Khangchendzonga Landscape Conservation and Development Initiative

Conservation and Development Strategy - Indian Part

Submitted to

Ministry of Environment, Forests & Climate Change, Government of India

New Delhi, India

G.B. Pant Institute of Himalayan Environment & Development

Sikkim Unit, Pangthang-Gangtok, Sikkim, India

FEBRUARY 2015

GBPIHED

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In collaboration with

Forest Environment & Wildlife Management Department (FEWMD), Government of Sikkim

&

Directorate of Forests (DoF), Government of West Bengal

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Executive summary

Khangchendzonga landscape (KL) India , located between 26° 29' 13.56" to 28° 7' 51.6" N and 87° 59' 1.32" to 89° 53' 42.96" E, with altitudinal gradients from 40 to 8586m asl, covers an area of 14126.36 km^2. The KL comprises of the entire Sikkim and three districts of West Bengal viz. Darjeeling, Jalpaiguri (with Alipurduar; excluding blocks along the borders of Bangladesh). The maximum coverage of agriculture and broadleaved forest area is 3110.95 and 3035.67 Km^2, accounting for 22 % and 21.5 % of total area of target landscape respectively. For the agriculture, the contribution of plains and foothills is the biggest including immense land cover by tea gardens. Besides, bare land is also huge as that makes 12.1 % of land use area. Owing to high mountains ranges including Mt. Khangchendzonga, the snow/glacier cover is vast, i.e. 11.1 %. Water-bodies and built-up area does not cover much, restricted to merely 0.2 % of the total KL, India spatial area.

Along the elevations climate varies; the landscape represents significant area of snow ice and glacier ranges (11 major high peaks mountain). Multiple land use provides wider biodiversity patterns (i.e. needle leaved forest, broad leaved forest, mixed forest, shrubland, grassland and agriculture land) with high frequency of lakes/ponds.

The KL-India has 6,325,457 human populations with significant livestock population especially in low lands. Landscape has mix of Buddhism, Neapli, Bengali, Christian, etc with high ethnicity with Limbu, Lepcha, Rai, Maggar, Gurung, Tamang, Butia, Newar, etc. The literacy rate of Sikkim is 82.20%, 79.56% in Darjeeling, and 73.25 % in Jalpaiguri (2011). The agriculture, animal husbandry, use of NTFPs, and tea garden industry play an essential role in livelihood of landscape people. In addition, natural, cultural and sacredness value and heritage sites offer opportunities and potential to extract enormous benefits through tourism in KL India. The springs (*Dharo* or *Pandhero* or *Muhan* or *Kuwa*) originating from the underground aquifer are the major source of drinking and irrigation, and firewood, cow dung, and biogas are the major source of energy in the rural areas.
The KL-India has 17 protected Areas, comprising of 1 Biosphere Reserve, 4 National Parks and 12 Wildlife Sanctuaries, covering 34.21% of its total geographical area, thus strengthening biodiversity conservation. KL-India has a unique feature of vegetation, covering tropical to alpine region, which is broadly categorized into different eco-elevational zones having wider range of rangelands and alpine-pastures and trans-Himalayan regions. As 34 global biodiversity hotspots, KL-India comprises floristic diversity of over 4500-5000 species including 1186 monocotyledons. There are 527 species found under Orchidaceae family. Among true ferns in Sikkim, Dryopteridaceae is the largest family with 23 genera, 155 species and 7 sub-species. Among bryophytes, Sikkim has around 464 moss and 267 liverwort species Darjeeling district has 300 fern, 422 moss and 58 liverwort species. The KL India represents high endemicity with several threatened taxa. The biodiversity rich ecosystems provide a range of provisioning services to inhabitants, like food, timber, fuel, medicines, hydropower and water; the cultural diversity and uniqueness further offer as potential of tourism entrepreneurships. Mt Khangchendzonga is considered as supreme deity for Sikkimese people, especially by Lepcha tribe.

KL India is enriched with high faunal diversity (over 5000 species), with 80-100 reptile species, 150 mammals, over 30 amphibians and about 50 fish, 700 butterflies, and numerous moth species. The KL India has sufficient resource management framework- National Environment Policy (NEP),

2006 encompasses dealing with environmental regulation like protection, restoration and conservation with respect to the better livelihoods. The prepared Feasibility Assessment on KL India provides details on all aspects of landscape.

KL-India has key challenges like defining conservation and management targets, understanding conservation and development trade-offs, building participatory conservation and development alternatives, incorporating climate change adaptation and mitigation dimensions, develop a functional network of institutions. Such challenges are prominent for dealing broad threats of landscape like illegal trade of wildlife and pastureland management, transboundary problems, information and knowledge gaps, limited livelihood options for marginalized people -tea garden workers, human-wildlife conflicts, declining cultural entity, climate change and vulnerability and unregulated tourist and management. With theses broad threats, KL-India has major opportunities like biological, cultural, management and physical resources.

The conservation and development strategy (CDS) for KL-India has included guiding principles as adaptive, gender and social inclusion and participatory approach. The vision and goal of the CDS embrace for major outcomes which further include several strategies (17), and each strategy has identified priority actions/activities. To implement the priority actions for achieving the goal of KLCDI with concurrent vision, the implementation mechanism with different available resources and scope and purpose of monitoring and evaluation approaches have been discussed.

Contents

1. INTRODUCTION

Development of appropriate strategy addressing various key issues that limit the development of landscape will be responsible for the overall and real achievement of biodiversity conservation and livelihood improvement. Under defined and specific strategies, the priority actions directly or indirectly connected to socioeconomic investment warrants deep understanding of situations, which seek remedial measures. Several organizations have formulated guidelines in different forms for the implementing activities, which focus to build up the idea of conserving biodiversity and sustaining developmental performance by utilizing the tools at hands. In this regard, it is necessary to have the feasibility of the programme assessed and suitable approaches formulated in the strategic manner in favour of sustainable conservation and development. In this context, Khangchendzonga landscape has been identified as a potential area for addressing biodiversity conservation and development advocating benefits of the transboundary approach through extensive effort by ICIMOD, which is being implemented in the three countries, viz. Bhutan, India and Nepal. As one of the biodiversity and culturally richest biomes, the entire landscape is a part of one of the 34 'biodiversity hotspots' and recognized as one of the most critical centres of biodiversity in the world. The inhabitants owe immense spiritual and sacred-values towards Khangchendzonga Landscape (KL) having attributes leading to enrichment with biological, cultural and physical sectors. The landscape exhibits an amazing array of socioeconomic structure, which in tune reveals vibrant connectivity with natural resources. Despite this, the landscape is under several pressure and susceptible for changing scenario of development activities, inverse socio-economic values and climatic phenomena. Consequently, accelerating alteration of biological, cultural and physical uniqueness of the landscape is witnessed or in other words, the ecological and cultural integrity of the entire landscape is consistently experiencing increasing pressures of various kinds as well.

Recognized as the most humid places due to its proximity to the Bay of Bengal influencing direct exposure to the effects of moisture laden SW monsoon, the KL- India exhibits distinct climatic variations all along its elevation ranges. The climate could broadly be divided into tropical, sub-tropical, temperate and alpine. Furthermore, the timberline, the transition zone of the Himalaya harbours both alpine as well as temperate elements, separating two floristically distinct regions, i.e., alpine scrub and alpine meadows on the upper limit and the temperate zone towards the lower limit.

At the present, several evidences indicate that the landscape is facing an accelerated change at various spheres of concern and thus invariably calls for early attention. A need to envisage a strategy for the landscape, which builds on ecological and economic realities advocating the suitable management practices towards sustainable conservation of bio-cultural resources and livelihood options, is definitely on the perspective. Considering above facts, the development of conservation and development strategy (CDS) for KL India has been attained, which would constitute the following major strategic outlines and includes-:

- Analyzing existing status of the KL India (i.e., bio-physical, socio-economic and cultural, management practices, institutional mechanisms, and policy dimensions)
- Assessing threats, gap areas and identifying priority actions under the most challenging circumstances
- Developing guidelines and specific strategies for conserving, maintaining, and promoting (i) biodiversity, (ii) cultural values, and (iii) eco-friendly sustainable and equitable livelihood development options

Based on the information generated through feasibility assessment, the purpose to develop CDS is to initiate national-level planning process, to build capacity and harness potential for the conservation and sustainable development of the target landscape under changing environmental scenario. The proposal is to: i) effectively hold emerging economic and environmental (including climate change) authenticity into conservation planning, ii) provide research based evidences for incorporation in local, national and regional level policies through understanding their dynamic interactions with human needs and factors, and to use development in the service of conservation. As well, adopting ecosystem management approaches and long-term monitoring planning within the KL-India, based on an improved knowledge base will build capacity at local, national, and regional levels. This will respond to climate change impacts, which provide a mechanism for the development and implementation of adaptation strategies that enhance the socio-ecological resilience of landscape communities. At long-term basis attempt is also there to develop a functional network of institutions and build capacity to address issues associated with ongoing changes in the KL-India on a long-term basis.

