

International Mountain Biodiversity Conference

November 2008

Conference Report

IMBC: Biodiversity Conservation and
Management for Enhanced Ecosystem Services:
Responding to the Challenges of Global Change

Workshop Reports

Mountain Transboundary Protected Area and
Connectivity Conservation 2008

Linking Geodata with Biodiversity
Information in the Himalayas

Research Strategy on Global Change in
Mountain Biosphere Reserves

**A Compilation of the Rapporteurs' and Workshop
Convenors' Reports**

Summary

The HKH region is one of the largest and also most understudied mountain regions in the world and one where the effects of global change are becoming apparent at an ever increasing rate. While there is a growing body of anecdotal evidence which strongly suggests that the mountain ecosystems and biodiversity which form the basis for local livelihoods are threatened by changing conditions, the hard data needed to substantiate what seems to be probable and plausible are sorely lacking. The mountainous regions of the eight countries that share the Hindu Kush-Himalayan (HKH) region share similar terrain, biological diversity, and climatic conditions, and face the same challenges of global change. They also share the fact that none has fully benefited from the experiences gained by global institutions and programmes. There is an added incentive to address these issues now as there is a growing awareness that the influence that mountain ecosystems exert on their neighbouring environments extends far beyond their geographical limits to encompass the surrounding lowlands dependent on them for goods and services. While highlands and lowlands have always been linked, globalisation has brought both new challenges and a greater awareness of the need to address them.

In recognition of the need for reliable data that will allow the region to benefit from climate change science, ICIMOD convened the International Conference on Mountain Biodiversity, which took place from 16-18 November 2008 at the ICIMOD Headquarters in Kathmandu. The objective of this meeting was to bring together global institutions involved in biodiversity conservation with regional groups familiar with the specific issues of the region. The aim was to share, network, and develop future strategies and alliances for mountain biodiversity conservation especially to meet the emerging challenges from climate change. It was the expressed intention of the organisers to bring together researchers from the region, who have an in-depth understanding of the region and its people, with representatives of global programmes, who have access to the latest methodologies for data collection and interpretation. Some 75 biodiversity, climate change, and conservation experts, representatives of global programmes, and representatives of the eight countries that share the Himalayan region, from more than 20 countries in all, met to discuss ways of systematically gathering and sharing the information needed, developing a reliable picture of the present situation, and formulating approaches to respond.

The Conference was accompanied by two pre-conference workshops on Mountain Transboundary Protected Areas (10-14 November 2008), and Linking Geodata with Biodiversity Information (15-16 November 2008), and a post-conference workshop on a Research Strategy on Global Change in Mountain Biosphere Reserves (19 November 2008) which provided further opportunities to discuss special aspects of this important topic.

One of the major discussion points was on how to fill the gap in availability of consistent data for the HKH region. The transect (latitudinal – north south) approach at various longitudes in the HKH, which includes both transboundary biodiversity rich landscapes and their connectivity corridors, was the highlight of the conference. The transect approach was accepted as the way forward, with the understanding that the concept still needs some further development and fine-tuning. Another area of concern was long-term continuity of research efforts for the generation of meaningful data through a coordinated effort. ICIMOD should take the lead in developing the transect approach and in implementing it with its regional and global partners.

The three main themes of the Conference centred on climate change and its implications for mountain biodiversity; biodiversity management for economic goods and ecosystem services from the mountains; and institutionalising long-term continuity in mountain research programmes. The papers presented on these themes provided the basis for animated discussions. These discussions helped to advance our understanding of the effect of climate change on the biodiversity and the lives and livelihoods of the people of the Himalayan region, and were recorded by the Chairs and the session rapporteurs. The conference report presented here is the sum of these reports for each of the sessions. The pre and post conference workshops were reported in a similar way by the conveners and these reports are also enclosed here for completeness.

The full conference proceedings, which will contain all of the invited papers, will be publishing by ICIMOD in electronic form, in mid 2009.

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Acronyms and Abbreviations

AAS	Afghanistan Academy of Sciences
ABS	access and benefit sharing
APN	Asian Productivity Network
ArcGIS	Arc Geographical Information Systems
ArcIMS	Arch Internet Map Server
ASCCI	Altai-Sayan Connectivity Conservation Initiative
ASP.NET	Microsoft's web application framework
BFRI	Bangladesh Forest Research Institute
BR	Biosphere Reserve
CAS	Chinese Academy of Sciences
CBD	Convention on Biological Diversity
CC	climate change
CCA _s	connectivity conservation areas
CCD	Convention to Combat Desertification
CCM	connectivity conservation management
CDM	clean development mechanisms
CEPF	Critical Ecosystem Partnership Fund
CESVI	Cooperation and Development (Cooperazione E Sviluppo)
CHM	clearing-house mechanism
CHT	Chittagong Hill Tracts
CITES	Convention on International Trade in Endangered Species
CKNP	Central Karakoram National Park
CMES	Centre for Mountain Ecosystem Studies
CODATA	Committee on Data for Science and Technology (CODATA)
CONDESAN	Consortium for Sustainable Development of the Andean Ecoregion
CoP	Conference of Parties
CRIS	Current Research Information System
DAR	Department of Agricultural Research
DG	Director General
DGCS	Directorate General's Guidelines for Developing a Cooperative System
DIGIR	Digital Imaging Information Resource
DIS	Data Information Service
DIVERSITAS	International Programme of Biodiversity Science
DNPWC	Department of National Parks and Wildlife Conservation
DSS	decision support systems
DST _s	decision support tools
ECES	Environmental Change and Ecosystem Services (ICIMOD)
EEA	European Environment Agency
EH	Eastern Himalayas
ES	ecosystem services
ESSP	Earth System Science Partnership
EU	European Union
EV-K2-CNR	Everest- K2- Italian National Research Council (CNR)
EWHALE	Laboratory of the Institute of Arctic Biology, University of Alaska
FAO	Food and Agriculture Organization
FTP	File transfer protocol
GBIF	Global Diversity Information Facility
GBPIHED	GB Pant Institute of Himalayan Environment and Development
GCOS	Global Climate Observing System
GCRN	Global Change Research Network
GDP	gross national product
GEF	Global Environment Fund
GEOSS	Global Earth Observation System of Systems
GHG	greenhouse gas

GIS	geographical information systems
GLOCHAMORE	Global Change in Mountain Regions
GLOF	glacial lake outburst flood
GLORIA	Global Observation Research Initiative in Alpine Environments
GMBA	Global Mountain Biodiversity Assessment
GTOS	Global Terrestrial Observing System
HAWS	high-altitude wetlands
HKH	Hindu Kush-Himalayas
HKKH	Hindu Kush-Karakoram-Himalayas
IBA	Important Bird Areas
ICIMOD	International Centre for Integrated Mountain Development
ICRAF	World Agroforestry Centre
ICSU	International Council for Science (ICSU)
ICT	information and communication technologies
IGBP	International Geosphere Biosphere Programme
IHDP	International Human Dimensions Programme
INGO	international non-government organisation
INSA	Indian National Science Academy
IP	intellectual property
IPCC	Intergovernmental Panel on Climate Change
IPR	intellectual property rights
IPROMO	International Programme on Research and Training on Sustainable Management of Mountain Areas
IPY	International Polar Year
IRBM	international river basin management
ISI	International Sciences Institute
ISO	International Organisation for Standardisation
ITIS	Integrated Taxonomic Information System
IUCN	International Union for the Conservation of Nature
IWHM	Integrated Water and Hazards Management (ICIMOD)
IWMI	International Water Management Institute
IWRM	international water resource management
IYM	International Year of Mountains
LIBIRD	Local Initiatives for Biodiversity Research and Development
LTER	Long-term Ecological Research Network
LULCC	land-use and land-cover changes
LULUCF	Land-use, land-use change, and forestry
Ma	Mega-annum
MAIRS	Monsoon Asia Integrated Regional Study
MaNIS	Mammal Networked Information System
MAPS	medicinal and aromatic plants
MBRs	mountain biosphere reserves
MDGs	Millennium Development Goals
MEA	Millennium Ecosystem Assessment
MENRIS	Mountain Environment and Natural Resources Information System
MIREN	Mountain Invasion Research Network
MoAIA	Ministry of Agriculture, Irrigation and Animals
MoEST	Ministry of Environment, Science, and Technology
MoF	Ministry of Forestry
MP	Mountain Partnership
MRI	Mountain Research Initiative
MS	Microsoft
NASA	National Aeronautics and Space Administration
NBC	National Biodiversity Centre
NBII	National Biological Information Infrastructure
NCBI	National Centre for Biotechnology Information

NDBR	Nanda Devi Biosphere Reserve
NEON	National Ecological Observatory Network
NEPA	National Environmental Protection Agency (Afghanistan)
NGOs	non-government organisations
NTFP	non-timber forest product
OBIS	Ocean Bio-Geographic Information System
OECD	Organisation for Economic Cooperation and Development
PA	protected area
PAD	Provincial Agricultural Department
PADM	Provincial Area Development Ministry
PC	personal computer
PED	Provincial Environment Department
PES	payment for ecosystem services
PoW	programme of work
PoWPA	Programme of Work on Protected Areas
PR	public relations
QNP	Qomolungma National Park
REDD	Reducing Emissions from Deforestation and Degradation
RMCs	regional member countries (of ICIMOD)
RS	remote sensing
SARD-M	Sustainable Agriculture and Rural Development in Mountain Regions
SBSTTA	Subsidiary Body on Scientific, Technical, and Technological Advice
SHARE	stations at high altitude for research on the environment
SLRP	Sustainable Livelihoods and Poverty Reduction (ICIMOD)
SNP	Sagarmatha National Park
TAAS	Tibetan Academy of Agricultural Sciences
TAR	Tibet Autonomous Region
TCP	technical cooperation programmes
TEK	traditional ecological knowledge
TNC	The Nature Conservancy
TRs	transboundary reserves
UHI	University of Highlands and Islands
UMN's	University of Minnesota's Map Server
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNESCO MAB	United Nations Educational, Scientific, and Cultural Organisation's Man and Biosphere programme
UNFCCC	United Nations Framework Convention on Climate Change
UNGA	United Nations General Assembly
UNU	United Nations University
US NSF	United States' National Science Foundation
WCPA	World Commission on Protected Areas
WFS	web feature service
WI	Wetlands International
WISA	Wetlands South Asia
WMO	World Meteorological Organisation
WMS	web map service
WSSD	World Summit on Sustainable Development
WTO	World Trade Organisation
WWF	WWF-World Wide Fund for Nature (formerly World Wildlife Fund)

International Mountain Biodiversity Conference

Biodiversity Conservation and Management for Enhanced Ecosystem Services: Responding to the Challenges of Global Change

16-18 November 2008, ICIMOD Headquarters, Kathmandu, Nepal

Background

Mountains are among the most fragile environments on earth but, at the same time, are also rich repositories of biodiversity and ecosystem services, and the sources of much of the water that sustains life on the planet. The influence that mountain ecosystems exert on their neighbouring environments extends far beyond their geographical limits to encompass the surrounding lowlands dependent on them for goods and services. International recognition of the important role that mountain ecosystems play has received more attention since Agenda 21 (Chapter 13) was adopted at the Earth Summit in Rio de Janeiro in 1992 and since then the International Year of Mountains (2002) also helped to focus attention on the need for research and development efforts directed specifically at mountain ecosystems.

In spite of considerable international goodwill, mountain areas continue to face enormous pressures, the origins of which can be traced back to changes taking place globally. The direct drivers of environmental change in mountain areas include climate change, changes in land use/cover and species introduction/removal; while the indirect drivers include demographic, economic, and socio-political changes. Many of these drivers adversely affect biodiversity conservation, ecosystem services, and the well-being of the people whose lives and livelihood derives from the mountain areas. It is well-documented that land use/cover and climate change have already contributed to substantial species range contraction and extinctions; for the future, the consequence of human-induced climate change will likely endanger species persistence. While the first to be impacted will be the livelihoods of mountain people and the biodiversity of mountain species themselves, the effects will also eventually spread to the downstream river basins where they will have global ramifications.

Mountains are becoming a focus for conservation biology because of a growing recognition that the ecological conditions and rich biodiversity found there favour speciation and evolution. These fragile environments, which house some of the world's most threatened species, also house some of the world's poorest people, dependent on the biological resources that the mountain ecosystems afford. Mountainous countries have acknowledged the special status of mountain areas by setting aside 11.4% of their areas for protected area networks. The rationale for creating these protected areas has evolved as the understanding of the role they play has deepened; initially the focus was on conserving wilderness and uniqueness, and now the focus has shifted to their ability to preserve biodiversity, maintain cultural landscapes, and deliver ecological services.

Today there is an increasing appreciation of the service that the rich biodiversity that mountain areas render to the survival of humankind. In 1992, the Convention on Biological Diversity (CBD) put forth global objectives on the conservation of biological diversity, on the sustainable use of its components and on the fair and equitable sharing of the benefits arising from genetic resources. The Conference of Parties in 2004 adopted an 'ecosystem approach' to biodiversity conservation and management which included a programme of work on 'Mountain Biodiversity'. A recent advance in generating information and knowledge on mountain biodiversity complements these global agreements. The 'Mountain Biodiversity' programme aims to implement the CBD to reduce significantly the loss of mountain biological diversity by 2010 at global, regional, and national levels, with a view to alleviating poverty in mountain areas and in lowland areas that are dependent on mountain ecosystems for goods and services. These

programmes strive to remain relevant conservation initiatives by striking a balance between safeguarding biodiversity and encouraging development, and in doing so need to devise meaningful participatory approaches in both species and landscape conservation. The challenge of biodiversity conservation is especially demanding in ecosystem mosaics that cross national borders such as transboundary landscapes.

Globalisation and climate change are threatening biodiversity in even the most remote parts of the Himalayan mountains. As rain patterns change and the temperature increases, the unique plants that grow in this harsh environment may die out, threatening the animals and insects that depend on them, and the livelihoods of the mountain people who use them. There are many stories of change, and anecdotal evidence is abundant, but in this vast region, there is very little hard scientific information, information that is urgently needed so that appropriate actions can be planned to combat and limit the coming problems. A key problem is the alarming lack of systematic data for the Himalayan region, so much so that recently the Intergovernmental Panel on Climate Change (IPCC) the world's foremost authority on this subject, has considered the entire Himalayan region as a data gap area, or 'white spot', on the global climatic map. The eight countries that share the mountainous regions of the Hindu Kush-Himalayas have attempted to tackle the issue of data scarcity but since the response by global agencies has often been bilateral, it has been fragmented; perhaps better progress can be made by taking a regional approach. Global institutions can become better acquainted with the specific challenges shared by the mountainous regions of the countries of the HKH region by engaging regional institutions who have already synthesised the concerns of the member countries into the an in-depth understanding of the underlying issues. Both global and regional institutions stand to benefit from interacting more closely with each other and working together to share, exchange, and develop strategies with the aim of proposing comprehensive solutions to meet the challenges of global change in mountain areas.

Aims and Objectives

The objective of this meeting was to bring together global institutions involved in biodiversity conservation with regional groups familiar with the specific issues of the region. The aim was to share, network, and develop future strategies and alliances for mountain biodiversity conservation together, especially to meet the emerging challenges from climate change.

Inaugural Session

Welcome

Dr Andreas Schild, Director General, ICIMOD

Inaugural Speech: Biodiversity, Environmental Change and Regional Cooperation Initiatives in Hindu Kush-Himalaya
Prof Bruno Messerli, Dept. of Physical Geography, Univ. of Bern

Inaugural Keynote Speech: Biodiversity Conservation in a Changing World: An Overview
Prof Christian Körner, Dept. of Botany, Univ. of Basel

Message: Biodiversity Conservation and Management for Enhanced Ecosystem Services: Responding to the Challenges of Global Change
sent by Dr Ahmed Djoghla, Executive Secretary to the Convention on Biological Diversity

Inaugural Remark: Convention on Biological Diversity: Mountain Biodiversity Programme of Work and 2010 Targets
Mr Krishna C. Paudel, Joint Secretary, Min. of Forests and Soil Cons., Govt. of Nepal; Asia Pacific SBSTTA Bureau Member of CBD

MC: Dr Eklabya Sharma

Rapporteur: Ms Greta Rana

Participants to the Conference were from most of the major global and national programmes, universities, and regional member countries involved in biodiversity conservation and management.

In his inaugural welcome and presentation, the Director General of ICIMOD, Dr Andreas Schild, focused on the 'Himalayas-Source of Vital Resources and Growing Vulnerabilities.'

The Director General's PowerPoint presentation commenced by drawing the participants' attention to three crucial factors: the Himalayas are the third pole of the earth; they form an ecological buffer between the Tibetan Plateau and South Asia; and they are a source of fresh water with 10 major river systems providing a lifeline for over a third of humanity. The features of the Himalayas are that they are the location of major river basins and a centre of rich biodiversity. Currently there is uncertainty concerning the risks to the Himalayan ecosystem and beyond from climate change. Scientific uncertainty needs to be reduced; and yet, in the fourth report of the Intergovernmental Panel on Climate Change (IPCC), the Hindu Kush Himalayan (HKH) region is singled out as an area where sufficient data is not available.

The focus of ICIMOD's work was outlined: it is centred on water and hazard management; environmental change and ecosystem services; and sustainable livelihoods and poverty reduction. Activities include monitoring change, assessing resilience and adaptation; promoting payment for environmental services; disaster risk reduction; and capacity building.

The presentation closed with a brief on ICIMOD's expectations from its work: reduced vulnerability; increased regional ownership of the programme; science and research leading to the use of biodiversity resources as means of poverty reduction; and promotion of trans-Himalayan transects for longer-term monitoring to address the issue of consistent data generation from the HKH region.

Prof Bruno Messerli, Dept of Physical Geography, University of Bern, delivered the inaugural address, commencing by drawing participants' attention to the spectrum of topics covered by the conference and the need to examine them in the context of ongoing climate and environmental changes. The HKH extends 3,500 km and has variety of peoples and cultures, precipitation and climate patterns, and immense diversity in terms of landscapes and genetic resources. How could all the knowledge they offer be organised and improved upon; and how could mountain resources be preserved for highland-lowland benefit?

Prof Messerli presented a map containing the first draft of selected transboundary landscapes and north-south transects in the HKH. There were four transects and seven transboundary complexes open to the north; and through these Chinese researchers could assess and fully understand monsoon regime changes from the south to the Tibetan Plateau. He stressed the importance of knowledge about the climate, water, biodiversity, and ecosystem services in order to plan conservation and development strategies: it was essential to integrate this knowledge into the Global Climate Observing System (GCOS).

Prof Messerli stated that the HKH region is perceived as a 'white spot' because of the paucity of data on it, making modelling and projection difficult; hence, the importance of transboundary cooperation. Exhaustive cover would not be possible, but remote sensing (RS) methods and data from well-equipped sites could help in making projections. He proposed seven sites in which all the RMCs could be involved; these would be test sites where regional-scale information could be applied at the local scale and observations at the local scale could be used to ground-truth regional-scale information.

A GCOS table showing six of the HKH countries with stations above 1,000m was also presented and the hope was expressed that more stations were in the pipeline considering the importance of monitoring glaciers, snow cover, land cover, water, soil, and so forth. The speaker closed with an appeal for interaction and cooperation in the HKH by participation in global and regional programmes and downscaling experiences from them. He hoped that ICIMOD would take the lead in developing the transect approach and start monitoring soon with the active cooperation and participation of ICIMOD's RMC partners.

Prof Christian Körner of the Global Mountain Biodiversity Assessment (GMBA), Institute of Botany, University of Basel, spoke on 'Mountain Biodiversity in a Changing World: An Overview.' In his presentation Prof Körner highlighted mountain areas from several perspectives, in terms of total land area, forest, potential forest, mountain (mountain forest: 2 types), area above and below the tree line, and so on. Prof Körner pointed out that mountains influenced territory, especially river systems, far beyond their area and impacted half of the terrestrial surface. He went on to say that mountain terrain is rugged, and that area decreases with altitude but that mountain biodiversity is surprisingly

far greater than the limited land area leads one to expect. He pointed out that mountains are 'islands in the sky' that fragment habitat into mosaics, and that their slopes and topography influencing climate and vegetation.

A brief presentation was given on the work of GMBA-DIVERSITAS on geo-referenced databases. Among them were illustrations of International Sciences Institute (ISI) publications per country based on the keyword 'alpine', differences in land cover, the usefulness of key species in mitigating land degradation.

A key message given by the speaker was "Plausibility is not evidence," and "absence of facts needs to be addressed by reducing talking and increasing doing."

At this point, a message was read out from Dr Ahmed Djohlaf, Executive Secretary for the Convention on Biological Diversity (CBD). Dr Djohlaf apologised for his absence, which was due to previous commitments. See letter in Annex below.

The letter covered the importance of mountain ecosystems and the recognition by the same of the Conference of Parties (CoP) of CBD in 2004 during which they promoted a programme of work (PoW) on mountain biodiversity. In the International Year of Biodiversity (2010) the next CoP would be hosted by the Government of Japan. In May that year the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) would meet to review the progress of the PoW on Mountain Biological Diversity. It was recognised that the biodiversity of mountain areas was a crucial factor in meeting the Millennium Development Goals (MDGs).

The final speaker was Dr Krishna C. Paudel of the Government of Nepal's Department of Forests. His presentation was on Nepal's CBD programme on mountain biodiversity. He reiterated the important role of the mountains in the context of water supplies, cultures, genepools, and livelihoods. Specific examples were given of all these in his presentation: the importance of biodiversity in terms of species' richness, upland-lowland linkages, fragility, and so forth were also well illustrated.

Nepal's CBD programme placed emphasis on the reduction of loss of biodiversity, addressing threats, and promoting sustainability and the integrity of the mountain ecosystem. Mobilisation of resources and equitable sharing of benefits were also emphasised. The PoW of CBD had led to the Nepal Biodiversity Strategy in 2002, an Action Plan for from 2006-2011, and plans were being made for Wetlands and Wildlife.

The speaker closed by appealing for inputs for the CoP to be held in Japan in 2010 through the Secretariat at secretariat@cbd.in.

This concluded the inaugural session.

