

## Changing paradigm and post 2010 targets: Challenges and opportunities for biodiversity conservation in the Hindu Kush Himalayas

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**Abstract:** Globally, both biodiversity and the overall natural capital of the world are declining rapidly. Considering its implications to humanity, the Sixth Conference of the Parties (COP 6) of the Convention on Biological Diversity (CBD) in April 2002 committed themselves 'to achieve, by 2010, a significant reduction of the current rate of biodiversity loss at the global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on Earth' and a number of indicators and targets were set by the CBD. However, by 2010, the targets have been missed by vast majority of nations. Our analysis from the Hindu Kush-Himalayan (HKH) region revealed that the countries are at very different stages of progress towards meeting the 2010 targets. In term as of protected area coverage, which is considered as an integral element of the targets, the HKH regional member countries made significant progress by bringing 39 % of its terrestrial area under some form of protection. However, at the national level, they are at different stages of progress. In terms of conservation policies and practices, the HKH region has witnessed significant conceptual development in regional approaches to biodiversity conservation, from 'people exclusionary' and 'species focused' to 'people-centred community-based' and 'ecosystem/landscape approach'. However, there are still numerous challenges that prevail in the region. Anecdotal evidence of change is abundant, but in this vast region there is little, hard scientific information. Improved knowledge, information and environmental data is urgently needed so that appropriate action can be taken to combat and limit the impacts of future changes.

**Resumen:** La biodiversidad y todo el capital natural del planeta están disminuyendorápidamente. Considerandolasimplicacionespara la humanidad, en abril de 2002 la Sexta Conferenciade las Partes (COP 6) dela Convenciónsobre Diversidad Biológica(CDB) se comprometió a 'lograr, para 2010, una reducciónsignificativa de las tasas actuales depérdida de biodiversidaden los niveles mundial, regional y nacional, como una contribucióna la disminución de la pobreza y en beneficio detoda la vida en la Tierra', y la CDB estableció un númerode indicadores y metas. Sin embargo, para 2010 las metas no se habían alcanzadoen la enorme mayoría de las naciones. Nuestroanálisisde laregión HinduKush de los Himalaya (HKH) reveló quelos paísesestán enetapas muy diferentesdeprogresohacia el alcance de las metas para 2010. En términos dela cobertura de áreas protegidas, considerada como un elementointegral de las metas, los países miembros de la región HKH hicieronun progresosignificativo al incorporar 39% de su área terrestre a alguna formade protección. Sin embargo, anivel nacionalestán en diferentesetapas de progreso. En términos de políticas y prácticas de conservación, la región HKH has atestiguado un desarrolloconceptual significativoen los enfoques regionalespara la conservación de la biodiversidad, desde los 'excluyentes de la gente' y 'enfocados en las especies' hastalos 'basados en las comunidades y centrados en la gente' y los 'de ecosistema/paisaje'. Sin

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embargo, todavía persisten numerosos retos en la región. Aunque abunda la evidencia anecdótica de cambio, para esta vasta región hay poca información científica sólida. Urge contar con mejores conocimientos, información y datos ambientales para poder tomar acciones adecuadas que permitan combatir y limitar los impactos de cambios futuros.

**Resumo:** Globalmente, a biodiversidade e o capital total natural do mundo estão diminuindo rapidamente. Considerando suas implicações para a humanidade, os membros da Sexta Conferência das Partes (COP 6) da Convenção sobre Diversidade Biológica (CDB), em Abril de 2002, comprometeram-se a alcançar, até 2010, uma redução significativa da taxa atual de perda de biodiversidade a nível global, regional e nacional como uma contribuição para a redução da pobreza e em benefício de toda a vida na Terra, tendo a CDB estabelecido uma série de indicadores e metas. Contudo, até 2010, as metas não foram atingidas pela grande maioria das nações. A nossa análise da região do Hindu Kush, Himalaias (HKH) revelou que os países estão em estádios muito diferentes de progresso no cumprimento das metas de 2010. Em termos de cobertura de área protegida, que é considerado como um elemento integrante das metas, os países regionais membros do HKH, têm feito progressos significativos, trazendo 39% de sua área terrestre sob alguma forma de proteção. No entanto, a nível nacional, eles estão em diferentes estágios de progresso. Em termos de políticas e práticas de conservação, a região do HKH tem testemunhado um desenvolvimento conceptual significativo nas abordagens regionais para a conservação da biodiversidade, desde a "exclusão de pessoas" e "espécies-alvo" até estratégias comunitárias centradas nas pessoas e numa abordagem "ecossistémica da paisagem". No entanto, ainda prevalecem na região inúmeros desafios. Ocorrem claras evidências de mudanças, mas nesta vasta região há pouca a informação científica sólida. Há pois uma necessidade urgente para um melhor conhecimento, de informação e de dados ambientais para que possam ser tomadas medidas apropriadas para combater e limitar os impactos de mudanças futuras.

