

# Landscape Conservation Approach for Bio-Socio Resilience in the Kangchenjunga Complex

*Nakul Chettri<sup>1</sup> and Eklabya Sharma*

**Abstract:** *Mountain biodiversity conservation is now a global agenda. The efforts for mountain biodiversity conservation have gain impetus in the recent decade. It was realized that the most important repositories of biodiversity are the mountains and the Himalayas. The traditional knowledge and practices towards sustainable biodiversity management are still prevalent and realized as an effective measure. However, these mountains are the most vulnerable in terms of socio-economic conditions of the people living there. Many models of conservation evolved considering species to protected area management, the social component, the major driving force in conservation, has always been ignored. Chapter 13 of Agenda 21 - "Managing Fragile Ecosystems: Sustainable Mountain Development" was a great step forward towards realizing the significance of the world's mountains. Now, it is realized that the protected areas alone cannot meet the demands of conservation and a holistic approach considering landscape/ecosystem, in which human beings are part, is the need for effective biodiversity conservation and management. It can be achieved only by involving local people in conservation mainstream and ensuring that they benefit to make 'conservation' truly sustainable. It is the time to think conservation beyond the boundaries to strengthen transboundary biodiversity management processes and socio-economic development of people living in the vulnerable condition along the border areas of the cooperating countries. Our paper highlights the ICIMOD's initiative on a regional collaboration for developing linkages between biodiversity conservation and sustainable development with a landscape approach in the southern half of Kangchenjunga landscape of the HKH region.*

## Introduction

The Eastern Himalaya, a part of Indo-Burman Biodiversity Hotspot, is endowed with rich natural and cultural resources evolved and preserved through process of civilization, and contain some of the most restricted and threatened ecological systems on earth (Myers et al. 2000). Large-scale human-induced environmental degradation is currently causing drastic reduction on natural forests leading to habitat degradation and biodiversity loss in this global biodiversity Hotspots (Brooks et al. 2002, Myers et al 2000). Establishment of protected area networks has long been one of the main strategies for safeguarding the world's biodiversity. Since last couple of decades, above 100,000 protected areas have been established worldwide with 12% of the global land area against World Conservation Union's (IUCN) global target of 10% (Chape et al 2003). This initiative is playing an important role in addressing the global objectives and decisions adopted during the various international conventions such as Conference of Parties (COP) for Convention on Biological Diversity (CBD), Millennium Development Goals etc. In spite of decades of conservation efforts, biological diversity throughout the world continues to dwindle. Prevailing conservation models have had greater success in determining which species and ecosystems to conserve than in fully taking into account the social and cultural aspects at a landscape level (Bawa et al 2004). There is a strong gap on understanding socio-economic aspect of biodiversity and the role of local people and their traditional practices for sustainable management of biodiversity. To date, the conservation measures have been taken only in a small scale, mostly focusing on the conservation of biological resources inside the protected areas through legal enforcement and regulatory mechanism. In recent analysis, it is revealed that the conservation measures taken by establishment of protected areas are inadequate and the effectiveness of protected areas for global biodiversity conservation has been questioned (Pressey et al 2003, Rodrigues et al 2004).

Rapid urbanization, habitat degradation and weak conservation measure in south Asia has resulted a drastic decline in biodiversity (Brooks et al 2003). Moreover, it was mentioned that the conservation of biodiversity through

---

<sup>1</sup> Integrated Natural Resource Management Programme, International Centre for Integrated Mountain Development, G P O Box 3226, Kathmandu, Nepal; Email: [nchettri@icimod.org.np](mailto:nchettri@icimod.org.np)

