

## Participatory conservation planning in Kangchenjunga transboundary biodiversity conservation landscape

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**Abstract:** Conservation planning in the Eastern Himalaya has taken strides forward during the past one decade. This particularly refers to cooperation for biodiversity conservation and sustainable development for the transboundary conservation landscapes. International Centre for Integrated Mountain Development has been facilitating discussion amongst stakeholders including government officials from India, Nepal, China and Bhutan for regional cooperation on transboundary biodiversity conservation. Kangchenjunga complex has been identified as an important transboundary landscape in the Eastern Himalaya. Geographically, it spreads over the natural and national boundaries of Nepal, India, Bhutan and Tibetan Autonomous Region of China. In its southern half there are 14 important protected areas within the landscape and also remnant areas with high biological diversity. Landscape conservation for connecting nine of the 14 protected areas by establishing biological corridors has been promoted. Participatory processes revealed that the transboundary biodiversity conservation is a necessity in the present straddling conservation and sustainable development arena. Kangchenjunga transboundary biodiversity conservation landscape initiative is enhancing regional cooperation for conservation in the landscape. This paper highlights the paradigm shift in conservation while analyzing landscape heterogeneity, conservation corridor linkages and their potentials, and socio-cultural and economic opportunities in the Kangchenjunga landscape.

**Resumen:** La planeación para la conservación en los Himalaya orientales avanzó mucho durante la década pasada. En particular esto se refiere a la cooperación para la conservación de la biodiversidad y el desarrollo sustentable de los paisajes de conservación transfronteriza. El Centro Internacional para el Desarrollo Integral de las Montañas ha facilitado la discusión entre los actores sociales, incluyendo a oficiales de los gobiernos de India, Nepal, China y Bhután para la cooperación regional en la conservación transfronteriza de la biodiversidad. El complejo Kangchenjunga ha sido identificado como un importante paisaje transfronterizo en los Himalaya orientales. Geográficamente se extiende a través de los límites naturales y nacionales de Nepal, India, Bhután y la Región Autónoma de Tibet en China. En su mitad sureña hay cuatro áreas protegidas importantes dentro del paisaje y también áreas remanentes con una diversidad biológica alta. Se ha promovido la conservación del paisaje para conectar nueve de las 14 áreas protegidas por medio del establecimiento de corredores biológicos. Los procesos participativos mostraron que la conservación transfronteriza de la biodiversidad es una necesidad en la arena actual de conservación y desarrollo sustentable. La iniciativa del paisaje Kangchenjunga de conservación transfronteriza de la biodiversidad está incrementando la cooperación regional para la conservación en el paisaje. Este artículo llama la atención sobre el cambio de paradigma en la conservación a la vez que analiza la heterogeneidad del paisaje,

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las conexiones entre los corredores de conservación y sus potenciales, así como las oportunidades socio-culturales y económicas en el paisaje Kangchenjunga.

**Resumo:** O planeamento da conservação nos Himalaias orientais teve avanços significativos durante a última década. Isto refere-se particularmente à cooperação para a conservação da biodiversidade e o desenvolvimento sustentável para a conservação transfronteiriça das paisagens de conservação. O Centro Internacional para o Desenvolvimento Integral das Montanhas tem vindo a facilitar a discussão entre os actores sociais, incluindo os representantes dos governos da Índia, do Nepal, da China, e do Butão para a cooperação regional na conservação da biodiversidade transfronteiriça. O complexo de Kangchenjunga foi identificado como uma importante paisagem transfronteiriça nos Himalaias orientais. Geograficamente ele estende-se através dos limites naturais e nacionais do Nepal, Índia, Butão e a região autónoma do Tibete, na China. Na sua metade sul há 14 áreas protegidas importantes dentro da paisagem e também áreas remanescentes com diversidade ecológica elevada. Para a conexão das 14 áreas protegidas foi promovido o estabelecimento de corredores biológicos. Os processos participativos mostraram que a conservação transfronteiriça da biodiversidade é uma necessidade na situação actual de conservação e desenvolvimento sustentável. A iniciativa de conservação da biodiversidade da paisagem transfronteiriça de Kangchenjunga está a reforçar a cooperação regional para a conservação da paisagem. Este artigo chama a atenção sobre a mudança de paradigma na conservação, uma vez que analisa a heterogeneidade da paisagem, as ligações entre os corredores de conservação e os seus potenciais, assim como as oportunidades sócio-culturais e económicas na paisagem de Kangchenjunga.

**Key words:** Conservation corridors, participatory approaches, protected areas, regional cooperation, transboundary landscapes.

## Introduction

Idea of landscape approach to support consistent and integrated management strategies for biodiversity conservation is gaining impetus in the Himalayas (Chettri & Sharma 2006; Gurung *et al.* 2006; Sharma & Chettri 2005; Sherpa *et al.* 2004). Efforts are being made to conserve biodiversity across the political boundaries with transboundary landscape approach (Chettri *et al.* 2007; Sherpa *et al.* 2003). It is realised that the effective biodiversity conservation can be achieved by incorporating conservation in both private and public lands in an integrated regional approach (Rastogi *et al.* 1997; WWF & ICIMOD 2001).

