

Biodiversity Management in a Changing Climate: Developing a Climate Change Resilient Conservation Strategy for the Eastern Himalayas

Nakul Chettri¹, Eklabya Sharma¹ and Tariq Aziz²

¹International Centre for Integrated Mountain Development, Kathmandu, Nepal

²WWF Living Himalayas Initiative, Kathmandu, Nepal

Summary

Climate change means more than just change in temperatures. In The Eastern Himalayas it impacts all aspects of the life. The Eastern Himalayas, is a fragile ecosystems whose poor and marginalized people and the variety of sensitive ecosystems and species face the most prevailing challenge towards adapting to a changing climate. Unpredictable rainfall, changing the character of the seasons, and an increasing likelihood or severity of extreme events such as flood and dry spells, is set to throw the lives of millions of people into a self consuming vortex of poverty and destruction of natural resources. This challenge could be met through a process of conservation action with a wider vision of pulling together traditional knowledge, contemporary approaches and new policy innovations at a regional scale.

Introduction

The 4th Assessment Report (4AR) of Intergovernmental Panel on Climate Change (IPCC) has made a strong science based rationale for the need of actions towards countering the potential ill effects of climate change globally (IPCC 2007). Whilst many reports of climate change focus on rising temperature, global warming means more than this: it affects all aspects of the climate, making rainfall less predictable, changing the character of seasons, and increasing the risk to biodiversity; human livelihoods and well-being including severity of extreme events such as cyclones, landslides and floods (Xu et al. 2009). What is worst, especially in the developing world, is that the impact of these changes is often aggravated by existing environmental and socio-economic problems, such as poverty, water scarcity and food deficiency to name a few (Mertz et al. 2009). These in turn contribute to a vicious cycle with adverse impacts on livelihoods driving people to desperate measures that decimate natural resources which further increases impacts of climate change.

The Eastern Himalayas (EH hereafter) spans within a wide spectrum of ecological and agro-climatic zones having complex topography and extreme altitudinal gradient; diverse vegetation, culture and ethnic groups; and different geo-political and socioeconomic systems (Sharma et al. 2009). It is also a meeting ground of three realms (Indo-Malayan, Palearctic and Sino-Japanese) making the region extremely rich in ecosystems, species and genetic diversities (CEPF

2005; Chettri et al. 2010). However, it is a paradox that this, one of the richest landmass of this planet, is home to the poorest people with high dependency on natural resources. The ever increasing human population, family (expansion or diversification) and the increasing demand on food and other resources are bringing tremendous pressure on this fragile mountain ecosystem (Arunachalam et al. 2002; Chettri and Sharma 2006). The fate of its rich biodiversity is, therefore, under great risk. The recent understanding on climate change and its ongoing and potential future impacts are bringing additional challenges to conservationists and management authorities in this region.

On the basis of some preliminary assessment done by The International Centre for Integrated Mountain Development (ICIMOD) on the impacts and vulnerability of this region to climate change it can be anticipated that in EH where small changes in temperature can turn ice and snow to water, and where extreme slopes lead to rapid changes in climatic zones over small distances, marked negative impacts of climate change will be seen on biodiversity, water availability, agriculture, and incidents of hazards (see Sharma et al. 2009; Chettri et al. 2010; Tse-ring et al. 2010; Shrestha and Devkota 2010). Consequently, these will have detrimental impacts on general human well being. In this paper, we bring forward an analytical view on the importance of EH in terms of biodiversity and associated goods and services and challenges faced by the countries sharing the region towards addressing prevailing climate change threats and also propose a plausible regional conservation framework for discussion and future actions.

The Eastern Himalayas: Conservation significance and challenges

The EH cover a total area of 524,190 sq km, extending from the Kaligandaki Valley in central Nepal to northwest Yunnan in China (encompassing Bhutan, northeast India, Sikkim and the Darjeeling hills of West Bengal in India, southeast Tibet and Yunnan in China, and northern Myanmar) (Figure 1). Bangladesh is in the immediate downstream side. Furthermore, the region also enriches and sustains many land-use types such as rangelands, shifting cultivation areas, forest and agro-forestry areas, freshwater lakes and river systems. These mosaics of habitats add additional diversity in the regions biological and agricultural resources and provide valuable goods and services not only by providing water, food and biodiversity products, but also by providing services such as soil retention, climate regulation, carbon sequestration, and providing reservoirs of pollinators, natural predators, genetic pools and others. Thus, the welfare of millions of people living in the region, countries downstream and beyond is inextricably linked with the natural resources of the EH (Gopal et al. 2010).

