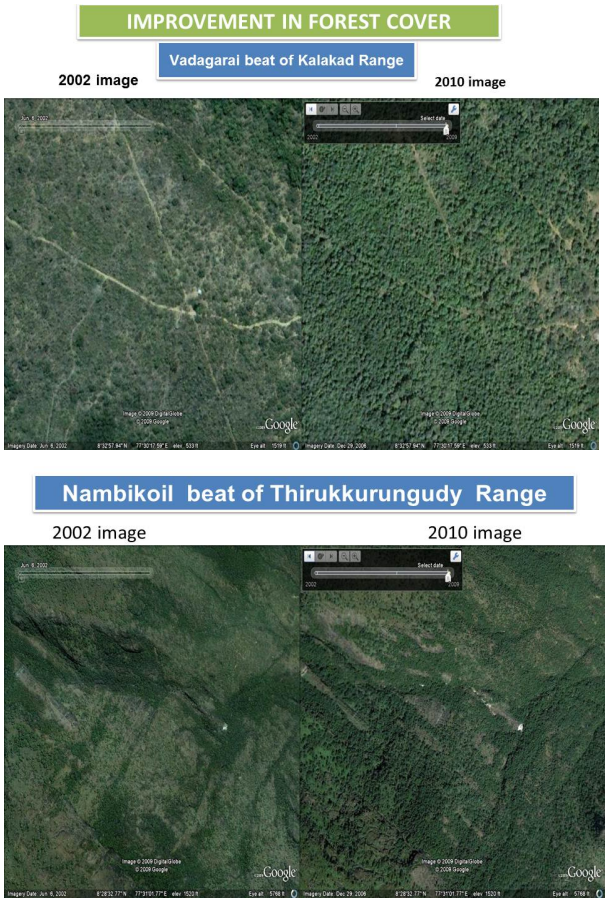
5. Impacts Of The Project

The overall project cost and the per household investment from the project (which works out to around Rs 7730 /average household) are not very high and therefore, might not have been a clear booster to stir peoples' involvement in the project. Despite this, the most outstanding outcome of the project has been the unique sense of commitment to the programme objectives and ownership of the project by the villagers, which enabled its success and sustenance. With about 113 villages covered under FREE Project during 1995-1999, the World Bank extended the aid for another two years till 2001 due to creditable impacts of the project. During this extended phase, 19 more villages were brought under the project. Thus, a total of 132 VFCs were functioning by 2001-2002. With further funding support from the Project Tiger, 96 more VFCs were added by 2012, thus bringing the number of villages covered to 228.

The conspicuous benefits of the project to the forest conservation and its impacts on the socio-economic conditions of the target villages became visible even during the project period.

5.1 Impact on forest protection:

The VFCs have been involved in forest protection and patrolling, fire protection, fire fighting, anti poaching surveillance, mitigation of man-animal conflicts and awareness programme. Various forest and wildlife conservation parameters showed significant improvement during and in the post-project period. Illicit cutting of trees for firewood and timber have come down drastically, showing obvious signs of recovery of the fringe forests. The number of head loaders, which was 3,215 at the inception of the project, got reduced to 410 in 2001 and became nil in 2012, as evidenced from the reporting of offences relating to felling of trees in the reserve. Grazing that was rampant with nearly 22,123 cattle entering the reserve at the commencement of the project in 1995, came down to 5,029 cattle heads in 2001 and 0 in 2012. Scrub cattle have given way to village level dairy enterprise with stall-fed improved breed cattle. The satellite images of different periods show marked change in vegetal cover. In fact, much of the bridle paths traditionally used by the head loaders and grazing cattle have been clothed by vegetation. Such improvements are essential for the survival and propagation of the wild animal population. On the achievements of the project, Melkani [10]noted that the VFCs have started informing the Reserve authorities about various attempts on the part of antisocial elements and offenders, thus facilitating the authorities to book the culprits early and observed that due to the decrease in interference by the local people, sightings of wildlife, including that of tiger even in the fringe forests of KMTR have become frequent. Forest cover assessment between 2003 and 2009 shows considerable increase in the area under very dense and dense forests **(Add Map 3 and Map 4).**



Map 1: Show improvement in Forest Cover

Poaching of larger animals is not a major problem now in the reserve in general, as excellent anti poaching network has been in place since last two decades. However, hunting or trapping of Indian hare was prevalent in the fringe and outside the limits of the reserve. Though eight cases of poaching were reported in 1995, no poaching was reported inside the PA after 2004, except for one incident in which a monitor lizard was hunted during 2007. Poaching cases detected after 2004 were recorded only in *patta* lands (private holdings) outside the sanctuary area. Fire that had been of serious concern for forest and wildlife management also registered down side trend. VFCs' assistance is taken to mobilize required force to prevent and control fire. From each VFC, five members are enlisted to the fire brigades, whose help is sought in emergencies. As they are paid wages for their service, they come forward without any hesitation and hence time delay is avoided in

containment of fire. Against 12 forest fires in 1995, the incidents came down to 5 in 2011. In 2010, there was no fire in KMTR area. Other organized crimes like illegal gemstone mining, cannabis cultivation and illicit brewing had completely stopped. The positive impact on the forest protection indicators and overall ecological improvement has been made possible by adopting a strategy of zero direct dependency on the bio resources of the reserve by the forest fringe dwellers.

5.2 Impact on Forest dependence matrix:

With reference to the bench mark survey conducted on the socio-economic status of each village prior to the project on the number of forest dependents in the project area, a reassessment was done in 2011[9]. Results revealed significant reduction of direct forest dependency in the project area in the last 16 years.

No of families with different levels of forest dependence				
Year	Red*	Yellow	Green	Total
1995	21960 (61.8%)	10336 (29.1%)	3260 (9.1%#)	35556
2011	11(0%)	9139 (25.7%)	26406 (74.3%)	35556

Table 1: Families with different level of forest dependence

Red indicates complete, Yellow partial dependency and Green no direct dependency on the Reserve. # indicates percentage of total number of covered families.

5.3 Impact on local economy through management of revolving fund:

With the amount allocated for loan component under the project, it was clear that coverage of marginalized and forest resource dependent individuals has not been adequately achieved within the eco development project time frame. It is noted that only 15.4% of the total number of forest dependents benefited by way of loan for alternate livelihood creation during project period and maximum coverage could require as long as a decade before assuredly neutralizing the effects of anthropogenic pressures[14]. With nearly 30,600 people availing the loan up to March 2013, the project results suggest that sustainable alternate rural livelihood for a large spectrum of VFC members was made possible by micro financing linked with micro enterprises and by promoting SHGs through revolving fund set up initially at

VFC level with seed grant. In fact, the amount set apart for loan component has been revolved 7.5 times in the last 15 years after the project period. The training extended to the women particularly on tailoring and embroidery helped to build up their skill to pursue the avocation using the loan amount. The SHGs play a vital role in the management of revolving fund. No SHG was in existence in this area at the time of inception of the project. The number of SHGs that were 312 at the time of project closure in 2002 has grown to 940 (837 are Women SHGs) by 2012. SHGs proved to be uniformly successful in handling the loan amount, as there was more cohesiveness and commonality of purpose in utilizing the loan amount for useful group-based economic activities. There has been excellent recovery of funds disbursed to the SHGs, which is nearly 100% and this enables further deployment of the amount for creating more opportunities for rural employment, raising family income and wealth creation.

Details	Amount (Rs. million)
Villagers enrolled as VFC members (No.)	40475
VFC members who availed loan under the project (No.)	30603
Project Contribution for alternate employment	68.40
Total loans issued to VFC members including revolving fund	513.99
Total amount recovered up to March 2013	443.50
Per cent recovery of loan amount (%)	86.20
Total amount outstanding with beneficiaries- overdue	25.77
Total amount outstanding with beneficiaries- within due	44.72
Balance in the bank accounts of the VFC	26.41
Total corpus with the VFC	96.90

Table 2: Kind of Balance sheet

The Project proved that management of the corpus by the grass root institutions besides improving the economic conditions of the poor and forest dependent villagers relieved them from the drudgery of moneylenders.

Another activity under the project is the training programme for the male members in driving, computer skill etc.2,281members benefitted from the project and helped 922 (40 %) of them found gainful employment[9].

5.4 Impact of Awareness programmes:

Various environment education and awareness programmers were carried out and are being continued in the PA and Eco Development villages. NGO workers engaged in the VFC are in constant dialogue through meetings, training sessions and workshops. Creation of a common vision using folk media, projecting the river Tamirabarani as lifeline for these people helped gaining community support and further spurred the participatory process[17]. Awareness through film shows / posters / hand bills etc., conducting of cycle rallies, *suzhal jyothi*(marathon torch run) etc. participation of VFC members in World Forestry Day, Wildlife Week celebration, and in wildlife census were continued. This project has changed the attitude and mindset of people towards forest and enabled total biodiversity conservation by minimizing the adverse influence of people on the reserve. The positive emotion generated by the project has been reflected through a series of mass rallies with high participation that was entirely voluntary[2]. As s result, institutional integrity has become deep- rooted, heralding successful sustainability.

6. Sustainability Of The Outcomes

Sustainability of benefits conferred on the target group is considered as the hall mark of any project. The corollary is that the cumulative gains made of the project during the project period must be able to continue and add up, even after the project fund flow culminates in the post- project times. In this regard, it can be stated with definiteness that the various sustainability parameters like the ecological, institutional, financial and social sustainability are showing firm trends in favour of such a hypothesis in KMTR. The continuous improvement in vegetation cover, with encouraging evidence of natural regeneration and overall enhancement in the hydrological parameters in the catchments are pointers to the ecological sustainability. Increasing numbers of VFCs, SHGs, NGO activities even a decade after project closure are indicative of the institutional sustainability. The institutional set up has been encouraged to adopt transparent and impartial implementation by the field management.

For ensuring financial sustainability, various safeguards have been evolved by the Reserve management in consultation with the VFC, which includes effecting a security bond for the members availing loan, issue of loan through cheque rather than in cash, repayment of loan installment by remitting in bank in triplicate chalan, encouraging issue of loan to SHGs over the individuals. These have resulted in the financial soundness of the VFCs. Social sustainability indices like participation in the management, partnership building, mutual trust between the partnering entities, societal harmony and cohesion, village level leadership resources, women empowerment, ownership feeling of the people on the reserve and overall pride of the community about the programme are well reflected from the impact assessment.

7. External Evaluation

The project initiatives in KMTR have been found to have potential to become a successful model for such endeavors at national and international levels[16]. World Bank Officials have visited KMTR and inspected various welfare activities for the forest dependents, interacted with the villagers especially women. Encouraged by the results, World Bank extended the project for two more years. World Bank's completion report on the outcomes of the Eco development Project points that *' the main objective to develop and test on a pilot basis, methods for conservation of biological resources in protected areas through eco development and improved PA management in and around PAs has been successfully achieved in KMTR'*. Indicating that the Institutional development impact at KMTR as substantial, the report suggests that 's*ocio-economic assessment indicates benefit to large number of families from alternate livelihoods, relief from rural indebtedness to money lenders, reduced forest dependency, improved biomass production and women empowerment are the outcomes'*. The report summarizes *that 'Kalakad Mundanthurai Tiger Reserve is a model for the wider acceptance of the eco development strategy for biodiversity conservation in many states across the country'*. It also noted that ' *the fact that the project had led to the formulation and implementation of the India Eco development Project is perhaps a clear indicator of the demonstration of project outcomes'*[17]. The Bank has subsequently selected KMTR as one of

the Biodiversity Conservation and Rural Livelihood Improvement Project (BCRLIP) Field Learning Centres for best eco development practices, with the Bank funding to the tune of Rs.32.43 million for the period 2010-11 to 2016-17.

Recording his decades long observations on the Western Ghats of Tamil Nadu, Johnsingh[6] noted about the KMTR thus '*..in KMTR we have significantly strengthened conservation with the help of the 208 Eco development Committees, which operate in 145 villages along the eastern boundary of the reserve. As a result many of the problems that arose from these villages have come down significantly. Till a few decades ago, for example, arrack distillation was very common in Thirukurungudi Range and now it appears to be a thing of the past. Same is the case with firewood cutting almost in all the ranges in the Reserve. There is a great recovery in gaur population as the cattle camps, which used to be an annual summer feature in locations like Kottangathatti, Kannunni, Sengaltheri, Panjamthangi and KalivarPulmottai no longer exist now. All the estates like Chinna Manjolai, Vazhayar, Kattlamalai and Kannikatti have ceased to function now. Blatant poaching is also no longer common now. Nilgiri langur and lion-tailed macaque populations do well..*'.

Seeing the soundness of the success and visibility of the eco development project and the perceived ecological benefits to the area, peer reviewed journal Current Science has brought out a special section on KMTR in one of its volume during 2001 (Vol 80 (3) February 2001), in which many articles written on eco development project were published. National NGOs, researchers, academicians have acclaimed the eco development model of KMTR as worth emulation. Senior forest officials from many State Forest Departments visited the project villages and the Reserve, which served as a learning experience for them.

In summary, the KMTR eco development model is considered to be a forerunner of the new millennium in providing several useful lessons for inducing similar people-centered interventions for the successful management of other vulnerable, biodiversity-rich mountainous ecosystems in Southern Asia, as conditions are quite similar in most areas.

8. Future Ahead

It is seen that 241 villages/hamlets forming a necklace around the KMTR eastern fringe have been declared as buffer zone for KMTR by Government of Tamil Nadu (2013)[1]. Therefore, there are still 13 villages yet to be tackled under eco development programme. Due to the spillover effect of the project impact, forest dependency has reduced throughout the buffer area. However, to sustain the status, it is desirable to bring in eco development works to these uncovered villages.

People from fringe villages need to be in continuous engagement to carry forward the benefits accrued from the project, which requires the presence of adequate number of eco development staff and NGO representatives with proper orientation. There is also a need to take the SHG economic activities to next level by establishing viable level micro enterprises. Creating a common federation of the VFCs will guide them to more harmonized functioning.

Eco development efforts have been effectively complemented by the field protection hierarchy that continues to meet the protection challenge posed by any outside organized groups. This needs to continue in future as well to consolidate the gains from the project. There is also a need to take up habitat improvement measures as part of PR management.

Moreover, human activity particularly from the enclaves and the leased areas within the core area of the reserve requires to be controlled to minimize human interference. A targeted plan to address the concerns of the small group of Kanis is considered relevant.

Continuous biodiversity assessment is vital to assess the success of eco development initiatives. Maintaining biodiversity Register as per the provisions of Biodiversity Act 2006 in each eco development village will be quite useful.

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Livelihood Opportunities Through Forestry Based Interventions - A Success Story of RFRI Association With Bhogpur, Govindpur and Madhupur Villages in Jorhat District of Assam, India

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Abstract
The Rain Forest Research Institute, Jorhat adopted a cluster of three villages viz., Bhogpur, Govindpur and Madhupur, which were located just adjacent to the Gibbon Wildlife Sanctuary (GWS), with a view to generate extra livelihood opportunities for the villagers so as to reduce pressure of illicit felling and poaching in the wildlife sanctuary. The various forestry based income generating activities included preparation of vermicompost and its marketing, planting of agar seedlings along the boundary of houses, agricultural fields and in tea plantations, planting of *Acacia mangium* as a block plantation, developing King chilli– arecanut agroforestry model , intercropping of Patchouli (*Pogostemon cablin*) under areca nut trees, training on preparing bamboo seedlings, setting up bamboo treatment tank and Jagriti Botchery Machine for treatment of bamboos used by the villagers, plantation of fruit-bearing trees and training on fruit processing , beekeeping etc. The participation level of villagers including womenfolk as well as impacts of all these activities on annual income and socio-economic conditions of the villagers have been discussed in detail in this paper

***Keywords**: user-friendly technologies, livelihood, income, sanctuaries, social cohesions.*

1. Introduction

The Rain Forest Research Institute, Jorhat with a view to extend its user friendly technologies for the benefit of the local people adopted a cluster of three villages viz., Bhogpur, Govindpur and Madhupur in 2009. These villages, located just adjacent to the Gibbon Wildlife Sanctuary (GWS), were selected in consultation with the officers of Assam Forest Department with a

view to generate extra livelihood opportunities for the villagers so as to reduce pressure of illicit felling and poaching in the wildlife sanctuary. Due to their location close to GWS, these villagers were dependent on sanctuary area for collection of various day to day items. Many of them were engaged in illicit felling of trees for selling fuel wood and charcoal in nearby markets. The incidence of liquor consumption was also high due to earning of free money from forest. The important socio-economic details of the selected villages are mentioned in Table 1.

Table 1: Socio-economic details of the villages selected for technology support

Parameters/Villages	**Percentage distribution in different classes**				
Family size	**Up to 3**	**4 to 6**	**7 to 9**	**10 and above**	
Bhogpur	13.85	67.70	13.85	4.62	
Govindpur	1.05	58.95	21.05	8.42	
Madhupur	17.36	70.25	9.92	2.45	
Average	**10.75**	**65.63**	**14.94**	**5.16**	
Land holding (bigha)	**Up to 5**	**5 to 10**	**Above 10**		
Bhogpur	56.92	36.92	6.15		
Govindpur	78.95	10.53	10.53		
Madhupur	57.85	33.88	8.26		
Occupation	**Agriculture**	**Tea cultivation**	**Business**	**Service**	**Labour**
Bhogpur	32.31	24.62	29.23	3.07	10.77
Govindpur	10.53	34.74	32.63	14.74	7.37
Madhupur	75.20	-	4.96	7.44	12.40
Number of cattle	**Up to 5**	**6 to 10**	**Above 10**		
Bhogpur	31/26[1]/9[2]	0/2/20	0/0/6		
Govindpur	48	8/3/2	0/0/3		
Madhupur	78/51/85	10/3/3	0/0/1		

[1]= Number of goats; [2] = poultry

The population of Bhogpur, Govindpur and Madhupur is 240, 452 and 882, respectively. The main occupation of the villagers is agriculture i.e. most of them take a single crop of paddy during rainy season, besides growing seasonal vegetables, areca nut, bamboos, banana and other trees in their home gardens. It was observed that around 20% households have planted tea and sell its leaves to nearby tea gardens. 22.73% households are engaged in business activities such as small grocery shops, 10.18% work as daily wage labour, while 8.42% are in service sector or retired from govt. services. The women folks are actively involved in agriculture fields, household works as well as weaving of clothes, etc. 64.57% household have up to 5 bigha (0.13

Ha) land, which consists of agriculture fields, home gardens, tea gardens or wastelands. The average annual income varies from Rs. 26,000.00 to over Rs. one lakh. However, maximum households were having average income within Rs. 35,000.00 to Rs. 60,000.00 per year. Till 1980s, the main agricultural crops were paddy, sugarcane, banana and local vegetables. However, due to regular damage of crops by the elephants, sugarcane has been completely replaced by tea and areca nut. The other common tree and bamboo species planted in the home gardens include *Anthocephalus cadamba* (Kadamb), *Artocarpus heterophyllus* (Jack fruit), *Bambusa balcooa* (Bhaluca bans), *B. tulda* (Jati bans), *Cinnamomum zeylanicum* (Dalchini), *C. tamala* (Tezpat), *Citrus reticulata (*Lemon), *Litchi chinensis* (Litchi), *Livistona jenkinsiana* (Toko pat), *Michelia champaca* (Tita sopa), etc.

The RFRI interventions in these villages were started in 2009. A participatory rural appraisal was undertaken to prepare the resource maps and detailed discussions were held with different groups to explore the possibilities of introducing appropriate forestry based income generating activities in these villages A committee, "Trinayan Unnayann Committee" (TUC) was constituted in 2009 to facilitate and organize various day to day programmes. Three sub-committees were also constituted (one for each village) to facilitate extension activities. A bank account was opened in the name of the committee in the State Bank of India with a view to deposit 5% of the benefits to the common fund. An Extension Camp cum Common Facility Centre was established at Madhupur as an entry point activity for conducting meetings, training and demonstration programmes. A shade house 'Ankur' was established in Madhupur during 2011 to train them for raising seedlings of commonly used tree

Photo 1: Common Facility Centre at Madhupur

species such as kadamb, agar and bamboos. Now villagers are using this facility through participatory manner and earning money by selling seedlings.

Photo 2:Nursery shade house 'Ankur' at Madhupur

2. Livelihood activities

The various forestry based livelihood activities based on RFRI research and other known technologies, which were extended in these villages and their impacts are discussed below:

2.1 Vermicompost

During PRA, it was observed that the productivity of tea leaves was quite low as villagers were not able to afford costly fertilizers and foliar sprays from market. Therefore, they were motivated to set up Vermicompost Units (VCU). Hands-on trainings were organized to demonstrate the complete process and its benefits to the villagers. 21 VCUs were established in 2009 based on their interest and recommendation of the TUC, and looking at their responses, another 16 VCU were established in 2010. It is a great success, which has resulted into proper utilization of agriculture and household wastes into income generation opportunity.

The villagers are using vermicompost for improving the productivity of bamboos, king chili, areca nut, tea plantation etc. Foliar spray with verminbedwash, a byproduct during vermicomposting process, has proven very effective in improving production of tea leaves, besides being purely an organic supplement. Besides this, Shri Dhiren Sharma is now earning money by selling the worms @ Rs. 1.00 each to various agencies e.g. Jorhat Forest

Division. Looking at the success of vermicompost units, now more villagers want to have a VCU in their houses. Therefore, a low cost VCU made from bamboo splits or areca nut stem has been designed, which cost around Rs. 800.00 per unit as compared to Rs. 8,000.00 for the permanent units.

Photo 3: Permanent Vermicomposting Units

Photo 4: Low cost Vermicomposting Unit made from areca nut stem and bamboos

Photo 5: Experiments conducted on application of vermicompost on the production of new culms at Shri Biswajit Bora home garden indicated that applying around 8 kg vermicompost on *B. balcooa* clumps has resulted into increased production of new shoots as well as the size of culms has also increased considerably.

Photo 6: In 2011, villagers of Madhupur supplied 50 quintals vermicompost to M/s Pronaali Pvt. Ltd., Tezpur and earned Rs. 25,000.00, while villagers of Bhogpur and Gobindpur sold over 10 quintals vermicompost to Jorhat Forest Division. RFRI, Jorhat is also a regular buyer of vermicompost from them.