Plenary Session I: Central Issues and Concerns

Theme: Climate Change and its Implications for Mountain Biodiversity

Biodiversity in the Himalayas - Trends, Perception and Impacts of Climate Change

Dr Eklabya Sharma, Programme Manager, ECES, ICIMOD

Global Change in Mountain Regions - Strategies for Biosphere Reserves

Dr Thomas Schaaf, Chief of Ecological Sciences and Biodiversity Section, UNESCO's MAB Programme with its World Network of Biosphere Reserves, Division of Ecological and Earth Sciences, Paris, France

Chair: Dr Yuri Badenkov

Rapporteur: Dr Arun B. Shrestha

Dr Sharma's paper introduced the status of biodiversity conservation in the HKH region. The need to link conservation with people and development was adequately stressed but, despite the existence of a legal framework, it has not materialised in real practice. The presentation then dealt with the climate trends observed in the Eastern Himalayas and the implications they might have on habitat shift. Examples were given of keystone species, e.g., *Rhododendrons* and *Alnus nepalensis*, which might be affected by climate change. Lastly, the presentation put forward the concept of transects and of landscape approaches. Altogether four transects were proposed

representing different geoclimatic zones and latitudinal variations. It was pointed out that transects also served as a framework for transboundary cooperation in biodiversity conservation.

Dr Schaaf's paper provided detailed information about the Biosphere Reserve Programme of UNESCO MAB. An overview of biosphere reserve (BR) sites around the globe (530 sites) and particularly in the HKH region was provided. It was mentioned that the number of biosphere reserves in the HKH region was very small. The basic criteria for what a biosphere reserve should possess and functions of biosphere reserves were clarified. A typical structure of a biosphere reserve and some examples of biosphere reserves were provided. The presentation urged the establishment of additional biosphere reserves in the HKH region. It was mentioned that biosphere reserve sites in the HKH region could attract additional funding opportunities for the programme.

Discussion

Dr Gregory Greenwood put forward a question to all HKH participants: what could be the linkage between the cryosphere workshop (held in July 2008) and the present conference? He mentioned that the cryosphere workshop was able to produce a clear and compelling narrative of the understanding and gaps in cryospheric processes and asked what could be the narrative of the present workshop. Dr Greenwood added that, from his recent hike in Nepal, he did not notice anything 'bad' happening in the mountains.

Prof Ramakrishnan responded that charismatic species are important to us (scientists) but not to people in general; and yet the focus of the discussions (in this conference) is the common people. He stated that there are enough species which play important roles in conservation of biodiversity as well as supporting livelihoods.

Prof Bruno Messerli asked Dr Thomas Schaaf why there were so few biosphere reserves in the Himalayas and mentioned this as a disparity. Dr Schaaf responded that this is indeed astonishing, compared to the Andes for example. He was optimistic that Nepal would propose a BR site in the near future. He mentioned that India has come out strongly on this issue and already has one site – Nanda Devi – and is proposing another potential site in Sikkim. China has also been active in this respect, but there have been no concrete initiatives from Bhutan and Bangladesh as yet whereas, in Pakistan, the Kalash Valley is being considered as a potential site for a BR. Thomas Schaaf added that a BR site could attract additional funding from the Global Environment Fund (GEF) as BR sites go through stringent selection processes.

Prof Christian Körner stressed that 'plausible' should not be mistaken for real evidence and urged that hard evidence be sought. He mentioned that biologically diverse landscapes are often manmade landscapes.

Prof Martin Price, referring to Dr Greenwood's comment, mentioned that small species are most impacted by climate and environmental changes, but this is often unnoticed. Nevertheless, these species, as opposed to charismatic species, are more important to people. He reiterated that the discussion was about biodiversity for people.

Dr Ashiq Ahmad Khan mentioned that, in the early 1990s, the emphasis had been on protecting keystone species. He mentioned a law in the mountain communities of Pakistan where taxes from the richer areas were channelled to the poorer areas for the protection of wildlife. He told participants about the success that sites originally established for trophy hunting had eventually had for the conservation of biodiversity. He suggested that sites used for trophy hunting could serve as excellent biosphere sites.

Dr L.M.S. Palni stated that India already has a number of mountain biosphere reserves including one in a cold desert area in India as national initiative, however the one BR recognized by UNESCO is the Nanda Devi BR. He informed participants that the use of proxy data, such as data from dendrochronology (tree-ring chronology), could be a good way of overcoming the problem of data paucity.

Dr Falk Huettmann said that the lack of BR sites in the mountains is due to the selective approach of UNESCO.

Dr Khairul Alam suggested that the Montreal Protocol provided a funding mechanism and it could be useful for the BR programme. He expressed the idea that there should be a mechanism for energy-intensive communities to contribute to less energy-intensive communities.

Dr Thomas Schaaf appreciated the suggestion by Dr Khairul Alam and responded (to Dr Huettmann) by saying that UNESCO does not designate BR sites. The proposal has to come from the government to UNESCO and it has to

be discussed and approved. Prof Christian Körner added that UNESCO has the sovereignty to acknowledge the proposed BR sites. Dr Thomas Schaaf stated that the International Advisory Committee makes decisions and not UNESCO; it makes sure that the three prerequisites are met.

The Chairperson, in his concluding remarks, mentioned that the two presentations were proposing well-known approaches developed in the 1980s and stressed that the approaches should be combined for good synergy. He expressed the need to link biodiversity conservation in the Altai-Sayan ecoregion to the Tianshan and then into the HKH. He touched upon the deliberations of the Madrid conference in BR. A message from Prof Emeritus Dr Larry Hamilton, concerning biodiversity conservation was delivered. In connection with connectivity, he urged the participants to think big, think bio-regionally, think even on a continental scale, and think outside the box!

Plenary Session II: Central Issues and Concerns

Theme: Biodiversity Management for Economic Goods and Ecosystem Services from the Mountains

Biodiversity Goods and Services – Increasing Benefits for Mountain Communities

Dr Robert Zomer, ECES, ICIMOD, Kathmandu, Nepal

Ecosystem Services Arising from Biodiversity

Prof Palayanoor S. Ramakrishnan, INSA Honorary Senior Scientist, Jawaharlal Nehru University, School of Environmental Sciences, New Delhi, India

Chair: Prof Martin Price

Rapporteur: Dr Isabelle Providoli

Dr Zomer addressed the increasing benefits for mountain communities from ecosystem services at local, regional, and global levels, elaborating on the roles of mountain communities and cultural diversity for maintaining biodiversity. Mountain farmers are stewards of genetic heritage and resources within both managed and semi-managed landscapes. He highlighted the following types of useful biodiversity fulfilling a multitude of needs.

- Flora, fauna, multipurpose trees, pollinators, medicinal insects
- Agrobiodiversity

Communities suffer when biodiversity resources are degraded. Drivers of degradation include poverty, poorly managed subsistence activities, population, urban growth, roads, commercial exploitation, resource extraction, unsustainable tourism, globalization, and global change.

With regard to payment for ecosystem services (PES) and upstream-downstream linkages, opportunities directly result from biodiversity conservation. As examples, Dr Zomer mentioned watershed services for the most part.

- Quality / quantity of water, e.g. China – Green for Grain
- India, e.g., large payments to mountain states
- China – rangelands, e.g, payments to reduce herd sizes

Still outstanding issues on PES are valuation of ecosystem services (ES), identifying provision of additional ES (indicators – quantification of ES), appropriate agreements, institutional framework, implementation and monitoring, equitable distribution of benefits, and transparency and governance.

Existing global climate change frameworks on carbon, greenhouse gases (GHG), forests and, biodiversity include the following:

The United Nations Framework Convention on Climate Change (UNFCCC) - Climate Change Mitigation

- Kyoto protocol 2008-2012
 - GHG emission reduction targets
 - Land-use, land-use change, and forestry (LULUCF)
 - Clean development mechanisms(CDM) – afforestation – reforestation

Reducing Emissions from Deforestation and (Forest) Degradation (REDD)

- The Stern Review (2006) emphasised inclusion of the prevention of deforestation as a key element in any future international climate frameworks.
- UNFCCC Conference of Parties (CoP) 15 – Copenhagen - 2009
- Post-Kyoto Framework – after 2012

ICIMOD - HKH and REDD

- Development of a Mountain REDD agenda
- Mountains have very different (and heterogeneous) conditions: biophysical, socioeconomic, and institutional.
- Methods and approaches applicable in lowland forests may not be applicable in the mountains – and they are data sparse.
- The unique conditions and challenges of the mountains need to be highlighted in the international policy arena to articulate the need for REDD policies relevant to the mountains and to the HKH.

Prof Ramakrishnan highlighted the importance of interdisciplinarity between the bio-physical and social dimension in his presentation “from ecosystems to socio-ecological systems.” He emphasised the understanding of mutually supportive dynamics existing between cultural diversity and linked biological diversity, with implications for community-centred sustainable developmental pathways. Biodiversity links knowledge systems and is the key to addressing sustainability concerns, especially through participatory approaches based on community ‘knowledge systems’.

Traditional ecological knowledge (TEK) is an economic, ecological and ethical process. Prof Ramakrishnan described some examples and case studies from India in order to discuss and highlight the sustainable landscape management approach. To conclude, he presented adaptive management, which entails participatory problem-solving and empowerment of all stakeholders.

Discussion

During the discussion, some issues were raised which were later on discussed during group work.

- PES / biological corridors
- How to make biological corridors visible?
- How to pay poor / local people to maintain biodiversity?
- How to engage downstream sectors in carbon payments?
- PES, carbon issues, and CDM need reality checks.

CDM (Clean Development Mechanism)

- Issue of source and sink, internal and external costs.

Mountain agriculture

- Mountain agrobiodiversity, e.g., India –subsistence agriculture in the mountains. Subsistence – sustainable agriculture: How to transform subsistence agriculture into commercial agriculture including organic production?

Poverty and climate change

- Statement: poverty is not responsible for landscape decline. There is a danger of interlinking poverty, biodiversity, and climate change and each case should be considered separately.
- Biodiversity has physical, social, cultural, and economic factors.
- The question remains how to respond to global challenges at local level.
- In the HKH the relationship between poverty and biodiversity is not clear. Therefore a transdisciplinary approach, including local people and which either can be bottom-up or top-down is needed.

Plenary Session III: Central Issues and Concerns

Theme: Institutionalizing Long-Term Continuity in Mountain Research Programmes

Hindu Kush-Himalaya - Current Status, Challenges & Possible Framework

Prof Ram Prasad Chaudhary, Central Dept. of Botany, Tribhuvan Univ., Kirtipur, Kathmandu, Nepal

Global Change in Mountain Regions: Research Strategy and its Implementation

Dr Gregory Greenwood, Director, Décanat, Faculté des Géosciences et de l'Environnement, Switzerland

A Global Long-Term Observation System for Mountain Biodiversity – Lessons Learned and Upcoming Challenges

Prof Harald Pauli, GLORIA: The Global Observation Research Initiative in Alpine Environments, Dept. of Conservation Biology, Vegetation and Landscape Ecology, Univ. of Vienna, Austria

Chair: Dr Uday R.Sharma

Rapporteur: Dr Mats Eriksson

Three presentations were made at the plenary session highlighting 'current status, challenges, and possible framework', the Global Observation Research Initiative in Alpine Environments (GLORIA) research framework and the Global Change in Mountain Regions (GLOCHAMORE) and related research frameworks.

The discussion became more of a questions and answers' session, with 11 questions posed to the presenters, to which they subsequently responded.

The issues touched upon largely evolved around the stakeholders who are, or will be, part of a more concerted long-term research programme. It is obvious that researchers themselves have the strongest stake, but several questions focused on the management level: what is the rationale for managers to become more closely involved in a mountain biodiversity agenda? It was concluded that the managers' group is sometimes difficult to reach and more and improved efforts need to be made. It was acknowledged that interest often follows funding: whenever funding is available the discussions and involvement of different groups are realised. The role of the beneficiaries was also discussed: who are they and how are they getting involved? One group of beneficiaries is at the grass-root level, and this brings the question of dissemination into focus: how are research results and new knowledge made available to those who are in need of them and can put them to use?

The session was summarised by the Chair, Dr Uday R. Sharma, who concluded with the following points.

- Research should be structured.
- Research should be interdisciplinary in the HKH Region and should be supported by governments and local people.
- Dissemination of results is very important.
- How can the research be linked to livelihoods and poverty alleviation? What is in it for the poor?
- How can the interest and ownership at national level be ensured? How interest and ownership are ensured and how dissemination is taking place should be spelled out and highlighted.

Technical Working Groups (Parallel sessions)

The conferees participated in one of five parallel 'working group' sessions on sub-themes in which they were asked to share their HKH regional experiences.

Group I - Theme: Climate Change Impacts on Biodiversity and Mountain PAs

Chair: Prof P. S. Ramakrishnan

Rapporteur: Dr Yan Zhaoli

Prof Ramakrishnan welcomed participants to the group and introduced the , and contributions to the topic and scope for discussion were given by Prof Christian Körner and others. The agenda had two presentations and a focused discussion on how climate change incidences were affecting mountain biodiversity.

The first presentation was an account of climate change from the World Wide Fund for Nature (WWF) Nepal and it was given by Dr Ghanashyam Gurung. The evidence for climate change included rising temperatures in Nepal (the higher the altitude the more rapid the increases), melting glaciers and threats to populations downstream, and increasing occurrence of natural disasters. WWF Nepal worked in various areas to minimise the impacts of climate change: building networks and partnerships, raising awareness, detecting and modelling changes, drafting a national climate change policy, identifying alternative energy options, and prioritising opportunities for negotiation and action.

The second presentation was about the impacts of climate change and coping strategies in Nanda Devi Biosphere Reserve. Dr R. K. Maikhuri from the GB Pant Institute stated that climate change impacts on mountain biodiversity were seen in agriculture, pasture, forests and timberline vegetation, alpine meadows, and so on. These impacts had consequences for human activities such as tourism and intensive harvesting of high-value mountain products. In the central Himalayas, local people's perceptions about climate change were mainly confined to warming and increased variability of rainfall. He also reported that coping mechanisms in the mountains included eco-tourism, cultivation of medicinal plants, and use of pack animals.

Discussion

Following the two presentations, questions were asked of the two presenters, but these questions went far beyond the presentations with contributions from other group members and lots of interaction. All the group members, Prof Christian Körner in particular, actively contributed their expertise to the discussion. Group members agreed that research data and publications defining exactly how climate change is taking place in the mountains and what are the differences from the plains were unavailable. From fragmented information, however, evidence of climate change could be seen from rising temperatures, changing rainfall patterns, melting of glaciers and permafrost, increasing aridity, drying up of wetlands, and reduced water supplies and an increase in water-induced disasters. The interesting point was that diverse mountain topography might mean the mountains were more adaptable to change, because change can go upwards and around the mountains.

The impacts of climate change on mountain biodiversity are not easily decipherable due to lots of uncertainties and the other drivers contributing to changes and their interactions. Nonetheless, there are still obvious impacts: plant succession in the last 150 years was quicker than ever before with faster regeneration; little mountain caps and some species are disappearing in Australia; there are changes in the habitats of wildlife and plant species with a general trend towards moving upwards (such as tigers being found at higher altitudes or exotic plant species invading alpine ecosystems); and loss/reduction of keystone species especially in changed environments such as drying highland wetlands. Water regime changes brought about by climate change might have greater impacts on biodiversity and people's livelihoods than climate change itself.

Climate change affects various biological resources in different ways. When change happens, species that are fast to respond will survive but life forms with narrow niches might disappear. Generally speaking, vegetation is more affected by climate change than animals, because vegetation cannot move. When suitable habitat spaces shrink in response to climate change, this favours competitive species, but many species in the mountains (especially the high mountains of the HKH region) are selective in terms of their environment and have narrow niches.

Protected areas contain only a fraction of mountain ecosystems. The smaller the protected area is, the more vulnerable it will be to climate change. Therefore, the suggestion is to design large protected areas with flexible boundaries (boundaries could be changed seasonally or as per the need). In many cases, corridors and transboundary protected areas should be established to assure sufficient area and connectivity for effective biodiversity conservation.

Protected areas, however, should not destroy livelihoods. Mountain people might not worry too much about the loss of biodiversity or keystone species, but their reactions to changes in land-use patterns, decisions about livestock management, new livelihood options, and migration interplay with the richness of biodiversity and effectiveness of conservation. Therefore, mobilising and involving people within and near protected areas is a key factor in conserving biodiversity. Carbon trade and payment for ecosystem services are potential opportunities for involving local people.

Group II - Theme: Land Use Change Trends and Impact on Mountain Biodiversity

Chair: Dr Daniel B. Fagre

Rapporteur: Birendra Bajracharya

Prof Xu presented the state of land cover/ land use in the Himalayas and stated that urbanisation was a slow process and the climate a long-term driver for change. Historical evidence and an integrated framework would be needed to understand change. An example from the Tarim Basin showed that the rangeland pattern shifted with changes in glaciers. Similarly, the variability of the Asian monsoon always had a strong effect on food production in China, and this could be traced back to 190 AD and the fall of Chinese dynasties being correlated with weaker monsoons. He described the five Chinese elements– gold, land, energy/ fire, water, and wood– and the balance between them which is believed to be important for a harmonious ecosystem.

Major causes of land-cover change in different geographical and historical contexts were identified as changes in the livelihoods of nomads in highland rangelands; forest transition due to plantation and agroforestry; agricultural intensification; and tropical forest and lowland plantation economies. There were also impacts of hydrological responses to land-use/cover and climate changes. These impacts were illustrated through giving examples of rubber plantations and agroforestry policies. Prof Xu attributed the regional pathways of land-use change to a new generation of traditional nomads, agropastoralists, and shifting cultivators whose livelihood patterns are changing, and interactions between different actors, between the highlands and lowlands, and between management decisions and policies. The alternative pathways contributing to sustainability of mountain ecosystems were identified as payment for ecosystem services, agroforestry, and sustainable forest management for carbon, biodiversity, and water-related ecosystem services. It was emphasised that policy support is essential and decision makers should not be forgotten.

During specific discussions on the presentation, Prof Martin Price commented that taking changes experienced in China as a mean in forest transition might not give a true picture when one considered the vastness of the country. Forest transition is a big topic of debate and actual functional aspects should be examined as forest biomass and density are not the same.

Dr Spehn presented land-use change and mountain biodiversity from a global perspective by giving examples from a number of Global Mountain Biodiversity Assessment (GMBA) research findings. The land-use changes that reduce mountain biodiversity are mainly cultivation of formerly pristine areas; intensification of agriculture/husbandry in montane areas; and abandonment of formerly grazed montane and alpine grasslands. The research agenda of GMBA on land-use change was presented with research examples from the European Alps, Caucasus, and Himalayas. The research questions focused specifically on use of highland vegetation and husbandry systems; fire ecology; highland cropping, hunting and gathering and medicinal plants; regeneration; and cross-cutting research issues on hydrology and erosion; interactions of land use with climate change; and indigenous knowledge. The Kilimanjaro study looked into the effects of forest fire on biodiversity and ecosystem functioning. The study in the Himalayas looked into the effects of grazing. It was found that moderate grazing increased species' diversity and that impact is low in the case of highland grasslands unless grazing rates are very high. Selection of less palatable species and appropriate animal selection helps in management of loss due to grazing. The studies and findings are synthesised in 'Eva M. Spehn, Christian Körner and Maximo Liberman (eds.) – Land Use Change and Mountain Biodiversity, Taylor and Francis'.

Prof Martin Price suggested that it is necessary to look at the whole picture of forest, agriculture, and grazing land. There were comments that some systems required fire to increase biodiversity, but it depended upon the frequency of burning. Similarly, the impact of abandonment also depended upon where pastures were and for how long they had been abandoned.

Discussion

The points raised during discussion are summarised below.

No information is available on the overall trend of land-cover/ land-use changes in the Himalayas.

There is a need to look at the definitions of land use and land cover as these will lead to different interpretations of change. Land use and land cover are linked, but they are separate concepts.

- Assessing land-use change and its impact on biodiversity is scale dependent.
- On the largest scale, there can be such intense land-use and land-cover changes (LULCC) that minimum habitat and population of organisms can suffer negative impacts and mountain biodiversity can be reduced.
- On intermediate and local scales, LULCC is site specific, dependent on history, national policies, and upon whether natural mountain biodiversity, agricultural biodiversity, or functional biodiversity are being measured. On these scales, LULCC can have both positive and negative impacts.
- Large habitats and connectivity are matters for large species and usually managed by governments, but farmers' landholdings, home garden management, and small-scale biodiversity species, such as keystone species, should also be taken into account. Similarly, underground biodiversity such as fungi and bacteria should not be forgotten as they support productivity above ground.
- Policy plays an important role in bringing about LULCC. The Chinese government considers introducing rubber plantations and forests as conservation measures, but monocultural plantation is not good for biodiversity, fire, and water regimes.
- Fire is used by herders to increase grass cover, but policies do not permit burning of grasslands. Conflicting policies of different government departments sometimes drive different LULCC (e.g., promotion of plantation by the forest department and promotion of horticulture by departments of agriculture).

Example - 30 years ago poplars were planted in Kashmir to meet timber requirements, but this changed the moisture in the atmosphere and introduced fungus into apple plantations.

Example - Scottish forestation was intended to meet the demand for fuelwood by coal mines during the Second World War, but the spin-off is that now there is an abundance of mushrooms in the forested areas and they are a very big mountain product.

Example – Chittagong Hill Tracts – the land-tenure system is causing changes in land use

- Livelihood and ecological processes needs to be looked at together. It is important to see how management affects biodiversity and ecosystem functions such as slope stability and water supplies. Habitat degradation and fragmentation cause conflict between human and wildlife populations, e.g., elephants in India and Nepal.
Example – In upper Mustang, less snow in recent years has resulted in a decrease in fodder, resulting in fewer animals being raised and less dung for cooking: this in turn has led to an increase in collection of wood from the scarce forest resources.
- We need compelling narratives that motivate programmes from funding agencies.
Example – the narrative 25 years before about intensification of land use in the middle Himalayas increasing landslides and floods in Bangladesh provided a lot of impetus.
Example – the recent glacier studies, which are plausible although not proved, have drawn attention to climate change.
- We should not assume too much, however, the example of shifting cultivation in the Eastern Himalayas shows us that many assumptions are incorrect.

The Himalayan Region is so diverse and we need stories for each area which factor in history and policy but avoid generalisation. We should not look vertically above and below the tree lines only but also at eastern and western areas which are very different.