Protected areas (PAs) are essential for conserving biodiversity but they are often smaller than the required habitat of many keystone species and are scattered as 'conservation islands'. The conservation value of such PAs could be significantly enhanced when environmentally

managed corridors link them (Bennett 2003; Sanderson *et al.* 2003). In addition to linking existing pieces of remnant vegetation and provide wildlife movement, 'corridors' can also reduce soil and water degradation, provide a source of timber, provide shelter for livestock, and contribute to recreational activities and tourism (Chettri & Sharma 2006; Sharma *et al.* 2006). Such initiatives with a landscape approach in the mountains could be instrumental in transboundary landscapes where twin objectives of conservation and livelihoods may be addressed (Hamilton 1997).

There are evidences from Mt Everest Ecosystem (Sherpa *et al.* 2003), Kangchenjunga complex (Chettri & Sharma 2006) and B2C2-Bhutan Biological Conservation Complex (Sherpa *et al.* 2004) where collaboration and community participation have made substantial contribution in conservation planning for sustainable resources use. International Centre for Integrated Mountain Development (ICIMOD) by virtue of its mandate for the Hindu Kush-Himalayas (HKH) is working

in collaboration with the regional member countries. It is facilitating regional perspectives for achieving the common goals of effective biodiversity conservation. This paper deals with participatory processes and advances made in establishing conservation corridors between the existing protected areas of the Kangchenjunga transboundary biodiversity conservation landscape (KTBCL) in the Eastern Himalayas.

### *What we mean by transboundary conservation landscapes and why they matter?*

Dating back to the establishment of the conservation history, places of high aesthetic quality with a characteristic of being "wild" or "natural", were placed into zones of protection. These areas through time have remained a historical remnant of the landscape while the surrounding environment, outside of the boundaries of protection, has been subject to the effects of use and change. Human induced modifications such as fuelwood extraction, overgrazing and recreational activities (to name just a few) are rapidly altering the biodiversity in the Himalayas (Chettri *et al.* 2002; Jain *et al.* 2000; Singh *et al.* 2003). These alterations of the environment are making the Himalayan landscapes more hospitable to environmental change leading to further loss of endemic flora and fauna (Ives *et al.* 1997). While this was (and still is) occurring, the area that was designated as place of special protection in the form of protected areas became more like what are known as "conservation islands". Over the past ten years a number of researches discussed on how to achieve a biologically diverse and sustainable natural environment outside of these isolated islands (Gurung *et al.* 2006; Rastogi *et al.* 1997; Sharma & Chettri 2005; Yonzon *et al.* 2000). Landscape ecologists, geographers and wildlife biologists alike were frequently asking the same questions on how to protect maximum species diversity in areas beyond the protected wilderness. The responses ranged, but often a similar answer was found to be: protection for the species at the top of the food chain, such as a snow leopard (*Uncia uncia*) or tiger (*Panthera tigris*), and if they can sustain themselves, then other species down the food chain could also be managed. However, the present protected areas are scattered and distant without natural connectivity among them. Paths of

migration in between such isolated zones of management could become a corridor if there is compatible habitat for animal movement (Burel & Boudry 2005; Haddad & Baum 1999; Haddad *et al.* 2003). In addition large mammals, flora and other fauna could more easily pass genetic material along an area that is somewhat contiguous than one that has been fragmented and parceled up, thus contributing to increased or sustained biodiversity (D'Eon *et al.* 2002; Dixon *et al.* 2006; Fuller *et al.* 2006; Shepherd & Whittington 2006). It is from these tenets of thought that the notion of biological corridors and formations of KTBCL came about.

### *Rationale for conservation planning in the Kangchenjunga complex*

The KTBCL is one of the richest landscapes shared by Nepal, Bhutan, India and China (WWF & ICIMOD 2001; Yonzon *et al.* 2000) which forms a part of the Himalayan 'Biodiversity Hotspots', one of the 34 global Biodiversity Hotspots (Mittermeier *et al.* 2004). Conservation initiatives in the past were often ecologically oriented while ignoring the social considerations and overlooking the reconciliation of conservation with human needs. Conservation does not mean non-use but wise use of biodiversity, which contributes to sustainable development. This has been reflected in Chapter 13 of Agenda 21 with a phrase "Managing Fragile Ecosystems: Sustainable Mountain Development". However, the mechanism on how to achieve this goal was not clearly defined and poorly practiced. There is a great need to find means to balance between biodiversity conservation and human development, which will determine the sustainability and conservation of biodiversity. It is realised that the existing parks and protected areas are just as islands in conservation measures and needs boarder areas addressing human dimensions with an ecosystem/landscape approach (Secretariat of the CBD 2004). This is because the environmental goods and services provided by landscapes and the human dependency on these services do not recognise political boundaries. They are more guided by ecological, socio-cultural and socio-economic parameters (Chettri & Sharma 2006). Therefore, to bring resilience among the living beings, conservation initiations at a landscape

become vital for common interests of the countries sharing such landscapes.