2.2 Planting of agar seedlings

Planting of agar (*Aquillaria malacansis*) in the home gardens is quite popular in Assam due to its high economic value. However, everyone is not able to plant due to non availability of seedlings. During 2010 and 2011, around 3,000 seedlings of agar were distributed to the farmers for planting. The seedlings are growing fast thus promising a very high return to the owners in due course of time. Now we are planning to inoculate these trees artificially for agar wood oil production by using RFRI artificial inoculation technique.

The message has spread fast and now the demand of seedlings has increased considerably. Therefore, the villagers have been trained for raising agar seedlings and two nurseries, one each at Gobindpur and Bhogpur have been established for the villagers to produce seedlings and sell them as per the demand.

Photo 7: In 2011, Shri Dhiren Sharma of Gobindpur sold 5,000 agar wood seedling and earned Rs. 20,000

2.3 Planting of Acacia mangium

A. mangium is a fast growing high economic value tree species. It is also known as poor man's teak. The villagers were informed about the advantages of this species during an awareness programme in June 2009 after that around 1,800 seedlings have been distributed to the farmers for planting.

Photo 8: 60 days old plantation intercropping with tea

Photo 9: *Acacia mangium*

Photo 10: Two year old plantation of Acacia mangium

Photo 11: 90 seedlings of *mangium* were planted in a block on Shri Rangai Bora's land at Madhupur. Patchouli (*Pogostemon cablin*) was planted as an intercrop for getting extra income from the same area. First year around 3 quintals patchouli was harvested and Rs. 3,000 was earned by him.

Later on, it was observed that growth of patchouli and king chili was not good under *mangium* trees due to their dense canopy. Therefore, no extra crop is being planted under these trees. However, now a four year old tree has a value of around Rs. 1000.00 in the market.

2.4 King chilli – Arecanut Agroforestry model

Areca nut is one of the important commercial crops of the region. Most of the households raise a small block of areca nut trees for getting extra income. The average income provided by a single tree in a year varies from Rs. 100.00 to Rs. 300.00. The trees are normally planted at a spacing of 5m x 5m. Its canopy is thin; therefore, there is a scope of raising additional crop under them.

Since king chilli is also the most preferred species for providing immediate economic returns, it was introduced as an intercrop under areca nut trees. The survival and growth of King chili was better under areca nut trees in comparison to its monoculture, therefore it was developed as a model for generating additional income. This model is very successful and most of the farmers are earning around Rs. 3,000 to 5,000/- in a year from king chilli cultivation.


Photo 12: King chilli seedlings in the Nursery King chilli crops in farmer's field


Photo 13: Cultivation of king chilli under areca trees Fruits ready for sale in local market


Photo 14: Chillies under the tree and generated Rs. 18,000

It has become the most popular model as more than 60% farmers are cultivating *bhootjolokia* under areca nut trees, a space which was otherwise not being utilized for any purpose. A mature plant produces 1.5 to 2kg fruits per season, which is easily sold in local market at a rate of Rs. 150 to Rs. 200 per kg.

The demand of *bhootjalokia* seedlings is very high. Every year 2,000 to 4,000 seedlings are being raised at RFRI nursery for distribution to over 150 families, which help them in earning Rs. 1000/- to Rs. 15,000/- as extra income from its cultivation.

2.5 Intercropping of Patchouli (Pogostemon cablin) under areca nut trees

A training was organized on cultivation of patchouli at RFRI, Jorhat. After that two nurseries were established on participatory basis for rising patchouli seedlings and planting was done under areca nut plantations of interested farmers under the supervision of RFRI staff. I is a good option for earning extra income but now most of the farmers have shifted to king chilli cultivation because of i). non-availability of easy market, and ii). better returns from *bhootjalokia* cultivation

Photo 15: Patchouli nursery

Photo 16: Intercropping of Patchouli under areca

2.6 Bamboo nursery

Bamboo is the most important resource for rural people. Every household has bamboo clumps in their home gardens. Bamboo is widely used for house construction and around 30% portions of their houses are made from bamboos. It is used for making various household items, agricultural tools, welcome gates on specific occasions, fencing around the houses, agricultural

fields, nursery, plantation areas, etc. therefore, consumption of bamboos is very high at the village level itself. Since no management practice is followed for bamboos, and culms are harvested whenever requirement is there, therefore condition/productivity of most of the clumps was not good. The villagers normally do not add bamboos in their home gardens assuming that it would spread naturally. Two bamboo nurseries were established in these villages to provide seedlings for extending the area under bamboos. However, now a day, villagers do not prefer planting of bamboos other than already existing in their home gardens due to tuskers' terror, who visit the home gardens for new bamboo shoots.

Photo 17: Hands on training on bamboo macropropagation and nursery preperation

Photo19: Nursery damged by elephants

Photo 18: Bamboo Nursery at Madhupur

2.7 Setting up bamboo treatment tank/ Jagriti Botchery Machine:

Due to high rain fall in the region, bamboo culms used for construction and fencing tend to deteriorate early. The life span of various bamboo items such as fencing can be extended through biological or chemical treatment. Keeping this in view, two bamboo treatment tanks were installed, one each at Bhogpur and Madhupur. However, due to high cost of preservatives and its impact on soil, we are discouraging their use and experiments are being carried out to develop plant based formulations.

Photo 20: Bamboo treatment tank machine treated bamboos

Photo 21: Demonstration of treatment process by boucheri

Photo 22: Fencing made

2.8 Plantation of fruit-bearing trees and training on fruit processing

It was observed that villagers were collecting various fruits e.g. *Dillenia pentaphylla, Garcinia, Aegle marmelos, Phyllanthus emblica Mangifera indica, M.sylvatica, Syzygium obalata, Artocarpus heterophyllus* etc. from

the Gibbon wildlife sanctuary for self consumption and for sale. Therefore, planting of common fruit-bearing trees e.g. jackfruits, mango, jamun, citrus, etc. was facilitated by providing seedlings. In addition to this, training on value addition of bamboo shoots, pickle, jam and jelly making was organized with a view to generate additional income opportunity particularly for the womenfolk of these villages.

2.9 Bio-fencing adjacent to Gibbon Wildlife Sanctuary:

Since these villages are located close to Gibbon Wildlife Sanctuary, damage to paddy crops by the elephants is a recurring phenomenon. This issue was discussed along with villagers and wildlife officials, and as per their advice, 500 seedlings of *Bambusa bambos* (thorny bamboo) were planted at close spacing along the boundary of the sanctuary to provide a natural barrier. The seedlings are growing fast, and once spread, it is hoped that it may provide some relief to the villagers from elephant damage.

Photo 23: Planting of B. bamboos along the boundary

2.10 Beekeeping

The villagers were collecting honey from sanctuary area and using it for self consumption or sale. In view of above, a training was organized during

November 2009 on beekeeping by inviting experts to provide them another source of income generation. 57 beehives costing Rs. 1,000.00 each were distributed to the interested farmers. Now 30 of them are still continuing with this activity, while few of them have sold these boxes to their neighbourers. Some of the villagers wants RFRI to procure bee colonies so as to enable them to continue this endeavour.

Photo 24: Beekeeping box with a colony to extract honey

A close of of the colony ready

Photo 25: Local people are quite innovative for making useful tools from bamboo and canes. A simple tool for extraction of honey from beehives made from bamboo was developed by Shri Mohan Saikia, master trainer of bamboo from Shivsagar.

3. Impacts of RFRI interventions

An attempt was made to assess the impacts of RFRI interventions after completion of four years' association with the villagers. The direct as well as indirect benefits were analyzed with the villagers and the officials of Gibbon Wildlife Sanctuary. The details of finding are mentioned below:

3.1 Direct benefits

The villagers were able to generate approximately Rs. 5,63,000.00 annually from various income generating activities as promoted by RFRI. The maximum income was generated from *bhootjolokia,* followed by vermicompost, sale of agar seedlings, beekeeping and bamboo nursery, etc. (Table 2). The actual income may be even higher as many of them were not able to indicate the total benefits. The item wise details of the calculation of annual benefits from RFRI interventions are mentioned below:

Table 2: Direct benefits accrued annually to the villagers from RFRI interventions

Activities	Initial number of Beneficiaries/ units	Number of operational units in August 2013	Average annual income/ family (Rs.)	Average self Consumption/ family/ year	Total income generated in a year (4+5)
Vermicomposting	36 Units, 21 in 2009; 15 in 2010	20	1,000 to 3000/- @ 600/ per quintal	3.5 Quintal	82,200.00
Sale of worms	-do-	1	worms @ 1/- each		400.00
Vermi-bedwash	-do-	20	Nil	20 liter/ year Rs. 20 per liter	6,000.00
Beekeeping	57 units in 2010	30	Rs. 500/- @ 250/- Liter	1 Liter	22,500.00
Low Cost Vermicomposting Unit	10 Nos 5 each in 2009 & 2010	10	Nil	1.5 Quintals	9,000.00
Bhoot Jolokia (*Capsicum assamicum*)	156 Nos. 5000 seedling per year 25 to 40	All	1,500 to 2,000/- @ Rs. 250 to 300/ kg	Rs. 1,000/-	4,29,000.00

	plants/ family				
Bamboo nursery	2 One each in 2009 & 2010	2	2000/-	Few seedlings planted in own home garden	4,000.00
Raising of Agar seedlings (Nursery)	2 Nurseries 3000-4000 seedling/yr 2010, 2011 and 2012)	All	10,000/- @ Rs. 6-7.5 /- per seedling	Few seedlings planted in own home garden	10,000.00
Cultivation of Muskdana (*Abelmoschus moschatus*)	5 families in 2011	2	Rs. 1,200/- per year	Nil	2,400.00
Cultivation of Patchouli (*Pogostemon cablin*)	30 families 2009 and 2010	Nil	-	-	-
			Total income generated in a year		5,63,000.00

3.2 Indirect benefits

The indirect benefits are many and difficult to assess. The overall atmosphere of the villages and cohesion amongst them has improved. The villagers have acquired a great deal of knowledge and exposure about various environment and developmental issues pertaining to their day-to-day life. They now feel confident in putting their demands to different government departments for undertaking various developmental activities in their villages. Some of the visible impacts, which were observed in these villages after RFRI interventions, are mentioned below:

Table : Some of the visible in-direct impacts

Activities	**Status in 2009**	**Impacts in 2013**	**Remarks**
Improved social cohesion	++	++++	RFRI activities brought villagers together to a common platform to discuss various environment and development issues to resolve their problems. In 2009, due to involvement of RFRI, three villages celebrated BIHU Festival together for the first time in the history of these villages, which indicated that social harmony amongst them has increased a lot.
Participation of womenfolk	5 women SHGs	More than 10 SHGs	Programme like fruit processing encouraged the women's to participate in many activities.

Number of economic activities	++	++++	Earlier main source of income was tea and areca nut. The additional income generating activities developed through RFRI intervention were: *bhootjolokia* cultivation, vermicomposting, bee keeping, etc.
Impact on education	++	++++	Due to involvement of school children in programmes like World Environment Day, Wildlife Week, World Forestry Day etc. motivated them for higher education. Now more than 50% children go to nearby towns for better education.
Felling of trees from sanctuary area	++++	+	Earlier many villagers were involved in illicit felling of trees from sanctuary area. Now due to additional sources of income, illicit felling of trees has gone down considerably
Consumption of liquor	+++	++	Probably due to more social cohesion amongst them and more women participation, consumption of liquor has gone down
Water supply	-	++	In 2011, Irrigation Department, Assam established a pump house for supplying water to these villages
Electricity supply	+	+	All houses have electric connection
LPG Connections	+	++	The number of LPG connection has increased by 30%
Involvement of other govt. departments	+	++	RFRI helped them contact different Govt. Departments for initiating development schemes for these villages. Now the State Bank of India is opening a branch there
Condition of road	+	+	Condition of road has improved. However, more efforts required to make it a pucca road
Health opportunities	-	-	Efforts are being made to get a Primary Health Centre approved by the government.

+,++, +++, & ++++ indicate 25%, 50%, 75%, and 100% involvement/improvement over 2009 conditions.

The other indirect benefits accrued to the villagers are mentioned below:

- ✓ Increase in tree cover of these villages by planting of over 10,000 seedlings of agar, *Acacia. Mangium,* fruit bearing trees and bamboos (*Bambusa balcooa, B. tulda* and *B. pallid,*
- ✓ Clean air, more ground water recharging, improvement in soil quality as well as productivity due to application of vermicompost,
- ✓ Planting of *A. mangium* help improving soil fertility through nitrogen fixation,

- ✓ As per Gibbon Wildlife Sanctuary officials, the incidence of tree felling has gone down considerably after RFRI interventions. At present no one is engaged in charcoal making. The condition of forests along the boundary of these villages is improving as indicated by regeneration of local species and sighting and signs of birds and other wildlife,

- ✓ Shri Dhiren Sarmah has become a Master Trainers now to demonstrate the low cost vermicomposting process. He is invited by various organizations including local NGOs at Jorhat, ATREE, an environmental NGO at Kaziranga National Park, and State Forest Department, Tripura to convince the villagers for taking up this venture as an income generating activity, and

- ✓ Efforts are on to train village youths as tourist guides for accompanying tourists visiting Gibbon wildlife sanctuary.

Although various interventions as initiated in these villages were successful in generating additional income opportunities to the villagers, yet adoptability/success was higher only in those activities, which the villagers were either familiar with or which had a readily available market e.g. *bhootjolokia* was a great success as villagers were familiar with its cultivation, and it was easily sold in local markets. Besides this, its cultivation under areca nut was another advantage, as no additional space was required for this purpose.

Similarly, villagers were also familiar with agar trees and its economic value. The only problem was the availability of seedlings, which was facilitated by RFRI team. *Acacia mangium* was also successful as it grew very fast and can easily be planted on degraded lands, boundaries of agriculture fields, and promised assured returns.

However, it was observed that in rural areas, people are generally happy and satisfied with their traditional way of living, custom and culture. One cannot expect all of them to develop entrepreneurship as per our perception or visualization. Therefore, it becomes quite difficult to motivate them to continue with all income generating activities. For example, many of them, who have vermicompost units, do not continue it just because of lack of

entrepreneurship. Many of them say that cow dung is not available and they want RFRI to provide cow dung for this purpose.

It is hoped that gradually with their greater exposure to cities as well as with increased demand of organic products in future such as vegetables, honey, vermicompost, bamboo shoots, etc. someone of them would take a lead and develop the desired level of entrepreneurship to be in the competition.

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Application of Traditional Knowledge and Customary Use of Biodiversity into Community Based Resource Management and Governance of Community Conserved Area, Arunachal Pradesh, India

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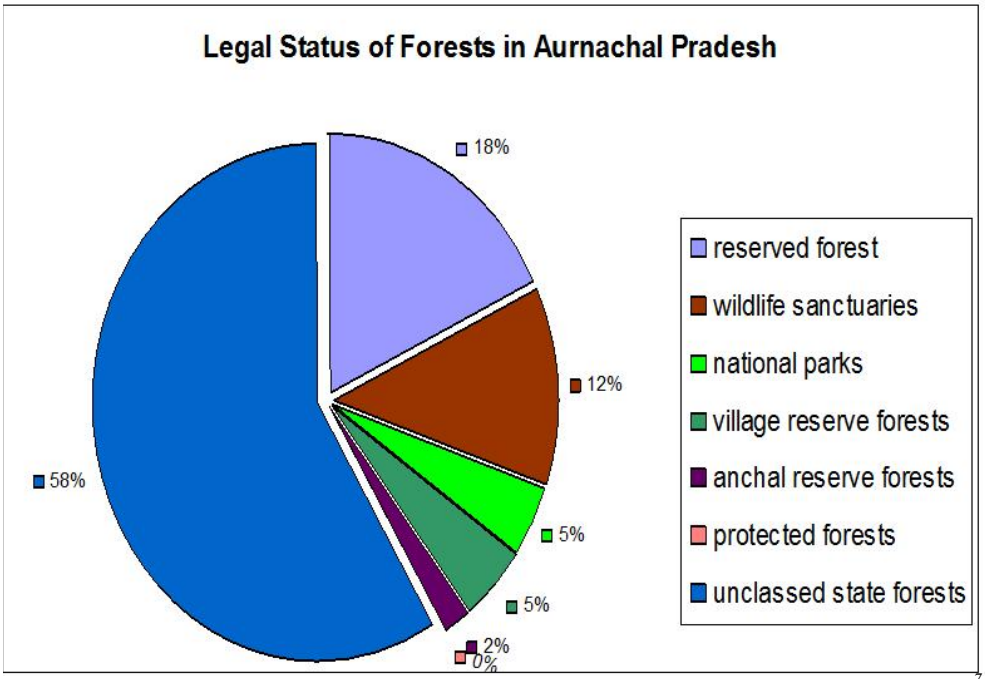
Abstract

The paper explains a correlation of innovation in participatory governance, integration of customary conservation norms and traditional institution with statutory laws to organize and formalise the *Community Based Natural Resource Management* approach. The paper is based on a case study sited from the project, *biodiversity conservation through community based natural resource management,* implemented to harmonize management and governance for conservation of biodiversity in four states in the Republic of India. The case study, discussed in the paper is sited from two sites-Tawang-West Kameng Biosphere Reserve and Apatani plateau in Arunachal Pradesh, one of the project states. The case study describes a model that concerns protection of customary rights of tribal community-Monpas, Apatanis and Akas (Hrusso) to use and conserve biological resources of community owned forests, now facing environmental threat-*biodiversity loss*. The paper through a case study describes how twin objectives are achieved for improving the biodiversity status of community owned forests by empowering tribal community to be legal actors for possessing common rights to territory and resources and re-look into policy gaps for conservation of community owned forests specially in context of community land tenure system of forest land and participatory governance for access and benefit of resources related to income generating livelihood.

Key words: *Participatory, governance, integration, customary conservation, norms, tradition, institution, biodiversity, legal factor, empowering, tribal, policy, tenure system livelihood.*

I. Situation

The enormous natural resources- land, water, forests and biodiversity of Arunachal Pradesh offers both tangible and intangible ecological services and goods. The state has 15.76% of the Himalayan Region and 43.62% of the Biological Hot Spot of Eastern Himalaya.[1] More over, with an altitudinal



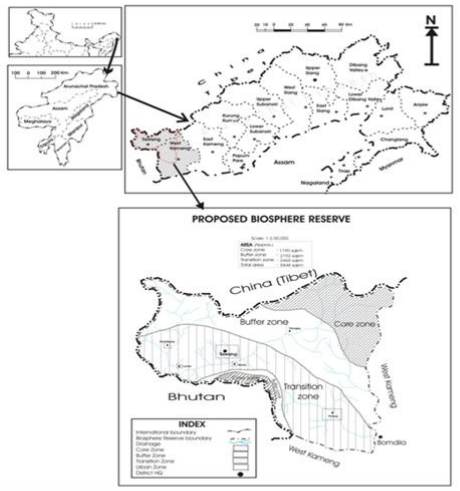
Source: SFRI Information bulletin No 27 Forest and Forestry in Arunachal Pradesh 2008)[7]

range of 100 m to > 7000 m and unique bio-geographic location the state is enriched with unparallel biodiversity of habitat and forest types from Palearctic and Indomalayan realms.[1] Arunachal Pradesh has the second highest forest cover of 80.50% of state's geographical area. [2]

In the state, recorded forests cover some 51,540 Sq. kms and are legally classified as Reserved Forests (9815.37 sq km), Wildlife Sanctuaries (6777.75 sq km), National Parks (2468.23sq km),Village Reserve Forest, (175.20 sq km), Anchal Reserve Forest (256.08 sq km), Protected Forests (7.79 sq km), and Unclassed State Forests(32039.00 sq km), under relevant legal provisions of Assam Forest Regulation 1891, Anchal and Village Forest Reserve Act, 1978 and 1981 and Wild Life Protection Act 1972. [3](Figure 1) Large chunk of degraded forest areas belong to the communities inhabiting the State and traditionally have rights over them. Un-surveyed forests where status of right and ownership is not settled are Unclassed State Forests (USF) areas with not much departmental control.[4] However, limited actions are taken to conserve the "Unclassed State Forests". As per legal status about 61.50% of the state's forests, is under Unclassed State Forests.[5]

Further more, the Unclassed State Forests has a propensity to be at risk of environmental degradation, mostly caused by shifting cultivation, locally referred to as *Jhum* and hunting of wildlife, a common practice with socio-cultural significance, is the challenge.[6] Despite laws in the state prohibit hunting of any wild life, illegal hunting continues. *Jhum*, is a source for livelihood as it is considered to be an ecological and cost-effective method for cultivation. In recent years this practice is becoming unsustainable as fallow period between cultivation seasons is reduced for growing more cash crops and shortening the *Jhum* cycle for cultivation.[7] As per the latest report of National Wasteland Atlas, 2011[8], in Arunachal Pradesh, area under shifting cultivation during 2005-06 was 1, 40,465 hectare and has increased by 54,471 hectare in 2008-09 to about 1,94,936 hectare. Shifting agricultural practice is mostly confined to the land categorized as "Unclassed State Forests" over which tribal community claim their traditional rights.[4] According to India State of Forest 2011[9] report there is a decrease in forest area by about 7400 hectare with reference year to 2009, which includes 500 hectare of highly dense forests and 5500 hectare of moderately dense forest. In addition, present state legislation for Protected Area (PA) requires reformation to adequately define legal provisions for recognising customary rights and ownership of forest land.[8] Tribal communities are not willing to create more Protected Areas from forest land owned by them.[5] More over, tribal communities continue to have limited options to socio-economic development, and are forced to be directly dependent on resources derived from Unclassed State Forests in particular. More so human led activities has increased deforestation process in the Unclassed State Forests only to reduce the biodiversity of wild fauna and flora.[6]