Group III - Theme: Wetland Ecosystem Functions and Services – Implications of Climate Change

Chair: Dr Chris Baker

Rapporteur: Mr Pradeep Mool

There was one presentation by Chaman L. Trisal from Wetlands International – South Asia on 'Wetlands of the Hindu Kush Himalayas - Ecosystem Functions, Services and Impacts of Climate Change'. The presentation was followed by a short video clip of about seven minutes duration on issues related to the wetlands and climate change in the Wular Lake's Jhelum Basin area.

The presentation highlighted key issues concerning wetlands in the HKH region. The speaker stated that wetlands accounted for about 17% of the area of the region which was the source of ten major Asian rivers, supporting 29% of the global population. The importance of some ecosystem services was discussed in the presentation.

Carbon sequestration: for example, Ruoergai marshes in China stored 750 million tonnes of carbon – 7.5 times the annual fossil fuel emissions of the Chinese transportation sector.

Hotspots of biodiversity: for example, Bar-headed geese used the voer (creek) marshes and high-altitude wetlands (HAWs) of Bhutan as breeding grounds; along the rivers of Kashmir – high-altitude wetlands provided cold-water habitats for fish (trout). Cultural linkages and support to livelihoods: for example, Ruoergai marshes supported more than 50,000 Tibetan herders, and several high-altitude wetlands, such as Gokyo in Nepal, were of religious and spiritual significance, especially for Hindus and Buddhists.

Water diversions, drainage for agriculture, overgrazing, and stresses induced by climate change were leading to degradation and contributing to a wide range of human- and environment-driven threats. Significant changes had occurred as a result of climate change in the Himalayan Region, and these would result in rapid increases in glacial melt, which contributed 4 – 45% of the river base flows– increased variability of flows, and frequent droughts and floods.

Shifts in biodiversity – this rendered species with restricted habitats vulnerable and would lead to high levels of vulnerability within communities. Wetland vulnerability in turn would increase vulnerability to climate change. There was also an adaptive role wetlands could play in contributing to climate change as they could provide services to regulate hydrological regimes – storing peak flows, augmenting lean flows, and storing carbon – peatlands, and supporting biodiversity.

The example of wetlands in the Wular Lake Basin of the Kashmir Valley in Jhelum Basin was given. About seventy per cent of the area was originally marshland and was converted to agricultural and plantation land from 1911 to 2007. An analysis of river discharge data (from the past 100 years) showed higher flow volumes and earlier onset of high flows due to increasing glacial melt in the Jhelum Basin. This would lead to increased vulnerability of downstream areas with floods and droughts and loss of wetlands. Poverty and marginalisation of communities in the lake area because of degradation of the lake were considerable. The percentage of population below poverty line had increased significantly compared to the state of Jammu and Kashmir as a whole.

A management package for wetlands and river basins was necessary to integrate wetlands into climate-change adaptation measures. The following factors needed to be considered:

- the functioning of high-altitude wetlands is considered critical to ensure sustained provision of ecosystem services to the downstream reaches;
- wetland conservation and wise use as alternatives to structural approaches; and
- the connectivity of wetlands to river systems is critical for maintenance of ecosystem services.

The following points were also raised.

1. The current status of policy integration for biodiversity and water regimes is that a sectoral approach to wetlands and water management is used with a limited degree of integration.
2. The role of wetlands in water management and river- basin management is not explicitly recognised.
3. Water allocation strategies are focused on human needs without considering ecological requirements.
4. The principal focus in management of water resources is on the role of the state and community institutions – the private sector's role is limited and incentive mechanisms diffused.
5. There is an urgent need for action as inadequate integration increases the vulnerability of large populations and ecosystems – especially on account of climate change.

The 'Himalayan Wetlands Initiative' was a regional initiative of the Ramsar Convention, initiated by regional member countries and other international organisations such as the International Centre for Integrated Mountain Development (ICIMOD), WWF, and Wetlands International (WI): it still needed endorsement by member countries. ICIMOD and other partners were coordinating this. The 'Himalayan Wetlands Initiative Strategy' for the conservation and wise use of Himalayan Wetlands was finalised recently by participants at the workshop (1-3 September 2008) in Kathmandu and the following areas were included.

1. Database methodologies for Himalayan Wetlands
2. Mechanisms and facilities for cooperation, networking, and capacity building
3. Improved knowledge of climate change impacts and adaptive responses
4. Devising and promoting best practices on Himalayan wetland management

5. Development of participatory communication, education, and awareness (CEPA) programmes
6. Development of policy support for implementation of wetland conservation

Discussion

The following issues emerged from the discussion following the presentation.

- High-altitude peatlands in China, such as the Ruogai marshes, were experiencing changes in water regimes as a result of rises in temperature, and this was causing a 47% reduction in river water regimes.
- Payment for ecosystem services for downstream benefits from upstream were already in practice in China in the high-altitude wetlands and rangelands to compensate herders for not controlling grazing.
- In the Chinese high-altitude peatlands, about 100 tons of carbon would be released if the water table on one hectare of land decreased by one metre.
- There had been negative impacts on some wetlands, such as Napa Lake in China, due to tourism, horse riding, and mining activities.
- Some lakes on the Qinghai - Tibet Plateau were shrinking and water sources needed assessing to find out whether they were rainfed or from glacial melt. This would make a significant difference in the response to climate change.
- The decrease in permafrost had resulted in a reduction in water reserves and wetlands by about 27% in the Yangtze and Yellow river headwaters in Qinghai.
- There was inadequate knowledge about the relationship between water management, climate change, and wetlands. Further research on hydrological data was needed to understand the water sources for wetlands and the climate patterns in HKH mountain areas. Siltation and debris were filling dams and reservoirs rapidly in HKH regions such as Pakistan.
- There could be a potential positive impact from climate change in the wetlands such as that from glacial melt. It should be recognised, however, that this would imply a change in wetland types.
- There were specific research gaps when it came to integration of wetland ecosystems into water, and linking research to policy to livelihoods and local knowledge meant better research.
- There was an example from Machu County in China where people were working together with researchers, policy makers, and local communities of herders to implement a system of ecological service payments.
- In Myanmar there was little information and an inventory of wetlands was needed: this could be put together in collaboration with Wetlands International and ICIMOD.
- Most infrastructures, such as dams and hydropower projects, disturbed the free migration and breeding of aquatic life: the aquatic life along the Irrawaddy River was one example.
- The 'Himalayan Wetlands Initiative' offered an opportunity to move from a fragmented national approach to a regional multidisciplinary approach with common methodologies for data collection and sharing.

Some key conclusions were drawn from the session.

- More integrated, multidisciplinary research would be essential to bring about wetland conservation and understand the relationship of wetlands to climate change.
- Practitioners and policy makers should be more engaged in setting research agendas and encouraging development agendas.
- Research should take into account relationships between communities and livelihoods.

Some key research issues were identified.

What is the role of high-altitude wetlands and especially peatlands in climate change mitigation?

- Is there a role for restored/maintained wetlands as tools in climate change adaptation?
- Payment for ecosystem services is an emerging tool to support wetland communities in conserving high-altitude wetlands. Research is needed to identify the best practices and these should be developed based on evaluation of current examples.
- More investment in data infrastructure and research for understanding the relationship between wetlands and water resources is needed.

During Plenary Session IV the Reporting of Group Work for this session raised the issue of the resilience of the biodiversity approach through introduction of valuable genes and species. The opportunity provided by the carbon sequestration dimension of the wetlands was also discussed and highlighted as a key area for future work.

Group IV - Theme: Balancing Biodiversity Conservation with Community Livelihoods

Chair: Prof RP Chaudhary

Rapporteur: Dr Brigitte Hoermann

Dr Libor Jansky from the United Nations University and Dr Thomas Schaaf from UNESCO gave presentations about how biodiversity conservation and community livelihoods can be balanced.

Dr Jansky referred to the Pamir-Alai Mountain project in Central Asia. The project's aims are to restore, sustain, and enhance the productive and protective functions of the transboundary ecosystem in order to improve the social and economic well-being of rural communities and households using the resources from the region's ecosystem for their sustenance, while preserving its unique landscape and globally important biodiversity. This distinct ecosystem hosts global values that face immediate threats. Endemic animal species are endangered because of overuse by local communities, habitat destruction, and international hunting activities, while endemic plant species are endangered as they are used as fuel substitutes. Overexploitation of grasslands is leading to pasture degradation. The overuse of biomass resources as fuel substitutes grew after the Soviet Union stopped the supply of fossil fuels and electricity. Further, the water towers and global carbon sinks were affected. To conserve ecological and cultural diversity, new adaptive land-use systems, such as irrigated and rainfed agriculture or transhumance livestock breeding, have to be identified in a participatory manner to increase capacity and create ownership of the local communities over their natural resources.

Dr Schaaf presented a global perspective on balancing biodiversity conservation with community livelihoods with examples from the United Nations Educational, Scientific and Cultural Organisation's (UNESCO) Biosphere Programme (MAB). UNESCO's 'Biosphere Reserve' concept was presented as a feasible and sustainable way of balancing biodiversity with community livelihoods. Biosphere reserves are areas that are internationally recognised for promoting and demonstrating a balanced relationship between people and nature, thereby combining conservation with sustainable development. For mountain areas, clear assets can be identified: they have spectacular scenery, a clean environment, rare and endangered species, and cultural uniqueness. These assets particularly favour tourism as a means of balancing biodiversity conservation with community livelihoods. With several examples of biospheres (BSP) around the world, different approaches to balance conservation and livelihoods have been used—ecotourism in the Issyk-Kul BSP, Kyrgyzstan; eco-lodges and organic food production in the Dana BSP, Jordan; licensing for protected biosphere products in Africa; and biospheres as a brand fetching premium prices in Switzerland. Further information is available at www.unesco.org/mab.

Discussion

The following sums up the key issues discussed by the participants.

- The longstanding debate that a balance between conservation and livelihoods is not possible was rejected on the basis of the participants' experiences throughout the HKH countries.
- The working group agreed that the conservation of biodiversity is a global responsibility as its loss will have global impacts.
- Degradation and loss of biodiversity have been identified to be principally a result of human impacts; therefore balancing of conservation and livelihoods is of utmost priority.
- As long as there are insufficient opportunities for earning livelihoods, the pressure on biodiversity cannot be eased. Any conservation programme must, therefore, also address livelihood options.
- Balancing conservation and livelihoods can only be successful if local communities are involved in conservation programmes. A sense of ownership for and understanding of the value of biodiversity among communities must be achieved. In addition, interventions should build on local culture, knowledge, and experience.
- Tourism is a very promising strategy for livelihoods in mountain areas; however, this is not applicable throughout the region. Other opportunities need to be identified or developed, and this is difficult for very remote and inaccessible mountain areas.
- Some participants argued that agrobiodiversity had been neglected during the conference and needed to be looked at more thoroughly. Agrobiodiversity is not only important in terms of food security in the mountains, but also crucial for conserving genes important for the global (research) community.
- Generalisations are difficult to make about ideal, sustainable livelihood options for communities. It is necessary to diversify, adapt, and blend traditional and modern technologies.

Group V - Theme: Biodiversity Transects and Transboundary Connectivity Approaches in Mountains for Long-term Monitoring and Regional Cooperation

Chair: Dr LMS Palni

Rapporteur: Dr Krishna Prasad Oli

Two presentations were made by Dr Nakul Chettri of the International Centre for Integrated Mountain Development (ICIMOD) and Dr Graeme Worboys, Chair of the World Commission on Protected Areas (WCPA) of the International Union for the Conservation of Nature (IUCN). Dr Chettri addressed the possibilities of developing and implementing biodiversity transects while Dr Worboys made a presentation on corridor connectivity approaches to link landscapes with protected areas and protected areas with fragmented landscapes.

In his presentation, Dr Chettri talked about the major challenges of conservation and development in the HKH Region. Challenges related to physical change include, inter alia, land degradation, land fragmentation, habitat fragmentation, and biosphere reserves and protected areas increasingly being turned into islands of conservation. There are direct and indirect drivers of change that are impacting ecosystem services and the wellbeing of people in the Himalayan region. In order to address the impact of different drivers, several institutions are working with local communities, on one hand, and with regional member countries on the other. This has resulted in development of momentum among participating countries, resulting in the promulgation of different policy frameworks for transboundary biodiversity management. Examples include the sacred Himalayan landscape in the Nepal- Bhutan biological corridor complex and the Terai arc landscape in Nepal. These initiatives are milestones in terms of enhancing transboundary biodiversity conservation. More transboundary landscapes have been identified in the Himalayan region by ICIMOD.

Although transboundary biodiversity conservation has been one of ICIMOD's main thrusts, in view of climate change issues, a new approach to transboundary biodiversity conservation research through the transects has been proposed. This concept includes extensive parts of entire ecosystems found within given latitudes and longitudes. This approach will examine the entire gamut of biophysical aspects as well as monitoring the drivers of climate change.

The second presentation was made by Dr Graeme Worboys on Connectivity Conservation Management (CCM). The major thrust of his presentation was how to develop corridor connectivity and retain interconnection between the natural land and people in response to climate change. This is a necessary measure in order to respond to global change and biodiversity and invest in ensuring the future of the earth. In mountain areas both culture and biological resources should be viewed in tandem as providing a basis for people's livelihoods. Therefore conserving the natural landscape, conserving habitats and their links, retaining connectors of the ecological evolutionary process, and managing major threats will facilitate adaptation in the face of climate change. The speaker indicated that protected areas and biosphere reserves are good ways of monitoring the effect of climate change and the best method of species' conservation because a network of nature reserves provides core habitats for many species in the transects. Landscape connectivity can promote biocultural conservation.

Several methods can be used for conservation connectivity. Currently, many national governments in the region have set aside protected areas and biosphere reserves where there are already bio links or ecological networks that can be strengthened by adopting the transect concept and vision as a method of conservation connectivity. In order to achieve connectivity conservation, a vision with three settings — nature settings, management settings, and people settings— was proposed. Natural settings include landscape connectivity, ecological connectivity, habitat connectivity, and evolutionary process connectivity. Similarly, management settings include policy legislation and information while people settings provide the life-support system.

Discussion

After the two presentations, participants discussed them and made the following recommendations.

The concepts of transect and landscape corridor connectivity were discussed. Key areas of discussion are given below.

Comprehensive list of species including lower taxa – In major biodiversity inventories prepared by authorities, ecologists, and others from national parks and protected areas, emphasis has been given to wildlife flagship species

and angiosperms whereas the lower taxa which play a significant role in maintaining transects or connectivity and enhancing the conservation of biological resources have been neglected. Therefore the biodiversity of the lower taxa should be documented also as they can act as indicator species.

Risk of having invasive species – Large areas in the HKH region are farmed. In such areas many species that were not endemic have been incidentally or intentionally introduced, and have colonised and dominated the native species. Active management is required to prevent their domination of indigenous species.

Technology transfer – Within HKH countries, there are several useful technologies that have been developed and have economic potential but which are not shared with other countries. These technologies have a great potential to improve livelihoods and should be shared among regional member countries (RMCs). Examples of such technologies are: harvesting musk from the musk deer without killing it and manufacturing seabuckthorn products. ICIMOD should promote the sharing process and help to transfer technologies to other countries that may need them.

Confidence building – Several times during discussions, it was emphasised that ICIMOD should be engaged in building confidence between various partners in the region. This is crucial for effective implementation of any transboundary biodiversity management programme.

Communication at different levels – Often decision and policy makers at different levels are unaware of how policies have been implemented and what the international and regional policies governing conservation of keystone species in the region are. In addition even national policies and laws are not clear within different government departments. Therefore a communication strategy is essential.

Dealing with uncertainties – The biggest problem in conservation and management of transborder biodiversity resources, in particular in mountain areas, is uncertainty in the face of climate change. What will happen is hard to forecast. Therefore, resilience methods and practices and resilient species need to be learned from local communities and important components identified for adoption in the face of uncertainty.

Databases – Data on the climate and biodiversity are available in different countries, but they are not shared with others and their use has not benefited transboundary biodiversity conservation processes. The group felt that data needed to be generated using existing databases as a starting point. This means making fresh commitments to regional data sharing and establishing a regional clearing-house mechanism (CHM).

Clarification of the concepts – Since the concepts of corridor, landscape connectivity, and transects are new to many RMCs in the HKH region, it is important to make it clear what these terms actually mean to the stakeholders concerned.

The discussion points outlined above led to some recommendations for improving transboundary corridor conservation, developing corridor connectivity, and adopting transects as one of the concepts for transboundary biodiversity conservation and monitoring and improving livelihood options.

Recommendations

- The group decided to promote the concept of transects for transboundary biodiversity conservation, landscape, and corridor connectivity development. This, however, needs to be made conceptually clear and shared among participating countries.
- Any policy development (including framework or guidelines) on transects needs to be simple and location specific. Policies should be developed in collaboration or in conformity with the partners and their national policies (for example, India has recently announced a national mission on sustaining the Himalayan ecosystem and has commitment at the highest level).
- In order to develop the concept and framework of transects and corridor connectivity and to develop a cooperative framework, the group recommended that an internal multi-disciplinary team should be formed in ICIMOD to develop the concept, share it with a select group of participant from this conference, and stakeholders, and then recommend a methodology for implementation.

Plenary Session IV: Reporting of Group Work

During this plenary, the facilitators for the group discussions on the five sub-themes summarised the discussions that took place in their groups on the HKH regional experience. The summaries were followed by a discussion, and question and answer session.

Chair: Dr Douglas McGuire

Rapporteur: Ms Brigitte Leduc

Group 1: Climate Change Impacts on Biodiversity and Mountain PAs

Discussion

Evidence of climate change

- It is happening; warming effects are felt.
- There are changes in precipitation.
- It is drier in winter and in the dry season.
- There are benefits from changes in the middle mountains.
- Scarcity of water resources is increasing.

Impacts of climate change

- Pastoral species survive better.
- Vegetative species are more at risk than animal species (they cannot move).
- The habitats of many species are shrinking, species in the Himalayas very much affected.

Implications for PAs

- Feasibility of moving boundaries
- Flexible barriers for PAs to benefit protected areas
- Coping mechanisms for people – alternative livelihoods, migration
- Conservation and functions (for livelihoods) - both have rights

Questions and Answers

Q. Did the group discuss how much information we have or do not have: how much do we know about climate change? And how much do we know about where species are?

A. There is a lot of discussion, but the information is very patchy. Broad generalisations cannot be made at the regional level. There are human dimensions to be considered and measures have to be taken to protect as many resources as possible.

Many changes happen but not all changes are the results of climate change. We do not know to what extent climate change is having affects on the environment, it is difficult to evaluate. Variations in global changes affect the situation.

Q. Did you discuss what the key indicators are for monitoring biological changes?

A. We did not reach that point. In each PA some species are identified for measuring impacts of climate change because they are more vulnerable to it.

Group 2: Land-use Change Trends and Impacts on Mountain Biodiversity

Discussion

- Livelihood and ecological processes needs to be looked at jointly.
- Disconnected and/or conflicting policies
- Examine the eastern and western Himalayas apart from above and below tree lines.

Questions and Answers

Comment: Land-use changes: the composition of livestock has changed in Leach and this has an impact on land use.

Comment: One thing is missing: fragmentation of habitat, wildlife disappearing: human and animal conflict is rising – elephants and monkeys conflict with humans in Bangladesh

Comment: Pamir Alai – we cannot change anything: the land is changing us because it is degrading too rapidly.

Biodiversity is disappearing: people's survival is challenged. Different approaches are needed for different mountain contexts.

Group 3: Wetland Ecosystem Functions and Services – Implications of Climate Change

Discussion

- Wetlands always influence the water regime
- How do we link ecosystem services, wetlands, and climate change - the knowledge gap is important.
- There is evidence of climate change in some regions.
- Experiences and observation should be shared among different countries in the region.
- Resilience of ecosystems and the people
- How to restore wetlands
- Payments for ecosystem services – a lot of research needed to show if it is really working because nobody monitors.
- There is no inventory of wetlands in Myanmar.
- To fill research gaps more efficiently interdisciplinary research is needed.
- Research has to be linked with the real world and to the policy/ decision makers who should participate in setting the research agenda
- A framework should be put in place for research into different dimensions of the wetlands.

Questions and Answers

Q. Comment on resilience: systems are not resilient.

A. The talk is more about ecosystem levels than about specific species.

Q. The carbon dimension of pit lands is disappearing: it is important to consider this.

A. This was not discussed much during group work, but our institution has started working on that. Link with the programme on Reducing Emissions from Deforestation and Degradation (REDD). There is a lack of understanding about this.

Group 4: Balancing Biodiversity Conservation with Community Livelihoods

Discussion

- Can humans achieve a balance with nature? Debates at international level.
- Since it is people's livelihoods that challenge natural resources, it is people's livelihoods that have to be adapted for conservation.
- There is no universal answer to whether livelihoods can be balanced for biodiversity conservation: there is great diversity.
- Conflicts between culture and animal protection
- Loss of agricultural biodiversity because of commercial agriculture
- Ecotourism as an alternative livelihood in some regions
- Use of medicinal and aromatic plants (MAPs) and non-timber forest products (NTFPs)
- Branding agrobiodiversity products
- Organic agriculture is mentioned but is it possible in poor countries?
- Diversified approaches are necessary.
- Water needs should be addressed.

- Community-driven and resource ownership: conservation initiatives work better.
- Supporting policies and institutions is necessary.
- Livelihoods and conservation cannot achieve balance themselves.
- Market changes, technology changes, and climate changes – all influence the situation.
- An interdisciplinary approach is necessary to address conservation issues.
- The concept of agro-biodiversity has been discussed.

Group 5: Biodiversity Transects and Transboundary Connectivity Approaches Long-Term Monitoring and Regional Cooperation in the Mountains

Discussion

- Dealing with uncertainties: support resilience and adaptive practices.
- Do not spend too much time on research – the need for intervention is urgent.
- Instead of spending too much time on building something new, it is better to build on existing practices.
- The concept and scale of corridor transects need to be clarified.

Recommendations

- The concept of transects must be taken forward.
- The framework needs to be simpler.
- A committee to monitor implementation is needed.

Questions and Answers

- Q. The Western and Eastern Himalayas meet – one of the richer areas for biodiversity: study this area. Think about community management of resources.
- A. There are significant differences between the western and eastern Himalayas, but there are a gap and transect approach which can help bridge the gap.
- A. Academic thinking – no dispute on the topics of transboundary and biodiversity transects. It needs a simple approach for implementation. The challenge is how to coordinate at the regional level. ICIMOD could work as a facilitator, notably in transfer of technologies.
- Q. How about a water basin approach for this transect approach?
- A. Water is a very political issue: we may not succeed using a river-basin approach for the transboundary approach.