**Key words:** Biodiversity conservation, conservation challenges, conservation opportunities, Hindu Kush - Himalayas, 2010 targets.

## Introduction

Globally, both biodiversity and the overall natural capital of the world are declining rapidly. These losses have serious implications for our own species: humanity depends on the natural world, not just for harvested goods such as food, timber and medicinal plants, but for the provision of a broad array of ecosystem services, ranging from the provision of fresh air and water, to climate regulation, carbon storage, and the maintenance of aesthetic, cultural and spiritual values (Costanza *et al.* 1997; MA 2003; Turner *et al.* 2003). Triggered by an emerging appreciation of the magnitude and impact of biodiversity decline on human well-being, more than 120 Ministers at the Sixth Conference of the Parties (COP 6) of the Convention on Biological Diversity (CBD) in April 2002 committed themselves 'to achieve, by 2010, a

significant reduction of the current rate of biodiversity loss at the global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on Earth' (UNEP 2002). This target was endorsed by the leaders of the 190 countries at the Johannesburg World Summit on Sustainable Development in 2002, and has since been adopted formally by the parties to the CBD. Now, more than fifteen years after the CBD came into force, and at a time when the international community is actively preparing for the Rio+20 summit, is a crucial time of reckoning for decision-makers committed to the global effort to safeguard the variety of life on Earth and its contribution to human well-being. It is evident and well documented that the targets the CBD set aside in 2002 have been missed by vast majority of nations (see Butchart *et al.* 2010; Secretariat of the CBD 2010). These milestones

missed by the CBD have served to inform decision-makers and the wider public about the urgent state of biodiversity in 2010, the implications of current trends, and options for the future.

The Hindu Kush-Himalayan (HKH) region is among the high priority list of conservation priorities at the global level (Brookes *et al.* 2006). However, in terms of the 2010 targets, the HKH region is not an exception to the global failure to meet these commitments. The HKH is a particularly dynamic region with a rich and remarkable biological and cultural diversity (Dhar 1993, 1997; Guangwei 2002; Pei 1995; WWF & ICIMOD 2001). The region, with its varied landscapes and high diversity of vegetation types, soils, and climatic conditions, is well known for its unique flora and fauna showing high levels of endemism (CEPF 2005; Dhar 2002; Mittermier *et al.* 2004; Myers *et al.* 2000). The mountainous ranges of the HKH, such as Himalayas, Nyainqentanglha, Kunlun, Hindu-Kush, Karakoram, and Tian Shan, and including the high elevation Tibetan Plateau, provide subsistence to over 200 million inhabitants, a range of mountain agricultural and pastoral communities, and many diverse cultures. All play an important and essential role in providing goods and services to the multitudes of people who live downstream (Schild 2008) in the ten river basins which emanate from these mountainous regions, and support over 1.3 billion people.

The HKH region faces the overarching threats to biodiversity of species loss and extinction from habitat degradation and fragmentation (Ives *et al.* 2004; Myers *et al.* 2000; Pandit *et al.* 2007), poor or lack of management of natural resources, and illegal trade in wildlife and other bio-resources. Biodiversity in the HKH region is declining partly due to lack of incentive provisions for conserving biodiversity and as a result of economic growth and environmentally destructive development. Even protected areas (PAs) such as national parks, nature reserves and wildlife sanctuaries face tremendous pressures from external driving forces and communities living both inside and outside their boundaries (Sharma & Yonzon 2005). This paper briefly reviews the status of the 2010 targets within the HKH region, and seeks to provide some insight on the state of biodiversity conservation in the HKH through focussing on past biodiversity conservation and management trends, specifically in relation to 2010 targets, and outlining future challenges and opportunities.

### *State of biodiversity conservation with reference to the CBD 2010 targets*

Twenty-two headline indicators with seven focal areas (Table 1) were identified by the CBD in order to assess the progress made towards meeting the 2010 targets. The overview of the global analysis (BIP 2010, Table 4 page 53; Secretariat to the CBD 2010, Table 1, page 18) revealed that majority of the indicators set were not achieved at the global level and displayed declining trends. The extent of habitat in most parts of the world is declining and increasingly fragmented; populations of threatened species have been further reduced; and threats to biodiversity have increased with an increase in the number and rate of spread of alien species in all continents and all ecosystem types (BIP 2010).