II. Case Study



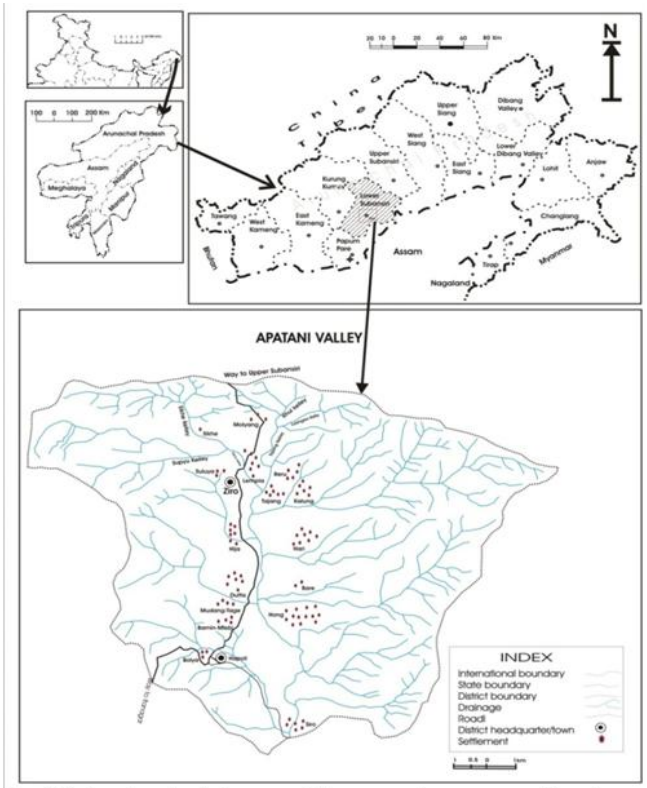
site-I Tawang-West Kameng Biosphere Reserve in Tawang and West Kameng districts. Source of Map G.BPPIHED2008

In this paper a case study is sited from the project: *Biodiversity Conservation through Community based Natural Resource Management.* The case study is located in the state of Arunachal Pradesh, in the Republic of India, and covers two sites with wide altitudinal gradient with northern boundary formed by the Himalayan Range and state's highest peaks-Kangtey and Gorichen at site-I Tawang-West Kameng Biosphere Reserve in Tawang and West

Kameng districts, also designated as World Peace Park and proposed high altitude Biosphere Reserve and site-II Apatani plateau[10], the scenic zero valley in Lower Subansiri district, is proposed as UNESCO's Globally Important Agriculture Heritage Site. Case study includes 32 villages home to three tribal communities.[11]

Monpas tribe of 15 selected villages in Tawang and West Kameng districts, follow lamastic tradition of Mahayana Buddhism, and are agro-pastoralists. Breeding and rearing of cattle form an integral part of Monpas livelihood. The tribe is divided into three status groups based on locality and area of habitation. Influenced by their religion and culture Monpas tribe are known for traditional conservation practices.[12]

Akas (Hursso) tribe of 1 selected village in West Kameng district practice shifting (*jhum*) cultivation and subsidiary livelihood from collecting forest produce, fishing and hunting. The tribe believes in benevolent spirit and soul in sky, mountain, earth and water and perform their rituals in the months of April and May after clearing the *jhum* fields.[12]



ite-II Apatani plateau with a scenic zero valley in Lower Subansiri district, source of Map GBPIHED 2008

Apatanis tribe of 16 selected villages in Lower Subansiri district, live in compact structured villages and houses built of bamboo and timber. The tribe believes in Donyi-poloism religion and are patriarchal in their social system and sub-divided into clans, which is a social unit. A three tier traditional village council regulates the tribal customs and age old indigenous institution for management of forests, bamboo plantation, land and water utilization by Bogo system to irrigate

rice-cum-fish fields specialized over centuries for harvesting fish along with paddy in a year.[12]

Tribal community continue their customary use of biodiversity for food, medicines and apply traditional knowledge for managing natural resources that is evolved from their rituals and cultural life style, and has sustained the tribal identity.[6] (Table1). Attention is paid to protect plant and animal species by restricting hunting and extraction of plant species from certain forest patches i.e. sacred groves and water bodies are conserved by restricting cultivation, cutting of trees and human interference. Monpas value *Juniperus* sp. for religious utility, Oak (*Quercus grifithii*) forest is managed for using Oak leaves and ferns (Pteris sp.) to mulch crop fields. Apatanis follow a traditional method to manage forest land and classify its value as per household and religious use. [13] (Table 1)

Table 1: Apatani community traditional method to use forest land and its derived resources[13]

Local name of forest land	Description of forest land	Importance of derived use/resources
Bije	Individual bamboo forest, mixed with pine & *Castanopsis spp*.	Bamboo, timber and fuelwood extraction for construction & household requirement.
Sansung	Individual forest (*Castanopsis*/ pine dominant forest, mostly monoculture)	Extraction of timber, fuelwood and materials for ritual ceremony.
Uru Morey	Sub-clan community forest (mostly mixed forest)	Extraction of timber, bamboo, cane, fuelwood & other NTFPs for household requirement. Collection of materials for ritual ceremony, hunting & rearing of mithun.
Hallu morey	Clan community forest (monoculture of pine, castanopsis dominant & mixed forest)	-do-
Lemba Booth Morey	Village community forest (mixed vegetation forest)	-do-
Supung Booth Morey	Tribe (Apatani) community forest	-do-
Polung	Community/village grazing land	Grazing land for cattle
Rantee	Sacred groves (Village land)	Restriction of extraction except for

Source -G.B. Pant Institute of Himalayan Environment and Development 2012

A resource dependence assessment conducted as part of the project by G.B. Pant Institute of Himalayan Environment and Development from 2008 to 2011 focused on the Unclassed State Forests area including community owned forests at sites referred in the case study are rich in flora and fauna with forest types ranging from tropical evergreen, tropical semi-evergreen, subtropical temperate, sub alpine including alluvial grasslands, alpine meadows.[4] (Table 2).The assessment recorded about 327 floral species and 296 angiosperm species belonging to 83 families at site-I of Tawang West Kameng Biosphere Reserve and 158 ethno-medicinal plant species belonging to 73 families and 124 genera at site–II of Apatani Plateau. Both sites I & II are enriched with more than 257 faunal species belonging to

4 species of amphibians, 13 species of reptiles, 38 species of butterflies, 149 avifauna and 657 species of birds including 10 globally threaded species. Further more, 12 species are included under the schedule–I category of Wildlife Protection Act1972 and 8 are categorised under schedule–II reveals killing of these species is for trade purpose and retaliation for livestock and crop damage. [13]

Table 2: Forest types and important plant species in Apatani plateau[13]

Forest	Species	Significance/usage
Bamboo forest	Phyllostachys bambusoides, Castanopsis indica,, C. hystrix, C. tribuoides, Alnus nepalensis, Dendrocalamus hamiltoni, Prunus nepalensis, Myrica esculenta, etc.	Timber, fuel wood, food, handicraft, housing and ritualistic materials.
Pine forest	Pinus wallichina, Pyrus pashia,, Prunus nepalensis, etc.	Timber, fuel wood and wild edible fruits
Castanopsis forest	Castanopsis indica, C. hystrix, C. tribuoides, A. nepalensis, Myrica esculenta, etc.	Timber, fuel wood, ritualistic materials and wild edible fruits.
Sub-tropical forest	Quercus lanata, C. tribuloides, C. indica, C. hystrix, Michelia champaca, Terminalia chebula, Exbucklandia populnea, Helicia robusta, Spondias axillaris, Illicium griffithii, Actinidia callosa (wild kiwi), Dendrocalamus hamiltonii, Chimonobambusa spp. Etc	Timber, fuel wood, ritualistic materials, handicraft, wild edible fruits and herbal medicine.
Temperate forest	Taxus baccata, Pinus wallichina, Cephalotaxus sp. Cedrus deodra, Tsuga dumosa, Rhododedndron arboreum, Pleioblastus simoni, Arundinaria sp. etc.	Timber, fuel wood, ritualistic materials, wild edible fruits and herbal medicine.

Source: G.B. Pant Institute of Himalayan Environment and Development 2012

III. Background of Project activities

In concern for protecting customary rights to use and conserve biological elements of community owned forests focusing on Unclassed State Forest Areas, in Arunachal Pradesh, through the project on *Biodiversity Conservation through Community based Natural Resource Management*, a model for applying traditional knowledge and customary use of biodiversity was integrated into community based resource management and governance for Community Conserved Areas at the sites in Tawang-West Kameng Biosphere Reserve and Apatani plateau.[10] The project jointly supported by Government of India and United Nations Development Programme was implemented in Arunachal Pradesh, Chhattisgarh, Jharkhand and Odisha, four states in the Republic of India, is an example of being relatively successful in implementing the Community based Natural Resource Management model for reducing vulnerability of tribal communities and other forest dwelling tribes to environmental degradation-*loss of biodiversity*. The project is executed by the Ministry of Environment and Forests, Government of India and supported with 3 million USD for five years 2008-

2012 by United Nations Development Programme in collaboration with four state coordinated agencies in Arunachal Pradesh, Chhattisgarh, Jharkhand and Odisha.[10]

Project Activities-Arunachal Pradesh one of the project state, has G.B. Pant Institute of Himalayan Environment and Development, as the coordinating agency and four implementing partners-State Forest Research Institute, North Eastern Regional Institute of Science and Technology, WWF-India, Nature Care and Disaster Management Society. Site based activities were managed along with Department of Environment & Forests, Department of Tourism of the Government of Arunachal Pradesh, Biodiversity Management Committees of 32 selected villages, its community and project staff and State Steering Committee, headed by the Principal Chief Conservator of Forests and Principal Secretary, Department of Environment and Forest, Government of Arunachal Pradesh.[10] Goal of the project in Arunachal Pradesh was to influence policy reformation through community led management actions and governance for Community Conserved Areas and integrate conservation of biodiversity of community owned forest land for sustenance of livelihood.[10] Key activities based on micro-plans developed in consultation with tribal communities focused to declare and create series of Community Conserved Areas aimed to meet the twin objectives of improving biodiversity status through *In-situ* and *Ex-situ* conservation measures and empower tribal communities-Monpas, Apatanis and Akas (Hrusso) to be organised as Biodiversity Management Committees (BMC) for managing bio-resources derived of declared Community Conserved Areas.[6]

Community Conserved Areas are increasingly being recognized world over as critical areas for conservation of biodiversity and facilitate to bring a greater area under conservation, beyond state government defined protected areas such as national parks and sanctuaries etc.[14] Establishing and supporting Community Conserved Areas is perhaps one of the significant intervention made by this project in Arunachal Pradesh and is alike to Indigenous peoples and Community Conserved Areas and Territories (ICCA) recognized by IUCN World Parks Congress Durban 2003 and 7th Conference of Parities to the Convention of Biological Diversity.[15] Community Conserved Areas under this project are defined as, "natural or modified ecosystems with significant biodiversity, ecological and related cultural values, voluntarily conserved by indigenous peoples and local communities through customary laws or other effective means.[16] It include three essential features: (i) one or more community closely related to the ecosystems and /or species, because of cultural, livelihood, economic or social ties; (ii) community management decisions and efforts leading to conservation of habitats, species, ecological benefits and associated cultural

values, although conscious objective of management may not compulsorily be conservation of biodiversity; and (iii) communities are the major players in decision-making and implementing actions related to ecosystem management implying that some form of community authority exists and is capable of enforcing regulations under the local norms and traditions" [15]. Community Conserved Areas are of various categories (i) indigenous peoples' territories managed for sustainable use, cultural values, or explicit conservation objectives; (ii) territories over which pastoral communities have traditionally roamed, managing the resources through customary regulations and practices; (iii) sacred spaces, ranging from tiny forest groves and wetlands to entire landscapes; (iv) resource catchment areas, from which communities derive their livelihoods or key ecosystem benefits, managed such that these benefits are sustained over time; nesting or roosting sites, or other critical habitats of wild animals, conserved for ethical or other reasons explicitly oriented towards protecting these animals; and (v) landscapes with mosaics of natural and agricultural ecosystems, containing considerable cultural and biodiversity value, managed by farming communities .[15]

As indicated in the definition above, the north-east mountain region in the Republic of India is perhaps the only place in India were most of the forests are still owned by the community.[13] This project has used this concept to encourage tribal communities to protect their community forests more effectively through Community Conserved Areas established under the project and is envisaged to (i) conserve and protect faunal diversity by restricting hunting and floral diversity by sustainable extraction; (ii) secure the access to livelihood resources such as timber and Non Wood Forest Products (NWFP) including ritualistic value species; (iii) obtain benefits from ecosystem functions such as protecting hydrological benefits of forests for irrigation and drinking water; (iv) maintain religious, social identity and cultural needs through protection of sacred sites and species; (v) obtain financial benefits from ecotourism, sustainable extraction and marketing of high value NWFPs and medicinal aromatic plants; (vi) revive threatened species of wild fauna and flora through *In-situ* and *Ex-situ* conservation. [16].

For recognizing Community Conserved Areas with a special conservation status and its potential to conserve the category of Unclassed State Forests in Arunachal Pradesh, there are references sighted by the project to link with other national laws that do provide some statutory provisions that respect tribal peoples symbiotic relation with forest and related resource use.[6] The Constitution (Seventy-third Amendment) Act, 1992 for Panchayati Raj Institution (self government) including the Panchayat Extension to Scheduled Areas 1996 provides legal reference to tenure security over forest produce for forest dependent communities, the category of Community Reserves under Wildlife Protection Act 2002

provides legal provision for local involvement within wild life protected areas, Biological Diversity Act 2002 and Rule 2004 has made two provisions that could be used for management of community conserved areas by formation of Biodiversity Management Committees at village (panchayat) level and creation of biodiversity heritage sites.[17]

IV. Results

Sites-I and II significantly important for its biodiversity, ecological and

Photograph: Namshu Biodiversity Management Committee declared *Ritosa Ree-Mainarang Ree* Community Conserved Area *(Site I -Tawang West Kameng Biosphere Reserve)*

cultural values, conserved by tribal customary norms, the project made a conscious effort to set up the community based governance structure through innovation in participatory management by integrating traditional and customary knowledge and statutory laws to empower traditional institutions through legal provisions defined by national legislation, the Biological Diversity Act 2002 and Biological Diversity rule 2004 referring to chapter X, Section 41, sub section 1,2,3 and Arunachal Pradesh Biological Diversity rule 2011.[13] Tribal community of 32 villages at sites I and II decided to further strengthen their traditional institution by forming 22 Biodiversity Management Committees a formal governance structure comprising of seven

executive members including a chairman and secretary for each Biodiversity Management Committee, drawing its 234 members represented by village head men and women, elected members of village self governing body (Panchayat Raj Institution), Anchal Samitee (Intermediate Panchayat),youth, members of Self Help Groups, NGO representatives, school teachers and village people (Panchayat) as its members. [18]

For promoting conservation, sustainable use and value of community owned forest land, Biodiversity Management Committees in consultation and concurrence from tribal community of 32 villages presided to declare and create Community Conserved Area[19] (Table 3). At site I of Tawang-West Kameng Biosphere Reserve, Namshu Biodiversity Management Committee declared *Ritosa Ree-Mainarang Ree* Community Conserved Area of about 100 hectare of forest patch bounded by two streams (*Ree*) locally known as *Ritosa* and *Mainarang,* is useful to people for drinking and agricultural use. Biodiversity Management Committee in about 10 hectares of community forest land planted *Gamin Seesa*, *Taxus wallichiana* and imposed restriction on agriculture activities, felling of trees and hunting. However selective harvesting of fuel wood and timber is permitted to the people under special permission of Namshu Biodiversity Management Committee. Namshu, Sangti and Thembang villages declared part of the community-owned forests of about 300sq km as a *Thembang Bapu* Community Conserved Area, where strict rules of conservation are adhered. Hunting is strictly prohibited. Home Stay Community based Tourism is promoted to give people of Namshu, Sangti and Thembang villages an alternate source of livelihood. Also an incentive to conserve the biodiversity within the Community Conserved Area, the Biodiversity Management Committee planted species like *Taxus wallichiana, Swertia chirayata, Illicium griffithii*. Jamiri Biodiversity Management Committee declared *Hugore Sewaphu* Community Conserved Area of around 50 hectare, planted with *Michelia champaca* and *Taxus wallichiana*- two valued medicinal plant species in the Community Conserved Area and imposed social restriction only to allow selective harvesting of fuel-wood and timber under special permission At site–II in Apatani plateau with concurrence of local people of Hong Niichii and Hong Niitii villages, the Biodiversity Management Committee declared the community owned forest patch as *Mihin-Radhe* Community Conserved Area of nearly 5000 hectare for *In-situ* conservation of tree species- *lllicium griffithis, Michelia champaca, Termanilia sp. Castanopsis sp Exbucklendia populenia, Myrica esculenta*. And *Siikhe-Bo* Community Conserved Area of nearly 18-20 hectare of community owned forest patch is conserved to recharge the Siikhe stream which is drying up as the upstream tree cover is disappearing and fish species *Schiziothorax,* locally known as *Ngilyang-Nyige*, culturally consumed by local people for

socio-cultural ceremonies is gradually declining in the Siikhe stream, because of two basic reasons i) drying up of the stream and ii) over extraction of water for irrigation. Three Biodiversity Management Committees of Moilyand, Lempia and Tajnag villages declared a forest patch as *Tanjang Rantee* Sacred Grove. [19]

Table 3: Declared and Created Community Conserved Area out of community owned forest Land at Site –I and II [19]

Project sites	Districts	Block s/Villages	Biodiversity Management Committees constituted	Community Conserved Areas created /declared from community owned forest land
Site I - Tawang West Kameng Biosphere Reserve	West Kameng district Tawang district	Dirang block-Namshu, Sangti, Thembang, Chander, Lish, Senge (6) villages Nafra-Buragaon block–Jamiri (1) village Thingbu block -Muktoblock-Kharsa, Lhou (2) villages Lumla block- Shakti, Zemithang, Lumla, Buri, Loudung, Muktur, Thongleng, Kharen and Shakyur (8) villages	6 BMCs of villages -Namshu, Sangti,Lish, Jameri,Lhou and Kharsa of 70 member, 1 Ecotourism and Conservation Committee in Sululya village (Apatani Plateau) of 8 members d 1 Community Based Tourism (CBT) at Thembang Bapu	Ritosa Ree-Mainarang Ree Community Conserved Areas 100ha Hugore Sewaphu Community Conserved Areas 50 ha Thembang Bapu Community Conserved Area 300 sq km
Site-II Apatani plateau	Lower Subansiri district;	Ziro-I block –Molyang, Suluya, Lempia, Tajang, Kalung, Reru, Siro, Hija, Mudang-Tage, Hong (Nichii), Hong (Nithii), Sibey Salang, Dutta, Bamin Michi, Hari (15) villages	15 BMCs at Apatani plateau of Hija ,Mudang-Tage, Hong (Niichi) ,Hong (Niitii) Suluya Reru, Moilyang ,Sibey Salang ,Dutta Bamin-Michi, Siro, Hair Lempia ,Tajang villages constituted with membership composition with special emphasis on gender presentation as per the National Biodiversity Authority (NBA) & Arunachal Pradesh Biodiversity Board (APBB) (Arunachal Pradesh Biological Diversity Rules, 2011)	Mihin-Radhe Community Conserved Areas 5000 ha Siikhe-Bo Community Conserved Areas 18-20 ha Tanjang Rantee sacred grove

Source: G.B. Pant Institute of Himalayan Environment and Development CBRNM newsletter July 2011

Biodiversity Management Committees in consultation and concurrence from tribal community of 32 villages enforced socially accepted rules formulated on traditional customary norms and statuary rules.[18]

Photograph: Sangti Biodiversity Management Committee displays norms prohibiting illegal hunting of wild life and extraction of NTFPs from Community Conserved Area (*Site I -Tawang West Kameng Biosphere Reserve)*

Biodiversity Management Committees imposed and displayed signboards notifying by-law the norms to i) prohibit illegal hunting and marketing of wild faunal species in local markets ii) prohibit electrocution and use of bleaching powder, chemicals for fishing iii) unauthorized extraction/ collection of NWFPs, Medicinal Aromatic Plants, wood, collection of river bed sand etc is not be permitted iii) restriction on shifting agricultural activities, felling of trees and hunting with selective harvesting of fuel wood and timber from respective community forests is permitted to bonafide people of villages with permission from Biodiversity Management Committees iv) levy charges for collection of fine fees of Rs 5000 to Rs 10000 (INR) for any person caught violating, accessing or collecting any biological resources for commercial purposes from Community Conserved Area falling within its territorial jurisdiction. This amount is use for creating corpus fund to manage Community Conserved Areas, v) Regular patrolling of forests land and monitoring local markets to confiscate selling of wild life fauna is conducted time to time by Biodiversity Management Committees jointly with Department of Environment & Forests to restrict hunting and cancellation of license if used illegally. [18]

V. Impact

Declaration of Community Conserved Areas by tribal communities presided by Biodiversity Management Committees promotes local action and responsibility for conservation of the mountain ecosystem by maintaining crucial ecosystem functions-water, soil conservation and gene pool of valued wild flora and fauna, apart from ensuring sustained benefits from ecosystem functions such as protecting perennial watershed of streams to benefit the forests as well provide people with water for irrigation and drinking purpose.[16] The intervention by people and Biodiversity Management Committee of Hong Niichii and Hong Niitii villages in Apatani plateau to declare *Siikhe-Bo* Community Conserved Area has helped in recharging of Siikhe stream, which was drying-up as its upstream tree-cover was disappearing. Siikhe stream feeds the irrigation canals of rice-cum-fish fields of Hong Niichii and Hong Niitii villages and *Schiziothorax*, a fish species locally known as Ngilyang-Nyige, is culturally valued by local people, is protected from further decline in the Siikhe stream.[14] While preparing the Peoples' Biodiversity Register (PBR) maintained by the villages revealed the rich biodiversity of *Siikhe-Bo* Community Conserved Areas that included identified 40 species of plants and 10 species of animals including the culturally valued Orange-bellied Himalayan Squirrel (*Dremomys lokriah*) and a species of monkey (*Macaca assamensis*) locally known as sibee-bidding.[4] Biodiversity Managements Committee evolved a governing mechanism to impose prohibition on harvesting of plant species without permission from Biodiversity Management Committees; the violators are penalised. Harvesting of plant species for ritual purposes are allotted to the representative villages only, under the supervision of Biodiversity Management Committees.[20a] Hunting of wild animals is strictly prohibited and no permission is granted unless for ritual purpose only. Fishing, by modern methods such as electrocution, bleaching, etc. is also prohibited. Fishing for ritual purpose is made with proper permission of Biodiversity Management Committees as per the ritual requirement only and by using traditional and non-destructive methods only.[18]