From the Chair

- Suggestions need to be plausible.
- There is wide diversity in the region.
- A narrative is needed.
- An interdisciplinary approach is essential.
- More research is needed.
- Local communities have to be involved.

Plenary Session V: (Parts 1 and 2)

This plenary gave each of the global programmes an opportunity to respond to the HKH regional experiences by providing global perspectives and providing ideas and suggestions on how their particular programme could contribute. As the background papers on the global programmes had been previously circulated, the presenters were asked only to respond to the regional experiences. The global programmes discussed how they are presently involved in the HKH and how they intend to respond to the challenges of the region, what they see as a role for partners and how ICIMOD can be involved.

Plenary Session V (Part1): Responses from Global Programmes

Chair: Prof Bruno Messerli

Rapporteur: Dr Isabella Bassignana Khadka

Towards Addressing the Issues of Global Climate Change

Dr L. M. S. Palni (G B Pant Institute of Himalayan Environment and Development (GBPIHED))

Dr Palni presented the Prime Minister of India's recently announced 'Action Plan on Climate Change' which focuses on establishing an effective, cooperative, and equitable global approach based on the principle of common but differentiated responsibilities and respective capabilities, as enshrined in the United Nations Framework Convention on Climate Change (UNFCCC). The action plan highlights eight areas of action or 'national missions', namely: solar, enhanced energy efficiency, sustainable habitats, water, sustaining the Himalayan ecosystem, green India, sustainable agriculture, and strategic knowledge for climate change. The details can be found on the web page <http://pmlIndia.nic.in/>.

These eight national missions simultaneously focus on multiple fronts by promoting understanding of climate change, adaptation and mitigation, energy efficiency, and natural resource conservation. The Indian government is committed to achieving key goals through multi-pronged, long-term integrated strategies and effective and accelerated implementation of time-bound plans through change in direction and enhancement of scope.

Dr Palni pointed out that, of the eight missions outlined, seven are sectoral and only one is site specific, namely, the mission on 'sustaining the Himalayan ecosystem'. This mission will encompass evolving management measures for sustaining and safeguarding Himalayan glaciers and the mountain ecosystem. The four approaches to this include: 1) enhanced monitoring of the Himalayan ecosystem with a focus on recession of Himalayan glaciers and its impact on river systems; 2) establishing observation and monitoring networks to assess freshwater resources and ecosystem health; 3) promoting community-based management incentives for protection and enhancement of forested lands; and 4) strengthening regional cooperation by exchanging information with countries sharing the Himalayan ecology.

The mission on sustaining Himalayan ecosystems would focus on the principles laid out in the National Action Plan on Climate Change and would encompass: 1) protecting vulnerable sections of society through resource management and livelihood options; 2) enhancing ecological sustainability within disturbance regimes for native and endemic elements and for glaciers and river systems; and, lastly, 3) deploying technologies for hazard mitigation and disaster management, ideal human habitats and agriculture, and forest sector innovations.

The mission on sustaining Himalayan ecosystems would link with the other missions to achieve the goal in a holistic manner. Possible approaches incorporating many aspects include solar and micro-hydel energy, forest-based economies, watershed management and ideal Himalayan landscapes, eco-based tourism, protected unique landscapes, local organic agriculture, and energy efficient infrastructure.

After his presentation, Dr Palni, commented on the importance of having input from all the regional member countries and said that this input would be highly appreciated. In the face of growing globalisation and mounting cross-boundary environmental challenges intergovernmental cooperation at the regional level cannot be avoided; and doors should be opened to allow this to happen. The question remains of what role ICIMOD should play in this regional cooperation.

EV-K2-CNR: How Everest-K2- Council of National Research (Ev-K2-CNR) can contribute to developing mountain ecosystem conservation and climate change research initiatives in the Hindu Kush-Karakoram- Himalayan region

Dr Gianni Tartari, EV-K2-CNR, stated that Ev-K2-CNR had activities in the Hindu Kush-Karakoram-Himalayan (HKKH) region in the Pakistan Karakorum Trust area and in Nepal's Sagarmatha National Park and China's (Tibet Autonomous Region [TAR]) Qomolungma National Park (QNP). They shared high-altitude research systems, including geographical information systems (GIS). They also had integrated management plans and climate change impact assessment programmes and, as part of the Hindu Kush-Himalayan partnership, were studying issues of forest management, water pollution, and impacts of climate change on forest and glaciers.

EV-K2-CNR has made a concrete contribution: it has had a network in the Khumbu Valley since 1994. The data collected are free of charge to all genuine researchers and are available either in excel or pdf formats. The data collection stations are located at >5,000 and 8,000 metres. Contact Dr Tartari at: tartari@irsa.cn.it.

Questions and Answers

Q: Dr Ukesh Raj Bhuju (Nepal National Committee of the International Union for the Conservation of Nature [IUCN] members) asked if there were any similar stations which were collecting the same type of data as Ev-K2.

A: Yes, there are two stations in Pakistan (one is in Baltoro) and there are plans for expansion. Dr Tartari appreciated the question and said that this is a critical area of research and that there is a lack of quality data collection at high altitudes. Stations can be established initially for about 15,000 Euro, but then they need to be maintained.

Q: Dr Gregory Greenwood (Mountain Research Initiative [MRI]) asked what Ev-K2 could contribute to the transect idea.

A: Dr Tartari said that Ev-K2 had worked in this area for the past 20 years and would be happy to share their experience and data. In places where socio-political and economic conditions were difficult, they had made a special effort to involve the local population.

Food and Agriculture Organization (FAO) and the Mountain Partnership Secretariat

Dr Douglas McGuire said the FAO has had technical programmes dealing with 1) food security and nutrition; 2) livelihood support and rural development; 3) Integrated watershed management; and 4) emergency support, a recent example being the latest earthquake in Pakistan. The FAO had been active in offering technical assistance for many years; it has responded to challenges in areas such as Reducing Emissions from Deforestation and Forest Degradation (REDD), agrobiodiversity, the Global Terrestrial Observing System (GTOS), and others, as well as capacity building and policy support.

The Mountain Partnership (MP) was established as a voluntary alliance and is now comprised of over 150 organisations which collaborate on sustainable mountain development; it is effective on the ground. Mountain Partnership HKH members include four of the eight Himalayan countries, namely, Afghanistan, Bhutan, Nepal, and Pakistan, as well as many international/non-government organisations (INGOs/NGOs). The MP has a decentralised hub for Asia and the Pacific hosted by ICIMOD (Zaya Batjargal). The MP biodiversity initiative had been involved in 'twinning' the Sagarmatha National Park in Nepal with the Gran Paradiso National Park in Italy.

MP can respond to challenges by providing a framework for cooperation on mountain biodiversity within the Biodiversity Initiative: it can also provide support to develop collaborative action with key stakeholders (such as project formulation, resource mobilisation, and so forth.) and form linkages to other regions as well as providing networking, information, and knowledge management support through Mountain Forum.

In conclusion, Dr McGuire said that ICIMOD should play a key role at the regional level by providing expertise. What is most needed is technical, financial, and political support in an integrated approach that also takes human aspects and livelihoods into consideration.

GLORIA - Global Observation Research Initiative in Alpine Environments

Dr Harald Pauli, GLORIA, University of Vienna stated that GLORIA studies pristine versus anthropogenically altered environments at high elevations (subnival); some boreal and arctic mountains in North America and in New Zealand. Through GLORIA's simplicity and the large number of sites it has, it has excellent potential for synergistic interaction with the Long-term Ecological Research Network (LTER), Global Mountain Biodiversity Assessment (GMBA) activities, Mountain Invasion Research Network (MIREN), ethnobotany, and the European Environment Agency (EEA)

GLORIA master sites also have additional activities on other organism groups (e.g., arthropods, amphibians) climatology, vegetation, and species' modelling) GLORIA is an open process – it can be joined at any time. GLORIA coordinates and communicates with more than 50 groups on standardisation, advice on methodology, training, publication strategy, data ownership issues, central database and website, method testing, master sites, public relations (PR), and policy.

How can GLORIA contribute to this region? By establishing mountain biodiversity observatories that are long term: the first thing being to focus on pristine areas, but these would be difficult to find and most areas are strongly impacted by land use such as grazing. It is necessary to keep in mind that observatories would be in different cultural situations.

Implementation of GLORIA: South America: the first sites through the United Nations Educational, Scientific, and Cultural Organisation's Man and Biosphere programme (UNESCO-MAB), then Peru and Chile, now eight transboundary reserves (TRs)—a further 11 are planned (Proyecto Páramo Andino – CONDESAN [Consortium for Sustainable Development of the Andean Ecoregion], Conservation International, Herbario Nat. Bolivia, Com. Andina de Naciones). The network is narrowly focused on mountain biodiversity, but it has excellent potential for interdisciplinary cooperation with other programmes, structures, and initiatives. Vegetation often grew slowly, so this kind of work is long term. It is important to have regional nodes to establish national sites: in Latin America there is already a regional node between Ecuador and Bolivia.

Ongoing work in the HKH area is in the Saipan region (Jumla-Rara area); Kanchenralba/Kanjiroba Himal area; Annapurna Himal Area; Gosaikunda and Langtang Himal area; and Sikkim's Kanchenjunga Himal area. Collaborative work is being carried out with the Missouri Botanical Garden and Nepalese partners as a West-East arrangement across Nepal to Sikkim, (Bhutan) with the Edinburgh Botanical Garden and Nepalese partners and in the Annapurna region (humid South and arid North).

Questions and Answers

Q: Who are your partners in Sikkim?

A: Dr Puna in Oxford.

Q: Data availability and on-line sharing?

A: This is not the initial idea but will be a requirement for the long term. It has to be discussed with the contributors, because we are not allowed to share data without their consent.

Q: How are Nepalese botanical gardens involved, except for individual scientists?

A: This cooperation will soon be strengthened.

Q: Can you confirm whether temperature monitoring takes place also?

A: Yes on four points, each of the summit sites monitors temperature.

GMBA (Global Mountain Biodiversity Assessment) and cooperation in the HKH

Dr Eva Spehn: University of Basel, Switzerland, discussed the outcome of the Pre-Conference Workshop, 15-16 November, 2008, ICIMOD, Kathmandu: Linking Geodata with Biodiversity Information in the Hindu Kush-Himalayas, Creating a Regional HKH Biodiversity Information Hub and Linking It to Global Initiatives.

Dr Spehn stated that ICIMOD has expertise in biodiversity and the Mountain Environment and Natural Resources Information System (MENRIS) and GMBA form a cross-cutting network of the International Programme of Biodiversity Science (DIVERSITAS). It actively explores and synthesises mountain biodiversity research, it links science and policy as in the case of the Convention on Biological Diversity (CBD) and the Millennium Ecosystem Assessment (MEA). It links biodiversity databases with geographic data to select mountain-relevant data and combine ecologically relevant information with biodiversity patterns in order to model species' distributions (niche models) and ecosystem boundaries. Data are available from data portals by species, country, or data collector. GMBA has kept a catalogue of who has which data and how well they fit mountain biodiversity research. ICIMOD already has a thematic portal for Nepal for protected areas, and this can be searched for data on biodiversity.

Dr Spehn said that GMBA's Mountain Data Portal at the Global Biodiversity Information Facility (GBIF) features an annotated catalogue of electronic geo-referenced mountain biodiversity databases. Specific search criteria for mountains include altitude, slope, ruggedness, and mountain life zones (below or above the tree line).

ICIMOD-GMBA A way forward

It was thought that there is an urgent need to increase the amount and quality of geo-referenced data on mountain biodiversity provided online to meet the challenges of global change. Data sharing and harmonisation includes

adoption of international standards for HKH data (Darwin Code, the Integrated Taxonomic Information System (ITIS), Metadata National Biological Information Infrastructure [NBII] standards). The next step would include data sharing, harmonisation, and standardisation of taxonomic names. ICIMOD should become a regional Global Diversity Information Facility (GBIF) node. There should be a regional training workshop for regional member countries (RMCs) on data sharing and collection methods. Once the mountain portal is in place, it will be easy to access the data.

Biodiversity data standards, metadata, geo-referencing tools and methods (BioGeomancer):

-> Capacity building and training (hands-on workshop with GMBA / GBIF) are the way forward.

A list of HKH biodiversity data should be compiled by feeding the geo-referenced data available into GBIF (e.g., Flora Tibetica), GMBA Mountain Portal, and the Mountain Geo-Portal of ICIMOD: easy and open access to biodiversity information from the HKH region will be provided on a global portal.

Questions and Answers

Q: (Dr Tartari) A more detailed discussion on data sharing is needed because presenting data in international journals takes years: the Internet Security and Acceleration Server (ISA) standard is used, and it is important to regulate data properly. Several projects have an idea about data sharing and property rights.

A: This is a critical bottleneck, but it has already been solved by GBIF, without all this nothing can happen. ICIMOD should also pay attention to this and remind the RMCs. Yes, material on this is available on the web. There are recommendations for GBIF regulations and sharing space. It is a template with a fixed column and is readily available.

IUCN-WCPA Mountains Biome

Dr Graeme L. Worboys, Vice Chair (Mountains Biome), IUCN World Commission on Protected Areas (WCPA) told participants that IUCN, the International Union for the Conservation of Nature is a non-government organisation governed by a council of elected representatives. It consists of 1,000 government and NGO members in 160 countries, 11,000 volunteer scientists, and 1,000 professional secretariat staff working in 60 countries. The IUCN WCPA is one of the six commissions of IUCN and has approximately 1,300 protected area specialists. The WCPA Mountains Biome was pioneered by Emeritus Prof Dr Larry Hamilton in 1993: it currently involves about 350 active mountain protected area professionals. WCPA facilitates connectivity conservation initiatives around the world as it is involved in connectivity conservation work, especially in the mountains, a key direction of the WCPA Strategic Plan and a key target of the Council on Biodiversity's Programme of Work on Protected Areas (CDB PoWPA).

WCPA facilitates connectivity conservation initiatives in the HKH as determined by the 2008 Connectivity Conservation Workshop at the IUCN World Council on Climate Change (WCC), Barcelona, and the 2008 Connectivity Conservation Workshop in partnership with ICIMOD and WWF in Dhulikhel, Nepal, from 11-15 November 2008.

Context for managing connectivity conservation: The realisation that a shared connectivity conservation vision is critical; people, nature, and management settings are critical; connectivity management is situational; and connectivity management is complex and it is dynamic.

People from the HKH (esp. Nepal) were present and influential in earlier meetings and involved in the big picture around the world. Small, focused workshops had been held to build the concept of connectivity conservation and protected areas.

Questions and Answers

Q: There was a shared vision about such a workshop here in Kathmandu, and it was realised, why?

A: It was a strategic reaction to global change.

Q: How to manage these complex areas, including conceptual frameworks on how to manage them?

A: The workshop gave feedback on a prepared framework and about what action should take place. Three contextual pathways first needed to be understood: people, management setting, and shared vision. This conceptual model was adopted and improved and will be published later this year.

Q: So how is it actually managed?

A: Leadership (at multiple levels and different people) is essential, as is evaluation and other things. Work has been undertaken in three corridors (Altai Sayan, Brahmaputra-Salween, and Pamir-Karakoram), and there is a special interest in working at the transboundary interface. The programme wishes to maintain contact as a voluntary, low-key international network.

Q: What is the role for ICIMOD and partners?

A: The role for ICIMOD and its partners is to continue to help facilitate these connectivity initiatives, particularly at the transboundary interface. At the request of the Dhulikhel participants, an informal, voluntary, network of connectivity conservation people will be established by IUCN WCPA. ICIMOD and IUCN WCPA can work together as part of a low key, voluntary, international network of connectivity conservation initiatives.

Q: Does this cover the Terai Arc landscape?

A: Yes, with good feedback and participation.

Mountain Research Initiative (MRI)

Dr Gregory Greenwood, Executive Director, Mountain Research Initiative (MRI), University of Bern, Switzerland, said that MRI is different from Global Change in Mountain Regions (GLOCHAMORE) and GLORIA which are well focused research projects. MRI only deals with interdisciplinary and transdisciplinary research. Some of the activities of MRI include networking meetings for synthesis and adaptation of the GLOCHAMORE strategy of research in various regions. In the HKH, MRI has worked through partners. MRI's approach to research is often expedient and tangential, making the most of what is already available; for example, MRI has started working with the Monsoon Asia Integrated Regional Study (MAIRS) which already has an established research strategy. For the same reasons, MRI expressly did not do this in the HKH-Tibet since there already were many previous claimants to global change research in the region. Notwithstanding MRI has been involved in discussions with Chinese researchers in Beijing who have indicated their interest in working with MRI and the Chinese Academy of Sciences (CAS). Such an alliance will help us to take a look at the whole system of mountain regions in Asia. Several proposals have been submitted to the Asian Productivity Network (APN) for funding, because funding is most important.

Questions and Answers

Q How will MRI deal with challenges?

A: It will pursue partnerships and new opportunities are coming up at this meeting. The transect project will provide MRI with a framework within which it can bring in researchers.

Q: How can ICIMOD be involved?

A: ICIMOD can be involved in the formal vetting of the GLOCHAMORE research strategy and use it as a yardstick for the kind of research that is happening in the region. The establishment of transects in the HKH will change the game plan for MRI. The Intergovernmental Panel on Climate Change's (IPCC) blank spot should be eliminated. ICIMOD can be the convener here as we have been in other regions.

Monsoon Asia Integrated Regional Study (MAIRS) Mountain Zone Science

Priority research areas for MAIRS include hydrology and water availability; ecosystems and biodiversity; agriculture, forestry, and food security; natural disaster management; energy and transport; and air quality and human health. MAIRS has worked with the Asia Pacific Network funding (two cycles); the Chinese Academy of Science is funding an office and staff; and MRI participates in project planning and provides links to European and North American expertise.

MAIRS has worked with ICIMOD in the Cryosphere and Hazard Workshop (April 2007) during which several potential collaborative projects were identified, and there is perhaps a role for the University of Nebraska and the United States' National Science Foundation(US NSF). Water supplies are a critically important area.

Questions and Answers

Q: How can MRI respond to the challenges of the region?

A: Barring new funding, MRI will continue to pursue partnerships that facilitate progress towards research. New

opportunities from this meeting : the Mountain Biosphere Reserve(MBR)-based network (from the UNESCO meeting) and, for GLOCHAMORE implementation, transects to fill in 'blank spots' for The International Panel on Climate Change's 5th Assessment Report (IPCC AR5). The necessary requirements are networking, funding, and coordination.

Q: How can ICIMOD be involved?

A: Perhaps by adoption/adaptation of the GLOCHAMORE research strategy; coordination of efforts to create a network of interdisciplinary research sites (e.g., MBRs); and coordination of efforts to create transects of mountain observatories: all aimed at eliminating the 'blank spot' for IPCC AR5.

United Nations Environment Programme (UNEP)

Mr Subhrata Sinha stated that an understanding is needed of the 1) uncertainty of ecological data and collection, hence the need to invest more efforts; 2) impacts of climate change on the mountains and at local level; 3.) the importance of the landscape approach and that the focus will be on this; 4) the importance of regional cooperation and the need to bring countries and agencies on to a platform for regional cooperation; and 5) the need to build capacities so that communities can deal with climate change with resilience.

As far as programming is concerned, the UN is undergoing reforms and UNEP also. This year UNEP formulated a new work programme which will be implemented from 2010 onwards, and it is no longer at activity level. The governing councils have given the following directions for action: climate change, ecosystem management, governance, disaster, and resource efficiency; and the first three are directly relevant to the HKH.

Questions and Answers

Q: How will UNEP be involved in the HKH and with ICIMOD?

A: 1) UNEP has a long standing partnership with ICIMOD. For example, UNEP was involved in the glacial lake outburst flood (GLOF) study. This was well received and now needs more investment (2002-2007). 2) UNEP was involved in the Mountain Environmental Knowledge Hub, for which ICIMOD is host. 3) UNEP worked with ICIMOD and DATA Nepal (on the World Bank site www.worldbank.np) on the Biodiversity Yearbook for Nepal. This is now available on the Mountain HKH portal. 4) The Kailash landscape programme which focused on the collection of both data and information on ecological and climate change and on the assessment of the impacts of climate change, as well as regional cooperation on these topics. 5) In the Karakoram area, UNEP has been involved in data collection, climate change, impact assessments, and promoting resilience and capacity building.

United Nations Educational, Scientific and Cultural Organisation's Man and Biosphere Programme (UNESCO MAB)

Dr Thomas Schaaf: UNESCO's MAB Programme stated that the Mission of UNESCO is to build peace in the minds of men through education, science, and culture. There are 50 field offices worldwide, including in Kathmandu, Delhi, Dhaka, Beijing, and Islamabad.

Dr Schaaf stated that climate change in mountain areas is a key priority for UNESCO. In terms of land-use changes and trends UNESCO focuses mainly on biosphere reserves. Balancing conservation with livelihoods is an area in which UNESCO can demonstrate how environment and economic development can go hand in hand. UNESCO has a number of transboundary-linked biosphere reserves, as well as a transcontinental biosphere reserves between Europe and Africa. In the HKH there is huge potential, and the banner of UNESCO could help to strengthen it, especially in sensitive border areas. Nanda Devi (India), Quomolongma (TAR) and a new one in Sikkim have potential for corridors and transboundary collaboration. UNESCO is also involved in capacity building, education, and outreach. ICIMOD will remain a privileged partner institution for UNESCO for everything related to the HKH. UNESCO has produced a teaching resource kit.

Chair: Prof Messerli stated that three UN organisations (UNESCO, FAO and UNU) were very much involved, so we should keep that in mind.

Questions and Answers

Q: Are these teaching kits also available for translation into regional languages?

A: Yes, we already have good examples of this, and there is hope for a new kit too.

United Nations University (UNU): Mountain Research and Development – An Adaptive Institutional Response to Evolving Knowledge and Needs – Responses from Global Programmes

Dr Libor Jansky: United Nations University (UNU) gave a short presentation in which he highlighted UNU's involvement in the Pamir-Alai (Altai) – a region with very similar geomorphologic and climatic conditions as the HKH. UNU's interest is in targeted research and capacity development through various projects. It is also interested in sharing knowledge and expertise among local, regional, and international partners as well as in collaborating through open global mountain partnership programmes. UNU would also be interested in an umbrella programme incorporating existing and future projects; and offering basic activities in methodology, institution building, social empowerment, and dissemination of knowledge.