At KL-India level, the Conservation and development strategy will feed the envisaged regional strategy, which would ultimately form a core element of the KL Regional Cooperation Framework. In the process of developing conservation and development strategy, several approaches were used and priority of the suggestions considered in

the course of document preparation. Several courses of actions were taken, which are following:

- As collaborative partner institution of KLCDI, participated in the KLCDI Regional workshop on the preparation of Conservation and Development Strategies at Pokhara, Nepal (27 to 29 August, 2014), where major outcomes and preliminary strategies were developed.
- A series of community-based Stakeholders' consultations (4 consultations from 6-9 September 2014 at transboundary area with Bhutan- Jalpaiguri and Alipurduar, the plains of KL-India, West Bengal) were organized (support: Himalayan Nature and Adventure Foundation (HNAF), Siliguri). One consultation was organized at Barsey Rhododendron Sanctuary, an important transboundary region connected with Nepal (5 November 2014; with support coming from The Mountain Institute (TMI)-India). One consultation was held at Dzongu area, an important transition zone of KBR (8 November 2014: support: Mutanchi Lom Aal Shazum (MLAS), Dzongu). Two major consultations were organized at Darjeeling transboundary area with Nepal i.e. Singalila and Mahananda range (from 12-13 November 2014; support: Centre for Mountain Dynamics (CMD), Kalimpong).
- National Consultation cum write-shop was organized at Gangtok (3-4 December 2014), wherein, the contents outlines of CDS was shared and priority actions under different strategies discussed among the participants. The event was fussed to revise the priority actions under different strategies through group wise exercise and healthy interactions.
- As collaborative partner institution with ICIMOD, participated in the Conservation and Development Strategy and Regional Cooperation Framework for KLCDI at Chalsa, Jalpaiguri on 4-5 January 2015, where country CDS draft was shared and comments received for further modifications.
- Organized brainstorming meeting of technical experts/partners from Sikkim (specially including nodal person from state forest department and other forest officers) at GBPIHED, Sikkim on 7.1.2015, for discussing and revising CDS strategies and actions.
- One to one meeting on CDS with nodal persons of two state forest departments at Gangtok-Sikkim and Siliguri-West Bengal during January-February 2015, and other experts.

- Reconsideration and general view of the Feasibility Assessment Report developed through a thorough consultative process with national partners and the other stakeholder groups/individual experts, as the base line information document for drawing the national-level Conservation and Development Strategy. The comments from ICIMOD received in December 2014 were equally considered for the revision of FAR. In addition, the document on review of policies and enabling environment feeds to the process of developing this strategy.
- Integration and analyzes of the inputs of the representatives of three major partners (i.e., GBPIHED, DoF, West Bengal, FEWMD, Sikkim) were made through participatory and consultative process to develop the draft of the KL Conservation and Development Strategy in the Indian part including the positive support received from the different participating NGOs.

1.1. Transboundary landscape approach

Khangchendzonga landscape emerged as one of the potential areas for addressing biodiversity conservation and development to support transboundary management, whereas three nations, viz. Bhutan, India and Nepal signatories to deal in transboundary problems. With the complexity and uniqueness of the transboundary attributes representing a wider space for large number of the floral and faunal advancement, the KLCDI offers opportunity to share and use biological, cultural and physical resources in sustainable manner among the concern people. However, appropriate transboundary approach may be stressed for wildlife movement across the landscape, for their long-term survival and maintenance of necessary genetic traits (Chettri et al. 2007). In addition, wastelands of transboundary areas are subject to higher level of threats, mainly from over extraction of resources, illegal trade, limited livelihood options and policy differences among the countries (Sharma et al. 2007).

Considering the KL-India, the corridors connect Sikkim, Darjeeling, Alipurduar and Jalpaiguri (West Bengal) and taken along with Nepal (Kanchanjunga Conservation Area) in west and Bhutan (Torsa Strict Nature Reserve and Jigme Dorji National Park) in east offering an enormous opportunity towards long time sustainability of the floral and faunal group, in general, and important biotic elements in particular.

Transboundary approach is needed for dealing several issues especially for the Indian part of the landscape, which encompass large area offering connectivity with different nations like Bhutan, Nepal and Tibet (China). KLCDI offers to setup an appropriate transboundary approach among Bhutan, India and Nepal strengthening the regional cooperative framework and ensuring the sustainable biodiversity conservation and

development at regional level. KL-India has 17 protected areas (PAs), out of which 7 are situated at transboundary level with Bhutan (Pangolakha Wildlife Sanctuary, Neora Valley National Park, Jaldapara National Park, and Buxa Tiger Reserve), and Nepal (Khangchendzonga Biosphere Reserve, Barsey Rhododendron Sanctuary, and Singhalila National Park).

Across the boundaries of KL-India, the socio-economic assemblage and diversity across the boundaries of the landscape (KL-India) also draws out deep cultural and ethnic sentiments among the local people. Realizing the above facts strengthening the country specific cooperation for developing effective sustainable conservation and development strategy of the critical transboundary complexes across the landscape has become the first move towards attaining the project goals. These approaches in this regard would involve: i) recognizing a transboundary protected area establishment in KL, ii) strengthening standardised information database of transboundary resources, iii) participatory approach promotion, iv) ensuring conservation awareness, and v) introduce socio-economic benefits by ecotourism and biodiversity-based enterprises, which would address various issues pertaining to transboundary as well as KL-India.

1.2. Khangchendzonga Landscape –India

A part of one of the 34 'biodiversity hotspots' (Mittermeier *et al.* 2004), the Khangchendzonga landscape-India is one of the biodiversity and culturally richest biomes. Representing the uniqueness and character of the bio-socio-climatic integrity of KL India, the diversity of biological, socio-cultural, and climatic phenomena are symbolized along the elevational gradients. Several faces of ethnic cultures extremely assimilate and recognized in the landscape, thus greeting to a strong unity of the well-beings. In KL-India, several mixed diversity enforcing to representative cultural paradigms are recognized, which are historically interlinked with the significance of the landscape. Nevertheless, such entity of the landscape is rapidly degrading and shrinking with the traditional practices and knowledge base losing ground under changing climatic regime. This invariably indicates an alarming signal for sustainability of biotic and abiotic assimilates vis-a-vis linkages being disturbed between natural and cultural entity.

Additionally, the large biodiversity complex in the target landscape easily invites several conservation conflicts adding a serious concern in the landscape and need to be managed to minimize negative impacts on biodiversity, human livelihoods and human well-being (Redpath *et al.,* 2013). Having a majority of marginal people in KL India

suffers from livelihoods insecurity, which is in need of provisioning alternative options of sustainable livelihoods.

Considering above, it has been an opportunity for the target landscape to deal all the critical issues through: i) understanding, ii) defining and iii) managing and iv) utilizing maneuvers. There are several enabling management practices are, however, under process in the KL India, which requires serious attention in setting-up a strong coordination framework among the stakeholders for rectifying and revising the existing management practices in the changing scenario.

1.2.1 Boundary and area

Khangchendzonga landscape, India (KL), spreads within 26°29′13.56″ to 28°7′51.6″ latitudes and 87°59′1.32″ to 89°53′42.96″ longitudes, with range of altitudinal gradients between 40 to 8586m asl and covers an area of 14126.36 km2, is recognized by the state of Sikkim, and northern part of west Bengal (district Darjeeling and Jalpaiguri with Alipurduar).

In KL India, the maximum coverage of agriculture and broadleaved forest area is 3110.95 and 3035.67 Km2, accounting for 22 % and 21.5 % of total area of KL, India, respectively. In KL-India, plains and foothills including immense land cover by tea gardens contributes largely to the agriculture sector. Besides, 12.1 % of land use area is bare and uncultivated land. Owing to high mountains ranges including the mighty Mt. Khangchendzonga, the snow/glacier cover is vast, i.e. 11.1 % of the entire spatial land cover of KL, India. Water-bodies and built-up area do not cover much, restricted to merely 0.2 % of the total KL, India spatial area.

Development of KL-India strategic document, with variant features and transboundary linkages, would provide an opportunity to initiate long-term monitoring plan and implementing the biodiversity conservation and development priority actions as a challenging task.

1.2.2 Physical features

The KL- India mainly forming hilly terrains with patches of foothills at its southern flange representing the Terai belt of Alipurduar and Jalpaiguri and northern boundary represented by the state of Sikkim forming an arm of the Greater Himalaya, which is separated from the Tibetan highlands. The landscape of these areas owe much to the drainage network of the river Tista which flow down from North to South. High relief in the Western and North-eastern part of Sikkim glaciated topography most of the rivers flow from north to south. Considering the physical features of KL-India, it portrayed

unique and challenging prospects towards conservation and development on the regional resources:

- Broad study area (i.e.14,126.36 km^2) varying along an altitudinal ranges i.e. 40 to 8586 m asl to work in wider perspectives (Figure 1),
- Variation in climatic events at spatial and elevational level recorded- *average 2 °C minimum temperature and 19°C maximum temperature in Darjeeling, 7°C and 27 °C in Gangtok and 11°C and 32°C in Jalpaiguri respectively,* offers to implement the approaches at spatial level,
- Tista river encompasses as a major stream flow varying from highest part of landscape i.e. glacier (Sikkim) to lowest part of landscape (Jalpaiguri),
- Significance area of snow ice and glacier ranges *having 11 major high peaks mountain*, offer the sustain downstream basin for multiple purpose of conservation and development,
- Multiple land use patterns providing wider biodiversity patterns (i.e. needle leaved forest, broad-leaved forest, mixed forest, shrub land, grassland and agricultural land)
- High frequency of lakes/ponds *(Total wetlands - 431 in Sikkim and 775 in Northern West Bengal)* provide a significance scope for conservation towards improving socio-economic status and resilience to cultural value
- Various geological stresses determining the soil diversity at spatial level *the Terai belt is predominant soil of alluvial, sandy and clayey, while northern hilly region has a series of steep hills and deep valleys, terraces and scarps at different altitudes*, contributes to biodiversity richness.
- Soil erosion is one of the major soil degradation processes in the hills of landscape due to steep slope aspects with high rainfall, as well as improper management of agricultural land and indiscriminate deforestation leads.