Steps taken by Biodiversity Management Committees to arrest extinction of species, through *In-situ* and *Ex-situ* conservation measures to retain the forest cover by having 142 hectares of community land planted with taxus (*Taxus wallichiana)*, 28 hectare planted with teeta chap (*Michelia champaca*), 15 hectare planted with bonsum (*Phoebe goaloarnesis*), hollock (*Terminalia myricarpa*) and Castanopsia sp and 40 hectare planted with nitrogen fixing plant alnus (*Alnus nepalensis*) also helps maintain pollinators

P*hotograph: Siikhe stream in Siikhe-Bo Community Conserved Area, a habitat of Schizothorax spp. (*Site-II Apatani plateau)

population. On 60 hectare of community land people of Namshu grew horticulture crops of cardamom (*Amomum subulatum*), orange (*Critus reticulata*) and kiwi (*Actinidia deliciosa*), walnut (*Juglans regia*) and pear (*Pyrus communis*) that has earned them an income.[6] At Apatani Plateau Suluya Community based Ecotourism Self Help Group developed a culture based ecotourism model to derive livelihood gains. At *Thembang Bapu* Community Conserved Area, a home stay community based tourism model helped people of Namshu and Sangti to earn from home stay tourism and charge fee on tourism activities to form a corpus fund, used to manage the community conserved area. Earning benefits has already started to flow from community based tourism.[6]

By declaring the community owned forests as Community Conserved Areas, the Biodiversity Management Committees have helped stakeholders to re-look into policy and legislation gaps of conservation concerned specially in context of the status of Unclassed State Forests, community land tenure system of forest land and participatory governance for access and benefit of resources related to income generating livelihood of tribal community.[20] The reformation in community led action has helped formulate a guideline for management of Community Conserved Areas, as part of the

project. [16] This is indeed a great contribution of the project to policy reformulation in the state. It will also be a model for other north-eastern mountain states in India.[20] At a more advanced stage of the project, a policy dialogue consultation for promotion and management of Community Conserved Areas in Arunachal Pradesh was held involving stakeholders from the Government of Arunachal Pradesh i.e. Environment and Forest, Wildlife and Biodiversity Departments, and from line departments such as Horticulture, Rural Development, State and Central government institutions and NGOs along with Biodiversity Management Committee representatives.[21] The stakeholders carefully deliberated on the guideline for management of Community Conserved Areas, its vision, objectives, institutional arrangement at both local and state level and benefits that will accrue to the communities from Community Conserved Areas. [22] Before the guideline is given preference as a matter of purposeful policy concerned for improving the status of biodiversity in the state, by focusing on the Unclassed State Forests, a conesus emerged that community conserved areas in an approach to meet the objectives of sustaining the ecology of the mountain state, Arunachal Pradesh and further strengthen the existing traditional resource use and livelihood practices of tribal community. [22]

Evaluation: Given the limitation of this project that was centrally administered for a time period and relied on an implementation framework to achieve conservation goals has still been able to initiate a model on Declaration of Community Conserved Areas (CCAs) at sites I and II as part of the project in Arunachal Pradesh has been very significant and indeed commendable.[13] With more time at hand the model can be replicated in other non project villages for improving the conservation status of biodiversity of Unclassed State Forests in the state.[20] However there is a need to enhance legal capacity of engaging institutions to capitalize on indigenous knowledge for improving inventory process on biodiversity including agro-diversity. Still there are information gaps in administering conservation related policies and development plans that are yet to ensure adaptation to indigenous and innovative solutions.[13]In addition to being sensitive towards recognizing tribal community as legal actors possessing common rights to territory and resources.[14] There is need for supporting the network of Community Conserved areas and resist threats of imposing changes to Community Conserved Areas from outside and within community for land or water use changes or 'development' projects, or commercial plantation/fishery/ pastoral activities. Community Conserved Areas are gaining recognition and acceptance globally and there is a great need to showcase examples where Community Conserved Areas exist or are being established.[15]

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Participatory Dimensions : A Comparative Study of The Sundarbans of Bangladesh and West Bengal, India

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Abstract

A comparative study of the Forest Resource Management Regimes between the Sundarbans of Bangladesh and West Bengal, India revealed that the effectivity in the resource conservation is more efficient in the latter than in the former, inspite of sharing the same physiographic and ethno-cultural backdrop and historical roots. The study identified its cause in the development of Participatory Forest Management, which had successfully evolved in case of the Sundarbans of West Bengal, India, while the same is still in its developmental processes in the Sundarbans of Bangladesh. Upon further analysis, the inceptional dynamics for the development of the Participatory Forest Management Regime was found to be dependent upon the development of the trust factor between the Forest Department (the owners of the resource) and the participating forest-fringe communities, and its effectivity was impacted upon by the factors related to the generation of relevant public consensus and the political will on part of the ruling entity to this effect. These factors were once again found to be embedded in the overall prevailing political economy of the State concerned and its developmental processes followed the unique historical trajectory of the socio-political evolution of that particular State entity.

Key words*: Participatory Forest Management, Sundarbans, trust, public consensus, political will, political economy, management effectivity.*

1. Introduction

The Sundarbans of India and Bangladesh is the only mangrove in the world where tigers still live (Barlow, 2009). At approximately 10,000 sq. kms., the Sundarbans of Bangladesh and India is currently the largest and most biodiverse mangrove swamp in world (Iftekhar and Islam, 2004a; Giri *et al*, 2008; Iftekhar, 2008). Its land formation is of relatively recent geological origin and has gone through substantial changes over time, driven by sea level changes, sedimentation, neotectonics, climate change, and human use. The area is of great economic value and provides essential ecosystem services, such as (1) land maturation, (2) protection of human habitation from cyclones, (3) oxygen production, (4) waste recycling, (5) food supply, and (6) carbon cycling (Iftekhar and Islam, 2004b; Biswas *et al*, 2008). The highly specialized mangrove ecosystem of the Sundarbans supports rich biodiversity. This mangrove forests contain 334 species of trees, shrubs and epiphytes and 120 species of fishes, 35 of reptiles, 270 birds, eight amphibian species and 42 species of mammals and it is different from the other mangrove forests in that it is not dominated by the Rhizophoraceae tree vegetation (Rahman, 2000). Its very existence as an exceptional mangrove ecology and ecosystem, support a myriad large groups of fish, shrimp, edible crab and also supply food and livelihood to millions of dependent coastal communities, apart from providing precious wood and Non-Wood Forest Products (NWFPs) (Dev Roy and Alam, 2012). Many floral and faunal species found here are highly endangered. For its outstanding natural value the World Heritage Committee of UNESCO inscribed the Sundarbans in the World Heritage list at their Twenty-first session in 1997. The area is subjected to frequent cyclonic storms and lacks fresh water, which has made the survival of faunal and floral species a challenge and therefore has resulted in a multitude of adaptations in respect to its unique morphological, anatomical and physiological characteristics. People of the Sundarbans live in the reclaimed areas of Sundarban, that was totally a mangrove forest tract until 1833 (Vyas, 2012). The last major deforestation of 1,500 sq. kms. occurred from 1873 to 1933 (Curtis, 1933; Eaton, 1990), after which the Sundarbans boundary has remained relatively stable (Iftekhar and Islam, 2004b; Giri *et al*, 2007). The reclaimed area in the Sundarbans is surrounded by earthen embankments, to keep away tidal saline water from running into

the habitation area, thus forming the vital lifeline to the survival of the people living in these tracts.

The Sundarbans along the Bay of Bengal has evolved over the millennia through natural deposition of upstream sediments accompanied by the intertidal segregation. Biotic factors here played a significant role in the physical coastal evolution process. The mangrove vegetation themselves assist in the formation of new landmasses and the intertidal vegetation play an important role in the swamp morphology (Rahman, 2000). However, explaining the origin of the Sundarban delta by only the infilling of the shallow continental shelf with the enormous amount of sediments carried down and settling down of those by the River Ganges and River Brahmaputra, is very difficult, as the same is lying in a mio-geosynclinal area. Some seismic and geophysical investigations have further complicated the fact of building processes of this delta of Bengal. Morgan and McIntire (1959) have attributed the change in river courses of the Ganges and the Brahmaputra to faulting and the resultant tilting of fault blocks and surmised that the faulting and structural uplift have continued into the recent epoch in the Bengal Basin. Each and every small to large tidal rivers or channels have a major role in the most complex hydro-morphological environment in Sundarbans. People of this region have always tried to tame the major tidal channels that gave birth to this largest deltaic tract and also tried to regulate and manipulate the tidal circuits in various ways so as to close the chapter of the bank erosion forever. But they forgot each time that bank erosion is a natural and inalienable process in building of newer floodplains in this region. Thus by embanking the tidal channels year after year to protect the inhabited floodplains in the Sundarbans, the delta dwelling people indirectly started closing the chapter on natural delta building processes in this region. This ultimately changed the natural flow that has led to the changing courses of these tidal rivers, channels and creeks from time to time (Gour, 2012). Consequent to the disasters arising out of this changing course of the rivers, the bank erosion and the fact that these tracts lie in a cyclone prone zone, the inhabitants of the Sunderbans are highly vulnerable to the natural disasters and also to those possibly arising out of the looming climate change threat.

The history of the management status of the Sundarbans incorporates a number of unique features including its distinction of being the first mangrove forest in the world to be brought under the scientific management (Rahman, 2000). The area was first mapped by the Surveyor General of the undivided British India as early as in 1764, soon after proprietary rights of these tracts were obtained by the British East India Company in 1757 from the Mughal Emperor, Alamgir II. Systematic scientific management of this forest tract started in the 1860s after the establishment of an independent Forest Department in the Province of the pre-partitioned Bengal, in British India. The first Forest Management Division to have jurisdiction over the Sundarbans was established in 1879, being headquartered at Khulna. The Sundarbans was declared a reserved forest in 1875-76, under the Indian Forest Act, 1865 (Act VIII of 1865). The first working plan was formulated for the period 1893-98. (Hussain and Acharya 1994; UNDP, 1998; Rahman, 2000). Presently, after the partition of India in 1947 and the liberation of Bangladesh in 1971, more than two-thirds of the Sundarbans territory has fallen in Bangladesh and the remainder has come under the jurisdiction of the state of West Bengal in India. The historical trajectory that followed in case of both these portions of the Sundarbans thereafter, shaped the present resource management regimes, which impacted upon the status of these forests and its inherent wildlife and biodiversity conservation differently. This article attempts to study the factors contributing to these separate outcomes in case of the otherwise similar physiographic landscape having almost identical ethno-cultural backdrop.

2. Methodology

The article made use of a comparative case study approach. The relevant published cases were selected from both portions of the Sundarbans - the Sundarbans of Bangladesh and the Sundarbans of West Bengal, India, that highlighted a contrasting perspective from the point of view of forestry resource management regimes as impacted through the Participatory Forest Management approach, or its absence. Published literatures were only utilized for the purpose of this analysis. Also, use of secondary data only were resorted to. The cases were analyzed in the back-drop of the politico – historical developments, considering a country or a nation as the basis, to understand the contribution of the historical factors to the process. Review of

relevant policies and notifications were also resorted to in connection with the purpose.

3. Sundarbans of the Bangladesh

The Sundarbans of Bangladesh cover an area of 577,000 ha, of which 401,600 ha is land and remaining 175,400 ha are under the water in the form of river, canals and creeks. It plays an important role in the economy of the southwestern region of Bangladesh, as well as in the national economy, by virtue of being the single largest source of forest produce in the country, including raw material for the wood based industries (Rahman, 2000). The Government of the People's Republic of Bangladesh declared the Sundarbans as World Heritage site in December 1997 (Nuruzzaman *et al,* 1999), immediately consequent to the World Heritage Committee of UNESCO's declaration of the Sundarbans in the World Heritage list at their twenty-first session in 1997. A moratorium order had been imposed as a restriction on all tree felling in the natural Reserved Forests in Bangladesh from 1989 until the year 2000. However, in the Sundarbans, cutting of Goran, Gewa and top-dying Sundri was permitted to facilitate the supply of raw materials to the pulp and paper industries (Rahman, 2000).

The management strategy for the wildlife in Bangladesh is specifically restricted to the protection of fauna from poaching, along with the designation of some areas as the wildlife sanctuaries where no extraction of forest produce is permitted to facilitate the survival of wildlife with fewer disturbances. The Bangladesh Wildlife (Preservation) Order, 1973 (P.O. 23 of 1973) stipules protection of certain key endangered species. Accordingly, three wildlife sanctuaries were established in 1977 under this Bangladesh Wildlife (Preservation) Order, 1973 in the Bangladesh Sunderbans, which are as follows a) the Sundarbans East Wildlife Sanctuary extending over an area of 31,227 ha; b) the Sundarbans South Wildlife Sanctuary of over an area of 36,970 ha; and c) the Sundarbans West Wildlife Sanctuary encompassing an area of 71,502 ha of forests. In spite of it, Hussain and Acharya (1994) reports that the faunal resource of the Bangladesh have diminished in recent times, including those of the Sundarbans. Anthropogenic pressure from dependent communities is causing this gradual resource reduction (Roy *et al*, 2012; Roy, 2009).

Tamang (1994) attributes this to the fact that the Forest Department here treats the forests as a source of revenue, where resources are over-exploited and the system is not ideal for its sustainable management. Top-dying disease and overharvesting have been identified as the cause for at least 50% reduction of tree density, posing a threat to its sustainability (Kabir and Hossain, 2008). As a reserve forest, Forest Department controls the overall top down management of the Sundarbans with no involvement of the local people. Dev Roy and Alam (2012) therefore opines that the prevalent management system here has failed to realise true sustainable indicators from the overall stakeholders' viewpoints, for instance, avoidance of local people's customary rights and knowledge in the resource conservation. Accordingly, reformulation of present management policy has been suggested by examining the feasibility in the introduction of Participatory Forest Management (PFM) which has become successful in different other countries as a new paradigm for sustainable forest management (Stone *et al*, 2008).

After the partition of British India, during the Pakistan era (1947-71) in East Bengal (the present day Bangladesh area), the forest policy undertaken was for the huge extraction of resources where the rights of forest-fringe people were denied (Kabir and Hossain, 2008). After independence in 1971, Bangladesh adopted its first National Forest Policy in 1979, but again it failed to address the issues related to sustainability, community participation and livelihood. The violation of this inclusive approach still continues inspite of the revised Forest Policy of 1994 incorporating provisions for the preservation and management of designated forests through a participatory approach with the local residents (Muhammed *et al*, 2005). Nevertheless, due to the absence of a defined ownership and established rights, the dependent population surrounding the Sundarbans have not yet been able to be a part of the strategies and activities aimed at conserving the forest or using its resources sustainably (Dev Roy and Alam, 2012). Although Participatory Forest Management in the form of social forestry (forestry initiatives outside the regular forest areas) has been successful in Bangladesh, in consequence to the latest National Forest Policy of 1994, there has actually been no research on its implication in case of the

Sundarbans. The programme in this case had totally been donor-driven and it adopted a top-down policy approach (Dev Roy and Alam, 2012). From the participatory management experience in Bangladesh, it is found that Forest Department is the main stakeholder who takes decisions unilaterally. Participants have no role in planning and management of forest resources. No local level institutions were developed and operational plan for community involvement was never introduced. Accordingly, Dev Roy and Alam (2012) , from this experience suggests that it needs future participatory management intervention to investigate the potential for combining existing methods of stakeholder analysis (Reed *et al*, 2009) to derive more fruitful results and benefits for each stakeholder to be involved in the sustainable management decision making process.

4. Sundarbans of the West Bengal, India

The Indian Sundarbans Delta, spread over about 9630 sq. Kms. between 21˚40'04"N and 22˚09'21"N latitude, and 88˚01'56"E and 89˚06'01"E longitude, is the smaller and western part of the complete Sundarbans delta. It is bounded by the Ichamati - Raimangal River in the east, by the Hugli (Bhagirathi / Ganges) River in the west, the Bay of Bengal in the south, and the hypothetical Dampier- Hodges line drawn in 1829-1830 in the north. A little over half of this area has human settlements on 54 deltaic islands and the remaining portion is under mangrove vegetation. The landscape is characterised by a web of tidal water systems very much like its Bangladesh counterpart. This area also is prone to extreme storm events that are frequent during the pre-monsoon period, and again from September to November. Historical records indicate a high frequency of extreme weather events, such as severe storms or cyclones (Danda *et al*, 2011).

Out of the 9,630 sq. kms of land comprised in the Indian Sundarbans, 4,260 sq. kms is classified as reserved forest under the exclusive jurisdiction of the West Bengal Forest Department. In December 1878, the colonial administration in British India notified the Sundarbans forest as 'Protected Forests' such that these lands could be opened for reclamation/conversion to agriculture with the consent of the Forest Department. By designating the 24-Parganas's tidal forests as 'Protected' rather than 'Reserved' forests, the Forest Department left an option for itself: To either lease these lands for clearing and conversion to farming, or to transfer them to timber production

and management as reserved forests. Within May 1943, all these residual 'Protected' forests was reclassified as 'Reserved' forest to forestall any further reclamation/conversion.

This forested part of the Indian Sundarbans as we know it today is overseen by the Director of the Sundarban Biosphere Reserve (SBR) through the Divisional Forest Officer of 24-Parganas (South) Forest Division and the Field Director of the Sundarban Tiger Reserve (STR), the latter of which came into being through a notification in December 1973. It is one of the first nine Tiger Reserves declared under Project Tiger Scheme in the year 1973 by the Government of India (Pandit and Mukherjee, 2011). All of the Indian Sundarbans was declared as Biosphere Reserve in March 1989, but the human inhabited part is *de jure* not under the jurisdiction of the Director of Biosphere Reserve (Danda *et al*, 2011), but forms part of the Civil Administration in two respective Districts – 24-Parganas (North) and 24-Parganas (South). The Sundarban National Park within the Tiger Reserve was declared a World Heritage Site in 1987 and is provided with the highest level of official protection, classified as a Category Ia (Strict Nature Reserve) Protected Area under the IUCN classification system (Danda *et al*, 2011). There are two Protected Areas under the STR, the Sundarban National Park (declared vide Government notification No. 2867-For dated 04.05.1984) and the Sajnekhali Wildlife Sanctuary (vide G.O. No. 5396-For dated 24.06.1976). Rest of the forest area here has been declared as a buffer zone vide G.O. number 615-For/11M-28/07 dated 17.02.2009. As regards the 24-Parganas (South) division, there are two Protected Areas here too, declared under the Wildlife Protection Act, 1972. Halliday Island Wildlife Sanctuary (vide 5388-For dated 24.6.1976) and Lothian Island Wildlife Sanctuary (vide 2771-For dated 19.8.1998) comprises of this two (Wildlife Wing, 2012). In a recent development, the residual Reserve Forest Areas of the 24-Parganas (South) division was declared a Protected Area, named the West Sundarban Wildlife Sanctuary, vide Government Notification number 1828-For/11M-86/2012(Pt.I) dated 11.09.2013, in keeping with the recommendation of the State Board for Wildlife, West Bengal in its meeting dated February 06, 2012.

The National Forest Policy of India, redrafted in 1988 to improve the consideration for the environmental sustainability issues, the conservation, as well as the social and economic values of forests, subsequently led to the Participatory Joint Forest Management Resolution of the Ministry of Environment and Forests, Government of India on 1st June, 1990, in a major policy shift since the Indian Independence in 1947. The Government of West Bengal, the state pioneering this participatory forest management experiment, subsequently issued two specific resolutions in 1991 and 1996, both of which have a bearing on the management of Sundarbans forest. These are for (1) general notified Mangrove forest areas of Sundarbans, and (2) National Parks and Sanctuaries of the State respectively (Danda *et al*, 2011). With Resolution No. 8556 – For, dated 15th November 1991 the Joint Forest Management concept, pioneered at and overtly successful in the South West Bengal districts, were extended to the Sunderbans (Deb, 2009). To cater to the Protected Areas (the National Park and Wildlife Sanctuaries), where felling operations have been stalled by the interim ruling of the Supreme Court of India, Resolution number 3841-For dated 26.06.1996 was passed by the state Government of West Bengal. In the second case, the Joint Forest Management Committees (JFMCs) were to be called Eco-Development Committees (EDCs) instead of FPCs (Forest Protection Committees), and were stipulated to share benefits from the eco-development schemes instead of the direct share from the timber harvests as practiced elsewhere in the state. Based on these notifications, community based committees, devised to increase community involvement in ecosystem management as well as to redistribute the benefits of appropriate management more fairly, were developed. Accordingly, 51 Forest Protection Committees (FPCs) and 14 Eco-Development Committees (EDCs) were formed in the fringes of the Indian Sundarbans (Danda *et al*, 2011). Despite several difficulties, by virtue of the positive engagement with the local population through the EDCs and FPCs, the Forest Department, since 2001, has been able to achieve zero mortality of strayed tigers caused due to retaliation by villagers (Danda *et al*, 2011).

The Joint Forest Management has been highly successful in Sundarbans during the last decade, as not only have all the strayed tigers been rescued by Forest Department with peoples' co-operation, but also other wildlife species

have also been saved by the Forest Protection Committee and Eco-Development Committee members. Here, primarily human-wildlife conflict (mainly tiger straying) centric JFM management has been really a success in mitigating the human-wildlife conflicts. Actual efforts to utilise this concept as a management tool in Sundarbans started since 2001 onwards, after the incidence of killing of straying tigers by mob in Pakhiralaya and in Kishorimohanpur villages. Since 2001, in a major success to the JFM programme, a total of 324 tiger straying have been recorded in Sundarban, but due to peoples' cooperation a total of fifty-five tigers have been captured, nineteen by immobilization and thirty-six by trapping in cages with bait. It is a major breakthrough especially after the incident when two tigers were brutally killed in two separate incidences in the year 2001. This is an indication of the trust developed between the Forest Department and the Sundarban people in the last decade (Vyas, 2012). Since 2002 not a single strayed animal have been killed and all have safely been returned to the wild as a result of the absolute success of the confidence building measures undertaken by the Forest Department (SBR Report, 2010).