In order to comply to the global commitments on Convention on Biological Diversity (CBD), India has already brought Kangchenjunga area under a protected area network by managing it as Kangchenjunga Biosphere Reserve in Sikkim, Singhalila National Park, Neora Valley National Park, Senchal Wildlife Sanctuary and Mahananda Wildlife Sanctuary as protected areas within Darjeeling Gorkha Hill Council. Adjacent to these, Kangchenjunga Conservation Area is an important part of the protected area network in Nepal. Some parts of western Bhutan also fall in the wider Kangchenjunga landscape covering Toorsa Strict Nature Reserve, which is connected with natural corridor to Jigme Dorji National Park (Sharma & Chettri 2005). However, most of the efforts for biodiversity conservation in this landscape have focused primarily on protected areas and reserves. There are 14 protected areas ranging from as small as 0.4 sq km to 2620 sq km and are scattered as 'islands' in the landscape (Table 1). The corridors between the protected areas, that are necessary for connectivity within wider existing habitats for flagship species such as tigers, elephants (*Elephas maxima*), red panda (*Ailurus fulgens*), takin (*Budorcas taxicolor*), musk deer (*Moschus chrysogaster*), and the elusive snow leopard are practically non-existent. It was

realised that the existing parks and protected areas 'cannot exist in isolation as islands' neither within countries nor across national borders if conservation objectives for these 'flagship' and 'threatened' species are not broadened at landscape level. Connecting these protected areas with conservation corridors and addressing conservation measures at a landscape level is needed to have a vertical (altitudinal) and horizontal coverage of habitats. With this realization the concept of conservation corridor was conceptualized and implemented as an effort to minimize future problems associated with island biogeography. So called 'islands' are created when distinct areas are placed into a conservation plan while the surrounding 'matrix' is subject to the deleterious effects of the human induced pressures of 'no' management. In order to meet such challenges a conservation corridor and landscape development process was initiated to connect individual protected areas across the shared landscape in Kangchenjunga.

### The strategic process

Over the past one decade, ICIMOD has been instrumental in developing consensus among the various stakeholders through consultations, participatory research and planning for advocating transboundary landscape and development of

**Table 1.** Protected areas in the Kangchenjunga landscape

Protected Area	Location	Area (sq km)
Kangchenjunga Conservation Area (KCA)	Taplejung, Nepal	2,035
Khangchendzonga Biosphere Reserve (KBR)	Sikkim, India	2,620
Barsey Rhododendron Sanctuary (BRS)	Sikkim, India	104
Fambong Lho Wildlife Sanctuary	Sikkim, India	52
Kyongnosla Alpine Sanctuary	Sikkim, India	31
Mainam Wildlife Sanctuary (MWS)	Sikkim, India	35
Singhba Rhododendron Sanctuary (SRS)	Sikkim, India	43
Pangolakha Wildlife Sanctuary	Sikkim, India	128
Jore Pokhari Salamander Sanctuary	Darjeeling, India	0.40
Singhalila National Park (SNP)	Darjeeling, India	79
Senchal Wildlife Sanctuary (SWS)	Darjeeling, India	39
Mahananda Wildlife Sanctuary (MaWS)	Darjeeling, India	127
Neora Valley National Park (NVNP)	Darjeeling, India	88
Toorsa Strict Nature Reserve (TSNR)	Bhutan	651
Total		6032

conservation corridors. Such a process have been tried in the southern half of the Kangchenjunga landscape covering parts of eastern Nepal, Darjeeling and Sikkim of India and western Bhutan (Rastogi *et al.* 1997; WWF & ICIMOD 2001). The initiative was inspired by the decision from Conference of Parties to CBD that recommended 'Ecosystem Approach' in biodiversity conservation. It was also guided by conservation corridor development manual developed by Conservation International (Sanderson *et al.* 2003). As a guiding principle ICIMOD followed strategic criteria in identifying key transboundary complexes such as Kangchenjunga and developed the process framework to achieve transboundary cooperation in the mountain biodiversity programme elements of the CBD. A number of methodologies such as consultations, participatory tools and approaches, action research for baseline information and gap analysis, Geographical Information System (GIS) and Remote Sensing (RS) tools were applied for corridor planning (Fig. 1).