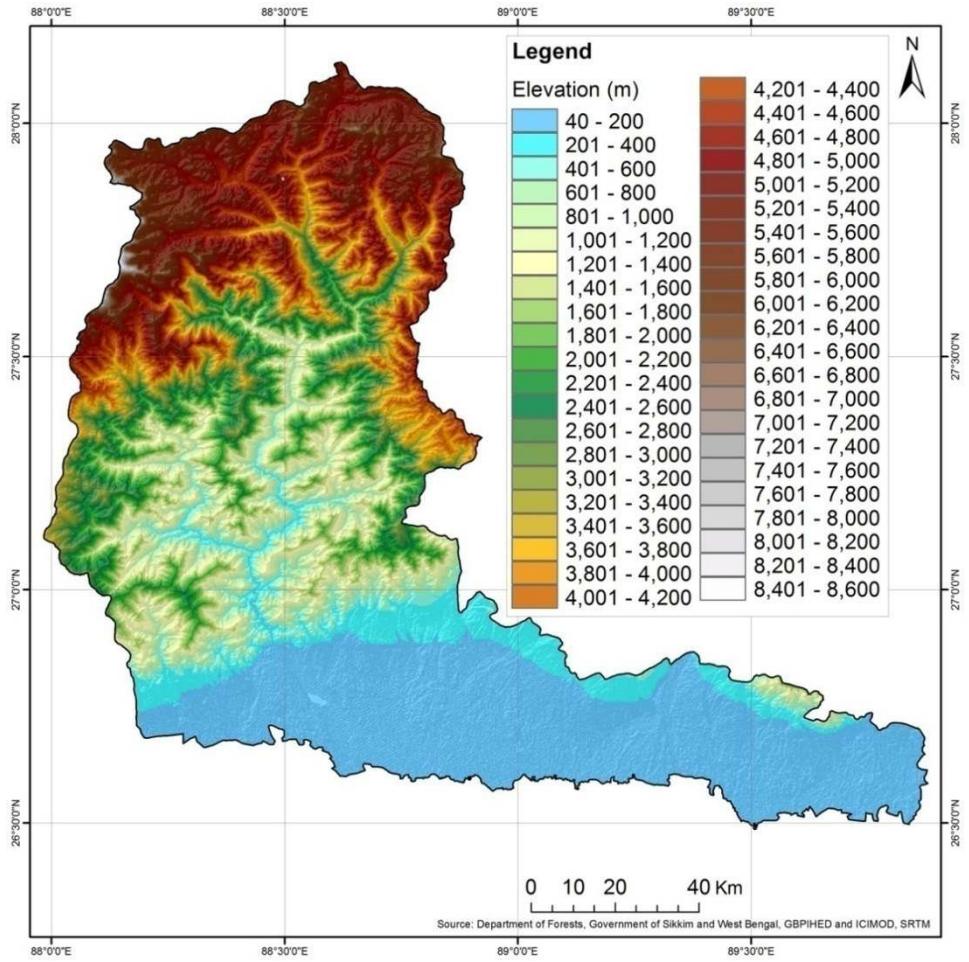

Figure 1. Land cover of KL-India along different altitudinal gradients

1.2.3 Socio-economic, gender and livelihood

The Khangchendzonga landscape, India encompasses 6,325,457 populations with 3,243,393 male and 3,086,853 female with a very low human density of 1,294 persons per Km^2. Within demographic features, target landscape exhibits a myriad of ethnicity and clans and sub-clan orders within groups with its individual language/dialects, culture, social make-up and religious beliefs. People in the KL-India come from different castes and ethnicities. In the upper part of landscape, Lepchas, Bhutias, Nepali, Limboo constitute the major caste/ethnic groups. The Lepchas are the ancient tribe of Sikkim and Darjeeling hills (Pradhan and Badola, 2008) and other old tribe is Limboo (Badola and Pradhan 2013). In the plains, there are several communities like, Gorkha, the Adivasi people originally from Chotanagpur and Santhal Parganas and a greater bulk of Bengalis. In terms of population composition, the Jalpaiguri district (including Alipurduar now) has the second largest percentage of schedule castes (i.e. 34 percent) and the largest percentage of scheduled tribes (i.e. 22 per cent) of the state West Bengal. On taking together the scheduled castes and schedule tribes account more

than 50 % of the population of the district. In addition, Oraon, Munda and Kheria tribes are not indigenous to the region.

The KL India represents incredible cultural diversity that includes largely the Bengali and Nepali cultures. Sikkim state is legendary for its peaceful nature and simplicity and known for Khangchendzonga, the third highest mountain in the world (8586 m). Buddhism and Hinduism are the two main religions followed in the hills.

In KL-India, the literacy rate of Sikkim is 82.20, as an increase of about 14 % over the last 10 years. Both male and female literacy has significantly increased, which is 87.30 % and 76.43 % respectively. In Darjeeling, the average literacy rate in 2011 was 79.56, in which male and female literacy figured out 85.61% and 73.33%, respectively. The literacy rate of Jalpaiguri in 2011 was 73.25 %, with male and female literacy as 79.95 % and 66.23 %, respectively. In-spite of increasing literacy, the equal contribution in the decision-making is still missing in the landscape. However, women in the hill society are the backbone of families and in agriculture, as they have to contribute time on the field for harvesting and weeding, taking care of the animals, needing several hours for collecting and carrying the quite heavy loads of fuel wood and fodder and of course look-after the families. To what extent the policy has implications on gender equality, the women empowerment, and organizational effectiveness however would be important area to research.

Within KL-India, large portion of the populace is not successful in obtaining the desired economic status and improved livelihood due to their below poverty level status. Following are some of the highlights of socio-economic profile in KL India:

- The distributional aspect of agricultural status plays an essential role in livelihood. There is a strong practice of growing many cash crops, such as, Large cardamom, Ginger, Orange, Pineapple, Arecanut, etc, which have been directly influencing the economy of the farmers.
- Landscape widely produces large number of natural food resources and other articles on general utility for livelihood. The NTFPs grown within the agroforestry systems and in the natural forest areas adjacent to the cultivated systems provide alternative sources of food and income, especially during the periods of crop failure, low productivity, or excessive drought periods and unfavourable weather conditions. The indigenous communities harvest wild vegetables, fruits, medicinal plants, tubers and other edibles including mushrooms from the forest, especially in the season of greatest food scarcity.

- The tea industry is considered very important bringing economy to the region. Since inception, tea continued to act as the backbone of the local economy especially the marginal people *(Approx 243,630 persons are directly or indirectly engaged in tea plantations in the part of KL India, especially in Darjeeling).* Notwithstanding, tea is the survival source of high population of tea garden workers. The tea garden workers have fear for instability and unsustainable survival sources due to limited alternative income and low wages in tea gardens.
- The organic farming in Sikkim offers an opportunity to farmers for getting benefits under State Organic Mission. After inception in 2010, Sikkim Organic Mission has credibly accelerated work for making Sikkim as fully organic state by 2015. Weaving and knitting constitutes one of the major occupations of people in KL-India as an alternative livelihood option, although the transfer of related indigenous knowledge has declined due to limited interests of the younger generation in the same. Women in high mountain areas (Sikkim and Darjeeling) of the landscape involve in indigenous handicraft weaving techniques. Bamboo production in the landscape is a priority sector for the investment, offering potential for developing handicrafts, construction, medicine, packaging and food processing industries.
- Animal husbandry is the integral element of farming system, as principal source of farm economy to the farmers. With increasing poultry entrepreneurship in the lower and middle hills areas, Yak rearing has become an important source of income at high elevational zones. In addition, pisciculture has a visible pressure in the foothills.
- Natural, cultural and sacredness value and heritage sits of KL India have a potential to extract enormous benefits from tourism enterprises in the region. Development in tourism sector invariably leads to economic growth of the landscape, which is manifested in terms of increase in income and employment opportunities, infrastructural growth, and improvement in the standard of living. KL-India has a potential to become a diversified tourist destination due to its natural attraction and sacred and historical places. Nevertheless, the high frequency of the tourists in the landscape offers employment to marginal people.
- Setting up of local bazaars or hats appeared as a unique concept in the landscape (KL-India), offering opportunities to farmers and villagers for displaying their agriculture/agro-biodiversity produces and thus enhancing their

economy by selling the products. Farmers also sell their agricultural goods and wild edibles in the town and in village areas, as well. In recent years, women growers sell their vegetable produces along the motor roads and they earn good money.

- On the transboundary, trade offers an alternative option to enhance livelihood by sharing domestic goods and items as well as some traditional medicinal products etc, between the countries. In addition, it is an opportunity to re-open the old trade routes along KL, India, which may be beneficial for both country partners Bhutan and Nepal.
- The springs (*Dharo* or *Pandhero* or *Muhan* or *Kuwa*) originating from the underground unconfined aquifers are the major source of drinking water and irrigation, etc. Nevertheless, in the current situation, several natural water sources are shrinking (more than 724), which is emerged as the major water crises in KL-India.
- Firewood, cow dung, and biogas are the major source of energy in rural areas. However, KL India has sufficient availability of LP gas and electricity in urban and even in the rural area but the farmers, people living in remote areas and marginalized people especially tea garden workers are dependable on fuel wood. An estimation i.e. about 20,000 tons of fuel wood annually is used to dry the harvested crop of large cardamom, which indicates an alarming signal for the landscape.

1.2.4 Ecological features

The Khangchendzonga landscape (India) is broadly categorized into different eco-elevational zones i.e. a) tropical <1000m asl, b) sub-tropical 1000-2000m asl, c) temperate 2000-3000m asl, e) sub-alpine 3000-4000m asl and f) alpine > 4000m asl. With complexity of the eco-region, as whole eco-regions falls in three distinct eco-regions, viz. i) broad-leaved and conifer forests, ii) the Himalayan Alpine meadows and iii) Terai-Dooars' savannas and grasslands. The Himalayan broad-leaved and conifer forests vary within the landscape, supporting both their rich species diversity and endemism. Several characteristic ecosystems like wetland, broadleaved, coniferous dominated forests, alpine and sub-alpine regions are the distinguishing features of KL India ecology.