Significantly, the EH are listed among the ‘crisis ecoregions’; ‘biodiversity hotspots’; ‘endemic bird areas’; ‘mega diversity countries’; and ‘global 200 ecoregions’ (Brooks et al. 2006; Wikramanayake et al. 2001). Among the biologically richest areas on Earth, the EH harbour a staggering 10,000 plant species, 977 birds, 300 mammals, 269 freshwater fish, 176 reptiles and 105 amphibians; a third of all plants and reptiles are endemic as are 40% of all amphibians (CEPF 2005). Only in the EH one can find tigers living alongside Asian elephants and greater one-horned rhinos. It is home to endangered snow leopards, red pandas, golden langurs and the

unique goat-antelope - takin. The world's rarest freshwater dolphin is found in its rivers. Even today, the rugged and largely inaccessible landscape of the EH hides the real extent of the region's biodiversity. From 1998 to 2008, more than 350 new species have been identified here including one of the world's smallest deer; a flying frog and a 100 million-year-old gecko fossil (see Thomson 2009). Many more species are yet to be discovered.

Land use change from forest to other usages has been quite conspicuous in the last three decades (1977-2000) causing depletion of natural resources in the region (Pandit et al. 2007). Studies reveal a substantial increase of (40.4%) in shrubland as compared to a baseline of 1977. The forests have decreased by 3.4% and its grasslands by 8.2% since then (Chettri et al. 2010). On the other hand cultivated area has increased by 0.5%. The other indicators of climate change such as temperature and precipitation also showed variations than the average trend. It was noted that the annual mean temperature is in increasing trend at the rate of 0.01°C/yr to more than 0.02°C/yr and expected to rise from 2°C to 2.9°C by 2080 (Shrestha and Devkota 2010). The trend also showed that the warming increases progressively with elevation and the areas >4,000 m are experiencing the higher warming rates (Table 1). Interestingly, seasonal temperature variability is increasing and the altitudinal lapse rate in temperature is decreasing. Similarly, the area-averaged sensitivity of the simulated seasonal and annual precipitation expressed in terms of percentages of the current simulation over the EH projects an increase of monsoon precipitation by 7% to 17% and the greenhouse warming scenarios of models predict an enhancement of monsoon precipitation up to 30% over most parts of this region and even up to 40% over a few high-altitude pockets (Shrestha and Devkota 2010).

Similarly, the vulnerability assessments considering exposure to impacts of climate change, sensitivity of the particular regions, and adaptive capacity, reveal that among the most vulnerable areas in EH are the Brahmaputra valley, segments of the lower Gangetic plain falling within the EH, the Terai-Duar tract from Nepal to eastern Bhutan, and the vicinity of Loktak lake in Manipur (Tse-ring et al. 2010). One factor common to these areas is population pressure and subsequent devastation of natural biodiversity. This turns these places highly sensitive to climate change. The findings indicate that the warming of the high altitude zone, river basins and wetland areas, as the most vulnerable zones with serious implications for the region's rich biological and cultural heritage.

As a global measure, the United Nations Framework Convention on Climate Change (UNFCCC) has made it clear that all Parties must formulate and implement national or regional programmes containing measures to facilitate adequate adaptation to climate change (Art.4.1.b). Although the climate change community is guiding and encouraging analysis and assessment, its work remains largely scientific and theoretical, and does not yet involve practical ground level action. In fact, researchers and policy makers in this arena have yet to make concrete and specific recommendations for *how* adaptation ought to be undertaken, and have not actively engaged in responses to specific instances of biodiversity and human vulnerability.

Conservation measures and practices

There is an urgent need of addressing conservation issues and sustainable use of natural resources in EH. However, the ICIMOD study also reveals that the present conservation inputs are inadequate and practices lack systematic monitoring, and documentation on the status of biodiversity in the region. As a result, the region witnesses inadequate scientific evidence to determine the impact of climate change on human wellbeing with any certainty. Equally, the majority of available research focuses on the adverse impacts of climate change and overlooks both the adaptation mechanisms adopted by the local people and the new opportunities presented.

Nevertheless, the conservation of biodiversity in the EH region has been progressive in terms of establishment of protected areas (PAs). Till 2009, there were 99 protected areas of different sizes covering more than 79,000 sq km (15% of the total area) across the region (Chettri et al. 2010). This is quite significant in terms of protected area coverage compared to the global percentage of 11.5% for mountain protected areas (Kollmair et al. 2005; Chettri et al. 2008). The trend in establishment of protected areas shows a considerable growth in the last 80 years (Figure 2). The last two decades show exponential growth in both the number and coverage of these protected areas. The cumulative area has increased from 23,379 sq km (1977-1987) to 71,972 sq km (1997-2007) and the number increased from 46 to 99.