protected areas alone was ill suited in developing nations where the majority of the protected areas are surrounded by agricultural lands with dense human population. Moreover, the local people had been accustomed to the free collection of the forest products in the areas and later were designated as national parks or reserves. Thus, there is higher dependency of the people on these resources for their subsistence living (Nepal and Weber 1995). So far, conservationists have often been reluctant to incorporate land occupied by people into conservation plans because of social disputes and the associated cost of managing conflicts (Wells 1992). The conservation initiatives are often purely ecologically oriented, and ignore social driving forces and the relationship between conservation and human needs (Nepal and Weber 1995). In the past conservation dialogue, the conservationists have been stressing on what to conserve and where to conserve than addressing how to conserve biodiversity effectively (Bawa et al 2004). The most pressing question in the present conservation paradigm is “for whom we are conserving these biological resources?” Conservation does not mean non-use but wise use of biodiversity, which contributes to sustainable development. It has been reflected in Chapter 13 of Agenda 21 by saying "Managing Fragile Ecosystems: Sustainable Mountain Development" but the mechanism on how to achieve this goal is ill defined and poorly practiced. Therefore, there is a great need to find a means to balance between biodiversity conservation and human development, which will determine the sustainability and conservation of biodiversity (Vanclay et al 2001, Velazquez et al 2003, Bawa et al 2004).

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 a landscape approach (Sharma and Chettri 2003a, Secretariat of the CBD 2004). This is because the environmental goods and services provided by landscape and the human dependency on these services do not recognise political boundaries. They are more guided by ecological, socio-cultural and socio-economic parameters. Therefore, to bring resilience among the living beings, conservation initiations at a landscape become vital for common interests of the countries sharing such landscapes. This paper addresses the importance of a) the Kangchenjunga complex for biodiversity conservation; b) threats to bio-socio resilience in this complex and c) landscape conservation approach as a means of holistic conservation measures.

### ***Kangchenjunga landscape as biodiversity repository***

The eastern Himalayas is shared by Nepal, Bhutan, India, China and Myanmar. This whole range of landscape is part of the Indo-Burman hotspot, one of the 25 ‘biodiversity hotspots’ in the world and many critical transboundary ecosystems within this landscape are of global importance (Myers et al. 2000, Sandwith et al. 2001, Brooks et al. 2002, Wikramanayake et al. 2001). The area surrounding Mt Kangchenjunga is one of the richest landscapes within the ‘biodiversity hotspots’ and an important mountain ecosystem shared by Nepal, Bhutan, India and China (Sandwith et al. 2001, Wikramanayake et al. 2001, WWF and ICIMOD 2001). Due its strategic location, it is endowed with rich biological resources and an important area for transboundary cooperation (Shengi and Sharma 1998).

The governments of Nepal, India and Bhutan have has taken serious efforts to protect this important landscape. Being signatories to CBD biodiversity conservation has become top priorities in the national agendas of Nepal, India and Bhutan. A decision at the Conference of Parties for CBD in 2004 on adoption of “Mountain Biodiversity” has further strengthened the commitment of mountain countries on biodiversity conservation. India has already brought the Kangchenjunga area under a protected network by managing it as Kangchenjunga Biosphere Reserve and other five protected areas in Sikkim. Adjoining Singhalila, Neora Valley, Senchal and Mahananda protected areas within Kangchenjunga landscape falling in Darjeeling Gorkha Hill Council are also managed as national parks and wildlife sanctuaries. In Nepal, the area is equally important and has been brought under Kangchenjunga Conservation Area through the work of Ministry of Forests and Soil Conservation, HMG Nepal and WWF-Nepal in its northern region. Some parts of western Bhutan also fall in the wider Kangchenjunga landscape and the Royal Government of Bhutan has brought Toorsa Strict Nature Reserve, which is connected with natural corridor to Jigme Dorji National Park under protected areas network of the region.