UNU's interest in research is in the areas of: 1) maintaining peace and security in complex political environments; 2) supporting the coexistence of people with different cultures, languages, and social systems; 3) seeing that issues of human rights and gender equity are an integral part of local development options; 4.) studying the economic and social aspects of transformation in the context of globalisation and global climate change; 5) studying the vulnerability and adaptation of coupled human-ecological systems in the mountains; 6.) seeing that science and technology are applied for the benefit of mountain regions and the people who live there; and 7.) using human values to improve the quality of life.

UNU is also interested in capacity building when it is specifically related to: 1) building a knowledge base and bringing about awareness to facilitate better decision-making; 2) improving individual health, literacy, and other skills required to adapt to differing and changing circumstances; 3) integrating laws, policies, and strategies to encourage sustainable development and promote environmental integrity; 4) improving management practices and techniques; 5) fostering institutions that encourage and support partnerships and cooperative arrangements; 6) developing appropriate infrastructure and technology to support sustainable development; and 7) identifying and promoting sustainable financing mechanisms.

Several decades of mountain programmes in collaboration with Prof Messerli and others and particularly programmes in different regions had shown that, as far as UNU is concerned, sustainability-in any and all aspects- is crucial. The mountains closest to the Himalayas are the Pamir-Alai and here UNU has had experience with local researchers and pilot sites. Key issues for mountain areas, including the Himalayas, were discussed and recommendations were summarised in a publication 'Mountains of the World: A Global Priority' (edited by Bruno Messerli and Jack D. Ives) in 1997. This publication contributed to much-needed worldwide awareness of mountain issues. There are already several types of partnerships that could be used under a type of umbrella project. Research should be linked to the local people and local expertise, in spite of the fact that it might sometimes not be what the scientific community or peer-reviewed journals want.

Questions and Answers

Q: Prof Martin Price asked do you mean that a UNU umbrella or some other existing mountain partnership umbrella should be used?

A: Definitely not a UNU umbrella: the existing Mountain Partnership umbrella can be used but efforts should be made to see that it is not overly bureaucratic. Care should also be taken to see that the process does not stay at the political level: it should be made concrete and have a good operating mechanism.

Wetlands International (WI)

Dr Chris Baker from The Netherlands told participants that WI is an NGO that focuses exclusively on wetland conservation but, in the past, it had focused also on biodiversity in general. WI tried to encourage sound science as

much as possible. Its current activities include the HKH, but in the past it had traditionally been active in India and in China. Its recent initiatives are on the Regional Wetland Initiative and the International Waterbird Census.

WI will need to strengthen linkages with available knowledge bases. WI's future plans include continuing its present work, especially with ICIMOD and especially on the Himalayan Initiative.

From this meeting it was understood that it will be necessary to improve linkages, Wetlands need to be in the overall picture in terms of linkages between practice and policy, knowledge-based development, broadening the partnership to development, and water and agriculture-related organisations. The landscape approach must include wetlands. The partnership needs to be broadened to include development agencies.

WWF Critical Ecosystem Partnership Fund, Eastern Himalayan Programme (CEPF)

The focus of this programme is on the Eastern Himalayas, not the whole of the HKH. Investments are based on biodiversity hotspots. The programme has a unique partnership for funding with many contributors, for example, l'Agence Française de Développement, Conservation International, Global Environment Facility, Government of Japan, Mac Arthur Foundation, and the World Bank.

The coordinator for the Eastern Himalayas is WWF Nepal. It gives out grants to civil society organisations for biodiversity conservation projects, because they are effective but they are usually deprived of funding. Local groups are at a disadvantage and, normally cannot get access to large amounts of funds. Grants are targeted at hotspots which have a profile, each based on scientific findings.

Bhutan, India and Nepal's Kanchenjunga complex form the main focus and some parts of the Terai Arc landscape. Species, sites, and landscapes receive attention; and especially through local-level linkages where the action happens. Examples of projects are policy advocacy, involving the media; social forestry in corridors, civil society networks, and small grants which are very effective for individuals, universities, and local organisations, Work is focused on particular species for which there are no other monitoring resources.

WWF grants target biodiversity hotspots in developing countries. They are guided by strategies developed with stakeholders and go directly to civil society; moreover, they create alliances combining skills, eliminating duplication of efforts, and achieving results through an ever-expanding network of partners.

The Critical Ecosystem Partnership Fund in the Eastern Himalayas invests in 1) Bhutan Biological Conservation Complex; 2) India in the Kanchenjunga-Singhalila Corridor North Bank Landscape; and 3) Nepal in the Kanchenjunga-Singhalila corridor of the Sacred Himalayan Landscape and Critical Areas of the Terai Arc Landscape. The Fund carries out policy-level work on promoting corridors and the role they can play: work on how species' level projects can be implemented is in the pipeline also.

In India restoring corridors and transboundary collaboration among local communities receives focus, as well as projects in Sikkim and North East India. In Nepal there are ongoing projects focusing on livelihoods, education, capacity building, and traditional knowledge, as well as forest management in the Ilam and Darjeeling corridor.

Partners are involved in networking and upscaling, innovations, documenting, policy advocacy, and learning and feedback. ICIMOD has been a partner in this.

Questions and Answers

Q: How much funding is available from these small grants?

A: The maximum is \$20,000 per project.

Chair: Very interesting but very short, now how do we include transects in all these activities.

The paper gives a list of those involved in the Critical Ecosystem Partnership Fund (CEPF) programme. How can they be included?

Plenary Session V (Part 2): Global Programmes' Responses and Reactions of Hindu Kush-Himalayan Countries

Prof Martin Price, Centre for Mountain Studies, UK

Synthesis of HKH Institutions' Reactions

Dr Robert Zomer, Environmental Change Specialist, ICIMOD

Chair: Prof Xu Jianchu

Rapporteur: Ms Elisabeth Kerkhoff

The Chair of this session, Prof Xu Jianchu, set the tone by saying that the objective of the session was to ensure that the voices of the Regional Member Countries were also heard.

Prof Martin Price presented the synthesis of global programmes. The key themes expressed by the global programmes could be summarised by asking who was doing what where. Research on the climate was carried out by Global Observation Research Initiative in Alpine Environments (GLORIA): they had data loggers and Everest-K2-Council of National Research (Ev-K2-CNR) had also been collecting data for a long time. Biodiversity was being studied by Ev-K2, GLORIA, and Global Biodiversity Assessment /Global Biodiversity Information Facility GMBA/GBIF. Ecosystem management was being studied by Ev-K2. The United Nations University (UNU) had done a lot of work on capacity building, but it was not clear how this applied to the HKH region. Data compiling and sharing were essential but there were issues about whether access would be 'open' access or whether there would be limitations to access etc. One key UN organisation that was not present was the World Meteorological Organisation (WMO), and it dealt with climate issues. Who does capacity building? Many organisations could provide links to other regions and global programmes. GMBA deserved a special mention in this context. It was important to note that organisations that were working together were working with ICIMOD already.

How did the global programmes respond to the transect idea? In general, the global programmes were supportive and concurred that many of the projects they were already working on clearly fit into the transect framework. A few specific comments: Mountain Research Initiative (MRI) responded very positively and noted the importance of addressing the serious lack of data known as the 'white spot' on the earth's ecological map. They also noted that it would be necessary to formally vet Global Change in Mountain Regions (GLOCHAMORE) and asked whether the transect idea was intended to be a platform for global action. Active collaboration was already taking place but the Mt. Kailash transect could be the first concrete realisation of the transect idea.

Many global programmes had had ongoing interactions with ICIMOD through its Mountain Environment and Natural Resources Information System (MENRIS) and this could be a knowledge-sharing hub for The United Nations Environment Programme (UNEP). The United Nations Educational, Scientific, and Cultural Organisation (UNESCO) commented that it had many linkages but that it was important for all to be on target. The biodiversity transects fell right into the mainstream, thereby filling many of the other categories. Wetlands International was a good source of information for profiling wetlands, and this was an ongoing Himalayan initiative. The issue of carbon was also mentioned. The idea of flyways was cited as an interesting proposition. WWF already had a strong regional presence and link with civil society: there could be an opportunity for focusing on species that received relatively less attention.

Discussion

Comments from Global Programmes

The present listing of actors was limited. Only the larger global programmes had been invited to this conference for initial discussion of the transect concept. Should the transect concept prove viable, it would be necessary to include the numerous smaller organisations which also worked in these areas. For example, the Mountain Institute and several others needed to be included. Prof Christian Körner and Prof Martin Price both commented that this list was perhaps limited and that for the sake of the proceedings a longer list would have to be compiled. Possibly this could be circulated for comment.

The Chair, Prof Xu Jianchu, commented that capacity building was a long-term process which could involve global programmes, ICIMOD, national partners, and others. Information was much more than just databases, and on-site in-country training was essential.

Reactions of the Hindu Kush-Himalayan Countries'

Once the global programmes had presented their syntheses, ICIMOD's regional member countries (RMCs) were requested to comment on what they thought the global programmes could contribute to their countries.

Afghanistan

Er Latif Ahmad Ahmadi stated that, in 2001, the government of President Hamid Karzai had created the National Environmental Protection Agency of Afghanistan (NEPA). NEPA was working to protect the country's natural resources and rehabilitate the land; however, NEPA was a new organisation and Afghanistan/NEPA needed help with environmental policy in general since the country was in the early stages of national reconstruction. ICIMOD presently had a field office in Kabul and this could help. Afghanistan would need to have separate meetings to discuss a strategy and development plans.

Prof Xu Jianchu commented that ICIMOD's field office could help facilitate networking between NEPA and international agencies in areas such as forestry, rangelands, and others.

Later, Er Latif Ahmad Ahmadi went on to say that much of the conservation work that had been carried out in Afghanistan in the past had been disrupted by war for 25 years. The Ministry of Agriculture used to do much of this work previously, but now most of the knowhow had been lost. The Environmental Protection Agency had established legislation and added protected areas. Several agencies were already supporting this, but the need was much greater than the current support. Afghanistan supported collaboration on the Wakhan corridor but would need assistance to make it happen.

Bangladesh

Dr M Khairul Alam (Bangladesh Forest Research Institute [BFRI]) noted that of all the global programmes present at this meeting, some (such as UNEP and UNESCO) were already active in Bangladesh but many were not. There were some activities in wetland areas but not in the Chittagong Hill Tracts. Bangladesh had received small grants from WWF. The Food and Agriculture Organisation (FAO), and the International Centre for Integrated Mountain Development (ICIMOD) could take initiative through the United Nations Development Programme (UNDP). The ICIMOD initiative on livelihoods could work and, if possible, WWF could give grants for lesser-known species.

Prof Xu Jianchu commented that while much of Bangladesh was not mountainous, upstream-downstream linkages were important and that one could look at the effects that the economic corridor posed to biodiversity.

Prof Bruno Messerli commented that Bangladesh and, especially, the Chittagong Hill Tracts played an important role in the monsoon system of South Asia. It is important to study this system since any changes can have a severe impact in this part of the world; they should not be neglected.

Bhutan

Mr Karma Jigme (Ministry of Agriculture) said that at present Bhutan received substantial support from international organisations: Bhutan was actively participating with them and obtaining positive results. There was still scope for more research and capacity building support because Bhutan had a lot of biodiversity. He asked if there was any sort of platform through which young minds could actively participate to share innovative ideas for environmental conservation. The next generation needed to be groomed so that they could eventually take over.

Dr Thomas Schaaf commented that there was support for the younger generation from UNESCO's Man and Biosphere (MAB) programme through its young scientist research grants. These were available for researchers of up to 35 years of age to study environmental conservation and sustainable community-based approaches. Application forms were available on the website.

Prof Xu Jianchu commented that in this context the work to be done by the Himalayan University Consortium would be very important for training young leaders in this area.

Dr Douglas McGuire commented that the International Programme on Research and Training on Sustainable Management of Mountain Areas' (IPROMO) initiative of the Mountain Partnership offered a 2-week course for young professionals interested in mountains.

PR China

Prof Ruijun Long (International Centre for Tibetan Plateau Ecosystem Management) stated that in China there was much discussion about the Tibetan Plateau which comprises 1/4th of the country's territory and is the source of important rivers such as the Yellow River. In particular, the Current Research Information System (CRIS) and local universities had done a lot of research in this area in recent years. The government was promoting good policies by which herders shared their lands with neighbours to increase the amount of land available for grazing. The government had initiated a number of projects for grass supplements and backyard feeding in these areas: thus the government was engaged and work at the policy level was good. At the technical level, there had been a great deal of research on cross-border grazing, wetlands, rangelands, and forestry. It was likely that within the next five years the government would pay herders for environmental services to reduce herd sizes and improve ecological benefits. The area of land might be vast, but economic activities only accounted for 4% of the total GDP. ICIMOD could be involved at the research level by working out a way ahead for local herders and their livelihoods.

Prof Xu Jianchu commented that China was the biggest country in the HKH and international organisations were very welcome to work there. The Xinjiang group already had a large terrestrial carbon project in the Tibet Autonomous Region (TAR). The National Science Foundation of China was also discussing how to work through ICIMOD on regional cooperation.

India

Dr L. M. S. Palni (G B Pant Institute of Himalayan Environment and Development [GBPIHED]) stated that the GBPIED was an influential institution: it networked by sharing data with centres throughout India. Lead institutions which compiled scientific data on various themes to make them available to managers and communities had been designated. Producing data that could be understood and used by local communities remained a continuing challenge. Nowadays all information was made available through the website.

Dr S Vanuatu Reddy (Ministry of Environments and Forests, India) commented that the previous day's presentations showed that there was an interest in economic development of local communities and that this was important. Global programmes such as the International Union for the Conservation of Nature (IUCN), WWF, Wetlands International, and UNEP were interested in this and India had a lot of experience with self-help groups for this purpose. The Indian Research Councils and Institutes were very important players as well. They could help implement the projects of global organisations for socioeconomic development of India's mountain communities. India already had 15 biosphere reserves and other protected areas. In India communities were strongly involved in biodiversity monitoring. We should look for the gaps in research and think how organisations could help to fill them.

Prof Xu Jianchu commented that India had very strong national programmes and was already working with ICIMOD on many aspects.

Myanmar

Ms Naw May Lay Thant (Ministry of Forestry) stated that Myanmar did not have any programmes of its own in the area of mountain biodiversity. A biodiversity database on flora was previously published on CD. Perhaps the Global Mountain Biodiversity Assessment (GMBA) programme could standardise this and make use of it within their or other databases. IUCN activities in Myanmar had already been discussed with India and Myanmar, and these would continue. UNEP and UNESCO already provided support, maybe biodiversity activities could be mainstreamed into these if there was more support. Myanmar needed training in the HKH context.

As for conservation activities in wetland areas, Myanmar would like a RAMSAR (International Convention on Wetlands) site. At present Myanmar had no collaboration with WWF, but it would be interested in collaborating. Myanmar had 30,000 sq. km. protected under the protected area (PA) system, namely the Hkakaboraji National Park and other wetland areas. It was supported by various organisations: Wildlife Conservation Society (WCS), Harvard University's plant project, and a Japanese university. There were also both lowland and highland wetlands sites. Myanmar was also in a good position to collaborate in conservation with China and India in transboundary biodiversity in the Eastern Himalayas. The government also needed to be involved because there might be issues of illegal logging and trade.

Participants commented that Myanmar had tremendous potential for transboundary conservation, as well as being part of the Mekong region. The Chittagong Hill Tracts' border area also had potential. Unfortunately, much of the expertise on Myanmar was in institutes based in the US. National-level capacity building was very important for Myanmar.

Prof Bruno Messerli commented that Myanmar was very important for biodiversity conservation because of its rivers, but now it was also important to look at the mountain areas as they were the sources of the rivers. At present Myanmar had three stations in the plains but none in mountain areas – at least one should be established in mountain areas. Myanmar was the only country that did not have a station in the Global Climate Observing System (GCOS) programme for long-term data logging.

Nepal

Prof Ram Prasad Chaudhary (Tribhuvan University) observed that global programmes had been working with many government departments, the National Planning Commission, and non-government organisations (NGOs) in Nepal. Nepal had five strategic focus areas: protected areas, forests, mountain areas, agricultural biodiversity and wetlands. It was important for Nepal to have policy interventions during this transitional phase in its history – this was especially important in the context of understanding biodiversity conservation. Research and collaboration were needed. Nepal had had many endeavours in terms of long-term stations: in addition interdisciplinary stations were required.

- The Himalayan University Consortium would be very important for bringing together many universities under one forum and developing a curriculum specifically for biodiversity conservation.
- Local communities felt marginalised currently but it was community forests that had contributed significantly to biodiversity conservation: they needed to be assisted. Very specific monitoring tools would be needed to help farmers.
- The work that ICIMOD was doing with highland-lowland linkages was important – water-down and food-up links were essential.
- Tourism was also having tremendous impacts on Nepalese mountain slopes, and tourism was a very important economic activity. ICIMOD could take the initiative to educate the upper tiers of policy makers.
- The challenges of an emerging democracy were many. For example, some of the technocrats who were trained in infrastructural development tried to overrule national financial and environmental regulations. How could this be controlled?
- Nepal had many NGOs: they were very active and were a strong force in the country and could be important partners. This conference did not discuss how to make best use of them for addressing issues of biodiversity conservation and in working with global programmes. One of the challenges for international organisations would be how to develop local indicators and how to involve local NGOs.
- Support from global programmes was important for the growth of environmentally responsible tourism.
- One of the roles of the Mountain Forum was to help link Nepali NGOs with global programmes.
- The Department of National Parks and Wildlife had been successful in conservation at the landscape level through participatory conservation approaches—this had been achieved with help from many international organisations. Climate change could now be incorporated and opportunities for local communities could be included.
- On mountain biodiversity conservation there was still a lot of work to do. For example, research databases needed to be made more accessible to those who need to use them – they were still very academic. Additional wetland sites were needed, even though Nepal already had four RAMSAR sites.

Mr Ukesh Raj Bhuju (Nepal National Committee of IUCN Members) commented that tourism was really impacting mountain slopes all over Nepal, and was a threat to the mountain environment. Policy makers needed to be educated.

Mr Tara Lama of Local Initiatives for Biodiversity Research and Development (LIBIRD) supported the statement that NGOs play a very important role but that nevertheless they were not well represented at this conference. The role of NGOs was very important for penetrating into those sectors where government and global programmes could not.

Prof Christian Körner commented that the footprint tourism had on the landscape was usually quite small and that tourism could be very beneficial.

Pakistan

Dr Ashiq Ahmad Khan (WWF-Pakistan) stated that there were many active programmes in Pakistan; and, whereas some were very small and had no impact on the overall magnitude of the programme, others had been very successful and could be used as a model for programmes elsewhere.

Pakistan needed international support in connectivity corridors, especially in the vicinity of the Karakoram where it connected with the Himalayas. For example, the Karakoram, Tibetan Plateau, and Pamir could be connected, through various protected areas (PAs). Since it was one strip, it could easily be connected to Wakhan and Central Asia as well. This would be a big project and would have a tremendous impact on the local environment; but, in order to succeed, it would need international support. UNESCO had helped the People and Plants' project in Pakistan, and this had been very successful. If the International Centre for Integrated Mountain Development (ICIMOD) could also support this, the collaboration would be beneficial. Pakistan had a wetland programme but, although some areas were well represented, others remained neglected. ICIMOD and the Wetlands' Initiative (WI) could join hands with Pakistan on this programme. The MAB programme could be important in Pakistan, here again it would be beneficial if ICIMOD could facilitate.

Participants in Pakistan the focus was on connectivity, and connecting four countries was very interesting. The People and Plants' programme had been a great success and its publications could be used in curricula as well.

Discussion

- An electronic database for flora in Afghanistan was in the pipeline. This was very complex so help from partners and links with donors would be much appreciated.
- Universities should also be considered for collaboration because they had the capacity. The possibility for distance learning opportunities should not be forgotten.
- Dr Ambika Gautam (ICIMOD): Afghanistan was in a rebuilding phase after many years of social upheaval. Two main government institutions were directly engaged in biodiversity conservation: (i.) the National Environmental Protection Agency (NEPA), an autonomous body mandated to develop policies and strategies. It worked on planning for national protected areas. The NEPA was very interested in establishing the Wakhan transboundary system. It was working on wildlife conservation in a working group in which ICIMOD was also a member. The other institution was (ii) the Ministry of Agriculture, Irrigation, and Livestock. The UNEP policy development programme and others were engaged there also.
- Dr L. M. S. Palni (G B Pant Institute of Himalayan Environment and Development) suggested looking at the types of programmes that were funded: some were very focused, while others were broad. Those programmes should decide on common priorities to which everyone could contribute. Otherwise, the money which was available would become insufficient for doing anything in an in-depth manner.
- Knowledge transfer and joint funding mechanisms were also very important. The global programmes were not donors, but donors should help in such mechanisms.
- Ukesh Raj Bhuju (Nepal National Committee of IUCN Members) commented that prohibiting the illegal trade of wildlife, medicinal herbs, and so on should be considered as part of conservation strategies. Several members commented that, in principle, mechanisms already existed to address this.

Prof Xu Jianchu summed up the session by saying that national ownership was very important for global programmes and that coordination among them was needed in order to avoid the exercise becoming excessively demanding for both ICIMOD and national governments. Both human resources and financial resources were needed because what was being proposed would be a lot of work.

Plenary Session VI (Part 1): Strategy on Development of Coordination and Cooperation for the Hindu Kush-Himalayan Region

Chair: Dr Madhav Karki

Rapporteur: Dr A Beatrice Murray

The two sessions that closed the meeting were designed so that participants could reach agreement on an overall strategy, common elements, and a way forward for activities. In the first of these sessions, Dr Karki briefly reflected on all that had gone before, looking at elements contributing to a 'Strategy and way forward', 'What to monitor and why', 'Networking and partnership', and 'Harmony of policy and legal framework'.