Contemporary conservation approaches such as establishment of PAs; the concepts of conservation corridors and landscape approaches, as advocated by the Convention on Biological Diversity (CBD), are also being practiced in the region (see Chettri et al. 2007; Sherpa et al. 2003; Sherpa et al. 2004). This has brought a significant paradigm shift by soliciting community participation in PA management and bringing critical habitats and ecoregions and their species into new, evolving conservation measures that not only include biodiversity conservation, but also securing natural freshwater infrastructure as well as sustainable use of natural resources (Sharma et al. 2010). These large scale landscape level conservation measures allow species to move from otherwise isolated PAs; sustain natural resource for use by communities; increase resilience of the ecosystem they are in and make it possible for conservationists and development workers to plan conservation action in an integrated manner (Wangchuck 2007; Worboys et al. 2010). However, most of these new conservation approaches are still in the early stages of development in the EH and need appropriate actions and policies to implement them effectively and over a larger scale.

While acknowledging the significant diversity of biological resources in the EH region and the existence of a fair understanding of the important drivers of change, it is necessary to understand the broad issues and challenges faced by the region. The following are the highlights on issues and challenges:-

1. The EH has a complex geo-political system with diverse vegetation, ecosystem and habitat types with equally diverse culture and tradition. Thus, the level of climate change impact and the capacities among the countries sharing this region also vary.

2. The EH being part of the three global biodiversity hotspots, namely the Himalayas, Indo-Burma and Mountains of South-west China is home to many threatened and endemic species which have narrow habitat range. For these species, if the existing habitats are not maintained then they may face higher climate change impact risks.
3. The burgeoning human population and natural resources demand manifested by agriculture expansion or intensification, developmental activities and change in traditional agro-forestry system (shifting cultivation) are bringing habitat degradation across the EH.
4. Some of the vegetation types (ecotone areas between temperate and sub-alpine) and habitats (seasonal lakes *Majuli*, freshwater lakes, streams and river systems) are at higher risk from impact of climate change due to erratic unpredictable changing rainfall pattern.
5. Among the number of ecoregions found in the EH, some are highly vulnerable (Brahmaputra valley semi-evergreen forests, Lower Gangetic plains, Meghalaya subtropical, Terai-Duar savanna and grasslands, Northeastern Himalayan subalpine conifer forests etc).
6. There is a strong upstream-downstream linkages between the mountain areas of the EH countries and Bangladesh in terms of ecosystem services as well as hazards and need a holistic understanding of this dynamics.
7. There is still a low priority on systematic research and monitoring in the region. The limited information available are scattered and there is not information sharing mechanism developed. As a result, the holistic understanding from the whole strength of the EH is poor and inadequate for any response towards challenges faced by climate change.

What is encouraging in the EH is the emergence of many national policies and legal instruments for protection of the environment towards minimising the impact of global climate change. The countries sharing the EH: Bhutan, China, India, Myanmar and Nepal have all put efforts into developing adaptation policies to reduce their country's vulnerability to climate change either by minimising the exposure to impacts i.e. adoption of ecosystem approach or by maximising the adaptive capacity i.e. reducing non-climatic stresses, reversing trends that increase vulnerabilities, and increasing social awareness. These countries are in different stages of developing their policies and laws to manage their ecosystems in the face of climate change, thereby increasing resilience to climate change impacts, which would exacerbate in a scenario of decimated or degraded ecosystems. Efforts, therefore, need to involve governments, the private sector, non-government organisations and institutions to provide an integrated thrust towards securing ecosystem for human wellbeing and to analyse best options for conserving ecosystems and their contributions to meet human need and development.

Adapting to Climate change is an interdisciplinary issue, hence the efforts of various local, regional, and global organisations operating in the EH and providing capacity-building interventions must be coordinated and collective partnerships with governments and local people developed so that the entire EH region is able to cope with the present and future impacts of

climate change. Therefore, a regional initiative with institutional and policy innovations to address the emerging issues such as ecosystem degradation, genetic and species loss is made pre-requisites. The imperative for the region is to create a long-term regional vision towards minimising the impacts of climate change on biodiversity with a broad but integrated response and measures that addresses local level poverty reduction as well as enhance resilience of the ecosystems of EH

Regional initiatives towards climate change adaptation in conservation

ICIMOD and its long term international partner – WWF have been active in facilitating conservation and development approaches, such as participatory and community based biodiversity conservation and management using the ‘ecosystem/landscape’ approach advocated by the CBD. ICIMOD’s ‘Transboundary Landscape’ and ‘Trans-Himalayan Transact’ initiatives towards promotion of regional cooperation in biodiversity conservation and management along with its institutional adaptation strategy and WWF’s science based ‘Ecoregion’ and community lead ‘Living Himalayas’ approaches have made significant contribution in bringing contemporary Systematic Conservation Planning models in the Himalayas with a high degree of positive response from the global communities. Based on these comparative advantages and the long term experience in the region, the two organisations are committed to facilitate developing a **Climate Change Resilient Conservation Strategy for the EH** in partnership with the countries sharing the region. The following conceptual framework is proposed along with short term and medium term action points for discussion in the forum.