The Kangchenjunga landscape is an extended habitat, beyond the political as well as protected area boundaries for many umbrella species such as snow leopard, musk deer, red panda, takin, and tigers, and for a number of

threatened and endemic plants. While most efforts for biodiversity conservation have focused primarily on protected areas and reserves, the unprotected lands surrounding that areas- the “matrix”- are so far ignored. This matrix is equally important to preserve large proportion of global biodiversity they maintain. The existing conservation efforts through protected area management and the wide-ranging habitats needed by many globally significant species are far from the conservation goal. The missing links between the protected areas that are necessary for connectivity within wider existing habitats for flagship species such as tigers and elephants in the tropical and red panda, takin, musk deer, snow leopard and many other threatened plant species at the sub-alpine and alpine areas need attention. Connecting these protected areas with biological corridors and addressing conservation in landscape level has important role on both vertical (altitudinal) and horizontal coverage for biodiversity conservation in this important landscape (Sharma and Chettri 2003b).

### ***Threat to bio-social resilience***

The ecosystem of the Kangchenjunga landscape is important not only as habitat for the plant and animal species they harbor, a large number of which are rare and endemic, but also they are the home of many historical ethnic communities such as Kirats, Tamangs, Bhutias, Lepchas and many others with diverse socio-cultural values. The long history of human presence in this ecosystem and maintenance of its fragility is an indicator of compatibility of satisfaction of community needs through traditional practices, with biodiversity conservation. The traditional natural resources management systems such as Dzumsa by the Phipons (village head) among the Lanchungpas (Rai et al 1994, Pant 2002), wise knowledge and sustainable natural resources use practices among the Lepchas (Ali 1989) and effective rangeland management by Kiratis and Limbuwans (Oli per.com) are some of the effective traditional conservation measures that addresses its “sustainability”. This reveals the fact that in the past there was resilience between biological resources and the human needs.

Though the landscape offers an array of resources with diverse produce such as agricultural and agroforestry goods, firewood, fodder, timber, and many non-timber forest products (NTFP) to the people from time immemorial; the communities are economically, physically, and socially vulnerable. Majority of rural people are still solely dependent on the surrounding resources for their subsistence livelihoods since other commercial resources are beyond their reach due to difficulties in access, high prices and limited supply (Sharma et al. 1992). Moreover, the legal obligations brought in the people’s rights for resource uses and limited market access is further limiting the economic opportunities.

Thus, the whole landscape is changing because people's interactions with the land are changing (Jain et al 2000). The traditional use of natural ecosystems is changing. There is increased demand on land for cultivation, timber, fuel and animal grazing due to population growth; farm based family fragmentation and growth in tourism (Sharma et al 2000, Chettri et al 2002, Singh 2000). The dependency of people on agriculture as primary occupation is changing. With recent development in tourism, some communities in the tourism-destined area are associated in this enterprise as lodge operators, porters, pack animal operators, cooks and trekking guides (Rai and Sundriyal 1997; Maharana et al 2000). A large number of tourists are now visiting some of the destinations within the landscape. The burgeoning human and livestock population in rural areas are exerting immense pressure on the bio-resources to meet the requirements of food, fuel, fodder, timber and other human needs. There is an increased demand of consumptive resources from growing population and tourism (Chettri 2000, Chettri et al 2002). The pressure has made a considerable impact on the forest vegetation and wild life (Chettri et al. 2001, Chettri et al. 2002). As a result, most of the forests from the landscape have been lost often due to unsustainable levels and ways of exploitation and the process continues.

These human accelerated changes are one of the most important factors that led to habitat degradation and equally important as a conservation challenge. We have not been able to address the socio-economic component, which is a major driving force in the biodiversity management. Vanley et al (2001) and Bawa (et al 2004) have argued that there is no other option than to broaden the focus of conservation including the people in larger landscape. Our recent researches revealed that there is a strong ecological interdependence across the international boundary among communities located along or close to the border. The increasing economic and environmental

interdependence between Nepal, India and Bhutan offers opportunities for cooperation, particularly in matter of wise and sustainable use of biodiversity and its management. In this regard international boundaries play an important role given their multifaceted functions as filter zone for illicit activities, gateway for people and goods, and also as zone of socioeconomic, cultural and environmental integration. Now, it is important to think for sustainability of the existing resources since man's existence depends upon their higher productivity (FAO 1994). The question primarily is how much to use for its sustainability.

