DISCUSSION DRAFT

Hindu Kush-Himalaya – Current Status, Challenges and Possible Framework[1]

Ram P. Chaudhary
Central Department of Botany
Tribhuvan University, Kirtipur, NEPAL
Phone: (977-1) 4333722 (Off.).
Email: ram@cdbtu.wlink.com.np

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Executive summary

Background

The Hindu Kush-Himalayas (HKH) comprises vast ice reserve. The countries in the HKH are among those countries of the world whose livelihood, agricultural productivity and economic development rely heavily on mountain discharge of water, sustainable management of natural resources including biodiversity. The region is among those with the richest biological diversity of global significance; however, the region is beset by a long list of problems. Thus, what is going on in the HKH in the era of globalisation has relevance far beyond the region. In this presentation, my intention is to give a glimpse of status, major challenges, and possible framework on biodiversity and its conservation.

Status

The HKH hosts four global biodiversity hotspots; 60 ecoregion types; and 488 PAs. Similarly altogether 1,106 Important Bird Areas (IBAs) in the eight member countries; and 53 Important Plant Areas (IPAs) in five member countries have been identified; however, many important biodiversity areas fall outside PAs. The HKH is rich in endemic genera and species of angiosperms. Hotspot comprising Indian northeastern Himalaya is a refugium of flowering plants of primitive families and genera, and an active centre of speciation, and the cradle of flowering plants. In the HKH, as many as 25,000 species of angiosperms, 75,000 insects, and 1,200 birds are estimated to occur; and the region is also rich in agrobiodiversity and wild relatives of crop plants. However, there is considerable gap in our knowledge about biodiversity, in particular lower groups of plants and invertebrates.

Challenges and Possible Framework

Major challenges to biodiversity conservation at various levels in the HKH stem from inadequate policies and strategies; weak institutional, administrative, planning and management capacities; inadequate data and information management; unsustainable harvesting of resources; and poverty. Possible challenges and framework include as follows:

(i) CBD 2010 target aims to develop goal, targets and indicators in consistent with CBD and incorporate them into relevant plans and programmes.

(ii) Climate change process and its effect in the environmental and socio-economic conditions of mountain and lowland people are not adequately understood. It is suggested to establish a long-term monitoring through systematic research on species richness representing different ecoregions in the HKH along different gradients.

(iii) Transboundary poaching and illegal hunting for trade continues within the countries and across the transboundary areas, despite the countries have laws for biodiversity conservation. Harmonization of laws, and coordination among HKH member countries for transboundary conservation could be an effective way to control the transboundary poaching and illegal hunting to an extent.

Other specific challenges pertinent to member countries include **sustainable harvesting of biological resources, Access to genetic resources and benefit sharing, sustainable tourism, livelihood, pasture management**, and **human-wildlife conflict**; and these could be managed through regional coordination among the member countries and good governance at the national level.

The three objectives of CBD: conservation, sustainable use, and fair and equitable sharing of benefits is likely to success if legislation, governance and society move forward in harmony.

1. Background

The Hindu Kush-Himalayas (HKH), extending from the borders of Myanmar and China across northern India, Bhutna, Nepal, Pakistan, Afghanistan, comprises vast ice reserve. The countries in the HKH are among those countries of the world whose livelihood, agricultural productivity and economic development rely heavily on mountain discharge of water, sustainable management of natural resources including biodiversity. The region is among those with the richest biological diversity of global significance including high endemism, and centre of origin of some crops and livestock. However, the region is beset by a long list of problems. Thus, what is going on in the HKH in the era of globalisation has relevance far beyond the region. In this presentation, my intention is to give a glimpse of status, major challenges, and possible framework on biodiversity and its conservation.

2. Status

The HKH, stretched over 4,000,000 km^2, is geologically young and comprises most diverse elevational, topography, slope, exposute, microclimate, substrate, and climate (Ives et al. 2004). The HKH is often been called "hotspots" of biodiversity with unique and rich biodiversity at ecosystem, species and genetic level.

2.1 Biodiversity at ecosystem level

The HKH hosts four global biodiversity hotspots such as Himalaya hotspot, Indo-Burma hotspot, the mountains of southwest China, and the mountains of Central Asia (Mittermeier et al. 2004).

Similarly, among 60 ecoregion types found within the HKH, 30 are critical and represent 12 of the Global 200 Ecoregions (c.f. Chettri et al. 2008). The prominent ecoregions within the HKH include eastern Himalayan alpine meadows; Tibetan Plateu steppe; eastern Himalayan broadleaf and conifer forests; Terai-Duar Savannas and grasslands; western Himalayan temperate forests; Middle Asian montane woodland and steppe (Olson and Dinerstein 1998).