From a study of the JFM in the Indian Sundarbans, Vyas (2012) concludes that the data indicates a direct co-relationship of the governance of Forest Protection Committees and Eco-Development Committees with the incidences of human-tiger conflicts. Committees, which had incidences of human-wildlife conflicts, especially tiger straying, had better governance and the stipulated Annual General Meetings of these committees were also held regularly. The reason for this is that the committees with high incidences of human-wildlife conflicts have received maximum attention and inputs from Forest Department, whereas other committees that have received less attention have resulted in lack of awareness, which affected their functioning. Committees that received high benefits from the Forest Department have reciprocated very well and the committees with moderate or low benefits have not co-operated to the extent to make the operation smooth. In the areas of success, the local political leadership has helped in the implementation of alternate livelihood programmes (conducted by the Forest Department) and also has come forward in saving the wildlife and in the tiger rescue operations. A clear positive co-relation has also been observed in this study, between the alternate livelihood programme

implementation in the Forest Protection Committees and Eco-Development Committees with the peoples' cooperation received in wildlife rescue operations. Maximum weightage to the committees in tiger straying sensitive areas was found to have given excellent results (Vyas, 2012).

5. Analysis and Discussions

From the comparative analysis of the two portions of the Sundarbans, it was decipherable that in spite of sharing the same physiography and ethno-cultural background and historical roots, the management affectivity has differed in case of the Sundarbans of Bangladesh and the State of West Bengal, India. Factors related to the development of the participatory approaches to forestry management seem to have made the difference in both these cases. In case of the Bangladesh Sundarbans, Hoq(2007) reported that the Forest Department controls the inherent fishery resources(considered a NWFP in this context) through the allocation of permits for fishing . However, it presently neither controls permit licenses to reduce overharvesting, nor monitors fishing pattern to stop the catch of wild shrimp fry, which is banned by regulation. From a survey, Kabir & Hossain (2008) finds that more than treble the amount of permit fees are charged as bribes by the Forest Department, Police and dacoits for collecting NWFPs, of which the local people are the prime beneficiaries. The local people identified Forest Department's malpractices and corruption as the main reasons for massive destruction. Concluding from these observations, Dev Roy and Alam (2012) state "In spite of clear policies for community oriented management and their involvement under different projects since 1994, the Forest Department did not involve them in planning and management of the Sundarbans. From the above analysis, it is also found that the Forest Department introduced flawed participatory Forest Management (PFM), where participation was not ensured". Ali (2002) adds on to these observations further by stating that this alienation of individuals from the forest made then wasteful in their use of the forest and reluctant to create new forests. Accordingly, Dev Roy and Alam (2012) opined that the State monopoly with the sole power to the forest bureaucracy and top down approaches for the mangrove management needs to be critically evaluated as they have proved progressively ineffective to stop depletion. They suggested finally that participatory management, by decentralising administrative

authority and delegating responsibility to local organisations that are controlled by local communities, may be the most appropriate alternative for the sustainable management of the Sundarbans.

In contrast, in the Western part of the Sundarbans, falling within the state of West Bengal, India, participatory Forest Management, in the form of JFM was already extended to the Sundarbans in 1991, building upon the success of the JFM concept in the south-west Bengal districts of West Bengal that pioneered this concept. However, this JFM concept was realigned to encompass participatory dimensions in mitigating man-animal conflict and was revitalized after the case of retaliatory killing of two straying tigers in the adjacent villages in 2001 (Vyas, 2012). In a major success to this approach, not a single straying tiger have been killed in the Indian Sundarbans since 2002, but was returned to the wild safely by the Forest Department with the co-operation of the people (SBR Report, 2010). Vyas (2012) attributes this to the development of trust between the forest Department and the participating fringe community. In this study, Vyas (2012) correlates that the community that received more benefits in terms of eco-development projects have reciprocated very well than those that received less benefits. Local political leadership in those areas also helped in the rescue operation of straying tigers.

Through this study in contrast between the two portions of the Sundarbans, it can be analysed that the involvement of the local people through participatory means does have a positive impact upon the conservation of the forestry resources. This has been made possible due to the development of the public consensus in regard to the resource protection and the resulting institution building that followed through to augment such initiatives.

From a case study in two villages at Munshiganj in the Shyamnagar Upazilla of Satkhira District in the Bangladesh Sundarbans, Koli (2013) finds that most respondents view that relationship with the Forest Department as confrontational, unfriendly and not trustworthy. This “fence and foe” relationship not only generates mistrust between the Forest Department staff and the local community, but also increases the unsustainable extraction of resources either legally or illegally. However, this trust has not been a

detrimental factor in case of the Indian Sundarbans as reported by Vyas (2012). The generation of trust in the latter case has helped in the protection of the wild life resources. Hence, the factor of generation of trust between the administrative agency and the local community proves to be vital for the development of any co-management initiative involving the people. This demands willingness on part of the administration to share power with the people, which definitely is a spin-off of the development of a political will on part of the Principal State Actor (i.e. the ruling Government) to this effect.

In case of Bangladesh, Khan (2009) quoted that the Forest Policies still continue to promote the historical tendencies of commercialization of forestry "Equipped with effective political technologies, these tendencies are masked under rational and technical languages and the use of *tropes* (*tropes* are figures of speech, where words are not used in the literal sense. Development policy discourses often employ tropes to serve the political purpose of creating deliberate vagueness over, and masking the political elements of, the subject) " (Khan, 2009). This reflects upon the political will dimension on part of the Principal State Agent. That, the development of participatory approaches, which is consequent upon the willingness of the Government to share power, is co-related to the political will of the State Entity.

However, in the case of West Bengal, participatory JFM was pioneered in the state following the success of the Arabari Experiment in mid 1970s, that led to the successful emergence of the JFM concept in forest based co-management initiative. Poffenberger (1996) attributes the successful emergence of the JFM committees, at the place of its inception, to the synergy of different causes extant at that time. According to him, the socio-political context prevalent at the state, at that time, encouraged a pro-people programme and was empathetic to the community needs. Historically, at that period of time, a Government espousing progressive ideologies was in power in the state of West Bengal, which had parallel radical successes in the other realms of governance as well, including the successful implementation of the land reforms, etc. Thus, the emergence of participatory initiatives is a factor of the political will on part of the Principal State Agent, which is influenced by the prevailing political economy of the time. De Janvery and Sadoulet

(2001), while discussing the land and land policy reforms, also have concluded that there is a need to seek compatibility between land policy initiatives and the forces of the political economy. Land policy in this case has been co-related to participatory Forest co-management policy as because both deals with the tenurial rights of the people, heavily dependent upon and mostly marginalised, that is concomitant to the factors of the political will on part of the Principal State Agent.

Choudhury (2003) points out that the Forest policy in Bangladesh has been heavily influenced by the political changes that have occurred in the country over a long period. Delving into the history of Bangladesh, we can note that the borders of the present day Bangladesh took shape during the partition of British India in 1947, as part of the newly emerged state of Pakistan. As East Pakistan, this state passed through the historical trajectory of phases of Martial Rule as a part in the history of Pakistan. However, following years of political exclusion, ethnic and linguistic discrimination and economic neglect by its politically dominant western counter–part, a surge of popular agitation, linguistic nationalism and civil disobedience led to the Bangladesh Liberation War in 1971, resulting in the emergence of the independent Bangladesh nationhood. The new state proclaimed itself a secular multi–party democracy, but experienced phases of political turmoil and military coupes thereafter. Democracy was restored in 1991, after a phase of mass agitation and political unrest. However, the country's main political forces remained polarized, leading to development of an atmosphere of mistrust between the principal political players of the country. There is every possibility of trickling down of this mistrust factor into the lower levels of the administration, in general, encompassing the forest bureaucracy as well. The reluctance to share power with the people in the case of Sundarbans of Bangladesh also is thus a factor embedded in the political trajectory of the history of this state. Therefore, from the comparative study of the historical evolution in the case of the Bangladesh and West Bengal, it can be concluded that the development of participatory forestry in both the portions of Sundarbans has a bearing upon the overall political economy of these two states and is influenced by their unique historical trajectories.

6. Conclusion

From this comparative study of the resource management regimes in the Bangladesh Sundarbans and the Sundarbans of West Bengal, India, we may conclude that by virtue of the development of participatory forest management in the Sundarbans of India, the wildlife resources here are better protected and that it has impacted positively upon the mitigation of human–wildlife conflict, especially those involving straying tigers – the flagship species of these tracts.

In case of Sundarbans of Bangladesh, the participatory management regimes are still in the process of development and hence, could contribute very little to the rampant depletion of its resources, as cited in the case–studies reviewed from these tracts, here.

This comparative study could also enhance the realms of our understanding of the genesis, as well as the dynamics, of the participatory forestry resource management regimes and its impact upon the resource management dimensions in general. These have been enumerated as follows:
Participatory approach definitely enhances the effectivity of the conservation and management of the resource in question.

This effectivity in the conservation and management initiative involving the forest-fringe people, stems from the positive impact of the development of a public consensus to this effect amongst the concerning participating communities.

The development of trust between the holding government agency and the participant communities is essential for the development of such co–management initiatives.

This trust building process again is a fall out on part of the owners (the government Agency, i.e. the Forest Department) to genuinely share their controlling powers with the people and hence, agreeing to relinquish some of their hitherto held powers and privileges.

The development of the will to share power by the government agency is concomitant to, and a fall–out of, the overall political will on part of the prevailing State Actor (i.e. the ruling entity) of the time.

Development of this political will is influenced by the overall socio–political structures in the governance machinery of the state and therefore, is embedded in its unique political economy.

The socio–political governance structure supporting the development of participatory processes at the grass–root level, as well as the political economy of the time supporting such initiatives, follows the unique historical trajectory of the evolution of the State Actor (ruling entity) of the country or state.

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T a b l e 1. ***Year – wise straying of Tigers in Indian Sundarbans.***

Year	Sundarban Tiger Reserve	South 24 – Parganas Division	Total
1986	14	Not Available	14
1987	20	Not Available	20
1988	4	Not Available	4
1989	4	Not Available	4
1990	11	Not Available	11
1991	1	1	2
1992	3	1	4
1993	1	1	2
1994	8	2	10
1995	25	1	26
1996	18	2	20
1997	3	1	4
1998	5	2	7
1999	10	3	13
2000	6	3	9
2001	8	5	13
2002	24	2	26
2003	21	4	25
2004	17	3	20
2005	2	3	5
2006	10	11	21
2007	9	8	17
2008	11	1	12
2009	22	13	35

(**Adopted from Vyas, 2012**).

Eco-Restoration and Institution Strengthening of Forest Management in Mountain Ecosystems

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Abstract

Forest ecosystems, in particular mountain ecosystems are highly vulnerable to socio-economic pressures, leading to degradation. Climate variability and climate change will further aggravate degradation and loss, impacting biodiversity, ecosystem services and livelihoods of local communities. The example from Madhya Pradesh, outlined in this paper shows that forest degradation is a fact, the causes of which need to be urgently addressed. Amongst the main factors contributing to forest degradation in Mandla district are weak governance of forest resources, increasing human pressure on forests for timber and non-timber products, dysfunctional rules of use in both private and communal lands, and general lack of information. The project aimed to address these issues and involved a number of activities such as baseline assessment, strengthening of village institutions, implementation of agro-forestry on private lands, forest conservation, promotion of sustainable harvest of NTFPs, and provision of information and services hub. The findings of assessment of the project show that baseline assessment was successfully conducted, executive committees for conservation of natural resources were formed in all the project villages, village micro plans were prepared, agro-forestry was promoted and efficient cook stoves disseminated. The innovative part of the project was to put village institutions at center stage as a key approach for the conservation and sustainable management of natural resources. There is a need of landscape level engagement with village institutions providing an institutional

backbone for this engagement on land use, management of natural resources and making informed choices.

Key words: *Forest management, Eco-restoration, Institutional strengthening, Climate Change, Mountain ecosystem*

1. Situation/Background

Forest ecosystems are more resilient to biotic and abiotic stress factors than agri-ecosystems. They represent an important means for local community to adapt to climate change (FES, 2008). With degradation and loss of forests, the local communities dependent on forests would become more vulnerable to climate change and reduced adaptive capacity.

Climate change is amplifying the gradual degradation of forests in Mandla region. The Upper catchments in Mandla district which are either forests or common lands are fast getting degraded owing to soil erosion, encroachment, anthropogenic pressure for fodder and fuel wood (UNDP, 2012).Eventual breakdown of governance of forest resources is further amplifying the existing problems (Verma & Kumar, 2006). Forests form an important part of the subsistence for poor, who are dependent upon them for fodder, fuel wood, manure and forest produce (TERI, undated). This is especially true in times of hardship, drought and famine. Ecosystem services offered by forests play a critical role in supporting agriculture ecosystems by providing pollinator services, nutrient and hydrological cycles etc. (Lindberg et al, 1997).

The project aimed to address the current pressures on forests through improved governance over forest resources; recuperation of ancient or traditional knowledge and experiences; strengthening of institutional capacities, improved land use by re-introducing trees in the landscape, protecting upper catchments still under forest cover and reforestation of bald areas, creation of learning and information hubs. Some of specific activities implemented under the project include; dissemination of efficient smokeless chulhas, restoration of forests and demonstration of feasible alternatives to halt forest degradation.

2. Project area

Mandla district in Madhya Pradesh located in central India was selected for the study. This region holds crucial habitats for endangered flora and fauna. The region being an eco-tone has high biodiversity with both Sal and teak trees found on specific tracts. The district also possesses a large area under miscellaneous forests.

3. Programme Activities

In this section, the various activities implemented under the project, aimed at eco-restoration of degraded forests and institutional strengthening for forest management which are presented.

- ✓ Baseline Assessment of institutions, forest degradation and adaptive capacity
- ✓ A people-centric approach was adopted to understand the role of institutions in conserving the forest resources in Mandla region and study the current level of forest degradation.

  The objectives, methods, tools and data sources used for baseline assessment are given below in Table 1.

Table 2: Baseline Assessment Framework

Objective	Method	Tools	Output	Specify data and source of Information
Role of institutional control measures to improve conservation of forest resources	PRA	Timeline preparation	Time line of forest resource in terms of loss or gain of biodiversity, NTFP production and village level regulations around forests	Qualitative information from community members
Assess current level of forest degradation	Ecological baseline protocol (Forest ecosystem)	Forest plot survey, biodiversity and biomass assessments	Ecological baseline for existing forest cover	Primary data from forest department
Assess the adaptive capacities of households	Household economic analysis	Questionnaire and Focus Group Discussion	Vulnerability profiles on the basis of Income and expenditure and occupation	Data based on household survey

3.1 Strengthening village institutions

The results of baseline assessment (discussed in detail below) showed 'strengthening of village institutions to be the prime requisite for conservation of forest resources which could largely be achieved by strengthening of Gram Sabhas. The challenge was to organize frequent Gram Sabhas and improve transparency in the system. Following steps are taken by the project to ensure strengthening of local institutions in order to manage and conserve forest resources- -

Formation of Executive Committee-

An executive committee "**Prakratik Sansadhan Prabandhan Samiti**" (PSPS) i.e. Natural Resource Management Committee was elected by Gram Sabhas for the execution of the project. The PSPS was provided **residential training** on decentralized governance, Panchayat Raj system, preparing village perspective plan, formulating bylaws on conservation of forest, management and sustainable use of forest resources, collective actions, basics of PRA, and other public services.

The major responsibilities assigned to the PSPS were as follows-

- Advising the Gram Sabha on forest resource management
- Spearheading the process of developing rules and regulations around commons
- Planning for natural resources and land use management

Selection and training of rural volunteers (Gram Mitra)

Rural volunteers were selected to energize the institutions and fulfill the service and governance gaps.

Planning and adoption of By-laws for improving the governance of commons, strengthening of JFM, development of community level strategies for storage of NTFPs as well as seeds and grains.

Village transects were laid in the forests in each village to study the level of degradation, which was followed by the discussion with the local community on the causes of degradation.

3.2 Agro forestry in Private uplands

During the baseline assessment, the private uplands were found to be cleared due to various biotic pressures. The project, therefore focused on introduction of Agro-forestry on such private uplands to revive the gradually lost biodiversity of the forests, help bind the soil in the uplands, arrest forest fragmentation, improve canopy cover and diversify livelihoods of people.

A systematic approach was followed, with "capacity building" for the local community as the first measure in this regard, followed by the implementation of agro-forestry systems or schemes on 25 acres of land, which had been cleared due to biotic pressure for fodder and fuel wood etc.

3.3 Model villages for forest (energy/biomass) conservation-

The focus was to show how conservation of fuel wood leads to increase of forest biomass and improved nutrient flows, thereby improving forest resilience and productivity.

The model villages were selected based on following two criteria-

- Local communities' dependence on forests
- Communities' readiness for adopting efficient fuel conservation options

Demonstrations were conducted in three model villages (Malheri, Kusmi and Patha Devgaon) on benefits of using an improved chulha over traditional ones in terms of reduced fuel wood consumption, conservation of forest resources and availability of clean and efficient cooking fuel. The focus of comparison was on key aspects like fuel wood requirement, time taken to cook certain item, impact of the chulha flame on the utensils and the fuel wood residues (ash/black, soot) produced.

3.4 Sustainable harvesting of non-timber-forest-products (NTFP)

Focused trainings were conducted at regular intervals for the NTFP collectors to ensure sustainable harvesting of various forest produce including chironji (Buchnanialanzan), mahua (Madhucaindica), etc.

3.5 Community level storage banks of NTFPs

A Community managed storage bank has been planned to operationalize by October, 2013 with aim to minimize the risks in stress situations like drought or any other household level crisis.

3.6 Information and Services Hub for providing climate related information and trainings

The Information and services hub is placed within the Thanamgaon Panchayat and is currently acting as an extended arm for the Government's welfare programs. Many people have benefitted from the services of the hub. While the hub will continue to provide services, it will also become a source of information on the impacts of climate change, district level forecasts of rainfall, reading of news clippings, providing space for conducting trainings of various issues, maintaining data and maps obtained at village level in order to support Panchayats in decision making.

3.7 Documentation of best Practices

The best practices like agro-forestry, strengthening of village institutions and community managed storage banks are documented at household level, village institution level and Panchayat level.

4. Results/Impacts

The results/impacts of the project activities on strengthening of the institutions, spread of agro-forestry and biomass conservation are presented in this section.

4.1 Baseline Assessment

The baseline assessment documented existing initiatives among the local villagers and the limitations in the management of forest resources. The local communities have been involved in conserving the forests in many villages

as part of their tradition. Most village communities acknowledged over-dependence on forests for livelihoods in diverse manners. Over dependence was not regulated efficiently at the village level. The Village institutions were found to be weak, thereby making government schemes for forest conservation and management ineffective. The forest department showed no interest in strengthening of the local JFM committees. Numerous attempts to ignore Gram Sabha decisions often triggered neglect of forest resources. Weakened institutions were leading to loss of social control and erosion of collective wisdom of using what is needed (women pointed this out especially).

Strengthening village institutions:

Formation of Executive Committee-

All the nine villages currently have the PSPS as executive committees, and are raising issues of forest resource conservation in Gram Sabha (figure 1).As the direct impact of the project activities, most of the villages have now begun to conserve forests and other commons and have strengthened their existing conservation efforts, owing to regular engagement with the institution on the agenda of conservation.

Figure 4: Village meeting in progress

Specific areas have been demarcated where action for conservation is planned. Conservation is adopted initially in one of the demarcated areas and gradually actions are expanded onto other demarcated areas in the landscape on a rotational basis.

Five out of 9 project villages have re-introduced the Pari system of protection, which involves every household taking turns to watch and protect forests.

Figure 5: A regenerating teak tree in forest near Luhari owing to community conservation

Issues of conservation of forests are now being discussed separately with men and women for building an understanding of degradation of forest resources within the groups and the committee and thereafter the issues are taken to the forum of Gram Sabha.

The PSPS also undertook convergence with JFM committee and supported Forest Rights Committee in some villages to draft their claims for Community Forest Rights (CFR).
Strengthening of FRA initiated the process of claim filing under CFR in 7 villages. Tenurial security over forests now ensures access by local community, safeguarding them from growing pressure for lands and also helps achieve livelihood and conservation objectives.

Village Plans
The institutions have participated in the decentralized planning process to prepare the village plan with the local community. The earlier approved plans were cross-checked and new plans have been formulated and submitted to Janpad Panchayat at Niwas Block.

Selection and training of rural volunteers (Gram Mitra)
The rural volunteers (Gram Mitra) have been selected in all the nine villages through Gram Sabha and have been imparted training twice.
The Rural volunteers are actively engaged in facilitating improvement in delivery of the public services.
They are managing the claims under CFR. The Gram Mitrahave been instrumental in bringing all the village level committees take place and strengthening the Gram Sabha.

Planning and adoption of Bylaws
Village level bylaws have been evolved in consensus with the village institutions for ensuring conservation of forest resources. The meetings and focused group discussions took place on importance of forest resources and communities' livelihood dependence on it. With the focus on sustainable use of forest resources, villages decided upon some bylaws which are now implemented and followed by the community as a whole.

Major bylaws which were framed and adopted at village level are given in figure 3 below –

Figure 6: Major by-laws framed and adopted at village level

- *Not allowing straying of domestic animals in the area identified as "to be protected" in the Gram Sabha. In case of violation i.e. if any animal is found in the protected area, the owner pays a penalty to the village institution, which is deposited in the village fund.*
- *The informer who informs about the violation of rule is awarded some amount as decided by the village institution.*
- *In some villages, one time violation is overlooked, but action is taken if the same person commits the mistake again.*
- *Collection of dead or fallen wood as firewood from forest is allowed but felling of trees in forest is strictly prohibited. In case of violation, the person responsible pays a penalty to the village institution and the informer is rewarded.*
- *Collection of Lantana and Karonda is allowed for firewood or fencing material.*
- *In case of forest fire, all the community members have to rush to the spot to help control it.*

Village transects

Village transects to study the causes of forest degradation facilitated the village institutions in arriving at a set of rules on using forest resources. Primarily, these rules included boundary rules, protection rules for forests and usage rules to some extent. Focus was on controlling lopping and logging of trees. At some places, people formulated rules for sharing of fish produced in the village ponds, etc.