The rural areas of the landscape are rich in biodiversity, but are with persistent poverty where developmental programmes are often limited. Therefore, the efforts to conserve biodiversity needs a gradual shift from law enforcement towards more participatory approaches emphasizing equitable and sustainable use of natural resources. This has meant a new emphasis on finding ways of deriving new economic opportunities from biological resources, which do not lead to further losses of biodiversity (MacNeely 1988, Sharma et al 2000). This has necessitated thinking biodiversity management in a landscape level to integrate conservation and the interest of communities to bring resilience.

### ***Landscape conservation initiatives***

During the last three decades, efforts to conserve biodiversity have gradually begun to shift away from law enforcement and use restrictions towards more participatory approaches emphasizing equitable and sustainable use of natural resources by local people in the landscape (Sharma and Chettri 2003a) and elsewhere (MacNeely and Miller 1984). This change in approach is important in the remote rural areas of developing countries where biodiversity is concentrated, where poverty tends to be pervasive, and where the reach of development programmes is often limited. Wells (1992) has stated that beyond the economic principles involved, it is recognized that neither politically feasible nor ethically justifiable to attempt to deny the poor for using natural resources without providing them with alternatives. Thus, an alternative approach to biodiversity management that aims to integrate the interest of conservation with those of nearby resources dependent communities is necessary.

Landscape level biodiversity conservation is an evolving concept (Smith and Maltby 2003, Secretariat of the CBD 2004). ICIMOD's initiative for a regional collaboration for biodiversity management with a landscape approach in the HKH region started in 1995. Since then, regional collaborative programmes on mountain biodiversity were carried out. It was taken further and experimented in transboundary landscapes such as Mount Everest ecosystems (Sherpa et al 2003) and the Hkakaborazi mountain complexes (Guangwei 2002). With these experiences ICIMOD realized that the protected areas alone cannot meet the demands of conservation in the mountains and a holistic approach considering landscape/ecosystem, including human beings as part of the system, is the needed for effective conservation. From a series of consultations, Kangchenjunga complex was prioritized as a potential transboundary complex for immediate action (Rastogi et al 1997, Wikramanayake et al 2001).

Since 2002, the landscape concept was put into action for developing a transboundary conservation landscape for the Eastern Himalayas with special emphasis on the southern half of the Kangchenjunga complex considering eastern Nepal, Darjeeling district of the state of west Bengal, India and western Bhutan. Initially, an extensive consensus building process was undertaken with the communities living in this potential landscape, the conservation authorities of the area and conservation experts and organizations working in the landscape. They were appraised on the concept of transboundary landscape and views and opinions were gathered. With acceptance of the concept by all tiers of stakeholders, three national level consultative workshops were held in three different countries, namely Nepal, India and Bhutan. During the process, all levels of stakeholders' consulted and a consensus was raised for planning and improvement of biological corridors between the existing protected areas. The consultations were represented by various levels of stakeholders such as politicians, policy makers, government officials, academic and research institutions, NGOs, CBOs and communities and debated on the common platform on the issues that are prevalent in the area for community development and biodiversity conservation. During the consultations, it was debated that conservation without community development is impractical.

These challenges, which came as outcomes from different levels of stakeholders' consultations were further debated in length in a regional consultation in presence of experts and associated authorities from India, Bhutan and

Nepal, represented by Government, Non Government and civil societies. The long standing issues such as community involvement in conservation, their socio-economic development, alternative sources of income to those who solely depend on forest based resources, transboundary conservation issues and the need of a regional cooperation among the countries sharing this complex were debated, put into future actions and accepted by the respective countries. In addition, issues and strategies on future conservation promotion, livelihood enhancement, policy implications and institutional and partnership arrangements were placed for a common understanding.