The region is endowed with many globally significant plant and animal species (Pei 1995), and endemic species. Indo-Burma hotspot alone is home to 13,500 plant species including 7,000 (51.9%) endemic species; 2,185 vertebrate species including 528 (24%) endemic species (Myers, 2001). The eastern Himalayan alpine shrub and meadows along the Inner Himalayas support an estimated 7,000 plant species, and are distribution centre of taxa: *Rhododendron, Androsace, Primula, Gentiana, Leontopodium, Meconopsis, Saxifraga, Sedum, Saussurea, Potentilla, Pedicularis, Viola,* etc. Similarly, the ecoregion harbors about 100 mammal species including snow leopard (*Uncia uncia*), blue sheep (*Pseudois nayur*), takin (*Budorcas taxicolor*). (www.worldwildlife.org - accessed on 10 June 2008).

The **Protected Areas** (PAs) in the HKH host a unique assemblage of biological diversity. In 2007, a total of 488 PAs have been recorded along with a wide spatial coverage of more than 1.6 million km^2; and represent about 39% of the region's terrestrial area, with China, India and Nepal contributing the most PAs compared to other regional countries (Chettri et al 2008). These authors also analyzed an increasing trend in the establishment of PAs within the HKH for the last three decades i.e. from only 12 PAs in 1957, increasing to 98 in 1977, and to 346 in 1997.

The **Important Bird Areas** (IBAs) programme, has identified a total of 1,106 IBAs in the eight member countries of the HKH, of which around 30 % (330 IBAs) are within the HKH *per se*; however 73% of the total IBAs in terms of area, and 57% in terms of number are outside existing PAs network (Chettri et al. 2008).

Plantlife International and national partners in five countries (Bhutan, China, India, Nepal, and Pakistan) have provisionally recognized 53 **Important Plant Areas** (IPAs) for medicinal plants in the Himalaya, with a significant number of smaller sites at a more local level (Hamilton and Radford 2007). However, critical assessment of IPAs in terms of coverage of area, and along the west-east and altitudinal axes is yet to be undertaken for the entire HKH.

Another important aspect of biodiversity in the HKH is the **endemism**. The region is rich in endemic genera and species of angiosperms. In Nepal, it is estimated that at least 500 (almost 8%) out of estimated 7,000 species are believed to be endemic to Nepal; and in Bhutan as many as 750 species (15 %) of 5000 species are endemic.

Hotspot comprising Indian northeastern Himalaya, along with the contiguous region of the Chinese provinces of Yunnan and Schezwan is a refugium of flowering plants of primitive families and genera, and an active centre of speciation, and the cradle of flowering plants (Takhtajan 1969). Study conducted by Behera et al. (2002) in the Subansiri district, Arunachal Pradesh (AP) in eastern Himalaya showed predominance of five plant families (i.e. Rubiaceae, Lauraceae, Acanthaceae, Magnoliaceae, and Rosaceae), which accounted for 45.8% (27 species) of the total number of endemic species in AP. The same study concluded that occurrence of many primitive families and genera are indicative of long evolutionary age and affinities of the area with respect to species endemism.

2.2 Biodiversity at species and genetic diversity

The HKH lies at the crossroads of six floristic regions: Central Asiatic in the north, Sino-Japanese in the east, Southeast Asia-Malaysian in the south-east, Indian in the south, Sudano-Zambian in the south-west, and Irano-Turanian in the west. As many as 25,000 species of angiosperms (10% of the world's), 75,000 insects (10% of the world's), and 1,200 birds (13% of the world's) are estimated to occur (Jansky et al. 2002). The HKH is also rich in agrobiodiversity and wild relatives of crop plants (www.icimod.org).

There exists wide diversity of fauna in the in the region; for instance; in southwest China, there are as many as 2,175 species of vertebrates (70 % of the total) species in China, among which the mammals number 340 (60 % of the total in China); there are 165 species of amphibians (75 % of total in China); and 229 reptiles (60 % of the total in China) (www.icimod.org). The Eastern Himalayan Region is home to 163 globally threatened species including Asia's three largest herbivores – *Elephas maxima*, *Rhinoceros unicornis*, and *Bubalus bubalis*; and its largest carnivore, the tiger (*Panthera tigris*), as well as several birds such as vultures, adjutant storks, and hornbills (www.worldwildlife.org). A glance of plant and animal diversity in the HKH region by country is given in Table 1; however, there is considerable gap in our knowledge about biodiversity, in particular lower groups of plants and invertebrates. Also the figures need updating in the present context.