Overall Framework

The EH participating countries should come together and develop a **Climate Change Resilient Conservation Strategy** for conserving biodiversity, securing natural freshwater systems, and sustainable development, in the face of challenges of climate change. To initiate the process the following short and medium term action points could be the subject of discussion.

Short term action points (by 2011)

- Revisit country level conservation practices (PAs, landscapes, wetlands) in the EH and contextualise with the present climate change arena (vulnerabilities, livelihood, poverty) and identify challenges and opportunities.
- Identify commonality among the participating countries in policy and practice both in terms of conservation (e.g. NBSAP) and climate change adaptation (e.g. NAPAs in Bangladesh, Bhutan and Nepal, and Himalayan Mission in NAPCC of India).
- Establish a regional task force to take the concept forward
- Facilitate sharing of knowledge and expertise, and capacity building on climate change and biodiversity sciences.

- Develop a regional ‘Vision Document’ for the proposed Strategy by June 2011.

Medium term action points (Five years starting from 2011)

- Develop strategic phase wise plan for feasibility assessment, capacity building, scientific research, planning and implementation.
- Prepare feasibility assessment report based on the existing information through consultative/participatory process.
- Develop long term comprehensive environmental monitoring framework and plan for adaptation at a regional scale.
- Develop ‘Climate Change Resilient Conservation Strategy and Implementation Plan’ and institutional mechanism for implementation.
- Secure financial and human resources.

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Table 1. Temperature trends by elevation zones for the period 1970-2000 (°C per year)					
	Annual	DJF	MAM	JJA	SON
Level 1: (<1 km)	0.01	0.03	0.00	-0.01	0.02
Level 2: (1 km- 4km)	0.02	0.03	0.02	-0.01	0.02
Level 3: (> 4 km)	0.04	0.06	0.04	0.02	0.03

Source: Strestha and Devkota (2010)

Figure 1. Map showing the extent of Eastern Himalayas delimited as the study area

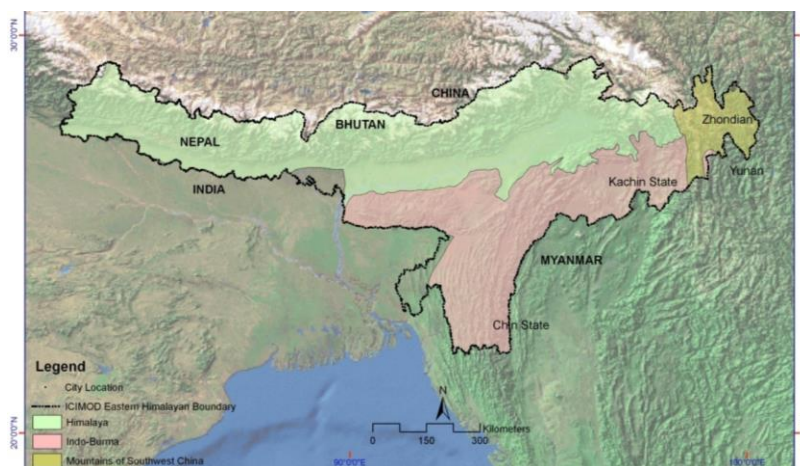
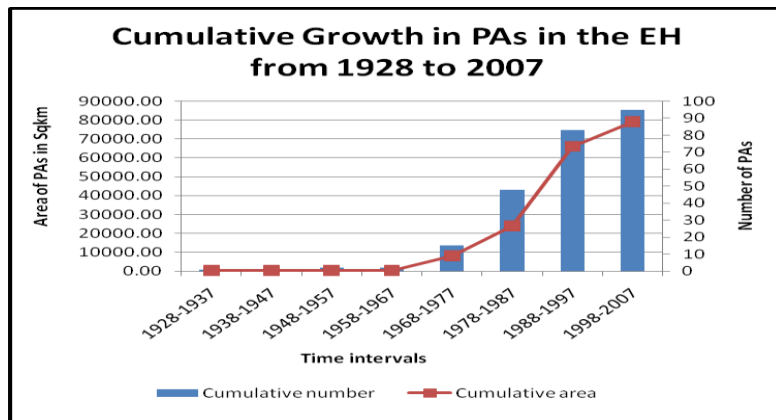


Figure 2. Number and the protected areas coverage under different management categories in the Eastern Himalaya



Source: Chettri et al. (2010)