Following these recommendations, ICIMOD with its partners initiated biological corridor development/improvement plan in the southern half of Kangchenjunga landscape. A comprehensive action oriented strategies and action plans were developed for the landscape. Feasibility assessments on biological corridor development and research on landscape elements, socio-economic condition of local communities, options for micro-enterprise development, and capacity building of the associated stakeholders were carried out. Potential areas of interventions such as herbal gardening, floriculture, organic farming, and bee keeping in the agricultural sector and ecotourism in non-agricultural sector were identified as developmental options and incorporated in the action plan.

After a decades' process, cooperation for conservation among India, Nepal and Bhutan has been initiated. For the first time the conservation and developmental issues were traced down from the communities prospective and placed in a regional forum for discussion. This process of collaboration for conservation considering landscape approach provided an opportunity to consolidate a cohesive partnership among the conservationists, developmental authorities and civil societies. This also brought about importance of regional cooperation among the member countries for long-term conservation activities in the landscape. As an outcome, the consultation brought out a number of commitments from the member countries and strategies for future biodiversity corridor development at the Kangchenjunga landscape has been initiated.

## **Conclusion**

In the Kangchenjunga complex, habitat destruction is the most widespread anthropogenic cause of biodiversity loss. Decline in biodiversity is associated with specific land-use changes, tourism activities adjacent to protected areas, fragmentation of forests because of resource extraction, and overgrazing. There are few specific studies, which addresses effect of human actions on biodiversity. We conducted numerous researches to obtain more information for a better understanding of the relationship between human actions, habitat alteration, and biodiversity loss at the landscape level. Considering these studies, we initiated conservation and development plans for each of the corridors in Nepal, India and Bhutan that take into account the human needs and opportunities. The studies revealed that the immediate causes of biodiversity loss in the Kangchenjunga area are due to overexploitation of natural resources, habitat loss through degradation and fragmentation, and introduction of alien species; however, many of these have social, economic, and political implications.

Increasing population and acute poverty are the main reasons for the prevalence of creeping disturbance in the protected areas. The human population is dispersed all over the landscape making it impossible to separate physically from forests and other natural ecosystems from the human influence. Due to actual and potential productive and consumptive uses of many species, it is expected to affect biodiversity and societies in many ways in the long run. Therefore, it has been apparent that protected areas alone cannot meet the demands of conservation, surrounding 'matrix' of the landscape and addressing the human need and in conservation efforts ensuring that people benefit from activities important to make 'conservation' truly sustainable. However, sustainability of protected areas is heavily influenced by local people who are largely dependent on natural resources for their livelihoods. The landscape approach of conservation seems to be ideal for the developing countries to be benefited from the resources they share. Landscape level conservation also enhances transboundary cooperation between the countries to meet their obligations under international agreements such as the Convention on Migratory Species and Convention on Biological Diversity. Hence, landscape level conservation provides objective of protecting biodiversity in their shared ecosystems and to combine their resources and expertise to achieve the resilience within the landscape.

## ***Acknowledgements***

The authors are thankful to the Director General, International Centre for Integrated Mountain Development (ICIMOD), for inspirations and facilities. We express our sincere thanks to Mr N S Jodha and Mr Birendra Bajracharya, ICIMOD for their inspiration and support. MacArthur Foundation is supporting this initiative. We are thankful to all the partners working with ICIMOD for their contribution towards this documentation