Table 1. A glance of plant and animal diversity in the HKH by country

Country	Geographical Area (sq. km)	Number of Flowering Plants & Fern species	Birds	Mammals	Reptiles	Amphibians	Fish
Afghanist	652,090	4,500	389	119	2	6	2

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Bangladesh	144,000	7,400	632	125	154	23	736
Bhutan	46,500	5,000	800	160	-	-	197
China	9,596,960	29,700	572	499	1,186	380	279
India	2,387,590	17,000	1,200	350	453	182	-
Myanmar	676,577	7,766	967	300	241	75	-
Nepal	147,181	5,568	844	181	100	43	185
Pakistan	796,095	6,000	666	188	174	16	156

Source: Pei Shengji (1995)

3. Challenges and Possible Framework

Major challenges to biodiversity conservation at various levels in the HKH stem from inadequate policies and strategies; weak institutional, administrative, planning and management capacities; inadequate data and information management; unsustainable harvesting of resources; and poverty. Possible framework with ultimate aim, goal and challenges is given in Table 2.

Table 2. Framework for Biodiversity Conservation in the HKH

Ultimate aim: To develop eco-referenced database on biodiversity in the Hindu Kush-Himalaya (HKH)			
Ultimate goal: Institutionalizing long-term continuity in mountain research programme in the HKH			
Level	**Challenges**	**Objective(s)**	**Approache/Programmes**
Global	CBD target	Monitoring tool of biodiversity trends in ecoregions/countries	Develop realistic, time-bound, measurable targets following 2010 target guidelines
	Climate change	Better understanding of biodiversity	Develop, test and demonstrate innovative analytical methods and tools through pilot studies
Regional	Transboundary poaching and illegal hunting	Long-term monitoring and cooperation among countries sharing transboundary landscapes	Develop connectivity of ecosystems & harmonization of laws through regional collaboration
National	Sustainable harvesting of biological resources	Reduce unsustainable use of biological resources	Develop good governance management
	Access to genetic resources and benefit sharing (ABS)	Ensure the fair and equitable sharing of benefits arising out of the use of genetic resources	Address ABS properly in the legislation or as fundamental rights in the constitution
	Sustainable tourism	Conservation of biological and cultural diversity & enhancing socio-economic status	Develop social equity mechanism to support local communities
Local	Livelihood	Enhancing diversification of socio-	Develop strong linkages with processes operating at regional

		economic activities	and global levels.
	Pasture management	Management of traditional pasture lands	Develop ways to minimize/avoid grazing pressure
	Human-Wildlife conflict	Crop damage and livestock depredation	Develop joint training programme

3.1 CBD 2010 Target: Biodiversity is currently being lost at unprecedented rates. The loss is due to complex response to several human-induced, and global changes (Jansky et al. 2002). To address this problem, representatives of 190 countries at the 2002 Johannesburg WSSD committed themselves to reduce the current rate of biodiversity loss as a contribution to poverty alleviation by adopting the Convention on Biological Diversity 2010 target (Balmford et al. 2005).

Steps towards developing global 2010 target indicators started in 2004 in the Conference of Parties (COP-7). Subsequently in 2006, COP-8 adopted framework for monitoring implementation of the achievements of 2010; and some are also linked to MDGs. In addition, COP has also invited the governments to develop measurable, time-bound, and outcome-oriented national and/or regional goals and targets, considering submission from indigenous and local communities and other stakeholders; and to incorporate them into relevant plans and programmes.

For the member countries in the HKH, challenges remaining ahead are to develop national goals, targets and indicators and incorporate them in their Fourth Biodiversity National Report to be submitted to the CBD secretariat by March 2009. It is being realized that 'the governments have set the ambitious target of reducing biodiversity loss by the year 2010. The scientific community now faces the challenge of assessing the progress made towards this target and beyond' (Pereira and Cooper 2006).

Many countries in Europe (such as EU, UK) seem to be in a better position with respect to progress in developing targets and indicators (www.parliament.uk); but the countries in HKH are less prepared. However, it would be preferable to aim to develop national framework of goals and targets in a format similar to those adopted by the COP (UNDP/GEF, 2008). Although each country may define timing and level of ambition to achieve time-bound specific national targets according to their institutional capabilities, a regional networking to achieve national targets would be most rewarding since biodiversity conservation in the HKH is in the process of interdependency.