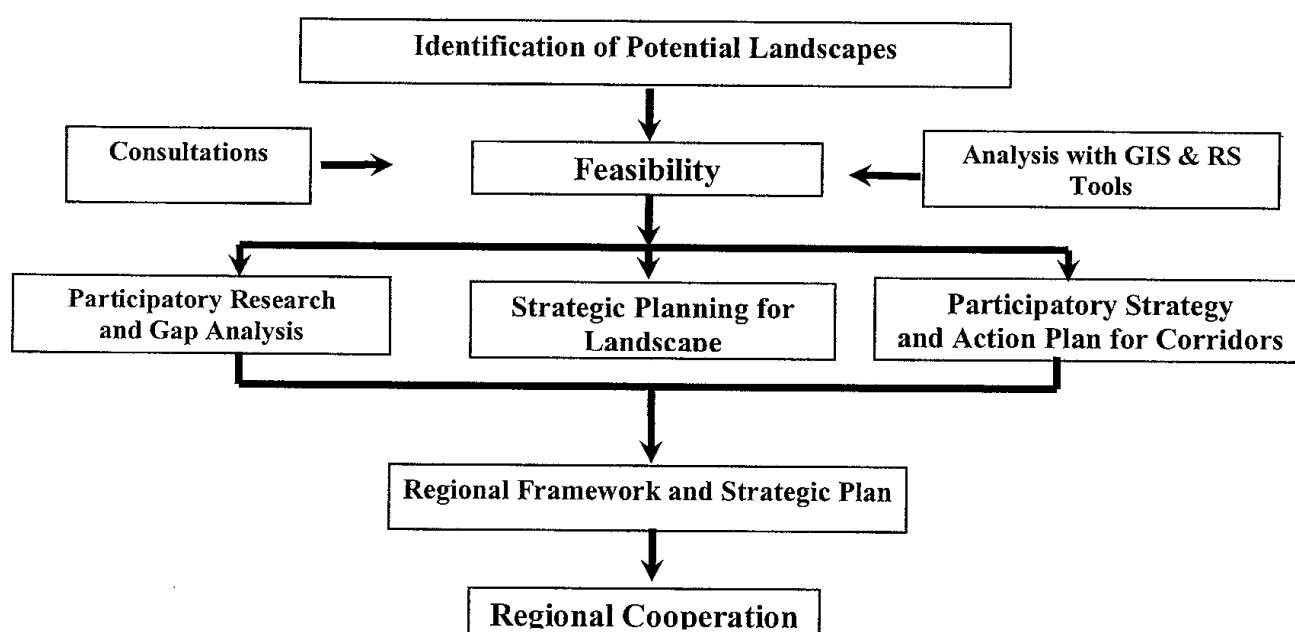
## Results

The KTBCL extends between 87°40'09.6" to 89°19'31.3" north latitude and 27°35'35.4" to 27°48'24.8" east longitude covering an area of

14,432 sq km from eastern Nepal through the Kangchenjunga region in Sikkim and Darjeeling in India to Toorsa Strict Nature Reserve in western Bhutan. During the last five years of extensive research and consultations, the initiative identified potential conservation corridors, local and transboundary conservation and development issues. It further developed strategies for landscape planning addressing social, economic and political perspectives of developing corridors in the landscape (Chettri *et al.* 2007; Sharma & Chettri 2005). Key outputs, elements of conservation corridors and the landscape planning results are presented in the following sections.

### *Conservation corridors: the potential linkages*

Embedded within the landscape are 14 protected areas—one in Nepal, twelve in India (Sikkim and Darjeeling) and one in western Bhutan that connects Jigme Dorji National Park—cover over 6028 km<sup>2</sup> of natural ecosystems (Table 1). The landscape has a contiguous link to two important conservation landscapes, the B2C2 that has the natural connectivity through the Toorsa Strict Nature Reserve to the protected area systems of the Kingdom of Bhutan and towards west it is a part of the Sacred Himalayan Landscape of Nepal. The participatory research and feasibility assessment identified six potential



**Fig. 1.** Strategic planning framework for developing KTBCL and the corridors.

conservation corridors<sup>1</sup> for re-establishing natural connectivity between the existing protected areas in the KTBCL (Fig. 2). They are (i) the buffer area on the Nepal side to Kangchenjunga Biosphere Reserve, Barsey Rhododendron Sanctuary and Singhalila National Park of India, (ii) the corridor between Singhalila National Park and Sanchel Wildlife Sanctuary in India, (iii) the corridor between Sanchel Wildlife Sanctuary and Mahananda Wildlife Sanctuary in India, (iv) the corridor between Mahananda Wildlife Sanctuary and Neora Valley National Park in India, (v) the corridor between Neora Valley National Park in India to Toorsa Strict Nature Reserve and (vi) the corridor that links Toorsa Strict Nature Reserve with Jigme Dorji National Park in Bhutan. These corridors were identified with an intertwined objective of biodiversity conservation and socio-economic development. They were delineated based on local knowledge, and GIS and RS tools considering presence of natural or semi-natural forests that are used and suitable for habitat for species found in the adjacent protected areas. These potential corridors connect the existing protected areas with north-south and east-west linkages with natural or semi-natural forests (Fig. 2).