## **References**

- Ali, S. 1989. *The Birds of Sikkim*. Second impression Oxford University Press.
- Bawa, K.S.; Seidler, R and Raven, H. P. 2004. Reconciling Conservation Paradigms. *Conservation Biology* 18 (4): 859-860.
- Brooks, B.W.; Sodhi, N.S. and Ng, P.K.L. 2003. Castastropic extinction follow deforestation in Singapore. *Nature* 242:420423.
- Brooks, T. M; Mittermeier, R.A.; Mittermeier, C.G.; da Fonseca, G.A.B.; Rylands, A.B.; Konstant, W.R.; Flick, P.; Pilgrim, J.; Oldfield, S.; Magin, G and Hilton-Taylor, C. 2002. 'Habitat Loss and Extinction in the Hotspots of Biodiversity'. *Conservation Biology* 16(4): 909-923
- Chape, S.; Blyth, S.; Fish, L.; Fox, P. and Spalding, M. 2003. United Nations List of Protected Area. IUCN, Gland, Switzerland and Cambridge UK and UNEP-WCMC Cambodge UK 1x-44pp.
- Chettri, N. 2000. *Impact of Habitat Disturbances on Bird and Butterfly Communities Along Yuksam-Dzongri Trekking Trail in Khanchendzonga Biosphere Reserve* [PhD dissertation]. North Bengal University, India.
- Chettri, N.; Sharma, E. and Deb, D. C. 2001. Bird community structure along a trekking corridor of Sikkim Himalaya: A Conservation Perspective. *Biological Conservation* 102(1): 1-16.
- Chettri, N.; Sharma, E.; Deb, D. C. and Sundriyal, R. C. 2002. 'Effect of firewood extraction on tree structure, regeneration, and woody biomass productivity in a trekking corridor of the Sikkim Himalaya'. *Mountain Research and Development* 22(2):150-158
- FAO 1994. *Forest Development and Policy Dilemmas*. Rome, Italy.
- Guangwei, C. 2002. *Biodiversity in the Eastern Himalayas: Conservation Through Dialogue*. Kathmandu: ICIMOD.
- Jain, A.; Rai, S.C. and Sharma E. 2000. Hydro-ecological analysis of a sacred lake watershed system in relation to land use/cover change from Sikkim Himalaya. *Catena* 40: 263-278.
- MacNeely, J.A. 1988. *Economic and Biological Diversity: Developing and Using Economic Incentives to Conserve Biological Resources*. Gland, Switzerland, IUCN.
- MacNeely, J.A. and Miller K.R (eds). 1984. *National Park Conservation and Development: The Role of Protected Area in Sustaining Society*. Gland, Switzerland, IUCN, WRI, CI, WWF-US and The World Bank, Washington DC.
- Maharana I.; Rai S.C. and Sharma E. 2000. Environmental Economics of Khangchendzonga National Park in the Sikkim Himalaya, India. *GeoJournal* 50:329-337.
- Myers, N.; Mittermiller, R.A.; Mittermiller, C.G.; Gustava A.B. da Foseca and Kent J. 2000. Biodiversity hotspots for conservation priorities. *Nature* 403(24): 853-858.
- Nepal, S.K. and Weber, K.E. 1995. The quandary of local people-park relationships in Nepal's Royal Chitwan National Park. *Environmental Management* 19(6): 853-866.
- Pant, R. 2002. *Customs and Conservation: Cases of Traditional and Modern Law in India and Nepal*. Community Based Conservation in South Asia No. 7. Kalpavriksha, India, and IIED, UK.
- Pressey, R.L.; Cowling, R.M. and Rouget, M. 2003. Formulating conservation targets for biodiversity pattern and process in the Cape Floristic Region, South Africa. *Biological Conservation* 112:99-127.