3.2 Climate change

Mountains areas are highly sensitive to global climatic change; however from the scientific point of view they provide unique opportunities to detect, model and analyse global change process and their effects in the environmental and socio-economic conditions of mountain and lowland people (Hofer 2005). Research programmes in the context of global change in mountain regions is particularly important: (i) for generating and strengthening knowledge about the ecological and sustainable development of mountain ecosystem; (ii) for understanding the dynamics, functioning and importance of providing a number of strategic goods and services essential to the well being of both rural and urban, highland and lowland peoples, particularly water supply and food security; and (iii) establish database devoted to mountains as to capitalize on knowledge to support interdisciplinary research, programmes and projects to improve decision making and planning (Hofer 2005). Biogeographic variation in species richness is essential to our understanding and conservation of biodiversity.

Species richness. Species richness is a simple, most widely used measure of biodiversity (Whittakar et al. 2001); and acts as a surrogate measure for many other kinds of variation in biodiversity. Changes in species richness along altitudinal transects is, therefore valuable in the study of global climatic change (Korner 2007).

Monitoring changes in species diversity by considering indicators that represent species richness at three different spatial scales, such as local, landscape, and macro-scale, have been essential and discussed by Whittaker et al. (2001). Weber et al. (2004) simplify and use the term local biodiversity for the biodiversity within one habitat type; landscape diversity for biodiversity in a given area with different habitat types (habitat mosaics); and macro-scale diversity for the regional biodiversity, i.e. biogeographic regions or countries.

Numerous studies have examined the relationships between plant species richness, climate, spatial and environmental variables such as size of area, latitude, elevation, precipitation and evapotransportation. Species richness in mountain is generally thought to decrease with latitude and elevation (Korner 2007); however the pattern of changes has been found to be variable. Several studies have shown a monotonic decrease with altitude in vascular plant species (Austrheim 2002); others have found a hump shaped relationship between vascular plant species richness and altitude (Grytnes and Vetaas 2002; Bhattarai and Vetaas 2003; Kharkwal et al. 2005) or non-random change with elevation (Carpenter 2005). However, species richness was significantly higher on the north facing slope than on the south facing slope in the dry inner valley of the trans-Himalaya, Nepal; and is determined by moisture and evapotranspiration (canopy and aspect) (Panthi et al. 2007).

The current knowledge for predictions of climate change impacts on biodiversity including species of narrow range in the HKH is inadequate It is suggested to establish long-term monitoring through systematic research on species richness representing different ecoregions in the HKH at altitudinal gradients and on both north (wetter) and south (drier) aspects. An ecosystem management approach is emerging between Bhutan, India and Nepal in Kanchenjunga landscape (Chettri et al. 2008).

Functional type. In the past and recent years, considerable time, efforts and money have been spent on collecting biological specimens. However, ecologists do not have ready access to datasets which allow them to assign plant species to **functional type**, i.e. biodiversity that provides goods and ecosystem services. The taxonomists may develop specimen database which combine taxonomic data at specimen level with physical data (variation among individuals) so that this information will be assigned to make predictions about the sensitivity of plant species responding to climate change. This is one way to predict which species will be under greatest threat under a range of climate change scenarios, and thus which vegetation types are most at risk (Pendry et al, unpublished manuscript). Specimens are the link between functional types and taxa. Some promising information are available for a part of HKH in eFloras site (www.efloras.org); however, most floristic database systems operate at taxon level. It is suggested to develop an integrated regional taxonomic and ecological data for an in-depth understanding of ecosystem function rather than on species *per se*, and tackling climate change issues.

3.3 Transboundary Poaching and Illegal Hunting

Most of the countries in the Himalayan region have laws for biodiversity conservation. The countries in the region have adopted CITES, and implemented their international obligations in their national laws; yet poaching of wildlife for trade continues within the countries and across the transboundary areas (Li et al. 2000).

The traded species include medicinal plants, and animal species and wildlife products used for food, medicine, and pets. The illegal trade in the Himalayan region is relatively active across the Sino-Nepal, Sino-India and Sino-Pakistan; thereby threatening survival of many endangered species. The main species involved in trade, an example from China include an endemic Tibetan antelope (*Pantholops hodgsonii*) for Shahtoosh wool and skin, an endangered animal the Giant panda (*Ailuropoda melanoleuca*) for skins, Saker Falcon (*Falco cherrug*), and Hill Mynas (*Gracula religiosa*) for pets (Li et al. 2000).

The degree of protection accorded to endangered plant and animal species differs from country to country. In China, the penalty for illegal hunting and trade in the Giant panda is very high, from imprisonment to death.

Legislation, however, alone will not solve the problem of illegal wildlife trade, because in many instances the national laws are not fully enforced. However, harmonization of laws (Li et al. 2000); and coordination among HKH member countries for transboundary conservation (Chettri et al. 2008) could be an effective way to control the transboundary poaching and illegal hunting to an extent.