An overview of the HKH region (Table 2) illustrates that the countries of the HKH are at very different stages of progress towards meeting the 2010 targets. Likewise, it is evident that the respective countries of the HKH region are at very different levels with respect to embracing the conservation measures outlined in the 2010 goals and targets. Emerging economies such as those of China and India have given high priority to most of the targets, while on the other hand, developing and underdeveloped countries such as Afghanistan, Bhutan, Nepal and Pakistan have given either a medium or low priority to most of the targets. While both Bangladesh and Myanmar give all the targets top priority, there is some concern as to whether they will have the means to follow through on their good intentions. Most of the countries had difficulty in setting targets for invasive alien species (Goal 6, Targets 6.1 and 6.2) and for technology transfer (Goal 11), perhaps since this could have financial or technology implications. Both Pakistan and Afghanistan were weak on setting targets in general (also see Desai *et al.* 2010).

Protected areas (PAs) are considered as an integral element of global biodiversity conservation (Brooks *et al.* 2004; Lovejoy 2006), and have often been used as a key indicator of the global commitment to biodiversity conservation and sustainable development (Secretariat of the CBD 2004; Chape *et al.* 2005). The global analysis revealed that the CBD target of 10 % of a country's total terrestrial area under some form of PA (UNEP 2002) we achieved and exceeded at the global scale, attaining 12.9 % under PAs globally (Jenkins & Joppa 2010). Similarly, the HKH regio-

**Table 1.** Global status on the CBD defined focal areas and headline indicators for achieving 2010 targets.

Focal area	Headline indicator	Global status of the indicator
Status and trends of the components of biodiversity	1. Trends in extent of selected biomes, ecosystems, and habitats	↓
	2. Trends in abundance and distribution of selected species	↓
	3. Coverage of protected areas	↑
	4. Change in status of threatened species	↓
Sustainable use	5. Trends in genetic diversity of domesticated animals, cultivated plants, and fish species of major socioeconomic importance	↓
	6. Area of forest, agricultural and aquaculture ecosystems under sustainable management	↕
	7. Proportion of products derived from sustainable sources	⊙
	8. Ecological footprint and related concepts	↑
Threats to biodiversity	9. Nitrogen deposition	↑
	10. Trends in invasive alien species	↑
Ecosystem integrity and ecosystem goods and services	11. Marine Trophic Index	↕
	12. Water quality of freshwater ecosystems	↕
	13. Trophic integrity of other ecosystems	⊙
	14. Connectivity/fragmentation of ecosystems	↓
	15. Incidence of human-induced ecosystem failure	⊙
	16. Health and wellbeing of communities that depend directly on local ecosystem goods and services	⊙
	17. Biodiversity for food and medicine	⊙
Status and trends of linguistic diversity and numbers of speakers of indigenous languages	18. Status of traditional knowledge, innovations and practices	↑
	19. Other indicators of the status of indigenous and traditional knowledge	⊙
Status of access and benefits sharing	20. Indicator of access and benefit-sharing	⊙
Status of resource transfers	21. Indicator of technology transfer	⊙
	22. Official development assistance provided in support of the Convention	⊙

Source: BIP 2010; Sharma *et al.* 2010. Upright arrow- Negative changes, Down turn arrow- Positive changes, Two way arrow- No clear global trend. Positive and negative changes are occurring depending on the region or biome considered, White circle- Insufficient information to reach a definitive conclusion.

nal member countries made significant progress by bringing 39 % of its terrestrial area under some form of protection (Chettri *et al.* 2008). However, at the national level, they are at different stages of progress (Table 3). Afganistan, Bangladesh, India and Myanmar are yet to reach the anticipated target of 10 % of their total geographical coverage.

It is important to bear in mind that these countries are not only diverse in terms of their biogeophysical characteristics; they are equally diverse in terms of their geo-political and socio-economic situations. As a result, they are at very different stages in terms of their development and socio-economic conditions, and, in turn, in their

**Table 2.** Reflection from the third country reports on 2010 targets (Crossed circle- national level targets developed; Bold circle- global targets used and triangle- targets not set).

