Protected Areas and Biodiversity Conservation in the Hindu Kush-Himalayan Region with Special Reference to the Kangchenjunga Landscape

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Effective biodiversity conservation relies to a significant degree on information about protected areas, their number, status, and components within and outside them.

Introduction

Protected Areas (PAs) have long been recognised as a significant form of land use (Chape et al. 2005) and an integral part of biodiversity conservation (Lovejoy 2006). The number of PAs worldwide grew significantly after the formation of the World Commission on Protected Areas (WCPA) which provided a framework for the establishment and effective management of PAs (Hamilton and McMillan 2004). There are now more than 110,000 PAs in the world covering nearly 19 million sq.km., and representing about 12% of the earth's land surface (IUCN/UNEP/WCMC 2005). In the eastern Himalayas, PAs in the form of national parks, conservation areas, wildlife reserves, wildlife sanctuaries, and biosphere reserves have been established to

protect species listed in the red list of the International Union for Conservation of Nature (IUCN) and the appendices of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES) (WWF and ICIMOD 2001). Conservation of the species within the protected area alone, however, does not ensure long-term conservation of species; this requires natural landscape linkages to provide sufficiently large connected habitat, migration possibilities, and interaction of population. Evidence of ongoing loss of species due to lack of connectivity has been reported from national parks in North America and Africa (Bennett 2003).

Long-term conservation of species needs conservation at the landscape level, covering wide ranging areas extending beyond even the political territory of each country. In turn a landscape approach requires an understanding of the overall elements of biodiversity in the entire landscape. ICIMOD's introduction to biodiversity conservation initiatives using this approach began with compilation and collation of information on PAs in the Hindu Kush-Himalayan Region (HKH). A computerised database was developed to organise the information covering those PAs falling within the HKH boundary coordinates as defined by ICIMOD (Box 1). The project on 'Developing Transboundary Biodiversity Conservation Corridors in the Kangchenjunga Landscape' (Sharma and Chettri 2005) was introduced using a landscape approach to facilitate biodiversity conservation in the southern part of the Kangchenjunga complex, which is shared by Bhutan, India, and Nepal. Information on PAs and adjoining areas was gathered so that potential conservation corridors could be identified. This paper provides a preliminary review of PAs in the HKH region in terms of number, area, altitudinal coverage, and IUCN management categories, together with an overview of the status of biodiversity in the Kangchenjunga landscape based on the information gathered.

Protected Areas in the HKH

The HKH covers an area of more than four million sq.km, which includes the whole of Bhutan and Nepal and some parts of Afghanistan, Bangladesh, China, India, Myanmar, and Pakistan. Elevation zones extend from tropical (<500m) to nival (>5,000m); principal vertical vegetation regimes consist of tropical and subtropical rain forest, temperate broad-leaved deciduous or mixed forest, and temperate coniferous forest including high cold shrub or steppe and cold desert (Guangwei 2002). All HKH member countries are signatories to the Convention on

Box 1: Database of protected areas in the Hindu Kush-Himalayas

The Protected Areas database serves as a repository for the vast and scattered information on protected areas (PAs) in the HKH. The main objective of the database is to collate and disseminate information on PAs in an accessible and comprehensive way. The major features include a detailed country profile of the eight ICIMOD member countries in the HKH; details of PAs; spatial data with a number of satellite images showing the precise location of the PAs within the HKH; profiles of flagship species; geographical, land use and climatic maps; references; and a glossary of general terms and IUCN conservation and management categories. The database has a simple keyword search facility. Specific searches based on genus, species, common name, or taxonomic groups such as mammals, birds, and amphibians can also be carried out.

Biological Diversity (CBD) and have designated protected areas valuable in terms of biodiversity. The PA data from the HKH database indicate that there are 488 PAs in the HKH covering a total area of more than 1.6 million sq.km, 39% of the total area. PAs in the region have grown significantly in the last three decades in both number and area with an increase in total area from about 98,000 sq.km in 1987 to more than 1.6 million sq.km in 2007 (Figure 1). The rate of increase in the number of PAs has slowed since 2000.

IUCN has defined management categories for PAs (IUCN 1994). Of the 488 PAs in the HKH, 189 belong to management category V, that is areas mainly protected as landscape or seascape particularly to safeguard aesthetic, cultural, and ecological values. Less than one per cent of PAs are managed as Category I, that is strict nature reserves or wilderness areas. In Afghanistan, India, and Pakistan most PAs are in category IV, that is habitat/species management areas or protected areas ensuring maintenance of habitats to meet the requirements of specific species. About 15% of PAs in the HKH, mostly in China (11 PAs) and Pakistan (48 PAs), have yet to receive formal IUCN PA management categories. Ecologically, the majority of PAs are in alpine regions or areas above 4,000m, followed by subalpine areas at 3000-4000m. Temperate regions between 2,000-3,000m are comparatively less represented. Many important habitats, such as wetlands in Afghanistan, mixed evergreen and littoral ecosystems in Bangladesh, alpine dry steppe in Pakistan, and mangrove wetlands in Myanmar are well represented (Pei 1995).