As major attraction, the KL India has wide range of rangelands and alpine-pastures-and trans-Himalayan region, as one of the most difficult habitats having cold winds and

blizzards. Pasture lands represent in the line of changing vegetation composition and numbers of livestock grazed at high altitudes, which has been broadly dominated by sheep and yak (including yak crossbreeds-*Urang*) for grazing purposes. The constant pressure of population and developmental activities in these fragile alpine regions can be witnessed as sheep and yak grazing and developmental activities like road construction and settlements.

As part of global biodiversity hotspot, KL-India comprises rich floral diversity with diversified genera and species of Angiosperms, Gymnosperms, Bryophytes, Orchids, Bamboos, Pteridophytes and fungus. KL India has estimated floral diversity of about 4500-5000 species. In Sikkim, the floral richness includes over 4500 plant species with 1186 species of monocotyledons. Orchidaceae is the riches family, representing 527 species and Cyperaceae figure out 146 species. Among true ferns in Sikkim, Dryopteridaceae is the largest family with 155 species Around 464 moss species and 267 species of liverworts have been recorded in Sikkim.

The Darjeeling district also indicates abundance in high plant species diversity. The district harbours about 4000 species of flowering plants under 160 families, endowed with a wide-ranging floral diversity of Mediterranean, Ethiopian, Indo-Malayan, Sino-Japanese, Palaearctic and Oriental biogeographic origin. The Darjeeling district harbours 6 species of gymnosperms and the Jalpaiguri has 4 species. About 283 species of orchids under 90 genera, 167 species have been recorded for Darjeeling. Records show 300 fern species for Darjeeling; it also has 422 moss species and 58 species of liverworts.

Many endemic and threatened plants are reported for KL India. *Takakia ceretophylla* is considered vulnerable. *Pogonatum leucopogon*, *Ditrichum apophysatum* and *Ditrichum darjeelingense* are endemic to Darjeeling; *Ditrichopsis clausa* and *Oreoweisia brevidens* are bryophytes endemic to Sikkim; *Ptychomitrium indicum*, *Ditrichium laxissimum* and *Trematodon hookeri* are endemics to both Darjeeling and Sikkim. KL-India is endowed with over 31 species of bamboos

Faunal communities are equally diverse, which include numerous species of mammals, birds, repitles, fish, and butterflies. Possibly 80-100 reptile species, 150 mammals, over 30 amphibians and about 50 fish and 700 butterflies and numerous moth species are found in KL India. It is estimated, for instance that Darjeeling district harbours about 4,166 species of fauna. For Sikkim alone over 550 types of birds are reported, and 48 species of fish are reported. About 700 butterfly species – almost half of the total in Asia- have been recorded for Sikkim

1.2.5 Resource governance (including legal framework)

Some of the initiatives have been taken to framework the policies and plans that drive conservation agenda at the National level. Among these, National Environment Policy (NEP), 2006 encompasses all the central Acts dealing with environmental regulation like protection, restoration and conservation with respect to the better livelihoods. NEP is one amongst the two policies in India that clearly seek regional cooperation in the conservation of bio-resources and protection of environment, which acknowledges the transboundary character of environmental problems. Similarly, synchronizing with the National Biodiversity Action Plan (NBAP) 2008, the National Biological Diversity Act covers conservation, sustainable use of biological resources (of natural resource base) and associated knowledge occurring in India for commercial or research purposes or for the purposes of bio-survey. It proposes to process its mandate through PA network, which includes consolidation of Biosphere reserves, establishment of more reserves designated under Wetlands conservation and augmentation of ex situ efforts through establishment of network of Lead Gardens and initiatives in conservation of genetic resources, etc. Relevant to above, the KL India has 17 protected areas (PAs), which comprises of 1 Biosphere Reserve, 4 National Parks and 12 Wildlife Sanctuaries, covering almost 34.21% of the total geographical area of landscape. Of the total, Darjeeling –Jalpaiguri-Alipurduar part has 9 protected areas with four National Parks, five wildlife sanctuaries (besides Eastern Dooars Elephant Reserve), which is a great step forward for conservation of biodiversity.

An attempt to strengthen and empower local people especially women and men from marginalized or vulnerable section of the society such as scheduled castes and scheduled tribes, Mahatma Gandhi National Rural Employment Guarantee Act 2006 has been formed. As a fact that the majority of the hunger lives in the rural India and depend on agriculture, National Food Security Act, 2013 has an opportunity, towards working and ensuing food security for all. In addition, some rural-based policies are quite tune to revitalize agricultural progress (National Agricultural Policy (NAP), 2000, National Policy for Farmers (NPF), 2007, National Livestock Policy (NLP), 2013 by making agrarian prosperity and food security and sovereignty as the bottom line for government policies and priorities in agriculture and rural development.

Back-up of National Action Plan on Climate Change (NAPCC), targets a mission for sustaining and safeguarding the Himalayan ecosystems and glaciers, which suggests for exchanging information between the countries that share the Himalayan ecology and

forms a part of countries' broader climate change adaptation strategy towards sustaining and management of Himalayan ecosystems.

Considering the importance and unique features of hill states, the Planning Commission, Government of India has constituted a task force to look into problems of hill states and hill areas and to suggest ways to ensure that these states and areas do not suffer in any way because of their peculiarities (Planning Commission, GOI 2010). The task force report, among others, recommends reshaping of policies to bring in the 'Mountain Perspective' for the Indian Himalayan Region, in the national planning. Emphasis has also been laid on developing norms for good governance and harnessing social capital at the grass roots. The report also recommends bringing in the concept of developmental zones and states that it should be better to balance between natural resource exploitation and conservation.

With respect to the rights of indigenous communities, the *Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006* recognizes and vests forest rights and occupation in forest land in forest dwelling Scheduled Tribes and other traditional forest dwellers who have been residing in such forests for generations but whose rights could not be recorded. The Act also provides a framework for recording the forest rights so vested and the nature of evidence required for such recognition and vesting in respect of forest land. This process of recognition of rights is based on two key concepts: community forest resources and community forest rights.

In addition to national laws, policies and programmes related to conservation, development and governance mentioned above, there are some state specific (i.e. Sikkim and West Bengal) policies and programmes, which exhibit states commitments for conservation and sustainable development. These policies and programmes are formulated and supported by various departments i.e. tourism, industries, forest, tribal affairs, human resources development, rural development, non-conventional energy, science and technology, etc. The Planning Commission of India has a special package for the region in the form of the Hill Area Development Plan.

Besides, a few other initiatives in the landscape like *State Green Mission*, 2006 and promoting plantation of ornamental and flowering trees and shrubs along the roads, institutional vacant lands, School complexes, College and University campuses and vacant lands of public and private sector undertakings are there. Ten Minutes to Earth, 2009, a programme now is made mandatory for all citizens including government, semi-government and non-government organizations as well as defense personnel. To address climate change the government of Sikkim had taken a very systematic and

proactive approach towards the formulation of the state action plan. The identified key areas of concern for Sikkim are: Water, Agriculture, horticulture and livestock, Forests, wildlife, and eco-tourism, Promotion of energy efficiency, and Urban and rural habitats and communities. Under each of these broad areas, the SAPCC highlights the measures that need to be undertaken for addressing these concerns. State Ecotourism Policy in 2012 proactively has made to promote ecotourism in a sustainable manner based on the Global Sustainable Tourism Criteria (GSTC), generate incentives to local communities for nature conservation through alternative income sources and livelihood, and empower local communities to manage ecotourism with the emphasis on economically disadvantaged people. In addition, it support existing biodiversity, ecosystems and religious monuments of the state of Sikkim as well as Sikkim people's culture and tradition and ensure that local communities have a role in determining the appropriate presentation of their cultural value. A strong Sikkim Biodiversity Action Plan 2012 offers a range of issues and suitable mitigation approaches through identifying potential organisations in the state.

The management of the information flows in these policy processes is the key to their success, including communication of research outcomes to policy makers, feedback from local community groups, and coordination of various levels of institutions, regulations and implementation efforts. Realizing the above, the KLCDI India has an opportunity to enhance governance by providing better and precise information to policy makers. To achieve this goal and implement the process effectively forest management and protection are two main functions of the state (Sikkim and West Bengal) in Khangchendzonga landscape (India).

1.2.6 Climate change- vulnerability and adoptions

Climate change indications observed in the part of KL-India (Sikkim) and estimated annual mean temperature indicates warming signal per decade (0.42-0.58 °C) significance ($p<0.001$). Mean annual relative humidity estimates increasing signal (i.e. 0.53-1.21%) per 10 years significantly ($p<0.02$). On an average 13.86-25.08 mm annual evaporation has increased over per 10 years significantly ($p<0.002$). However, sunshine hours indicates declining (i.e. 220-283 hrs) result over each 10 years significantly ($p<0.001$). Such indications are enough to consider the climate change happenings in the KL-India and that need further strengthening of climate change concept in KL India. In this context, there is an urgent need to have long-term data monitoring system at spatial level for projecting climate change signals in appropriate manner and their

impacts on various biosocial factors. The climate change impacts on biotic and abiotic components are discussed as:

- A linkage between biodiversity and climate change has been established and resulted higher vulnerability ranking for Darjeeling, followed by Sikkim and eastern Nepal. High sensitivity of some of the microclimatic habitats in the landscape such as alpine meadows, alpine scrub slopes, alpine dry and moist scrub, old growth fir forest, birch-rhododendron forests, Juniper forests, bamboo undergrowth, cloud forests, Juniper-rhododendron scrub, hemlock-spruce, larch forest, and willow scrub, which would succumb to climate-related stresses is known. Moreover, several native species in the temperate zone have high exposure risk due to impacts from invasive lowland species, insects and diseases.
- KL-India has observed the changing in avian habitats (Blood Pheasant has been recorded above 3300 m asl limits; snow Pigeon currently occurs in the sub-alpine and alpine zones; white-winged Redstart was recorded as low as around 1700 m) and there is change in distribution pattern of plants (*Rhododendron* species; Himalayan Alder- *Alnus nepalensis and some Orchids species).*
- Pollination agents (specially, bees and other pollinating animals) are gradually declining due to climate change and pollination service may be hampered due to change in any component of plant vis-a-vis pollinator by alterations in climatic variables.
- Glacial lake outburst flood (GLOF) is causing extreme floods downstream in the landscape and shrinking of glaciers causing nival zone shrink and increasing the extent of alpine zone. The glacial lakes are expanding up to 1.9 km due to glacier retreat from 1962-2008 and shrinking at 38.20 m per year, which indicate an arming signal of changing climatic events.
- Among the high value cash crops, large cardamom is the most vulnerable after ginger and broom grass in the traditional farming systems in hill part of KL India. Some naturalized exotics such as *Ageratum houstonianum*, *Erigeron karvinskianus*, *Galinasoga parviflora*, *Erichthites valarianiifolia* and *Calceolaria mexicana* have been observed profusely colonizing in agrobiodiversty systems in KL, India.