Goals		2010 global targets								HKH Countries compliance						
		Afghanistan	Bangladesh	Bhutan	China	India	Myanmar	Nepal	Pakistan							
Goal 1. Promote the conservation of the biological diversity of ecosystems, habitats and biomes	Target 1.1. At least ten percent of each of the world's ecological regions effectively conserved	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲							
	Target 1.2. Areas of particular importance to biodiversity protected	▲	⊕	⊕	⦿	⊕	⊕	⊕	▲							
Goal 2. Promote the conservation of species diversity	Target 2.1. Restore, maintain, or reduce the decline of populations of species of selected taxonomic groups	▲	⊕	⊕	⦿	⊕	⊕	⊕	⊕							
	Target 2.2. Status of threatened species improved	▲	⊕	⊕	⊕	⊕	⊕	⊕	⊕							
Goal 3. Promote the conservation of genetic diversity	Target 3.1. Genetic diversity of crops, livestock, and of harvested species of trees, fish and wildlife and other valuable species conserved, and associated indigenous and local knowledge maintained	▲	⊕	⊕	⊕	⊕		⊕	▲							
Goal 4. Promote sustainable use and consumption	Target 4.1. Biodiversity-based products derived from sources that are sustainably managed, and production areas managed consistent with the conservation of biodiversity	▲	⊕	⊕	⊕	⊕	⊕	⊕	⊕							
	Target 4.2. Unsustainable consumption, of biological resources, or that impacts upon biodiversity, reduced	▲	⊕	⊕	⊕	⊕	⊕	⊕	⦿							
	Target 4.3. No species of wild flora or fauna endangered by international trade	▲	⊕	⊕	⊕	⊕	⊕	⊕	⦿							
Goal 5. Pressures from habitat loss, land use change and degradation, and unsustainable water use, reduced	Target 5.1. Rate of loss and degradation of natural habitats decreased	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲							
Goal 6. Control threats from invasive alien species	Target 6.1. Pathways for major potential alien invasive species controlled	▲	▲	▲	⊕	⊕		▲	▲							
	Target 6.2. Management plans in place for major alien species that threaten ecosystems, habitats or species	▲	▲	▲	⦿	⊕		▲	▲							

Contd...

**Table 2.** Continued.

Goals		2010 global targets		HKH Countries compliance							
				Afghanistan	Bangladesh	Bhutan	China	India	Myanmar	Nepal	Pakistan
Goal 7. Address challenges to biodiversity from climate change, and pollution	Target 7.1. Maintain and enhance resilience of the components of biodiversity to adapt to climate change	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲	⊕	
	Target 7.2. Reduce pollution and its impacts on biodiversity	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲	⊕	
Goal 8. Maintain capacity of ecosystems to deliver goods and services and support livelihoods	Target 8.1. Capacity of ecosystems to deliver goods and services maintained	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲	▲	
	Target 8.2. Biological resources that support sustainable livelihoods, local food security and health care, especially of poor people maintained	▲	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	
Goal 9. Maintain sociocultural diversity of indigenous and local communities	Target 9.1. Protect traditional knowledge, innovations and practices	▲	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	
	Target 9.2. Protect the rights of indigenous and local communities over their traditional knowledge, innovations and practices, including their rights to benefit sharing	▲	⊕	⊕	⊕	⊕	⊕	⊕	⊕	⊕	
Goal 10. Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	Target 10.1. All transfers of genetic resources are in line with the Convention on Biological Diversity, the International Treaty on Plant Genetic Resources for Food and Agriculture and other applicable agreements	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲	⊕	
	Target 10.2. Benefits arising from the commercial and other utilization of genetic resources shared with the countries providing such resources	▲	⊕	⊕	⊕	⊕	⊕	⊕	▲	▲	
Goal 11. Parties have improved financial, human, scientific, technical and technological capacity to implement the Convention	Target 11.1. New and additional financial resources are transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with Article 20	⊕	▲	⊕	▲	⊕	⊕	⊕	▲	▲	
	Target 11.2. Technology is transferred to developing country Parties, to allow for the effective implementation of their commitments under the Convention, in accordance with its Article 20, paragraph 4	▲	▲	▲	⊕	⊕	⊕	⊕	▲	▲	

Source: Third National Reports from the respective country reports (<http://www.cbd.int>).

**Table 3.** Number and area coverage of protected areas in the HKH region.

Country	Total area of a country (Sq km)	Total no of PAs	% coverage by PAs	Total area within HKH (km <sup>2</sup> )	Total number of PAs within HKH	PA coverage within HKH (km <sup>2</sup> )	% of PA coverage with respect to total area of HKH
Afghanistan	652225	17	0.44	390475	6	2461	0.06
Bangladesh	143998	38	1.70	13295	5	632	0.01
Bhutan	46500	10	27.27	46500	10	12681	0.30
China	9596960	1974	15.15	2420266	221	1522172	35.51
India	2387590	636	8.99	461139	135	62417	1.46
Myanmar	676577	54	5.32	317629	16	23967	0.56
Nepal	147181	26	17.86	147181	19	24972	0.58
Pakistan	796095	158	11.85	489988	76	18721	0.44
Total		2913		4286473	488	1668023	38.91

Source: Chettri *et al.* 2008; Sharma *et al.* 2010.

compliance with the CBD (Desai *et al.* 2010; Sharma *et al.* 2010).