He noted that the overall approach was designed to answer the challenges of reducing scientific uncertainty, facilitating regional ownership and participation in global change research, coordinating research, and achieving a synergy of results by focusing on selected representative areas on different scales. The Global Earth Observation Systems' (GEOSS) network would provide a good base, and identification and research into keystone species by using a network of field sites would be important. Various relevant international programmes had been introduced to monitor and improve understanding of land-use change, mountain biodiversity, and ecosystem services. These included the Global Change in Mountain Regions' (GLOCHAMORE) research strategy and the Global Observation Research Initiative in Alpine Environments (GLORIA) and Global Mountain Biodiversity Assessment (GMBA) networks. All indicate the need for partnership and establishment of linkages with their strategies and work. National partners had highlighted their priorities and action plans, stressing the need for integrating trade agenda, poverty reduction strategies, and other relevant factors into biodiversity conservation. ICIMOD had emphasised the need for development of tools for valuation of biodiversity services for providing more benefits to people. The key elements of the 'Strategy and Possible Way Forward' were presented as following: a framework based on transboundary transects; an approach based on landscape conservation with emphasis on connectivity and management of existing conservation or protected areas; and the objective being to carry out multi-partnership and multi-locational research for long-term monitoring of species and ecosystems in order to obtain early warning indicators. Consideration of livelihood aspects and knowledge management were also important. 'What to monitor' in these transects was answered mainly by variables that would help in understanding and developing responses to long-term change, especially change related to climate and ecosystems. Networking and partnership were a prerequisite for effective work and a core base of the partners and key programmes present at the Conference. It would be important to promote a harmonised approach to implementation of international conventions among the countries of the region through regular regional consultations and sharing of good practices, especially in policy development and implementation. Promotion of the use of traditional knowledge and local species for sustainable livelihoods was an important factor in linking conservation with livelihoods.

Following this overview, the floor was opened to an interesting and lively discussion, the main points of which are summarised below.

The approach of multiple transects/transboundary transects, and harmonizing the policy and legal framework

Most of the discussion focused on the overall approach.

Participants generally agreed that the main focus here of 'global change' was actually climate change and its effects on species, habitats, and landscapes, while recognising that elements of globalisation would be captured in any socioeconomic factors included in the protocol.

There was general agreement that it was important to have a longer-term approach which could identify meaningful change. Examples were provided of previous transboundary studies that were very good but for which there is no continuing longitudinal research which helped us to assess changes.

The participants strongly supported the transect approach for focusing research efforts on representative areas. In particular, GMBA programme thought that it could facilitate global assessments, and the United Nations Educational, Scientific and Cultural Organisation's Man and Biosphere (UNESCO MAB) programme saw strong advantages in having transboundary transects to study climate change effects and would like to set up transect research sites in

the existing Biosphere Reserves. They also encouraged the regional countries to apply for Biosphere Reserve status so that there would be more sites to facilitate this cooperation. There was a comment that it would be interesting to see how water management could be built in as water is usually dealt with nationally and not in a transboundary manner. It would be easier to include wetlands in a landscape approach.

There was considerable discussion about the need to consider the impact of biodiversity conservation and climate change on people – their lives and livelihoods. Overall, participants considered that conservation of biodiversity is only possible if it is in the interest of communities. It was important to focus on livelihoods for two reasons: first, they are a major factor in climate change impact; and second, unless people benefit they will not support (and may actually work against) conservation efforts. Examples were given of how people could benefit from exploitation of medicinal and other plants, as well as ecotourism, trophy hunting, and others. Biodiversity conservation must focus on people to be successful. In general, though, it was felt that, in this programme, research on ecosystems should come first, including research into how changes affect livelihoods and new livelihood potentials; the programme should not focus on poverty reduction activities as such but on people as part of the ecosystem. We also need to think about what biodiversity and climate change mean for different groups of people and what people themselves think is good. There was a query as to how we are connecting water in general and wetlands in particular with livelihoods.

There was another focus of discussion on the problems arising from World Trade Organisation (WTO) and intellectual property (IP) protection and the impacts on local communities. Issuing of patents for single genes sometimes led to transfer of ownership to transnational companies, and the interests of farmers are not protected. Previously farmers' interests and rights were considered. Similarly the WTO is trying to introduce withdrawal of subsidies to poor farmers, if this happens conservation cannot be realised as the farmers will be forced to overexploit the resources in order to survive. The point was made that developing countries only give assistance to local subsistence farming communities and this should not be viewed as a subsidy. There are problems with intellectual property rights (IPR) in mountain areas. Protection of plants is a challenge as they are self replicating. Plant breeding and innovation are also ways of generating plants and should be taken into account in biodiversity discussions. Other participants noted that the access and benefit-sharing (ABS) provisions under the Council on Biological Diversity (CBD) did offer opportunities for communities to benefit from biodiversity, thus encouraging community-based conservation. Signatory countries should put the necessary policy and legal framework in place. The issue was to identify, capture, and generate revenue from local knowledge.

A further point was that not only biodiversity but also indigenous communities and cultures should be a focus of conservation efforts. In some places like the Chittagong Hill Tracts (CHT) there is plenty of funding available, but it is not helping the indigenous population who are shifting cultivators and guardians (and to some extent developers) of the existing biodiversity. The impact and sustainability of large artificial wetlands like the Kapta and Loktak Lakes also need to be studied. It was pointed out that ICIMOD has some activities addressing issues related to shifting cultivation in the CHT areas.

What to monitor and why – the research focus

The focus is all important and some felt that although the concept was interesting it was still too wide. We need to be clear what we want to achieve. Among others, it was important to align with the research priorities of the regional countries. Really we are interested in changes because they are important to people who get medicines, foods, and other essential services from the environment. The plea is to look at enough separate pieces that we can make sense of the picture. We need to think holistically, but activities must be packaged into fundable pieces.

What to monitor and why and how – the research protocol

What are the critical elements involved in biodiversity research related to global change?

Good protocols exist above the tree line (alpine biodiversity) but we have heard little about forest biodiversity and agrobiodiversity. The GLOCHAMORE strategy could be the basis for a joint protocol. For alpine regions, GLORIA would encourage extending the network in the HKH region, particularly to those countries without a site. There are several suitable possibilities, particularly in the west of Nepal and also in Bhutan. (A field trip would leave on the

21st to look at one site in Nepal.) We should also remember that wetlands are often good indicators of climate change.

How? – Networking and Partnership

It is important to have joint initiatives to make use of the limited resources.

We need committed people, funds, and government blessing. It might be necessary to have a separate committee for each transect.

Overall a strong 'anchor' was needed with a light and suitable facilitation mechanism, and ICIMOD could provide a useful basis and platform.

One possibility that should be investigated is to build stronger partnerships with universities and make use of the many graduates and postgraduates in the region.

Mountain Forum could provide a good basis for networking.

The session was concluded by the chair who commented that the overall strategy and way forward as presented and discussed had met the approval of the participants and that the major steps would be elaborated upon in the proceedings of the Conference.

The session was followed by a complementary session chaired by Dr Greg Greenwood in which partners were identified for specific tasks, especially networking, carrying out follow-up activities, and sharing information.

Plenary Session VI (Part 2): A Way Forward

Chair: Dr Gregory Greenwood

Rapporteur: Mr Karma Phuntsho

Dr Greenwood noted that it was usually the enthusiasm of individuals that made many things happen and in order to gauge this enthusiasm he engaged the audience in a show of hands 'poll' to see what they thought the next steps could be. He asked the following questions, the audience's responses are given in brackets.

First was a series of question on group demographics.

- How many in the audience are involved in research? (about 50%).
- How many work for government agencies or are government employees? (a few, ~3 people)
- How many control a budget of any kind? (a few, ~3 people)
- How many are involved in making policy at any level? (a few, ~4 people)
- How many work for NGOs? (many - about twelve people)
- How many would remain in active contact with other participants? (about 25%).

After this show of hands, Dr Greenwood concluded that most of the participants were involved in research. He continued by stating that the International Centre for Integrated Mountain Development(ICIMOD) would need to manage transects as an 'active' task so, defining 'active' as five per cent of working time over the coming six months how many would like to stay in active contact with ICIMOD and others on biodiversity as discussed at this conference? How many would be willing to give five per cent of their time to remain in touch with each other for the promotion of biodiversity conservation in the mountains? (A large number of participants expressed their willingness.)

- How many would be willing to contribute data? or fight for funding? (25-30%) Please contact Dr Eklabya Sharma
- How many would be willing to work with the Global Observation Research Initiative in Alpine Environments (GLORIA)? (about 10 people). Please contact Dr Harold Pauli.
- How many would be interested in the study of plants in mountain areas:
 - invasive plants? Please contact Dr Greg Greenwood.
 - aquatic plant biodiversity? (2-3 people)
 - the role that biodiversity plays in maintaining slopes? (more than 50%)
- GLORIA focuses on research in alpine plants, but how many other programmes would be interested in biodiversity programmes that contribute to ecosystem services?

- How many would be interested in education programmes related to biodiversity? (about 5 people)
- How many will go to Thomas Schaaf's workshop (United Nations Educational, Science, and Cultural Organisation's Man and Biosphere (UNESCO-MAB) programme tomorrow? (30%)
- How many are interested in past environmental change, paleoclimatology, paleoecology, or dendrochronology (tree rings)?
- How many are interested in how climate change affects protected areas and corridors?

After conducting this informal poll, Dr Greg Greenwood went on to conclude that the audience consisted mainly of researchers and that this was good, because most likely transect sites would start by being interdisciplinary research sites.

- Could ICIMOD consider promoting application of the Global Change in Mountain Regions' (GLOCHAMORE) strategy in the HKH?
- Could transects be put into operation by setting up observatories?
- How many are interested in addressing land-use and livelihood issues?
- Publications on and about the HKH have been around for 50-60 years. How many would be interested in looking at publications about the qualitative aspects of climate change?
- How many would be interested in participating in developing a book about climate change in the HKH?
- How many are interested in the Monsoon-Asia project?
- How many are interested in policy research on topics such as payment for environmental services? (10-15%)
- Tourism income benefits only about 20% of the mountain population. How many are interested in sustainable tourism? How to change tourism so that it can benefit more people. How many are interested in policy research to find out how income distribution can be improved

The enthusiasm that people have is what makes things happen; a lot of enthusiasm has been shown here today.

Discussion

Comments from the audience centred on the following topics.

- Payment for environmental services is important for future work.
- In addition to enthusiasm, institutions with the mandate to maintain continuity of development programmes are needed.
- Creating geo-referenced biodiversity data should be given due importance.
- It is important to involve the younger generation of professionals in biodiversity conservation. It is important to involve both individuals and institutions in biodiversity conservation initiatives.

Dr Karki (ICIMOD) added that it is important to study both past trends and to look forward. In particular, it is essential to look at valuation of payment for environmental services.

The Director General of ICIMOD, Dr Andreas Schild, commented that, in the scientific community, it was not uncommon to encounter great enthusiasm during the first two to three years but after that enthusiasm wanes and projects are abandoned: there is no continuity and consistency often because the initiative is too individualised. It is necessary to secure continuity as well as enthusiasm. Prof Christian Körner supported the idea that continuity is essential and went on to say that if there is continuity in data collection then it is also possible to overlay and link data from different fields, giving great additional value to the data collected individually.

Mr Ukesh Raj Bhujju (Nepal National Committee of the International Union for the Conservation of Nature [IUCN] Members) added that it is so important to communicate enthusiasm to youths so that they can carry on the work. Uzbekistan's Dr Ashiq Ahmad Khan (WWF-Pakistan) supported this notion and gave the example of the 'trophy hunting' that he had initiated many years ago as a small effort. As the idea caught on it was taken up by government and other agencies and now contributes significantly to conservation and livelihoods. It is important to propagate one's ideas.

Concluding Remarks

Remarks by HKH Regional Representatives, Global Programmes, and ICIMOD

Chair: Dr Eklabya Sharma

Rapporteur: Dr Isabella Bassignana Khadka

Dr LMS Palni, G. B. Pant Institute of Himalayan Environment and Development (GBPIHED) spoke on behalf of all the HKH regional member countries.

Prof Palni commented on the growing regional awareness of the need for conservation and gave the example of the Indian government which had recently allocated 1,000 crores* for the preservation of forests in mountain areas – the target being 66% forest cover. While this amount in itself was probably only a token, it was indicative of a general attitude on the part of the government and of a realisation on its part of the need to link biodiversity with livelihoods. Prof Palni encapsulated the need to link biodiversity conservation with the needs of real people by saying that ‘conservation without compensation is only conversation’.

This conference had shown that there is a general agreement of the real need for a long-term programme for data collection and that this needs to start now. He also commented that, in the recent past, funding for research had been decimated to such a degree that many researchers had lost interest and had not groomed a new generation for the task. How to rekindle an interest in science among a new generation? Is field-based science an endangered species? Other constraints were those of funding, available manpower, and inter-governmental issues.

Prof Christian Körner, University of Basel, Switzerland, summarised discussions on behalf of the global programmes. He commented that often global programmes, including those represented here, did not have big funding sources at their disposal and that more often than not their offices were manned by only one person. He gave the example of Graeme Worboys’ IUCN (The World Conservation Union) and the World Commission on Protected Areas (Eva Spehn) where in both cases the programmes were more or less manned by a single person. While these global programmes had the know-how, the actual funding had to come from elsewhere.

Prof Körner was of the opinion that all the data that had been collected to date had been paid for by the taxpayers and for this reason alone should be in the public domain.

He praised the International Centre for Integrated Mountain Development (ICIMOD) for having produced a significant number of publications (more than 500 books over the past 25 years) and for having convened many conferences and workshops. But, he went on to add, ICIMOD was much more than ‘noise and paper’ and that he had witnessed for himself the real impact that ICIMOD has had through its Godavari Demonstration and Training Centre. Many farmers in the immediate vicinity of the Centre had benefited from the improved methods disseminated by ICIMOD, and the difference they had made was impressive.

Dr Andreas Schild, ICIMOD, stated that changes were taking place worldwide, especially in mountain regions. These changes were due to globalisation, climate change, and other factors. There was recognition that mountains play a pivotal role and it would be ICIMOD’s role to explain this at the local, national, and regional levels.

Dr Schild outlined the following important points. In taking on the challenges that change would bring it would be necessary to enthuse the youth of the region because they were the ones who would eventually be taking this on. There was a growing awareness of the changes that were taking place in the region and that very specific approaches needed to be taken in the mountains. Two countries in particular had been proactive in this area: China had already instituted payment for environmental services in mountain areas and India had just announced its national strategy for dealing with climate change and, within this plan, had specifically acknowledged the important role that Himalayan ecosystems played and the need to help conserve and preserve them.

What have we learned from this conference? Prof Messerli emphasised the need for a regional transboundary approach and Prof Körner told us that we would need young people who were ready and willing to get their hands dirty. One thing was certain and that was that we would need a new generation of professionals who were enthusiastic and ready to take up research in the mountains.

* One crore is one hundred lakhs (100 x 100,000 rupees), equivalent to approximately US\$200,000 at an exchange rate of US\$ 1 = INRs 48

The alpine region of the Himalayan region, which covers three per cent of the globe, contains four per cent of its biodiversity. There were many exciting possibilities for establishing corridors. One possibility was the Pakistan Karakorum corridor another was the Afghanistan-Uttranchal-Nepal corridor: other exciting developments included developments in China where the government was involved in paying for environmental services to help herders reduce the size of their herds. Dr Schild acknowledged the concrete list proposed by Dr Chaudhary of Nepal. For this we needed to acknowledge the role that universities could play in cooperating with the Himalayan University Consortium – this would be of strategic importance in future. In this the farmer also would have a real role to play in capturing and preserving biodiversity in the mountains. Biodiversity was an essential element for sustainability in mountain areas – to produce viable products and prevent outmigration. Here it would be necessary to identify success stories to use as leverage in discourse with policy makers.

Global programmes work because of individuals. How to focus on the essential? It was important to see that whatever course was chosen it would be realistic and feasible. It would be ICIMOD's task to convene a committee whose job would be to prepare a concept note outlining the essential elements – this would be used as a basic menu to be shared with the regional member countries (RMCs) and discussed and refined with them. Strong national institutions were needed as partners – ICIMOD would hold discussions with them to agree upon a minimum protocol.

The United Nations Environment Programme (UNEP) had indicated that it would be willing to provide funding for studies in one specific corridor. One model that we could think of was having a minimum protocol common to all transect studies: in cases where funding was greater, additional elements could be incorporated. In any event, it needed to be clear that these studies were not for the short term. Could we not provide some concrete elements for the International Panel on Climate Change's (IPCC) Report #5 in cooperation with the RMCs?

It would be necessary to link biodiversity with livelihoods because it would not be possible to convince relevant funding agencies to invest in science alone – whatever course was to be taken it must be tangibly in the best interests of the RMCs. One tangible argument is that products from the mountains could help to prevent outmigration. So far, the buy-in from global sponsors was showing that ICIMOD was on the right track in its approach to climate change and biodiversity conservation. He thanked the ICIMOD staff.

Prof Bruno Messerli

Prof Messerli reflected on how very far we had come since the 1992 Rio Summit Agenda 21 Chapter 13 on Sustainable Mountain Development. This was a remarkable development, but it had taken 16 years to materialise. Now that mountains had been included could we look forward to having 'livelihoods' included in the next Summit? Much work had taken place at institutions such as the Global Climate Observing System (GCOS), Global Change in Mountain Regions (GLOCHMORE), and the Convention on Biological Diversity (CBD) but perhaps they had over defined it – it would now be our task to sift through this work and choose or focus on those aspects most relevant for transects in the HKH. Focusing would make it easier for intergovernmental cooperation and for funding agencies.

ICIMOD could be instrumental here. For each particular transect or site it would be necessary to decide upon the minimum information that could be contributed. More data could be contributed from sites with greater capacity. Transect sites should be selected keeping in mind that concrete data would need to be collected for a very long time. This could be done in conjunction or collaboration with the United Nations Education, Science, and Culture Organisation's Man and Biosphere programme (UNESCO MAB), Global Change in Mountain Regions (GLOCHAMORE), Global Observation Research Initiative in Alpine Environments (GLORIA), and Global Mountain Biodiversity Assessment (GMBA) or an integration of these. These could all then bring data up to the global level for information sharing. What would the role of ICIMOD be? ICIMOD could work with the RMCs to help sort out what would be feasible and what monitoring could realistically be expected based on potentials and limitations.

What would the time scale be? We would need to think on a very long-time scale, maybe one generation, maybe 30 years.

Annex 1 Letter From Dr Ahmad Djoghla, Executive Secretary, CBD



Secretariat of the Convention on Biological Diversity



Message from the Executive Secretary

Dr. Ahmed Djoghla

**To the International Mountain Biodiversity Conference
On
“Biodiversity Conservation and Management for Enhanced Ecosystem Services: Responding to the
Challenges of Global Change”**

**International Centre for Integrated Mountain Development (ICIMOD)
Kathmandu, Nepal, 16-18 November 2008**

Mr. Andreas Schild, Director General, ICIMOD and distinguished participants,

It is an honour and a privilege to be able to address this important meeting.

I would like to convey my warm-hearted congratulations to ICIMOD for organizing this important international conference, and my sincere apologies for not being able to join this conference due to other commitments.

The aim of this international conference “biodiversity conservation and management for enhanced ecosystem services and responding to challenges of global change” resonates strongly with the Convention on Biological Diversity (CBD) as we continue to promote the role of biodiversity in the delivery of ecosystem services in order to sustain and improve human well-being.

Mountain systems, covering about 27 per cent of the world’s land surface and directly supporting 22 per cent of the world’s people, are the water towers of the world, providing for the freshwater needs of more than half of humanity. The world’s mountains encompass some of the most spectacular landscapes, a wide variety of ecosystems, a great diversity of species, and distinctive human communities. The world’s principal biome types—from hyper-arid hot desert and tropical forest to arid polar icecaps—all occur in mountains. Mountains support about one quarter of the world’s terrestrial biological diversity, with nearly half of the world’s biodiversity “hotspots” concentrated in mountains. Almost every area that is jointly important for plants, amphibians, and endemic birds is located within mountains. Of the 20 plant species that supply 80 per cent of the world’s food, six species (maize, potatoes, barley, sorghum, tomatoes, and apples) originated in mountains. A large portion of domestic mammals—sheep, goats, yak, llama, and alpaca—originated in mountain regions. Genetic diversity tends to be higher in mountains associated with cultural diversity and extreme variation in local environmental conditions.

However, mountains are vulnerable to a host of natural and anthropogenic threats, including seismic hazards, fire, climate change, land cover change and agricultural intensification, infrastructure development, and armed conflict. These pressures degrade mountain environments and affect the provision of ecosystem services and the livelihoods of people dependent upon them. The fragility of mountain ecosystems represents a considerable challenge to sustainable development, as the impacts of



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unsuitable development are particularly intense, more rapid and more difficult to correct than in other ecosystems.

In response, the Conference of the Parties to the Convention on Biological Diversity adopted the programme of work on mountain biological diversity in 2004, as a set of actions addressing characteristics and problems that are specific to mountain ecosystems. The programme of work aims to conserve mountain biological diversity and maintain the goods and services of mountain ecosystems, and to contribute to poverty alleviation and the achievement of the Millennium Development Goals. Underlying the goals of the programme of work is the belief that sustainability will be achieved in mountain areas by reducing poverty, inequality, and marginality, preventing deterioration of natural resources and environments, and by improving the capabilities of institutions and organizations to promote the conservation and sustainable use of biological diversity.

The melting glaciers, the shifting of natural habitats, and the retreat and sometimes disappearance of species are stark reminders of the vulnerability of mountains ecosystems to rising temperature and precipitation changes. Activities that link upland and lowland management strategies can provide adaptation options. These options *inter alia* include mountain watershed management, establishment of both horizontal and vertical connectivity migration corridors, rehabilitation of degraded ecosystems, avoiding deforestation, and reducing human pressure on biodiversity. The CBD programme of work on mountain biological diversity provides for such adaptation options and its effective implementation is of paramount importance to minimize the adverse effects of climate change on mountain ecosystems.

Achieving environmental and human sustainability in mountains means finding ways to manage mountain resources and systems so that they can provide critical ecosystem services. There are win-win opportunities in this arena to not only protect mountain ecosystems and the biodiversity they harbour – but to use these more proactively and wisely to contribute significantly to meeting multiple human development challenges in the face of a rapidly changing world.

The United Nations General Assembly has designated 2010 as the United Nations International Year of Biodiversity. I cordially invite all governments and organizations present to commence preparations for this important event. In the same year the Government of Japan will host the tenth meeting of the Conference of the Parties (COP) to the CBD. In this meeting the COP will undertake an in-depth review of the progress made in the implementation of the mountain biological diversity programme of work. Prior to the tenth meeting of the COP, the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA) at its 14th meeting scheduled to be held in May 2010 will consider the progress made in the implementation of the programme of work on mountain biological diversity.