4.2 Agro forestry in Private Uplands

Capacity building exercise enabled the local community to relate the facts with their personal experiences and community eventually agreed that

private uplands are largely not being used for agriculture and do not have any tree cover, which is further aggravating the erosion of remaining soil.

The target of 25 acres of land under agro-forestry was achieved within first year itself. On10 acres of land, millet cultivation with *kodo*, *kutki*, and *ragi* with certified seeds was undertaken, leading toimprovement in economics of the farm.

The trees that have been planted include Mahua (*Madhucaindica*), Chironji (*Buchnanialanzan*), Bamboo (*Dendrocalamusstrictus*),Aonla (*Phyllanthusemblica*), Mango (*Mangiferaindica*), Guava (*Psidiumguajava*), Jackfruit (*Artocarpushetrophyllus*), Kranj (*Pongamiapinnata*), Baheda (*Terminaliabellerica*), and Harra (*Terminaliachebula*).

The 25 acres of upland that were brought under agro-forestry in year 2012have recorded reasonable survival rate despite lack of intensive care and irrigation. Since the plantation sites were at a considerable distance from the water resource, the farmers could not water them on regular intervals. Lack of irrigation facilities added further to this problem. This situation was well taken into account while planning and selecting the species. Therefore, a mix of hardy species and some commercially useful species were planted to cope with the water crisis. The survival rate for the month of December was 81% whereas during summer it came down to 48%.

To achieve restoration of the private uplands, the beneficiaries initiated gap filling activities with support from the project. The number of plants for various species like*Char*, *Mahua*etc is given in table 2below-

Table 3: Species wise details of Gap filling

Species	**No.of plants**
Char	50
Anola	385
Mahua	100
Guava	235
Jack fruit	30
Total	**800**

As part of the agro forestry system a women SHG has taken the initiative to develop a nursery in the village Patha Devgaon. The species raised in the nursery include Mango, *Khamer*, *Anola*, *Karanj*, *Harra*, *Kopilar*, *Bel* etc. Last year they had sold the plants worth Rs.1,16,000. In the month of June 2013 the group had sold 5530 plants of different species and had earned an amount of Rs. 29,275.

In most of the agro-forestry sites, it was noticed that the survival rate for Bel, Mango, Amla and Bamboo was high whereas the others showed low survival and growth rate. This encouraged the villagers to grow the species which had high growth rate.

4.3 Model villages for forest (energy/biomass) conservation

A comparative demonstration was conducted on the use and benefits of improved chulah over the traditional ones. The focus of comparison was on fuel wood requirement, time taken to cook, impact of the chulha flame on the utensils and the fuelwood residues (ash/black) produced.

Figure 7: Improved and Traditional Chulah

The findings of the demonstration (figure 4and figure 5) on making tea are given below in table 3:

Table 4: Comparison between traditional and improved Chulha

Traditional chulha	Improved chulha
Water used 750 ml	Water used 750 ml
Time taken was 15 minutes	Time taken was 10minutes
The quantity of fuel wood used 770 gms	The quantity of fuel wood used 700 gms
Utensil turned black	Utensil colour slightly changed but did not turn black
The water in the second pot was not warm	The water in the second pot was hot.

5. Preliminary Evaluation

In order to capture the learning from the project and make recommendations, it is imperative to monitor the impacts of the project interventions. Here the approach and the preliminary results of the evaluation are presented. For evaluating the impacts generated by the project activities, following two approaches were followed-

5.1 . Indicator based evaluation

A set of pre-fixed indicators was used to monitor and evaluate the impacts of the project activities.

The status of all the indicators was studied at the end of each quarter and documented. The status of the indicators as on June 2013 is presented in table 4

Table 5: The status of the indicators as on June 2013

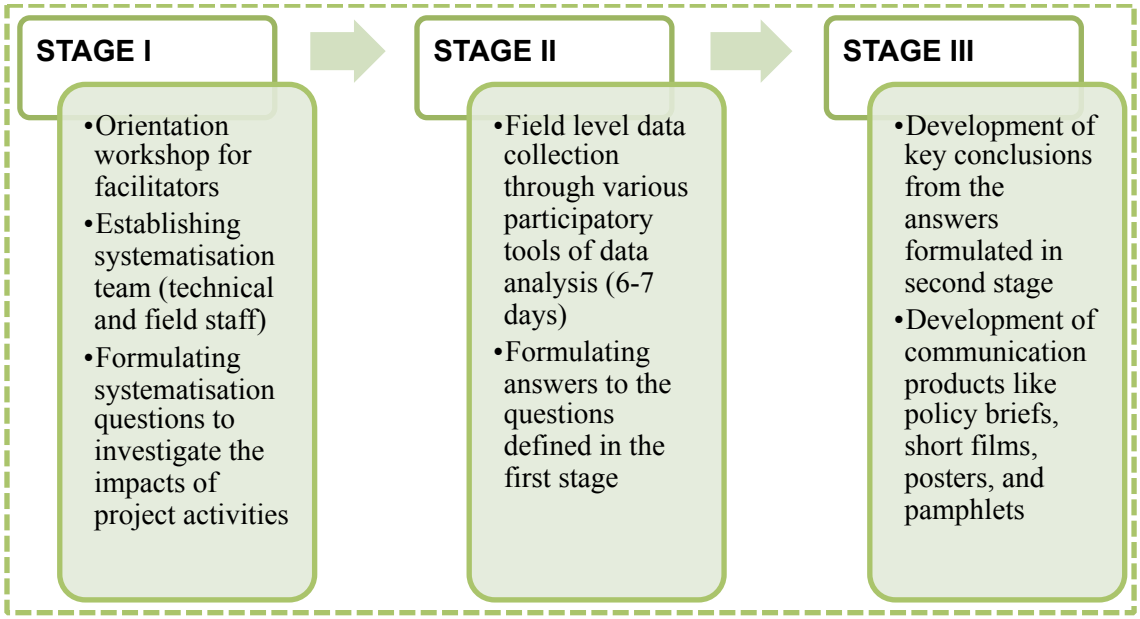
Indicator (according M&E framework)	Current status
Baseline report	Baseline assessment has been successfully conducted and results have been used for planning the project activities
Formation of executive committees in all the 9 villages of Niwas block in Mandla region	Executive committees in the name of "Prakritik Sansadhan Prabandhan Samiti" have been formed and are functional in all the nine villages
Frequency of Gram Sabha meetings	Gram Sabha is regularly convened at an interval of once a month. When needed, special Gram Sabha is also being convened. Proposals are presented before the PSPS and decisions are also being taken.
Village micro-plans and by-laws approved by Gram Sabha in all 9 villages of Niwas block in Mandla	Awareness and consensus building exercises completed in all the concerned panchayats. As part of village micro plans, village transect is completein

region	three villages namely Malheri, Paylai-Bahur and samaya. By-laws are ready in six villages.
60% of saplings planted surviving till July 2013.	Plantation of saplings in agro-forestry completed. During December, 2012 90% of the saplings survived. And in June, 2013 it fell to 48%
10 acres of additional area brought under millets	Achieved
40% reduction in firewood usage as a result of 40 cook stoves dissemination	Work in progress

5.2 Systematization exercise

Systematization exercise was carried out after the first year of project implementation to undertake mid-course corrections. It also served as an evaluation method for the project. Systematization, primarily involves a 3-stages approach

Figure 8: Systematisation exercise



As an illustration the results of 'strengthening of village institutions' studied against questions mentioned in table 5 below is presented.

Table 6: Systematisation question with answers for the component on 'strengthening of institutions'

Question	Response		
	Total Responses	Yes	No
Are there any rules relating to jungle	58	56	2
Permission/ penalizing outsiders on unauthorized entry to village forest	58	53	5
Collection of fire wood	58	46	12
Collection of NTFP	58	24	34
Protection of forest from fire	58	20	38
Grazing of cattle	58	17	41

There was agreement in most villages that rules have now been framed to penalize the people for logging and lopping. In village Kusmi, Rs. 250 was the fine for outsiders and Rs. 50 for villagers. Besides protection rules, other complex usage rules are currently under discussion. The meetings of the Prakritik Sansadhan Prabandhan Samitiare held regularly every month to discuss issues relating to natural resources and coordinate among village institutionsunite the village and ensure the sustainability of the forest resources.

In the village Malheri, people reflected in terms of increased say in governance of forest resources. Earlier the villagers had to approach the forester and beat guard for all issues related to forests. But now because of the stronger village level institution, it was other way round.

Some **case studies**[4] were also recorded as part of the systematization exercise. For instance, two case study on agro forestry are given in brief below-

[4] Case studies from the Systematization exercise, 2012: CCA-RAI project

Case Study I

Name of Beneficiary- Bala Ram, Kusmi Village

"The rate of survival and growth rate of different forest species (Char, Harra, Bahera, and Khamer etc.) has encouraged majority of households in the village to undertake such plantations. It would change fertility of the soil, productivity of land and overall NTFP based livelihood of poor."

Case Study II

Name of Beneficiary- Sukhsen, Thanamgaoun Village

"I have planted around 60 saplings of forest species. They have grown well and survived well. After five years, it would ensure additional income and nutrition to my family. The agro forestry site that was previously barren would benefit by the Village Pond developed with support of FES as it falls in its command area.Also this patch would provide me good yield of fodder for my livestock."

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Enterprise Based Conservation of Rhododendrons: A Case Study from Arunachal Pradesh

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Abstract
The livelihood of the communities living in the state of Arunachal Pradesh is by and large dependent on the available Natural Resources including forest ecosystems. Since the livelihood issues and environment degradation are highly intertwined in the area, it is difficult to address both these issues separately. Understanding this fact through detailed situation analysis, InsPIRE Network for Environment (InsPIRE) has developed a tailor-made, enterprise based conservation program as a pilot model to address both livelihood and conservation issues. Detailed situation analysis in western Arunachal Pradesh using GIS and Remote Sensing tools has been carried out by the authors. Large scale degradation of forest areas and deforestation of *Rhododendron arboreum* patches were identified. In order to address the issue, InsPIRE has established a community *Rhododendron* squash production unit in a selected village in the region and improved the capacity of the community to earn economic benefit from the same. As a tradeoff, the community actively practices sustainable resource extraction, community forest protection and also reviving the traditional Buddhist system of maintaining the protected areas. The project has demonstrated excellent success in all its objectives and the program has been recognized as a replicable pilot model project in the region. The paper discusses the different aspects of the program.

Key words**:** *Rhododendron squash, Enterprise Based Conservation, Sustainable Resource Extraction, Community Nursery, Restoration, Sacred Grove*

1. Background

As in other Third World countries, in India also, colonial invasive forces have plundered the natural resources including forests. Through initial botanical explorations to the remote forest areas in India, colonial forces have removed many species and introduced them in horticulture farms in Europe. Many species of orchids and other plants like *Rhododendron* species which are of Indian origin are being cultivated in the horticulture farms in western countries. *Rhododendron*s are tropical high altitude flowering plants with high value in contemporary global horticulture market (Cox et al 1997, Esen et al., 2006). The original habitat of most of the *Rhododendron* species, significant in horticulture industry is eastern Himalayan region (Jones et al, 2008) and most of the species were introduced in the horticulture market during colonial governance. The botanists who undertook pioneering expeditions in the region carried all the species to their respective countries – the Kew and Edinburgh botanical gardens have a good collection of Indian species of *Rhododendron*s. India, which is the home of many of these high value species, has not even been able to acquire a meager share in this multi-million horticulture business based on Rhododendrons. At present, different horticulture companies are sending the *Rhododendron* samples to India as part of international out sourcing of jobs for cost cutting. However, Indian companies are not able to utilize the Indian species to tap the export market on their own, due to lack of basic inventory, reproductive biology and cytotaxonomic studies on Rhododendrons.

The renowned taxonomist, Armen Takhtajan (1969), had aptly termed the North East India as the

"Cradle of Angiosperm", as many species of flowering plants have originated here. Owing to tremendous species richness, this region has been identified as one of the hot spots of biodiversity with high endemism (~ 56% of the total endemic plants in India). Many of these species are under threat due to decline in number, habitat destruction/modification and anthropogenic pressure. It is not known whether or not the perpetuation of these threatened species is limited due to any reproductive constraint.

The genus *Rhododendron* is distributed mainly in the Northern hemisphere of the globe. Pioneer European horticulturists initiated breeding studies on the genus for horticultural purposes in the early 1800s. In case of Indian *Rhododendron* species, the first scientific study was conducted in Kashmir on *Rhododendron arboreum* in 1796 (Paul et al, 2005). Hooker (1849-1851) developed a monograph, which brought out considerable information with respect to the taxonomy of 45 species of Himalayan Rhododendrons. A debate among researchers on the number of *Rhododendron* species present in India persists (Paul *et al*, 2005, Mao *et al*, 2001, Giriraj *et al*, 2008, Sastry and Hajra, 2009). Paul *et al* (2005) have reported 61 *Rhododendron* species from the state of Arunachal Pradesh. Indian Rhododendrons have two distinct flowering seasons - *viz* March–May and May–July. However, a large number of species flower during April–June. A careful observation of the publications regarding the Rhododendrons of North East India reveal that for all the data on species only point locations of existence are available which is insufficient to prepare distribution maps. Among the North Eastern states of India, Arunachal Pradesh has highest diversity of Rhododendrons. However, the state has no protected area for conservation of Rhododendrons, even though a list of conservation threats has been identified by many researchers. Paul *et al.* (2005) have identified an altitude wise distribution of Rhododendrons in western Arunachal Pradesh – Tawang and West Kameng. Isolated attempts of mapping habitats have been carried using spatial techniques, but because of the nature of the terrain in Eastern Himalayas, the precession is low.

Western Arunachal Pradesh, the most biologically rich region in the state has witnessed a steady economic progress in the recent past. Major portion of its forest ecosystems in this region, as well as the state, is under the control of the local communities, and classified as Unclassed State Forests (USF) where community decision making plays a critical role in forest management, land use conversion and resource utilisation. The ecological and local economic scenarios are intertwined as a result of which despite conservation efforts, the biodiversity of the region is under threat.While the region has been subjected to developmental activities that have helped the region in getting mainstreamed with the rest of the country, over extraction of forests for fuel wood, uncoordinated developmental activities (like construction work and unregulated tourism), forest fire and shifting cultivation have also collectively set in land degradation of forests in the state and the region. Forest wood is also used extensively by laborers engaged in developmental projects in the area; by the army personnel and by the monasteries. Participatory appraisals have revealed that while local communities have benefited from development, they are apprehensive of losing their forest wealth, the related ecological services and livelihood

security which these forests have been providing them since ages. Inspite of the mainstreaming, a sizeable percentage of the population is solely dependent upon forests for their livelihood, the highly valued medicinal plants in particular.

As part of nationwide operations in the thematic work area of Natural Resource Management, InsPIRE Network for Environment (InsPIRE) has been working on biodiversity conservation and forest enrichment in Arunachal Pradesh and has established a conservation landscape in the western part of the state. InsPIRE has the broad objective of conserving rhododendrons in Western Arunachal Pradesh. Thus, primarily the areas falling under the altitude and habitat ranges of different Rhododendron species were aggregated to form the landscape. The accessibility to the areas was also considered as a criterion and the areas accessible on the Bhalukpong – Tawang road were included in the landscape. Initial threat analysis revealed insufficient livelihood opportunities as a major threat, resulting in over dependence of the communities on forest resources.

This paper discusses InsPIRE's initiatives and success in conserving degrading Rhododendron forests over six years. *Rhododendron* is one of the dominant genera in the temperate and timberline forest ecosystems in Eastern Himalaya. The aim was to initiate a participatory protection program of the indigenous tree species which is facing extinction due to over extraction, ensuring livelihood enhancement along with conservation of the species in the natural habitat. The study highlights the requirement of undertaking case specific participatory planning instead of applying uniform measures like increasing the horticulture areas in the degraded forest and community lands. The study may thus provide a new dimension to the present thinking on improving horticultural activities in the state. InsPIRE has not only established an enterprise based and livelihood oriented conservation program in the landscape but also successfully attempted to revive the Buddhist tradition of establishing sacred protected areas.

2. Study Area

InsPIRE has established a conservation landscape in Western Arunachal Pradesh (Figure 1) including areas falling within Tawang and West Kameng

districts. The landscape was demarcated based on the bio-geographic factors, which encompass most of the areas of Tawang District and a considerable portion of West Kameng district. Longitudinally, the landscape extends between the international border with China in north and Rupa village in the south. The landscape lies geographically between $91^0$55' – $92^0$65' E and $27^0$10'– $27^0$85'N. The altitude varies from 600m MSL to 4200m MSL.

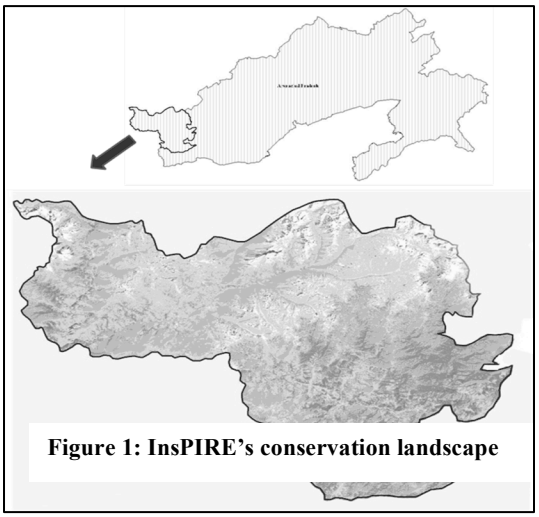

Figure 1: InsPIRE's conservation landscape

The land use and land cover map was prepared from Landsat image of the area using GIS and Remote Sensing Techniques. During the process of supervised classification detailed expert consultations were carried out with regard to the vegetation classes to be prioritised and included in the landscape (Figure 1). The major portion of the landscape is covered with temperate conifers and evergreen forest. The landscape also has 18.5 percent of agriculture land which is far higher than the proportionate agriculture land distribution for the entire state. Table 1 provides the details of the land cover classes in conservation landscape.

Table 1: Extent of different land cover classes in InsPIRE's conservation landscape in western Arunachal Pradesh

S.No.	Land Class	Percentage	Area (ha)
1	Grass land	9.50	864978.00
2	Water	1.50	136262.00
3	Snow	8.00	728983.00
4	Temperate broad leaf	7.79	709480.00
6	Temperate conifer	33.39	3040579.00
7	Open area/ Agriculture land/ grassland	18.57	1691309.00
8	Evergreen	21.25	1935646.00
		100.00	9107237.00

In India more than 90 species of rhododendrons have been recorded from the state. Arunachal Pradesh alone harbours 61 species, 17 subspecies and 12 varieties. The state also records a high number of endemic rhododendrons i.e., 9 species and 1 subspecies. Much of the state remains yet unexplored with respect to inventorisation; 43 of the known species have been categorized as rare, threatened and endangered by Botanical Survey of India, due to severe threats which the landscape faces. Most of the rhododendron habitats near roads are in degraded condition due to easy accessibility to local communities who use it as firewood. Besides, extension of grazing areas, agricultural land and shifting cultivation, human settlement and uncoordinated developmental activities like construction work have also resulted in habitat degradation. Natural calamities and forest fires have also affected the rhododendron habitats.

There were several constraints in initiating a programme on conservation of rhododendrons, including the lack of detailed scientific information regarding the species and limited awareness among the local communities regarding the wider potential usefulness of rhododendrons. A landscape with a forest cover solely owned by the local communities cannot be conserved if the communities fail to see tangible economic returns for protecting their forests. The activities of NGOs like WWF India in western Arunachal Pradesh showed the willingness of the local communities to set aside forests for protection, however, only as a trade-off once their livelihood is ensured. In this scenario the programme was designed in such a manner that a rhododendron based enterprise for realising tangible benefits for the communities would be established, and for their part, the community would establish a rhododendron arboretum in the community forest area.

3. Program Activities

3.1 Selection of village for pilot program

14 villages which fall in *Rhododendron arboreum* dense areas in the landscape were identified initially and the final selection of villages for implementation of the programme was carried out using PRA tools like focus group interview and SWOT Analysis. Then, SWOT (Strengths/ Weaknesses/ Opportunities/ Threats) analysis was carried out in the possible villages using community meetings and semi-structured interviews. Based on the outcome of the SWOT analysis, village Sakpret in Tawang district was selected for implementation of the project. Figure 2 details the villages surveyed.

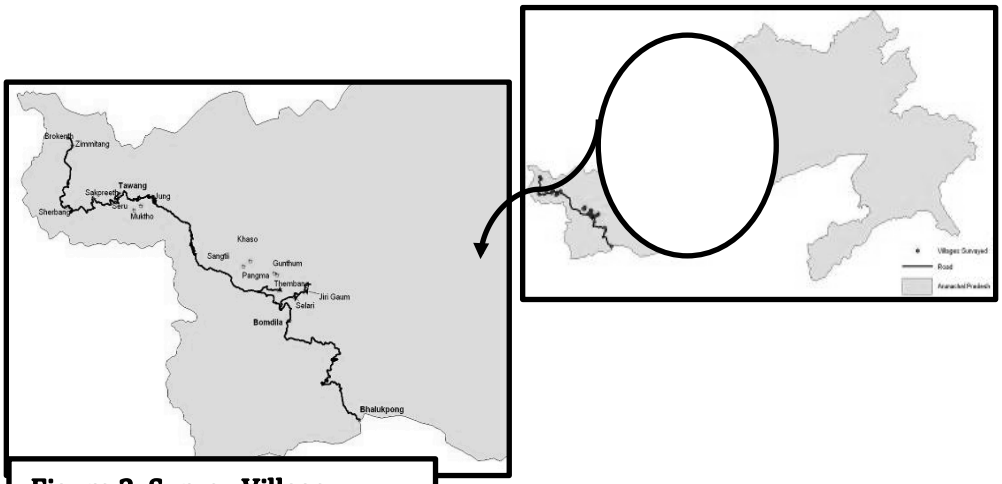

Figure 2: Survey Village

3.2 Resource Assessment

An inevitable part of any community initiative, based on natural resources, is investigating and ensuring the availability of the natural resource in the community area belonging to the selected village. Field survey was conducted in the community land to assess the availability of rhododendron flowers during the flowering season. Quadrat studies were carried out using 10X10m quadrates and an average density of 20 *Rhododendron* trees per 0.001 hectares was recorded. It was thus found that the area has the potential for sustainable extraction of 120000 kg of rhododendron flowers from the community forest area (considering 30% extraction as the sustainable bench mark).