### *Landscape heterogeneity*

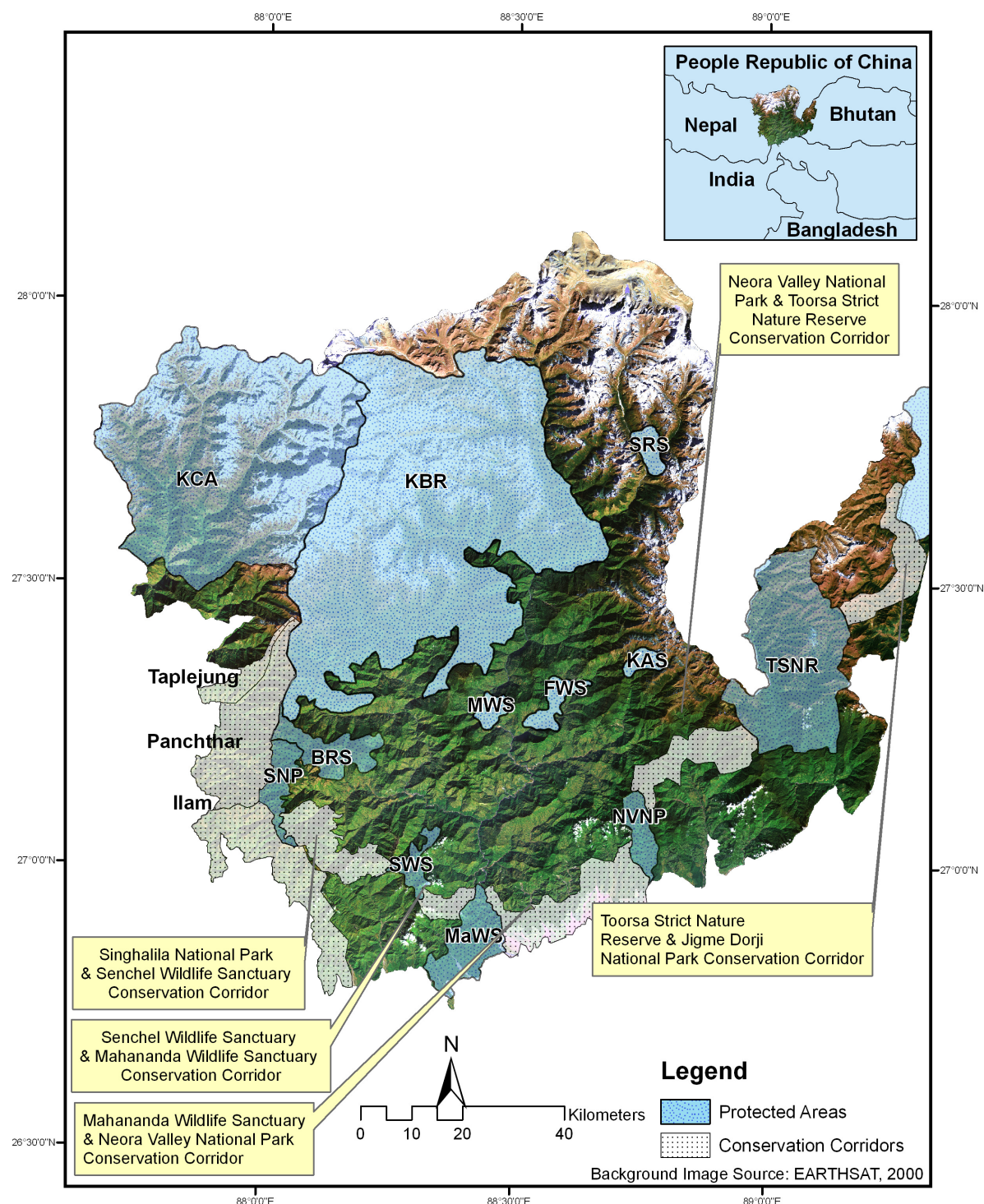
The criteria for corridor identification were based on the 'compatible land' found in the area. Initially, the participatory research through local knowledge arising from farmers, conservationist, and civil societies revealed adequate compatible land available for developing forested corridors in the landscape. Our analysis revealed that about 42% of the proposed landscape is covered with protected areas and 11% of the land was proposed as conservation corridors (Table 2). However, the forests are of diverse type mainly with reference to tenure and land rights. This diversity was mainly due to the land use practices and the socio-political

differences amongst the three countries sharing the landscape. It was noticed that the proposed corridor in Nepal is mainly dominated by private forests and agroforestry systems, while the corridors in India and Bhutan are mainly covered by reserve forest under government ownership. In general, majority of the identified areas across the corridors are covered forests including community forests, agricultural land, pasture and reserve forests. The land use cover analysis revealed that the proposed corridors have a substantial proportion (67%) of the area under natural forests (Table 3). These natural forests have shown contiguous forest patches that connect tropical to alpine zones. It was also observed that there is a high potential for connecting the existing protected areas in the KTBCL. The data revealed that the proposed corridors have 24% area under cultivated and managed land use systems. Major forms of the cultivated land use are tea gardens, agriculture, broom grass fields and large cardamom agroforestry.