Realizing the climate change happening and their impact on biodiversity elements and other related factors are the serious concerns in target landscape, which are emerging as an important challenge for the conservation and development initiatives. There is a

need to adopt a strong monitoring mechanism tools for gathering location specific long-term data on biotic and abiotic components vis-a-vis awareness generation among the community through real-time field observations.

2. Strategic Issues

2.1 Key challenges

2.1.1 Defining conservation and management targets

- Uncertainty paradigm of biotic components is the principal role in target landscape because the data deficit status on biological, water, land, and climate and their linkages are defining conservation and development challenges.
- Considering the heterogeneity in bio-physical conditions and strong variations in the relationship between people and nature, particularly along the wide eco-climatic range of KL India, the social and ecological values would manifest at different scales. Therefore, the fruitful dialogues of trade-offs may emerged out by giving appropriate focuses on the political, social, economic and ecological dynamics at various spatial and temporal scales. This will largely dependent on establishing interface among them. As well, the undefined conservation and management targets for human-wildlife conflicts are the major challenges, which have unwillingness of parties and engagement, striving for unrealistic goals, legislations and financial incentives.
- In view of above, understanding of resources and their linkages with human needs and aspirations are at very low interest in KL India and posses a big challenge while defining conservation and development targets at different levels and scales. In this context, it is significant to have knowledge on the variability in institutional and socio-ecological outcomes and their drivers.

2.1.2 Understanding conservation and development trade-offs

- For KL India, while analyzing conservation and development imperatives, the key challenge would be to use development in the service of conservation effectively. This implies, for achieving conservation and livelihood opportunity, the best choice is to utilize human welfare and development. It would also imply that the key challenge for attempting a conservation strategy for KL India is not to ignore the human activities, but focus understanding how they influence the ecosystem (i.e. goods and services). In view of above, the most prevalent challenge, to understand and address, is the ongoing process of rural

transformation, which includes rapidly disintegrating (i) socio-cultural value system, (ii) indigenous knowledge and practices, and (iii) local institutions. These entail to:

A. In KL India, the appropriate and precise data bank on natural resources is underestimated. Therefore, it is difficult to understand the value of natural resource system of the landscape,

B. Intensive migration from remote rural areas to the urban centers within the landscape especially for Darjeeling, Jalpaiguri and Alipurduar districts thereby resulting into a multifarious social and environmental problems ranging from the changes in land use to health and hygiene,

C. Slackening linkages of inhabitants with natural resources resulting into deteriorating state of resource protection,

D. Eroding genetic resources, especially from traditional farming systems, and

E. Diminishing the traditional and socio-cultural knowledge-base

- In addition, monitoring of biodiversity on functional aspects is more significant than compositional (e.g. species) and structural (e.g. threatened habitats) aspects (Lindenmayer *et al.,* 2000). To valuate ecosystems and biodiversity the landscape has a challenge to address the functional biodiversity.

2.1.3 Building participatory conservation and development alternatives

- In considering more inclusive view of conservation and sustainable use of resources, finding new or strengthening existing forms of community participation and local governance on natural resources have emerged as key challenges. That means, not to deny urgency of protecting resources, but to explore alternative and more participatory ways to reach this objective in order to seek sustainability (Pimm *et al.,* 2001). In recent times, worldwide, the participatory approaches have been used to represent a dependent and broadly agreed harmonizing modality for implementing conservation efforts.
- Vague and unrealistic role of community in forest management and utilization withstands the threat of becoming a subsidiary process inherit the divergent interests in main object due to its voluntary character and greater flexibility
- Agricultural practices are the major source of livelihood for, especially, marginal people in KL India. Diversity of the agricultural practices is fragmented in the landscape due to: a) socio-economic conditions, b) geo-climatic variations, c)

small farm holdings and change in farming systems, d) unrecognized practices and e) low trade-off. Also, the capacity building mechanism is overlooked in the landscape with declining awareness on agriculture-based entrepreneurship. Therefore, strengthening in capacity-building mechanism as profitable agricultural entrepreneurship is required for the livelihood stability

- Large population of marginalised people engaged in tea gardens are suffering from several livelihood crises and fragmented socio-economic status in KL India, which is an ultimate challenge to find their livelihood options linking with conservation and development activities.

2.1.4 Incorporating climate change adaptation and mitigation dimensions

- Considering that the climate change is a reality and the mountain ecosystems are extremely sensitive to changes, it is imperative to duly integrate climate change dimensions into the conservation and development framework. Based on the current scenario and past experiences on the impacts of climate change on socio economic changes, habitat distribution and land use changes possess a big concern. Future strategies on biodiversity conservation and development would face challenge to re-orient focus and scope by integrating spatially and conceptually greater dynamic facets at the landscape level. Further, accommodating the Climate Change adaptations strategies that fully incorporate amended priorities for biodiversity and the recognition of the rights and opportunities for involvement of indigenous peoples and local communities become a challenge.

2.1.5 Develop a functional network of institutions

- The management of the functional network is still reluctant in the landscape and has undefined practices for addressing: i) forest types and forest-related management activities appropriately, ii) primary, modified natural and planted forests (restoration and rehabilitation purposes), iii) inter-ecosystem leakages, and iv) integrated land-use planning.
- Realizing immediate need to address above-mentioned challenges, synergizing resources of various organizations to establish a functional network of institutions in KL India would be a big task. Bringing together the local, national, regional institutions, making them agree to take ownership of activities and assume responsibility for mobilizing resources in synergetic manner to address issues of conservation is a real concern.

2.2 Key threats/issues

The KL-India has major key threats, which are gathered from extensive and insightful consultations with different groups of expertise, ground level workers, NGOs and individual experts and field managers and administrators, etc. The major key threats in KL India are following:

2.2.1 Illegal trade of wildlife and pastureland management

Illegal wildlife related trades and poaching are proven issues in the landscape. Among several cases, illegal procurement and trade in leopard body parts is observed (47 leopards being killed to obtain the body parts between years 1997 to 2006). In addition, some wildlife trade incidences are occurred in especially relating Rhino, musk dear, snow leopard, and birds-pheasant, Himalayan monal, etc. Floral species are extracted in the landscape include *Fritillaria*, *Saussurea*, *Picrorrhiza,* among others.

Pasturelands are some of the most difficult habitats and high-altitude cold desert in the rain-shadow having typically Tibetan flora and fauna signifying trans-Himalayan range of the landscape are important area for conservation of biodiversity. The pastureland management issue has emerged extensively in the current scenario due to constant pressure as: i) increasing population of human and developmental activities (i.e. road constructions and settlements), ii) grazing by sheep and yak, and iii) growing tourist flow.

2.2.2 Transboundary trouble

KL-India has a large amount of transboundary problems like illegal trade of wildlife products, unregulated trade of natural resources, grazing, cross-border transhuman activities, as well as fire hazards. Among these, the dolomite mining activity along the Indo-Bhutan border is a recurrent issue at the Dooars plains. The major causes are : i) water pollution- Titi, Reti, Sukriti, Pagli and Torsha down steams, ii) dolomite affecting tea estates (around 55) in the Dooars areas as dust covers plantations and also affects soil fertility, iii) dust affecting human health and wild animals, especially the elephant, iv) threatening the flora and fauna, and v) affecting human livelihood. In addition, the grazing is a prominent issue at transboundary area, wherein partner countries are experiencing the same trouble.

2.2.3 Information and knowledge gaps

Documentation of the local natural resources, socio-economic components as well as dynamics including human-nature, etc have been found to be meagre in respect of KL-India. The socio-cultural part is even less prominent in the region where a great variety

of culture and tribes reside. The scientific studies carried out in the region are very scarce. It is under virtually data opaque situation; the area is not fully understood in regard to its process and products, as well as the entities that inhibit the KL-India region. Electronic media in the form of web portals and blogging sites would greatly help in pooling the information (archive) and made available for use and dissemination purposes (applications). Establishment of a central facility to deal with the information and knowledge gap is severely felt.

2.2.4 Limited livelihood options for marginalized people -tea garden workers

KL-India has a rich heritage of tea industry especially in Jalpaiguri, Alipurduar and Darjeeling districts extended along the corridor of wildlife and tea garden workers are prominently engaged for survival. The major issues have been emerged from the industry are: i) Human-wildlife conflict increased due to increasing presence of people in forested area, ii) limited livelihood options, iii) several health challenges to surrounding people emerged due to extensive use of pesticides and poor livelihood.