3.3 Socio Economic baseline survey

Detailed socio economic baseline survey has been conducted in the selected village to understand the livelihood pattern in the community. Their income sources and expenditure patterns were understood through questionnaire survey.

3.4 Community organizing activities

A village level committee with the following responsibilities was constituted for the administration of the rhododendron squash processing unit:

- Ensuring equitable profit sharing.
- Ensuring a constant supply of the required chemicals in the processing centre.
- Identifying a local person who will be responsible for the maintenance of the machines.
- Ensuring smooth functioning of the processing centre.
- Collecting a defined percentage from the profits generated and using it for other village development activities.

3.5 Construction of Community Food Processing Center

A community food processing center was constructed in the village; - the construction work being carried out by the villagers only. The building is 54 sqm in size; with a ceiling height of 2.5 meters. The walls are bamboo matted, locally fabricated by the villagers and the flooring has a tiled finishing. The roof is covered with tin sheets with wooden support. 262 person days of labor were required for the construction of the processing center, through which the villagers received a direct benefit of Rs. 52400. The basic equipment for rhododendron squash production was installed in the processing center by November 2009. The list of equipment installed in the initial phase of the project implementation is given in Table 2.

Table 2: List of machines installed in the Rhododendron squash processing center at Sakpret in the initial phase

SN	Equipment/Item details	Qty	Cost (Rs)	Purpose & usage
1	BSB Super Refractometer	1	1350	For checking the sugar concentration of the squash
	BSB Stainless steel tray	1	900	For collection of squash
3	BSB Fruit cutting knives	4	200	Cutting raw material into smaller pieces
4	BSB Mushroom grading sieve with	1	740	To sieve the squash before bottling it.

	wooden frame			
5	BSB Bottle washing machine	1	15800	To wash bottles before packaging the squash
6	Steam Jacketted Kettle	1	44800	To boil the flower petals
7	BSB Crown Corking Machine	1	5600	To cork the bottles after filling them with squash
8	BSB Fruit Mill	1	124000	To pulp the boiled flowers and extract the juice
9	Goldtech electronic Weighing Balance	1	5063	To weigh the chemicals and preservatives
10	Distillation Unit Innotech Engineering Devices Pvt Ltd	1	70000	To distill water
11	Bottling Unit S.S. Pharma Tech	1	36414	To bottle the squash

3.6 Training and capacity Building

Training and capacity building for Rhododendron Squash production

In March 2010, the villagers underwent a three-day training on rhododendron squash preparation in the processing center. These trainings were attended by 42 persons of which 31 were women. Training was provided for all steps- sustainable extraction of flowers, cleaning the flowers, petal separation, boiling, pulping, adding preservative, bottling and packaging of the final product.

Capacity building in conservation of resources

Eight hectares of thick rhododendron forest were delineated using GPS for the establishment of the arboretum for which about 22 hectares of the community forest area was surveyed. This area was declared as the Rhododendron arboretum by the village community under the leadership of the village headman (*Gaon Burah*). The village community passed a resolution to ban all anthropogenic activities inside the arboretum including timber cutting, firewood collection, grazing and other NTFP collection etc, violation of which invokes heavy fine.

Training and Capacity building for reforestation of degraded forest patches

Community has been trained in raising saplings and carrying out restoration of degraded forest landscapes. Many trainings have been conducted in four villages including village Sakpret, in different aspects of silviculture techniques. A community nursery has been established in village Sakpret, for the purpose of raising saplings and providing training. Following trainings have been provided to the local communities.

Training on seed germination techniques

Participants were trained in seed germination techniques mainly using Rhododendron arboreum seeds. The trainings were held at Sakpret. Rhododendron seeds were initially raised using growing medium of Sphagnum moss and coarse sand in the ratio of 50:50 by ensuring constant supply of moisture inside poly tunnel. At the stage when the seedlings have 2-4 true leaves in addition to cotyledons, they were transplanted to plastic bags.

Training on preparation of planting materials from collected saplings

Planting materials were raised from saplings collected from the grazing lands and seeds collected from wild. The grazing lands are subject to controlled fire every year to ensure growth of fresh and luxurious grass cover for the cattle, sheep and yak to graze. The seedlings were removed from the grazing lands before the annual burning of these areas by the community for grazing land maintenance. The saplings were planted in plastic bags and maintained in the nursery. These saplings were later planted in the degraded forest areas during the favourable spring season.

Training on plantation development along with establishment of model forest plantation in the degraded forest area

More than 1200 saplings were planted by the trainees in the community land of the village Sakpret as part of the training. 2 hectares of land was selected for plantation training, which is a degraded forest land due to intensive firewood collection and grazing. The seedlings were planted at a distance of 1.2 meters. The plantation established as part of the training are now

maintained as a model plot of participatory restoration of degraded forest land.

Training on Marketing

Marketing of Rhododendron Squash

Before the initiation of marketing, the squash was tested in the FICCI Research and Analysis Centre for FPO standards conformation and the certificate was obtained After the production, marketing of the squash was carried out along with the villagers who were provided hands-on training for marketing squash in the local market.

Direct Marketing by the villagers

Sales counters are established in local markets every year by the community, and also during different local celebrations like *Army Melas, Tawang Festivals,* Independence Day celebrations and Republic Day celebrations etc. The villagers also motivated some of the shopkeepers in Tawang to keep these bottles in their shops and promote the sale of this new product.

Marketing through retailers and dealers

Market response to the new product, from dealers and distributors' sides was not as positive as expected. Since the unit is producing only single product using a new brand name, and the product and brand are quite new to the region (*Rhododendron* squash was till now not available in the markets of Eastern India), there was a little hesitation from the retailers to provide the shelf space. Door to Door Marketing agencies were approached to resolve the issue of lack of sufficient shelf space for marketing. However, this strategy also was not able to resolve the problem because door to door marketing people preferred low volume units of the product to reduce their carrying weight and needed higher margins than that fixed for the product. For making the product familiar in the market and the region too, catering agencies and even management units were approached to introduce the squash as a special drink in parties and other events.

4. Results

So far, *Rhododendron* juice production has been carried out during the years 2010, 2012 and 2013. Due to prolonged winter, *Rhododendron* flowers were not available during the year 2011. The data of 2013 is yet to be consolidated by InsPIRE since the sales are still ongoing. The afforestation trainings were

completed during the year 2012 and the community has reforested 2 hectares of degraded forest area in their community area and declared it as a sacred groove. The overall results of the program are summarized below.

4.1 Socio Economic survey

Village Sakpret has 44 families with a total population of 115 men and 118 females. 50 per cent of the families depend up on labour work for their livelihood. The average monthly income per family from labour was calculated to be only Rs. 1364 (Table 3).

Table 3: Income status of families in village Sakpret

Source of Income	Number of dependent families	Average Income (per family per month)
Labour	22	1364
Contract	1	2917
Govt. Service	5	3233
Agriculture	8	1896
Cattle rearing	1	1250
Carpentry	1	2500
Service Pension	1	3500
Priesthood	3	667
Petty shop	1	833
No income	1	0

4.2 Livelihood benefits from Rhododendron Squash production

So far during two years the community has generated an average per family income which comes more than 2.5 - 3 times of the per family monthly income prevailing in the village. A profit of Rs 60,878.00 has been generated as net profit from the business by the community which the villagers have deposited in the bank; this will be used for further upscaling the program. The figures mentioned here are based on the sales in 2010 and 2012 since the over- all figures for the year 2013 are yet to be accounted.

Labour income (enhancement of income of women)

During 2010, 3448 litres of rhododendron squash was produced in the processing centre and 4500 litres during 2012. An employment of 605 and

908 man days was generated in this process during 2010 and 2012 respectively. Mostly the women folk of the community participated in the juice production work and earned from the labor activities. An annual total of Rs. 102,950 and Rs. 166,000 were earned by the community from juice production related labor during a span of three months in 2010 and 2012, respectively (Table 4).

Income from marketing of Rhododendron Squash

During first year (2010) a total of 3448 litres of the rhododendron squash was marketed through the collective efforts of the villagers whereas the quantity increased to 4500 litres during 2012. The squash is now available for sale throughout the year for tourists and locals in the Cirucit House and Government Emporium and many local shops. There has been immense support from Indian Army, District Administration and also the public representatives for marketing the product successfully even though the regular marketing agencies had shown an apprehension. The over- all income details including the profit generated are shown in Table 4.

Table 4:Overall Business Financials

Item	Year 2010			Year 2012		
	Rate (Rs)	Total	Grand Total	Rate (Rs)	Total	Grand Total
Sale Return	65.00	224,120.00	224,120.00	90.00	405,000.00	405,000.00
Variable Cost						
2.1 Bottle Cost	4.00	-13,798.00		4.40	-19,800.00	-337,500.00
2.2 Bottle Transport Cost	5.00	-20,688.00		5.00	-22,500.00	
2.3 Firewood (210 kg)	60.00	-12,600.00		60.00	-14,400.00	
2.4 Wages for Production	200/150	-102950.00		200/150	-166000.00	
2.5 Sugar (1068 kg)	35	-37,380.00		48	-77,376.00	
2.6 Juice Transportat					-23,450	

ion						
2.6 Chemicals		-4500.00			-4500.00	
Overall Profit (1-2)			32,204.00			28,674.00
Total benefit for the community (Profit + wages)			1,35,154.00			194,674.00
Average per family (total 38)			3556.00			5123.00

4.3 Ecosystem conservation

The community is still protecting 8 hectares of *Rhododendron* patch as arboretum avoiding any anthropogenic disturbances. Along with this the community has also re-forested 2 hectares of degraded forest area and declared it as traditional sacred groove. The community is also extracting *Rhododendron* flowers from the community forest area in sustainable manner with minimum ecological damage.

5. Project Impacts

5.1 Ecological Impact

Inculcating culture of sustainable resource extraction

InsPIRE has trained the community in sustainable extraction of *Rhododendron* flowers, during which the community was made aware about the necessity of practicing sustainable resource extraction on all fronts. The impact of this is clearly visible even in the day to day activities, wherein the community is practicing sustainable resource extraction in case of firewood extraction, timber extraction, NTFP collection and water resource utilization.

Forest protection

The community is already protecting 8 hectares of *Rhododendron* forest patch as arboretum banning any anthropogenic disturbances. Along with that, reviving the traditional Buddhist system of managing protected areas by the community which is locally called as *Nge*, the community has established a new sacred groove in their community forest area. This was established by re-forestation using the saplings raised in the community *Rhododendron* nursery. The activity has spread the concept throughout the region and the local Member of Legislative Assembly has purchased more than 5000 saplings for carrying out reforestation in the landslide affected area which have become a threat to the existence of historical monument in the area – Tawang Monastery.

5.2 Economic Impact

The community is able to develop two sorts of economic benefit from the program. The community has created a core fund of Rs. 60,878.00 from the program which will be used for up scaling of the project. Along with this the community has generated an amount of Rs. 268950.00 as labor from the enterprise in 2 years (refer Table 4). Considering the overall economic scenario in this remote village, this is a significant improvement in their income status. The culture of running an enterprise has been inculcated among the community which is another economic impact of the project.

5.3 Women empowerment

There has been a sheer improvement in the participation of women folk of the community in the program. Infact during both the years, more than fifty percent of the labor benefits were gained by the women of the community (Figure 3). The upper hand of the women in the overall process has tremendously improved their participation in the decision making process as far as the enterprise is concerned. Women thus actively participate in the decision making process and also in the marketing of the squash.

5.4 Impact on climate change mitigation

Global climate change has impacted the area through increase in number of landslides and water shortage. The saplings raised in the community nursery are being used to prevent landslide in the area especially to protect the historical monument – Tawang monastery.

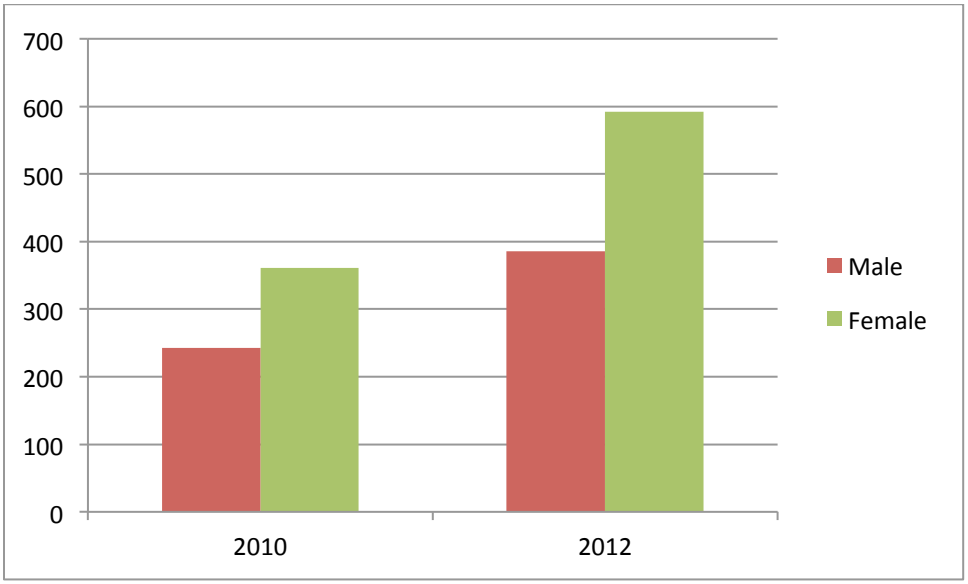

Figure 3: Labour details over 2 years (showing increased women participation)

6. Project Evaluation

The program was duly evaluated by the major funding agency of the program Department of Science and Technology, Government of India. Dr.Vijay Kumar Sharma, Deputy Director (NRM), State Institute of Rural Development, has visited the project area and carried out detailed interaction with the beneficiaries and prepared a detailed evaluation report appreciating the success of the project.

The success story of Rhododendron squash production and sustainable harvesting has also been covered in a documentary movie 'Rhododendron Hunting', prepared by Botanical Survey of India.

InsPIRE is carrying out many programs in the area with support from agencies like ICICI Bank; NABARD etc. All these agencies have carried out their own evaluation during their pre-project visit to the area and understood the success of the program during the visit and detailed community interaction.

Indian Army has its presence throughout the area since these areas fall in the Indo-Sino border. Understanding the success of the program the General

Officer Commanding (GOC) of the area Major General Vinod Pillai and Commander of Tawang Brigade Brigadier J.S. Rajpurohit have awarded letters of appreciation to InsPIRE and the authors.

7. Discussion

The biodiversity in Arunachal Pradesh is depleting because of many reasons including over extraction of resources and other land use changes. Horticulture is being popularised in the area as a measure to improve the livelihood of the poor communities. But the expansion of horticulture areas is at the cost of increasing degradation of the forest cover of the state, as the horticulture plantations are raised in the community areas which are either forest areas (even degraded) or abandoned jhum areas where secondary forests are emerging.

The case study is an example of additional livelihood generation for the communities through value addition of natural and wild resources without disturbing the ecosystem. The project has also demonstrated the need for awareness generation and capacity building of the local communities for protecting their natural resources and imposing regulations on forest dependency. The case study brings out the necessity for a detailed participatory planning which is critical for planning the expansion of horticulture activities in the state of Arunachal Pradesh while balancing other alternate options which help in better conservation of available natural resources.

The success in plantation of *Rhododendron arboreum* trees in the degraded forest areas shows the scope of the species to be used in horticulture. Many species of rhododendrons are already being used globally as ornamental plants after hybridisation. This species is, however, not used in India as a horticultural species. In order to ensure sustainable livelihood systems, we have to explore some out of the box ideas which need to be blended with the conventional horticultural practices, especially in biodiversity hotspots like the Eastern Himalayas.

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Urban and Peri-urban Forest Resource Governance – Emerging Patterns in South Asia

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Abstract

The sustainable management of urban resources and services are sine qua non for the balanced development of fast transforming cities especially in the current decade of urbanization with more than half of the world population living in cities (UN-HABITAT 2008). As per the reports 17out of the 27 megacities in the world are expected to be located in Asia (AFE, 2010). Urban forests are vital components in city landscapes with multiple service functions which are needed by the cities across the globe (Nilsson et al., 2009). The importance of urban forests has been further empathized with the equation of the resources with green infrastructure which are essentially required to complement the grey infrastructure in the cities (Mell, 2010).

The development and conservation of urban forest resources is often complex with the presence of multiple stakes holders interacting at different scales and directions (Van Herzele et al., 2005). The scenario calls for development of integrated design, planning and management strategies to

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synergize the interactions between structural and functional performance of green resources and people (Konijnendijk, et al 2004).The efforts towards sound management and better governance of urban forest resources are crucial in the context of rapid transformations to which the city landscapes are subject to and particularly in the context of their vulnerability for impacts due to climate change(Ordóñez et al , 2010).

The paper dwells on and describes the emerging patterns of urban forest governance in India, Nepal, Bengladesh and Pakistan, by selecting the cases form cities of Delhi (India), Dhaka (Bengladesh) Kathmandu (Nepal) and Islamabad(Pakistan). The aspects related to the sustainable management and development of urban forests such as environmental, economic and social are also analyzed and described. The paper also draws up a model for sustainable management of urban forests in the region.

Key Words: *Urban Forestry, forest governance, Sustainable Forest Management, case studies, South Asia*

1. Introduction

The Urban and Peri-Urban Forests (UPF) represent critical components for viable, vibrant and sustainable development of cities and other urbanized landscapes (Nilsson *et al.*, 2009). In many developed and developing countries, urban forestry has been recognized as an essential prerequisite for maintenance of urban ecosystem health, healthy human living conditions, fostering a harmonious human-nature relationship, as well as in achieving urban sustainability (AFE, 2010). The urban forest services constitute an integrated category of services which are required by the cities across the globe. The recent trend in the domain has been to equate UPF with *green infrastructure* (Mell, 2010) which emphasizes the importance of UPF for enhancement of life quality and environmental quality for urban population (Konijnendijk, et al 2004). The maintenance and improvement of UPF services are integral for the improvement of local and global living conditions, along with social integration, urban development, and environmental security in the urban areas (Jim, 2008). However, management and good governance of UPF resources are crucial in the context of rapid transformations to which the city landscapes are subject to and particularly in the context of their vulnerability for impacts due to climate change (Ordóñez et al , 2010).

The management domain of UPF resources is often complex with the interplay of multiple actors interacting at different scales and directions (Van Herzele *et al.*, 2005). The complex network of resource and user relationships calls for development of integrated design, planning and management strategies to synergize the interactions between structural and functional performance of green resources and people (Konijnendijk, et al 2004). The UPF community in a city landscape needs to be seen as a synergistically functioning matrix between trees, people and infrastructure in the city. In the recent times, the rate of urbanization in the developing countries has been found to be faster than developed countries. As per forecasts, 17 out of 27 mega cities in the world are expected to be located in Asia by 2015 (AFE, 2010).In UPF domain, the approach of 'governance by government' is increasingly being complemented by modes of 'governance with government', as e.g. reflected in public-private partnership and public

involvement processes in resource management and development . The partnerships governance models are gradually surfacing as the commonly advocated mode for engagement in UPF, and represent both a means for participation, and a delivery mechanism.

The basic features that characterizes the new mode of governance in the general forest domain are inclusiveness, participation, dialogue and consensus, networking, multi sector, cooperation, coordination, deliberation and accountability (Secco, 2011). Although governance as a strategy has been adopted in many developmental sectors, the forestry sector represents a much advanced field with a strong desirability for deliberation, participation and consensus oriented decision making approaches in resource management and development(Pülzl and Rametsteiner, 2002; Buttoud et al., 2004; Rayner et al., 2010). The concept of governance in an institutional context may be analyzed and cognized as decentralization, privatization, and all the formal and informal modes of interactions and power relations between institutions and other actors (horizontal interplay) as well as between different levels of the same administration (vertical Interplay) (Rayner *et al*., 2010). However, it anchors the approach on consensus-oriented, multi decision levels with dynamic interactions among a plurality of actors such as private partners, or environmental organized interests, inter sectoral links, and less clear-cut tasks (Kjer, 2004). *The Urban forest governance therefore refers to the structures, rules, partnerships and processes that shape decisions about urban and peri-urban trees and woodlands. Compared with traditional rural forest governance, urban forest governance involves a much wider range of stakeholders, interacting with state and non-state organizations operating at multiple scales. (Lawrence, et al,) All levels of government can impact on the urban forest, from national (administrations and policies relating to forestry, environmental protection, natural resources, nature conservation, but also transport or road works), to various scales of local governments (e.g. land use planning/zoning) (e.g. Schmied &Pillmann, 2003; Van Herzele et al., 2005b).*

In the article, the authors dwell on and describe the emerging patterns of urban forest governance in India, Nepal, Bengladesh and Pakistan, by selecting the cases form cities of Delhi (India), Dakka (Bengladesh)

Kathmandu (Nepal) and Islamabad (Pakistan) in the light of the above background.

2. Urban green governance in Delhi

Delhi the capital city of India is teeming with a population of 16 million people and with a population density of 11297 persons / km^2. It represents the 8^{th} largest metropolis in the world and is an active participant in the *C- 40 cities* Climate Leadership Group (SER,2010 & http://live.c40cities.org/cities). The city has been demonstrating an increasing trend in the area under UPF resources since last two decades and has presently more than 20 % of its area under UPF cover despite the escalating population pressure (FSI, 2012). The city is endowed with a range of UPF components such as the ridge forests, city forests, district parks, community parks, neighborhood parks, local parks etc,. The city along with other cities like Manila, the Philippines; Mexico City, Mexico; and New York, United States has demonstrated the potential to preserve and manage the UPF components through the commitment of residents and non-governmental organizations (Kuchelmeister, 1999).The mega polis has 15,000 parks and gardens under various civic agencies, representing around 5,000 ha area which are managed by civic agencies themselves or in association with Non Governmental Organizations (NGOs)/Resident Welfare Associations (RWAs) /Private Sector as part of the prevailing governance system. The distribution of the urban forests in the city is depicted in the Fig I (Singh, 2010).