### *Socio-cultural and economic opportunities*

The societal integrity of the different ethnic groups in natural resources management is strong in the KTBCL. The local communities have long standing traditions of conservation and restrained resource use guided by conservation ethics, customary laws and traditional rights. Many of the mountains such as Everest, Kangchenjunga and Zhumolari are sacred to the local people. The local people are the custodians and managers of considerable forested lands in the landscape. They are also instrumental in conserving biodiversity, both inside and outside the protected areas. The traditional natural resources management systems such as *Kipat* among the Limbus of Nepal, *Dzumsa* among Lachungpas and *Na Zong Nyo* among Lepchas of Sikkim and *Sok Singh* among the Bhutanese are some of the effective traditional conservation practices in favour of resilience and sustainability of resources. These practices also transferred indigenous knowledge and conservation ethics from one generation to another. Examples show that conservation is culturally enforced by many indigenous groups in the landscape. However, in recent years these practices are found to be fading slowly. There is a great opportunity to revitalize such practices that might regain the cultural values and contribute to conservation goals.

<sup>1</sup> Conservation corridors interconnect protected areas and other relevant territories surrounding them. Human activities are promoted in these areas on sustainable development basis; that is, activities are undertaken that do not endanger the rich natural resources contained therein and which benefits both nations in general and communities in particular. Conservation corridors are thus a flexible planning tool that interconnects protected areas through combination of land use strategy.



**Fig. 2.** Map showing the protected areas and the potential corridors of the Kangchenjunga landscape. KCA – Kangchenjunga Conservation Area, Nepal; KBR – Khangchendzonga Biosphere Reserve, BRS – Barsey Rhododendron Sanctuary, FWS – Fambong Lho Wildlife Sanctuary, SRS – Singbha Rhododendron Sanctuary, MWS – Mainam Wildlife Sanctuary, KAS – Kyongnosla Alpine Sanctuary, Sikkim, India; SNP – Singhalila National Park, SWS – Sanchel Wildlife Sanctuary, MaWS – Mahananda Wildlife Sanctuary, NVNP – Neora Valley National Park, Darjeeling, India; and TSNR – Toorsa Strict Nature Reserve, Bhutan



**Table 2.** Areas of the existing protected areas and proposed corridors in the KTBCL

Protected areas & corridors	Countries	Area (sq km)	Percentage of the total landscape
Protected areas	Nepal	2035	14.1
	India (Sikkim & Darjeeling)	3342	23.2
	Bhutan	651	4.5
Conservation corridor 1	Taplejung, Panchther & Ilam (Nepal)	752	5.2
Conservation corridor 2	Singhalila National Park – Senchel Wildlife Sanctuary Conservation Corridor (Darjeeling, India)	158	1.1
Conservation corridor 3	Senchel Wildlife Sanctuary –Mahananda Wildlife Sanctuary Conservation Corridor (Darjeeling, India)	45	0.3
Conservation corridor 4	Mahananda Wildlife Sanctuary – Neora Valley National Park Conservation Corridor (Darjeeling, India)	292	2.0
Conservation corridor 5	Neora Valley National Park – Toorsa Strict Nature Reserve	169	1.2
Conservation corridor 6	Toorsa Strict Nature Reserve – Jigme Dorji National Park Conservation Corridor (Western, Bhutan)	152	1.1

**Table 3.** Major land use types of the proposed corridors in the KTBCL

Major land use types	Dominant landuse	Area (sq km)	Percentage of the proposed corridor
Cultivated and Managed, and Terrestrial Areas	Tea gardens; Broom grass field; Cinchona plantation; Large cardamom; Agriculture land	376	24
Natural and Semi-Natural, and Terrestrial Vegetation	Tropical forest; Temperate forest; Shrub land; Alpine meadow	1051	67
Artificial Surfaces and Associated Areas	Settlements	19	1.5
Bare Areas	Degraded and un-utilized areas	110	7
Natural Water bodies, and Snow and Ice	Lakes and rivers; Snow and ice	8	0.5

Created by interactions of living organisms with their environment, ecosystem services support the inhabitants of the landscape by providing clean air and water, decomposing waste, pollinating flowers, regulating climate and supplying a host of other benefits. The water towers and the cascading streams, diverse forest types and agro-ecological practices within the landscape play an important role in hydrological processes, nutrient dynamics and economic development in the region. While delineating conservation corridors it was realized that human livelihoods are critical components in the conservation paradigm. The majority of the people living in remote border areas are economically vulnerable. The livelihood of most of these people revolves around agriculture and forest resources.

For instance agriculture accounts for about 39 percent of gross domestic product in Nepal and provides employment to more than 80 percent of the labour force. The cultivable land area in Nepal alone is estimated to be about 18 percent of the total land area of the landscape. However, only 5% of these productive lands are used for agriculture, which is to a large extent for subsistence, and the rest 13% has been converted to cardamom, tea plantations and other land use types.

The integration of community development for conservation goals is important in this landscape. Being located in remote areas, many of the livelihood options are beyond the reach of the local people. Challenges such as lack of modern technologies, market information for agricultural and non-agricultural products, and motivations to



try more profitable economic activities are evident. The communities have to struggle to market their products mainly due to lack of transport facilities or limited information on market opportunities. In many instances economic development is facing crises simply due to lack of human resources and institutional support. Coordination between development organizations, government agencies and social institutions, and appropriate policies for cross-border trade were found to be bottlenecks in the overall development of the landscape.