#### *Paradigm shifts in biodiversity conservation in the HKH*

In recent decades, the HKH region has witnessed significant conceptual development in regional approaches to biodiversity conservation, from ‘people exclusionary’ and ‘species focused’ to ‘people-centred community-based’ and ‘ecosystem/landscape approach’, as reflected by conservation policies and practices within the various countries in the region (Sharma *et al.* 2010). The classical approach of biodiversity conservation, which started with an emphasis on the conservation of flagship species (Wikramanayake *et al.* 1998; Yonzon 1989) evolved to the understanding that “conservation and management of biodiversity are impossible without people’s participation” (Chettri & Shakya 2008). Since 1980s, decentralization and devolution of authority for biodiversity conservation were evident in Governments’ efforts across the HKH region (see Sharma *et al.* 2010). The United Nations Conference on Environment and Development (UNCED) in 1992 placed a premium on people’s participation and promotion of this conceptual shift in both natural resources management and biodiversity conservation. In response, participatory forest management approaches evolved as accepted means in the HKH (Balooni & Inoue 2009; Gilmour & Fisher 1991; Joshi 2000;

Mikkola 2002; Pai & Datta 2006; Poffenberger & Singh 1989; Saighal *et al.* 1996). During the process, it was realised that biodiversity management by local people is more effective when the utility value and benefit to communities thereof is evident. For example, successful examples of community based biodiversity conservation linked to enterprise development include oak-based silk production in Garhwal (India); Jatamansi (*Nardostachys jatamansi*) in Humla (Nepal); traditional local paper from lokta (*Daphne* spp) and argeli (*Edgeworthia gardenieri*) in Nepal; and ecotourism in India (Sikkim) and Nepal (Annapurna Conservation Area) (see Sharma *et al.* 2006). In all of these examples, and many others, community-based biodiversity conservation was seen as instruments that enhance conservation and sustainable use of threatened or vulnerable species and/or ecosystems.

As early as 1999, conservation approaches in the HKH took on a new dimension with the concept of linking the existing PAs with corridors (Sherpa & Norbu 1999). This approach, while addressing the biophysical advantages of corridors for migration, habitat contiguity, species refugia for restoration, and shifting of species and habitat types in response to environmental pressures such as climate change, also incorporates the notion that communities and how they manage their natural resources play an important role both in connecting PAs, and the effective management of PAs. Subsequently, the concept of landscape-level

conservation approaches (Smith & Maltby 2003; Secretariat of the CBD 2004) evolved in the region generally adopted the 'Ecosystem Approach' advocated by the CBD. The ecosystem approach is defined by the CBD as 'a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way'. It places 'human needs at the centre of biodiversity management'. Furthermore, 'it aims to manage the ecosystem, based on the multiple functions that ecosystems perform and the multiple uses that are made of these functions.' The approach is based on principles 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 partnership building. There are a number of initiatives based on ecosystem management and landscape approaches now operational within the HKH, with different degrees of progress to date (see Chettri *et al.* 2007; GoN/MFSC 2006; Gurung 2004; Sharma & Chettri 2005; Sherpa *et al.* 2003; Sherpa *et al.* 2004; Zomer *et al.* 2010).

#### *Regional challenges and opportunities for reaching the post 2010 CBD targets*

On the larger, overall scale, the global analysis revealed multiple indications of continuing decline in biodiversity globally in all three of its main components, i.e. genes, species and ecosystems. In particular, species which have been assessed for extinction risk globally are on an average moving closer to extinction (Secretariat of the CBD 2010). Amphibians face the greatest risk; nearly a quarter of plant species are estimated to be threatened with extinction; the abundance of vertebrate species, based on assessed populations, fell by nearly a third on average between 1970 and 2006; natural habitats in most parts of the world continue to decline in extent and integrity; freshwater wetlands are showing serious declines; extensive fragmentation and degradation of forests and other ecosystems has led to loss of biodiversity and ecosystem services, and crop and livestock genetic diversity continues to decline in agricultural systems (see Secretariat of the CBD 2010). The five principal pressures identified as directly driving biodiversity loss (habitat change, overexploitation, pollution, invasive alien species and climate change) are either constant or increasing in intensity, globally. The ecological

footprint of humanity now exceeds the biological capacity of the Earth by a wider margin than at the time the CBD 2010 targets were agreed upon (see Secretariat of the CBD 2010).