2.2.5 Human-wildlife conflicts

Human-wildlife conflict is a major issue especially in the plains of Jalpaiguri, Alipurduar and Darjeeling districts of KL-India. The conflicts between Elephants and humans in north Bengal part are much more severe than any other conflicts with animals. In the earlier times, the elephants used to cross Mechi river and continue their journey to Nepal (also in the seventies) but now there seems no proper corridor habitats for them to crossing over to Nepal. Moreover, the habitats of elephants have considerably shrunk and fragmented and the forests are no longer, what it used to be in the past. Growing cases of human-elephant conflict highlights the following reasons: i) large destruction on migratory route and fragmented corridors, iii) unavailability of foraging resources in the migratory routes, iv) altered suitable habitat niches like recreational destinations along migratory routes, v) destruction and damage of elephants by trains in the corridors. Killing of leopard, Bison and other animals are reported. Whereas, the conflicts on human death or injuries due to leopard and other animals are yet another area of concern. However, there are human-wildlife conflicts in Sikkim part, majorly related to black Bear and monkeys, etc.

2.2.6 Declining cultural entity

The landscape has numerous cultural values, which linked with biodiversity and nature based fascination. Nevertheless, at the current scenario, the new generation of the

different cultural groups are losing their actual culture values and deteriorating the interest in traditional practices.

2.2.7 Climate change and vulnerability

Climate change impacts have been predominantly visible in the landscape. Socio-economic and biodiversity status has been changed due to increasing temperature and uneven rainfall events and increasing development activities, as well. To strengthen the understanding on climate change, it is required to have real-time filed observations for initiating adaptation and mitigation approach in the landscape.

2.2.8 Unregulated tourist movement

Developing the tourism master plan to administer and manage tourism industry in the Darjeeling area of KL-India region stands out as the first job to be undertaken. In the Sikkim context, the tourism plan, which was framed a decade back, needs comprehensive revamp and up-gradation to fall in line with the present and ensuring tourism activities and shift of priorities. The rapidly increasing tourist flux in Sikkim also poses concerns for the area especially in regard to tourist carrying capacity at towns/villages as well as at major tourist destination, especially wilderness. Collaborative measures taking in concerned government departments, civil societies and different tourist agencies/workers will be required to forge a sustainable tourism strategy in the area. The inflow of economy from tourism activities should percolate to the grassroots and direct incentives from the establishments, which will be more helpful in nurturing workforce as well as executing sustainability quotient in the tourism industry.

2.3. Major opportunities

2.3.1 Biological resources

Landscape has huge biomes with respect to altitudinal aptitudes, supporting to flourish habitats and surviving large and diverse amount of the faunal groups. With these, the over extraction of the NTFPs and timber for fuel wood, and pressure of grazing/ poaching of wild animal, forest fires and their diverse influencing factors including agrobiodiversity are the major issues as key challenges. The target landscape, however, provides immense opportunities to address issues and challenges as indicated above. The following are some major opportunities:

- Well- recognized altitudinal/climate gradients, existing heterogeneity in biophysical conditions and strong variations in the relationship between people and nature.

- Richness, representativeness and uniqueness of biodiversity elements and other biophysical resources
- Clear zones/areas of wilderness (including snow, alpine and sub alpine areas), sacred and uniqueness values
- Abundant forest zone with diversity of forest types are the source of proper goods and services
- Popularity of indigenous farming systems, knowledge and practices offer diversified traditions as a source of livelihood
- Availability of fertile river valleys with irrigated land for optimization of agricultural production. The rich mosaic of traditional rain-fed agriculture as a means of maintaining genetic diversity and provisioning for food security
- Corridor connectivity within PAs and a model landscape for biodiversity conservation and community-based development and existence of a legally defined large coverage of protected areas(17 PAs)
- A typical mountain landscape with multiplicity of climate sensitive resources, habitats and ecosystem goods and services
- Diverse responses of endemic, sensitive and key stone species
- Maintenance of global value of ecosystem services emanating from glaciers, forests, and rangeland.
- Diversity in vulnerability distribution
- Indigenous knowledge and traditional health practices to handle with and adaptations to hazards, changes and extreme events
- Long-term natural and cultural interactions which are depended on local level governance systems resulting into successful traditions of participatory, culture based management of natural resources
- With existence of traditional systems of co-existence and community based management, there is positive enabling environment and policy back-up
- Commitments at local and national level for environmental conservation and sustainable development
- Common agreement on socio-cultural, socio-economic and bio-physical values, and their rapidly deteriorating state in the target landscape

- Rich and diversified traditional ecological knowledge to connect intangible and concrete benefits

2.3.2 Cultural resources

Diversified cultural entity with respect to its ethnicity groups has an important course of the landscape, which has historically overwhelmed several cultures and micro cultures bringing together cultural harmony. The ethnic group amplifies with several cultural values, directly grooms the natural diversity through spiritual attachment. The intermixing of the various cultures as well as upward mobility of social groups had played pivotal role in evolving the driven diversity of the region.

The Buddhist ethnic groups like the Lepcha, Bhutia, Gurung and Tamang celebrate New Year Losar in January/February, Maghe Sankranti, Chotrul Duchen. Buddha Jayanti and Tendong-Lho-Rum-Faat provide the "regional distinctness" of Darjeeling's and Sikkim is part of KL-India.

Jalpaiguri and Alipurduar region of the landscape has majority of the Indo-Mongoloid class like Rajbanshi, Mech, Rava, Toto, etc. The planters brought from the Chhotanagpur Plateau area - the Nageshia, the Oraon and the Munda do work as labour in the tea gardens. All these tribes brought along with them, their culture and beliefs. Though different races and their diversified cultures are intermingled in the same land, each individual race retained their individual culture and heritage over the ages. Close to the forests and natural bounty and resources in wilderness, many cultures developed and flourished viz. the Bhutia Culture, the Rajbanshi Culture, the Lepcha-Limbu Culture together with the Cultures of the Koch, the Mech, the Rava, the Toto and the Bengalese. Majority of tribal cultures are folk cultures. Folk dance, folk songs and folk lore form an integral part of these cultures. And many festivals are common to both the Bengalese and the Rajbanshi who constitute the bulk of Jalpaiguri's population. Apart from the major festivals like the 'Durga Puja' and the 'Kali Puja', there is the 'Tista Burir Puja' epitomising the lifeline of this region.

Irrespective of diversity, rich tradition of conservation of natural resources is the most unique and common feature of human civilization in KL India. For example, Lepchas community, have intangible performance of the tradition linking towards sustainable conservation of natural resources utilizing bio-resources in tradition ways (Pradhan and Badola, 2008), however, such cultural-based traditions are diminishing with changing scenario, which have questioned to the up keeping of the historic-bases ethnic values. As sacred forests, sacred lakes, sacred boulders, stones and sacred spaces are flagging-down in the landscape, due to traditional beliefs, are slowly eroding under the influence

of modern education, consumptive lifestyles and other western societal pattern. Overcoming all the issues, the landscape offers tremendous opportunities, as:

i) Existence of cultural-based conservation and management practices in the landscape through scared grove or devrali forests, Dzumsa system, Bhasme system*, Gumpa/monastery forests, Taungya system and scared lake forests*

ii) Eco-cultural history and pilgrimage for the livelihood stability and conservation by strengthening eco-tourism practices

iii) Linguistic diversity has an attraction of KL India and in general, the Nepali, Hindi, and Bangla languages speaking group are dominated.

iv) Economic inter-dependency form of exchange of the goods and services existing from east to west and north to south, substantiates flow of economy and connectivity of the society

2.3.3 Management resources

In regard to management resources, there exists much strictness in the form of common national goals at National level initiatives. These include National Biodiversity Act, National Environment Policy, National Action Plan on Climate Change, National Mission on Sustaining Himalayan Ecosystems, Greening India Mission and Specific task force of planning commission to look into problems of hill states and hill areas, National Biodiversity Action Plan synchronized with both states policies and laws.

Such policies and laws are prominently applicable in KL India, but question arises on the feasibility of these policies and laws if they are compatible for implementing and processing. Currently, Forest Departments manage the biodiversity in wilderness and their role would be strengthen by effective coordination, under a single umbrella, as an important factor for achieving the conservation and development strategy in KL-India. Irrespective of the above challenges for managing biodiversity, some major management recourses exist in the landscape and their rational are as follow:

- Mobilization of community-based management group like DZUMSA, NA ZONG NYO, Bhasme, Taungya and existence of community-based conservation programme like Joint Forest Management (JFM), including gender sensitization, Himal Rakshaks, Pokhari Shangraksh Samitee, etc.
- Recognition of symbiotic relationship between the tribal people and forests, implores to associate the tribal people closely in the protection, regeneration and development of forests (as recognition by National Forest Policy 1988)

- Implementation of the multiple schemes for HWCs like improvement and preservation of wildlife habitat, infrastructure improvement, etc

2.3.4 Physical resources

The landscape recognition having large-scale discernible natural water zones glaciers, rivers, lakes, and springs and diverse climatic variability, offers unique and complex structure of the target KL India. The Tista River is significant in the landscape recognised as valuable water resource, which contributes in irrigation of downstream population.

3. THE STRATEGY (2015-2035*)*

National Biodiversity Action Plan (NBAP) consists with the ecological, social, cultural and economic mosaic of the country creates a momentum towards biodiversity conservation. In addition, National Wildlife Action Plan (NWAP), 1983 provides an opportunity broadly to establish a network of scientifically protected areas to cover adequate geographical areas, developing appropriate system of management concerning protected areas and restoration of the degraded areas, and providing corridors linking them in a particular area or zone. To meet all the activities within the concurrent strategies are the major concern of the programme.

3.1 Guiding principles

3.1.1 Adaptive strategies

3.6 Implementation Mechanism

Role of the Government of India

Strategies for achieving the conservation and development goals of the landscape should adopt the following considerations:

- Strengthen protected area management systems: development of a standard framework for monitoring, evaluating, and reporting effectiveness of protected areas management at target landscape and transboundary levels vis-a-vis strengthening capacity for enforcement of laws, rules, and regulations; conservation zoning; and biodiversity registration.
- Facilitate systems for the conservation and development in corridors and link protected areas as determined by national priorities for the conservation of biodiversity, and facilitate rehabilitation and restoration of habitats and degraded ecosystems within these conservation corridors.