### *Strategic direction and paradigm shift*

Unprecedented loss of biodiversity during the past one century all over the world has raised global concern. Poverty stands as one of the many causes of the biodiversity loss contributed by mountain specificities such as vulnerability, inaccessibility, low productivity and marginality. Reconciling the need to protect biodiversity with equally strong – some would argue even stronger – need to promote social and economic growth, particularly in the developing world, has therefore, become one of the biggest challenges of the recent times. Hence, in 1992, the Rio Convention on Biological Diversity (CBD) has set three fold objectives of (i) the conservation of biological diversity, (ii) the sustainable use of its components and (iii) the fair and equitable sharing of the benefits arising out of the utilization of genetic resources. This commitment made by the Parties, in which all the eight Hindu Kush Himalayan (HKH) countries are member, enfolded a wider picture to the global public about the significance of natural richness and the imminent threat faced by the HKH.

In this advancing scenario, the protected areas in HKH also have grown significantly over the past 25 years. There are now 488 protected areas across the HKH. Biodiversity, a term once solely considered by scientists, has moved to center stage of local, national, regional and global environmental debates. Our own experience of working in the KTBCL has shown that the stakeholders' environmental consciousness grew dramatically from protectionist's approach of conservation to 'people inclusive' with varied degree of understanding towards global climate changes, urbanization, population explosion, poverty and pollution as conservation threats. People began to realize why it was necessary to

view biodiversity conservation from still wider perspectives of environment including social, cultural, economic and political concerns. Conservation communities at large are now thinking to develop a strong link between conservation and development which otherwise were the two odd agendas thought to be often contradictory.

The KTBCL having a guiding strategic criteria experienced conservation interventions ranging from species preservation to landscape-level conservation. The outcome of this initiative has already reached to a policy framework for cooperation that emphasizes on (i) scientific and technical cooperation, (ii) information exchange and sharing, and (iii) regional guidelines and soft legal instruments. The framework also recommends strategies and activities that address conservation in a regional perspective (Sharma *et al.* 2007).

Conservation planners have accepted the concept and are actively participating in the process of landscape development. Now, they are cautiously using participatory approach in conservation activities. Results are encouraging because the landscape approach adopted the principle of sustainability (wise use of its elements), equitability (fair and equitable sharing of benefits), participatory management (ensuring participation of local, indigenous, disadvantaged and marginalized communities) and partnerships building (linking stakeholders at all levels). Thus, concept and understanding the role of conservation corridors, transboundary cooperation for effective conservation across the politically divided contiguous habitats and need of regional perspectives in conservation at the landscape level is emerging (Table 4). These changes in the perspective of conservation thinking could be an important milestone in arriving to the global conservation goals.

## **Discussion**

Habitat fragmentation evidentially accelerates species extinction as also witnessed by the KTBCL during the past century. The KTBCL faced fragmentation by establishment of tea industry as driven by international market forces. It is true that the protection of landscape features and biodiversity rests on the creation of networks of

**Table 4.** Paradigm shift in conservation understandings.

Conventional Understanding	Emerging Understanding
Protected areas as conservation units	Landscape as conservation units
Protected areas managed as islands, ignoring biodiversity values outside the protected areas	Managed as elements of the landscape, Protected areas connected by conservation corridors, valuing biodiversity outside protected areas.
Protectionist approach - local communities' rights ignored	Sustainable use approach respecting communities' rights
Managed reactively, with stringent rules and legal obligations	Managed adaptively through a participatory process
Local communities considered as threats to conservation	Local communities seen as means of conservation
Established in a technocratic way	Established through a participatory process supported by a political act
Managed by natural scientists or conservation authorities	Managed by multi-stakeholders or multidisciplinary team in an integrated approach
Ownership lies with the central government	Ownership lies with diverse partners, including different tiers of government, local communities, indigenous groups, the private sector, NGOs and others
Sustained by tax payers	Paid from many sources and self-sustaining
Benefits of conservation assumed as self-evident	Benefits of conservation evaluated and quantified
Viewed as national assets	Viewed as community heritage as well as national assets

protected areas (parks and reserves) and as well as on the environmental conditions of the outer unprotected areas (Bennett 2003). However, not many efforts were made in this direction in the past. The importance of the outer unprotected corridors for long term population viability and genetic movement were often neglected or poorly understood. ICIMOD's concept of establishing transboundary protected areas with corridors is widely recognized as being critical to nature and landscape conservation (Sharma *et al.* 2007). In conservation, many of the experimental models have shown that the corridors are important for three main reasons: (i) the environmental quality of corridor is critical to maintain ecosystem functioning of protected areas, allowing animal and plant dispersal and gene flow; (ii) to maintain ecosystem processes, and (iii) to enhance ecosystem resilience (Bennett 2003; Conservation International 2000; D'Eon *et al.* 2002).