While the prospects for biodiversity in Asia are precarious, as elsewhere, the vast scale of human activities in this region means that development poses a direct challenge to the resilience of the regional ecosystem (UNEP 2010). The serious effects of these activities are already evident today: rapid economic development in this region has led to massive changes in lifestyle and increases in correlated indirect drivers of biodiversity loss. As a result, nature has come under great pressure and much valuable biodiversity has been lost or continues to be degraded in the region. However, in spite of these challenges, some encouraging signs of progress have also been observed (UNEP 2010). For example, across the entire Asia and the Pacific region, about 87 per cent of the parties to the CBD have developed national biodiversity strategies and action plans. Almost half of these have been updated since 2002, demonstrating the willingness manifested by these countries to protect their biodiversity since the CBD 2010 targets were established.

The HKH region, in particular, is facing enormous pressures from an array of drivers and impacts from environmental change, including climate change and desertification (Erikson *et al.* 2009; Tse-ring *et al.* 2010). While the Fourth Assessment Report (4 AR) of Intergovernmental Panel on Climate Change (IPCC) made a strong science-based rationale for the need for actions countering the potential ill effects of climate change globally (IPCC 2007), it also pointed out the lack of reliable data and data collection efforts in the HKH region. It is evident that climate change in the HKH will affect all aspects of the climate, making rainfall less predictable, changing the character of seasons, and increase the risk to biodiversity (Xu *et al.* 2009). The increasing risk for human livelihoods and well-being include increasing frequency and severity of extreme events such as cyclones, landslides and floods. Within the HKH region, the impact of these changes is often aggravated by existing environmental and socio-economic problems, such as poverty, water scarcity or food deficiency (Mertz *et al.* 2009). These in turn contribute to a downward-spiralling cycle with adverse impacts on livelihoods driving people to desperate measures that decimate natural resources, further increasing the impacts of climate change.