- Promote sustainable livelihoods by adopting sustainable agriculture and grazing practices, promote improved livestock farming and sustainable pastoralism, promote ecotourism at landscape, national and regional levels, and strengthen marketing strategy for NTFPs and traditional agro products.
- Encourage sustainable use of components of biodiversity including use and management of forests, NTFPs, and grazing lands and water resources, and protect and encourage cultural and traditional practices and values such as ecotourism that are compatible with conservation and sustainable use.
- Develop and facilitate standardisation of policies and dialogues for resource extraction and illegal trade of species and their derivatives, spread of forest fires, and spread of disease and epidemic control.
- Promote conservation linkages towards generating income opportunities particularly for marginalised communities.
- Promote equitable bio-prospecting mechanism and trade in accordance with existing policies in the landscape

3.1.2 Gender and social inclusion

Women of the landscape are the user/custodian of biodiversity and play a critical role in its conservation and management. In the strategic evaluation and interaction of gender and their social inclusion towards sustaining conservation and development approach, the women participation should be an integral part of the adoptive approach in various dimensions as:

- In increasing access to economic opportunities and social services, the gender equitability is an important source, which provides enhancement of social and financial capital of women
- Traditional socio-cultural norms, values, beliefs and institutional practices, and lack of organizational support hinder women to participate meaningfully in forest management and biodiversity conservation programme.
- In biodiversity conservation, the role of women is likely to be important (Dhakal, 2012a, 2012b), however, gender agenda receives low priority in policy level discussions and decision making related to biodiversity conservation. In many policy forums and training/knowledge exchange programme, women's presence is nominal. Therefore, gender sensitization in forest institutions at all levels and engaging men in empowering women in forestry are vital.

- Empowering women in participation and representation in decision making, i) livelihood through skill development, employment and access to services, ii) institutional strengthening and iii) capacity building

3.1.3 Participatory approach

Khangchendzonga Landscape-India has experienced conservation interventions ranging from species preservation to landscape-level conservation. Effective conservation of biodiversity in the target Landscape will involve an integrated conservation and sustainable development approach, which encourages partnerships between the communities and government agencies within the landscape. Priority will be given to community development and the participatory approaches will embrace the following important points:

- Participation of community in real-time field observations under climate change understanding and adaptation mechanism
- Adoption of legislation that recognises indigenous practices and cultural traditions that promotes sustainable use of resources
- Increased access to resources and sharing of resulting benefits by marginalised communities
- Strengthening the skill of the community for sustainable conservation and livelihood
- Evolve the cultural/traditional based management systems like- Dzumsa, Bhasme, Taungya management systems

3.2 Vision

The vision upon the conservation and developmental programme i.e. KLCDI India, is define as *"**The Khangchendzonga landscape represents the biological, social and cultural entity, which is celebrated by the community living in the landscape through equitable access and conservation of natural resources**".*

3.3 Goal

The vision directed to set the goal of conservation and development strategy: ***to achieve the conserve natural and cultural heritage of Khangchendzonga landscape with equitable access and benefits for well being of people with enhanced resilience to climate change through sustainable development.***

3.4 Outcomes

To achieve the formulated goals under the specific vision of the programme, the explicit rout of sub goals encompasses as follows:

1. Natural and agro ecosystem assessed and prioritized
2. Socio-economic status of local communities, with focus on marginal people, improved
3. Effective natural resource management systems are in place and functional
4. Status of trends of ecosystems and human environment understood

3.5 Strategies and key actions

Strategy 1.1: Assess and prioritize ecosystems, ecosystem functions and valuate ecosystem services

Strengthening of knowledge base on ecosystems functions and their services, and availability of baseline data at landscape level is needed on priority bases. On the basis of baseline data, the approach of ecosystem management and conservation will be formulated in effective manner through understanding the ecosystem functions and services.

Actions:

- Information generation on ecosystems, ecosystem functions, ecosystem services
- Analysis and understanding of the linkages
- Identify threats and most vulnerable ecosystems
- Identify and prioritize the measures to minimize the impacts
- Valuation of ecosystem services

Strategy 1.2: Assess biodiversity and agrobiodiversity functions and services through participatory approach

There are strong biodiversity and agro-biodiversity linkages with cultural value in the landscape and there is a need to assess their actual services at different levels. By effective assessment of the biodiversity and agrobiodiversity and their services, the processes will lead to better understanding on conserving the ethno-cultural values of the local communities.

Actions:

- Evolve mechanism for active community participation
- Bio-resources- assessment and scientific validation and ethnobiological evaluation of important bio-cultural resources
- Develop protocols for documentation, characterization, evaluation and conservation of plant genetic resources, traditional knowledge and cultural diversity and their implementation
- Promote diversity of agroforestry systems and other cultivated systems to enhance their functions and services

Strategy 1.3: Strengthen and improve ecosystem management through policy review and multi-stakeholder dialogue

This strategy deals to strengthen the sustainable ecosystem management approach, which will help community to understand the ecosystem services. The strategy will deal to optimize the potential aims for benefit sharing and sustainable use mechanism. To lead the strategy, following priority actions will be undertaken.

Actions:

- Assessment / review of existing policies and identify gaps
- Optimize potential for access and benefit sharing (ABS) mechanisms
- Strengthen linkages between stakeholders and line departments
- Develop sustainable management tools and integrate existing plans and formulate/improve policies
- Implement sustainable conservation and management plans

Strategy 2.1: Diversify livelihood options; enhance on-farm and off-farm productivity

Development of the local communities though diversified sustainable livelihood options go hand in hand with the conservation of natural resources. Promoting and implementing various sustainable livelihood options for the marginalised people will be included in this strategy and priority actions will be undertaken as:

Actions:

- Promote high-value cash crops underutilized/niche products/lesser known crops/land races and production along with MAPs/ NTFPs/ off-season vegetable growing/floriculture

- Assess the grazing status and promotion of stall feedings
- Improve livestock production
- Promotion/improvement/development of Apiculture/Sericulture, value addition/ post-harvest technology, agroproduct marketing/ linkage
- Promotion and improvement of small scale enterprises including cottage industries, tradition-based wood-working/local handicraft

Strategy 2.2: Ensure equitable and fair opportunities for resource use and decision-making

The action will deal to ensure resource use in sustainable manner and strengthen the capacity for equitable use of natural resources through understanding the availability of resources and sustainable use by strengthening coordination between community and line departments. In the current strategy, the priority actions will be undertaken as follows:

Actions:

- Assess resource and knowledge base management (customary laws, modern regulations) and prioritize best practices focusing marginalized communities including tea garden workers
- Strengthen and involve social capital (between/within the communities, organizations etc.) for mutual trust and develop locally available resources

Strategy 2.3: Strengthen market access through value chain approach for agricultural produce (Tea, NTFP, agro-biodiversity, underutilized crops/species)

The landscape is producing various traditional, NTFPs, and other natural bio-resources. Nevertheless, the valuable market chain mechanism is overlooked in the landscape. Strengthening value market chain in the landscape level is required. In this context, the following possible and suitable activities will be carried out.

Actions:

- Inventorize, assess and improve marketable products
- Value chain analyses and economic valuables
- Establish/strengthen service/ marketing centres/ linkages including strengthening cooperatives
- Identify/ promotion of growers' groups

- Exhibition, agro-fairs and agro/seed/food festivals

Strategy 2.4: Promote community-based sustainable and equitable tourism

Tourism has emerged as a potential livelihood option in the landscape. There is a need to enhance sustainable livelihood through ecotourism, which would require capacity building and skill development of the community:

Actions:

- Identify cultural and natural heritage linkages with ecotourism/agro tourism and study on carrying capacity in high tourism footfall areas to determine optimum tourist flows for regulation and management
- Skill development of tourism service providers (youth, communities etc.) and strengthen
- Conservation awareness in tourism sector through sensitization trainings and inclusion in publicity materials and other training modules
- Explore transboundary tourism opportunities for developing Cultural circuits, Great Himalayan Trail, The Silk Route trail, Red Panda/Snow Leopard habitats, Himalayan village Homestay treks, etc.
- Strengthening market linkages, creation and management, familiarization tours and publicity campaigns

Strategy 2.5: Capacity building of stakeholders on recourses conservation and sustainable utilization

For conservation and development of biodiversity, the capacity building process is needed to understand the value added services and its sustainability. The following priority actions will deal the upgrading skills and enriching the related knowledge base of stakeholders towards conservation and development:

Actions:

- Need-based assessment of existing capacity building programmes
- Develop new modalities
- Establish training tools and extension in ToT mode

Strategy 2.6: Gender equality and women empowerment

Gender mainstreaming is a key strategy in promoting gender equality and women's empowerment in the landscape. Realizing this, the inclusive socio-economic growth,

environmentally sustainable growth and regional integration will lead to enhance the livelihood improvement. In the participation of women in various conservation and development initiatives through empowering the skill and education, the activities will focus to ensure and enrich the status of women in the society. Through this strategy, the gender equality will evolve towards sustainable conservation of biodiversity and livelihood improvement by accessibility to opportunities. The major activities will be undertaken as:

Actions:

- Understand the existing social and gender issues in the landscape
- Use the existing and the generated knowledge to educate and campaign for gender equity
- Ensure women involvement in various activities in different groups and cooperatives
- Women empowerment focusing vulnerable society

Strategy 3.1: Strengthen community participation in natural resource management

Community groups are essentially the major players of the natural resource management. For ensuring the community participation in resource management through enriching the knowledge and strengthening the strong linkages between community groups and line departments, the following actions will be undertaken:

Actions:

- Strengthen community participation through inter-institutional networks/organizations (GOs, NGOs, CBOs, BMCs, Himal Rakshaks, Pokhari Sanrakshan Samiti, EDCs, FPCs) including tea garden workers
- Formulate NTFPs extraction guideline, and promote agro- forestry practices in non forest areas
- Revive traditional natural resource management practices- religious/ ethnic lines
- Enrich knowledge-base through exposure of nature interpretation
- Develop plan on community-based natural resources management
- Share and exchange knowledge base