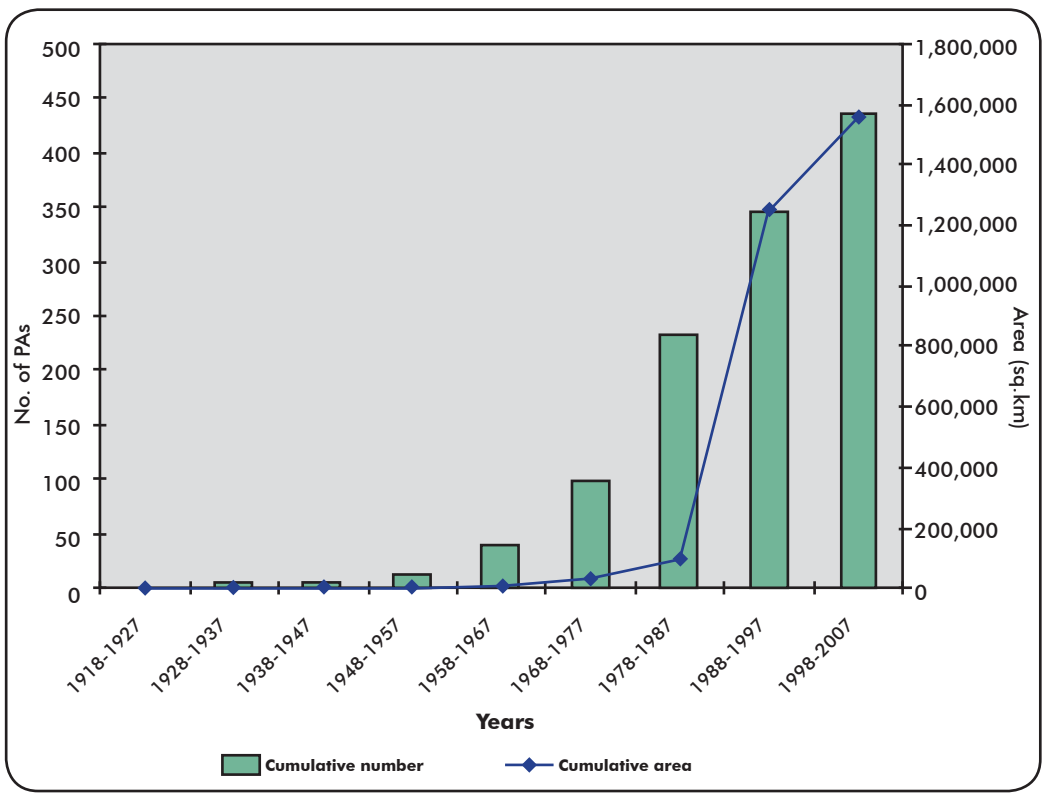

Figure 1: Cumulative growth in PAs in the HKH region from 1918 to 2007 (excludes 51 sites with unknown year of establishment)

PAs and the Status of Biodiversity in the Kangchenjunga Landscape

The work on developing a 'Kangchenjunga landscape' approach is a major initiative under ICIMOD's transboundary biodiversity conservation activities. The southern part of the landscape lies within the coordinates 87.5° to 90.5° E and 26.5° to 28.1° N and includes parts of eastern Nepal, western Bhutan, and Sikkim and Darjeeling in India. The landscape is one of six transboundary complexes identified by ICIMOD in the HKH region (Sharma and Chettri 2005). It includes important areas of the eastern Himalayan ecoregion which is comprised of temperate coniferous and broad-leaved forests (Wikramanayake et al. 2002), and includes fourteen PAs (Table 1). Nine of the PAs are connected by six proposed or implemented conservation corridors. The conservation corridors were identified by integrating layers of information on biology, climate, vegetation, landscape coverage, species' home range and viability of population, and sensitivity to the human population. The 14 PAs and 6 conservation corridors cover an area of 7754 sq.km. The protected areas in the landscape are habitats for many globally significant plant species such as rhododendrons (*Rhododendron nivale, R. sikkimensis, R. kesangiae, R. flinckii, R. maddenii*) and orchids (*Cypripedium elegans, Cymbidium hookerianum, Coelogyne treutleri*), and many endangered flagship species such as snow leopard (*Uncia uncia*), Asiatic black bear (*Ursus thibetanus*), red panda (*Ailurus fulgens*), Himalayan musk deer (*Moschus chrysogaster*), blood pheasant (*Ithaginis cruentus*), and chestnut-breasted partridge (*Arborophila mandellii*).