These milestones present the opportunities to not only reflect on what we have achieved in relation to the 2010 target but more importantly to set out our vision and goals for the future. In this process the contributions of ICIMOD and the galaxy of international organizations such as Global Mountain Biodiversity Assessment, Mountain Partnership, Mountain Forum, and the Mountain Research Initiative have been and will be critical. All of you are true partners in the fullest sense. We have the opportunity to showcase how well we have worked together and lay down our road map beyond 2010. I have no doubts that this will be achieved and that together we can set the bar even higher for collaboration towards our shared vision.

I wish you a successful meeting and assure you of my strongest commitment to our partnership.

Annex 2 Programme

16th November 2008 (SUNDAY) Inaugural Session and Reception-Dinner at Hotel Soaltee Crown Plaza

18:30-20:00	INAUGURAL SESSION
	Welcome – Andreas Schild, Director General, ICIMOD
	Inaugural Speech: Biodiversity, Environmental Change and Regional Cooperation Initiatives in Hindu Kush-Himalaya - Bruno Messerli
	Inaugural Keynote Speech: Biodiversity Conservation in a Changing World: An Overview - Christian Körner
	Message: Biodiversity Conservation and Management for Enhanced Ecosystem Services: Responding to the Challenges of Global Change - Ahmed Djoghlaif
	Inaugural Remark: Convention on Biological Diversity : Mountain Biodiversity Programme of Work and 2010 Targets - Krishna C. Paudel
	MC: Eklaabya Sharma
20:00-21:30	RECEPTION DINNER
17th November 2008 (MONDAY) Conference Hall ICIMOD	
08:30-09:00	REGISTRATION
09:00-10:00	PLENARY SESSION I Central Issues & Concerns
	Theme: Climate Change and its Implications for Mountain Biodiversity
	<ul style="list-style-type: none"> Biodiversity in the Himalayas - Trends, Perception and Impacts of Climate Change - Eklaabya Sharma Global Change in Mountain Regions - Strategies for Biosphere Reserves - Thomas Schaaf
	Discussion
10:00-11:00	PLENARY SESSION II Central Issue & Concerns
	Theme: Biodiversity Management for Economic Goods and Ecosystem Services from the Mountains
	<ul style="list-style-type: none"> Biodiversity Goods and Services – Increasing Benefits for the Mountain Communities - Robert Zomer Ecosystem Services arising from Biodiversity - P.S. Ramakrishnan
	Discussion
11:00-11:30	TEA/COFFEE BREAK
11:30-12:30	PLENARY SESSION III Central Issue & Concerns
	Theme: Institutionalizing Long-Term Continuity in Mountain Research Programmes
	<ul style="list-style-type: none"> Hindu Kush-Himalaya - Current Status, Challenges & Possible Framework - Ram Prasad Chaudhary Global Change in Mountain Regions: Research Strategy and its Implementation - Gregory Greenwood A Global Long-Term Observation System for Mountain Biodiversity – Lessons Learned and Upcoming Challenges - Harald Pauli
	Discussion
12:30-13:30	LUNCH BREAK
13:30-15:30	TECHNICAL WORKING GROUPS (Parallel sessions) The conferees will participate in one of five parallel 'working group' sessions on sub-themes in which they will be asked to share their HKH regional experiences

	GROUP I: Climate Change Impacts on Biodiversity and Mountain PAs (Two presentations of 10 minutes each from the HKH region by Ghanashyam Gurung and R.K. Maikhuri will be followed by theme discussion)
	GROUP II: Land Use Change Trends and Impact on Mountain Biodiversity (Two presentations of 10 minutes each from the HKH region by Jianchu Xu and for global perspective by Eva Spehn will be followed by theme discussion)
	GROUP III: Wetland Ecosystem Functions and Services – Implications of Climate Change (Two presentations of 10 minutes each from the HKH region by Chaman Trisal and Kun Shi will be followed by theme discussion)
	GROUP IV: Balancing Biodiversity Conservation with Community Livelihoods (Two presentations of 10 minutes each from the Central Asian region by Libor Jansky and Global perspective by Thomas Schaaf will be followed by theme discussion)
	GROUP V: Biodiversity Transects and Transboundary Connectivity Approaches in Mountains for Long-term Monitoring and Regional Cooperation (Two presentations of 10 minutes each for HKH Biodiversity Transects by Nakul Chettri and Connectivity Approaches by Graeme Worboys will be followed by theme discussion)
15:30-16:00	TEA BREAK
16:00-17:15	PLENARY SESSION IV - Reporting of Group Work During this plenary session, the facilitators for the group discussions on the five sub-themes will summarise the discussions that took place in their groups on the HKH regional experience
	Group presentations and discussion/clarification
18th November 2008 (TUESDAY) Conference Hall ICIMOD	
09:00-10:30	PLENARY SESSION V Responses from Global Programmes
	This plenary session will give each of the global programmes an opportunity (10 min.) to respond to the HKH regional experiences by providing global perspectives and providing ideas and suggestions on how their particular programme can contribute. The background papers on the global programmes will have been circulated beforehand via the web and the audience is expected to be familiar with them. The presenters will be asked only to respond to the regional experiences and not to present the papers they have submitted. In their responses the global programmes will discuss how they are presently involved in the HKH and how they intend to respond to the challenges of the region, what they see as a role for partners and how ICIMOD can be involved.
	<ul style="list-style-type: none"> • EV-K2-CNR • Food and Agriculture Organization (FAO) • Global Observation Research Initiative in Alpine Environments (GLORIA) • Global Mountain Biodiversity Assessment (GMBA) • International Union for Conservation of Nature (IUCN) • Mountain Forum
10:30-11:00	TEA/COFFEE BREAK
11:00-11:40	PLENARY SESSION V cont'd. Responses from Global Programmes
	<ul style="list-style-type: none"> • UNESCO's Man and the Biosphere (MAB) Programme with its World Network of Biosphere Reserves • United Nations University (UNU) • Wetlands International (WII) • World Wide Fund - CEPF • The United Nations Environmental Programme (UNEP)
11:40-13:00	PLENARY SESSION V cont'd. Synthesis of Global Programmes' Responses and Synthesis of HKH Institutions' Reaction
	<ul style="list-style-type: none"> • Presentation of Synthesis - Martin Price and Robert Zomer
	<ul style="list-style-type: none"> • Reactions from the HKH Institutions and ICIMOD
13:00-14:00	LUNCH BREAK
14:00-15:30	PLENARY SESSION VI Strategy and Way Forward
	<ul style="list-style-type: none"> • Strategy on 'Development of Coordination and Cooperation for HKH' (Plenary discussion, inputs and common elements defined period)
	<ul style="list-style-type: none"> • A Way Forward
15:30-16:00	TEA/COFFEE BREAK
16:00-17:00	CONCLUDING SESSION
	<ul style="list-style-type: none"> • Remarks by a HKH Region Representative • Remarks by a Global Programme Representative <p>Concluding Remarks:</p> <ul style="list-style-type: none"> • Andreas Schild • Bruno Messerli <p>Vote of Thanks, ICIMOD</p>

Annex 3 List of Participants

International

Rod Atkins, Australian Alps national parks Co-operative Management Program, Australia
 Yuri Badenkov, Russia
 Chris Baker, Wetlands International, The Netherlands
 Vladimir Bolshakov, Russian Academy of Sciences Ural Division, Russia
 Bernhard Wolf Dickore, University of Göttingen, Germany
 Daniel B. Fagre, US Geological Survey, USA
 Gregory Greenwood, Décanat, Faculté des Géosciences et de l'Environnement Amphipôle, Switzerland
 Falk Huettmann, University of Alaska, USA
 Libor Jansky, United Nations University, Germany
 Christian Körner, University of Basel, Switzerland
 Douglas McGuire, Mountain Partnership Secretariat, FAO, Rome
 Bruno Messerli, University of Bern, Switzerland
 Harald Pauli, GLORIA, University of Vienna, Austria
 Martin Francis Price, Centre for Mountain Studies, UK
 Thomas Schaaf, UNESCO's MAB Programme, France
 Subrata Sinha, UNEP
 Eva Spehn, University of Basel, Switzerland
 Susanne Stoll-Kleemann, University of Greifswald, Germany
 Gianni Tartari, Water Research Institute-CNR, Italy
 Graeme Worboys, IUCN, World Commission on Protected Areas, Australia
 Tatjana Yashina, Katunskiy Biosphere Reserve, Altai Republic Russian Federation

HKH Region

M. Khairul Alam, Bangladesh Forest Research Institute (BFRI), Bangladesh
 Siddhartha Bajra Bajracharya, National Trust for Nature Conservation, Nepal
 Ukesh Raj Bhujju, Nepal National Committee of IUCN Members, Nepal
 Muhammad Bashir Butt, MINFAL-AJK, Pakistan
 Gabriel Campbell, The Mountain Institute, Nepal
 Ram Prasad Chaudhary, Tribhuvan University, Nepal
 Ghanashyam Gurung, WWF-Nepal Programme, Nepal
 Karma Jigme, Ministry of Agriculture, Bhutan
 Sarala Khaling, WWF Nepal Programme, Nepal
 Ashiq Ahmad Khan, WWF-Pakistan, Pakistan
 Sudibya Kanti Khisha, CHTRDP, Bangladesh
 Tara Lama, Local Initiatives for Biodiversity Research and Development, (LI-BIRD), Nepal
 Ruijun Long, International Centre for Tibetan Plateau Ecosystem Management, P.R.China
 R.K. Maikhuri, G.B. Pant Institute of Himalayan Environment and Development, India
 L. M. S. Palni, G B Pant Institute of Himalayan Environment and Development (GBPIHED), India
 Ganesh Pant, Department of National Parks & Wildlife Conservation, Nepal
 Krishna C. Paudel, Ministry of Forest and Soil Conservation, Nepal
 Luo Peng, Chinese Academy of Sciences, P.R.China
 Palayanoor S. Ramakrishnan, Jawaharlal Nehru University, India
 R.K. Rai, Ministry of Environment & Forests, India
 G. S. Rawat, Wildlife Institute of India, India
 S. Venkata Reddy, Ministry of Environments and Forests, India
 Uday Raj Sharma, IUCN/World Commission on Protected Areas, South Asia, Nepal
 Naw May Lay Thant, Ministry of Forestry, Myanmar
 Win Naing Thaw, Ministry of Forestry, Myanmar
 Weikang Yang, Chinese Academy of Sciences, P.R. China

Xu Jianchu, World Agroforestry Centre, P.R. China
Xuefei Yang, Chinese Academy of Sciences, P. R. China
Yan Yang, Chinese Academy of Sciences, P.R. China
Yashmeen Tel Wala, University of Delhi, India
Zahoor A. Swati, Institute of Biotechnology & Genetic Engineering (IBGE) NWFP, Pakistan
Zhang Yuanming, Chinese Academy of Sciences (CAS), P.R.China

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Farooq Ahmad
Birendra Bajracharya
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Brigitte Hoerman
Ouyang Hua
Madhav Karki
Elisabeth Kerkhoff
Isabella C.B. Khadka
Michael Kollmair
Brigitte Leduc
Pradeep Mool
Beatrice Murray
Franciscus Neuman (Mountain Forum Secretariat)
Krishna P. Oli
Karma Phuntsho
Isabelle A. Providoli
Andreas Schild
Bandana Shakya
Eklabya Sharma
Arun Shrestha
Basanta Shrestha
Yan Zhaoli
Robert Zomer

Workshop Reports

Mountain Transboundary Protected Area and Connectivity Conservation

10-15 Nov 2008; Dhulikhel (near Kathmandu), Nepal

A workshop convened by the IUCN World Commission on Protected Areas Mountains Biome and Transboundary Conservation Task Force, ICIMOD and WWF-Nepal

This workshop examined the threats that climate change and the fragmentation of natural ecosystems pose to mountain environments. The focus was on mountains, and specifically those conservation connectivity corridors which include transboundary protected areas. The workshop endeavoured to assist the Convention on Biological Diversity's (CBD) Programme of Work on Protected Areas (PoWPA) to achieve its targets for transboundary protected areas and for connectivity conservation areas by: reviewing the existing status and protocols, identifying gaps, and preparing guides and tools as well as action plans for improved management. Since effectively managed large-scale mountain connectivity conservation corridors are a basis for improved species conservation and healthy environments for humans threatened by climate change, the workshop also aimed to facilitate long-term adaptive conservation responses. These adaptive responses are intended to help minimise species extinction and maintain healthy environments and catchments.

The workshop report was prepared by Dr Graeme L Worboys

Introduction

Thirty-six practitioners and experts in mountain transboundary and connectivity conservation management from 14 countries attended a workshop held in Dhulikhel (near Kathmandu), Nepal from the 11th to the 15th November 2008. The Workshop was convened in partnership by three organisations: 1) IUCN (the International Union for the Conservation of Nature) and, specifically, the Mountains Biome of the World Commission on Protected Areas (WCPA) in association with the WCPA Transboundary Taskforce; 2) The International Centre for Integrated Mountain Development (ICIMOD); and 3) The World Wide Fund for Nature (WWF). The purpose of the Workshop was to review a draft conceptual framework for Connectivity Conservation Management (CCM); to review 10 tools proposed for CCM; and to develop Action Plans for specific connectivity corridors. All of these objectives were achieved and the workshop was considered to be a success by participants. This report provides a record of the workshop and its achievements and follow-up actions.

Connectivity conservation corridors (and their associated transboundary protected areas) help conserve habitats; ecosystem processes; and the opportunities for species to evolve, adapt, and to move. When established and managed, especially on a large scale, connectivity corridors will provide additional opportunities for some species to survive in a world affected by climate change. The workshop aimed to facilitate large-scale connectivity conservation initiatives and the context for this work is briefly presented here.

Mitigating and adapting to climate change

The Earth is currently experiencing its sixth great extinction event and climate change, compounded by other human actions, is one of the principal causes. The root cause of climate change requires urgent and adequate

international responses and these should include mechanisms to mitigate and adapt to the effects of climate change. This workshop focused on connectivity conservation and actions to mitigate and adapt to facilitate conservation of biodiversity as biome shifts induced by climate change happen. It concentrated on protected areas and large natural areas in the mountains, their effective conservation management, the conservation of their natural interconnections, and the strategic role transboundary protected areas play in achieving connectivity conservation along international boundaries.

In a world impacted by climate change, large-scale conservation corridors the mountains can help conserve species. For mountain chains that run from north to south, corridors offer the capacity for both altitudinal and latitudinal biome shifts, with species moving up-mountain or towards the poles (or both) as temperatures increase and conditions become drier or wetter. Mountain connectivity corridors with limited latitudinal variation, but extensive longitudinal interconnections, offer both altitudinal opportunities for movement of species and potential opportunities to benefit from changed east-west rainfall patterns. They also help maintain ecosystem health at a time when the values of intact catchments become more important. The loss of permanent snow cover and glacial ice, for example, has already impacted streams that were once perennial in equatorial Asia, Africa, South America, and other parts of the world and the value of the remaining catchment areas has increased. Connectivity conservation management assisted by transboundary protected area management can help conserve species. They are important conservation initiatives of IUCN, WCPA, and ICIMOD.

IUCN WCPA's role in connectivity conservation

The IUCN WCPA, with its worldwide network of protected area professionals and specialists provides international leadership for best practices in protected area management. The WCPA Mountains Biome has the specific task of facilitating large-scale connectivity conservation, particularly in mountain areas, and this task is identified by the WCPA Strategic Plan (2005-2012). The rationale is clear. Habitat destruction and fragmentation lead to extinction of species while the retention of protected areas within larger, natural landscapes helps to conserve them. The WCPA plan also responds to priorities of the Convention on Biological Diversity's (CBD) Programme of Work on Protected Areas (PoWPA), including connectivity conservation and transboundary protected area management. The PoWPA connectivity conservation target (for Goal 1.2) states:

"By 2015, all protected areas and protected area systems are integrated into the wider land – and seascape, and relevant sectors, by applying the ecosystem approach and taking into account ecological connectivity and the concept, where appropriate, of ecological networks" (CBD PoWPA 2005) and for transboundary protected areas (for Goal 1.3) it states:

"Establish and strengthen by 2010/2012 transboundary protected areas, other forms of collaboration between neighbouring protected areas across national boundaries, and regional networks, to enhance the conservation and sustainable use of biological diversity, implementing the ecosystem approach, and improving international cooperation."

WCPA has responded strategically to these targets. It has focused on large-scale natural areas which offer important connectivity conservation opportunities for species, habitats, and ecosystem functions. The focus has been on mountainous areas of the Earth since many of these areas still retain large expanses of interconnected natural lands. Mountains are also highly vulnerable to climate change; they offer a myriad of refugia for species and they retain critical ecosystems for the health of many people on Earth.

The 2008 Dhulikhel Workshop was preceded by WCPA Mountains Biome workshops in South Africa (2003) [Africa]; Banff, Canada (2004) [North America]; the Cantabric Pyrenees, Spain (2005) [Europe]; and Papallacta, Ecuador (2006) [South America]. Each workshop has taken a step forward in the facilitation of connectivity conservation by the WCPA. This increasing sophistication and momentum evolved from inspiring and securing grand visions for mountain connectivity conservation, to sharing lessons learned, to working on capacity-building products, and to working on a clear conceptual framework for Connectivity Conservation Management (CCM) given that such theoretical knowledge did not exist. A new IUCN book on 'how to manage' these large landscapes is also being finalised. The draft manuscript entitled 'Connectivity Conservation Management: A Global Guide' has been developed and it is planned to publish it in 2009. As part of the book's development, some conceptual framework diagrams needed to be tested and the 2008 Dhulikhel Workshop provided an opportunity to do this.

Asia (2008) was also the next significant international venue for WCPA's work in facilitating connectivity conservation, although this need was always understood and the 2008 Kathmandu Workshop was targeted in 2004 in partnership with ICIMOD. For WCPA, organising the Dhulikhel (Kathmandu) Workshop was a natural partnership between WCPA's Mountains Biome and its Transboundary Conservation Taskforce given the scale of these connectivity corridors and the multiple countries and political boundaries involved.

ICIMOD's role

ICIMOD was a critical partner in convening the Dhulikhel Workshop. Based in Kathmandu, Nepal, ICIMOD is an intergovernmental organisation serving eight member countries in the Hindu Kush - Himalayan region. Its work focuses on mountains, on sustainable livelihoods and poverty reduction, adaptation to environmental change and ensuring ecosystem services, and water and hazard management. It is transboundary in its focus and has pioneered biodiversity and connectivity conservation in the Eastern Himalayas and specifically, the Kanchenjunga Conservation Landscape and the Sacred Himalayan Landscape. The Workshop is consistent with ICIMOD's Strategic Framework (2008-2012) and responds in part or fully to all five of its Strategic Goals. ICIMOD provides an institutional framework to facilitate transboundary protected area management and connectivity conservation across multiple countries as a basis for landscape-scale conservation. The workshop also responds directly to ICIMOD's 2007 strategic programme on 'Adaptation to Environmental Change and Sustaining Ecosystem Services.'

WWF's role

The World Wide Fund for Nature (WWF) (Nepal), the third partner for the Dhulikhel Workshop, has contributed significantly to connectivity conservation and transboundary conservation work. The staff members of WWF have been long-term colleagues and friends of the WCPA Mountains Biome and have been very supportive of this workshop. WWF is focused on ground delivery, and is a recognised world leader in connectivity conservation for its work in the Terai Arc Landscape connectivity corridor of Nepal and India.

The Workshop

Purpose and Objectives

The overall purpose of the Dhulikhel Workshop was to help with the implementation of the CBD PoWPA 2012 and 2015 targets for transboundary protected areas and connectivity conservation. On a regional scale, the purpose was to facilitate connectivity conservation and transboundary conservation corridors in the mountains in Asia. For most continents, large-scale connectivity conservation involves more than one country, and political boundaries that divide such lands are often found in mountain environments such as those along catchment divides. This may involve protected areas on both sides of borders and principles and practices that achieve transboundary management also assist these large-scale mountain connectivity corridor initiatives.

Connectivity corridors typically include protected areas, some critical transboundary protected areas, and many other land tenures in potentially more than one nation. Such initiatives are relatively new globally and there was a need to identify the tools required for connectivity conservation on such a large scale. Tools for transboundary protected areas (such as diplomatic agreements and security considerations), and tools for connectivity conservation management (such as stewardship incentives and a process for conservation planning) are often site (and single nation) based and may need to be improved for them to work effectively on the scale of multi-nation connectivity corridors. An effective suite of guidance tools is needed if countries are to help achieve the CBD targets. It was proposed that the Dhulikhel Workshop help advance the identification of these CCM tools. In addition, there was an opportunity, through input from practitioners and experts at the Workshop, to review and improve a draft CCM Conceptual Framework diagram to be published in the book. This (draft) conceptual framework could also be used by participants to review the management of their own connectivity corridors. The Dhulikhel programme provided this opportunity and participants from different countries worked together on their corridor Workshop Action Statements. The full workshop programme was developed based on these considerations (Attachment One). Thirty-six participants (Attachment Two) were involved in achieving the objectives of the workshop.

The overall objectives of the workshop were:

1. to help facilitate the implementation of the CBD PoWPA for connectivity conservation (ecological linkages) and transboundary protected areas; and, consequently
2. to facilitate effectively managed large-scale mountain connectivity conservation areas as a basis for improved species' conservation and healthy environments for humans in the face of climate change threats.

Agenda

The workshop commenced with presentations on the management of connectivity conservation to provide an introduction and to provide the very latest information on CCM. It was then split into two sessions (Attachment One). Session One reviewed a draft Conceptual Framework for CCM and 10 proposed CCM tools. Session Two involved people working on actual or proposed connectivity corridors in preparing Workshop Action Statements. The specific objectives for these sessions are given in the following section.

Session one objectives

1. To review and recommend improvements to the draft Connectivity Conservation Management (CCM) Framework
2. To review the 10 key CCM tools presented in order to:
 - identify their relative importance as a CCM tool;
 - help identify other important CCM tools; and to
 - help identify the most important CCM tools needed.

Session two objectives

1. To review the status of CCM for individual connectivity corridors in the light of the improved CCM Framework
2. To prepare a brief, realistic, Workshop Action Statement for each connectivity corridor with actions identified at national level (for existing corridors and new initiatives)

The Dhulikhel Workshop was very successful, and the objectives for the two sessions were achieved. The results are summarised in the following.