Strategy 3.2: Improvement of knowledge on conservation and management of soil and water resources

Variability in soil and water resources and insufficient capacity to manage that variability lies behind much of the prevailing crisis and food security in the landscape. In addition, soil and water resources are directly influence the biodiversity conservation and management activities. Therefore, it is required to initiate an improved knowledge base on the conservation and management of soil and water resources. The following actions are proposed:

Actions:

- Assess and demonstrate soil and water
- Promote and enhance Traditional and organic farming
- Study on effect of dolomite mining on agriculture and water resources at Dooars region
- Revive traditional water conservation approaches and innovative interventions

Strategy 3.3: Mitigation of human-wildlife conflicts (HWCs)

Human-wildlife conflicts are increasing and need to be managed to minimize negative impacts on biodiversity, human livelihoods, and human well-being. Effective conflict management and long-term conservation benefit will be enhanced by better integration of the underpinning social context with the material impacts and evaluation of the efficacy of alternative conflict management approaches. In view of above, it is important to understand the root cause of HWCs in the landscape and develop the mitigation measures accordingly at various levels in the landscape. The current strategy will lead to deal the mitigation of HWCs by focusing on the following priority actions:

Actions:

- Assess human-wildlife conflicts including feral populations for specific areas with consideration of root causes of the menace
- Develop/ implement mitigation in prioritized HWCs through inter-country consultations/ cooperation
- Studies on population estimation and to correlate wildlife and its habitats
- Wildlife-specific capacity building in monitoring wildlife movements, etc. and promote community-based volunteer groups for HWCs management
- Strengthen wildlife corridors/habitats and connectivity of tea plantations

Strategy 3.4: Curbing illegal trade in wildlife produce [animal and plant origin]

At transboundary and even landscape level, various illegal trades of wildlife products are the major issues. To deal/curb the issues, the actions under the current strategy will assess illegal trades, which will provide the valuable inferences. Possible inferences would be helpful directly or indirectly to mitigate these issues through strengthening the governance systems.

Actions:

- Assess illegal collection and trade and strengthening information network
- Improve and deal governance issues
- Correlate, mitigate and regulate the issue
- Formulation of action plan

Strategy 3.5: Improved access and benefit sharing (ABS) through mechanism like National Biological Diversity Act

The several existing policies are placed in the target landscape, however, the fragmented landscape nature needs appropriated mechanism for sustainable access and benefit sharing of natural resources. The priority actions will undertake the policy reviews and analysis. Sharing profitable objectives among stakeholders and develop community-base resource management mechanism would be important.

Actions:

- Establish/strengthen mechanism for inter-institutional coordination
- Partnership building among local community groups
- Awareness generation among community through inter-institutional network
- Develop community base biological resource management mechanism

Strategy 4.1: Monitoring mechanisms established in key sites, through participatory approach

Climate change issue is observed all across the globe and the target landscape is not able to project climate change consequences due to lack of long-time series data. To strengthen the adoption of climate change, it is pertinent to have long-term series of data. Realizing these, participation of community in real-time field observation based mechanism will be a strong component, which will deal awareness and temporal and spatial data gathering as well.

Actions:

- Establish monitoring mechanism on physical, biological and social areas functional at landscape, ecosystem, village and plot level ensuring community participation-*real-time field observations*
- Develop monitoring mechanism tools- *formulate monitoring protocol /modules*
- Strengthen community as ToT and establish network of Resource Persons
- Ensure uninterrupted data flow *at temporal and spatial data scale*
- Generate Climate Change detection models and strengthen understanding short term coping responses
- Ensure uninterrupted data flow *at temporal and spatial data scale*
- Framework/ pursue best practices to avoid climate change impacts, and adaptation
- Strengthen knowledge sharing and dissemination systems and prioritize climate change adaptation and mitigation measures

Strategy 4.2: Long-term monitoring of biodiversity, ecosystems and climate change

To understand the climate change impact and anthropogenic pressure, long-time comprehensive and coherent biodiversity, ecosystem and climate data is required at preliminary level. That will be helpful to fostering long-term planning for sustainable conservation and development of biodiversity and adaptation approaches. Under the strategy, the following priority actions will be taken:

Actions:

- Monitor sensitive/keystone/flagship species: *Plant*-phenology/animal movements, etc
- Understand interaction between plant and animals e.g. *pollination, dispersal and regeneration*
- Monitor important ecosystems and key habitats *e.g. community composition and dynamism, etc*
- Correlate biodiversity, ecosystem and climate change: *generating modelling*
- Assess climate change consequences through community and traditional management systems
- Strengthen mitigation and adaptation tools

- Improve understanding climate change vulnerability *(i.e. exposure, sensitivity and response capacity)*

Strategy 4.3: Long-term monitoring of socio-economic, socio-ecological and socio-cultural changes at local and transboundary levels

To understand the socio-economic changes across the years, long term monitoring mechanism is needed, which will attempt to estimate the changing demographics, economic and resource management processes. Also, long-term monitoring process will provide large amount of data gathering at temporal and spatial level that will help project for understanding the future consequences and strengthening and understanding adaptation methodologies.

Actions:

- Assess demography, socio-economy and resource management
- Gain perspectives of indigenous people on socio-economic, socio-ecological and socio-cultural changes
- Increase indigenous people participation in climate change dialogues
- Monitor resource use changes and assess impact of large infrastructure/hydropower projects
- Establish socio-economic impact models and overlap with global scenario
- Enhance adaptive capacity in sustaining food/ health aspect ensuring increasing socio-economic level

The Ministry of Environment, Forests and Climate Change (MoEFCC), Government of India, will be the focal ministry and establish coordination and support with other national level ministries, etc. For the KL India, GBPIHED, a potential nodal institute will lead the programme under the guidance of MoEFCC, GoI. The state level governments of Sikkim and west Bengal will coordinate and supporte the programme at their region.

Role of the States' Government

State level departments, viz. Directorate of Forest, Govt of West Bengal and Forests, Environment and Wildlife Management Department (FEWMD), Govt. of Sikkim will participate for implementing the programme activities as potential partners of the KLCDI-India. Apart from these, there is several landscape level research and educational

organizations are actively engaged in the conservation and management of natural resources and livelihood improvement.

Role of Non-Governmental Organizations (NGOs) and other organizations

NGOs, the private sector and other agencies will also be important in this endeavor. Among these, NGOs and other organizations are actively participating in various conservation and developmental themes in the landscape with diverse expertise. These groups of organizations can become important players in the development of the district in future, given the opportunity. The local private sector will continue to play an important role in local tourism as well. NGOs and the private sectors need to diversify and be involved in other developmental activities as well.

Village development committees (VDCs) and the municipality

The main role of VDCs and the municipality is to strengthen, coordinate, and consolidate local-level needs, demands, and requirements. Besides, their additional responsibility includes the identification and development of critical social and physical infrastructure that may be needed at the local level. Many of the functions at this level have been identified in the Local Self-Governance Act, 1999. This level of government should be a major voice that advocates for the local needs of residents and garners support from different organizations at higher levels.

District-level government, including line agencies

There is a major role for the district-level governments and district line agencies as a part of their regular responsibilities. All organs of the district level management must play a critical role in the successful implementation of the conservation plan.

Role of Community groups-

The KL-India has a potential to have large amount of community groups like Himal Rakshak, Pokhari Sankrakshan Samiti, JFMCs, BMCs, SHGs, etc. These groups are actively engaged in the conservation and development activities at various levels.

4. MONITORING AND EVALUATION

4.1 Scope and purpose

While considering the scope of Monitoring and Evaluation Mechanism (MEM), it would be applicable to refer to the long-term goals of the proposed Conservation and development Strategy. The MEM give emphasis for i) ensuring the concurrent focus on vision of the programme with dealing conservation and development issues in the target landscape and ii) proper implementation of the priority actions with appropriate methodology and

long-term sustainability. Besides, the scope of MEM would span from understanding the on-going processes, which evaluate the implementation of priority actions through proper supervision and review.

4.2 Monitoring mechanism (MM)

While the institutional mechanism, as depicted above, will govern the monitoring mechanism, broadly, the following points are underlined for better governance procedures:

- The local community groups will monitor the success of implementation.
- The KL-India team of organizations will play key role, largely as a facilitator for in-word and out-word flow of resources and information as well as a Technical Resource Group for smooth conduct of research, monitoring and evaluation. This group would monitor progress of participation at community level, effectiveness of benefit sharing, and successful ground level implementation of various programmes and projects. In addition, the team would play a key role in evaluating ecological, economic and socio-cultural suitability of programmes and projects. Synchronization of KL activities with ongoing and proposed in-house/externally funded R&D programmes of these organizations has been proposed as a base for developing KL initiative.

The Monitoring Mechanism Committee will be formed under the project, which will govern by the experts of the subjects and representatives from different groups under the guidelines of the Institute. The major area under monitoring includes i) climate (ii) biodiversity (assessment of forest cove, assessment of habitat, assessment of indicator species) (iii) socio-economic (demographic, economic and social).

4.3 Evaluation mechanism (EM)

For proper implementation of the programme, it is an important need to undertake the evaluation process of the activities. This will guide in proper direction of the goal of the programme and further improvement. Keeping in view of above, the evaluation mechanism will be form at the landscape level and employed the carry out the evaluation. The evaluation mechanism will include the assessment of the best outputs and show the way to achieve the outcomes with logical manners. The experts and experienced forces will be a part of the evaluation committee for the landscape. Eventually, evaluation mechanism will evaluate the results and their significance with the ultimate goal of the programme. The evaluation the programme activities under taken will be reviewed at regular intervals.

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