The twelve PAs in Sikkim and Darjeeling in India have been strictly managed for the protection of globally-threatened species. The two national parks Neora Valley and Singhalila are managed for both ecosystem protection and recreation. The Kangchenjunga Conservation Area (KCA) in eastern Nepal is the only PA in category VI, in other words managed by the local communities. The Khangchendzonga Biosphere Reserve (KBR) in Sikkim is the largest of the PAs, with 1,784 sq.km of core zone and four buffer zones with a total area of 836 sq.km giving 2620 sq.km in total. This PA alone has some 2,500 species of recorded flowering plants, 42 species of mammal, and 450 species of bird (Chettri and Singh 2005). The first of the PAs were established in 1940 (Senchel Wildlife Sanctuary and Mahananda Wildlife Sanctuary), and the most recent in 2000 (KBR and Pangolakha Wildlife Sanctuary).

Ecosystems and species' diversity

The PAs in the Kangchenjunga landscape cover various bioclimatic zones. The diversity of forest and vegetation differs from one protected area to another. KCA is comprised of subtropical evergreen forest, mixed broad-leaved forest, coniferous and rhododendron forest, and alpine scrub (Shrestha and Ghimire 1996). Some of the PAs in India, such as KBR in Sikkim, contain subtropical broad-leaved forest, moist temperate forest, subalpine rhododendron and coniferous forest, and alpine scrub (Department of Forest, Government of Sikkim 1997). Similarly, Singhalila National Park (SNP) supports lower temperate evergreen broad-leaved forest and upper temperate *Tsuga* forest and oak-hemlock forest (Pradhan and Bhujel 2000). Mahananda Wildlife Sanctuary (MWS) mostly contains deciduous hill forest, *Acacia-Dalbergia* riverine forest, sal forest, and riverine grassland (Pradhan and Bhujel 2000). The six proposed

Table 1: **Protected areas and proposed corridors in the Kangchenjunga landscape**

Protected area proposed corridor	Country	IUCN Category	Year Established	Area (sq.km)	No. of recorded species[a]		
					Flowering plants	Birds	Mammals
Kangchenjunga Conservation Area (KCA)	Nepal	VI	1998	2035	1026 (13)	207 (3)	22 (7)
Barsay Rhododendron Sanctuary (BRS)	India	IV	1998	104	141	113[b]	22[b]
Fambong Lho Wildlife Sanctuary (FWS)	India	IV	1984	52	(NA)	135 (6)	24 (4)
Jorepokhari Salamander Sanctuary	India	IV	1985	0.4	(NA)	40[b]	5[b]
Khangchendzonga Biosphere Reserve (KBR)	India	not set	2000	2620	2500	450[b]	42[b]
Kyongnosla Alpine Wildlife Sanctuary (KWS)	India	IV	1977	31	(NA)	120 (4)	16 (2)
Mahananda Wildlife Sanctuary (MaWS)	India	IV	1976	127	329	243[b]	35[b]
Mainam Wildlife Sanctuary (MWS)	India	IV	1987	35	(NA)	185 (5)	16 (4)
Neora Valley National Park (NVNP)	India	II	1992	88	172	19[b]	18[b]
Pangolakha Wildlife Sanctuary (PWS)	India	IV	2000	128	(NA)	(NA)	(NA)
Senchel Wildlife Sanctuary (SWS)	India	IV	1940	39	379	73[b]	22[b]
Shingba Rhododendron Sanctuary (SRWS)	India	IV	1992	43	(NA)	150 (6)	20 (3)
Singhalila National Park (SNP)	India	II	1992	79	383	156[b]	26[b]
Toorsa Strict Nature Reserve (TSNR)	Bhutan	Ia	1993	651	266	72[b]	15[b]
Corridor 1: Nepal side of KBR and BRS adjoining KCA	Nepal	Proposed		752	367 (20)	274 (28)	37 (25)
Corridor 2: Between SNP and SWS	India	Proposed		158	331 (8)	45 (5)	16 (10)
Corridor 3: Between SWS and MaWS	India	Proposed		46	498 (15)	29 (1)	17 (13)
Corridor 4: Between MaWS and NVNP	India	Proposed		292	575 (14)	17	25 (18)
Corridor 5: Between NVNP and TSNR	India	Proposed		169	21 (1)	19 (1)	13 (12)
Corridor 6: Between TSNR and JDNP	Bhutan	Proposed		147	129 (3)	141 (14)	16 (11)

[a] numbers in parentheses indicate globally significant species; [b] number of globally significant species not available; NA= data not yet available

and implemented corridors add about 1722 sq.km to the existing protected area system and could help ensure the survival and maintenance of a significant number of globally-threatened species of mammals, birds, and flowering plants protected by PA management (Table 1). The corridors are areas where there is structural connectivity in terms of vegetation and species' composition and minimum human intervention.