3.4 Sustainable harvesting of Biological Resources

A majority of people in HKH depend largely on biological resources, mainly non-timber forest products (medicinal plants, bamboos, mushrooms, etc) for sustenance as well as economic development. However, unsustainable harvesting has reduced the quantity and quality of many NTFPs from wild in HKH including Nepal (HMGN/MFSC 2002).

Studies have proved that many major natural resource management crises are in badly governed countries, because correlation exists between bad governance and bad resource management. Good governance management appears to be much more likely in countries with stronger economies and effective democratic processes (Sayer and Campbell 2004).

3.5 Access to genetic resources and benefit sharing (ABS)

Access to genetic resources and benefit sharing (ABS) can be a major force for: (i) conservation of knowledge, innovation and practice of indigenous communities who possess in-depth knowledge about the ecology and economy of plant species, and (ii) emergence of the institutions and governance structures that are essential for sustainable use of biological resources. Rules and regulations regarding fair and equitable sharing of benefits from genetic resources have been weakly addressed by the countries in HKH. The ABS process will remain incomplete without addressing the social and economic well being of people, and governance issues. For a country like Nepal which is progressing to develop New Constitution, ABS should be endorsed as fundamental rights of the indigenous peoples' who are strongly dependent upon availability and sustainable use of the biological resources for their livelihood.

3.6 Sustainable tourism

Nature and culture based tourism are becoming increasingly popular in the HKH. Bhutan with its relatively intact natural environment has great potential to benefit from this growing demand. However, a part of ecotourism incomes need to used to support conserving bio-cultural diversity; and enhancing socio-economic status of local communities through social equity, as in case of Annapurna Conservation Area, Nepal.

3.7 Livelihood

Mountain peoples have a holistic view of the eco- and societal system and their relationship with nature is based on coexistence rather than competition (Ramakrishnan, 2005). The livelihood of the inhabitants in the HKH is dependent upon existing processes and activities, namely: (a) glacier retreat, water management; (b) agricultural practice, animal husbandry, tourism, trade, and migration; and (c) traditional knowledge and intellectual property rights. The above processes interact with each other besides having strong linkages with processes operating at the regional and global levels. For example, the people of Manang (trans-Himalaya) achieved success not by avoiding the process of globalization, but precisely by linking up to such processes (Chaudhary et al. 2007).

3.8 Pasture management

In the HKH region, traditional pasture lands near the tree line are common and used by villagers for grazing as a common property, with little or no consideration of carrying capacity of the pasture lands. Current predictions suggest that effects of warming only will be minimal in the tropics and maximum at high altitude (Korner 2007). Two issues are pertinent in pasture management. The first issue is related to overgrazing by livestock in the high altitude grassland often leading to dominance of unpalatable species (*Ranunculus, Anemone*) in the pasture lands. The second issue is about the indications of future climate change where a shift to warmer habitat would lead to extension of the xerophytic vegetation types which, at best offer some browse for goats, but little for sheep and bovines.

3.9 Human-Wildlife Conflicts

Livestock depredation and crop damage by wildlife are two areas of concern that are now emerging as the main issues/problems encountered by the local communities in HKH. In Bhutan, crop damage by wild animals is ranked as one of the biggest problems faced by most rural communities. Another problem that seems to be on the rise is livestock depredation by wild animals such as tiger, leopard, wild dog, bear and snow leopard. While people are (environmentally) conscious, their main source of livelihood is severely affected by their tolerance to wildlife. Joint training programmes between government and communities need to be developed to resolve the human-wildlife conflict.

4. Conclusion

Biodiversity monitoring requires reliable information on status, condition, conservation value and trends of biodiversity at different levels from a broad, global or continental context, to comparisons of landscape within defined regions, and comparisons of stands within and among regions. However, there is considerable gap in the knowledge not only about the biotic wealth in the HKH-region *per se*, but also about distribution and the composition of communities and ecosystems. There is need to establish long-term systematic research at all levels representing varied ecoregions in the HKH along gradients for generating knowledge to predict climate change. The information thus documented should be highly reproducible and statistically sound for easy communication to a broad range of society including politicians, planners and policy makers.

To fulfill the commitment of CBD, it is suggested to develop biodiversity indicators that are used to assess national performance important for monitoring the status and trends of biological diversity. Biodiversity indicators also provide feed back information on ways to continually improve the effectiveness of biodiversity management programmes.

Regional coordination among the member countries of HKH could be an effective way to control transboundary conservation and sustainable use of resources; while good

governance and political stability would strengthen implementation of biodiversity programmes at the national and field level.

The three objectives of CBD: conservation, sustainable use, and fair and equitable sharing of benefits is likely to success if legislation, governance and society move forward in harmony.

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