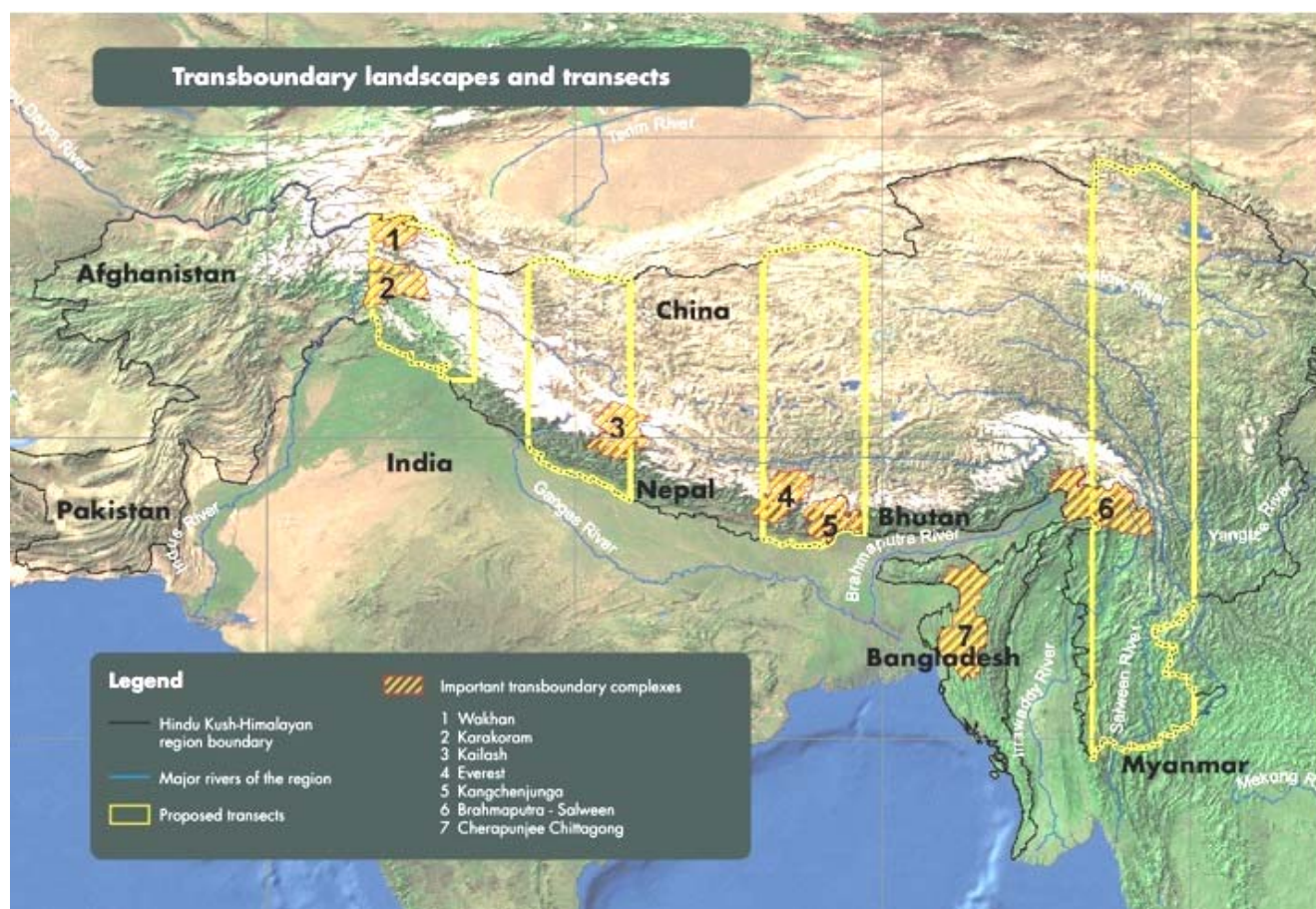


The prevailing climate change scenario in the HKH is somewhat incomplete and scattered (IPCC 2007; Tse-ring *et al.* 2010). However, recent evidences from the HKH (Chaulagain 2006; Liu & Chen 2000; Shrestha *et al.* 1999; Shrestha *et al.* 2000) are raising alarming signals for the fate of Himalayan biodiversity and its services. In the HKH, as in mountains elsewhere, small changes in temperature can turn ice and snow to water, and extreme slopes lead to rapid changes in climatic zones over small distances, with steep climatic gradients controlling habitat types and species distribution. For these reasons, mountain regions have been recognized as ecologically fragile and particularly vulnerable to climate change. For example, on the basis of a preliminary assessment done on the projected impacts and vulnerability of the Eastern Himalayan region to climate change, it is estimated that, there will be significant negative impacts on biodiversity, water availability, agriculture, and incidence of hazards such as glacial lake outburst floods (see Chettri *et al.* 2010; Sharma *et al.* 2009; Shrestha & Devkota 2010; Tse-ring *et al.* 2010). These will generally also have detrimental impacts on general human well being and the livelihoods of highly natural resource dependent mountain communities.

The HKH region has made significant progress in the establishment of PAs in recent decades. Although a wide number of scholars have used PAs as a key indicator for assessing progress in reaching the CBD 2010 targets (Chape *et al.* 2005; Coad *et al.* 2009; Jenkins & Joppa 2010; Loucks *et al.* 2008; Rodrigues *et al.* 2004; Zimmerer *et al.* 2004), many of these scholars pointed out that the percentage of area protected in a given country or biome is not a strong indicator of actual conservation needs or effective action. In particular, this indicator overlooks the fact that biodiversity is unevenly distributed across the region. More significantly, perhaps, is the very evident fact that actual implementation of conservation measures within PAs varies significantly across the region. This fact is illustrated by the case of Myanmar, where human-induced pressure and lack of financial and skilled human resources are impinging on the effective management of PAs (Rao *et al.* 2002). Bawa (2006) also points out that local challenges, such as the lack of economic opportunities, interdisciplinarity in conservation actions, institutional development, skilled human resources, and large scale conservation approaches hinder conservation.

Several recent initiatives in the region offer

significant opportunities for advancing and piloting innovative and regionally appropriate conservation approaches. In particular, the importance of regional cooperation for the application of an ecosystem approach as advocated by the CBD has been stressed by the International Centre for Integrated Mountain Development (ICIMOD), a regional inter-governmental organization based in Kathmandu, Nepal, whose geographical mandate is the HKH region. The transboundary landscape approach recognizes that application of ecosystem management within the HKH will require increased regional cooperation, in part due to the biophysical nature of these mountainous areas, the extreme heterogeneity of the region, inter-linkages between biomes, habitats, and sectors, and the strong upstream - downstream linkages related to the provisioning of ecosystem services. Seven critical 'Transboundary Landscapes' have been identified by ICIMOD (Fig. 1), highlighting the crucial role of improved cooperation amongst the countries of the region if the CBD post-2010 targets are to be met. An ecosystem management based landscape approach has been developed and piloted in a number of these transboundary landscapes since late 1990s (See Chettri *et al.* 2007; Sharma & Chettri 2005; Sharma *et al.* 2007; Sherpa *et al.* 2003; Sharma *et al.* 2007). Likewise, in recent years, ICIMOD has been engaged in promoting conservation corridors for enabling climate sensitive species to move and adapt to changing climate scenarios in the Kangchenjunga Landscape, across an area including portions of eastern Nepal, Sikkim and Darjeeling of India, and Western Bhutan (Chettri *et al.* 2007). The Kailash Sacred Landscape (Zomer *et al.* 2010), comprising an area of the remote south-western portion of the Tibetan Autonomous Region of China, and adjacent parts of north-western Nepal, and northern India is piloting innovative approaches for regional cooperation based upon the development of a Regional Cooperation Framework for biodiversity conservation and sustainable development of this area. This initiative is based upon a consultative process which engages regional, national and local stakeholders for facilitation of transboundary, integrated approaches to sustainable development and conservation. Ecosystem management is promoted through the Regional Cooperation Framework development process, based upon the development of a long-term Conservation Strategy, supported by a Comprehensive Environmental Monitoring Strategic Plan, to address threats to the environ-