- Rastogi, A.; Shengi, P. and Amatya, D. 1997. Regional Consultation on Conservation of the Kangchenjunga Mountain Ecosystem. International Centre for Integrated Mountain Development, Kathmandu, Nepal
- Rai, S.C. and Sundriyal, R.C. 1997. Tourism development and biodiversity conservation: A case study from the Sikkim Himalaya. *Ambio*, 26, 235-242.
- Rai, S.C.; Sharma, E. and Sundriyal, R.C. 1994. Conservation in the Sikkim Himalaya: traditional knowledge and land use of the Mamlay watershed. *Environmental Conservation*, 15, 30-35.
- Rodrigues, A.S.L.; Andelman, S.J.; Bakarr, M.I.; Boltani, L.; Brooks, T.M.; Cowling, R.M.; Fishpool, L.D.C.; da Fonseca G.A.B.; Gaston, K.J.; Hoffman, M.; Long, J.S.; Marquet, PA; Pilgrim, JD, Pressey, RL; Schipper, J; Sechrest, W; Stuart, SN; Underhill, L.G.; Waller, R.W.; Watta, M.E.J. and Yan, X. 2004. Effectiveness of global protected area network in representing species diversity. *Nature* 428:640-643
- Sandwith, T.; Shine, C.; Hamilton, L. and Sheppard, D. 2001. *Transboundary Protected Areas for Peace and Cooperation*. IUCN, Gland, Switzerland and Cambridge, UK.
- Secretariat of the CBD. 2004. *Biodiversity Issues for Consideration in Planning, Establishment and Management of Protected Area Sites and Networks*. Montreal, SCBD. CBD Technical Series No 15. 164pp.
- Sharma, E.; Sundriyal, R.C.; Rai, S.C.; Bhatt, Y.K.; Rai, L.K.; Sharma R. and Rai, Y.K. 1992. *Integrated Watershed Management: A Case Study in Sikkim Himalaya*. Gyanodaya Prakashan, Nainital.
- Sharma, E. and Chettri N. 2003a. Sustainable Biodiversity Management Practices in the Hindu-Kush Himalayas. *Proceedings of Norway/UN Conference on Technology Transfer and Capacity Building*. Trondheim.
- Sharma, E. and Chettri, N. 2003b. 'Corridor Development for Biodiversity Landscape Conservation' poster abstract. In *Facilitating Conservation and Sustainable Use of Biological Diversity, Protected Areas and Technology Transfer and Cooperation*, CBD Technical Series 9. Montreal (Canada): Secretariat of the CBD.
- Sharma, E.; Jain, N.; Rai, S.C. and Lepcha, R. 2000. Ecotourism in Sikkim: Contribution toward conservation of biodiversity resources. In *Institutionalizing Common Pool Resources* (Ed. Marithia, D). Concept Publishing Company, New Delhi.
- Shengji, P. and Sharma, U. R. 1998. Transboundary Biodiversity Conservation in the Himalayas. In *Ecoregional Cooperation for Biodiversity Conservation in the Himalayas*. United Nations Development Programme, New York, USA.
- Sherpa, L.N.; Peniston, B.; Lama, W.; Richard, C. 2003. *Hands Around Everest: Transboundary Cooperation for Conservation and Sustainable Livelihoods*. Kathmandu: ICIMOD.
- Singh, H.B. 2000. Grazing impact on plant diversity and productivity along a tourist trekking corridor in the Khangchendzonga Biosphere Reserve of Sikkim. Ph.D. thesis submitted to the University of North Bengal, India.
- Smith, R.D. and Maltby, E. 2003. *Using the Ecosystem Approach to Implement the Convention on Biological Diversity: Key Issues and Case Studies*. IUCN, Gland, Switzerland and Cambridge, UK. 118pp.
- Vanclay, J.K.; Bruner, A.G.; Gullison, R.E., Rice, R.E.; da Fonseca, G.A.B. 2001. The Effectiveness of Parks. In *Science*, 293: 1007-1008
- Velazquez, A.; Bocco, G.; Romero, F. J.; Vega, A.P. (2003) A Landscape Perspective on Biodiversity Conservation: The Case of Central Mexico. *Mountain Research and Development*, 23(3): 240-246
- Wells, M. 1992. Biodiversity Conservation. Affluence and Poverty: Mismatched Costs and Benefits and effort to remedy them. *Ambio* 21(3):237-243.
- Wikramanayake, E., E. Dinerstein, C.J. Loucks, D.M. Olson, J. Morrison, J. Lamoreux, M. McKnight, and P. Hedao.

2001. *Terrestrial Ecoregions of the Indo-Pacific: A Conservation Assessment*. Washington: Island Press.

WWF and ICIMOD (2001) *Ecoregion-Based Conservation in the Eastern Himalaya: Identifying Important Areas for Biodiversity Conservation*. Kathmandu: WWF Nepal