Of the approximate total of 3,038 recorded species of flowering plants in the protected areas and corridors (Chettri et al. 2006), about 20% were found in the three corridors in the Darjeeling district in India. As indicated in Table 1, the proposed conservation corridors, in particular the corridor on the Nepal side of the KBR and Barsey Rhododendron Sanctuary (BRS) adjoining KCA, and the corridor between MWS and Senchel Wildlife Sanctuary (SWS), host significant numbers of globally important species: they include spot-bellied eagle owl (*Bubo nepalensis*), wood snipe (*Gallinago nericola*), red-headed vulture (*Sarcogyps calvus*), black baza (*Leuphotes accipitidae*), Himalayan tahr, (*Hemitragus jemlahicus*), snow leopard (*Uncial uncia*), large Indian civet (*Viverra zibetha*), Himalayan goral (*Naemorhedus goral*), and rhesus macaque (*Macaca mulatta*). Similarly 12 of the 13 species of mammals recorded in the corridors between Neora Valley National Park (NVNP) and Toorsa Strict Nature Reserve (TSNR) are globally significant, as are 9 of the 18 species of mammals found in the TSNR-Jigme Dorji National Park (JDNP) conservation corridor.

Conservation challenges

The PAs in the Kangchenjunga landscape have faced various conservation threats including interference from outside the park and human activities on the fringes. The activities include forest encroachment, poaching of wildlife, overgrazing by livestock, illegal fuelwood collection and timber extraction, extensive collection of non-timber forest products (NTFP), and, often, unregulated tourism. Habitat fragmentation and transformation of natural habitats are aggravated by landslides, soil erosion, flooding, much shortened fallow cycle of shifting cultivation, deforestation, agricultural extension, and forest fires. Corridor areas were highly fragmented because of deforestation practices, overgrazing, and overexploitation of forest resources such as NTFP and medicinal plants.

Discussion

Conservation at the landscape level imply the protection of natural habitats so that all the ecosystem components are maintained. Extending biodiversity management beyond protected areas plays a significant role in delivering the three objectives of the Convention on Biological Diversity (CBD); conservation, sustainable use, and equitable sharing of benefits (Secretariat of the CBD 2005). The HKH region contains many globally significant ecosystems and species and isolated protected areas are inadequate for their conservation (CEPF 2005). In the Kangchenjunga landscape, six potential conservation corridors have been identified to provide landscape connectivity among the existing PAs and to ensure long-term conservation of entire elements of biodiversity in the region (Sharma and Chettri 2005). Establishment of such corridors implies the establishment of continuous habitats to not only preserve endangered and rare species of plants and animals, but also diverse ecosystems that provide significant services for the well-being of communities dependent on their resources.

Protected area management in recent years has been considered in the context of integrated development through which resource conservation is carried out along with sustainable economic opportunities for the local communities directly dependent on natural resources. It is evident from the PA database of the Hindu Kush-Himalayas that PAs in category VI have a greater area coverage than other PAs. They include predominantly unmodified natural areas meant for long-term protection and maintenance of biodiversity but in which sustainable use of natural resources by the community is permitted (Chettri et al. 2006). In Nepal, collaboration in forest management between the park authorities and local communities in buffer areas of PAs has brought economic benefits to the people (Oli 2005). Information collected about the PAs in the HKH region can be analysed to identify and prioritise areas for future protection and to facilitate development of effective management plans. The PAs of the HKH can be revised with new information about various aspects of PA management such as socioeconomic status, indigenous knowledge, and information on associated corridors and buffer zones.

Conclusion

The PAs in the HKH are managed in a variety of ways, ranging from management as strict nature reserves and wilderness areas to community-based resource management, which transfers the responsibility for conserving biodiversity and sustainable harvesting of forest products to local people. Considering habitat connectivity, the number of species recorded in the corridor areas is significant enough for the areas to be designated biodiversity conservation corridors in the Kangchenjunga landscape. Transboundary protected area management in the Kangchenjunga landscape is an important initiative in terms of taking conservation beyond the PAs and beyond political boundaries in the HKH. National and regional collaboration is taking place to help establish effective and ecologically-managed biodiversity conservation corridors between selected PAs and the buffer zone system so that the rate of biodiversity loss can be significantly reduced and comprehensive participation of a wide range of stakeholders solicited to manage them. Learning from the Kangchenjunga landscape, gap analysis of protected area coverage should be carried out across the HKH to identify ecoregions and globally significant species and help establish an ecologically sound network of PAs and corridors in the whole Region.

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