Landscapes are shaped by the interaction between social and ecological systems. The long history of human presence in the landscape and their resources use patterns show that the sustainability was strongly enforced through traditional and customary laws (Jha 2002; Pant 2002; Ramakrishnan 1996). Resources use and interaction between socio-ecological systems were found as an important driving force that helps to shape conservation areas (Jha & Bawa 2005).

However, the economic development in the form of tea industry brought a drastic change in the land use in the landscape. Substantial forested area of Darjeeling and the proposed corridors was changed into tea gardens during the second-half of the 19<sup>th</sup> century. According to records, the first commercial tea gardens were planted in 1852 and the number of tea gardens increased to 186 by 1905 (O'Mally 1907). This seems to have lead to large-scale deforestation, soil erosion, loss of wildlife and biodiversity (Starkel 1993; Starkel & Basu 2000). At present, 78 gardens are running with an average area of 17.5 km<sup>2</sup> that was once covered with biodiversity rich forests (Chettri 2004). Small scale tea industries are mushrooming at an alarming rate in one of the proposed corridors- Mahananda Wildlife Sanctuary to Neora Valley National Park.

Similarly, the state of Sikkim and eastern Nepal also witnessed drastic change in land use. Urbanization and migration from east to west; change in land use, initially with intensive agriculture practice and later with change in cropping pattern from agriculture to agro-forestry system (cardamom cultivation) showed dramatic change in land-use pattern. The commercial cropping driven by market forces were the main driving forces for such changes. During 1975-1996 the cropping pattern and agricultural intensification was the highest in Sikkim with

2.5% growth in cardamom cultivation area and other cropping systems (Sharma *et al.* 2000). Such intensification was even higher in some micro-watersheds (Jain *et al.* 2000). Our participatory action research revealed that the land use types in the proposed landscape are complex not only due to the diverse land-use types but also with complex tenure systems (Chettri & Sharma 2006; Oli 2004).

Humans continue to shape the current and future use, productivity, and patterns of sustainability of landscapes (Turner *et al.* 2001). This was evident from the land use change over time in the KTBCL. The conventional conservation approaches developed over time put more emphasis on understanding causes of biodiversity loss without addressing the human needs and aspirations. Efforts to overcome the degradation of ecological resources supporting society and economies were, however, constrained by a lack of understanding the linked between social-ecological systems. These complex systems could be viewed as landscape mosaics, a jigsaw of interacting human and natural systems operating at multiple scales (Brunckhorst 2000; 2005). The efforts in KTBCL have reached an advanced stage to understand such linkages and bring about benefits of the environmental services provided by the landscape. The regional framework recently developed by ICIMOD (Sharma *et al.* 2007) could be taken as a guiding instrument for addressing conservation and development in a regional perspective taking transboundary landscapes as examples. This would also compliment to the CBD agenda of the ecosystem approach and mountain biodiversity programme of work (Sharma & Acharya 2004).

## Conclusions

Transboundary conservation is receiving more and more attention as countries recognize that their environmental security and social welfare depend upon the conservation and management of biological resources that span political borders. Transboundary conservation is particularly important in the Himalayan region, as many areas of rich biodiversity are located along natural borders. As a result, the concept of transborder protected areas and corridors are gaining popularity in the region and beyond.

Transboundary reserves are defined as contiguous areas of protected natural habitat, extending nationally across two or more states or provinces and internationally across two or more countries. The main aim of transboundary reserves is to increase the protection of biodiversity beyond the extent possible by any single state, province, or country. While a nation's reserves within its borders can be strengthened by national governments alone, transborder conservation across international borders requires cooperation from the participating countries, and often a facilitating regional or international organization. There are numerous global and local initiatives taken by the Himalayan countries but there was a strong gap on regional perspective on conservation. ICIMOD initiatives tried to fill this gap while facilitating the regional countries for complying with common objectives of conservation agreed in the CBD. The elements for successful conservation in transboundary landscapes that emerged from the KTBCL experience are: (a) enhance friendly relationship among the countries sharing the landscape to promote exchange of views and information on transboundary conservation, through meetings and exchange visits of local community members, park management and government officials of the countries of the region that improves communications at local levels; (b) formalize dialogue and cooperation process between government officials and protected area administrations of different countries on policies related to wildlife management and trade in plants and animals; (c) increase enforcement on cooperation and protected area coordination for transborder poaching, illegal logging, and harvesting of rare and threatened species in border areas; (d) establish joint committees between transboundary protected areas to cooperate in developing management plans and common guidelines, research collaboration, and in implementation of international conventions and agreements; (e) organize joint training activities on transboundary conservation and collaboration in research, monitoring, and management technologies through regional or bilateral programmes and collaboration; (f) promote participatory management in transboundary conservation at the local level - local communities, the private sector, and concerned institutions should be encouraged to join hands with protected

area administrations for ensuring participatory planning and management of transboundary protected areas; and (g) develop awareness programmes and produce publications on transboundary conservation subjects and laws at national and local levels.

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