**Fig. 1.** Map showing the delineation of the four geographically defined 'Transects', and the seven 'Transboundary Landscapes' in the Hindu Kush-Himalayas.

mental and cultural integrity of this area, analyze change processes, and to develop a knowledge base upon which to build regional cooperation. Likewise, this concept is being promoted for the Brahmaputra-Salween Landscape in the far eastern Himalayas, comprised of the *Namdapha - Hkakaborazi - Gaoligongshan* complex that covers adjacent protected areas of China, India and Myanmar. The complex is biologically highly diverse with a common ecosystem shared by many species of global importance, and an important habitat and refuge for these species. During a regional consultation held in Tengchong, Yunnan, China in 2009, the representative members from the three participating countries recognized the importance of regional cooperation for this biodiversity rich complex and delineated a set of actions towards developing a regional cooperation framework (ICIMOD 2009). These landscapes provide opportunities for piloting of innovative approaches, including approaches to providing a range of environmental monitoring and the initiation of

long-term ecological research for the region. Important aspects of the transboundary landscape approach is the recognition of essential cross-cutting issues related to policy, governance, social equity, gender, and inclusion, while at the same time mainstreaming knowledge management principles (see Chettri *et al.* 2009; Sharma *et al.* 2010), and highlights the crucial importance of open knowledge exchange.

The HKH-Transect Initiative (Chettri *et al.* 2009), an approach to address the information gaps across the HKH, was conceptualized and discussed among global and regional stakeholders in 2008 at the International Mountain Biodiversity Conference (ICIMOD 2008). Four 'Transects' were identified, taking into account gradients from west to east, dry to wet and the south to north latitudinal expanse of the HKH (Fig. 1). This conceptual framework was developed to address the deficiency in environmental data from the HKH. Likewise, it promotes capacity development, regional cooperation, and a participatory approach

specifically for long-term and standardised environmental monitoring, ecological research, and the enhancement of a shared regional knowledge base. The geographically defined “Transects” allow for co-locating research, monitoring and sampling sites, in-depth studies, and action research projects across the region, allowing for both comparative research and synergistic efficiencies, while creating “policy enabled” virtual sampling frames. Likewise, this initiative recognizes that success will depend on cooperation amongst the regional, national and local partners, and the global research community and other stakeholders, and the institution of participatory and consultative processes encouraging regional cooperation and national ownership.

### Conclusions and future prospects

Many scholars have pointed to the evidence of poor achievements in terms of the CBD 2010 targets for conservation, and have argued for development of more robust targets and careful monitoring mechanisms (see BIP 2010; Butchart *et al.* 2010; Hoffman *et al.* 2010; Mace *et al.* 2010; Rands *et al.* 2010; Walpole *et al.* 2009). Projections of global change impacts on biodiversity show continuing and, in many cases, accelerating species extinctions, loss of natural habitat, and changes in the distribution and abundance of species and biomes over the 21st century are equally valid and alarming for the HKH region. The HKH region is an exceptionally important biogeographical region with high conservation value. However, it is evident that the region is particularly vulnerable to the impacts of globalisation, economic growth, and climate change, with mountain biodiversity under threat. Anecdotal evidence of change is abundant, but in this vast region there is little, hard scientific information. Improved knowledge, information and environmental data is urgently needed so that appropriate action can be taken to combat and limit the impacts of future changes. Data collection and sharing in the HKH have been limited in many ways, but principally the Himalayas are too vast a range for any one group to study as a whole. Cooperation among the regional member countries, along with the efforts of global partners, is required to strengthen biodiversity conservation, and provide the information and knowledge needed to apply ecosystem management on a long-term basis.

The Global Biodiversity Outlook 3 makes clear

that the CBD 2010 targets were not achieved, and highlights the dire need for better and more integrated global- and regional-scale scientific information on biodiversity and ecosystem services. The need for building scientific capacity at local, regional, and international levels was a central concern of the CBD's 2011-2020 Strategic Plan, finalized at COP-10 in Nagoya with the participation of a broad range of stakeholders, and is not only particularly relevant to meeting the targets within the HKH region, but crucial to providing the knowledge base for ecosystem management in the region.

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