The protection, conservation and planned expansion of urban forest greens in mega polis is found to be coordinated by the State Forest Administration with the different land agencies owing urban forests or land parcels with potential for developing new urban greens (http://delhi.gov.in/ doit_dpg/). The annual urban green expansion strategies for the city state, are planned in coordination with different stakeholders under an annual Greening Delhi Action Plans. These annual strategic documents are also found to contain the planning targets for involving different stake holders in the greening programmes. The free of cost distribution of the saplings has been one of the major instruments with public interface that could be observed in these planning documents. A decadal analysis of this participation front shows

that, tree saplings have been provided to the stakeholders at an annual average rate of 5 lakhs/yr. The annual trends in the scale of operation of the instrument of governance involvement may be gauged from the Fig II representing the free distribution of saplings by the State Forest Administration over the last ten years and Fig III representing the expansion of the plantation activities over the years.

The operation of accountability within and among the greening agencies could also be gathered from the year review performance statements given in the Greening Delhi Action Plans. The transparency facet of the prevailing governance could also be appreciated with the web interface of the management agencies on urban forest management related issues by the public and other organizations.

As is commonly observed in many other cities, the landscape under the green cover in Delhi is also owned and managed by multiple agencies. As per the estimates of the Delhi Parks and Garden Society, the metropolis has more than 15000 parks and gardens spread out over 5000 ha in various locations. The inter agency co ordination in urban green governance is fostered in the city by a permanent and structured manner with the constitution of a dedicated organizational arrangement called Delhi Parks and Garden Society under the Government of National Capital Territory of Delhi (http://delhi.gov.in/ doit_forest/).

Besides, the institutional arrangement in position, the legal and policy aspects of the stability of the forest institutions and conflict management is also secured in position through the instrument of Tree Authority constituted under the Delhi Preservation of Trees Act, 1994. The Act prescribes several measures to ensure the stability of the mechanisms directed towards the protection, conservation and expansion of green cover in the city state and for conflict management. The prescribed measures include *preservation of all trees, census of the existing trees, development and maintenance of nurseries, supply of seeds, saplings and trees to persons who are required to plant new trees or to replace trees which have been felled, getting planting and transplanting of trees necessitated by construction of buildings, new roads or widening of existing roads or replacement of trees which have*

failed to come up along roads or for safeguarding danger to life and property, organization of demonstrations and extension services for the purposes of this Act and assisting private and public institutions connected with planting and preservation of trees, undertaking critical study of the proposals of various government departments and private bodies for construction of buildings, roads, factories, irrigation works laying out of electric, telephone, telegraph and other transmission lines with regard to protection of existing trees and planting of more trees, wherever possible, etc (DPTA, 1994)

As it is true with other cities across the world, the urban forest resources in Delhi also is not free from multiplicity of ownerships and management. Although the administration of the urban forests is carried out by the City state Forest Administration of Government of NCT of Delhi, the greens in general are managed by several agencies called Greening Agencies (Delhi Development Authority ,New Delhi Municipal Council ,Municipal Corporation of Delhi ,Delhi International Airport Limited, Delhi Cantonment Board ,Public Works Department, Delhi Metro Rail Corporation , Education Department, Health Department, BSES, Delhi Jal Board, Indra Prastha Gas Company Limited, New Delhi Power Limited, Central Public Works Department, Delhi Small Industries Development Corporation ,Delhi Transport Corporation, Irrigation & Flood Control Department, Dev. Department and Northern Railways.) are co ordinated by the Forest Administration on an intensive mode to further cause of the green cover expansion and development in the city. The annual co ordination is ensured by yearly Greening Delhi Action Plans (GADPs) which represent an instrument of policy and implementation coordination. The performance quality of the administration in this domain can be observed with the the expansion of the green cover in the mega polis. Fig IV shows the change in forest and tree cover in the metropolis over the last decade

The Urban Greens in the National Capital Territory are legally secured by the umbrella legislation called Delhi Preservation of Trees Act (DPTA), 1994. The city specific law is complemented with other legislations viz. Indian Forest Act,1927,Forest Conservation Act, 1980 and Wild Life (Protection) Act, 1972, Biodiversity Act, 2000 etc for conservation of the

green resources in the megapolis. The strategies for expansion of green cover in the megapolis have been coordinated under the National Forest Policy of India which stipulates for securing 1/3 of the geographic area of the territory under the forest cover. The mega polis specific DPTA has been instrumental in securing the protection and conservation of the green cover in Delhi. The act regulates the destruction of the green cover with penal, pecuniary and compensatory instruments. The DPTA recognizes *to fell a tree as "with its cognate expression, means serving the trunk from the roots, uprooting the tree and includes bulldozing, cutting, girdling, lopping, pollarding, applying arboricides, burning or damaging a tree in any other manner* and it also mentions that *notwithstanding anything contained in any other law for the time being in force or in any custom or usage or contract and except as provide in the Act or the rules made there under, no person shall fell or remove or dispose of any tree or forest produce in any land, whether in this ownership or permission of the Tree Officer"*. The coherence between the forest legislation and rule of law could reflect from the progress of implementation of these instruments in the mega polis. The trends in felling of trees and the compensatory plantation created over the years could vouch for the level of synergy between these two important components of urban forest governance, the details can be seen in Table I (Dept. of Forests & Wildlife, GNCTD).

The domains of efficiency, equity and incentives in UPF governance pattern in the city may have been seen as an area that is much institutionally activated by the various participatory governance schemes launched by the DPGS,DDA along with other agencies. The DPGS offers a host of support incentives for development of urban greens such as investment on managing parks on following services ; land preparation ,organic fertilizer ,inorganic fertilizer, shrubs and plants, trees, labour costs, irrigation , electricity costs, regular pruning and weeding, changing flowers and plants as per seasons, holding competitions and awareness camps, security lighting, etc. (http://delhi.gov.in/ doit_forest/) whereas the DDA has been found involving various actors involved in governance through Public Private Partnership schemes for management of urban greens. It could also be observed that, the DPGS has been furthering objectives to *create a green environment in Delhi, identify vacant spaces and take up greening projects,*

work with local bodies to take up greening works in parks, take up projects for planting trees and shrubs in avenues, involve RWAs in maintaining parks and gardens, incentivize the NGOs in taking up greening activities, give funds to RWAs and NGOs who are involved in greening activities, hold competitions to encourage greening, provide advice to others by engaging consultants, maintain nurseries and parks on its own.

As it could be gathered from the descriptions of the various aspects related to development and conservation of urban greens in Delhi , various vital features of good governance such as transparency, accountability, public participation, stability of forest institutions, conflict management, quality of forest administration, coherence of forest legislation and rule of law economic efficiency, equity and incentives are present in varying degrees in the prevailing urban green governance paradigm for the mega polis.

3. Urban green governance in Dhaka

Dhaka, the capital city of Bangladesh and one of the "mega cities" of the world is located towards the central part of Bangladesh. According to a recent UN data sheet, the Dhaka metropolis, which is currently the 22nd largest urban agglomeration in the world, is tipped to be the 5th largest metropolis, with a population of 19.5 million, by 2015. A few cities in recent history have experienced such rapid population growth as Dhaka across the world. The rate of population growth in the city is estimated at nearly 6 percent per annum (BBS 2012). The nature of Dhaka's urbanism is quite unique, a peculiar mix of rural and urban traits and attitudes.

Dhaka mega city with 1,530 square km is comprised of areas under Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) with two adjacent city corporations Narayanganj and Gazipur, and three Municipal areas Savar, Kadamrasul and Tongi. (DSS 2012, BBS 2012). The Rajdhani Unnayan Kartripakkha (RAJUK) which looks after the Dhaka city has a Strategic Planning Zone-wise definition of Dhaka city which currently consists of total 26 zones of which 19 may cover Dhaka Statistical Metropolitan Area. In Bangladesh the governance in bigger cities is serviced by DHAKA Development Authority (parastatals). Development authorities or City Corporations with metropolitan wide jurisdictions created by statutes.

These organizations undertake regional planning, and coordinate multi-sectoral programmes including urban greening. Higher-level governments exert strong control but moves have been made towards increasing local government autonomy (World Bank 2007). Therefore Dhaka City Corporation (DCC) is the principal organization responsible for city management and welfare of its citizens. The 1983 Ordinance, called the Dhaka Municipal Corporation Ordinance, made the city of Dhaka a Corporation to be called the Dhaka Municipal Corporation. The Ordinance defined that *'The Corporation shall be a body corporate, having perpetual succession and a common seal, with powers, subject to the provisions of this Ordinance and the rules, to acquire, hold, and dispose of property, both movable and immovable, and shall by the said name sue and be sued'*. (DSS, 2012). Under the ordinance Dhaka City Corporation was made an autonomous body but the Government reserved the right to intervene in its affairs in several ways.

In association with Asian Development Bank (ADB) Government has taken up the Urban Governance Improvement Action Program (UGIAP) for the Governance Improvement and Capacity Development of City Corporation and Pourashavas. They will carry out series of reform activities in six key areas defined in the Urban Governance Improvement Action Program (UGIAP): (i) citizen awareness and participation, (ii) urban planning, (iii) women's participation, (iv) integration of the urban poor, (v) financial accountability and sustainability, and (vi) administrative transparency (ADB 2008). The details can be seen in Fig. V

The professional concept of urban forestry is completely new in Dhaka. As a city of developing country, city authorities accord priority to the basic service facilities (electricity, water, medical support, transport, communication etc.) as compared to green resources. Although there has been a range of activities, involving various areas of forestry, tree plantations, establishing parks and gardens, landscaping, nature conservancy etc carried out by the land management authorities over time with overlaps in a general way.

According to the statistics of Sustainable Development Networking Programme, Bangladesh (SDNPBD) 2005, the open space in Dhaka city is accounted only 21.57% of its total area where agriculture comprises the highest proportion of open spaces that was 12.12% (Nasir 2006). The urban greens in the city to a great extent are represented by natural vegetation which have been conserved over years, parks, gardens etc. It also includes the urban greens created and maintained by private agencies /homesteads. The urban greens in the landscape are managed by the local authority except private gardens, nursery, agricultural land and fruit and other trees within the home premises. Green resources can be considered as trees or tree stands within the legal boundaries of DCC with the purpose of providing amenities for the population; namely shelter, recreation, landscaping, beautification etc. and additionally, both public and privately owned large green areas, woodlots, social or community forest areas in the peri-urban areas of DCC for recreation and mostly timber, fuel wood and other products purposes (Nasir ,2006 ; Ansari 2008)

The Dhaka city has very few green areas where most of the green areas exist in the middle and south western parts of the city dominated by different parks which represent a significant part of the green cover in Dhaka. Most popular parks like *Ramna Udyan* (*Ramna* Park) *Suhrawardy Udyan* (*Suhrawardy Udyan* Park) and Dhaka University campus, *Osmani Udyan*, *Gulistan* Park are the most important green spaces in this conglomeration. Besides, some tourist spots such as National Parliament Building, *Chandrima* Park, *Bahadur Shah* Park, National Botanical Garden and Zoo and some educational institutes, Prime Minister's Office, Dhaka Cantonment etc., can be considered as important urban green areas located at different part of the city. Moreover, the low lying areas of Dhaka city in the east and western side have some green spaces of water tolerant trees (Ansari 2008).

However, the evolution of an appropriated governance model for the management and development of the urban greens in the city has been constrained by absence of support systems such as tree inventory or long term planning about park and green resources of the city. Nevertheless, different institutions in the city and government deal with large scale urban greening programmes by resorting to tree plantation activities. According to

Mr. Tapan Kumar Das Gupta, Chief Town Planner of DCC, an ideal city needs 20 percent areas covered by trees, but the city has only 8% area under the green tree cover. (www.thedailystar.net/2003/06/11). In order to realize the vision of securing 20 percent area under tree cover, Dhaka City Corporation has taken the Infrastructure Development & Environmental Improvement Project in 2002.

In the first year, Dhaka City Corporation planned a plantation of 45000 trees in the vacant spaces in the city and were able to achieve to plant only 29000 because of lack of suitable vacant spaces in the city. In 2003 DCC made another target to plant 6000 trees to replace uprooted trees and another 10000 in the vacant space is available in Uttara and Mirpur area of Dhaka. The shortcoming in the achievement of the targets may be ascribed to the conflicts arising out of the competing requirements for land for different development activities in a fast growing city like Dhaka (except agriculture activities, the open space is encompasses only 9.45%) which can be considered as green resources in point of view of urban forest governance in Dhaka city that is very limited space according to the population size. (Nasir 2006).

In 2008, the Dhaka City Corporation has taken up another urban forestry project in urban and peri-urban areas of Dhaka in association with ADB, where open space shortage problem has been overcome by implementing the project around the river bank. As the city is surrounded by rivers and canals there is a possibility for plantation of trees along the river bank. There are 18 rivers with 328 km which are flowing inside and outside the city and have been considered under greening programme. Moreover area along roadsides, forest and fallow lands are also included in the new forest development plan in the Dhaka mega city. The details of the scope for implementation can be seen in Table II given below.

However, according to Dhaka Metropolitan Development Plan (DMDP) of the RAJUK (Capital Development Authority) for 1995-2015 there have wide range of possibility in peri-urban area utilizing some wetland and open spaces under greening programme. Considering the area of Dhaka mega city (1,530 sq. Km) which included the area of some parts of the districts

like Dhaka, Gazipur, Manikgonj, Narayangonj, Munshigonj, Narsingdhi etc, a plan has been envisioned to create new woodland around the peri-urban areas in future as well.

As could be observed from the scheme, that, the city aims to achieve an integrated developmental path with an important role ascribed for urban forestry with emphasis on participation, institutional stability, monitoring etc, in the prevailing governance paradigm for the city.

4. Urban green governance in Kathmandu

Kathmandu Metropolitan City(KMC), covers an area of about 667sq.Km. The city stands at an elevation of approximately 1,400 metres (4,600 ft) in the bowl-shaped valley in central Nepal surrounded by four major hills: Shivapuri, Phulchowki, Nagarjun and Chandragiri. Kathmandu valley is part of three districts, Kathmandu District, Lalitpur District and Bhaktapur District, with the highest population density in the country and accounting for about 1/15 of its population (Kathmandu Metropolitan Office 2011).The KMC is considered as a historical, cultural and a site of great economic interest and development. Kathmandu has witnessed a significant increase in its population over the last few years because of the centralization of the service and economic development within the valley. The idea of greening in KMC can be looked at two aspects i.e., within the city itself and outside the city. Although the city is growing rapidly, the forest surrounding the valley has been intact. The largest of this is the Shivapuri Nagarjun National Park (SNNP). At 160 square kilometers SNNP is larger than either Tikuja or Sanjay Gandhi National Park but it is not mentioned as an 'urban forest' in the literature, perhaps because of the small size of Kathmandu.

The area around the valley, is at a better state. However, within the city there is a major lack of green and open spaces. Its center is totally devoid of trees and foliage. This is an important facet to be considered within urban forestry as majority of the people are inhabiting and working within the city. The pollution in the valley is so severe that according to a report published by Ministry of Environment in 2004, the high concentration of airborne particles has caused excess death rate of 1,600 inhabitants per year. Furthermore, the air pollution is undoubtedly causing increase in lung

diseases in the city. Similarly, in 2006, World Health Organization (WHO) experts rated Kathmandu as the second most polluted city in Asia with respect to air quality. Due to rapid and unplanned urbanization, commercial development, along with population pressure, the overall city environment is being worsened seriously day by day. Although the City was once forested, but at present the tree cover is almost transformed to urban habitats to accommodate excessive population due to high rate of rural–urban migration. Both the population and the economy of the valley have grown at the expense of natural and cultural resource degradation (NBS, 2001).

These urban forestry related activities in the cities are carried mainly by the concerned municipalities. Besides, plantation activities have been carried out from time to time, though not in adequate frequency. In the recent years, among the urban forestry activities, most fascinating one has been roadside plantations. Some of the remarkable examples can be seen in the cities of Pokhara, Hetauda, Damauli, Narayangadh etc.The Act and Bylaws related with forestry has not yet considered urban forestry as a potential sector for development. But there are some rules and regulations like Forest Act 2049, Forest Regulation 2051, Environment Conservation Act 2053, Environment Conservation Regulation 2054, and other act related to Plant Conservation, and Private Forest that are directly related to naturally present or planted forest as well as the living creatures residing in urban area. Also, there is no particular section for urban forestry in government organizations. There is still a contradiction about the responsive agency for the management of urban forestry. Land use in Greater Kathmandu, especially in Kathmandu Metropolis and Lalitpur Sub metropolis has changed dramatically in the last three decades; population growth in Kathmandu Metropolitan City between 1991 and 2001, was 4.71% (NBS, 2001).

Though the urban forestry helps in different ways, we are not benefiting directly from the urban forestry. So people are ignoring plantation on urban areas. Each small patch of land in the urban area is encroached for dwelling purposes. Only dwelling is not important factor, we have to be conscious about the health. Land availability in the urban areas is limited and even the available land is stressful. Ignorance and lack of awareness and education to

the urban people regarding the benefits has become a big hindrance to the success of urban forestry (Pokharel, 2000).

4.1 Institutions working in the field of urban forestry

There are several organizations working in the field of urban forestry in Lalitpur. These organizations are involved in conducting number of activities such as plantations, park development, greenbelts, nurseries, researches, awareness raising activities etc.

4.2 Government organizations

District Development Committee- Lalitpur District Development Committee is one of the organizations working in the field of urban forestry. The DDC is not involved directly in conducting urban forestry activities but provides financial support for developing urban forestry.

District Forest Office/ Department of forest-Department of forest is one of the directly related organizations for the development of urban forestry.

Department of road- Road side plantation is one example of the work conducted by Department of Road in the development of urban forestry. The Department organizes activity to remove hazardous trees and some tending activities as demanded by people living nearby road. It has made a plan of road map separating 10.4 m width for the development of Green belt around the Ring road.

4.3 Non government organizations

United Nation Park Development Committee- United Nation Park Development Committee is under the umbrella of United Nations. TheUNPDC has established UN Park on the bank of Bagmati River as a step for promoting urban forestry. The Park project has been running for last thirteen years. The project was initiated by the government in 1996, to commemorate the 50th anniversary of the founding of the United Nations. The main objective of the project was to provide Kathmanduities with an oasis of greenery and open space. Spread over a 3 kilometer stretch of the Bagmati from Shankhamul to Teku Dovan, the park covers some 59.25 hectares of land. The master plan of the Park aimed at building UN memorial

pillar, gardens, lawns, paved walk-ways, car park, kiosks, suspension bridges and children's parks, among other things.

National Trust for Nature Conservation- NTNC started its contribution in urban forestry with the conservation, promotion and management of natural resources, and has also undertaken scientific studies and conducted researches. The trust established in accordance with the NTNC Act 1982 with a view to striking a balance between the needs of conservation and sound management of the country's wealth of natural resources.

The greenery in the surrounding is decreasing due to unplanned urbanization. People perceive unavailability of land as limitation for urban forestry development in the city. In the current scenario, there is lack of public participation and interest in encouragement and motivation for the development of more open and green spaces. Numbers of efforts are on-going in the area of urban-forestry within KMC. There are scattered efforts of urban forestry by some non government, volunteer and private organizations as well. Such efforts need to be harmonized in order to give continuity to the idea and implementation of this idea under a good governance system

5. Urban green governance in Islamabad

Islamabad, the capital city of Pakistan is declared as a Green city by Ministry of Environment with the promise that every resident, industrial and business entrepreneur, administration and developers will act in a environment friendly manner . The governance model in the city adopts a series of strategic initiatives to achieve the objective. The prominent initiatives are 1) Adoption of an Islamabad green city charter: All concerned ministries, donor agencies and NGO's will sign a charter that all concerned parties will work for Green City. The charter in fact will be an endorsement of United Nations green cities declaration, 2) Islamabad Green city action plan (Isb-GCAP): with the components such as;

- energy conservation: promotion of renewable energy,
- solid waste management: reduction of solid waste by 5% in next five years, segregation of waste at source, placing of baskets in parks ,roadsides etc,

- water conservation and quality management: Monitoring of water quality of reservoir and tap water and water auditing,
- waste water management: Cleaning of rain water streams, repair of broken sewage pipes, establishment of waste water treatment plant,
- Urban design: the revised Islamabad master plan will undergo strategic environmental impact assessment, adoption of green building practices to promote the construction and operations of environmentally sound buildings in the city, establishment of green spaces for recreation,
- Parks and Gardens: maintenance of existing parks and development of new parks,
- Tree plantation and grass cover: city tree plantation will be enhanced through public and private participation and through tree plantation campaigns,
- Constitution and legalization: steering committee headed by Federal Minister for environment will be constituted for review on Green city program,
- Core of green journalists: a green journalist award will be initiated, and other promotion of events like photographic competition will be held on different themes,
- Islamabad green city fund: the fund it to be built up with government grants, donations by NGO's and private sector, contribution by donor agencies, etc

Thus it could be seen that the emerging tendencies in the governance pattern are congregated towards an integrated fabric and the basic elements of good governance are in the formation stage and requires to develop into a good governance system.

5.1 Development of a governance frame work

Although the context, potentials, constraints for developing a good governance model for the conservation and development of urban greens depend on the prevailing resource, socio political and economic contexts development status, there exists a scope for incorporating basic elements of good governance in the scenario of urban greens as well. This scope for adaptive evolution has been substantially observed in the scenarios of the four case studies discussed in the paper. In the premises of the above lines of thought as well as based on the lines of thought put forward by viewpoints already expressed by the other researchers, an approach model has been

proposed herein to address the evolution of a good governance model in the context of urban greens

6. Discussion and findings

It could be gathered from the discussion and description of the features of urban green governance across the cities, that the levels of evolution of governance patterns differ significantly across the cities in terms of the presence of basic elements for a good governance system. Although development and conservation of urban greens have been found recognized as an integral requirement for sustainable development of cities, the positioning of these objectives under a good governance system is quite at a beginning stage. However the process needs to undergo great level of evolution and self adaptation to meet the local requirements before we could recognize them as full fledged self operating dynamic institutions. The complexity of urban systems further flags the need for application of adaptive strategies for effective planning and management of UPF resources along with aims to promote their climate change mitigation roles with a roadmap for interplay of different actors and stakeholders to facilitate sustainable resource management.

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