Results of session one

Review of the (draft) CCM Conceptual Framework

All four groups presented ideas for improving the draft CCM Conceptual Framework. There was general support for all elements of the draft. The groups supported the 'Conceptual Model' which identified the situational context of CCM including its dynamic and interacting 'People', 'Nature' and 'Management' settings. The groups also supported the central importance of the 'Vision' and agreed that the four key management functions identified, 'Leadership'; 'Strategic Management Planning'; 'Action', and 'Evaluation', were all important for CCM. One group identified 'Finance' and 'Governance' as additional management functions. The groups supported the concept of CCM being dynamic and situational. They also supported the idea that CCM be undertaken at different geographic levels, such as local, landscape, national, and international geographic settings, and that leadership at each of these levels was important.

The groups challenged aspects of the draft framework and sought improvement. Clarification of some of the terms used was sought. Groups did not support the draft three-dimensional Framework Model presented. It was too complex and there was consensus that the two-dimensional version of the diagram of the draft framework also needed improvement and three slightly different versions of the diagram were proposed. Due to lack of time, no attempt was made to resolve these differences at the workshop. A commitment was made to analyze each version carefully afterwards and to prepare and circulate a report. The analysis report ('Improving the [Draft] Connectivity Conservation Management Framework') was subsequently prepared and an improved framework developed. It has been circulated to workshop participants, and is posted on the WCPA Mountains Biome Website www.mountains-wcpa.org. The improved Conceptual Framework diagram will be published in 2009.

Review of ten CCM tools

All four groups supported the ten CCM tools presented in principle: one group organised the 'tools' as a series of management steps. It was agreed that the terms used needed to be improved and it was suggested that each of the ten tools was more like a thematic area of CCM than a tool and more specific tools needed to be identified to achieve each of these 'thematic' areas. One group proposed an additional tool. Based on this feedback, the ten tools will be improved and more specific information included and published in the new IUCN book.

Results of session two

One new connectivity corridor, two geographically enhanced corridors, and three corridors with improved management were described by six groups working on individual areas. This was an outstanding result and the work by the groups is described here. Based on the information generated, a 'background statement' and the 'Workshop Action Statements' are presented for each connectivity corridor. In addition, each group nominated a Facilitator for their connectivity conservation work. The Facilitator's future role will be to maintain communication with the group, to encourage and coordinate implementation of the Workshop Action Statement, and to work as part of a wider network to achieve global connectivity conservation outcomes.

(i) The Altai-Sayan Connectivity Corridor (China, Kazakhstan, Mongolia, and Russia)

Background

A new, outstanding vision for an Altai-Sayan Connectivity Corridor was described by the Altai-Sayan Group. The proposed cooperative management involves Russia, China, Mongolia, and Kazakhstan, and its purpose is "to ensure the natural and cultural heritage of the Altai-Sayan (The Heart of Asia) always stays intact and interconnected and nurtures its traditional people and their cultural legacies".

The Altai-Sayan Connectivity Corridor Workshop Action Plan

The group identified the following specific actions.

- Establishing an Interim International Committee for the Altai-Sayan Connectivity Conservation Initiative (ASCCI) which will guide and coordinate planning, operating principles, and actions
- Facilitating an IUCN-WCPA (Mountains Biome) mission in July 2009 to meet key ASCCI country representatives to discuss the potential for a transboundary connectivity corridor. If it agrees to proceed, the meeting will then discuss and formalise the concept of an 'Altai-Sayan World Connectivity Conservation Congress' for July 2010.
- Facilitating the presence of ASCCI representatives at the connectivity conservation forum to be held at the Wild 9 Conference in Mexico in November 2009
- Undertaking a number of specific actions including
 - providing connectivity conservation educational material (in four languages) and developing a web-based information hub;
 - cooperatively producing an Atlas of the Altai-Sayan Region;
 - establishing research and monitoring;
 - establishing a link between the Altai-Sayan Initiative and the Hindu Kush-Karakoram-Himalayan(HKKH) partnership for exchange of information and lessons learned;
 - requesting IUCN WCPA to officially inform the governments of the four countries of the ASCCI of the plan, including the next steps; and
 - briefing Kazakhstan representatives about the ASCCI.

The Altai-Sayan group members

Tatjana Yashina [Facilitator]; Yuri Badenkov (Russia)

Galbadrakh Davaa (Mongolia)

Yuanming Zhang, Zhang Yili (China)

Marie-Eve Marchand, Harvey Locke (Canada)

(ii) The Karakoram-Pamir Region Transboundary and Connectivity Conservation Area (China and Pakistan)

Background

The Karakoram-Pamir Group described a proposed connectivity conservation area of 35,000 sq. km that has a population of about 200,000 people on the mountainous border area between China and Pakistan. The connectivity area expands an existing Transboundary Protected Area along the China-Pakistan border. The group identified this outstanding natural area as one that contains the catchment headwaters of the Indus and Xinjiang; that provides a habitat for rare fauna species such as the Marco Polo sheep, Blue sheep, Snow leopard, Brown bear, Ladakh urial and Himalayan ibex; that has over 400 plant species, and that has outstanding mountain scenery such as the peaks of K2, Rakaposhi, and Nanga Parbat and mountain glaciers, lakes, and streams. The area suffers from human impacts— including fragmentation of habitats. The vision of the group is to improve the management of the corridor's core protected areas; to restore the corridor's ecological characteristics; and to promote sustainable development.

Some progress in connectivity conservation management has already been made as follows.

- A Memorandum of Understanding (MoU) between China's Xinjiang Institute of Ecology and Geography of the Chinese Academy of Sciences(CAS) and WWF Pakistan (2006)
- Support pledged by Xinjiang Wildlife Conservation Society and the United Nations Development Programme (UNDP) Pakistan (2007)
- A workshop was held in Kashgar in 2008 which resulted in key resolutions such as
 - recognition of a 'Sino-Pak Conservation and Development Area' for the transboundary Khunjerab National Park and Taxkorgan Nature Reserve;
 - recognition of management protocols for the area;
 - development of a joint management strategy for the area;
 - promotion of tourism in the area;
 - joint research and the exchange of researchers, managers, and students; and
 - establishment of a steering committee to take the transboundary cooperative initiative forward.

The Karakoram-Pamir Region Workshop Action Plan

The Workshop Action Plan recommended that the Kashgar Workshop cooperative work be expanded and expedited in the following three phases.

Phase One

- Hold a steering committee meeting.
- Develop a strategic framework to implement the decisions of the steering committee.

Phase Two

- Convene a stakeholder workshop to discuss and agree upon connectivity conservation to link protected areas of the Karakoram and Himalayas to the transboundary conservation area.
- Initiate the linking of the Wakhan corridor in Afghanistan, Pakistan, and Tajikistan to the proposed connectivity conservation areas.
- Assess the feasibility of a trans-Pamir-Hindu Kush connectivity conservation area between Afghanistan and Pakistan.
- Identify conservation areas of the Kullong Mountains in order to link them to the protected areas of the Pamirs.

Phase Three

- Develop a collaborative management plan involving partners from China and Pakistan.
- Secure approval of the plan from the governments of the northern areas of Pakistan and the Xinjiang Autonomous Region of China.
- Implement.

Karakoram-Pamir Region group members

Ashiq Ahmad [Facilitator] (Pakistan)

Yang Weikang (China)

Latif Ahmad (Afghanistan)

Krishna Prasad Oli (Nepal), Farooq Ahmad (Pakistan)

(iii) The Brahmaputra-Salween Transboundary Complex (China, India and Myanmar)

Background

The vision for the Brahmaputra-Salween Transboundary Complex (BSTC) is:

"Biodiversity conservation and maintenance of ecological services in the BSTC for sustainable development in the region" The project involves ICIMOD a facilitator working in close relationship representatives from China, Myanmar, and India as well as three big non- government organizations(NGOs);viz., Conservation International, the World Wide Fund for Nature, and the Wildlife Conservation Society. Each nation has a significant role to play by facilitating a national consultation of experts and stakeholders; reviewing research information; and development of a data base; developing a CCM Framework; and, developing a Strategic Plan. Specific tasks have been recognised in the Workshop Action Statement.

The Brahmaputra-Salween Transboundary Complex Workshop Action Statement

The Workshop Action Plan identified specific tasks for each nation as well as the development of a Connectivity Conservation Strategy.

Myanmar

- Training of a professional at ICIMOD for connectivity corridor mapping
- Exposure of one professional each from the Forestry University and NGO to Kanchenjunga landscape sites and ICIMOD and review of the existing literature
- Identification, delineation, and mapping of corridors; assessing biodiversity in corridors; and, identifying transboundary management issues
- Awareness about landscape conservation, livelihoods, and conservation corridors
- Exchange of personnel between Myanmar and Yunnan
- Formulation of a national strategy and development of an action plan

China

- Identify potential stakeholders and initiate dialogue.
- Organise a meeting with stakeholders.
- Review the literature on biodiversity and conservation issues.
- Undertake a policy review on conservation in Yunnan, China.
- Triangulate the information with field verification.
- Organise a technical workshop (late November 2008).
- Prepare a draft status report.
- Help organise an international workshop sponsored by ICIMD which helps define the future course of action.
- Organise field visits.
- Prepare a final technical report.

India

- Identification of partners
- Review existing information.
- Undertake consultation about the connectivity conservation concept.
- Initiate a workshop of biodiversity conservation stakeholders to establish a gap analysis and identify future activities.

Strategy plan

- A connectivity conservation strategy plan will be developed which includes
- capacity building,
- joint research and participatory planning,
- policy analysis, and
- an implementation statement.

Brahmaputra-Salween Transboundary Complex group members

- Xuefei Yang, Linshan Liu (China)
- Nakul Chettri (Facilitator)
- Karma Jigme (Bhutan)
- Naw May Thant, Win Naing Thaw (Myanmar)
- Mingma N. Sherpa (Nepal)

(iv) The Terai Arc Landscape Connectivity Corridor (India and Nepal)*Background*

The Terai Arc Landscape (TAL) is a well-established connectivity corridor, and CCM is actively being undertaken under the leadership of WWF (Nepal). Located along the Nepal-India border, the TAL vision is "A globally unique landscape where biodiversity is conserved, ecological integrity is safeguarded, and sustainable livelihoods of its people are secured". In 1999, the Biodiversity Vision for Nepal recommended linking protected areas through corridors. The TAL connectivity corridor, which conserves a globally significant ecosystem, was initiated by WWF in 2000 and endorsed by the Government of Nepal in 2001. It includes 11 protected areas, four of which are in Nepal and seven in India. A TAL Strategy was developed and implementation commenced in 2001.

The Terai Arc Landscape Connectivity Corridor Workshop Action Plan

The Terai Arc Landscape Connectivity Corridor Workshop Action Plan is the current (2004-2014) TAL Connectivity Strategic Plan. This plan was approved by the Nepalese Government and it identified key threats and their root causes; and these included direct causes (such as forest conversion, excessive extraction of fuelwood, poaching, human and wildlife conflict, and overgrazing); biological threats (such as invasive species, imbalance in predator-prey populations, and use of agrochemicals); and cross-cutting issues such as population growth, low agricultural productivity, and lack of off-farm livelihood opportunities). Governance for TAL involves six levels, and they are a policy-level steering committee; a project execution executive committee; a programme coordination and monitoring committee; project team managers; district or protected area level committees; and grass roots' groups to facilitate action with user groups. Clear lines of communication and accountability were established. TAL priorities for action were identified such as managing 'bottleneck' locations and other key issues.

The actions identified included the following.

- Undertaking transborder, national, and field-level cooperative management meetings
- Wildlife monitoring
- Habitat management
- Human-animal conflict mitigation
- Anti-poaching
- Community forestry
- Capacity building and education
- Providing alternative energy
- Achieving income generation

The Terai Arc Landscape group members

Ghanashyam Gurung [Facilitator], Siddhartha Bajra, Hem Baral, and Shiv Bhatta, (Nepal)

(v) The Greater Virunga Landscape Transboundary Area (Democratic Republic of Congo, Rwanda and Uganda)*Background*

The Greater Virunga Landscape Transboundary Area (GVL) is part of the Albertine Rift Valley of Africa and includes parts of the Democratic Republic of Congo, Rwanda, and Uganda. The area hosts the greatest species' richness and numbers of endemic vertebrate animals in Africa, including the mountain gorilla. It has the largest mammal biomass ever recorded, but is threatened by landscape fragmentation caused by increasing population numbers, poverty, and conflict. Other threats include poaching, clearing of the forest for charcoal production, oil exploration, and human-wildlife conflicts. Transboundary conservation commenced in January 2004 with a Memorandum of Understanding (MoU), and, in 2006, a Transfrontier Strategic Plan was prepared and a Secretariat established. Governance of the transboundary area recognises a policy-level MoU involving national ministries; an executive level committee; a

transboundary secretariat; and technical advisory groups (research, tourism, community and private sector, and law enforcement). The Secretariat's role included coordinating fund raising efforts for the transboundary site; coordinating implementation of the strategic plan; undertaking monitoring and evaluation; and facilitating capacity building.

The Greater Virunga Transboundary Area Workshop Action Statement

The following CCM actions were recognised for the transboundary area.

- Enhance the Vision for the GVL. Add new goals, including broadening the connectivity conservation scope to lands beyond the protected areas, and broaden the values of connectivity corridors and community conservation for ecotourism and other ecosystem services.
- Ensure that the strategic goals are revisited and assessed annually.
- Undertake leadership and position the Secretariat to push innovation, to evaluate the effectiveness of coordination mechanisms, and to make the transition sustainable funding.
- Review the existing Connectivity Strategic Plan in relation to 1) climate change and the potential for the connectivity conservation area to support adaptation; 2) trends in carbon storage; 3) marketing the benefits of the corridor initiative; 4) recognition of the corridor by cross-sectoral interests and 5) specific improvement in areas such as communication, policy, funding, expansion of corridors, social-economic impact assessments, and others.
- The Greater Virunga Trans-boundary Secretariat will coordinate a process of country-based corridor assessments by the protected area management authorities which will include
 - identifying the priority connectivity corridors,
 - identifying threats,
 - establishing alliances and opportunities to gain access to resources,
 - assessing climate change adaptation, and
 - defining conservation activities and implementing mechanisms.
- Undertake monitoring and evaluation of connectivity conservation targets as well as other evaluations. Use the 'protected area management effectiveness tracking tool' for protected areas within the corridors.

The Greater Virunga Transboundary Area group members

Tom Sengalama [Facilitator] (Rwanda)

Bruce Jefferies (New Zealand)

Kathy MacKinnon (United Kingdom – currently Washington DC, USA)

Trevor Sandwith (South Africa – currently Washington DC, USA)

(vi) The Great Eastern Ranges Connectivity Conservation Initiative (Australian Alps to Atherton, [A2A]) (Australia)

Background

A vision for an 'Alps to Atherton (A2A)' connectivity corridor was described in the early 1990s, documented as a concept in 1996 and in 2004, and was officially recognised by the Australian governments in February 2007. The connectivity corridor extends for more than 2800 kilometres along the east coast of Australia, which is one of the wetter areas of the country and contains rich assemblages of fauna and flora. Most of Australia's mainland rainforests and tall Eucalypt forests with their associated tree-dwelling fauna are found there. The connectivity corridor protects the catchments of impoundments that supply water to more than 52% of Australians. The Vision for A2A prepared by the New South Wales (NSW) Department of Environment and Climate Change states "Our vision is for the ecosystems of Australia's great eastern ranges to be healthy and connected from the Australian Alps to Atherton (and beyond), which will contribute to the long term economic, social, cultural and spiritual well being of the community, and of native plants and animals". Connectivity conservation management for the NSW section of A2A (which the NSW Government describes as the great eastern ranges) is currently being implemented. A three-year Business Plan guides this implementation.

The Great Eastern Ranges Connectivity Conservation Initiative (A2A) Workshop Action Plan

The following proposed actions are focused on the NSW section of A2A and include.

- Achieving a process for generating a community 'owned' Vision for NSW for the great eastern ranges (A2A)
- Achieving national support for the Vision
- Achieving natural, cultural, social, and economic context analysis statements for NSW and for the Hunter Valley for various audiences

- Developing a national-level Memorandum of Understanding for A2A stakeholder governments
- Developing a discussion paper on potential governance models for A2A
- Developing a discussion paper on potential models for an A2A Secretariat and its method of funding
- Seeking advice from NSW 'priority area' facilitators on how to fund longer-term connectivity conservation
- Seeking funding mechanisms for land stewardship incentives
- Expanding the support base for A2A connectivity conservation
- Producing a connectivity conservation action plan for the Hunter Valley strategic area
- Developing and applying a connectivity conservation management evaluation framework (plan) and indicators and produce evaluation information for use by a range of audiences
- Adaptively developing an improved Action Plan based on the evaluations

The Great Eastern Ranges Connectivity Conservation Initiative (A2A) Group Members

Ian Pulsford [Facilitator], Lesley Pulsford, Michael Lockwood, Rod Atkins (Australia)

Linda McMillan (USA)

Workshop Outcomes

Positive workshop outcomes were achieved. The conceptual 'Framework for Connectivity Conservation Management (CCM)' was improved and ten proposed CCM tools were verified as important. These (now) well-grounded advances in theoretical knowledge for CCM will provide certainty (and a degree of comfort) for current and future connectivity conservation investors and practitioners. It will help create order and a process for potential significant international investment in large-scale conservation initiatives and, consequently, will contribute to meeting the CBD 2015 PoWPA targets. This theoretical work will be published in 2009 in the new book by IUCN and Earthscan entitled 'Connectivity Conservation Management: A Global Guide'.

The achievement of a new, very large connectivity corridor in the heart of Asia, the 'Altai-Sayam Connectivity Conservation Corridor' was an outstanding outcome for the workshop. In addition, achieving major corridor enhancements for the Karakoram-Pamir Transboundary Area of China and Pakistan and a focused connectivity conservation improvement for the Brahmaputra-Salween Transboundary Area for India, China, and Myanmar were also important outcomes. All of these large mountainous areas contain very important ecosystems and species. Important consolidation and improvement advances were also recognised for the Greater Virunga Landscape, the Terai Arc Landscape; and the A2A Connectivity Conservation Corridor.

Workshop Evaluation

The workshop was very successful according to respondents of the Workshop Evaluation Questionnaire. A very high number (88%) identified that their overall level of satisfaction was either High or Very High in relation to their expectations. [The Questionnaire used a rating scheme with five choices from Very Low to Very High.] The lowest rating identified was Moderate for 12% of respondents. All respondents advised that they would like the IUCN WCPA to conduct similar workshops in future.

General comments

Many brief comments were received from attendees including: "Well done, exceptional opportunity; Extremely useful plus future useful guidelines"; "Thank you!" "Excellent overall! and excellent wrap-up presentation summarising outcomes"; "Great experience: thanks to all those that shared knowledge"; "Excellent arrangements"; "Well done"; "Job well done"; "New ideas are in great scarcity"; "It has been good to hear stakeholders such as business and youth considered as very important at this workshop.....crucially"; "This was extremely useful and provided useful guidelines for the future work on connectivity corridors"; and "Everything was well prepared and now even Australian English is understandable."

Improvement (needed) comments

Some people wanted further improvements, and comments included: "IUCN field trips should spend less time in the bus and more on the ground"; "Improvement of the facilitators in the working groups – organise facilitation in a way

that it enables everyone's participation"; "Ensure field trip gets into the biodiversity more if possible"; and "Provide at least one evening of free time and opportunities to exercise."

Follow-up recommendations

Some attendees sought additional actions including: "A web-based forum on communication; a clearer follow-up plan [is needed]; the networking established should continue somehow."

Future workshop recommendations

Attendees provided comments about future workshops including the following.

Workshop topics

Focused protected area activities to promote connectivity conservation areas and transboundary protected areas; inform and advance [connectivity conservation]; and an Altai-Sayan Workshop.

Workshop organisation

These should assign tasks to participants before they arrive and set a clearer agenda and create a regional core group to draft and finalise the workshop agenda.

Workshop venue

World Wilderness Congress, Wild 9, and Mexico the next venue for connectivity conservation

Follow-up Plan

The Workshop Evaluation survey was very helpful, including the request for a better follow-up plan. Such a follow-up plan is provided here as a series of actions as well identifying accountabilities for this work.

Action one – Circulate the Workshop Report to participants, partners, sponsors, the IUCN WCPA, and Programme on Protected Areas (PPA), the Secretariat of the Biodiversity Convention and the Global Environment Facility (GEF) (Vice Chair Mountains Biome).

Action two – Circulate the completed analysis report of the different improvement options for the Conceptual Framework (Vice Chair Mountains Biome).

Action three – Circulate an invitation for all participants to become members of the IUCN WCPA (Mountains Biome) team (Vice Chair Mountains Biome).

Action four – Correspond with the IUCN WCPA Vice Chair for Russia as a basis for following up on the Altai-Sayan Group's action request to IUCN WCPA (Vice Chair Mountains Biome).

Action five – Subject to final organisational arrangements during early 2009, the IUCN WCPA (Mountains Biome) should participate in a preliminary meeting with representatives of the governments of China, Kazakhstan, Mongolia, and Russia in the Altai Mountains in July 2009. The purpose of the meeting would be to facilitate a potential Altai-Sayan Connectivity Conservation International Congress for July 2010 (Facilitator Altai-Sayan Group, Vice Chair Mountains Biome).

Action six – Correspond with the six 'Connectivity Conservation Facilitators' in May 2009 and November 2009 to identify progress against their respective Workshop Action Statements. Publish the results on the Mountains Biome Web Site (Vice Chair Mountains Biome, Deputy Vice Chair Mountains Biome).

Action seven – Consistent with a request by the Dhulikhel Workshop participants to continue networking opportunities, a proposal to establish a new voluntary network of international large-scale connectivity conservation initiatives will be developed. This proposal for an 'umbrella network' (i.e., a network with a broad category of functions and actors) of connectivity corridors will be a part of the IUCN WCPA's Mountains Biome network. The proposal will be developed during 2009 and circulated for comment. Our Dhulikhel facilitators are anticipated to have a key role in this work (Vice Chair Mountains Biome; Deputy Vice Chair Mountains Biome; Rod Atkins).

Action eight – To advise participants of the next major Mountains Biome Connectivity Conservation initiative, to be held at the Wild 9 Congress in Mexico, November 2009 (Harvey Locke)

Conclusion

The 2008 Mountain Transboundary Protected Area and Connectivity Conservation Workshop held in Dhulikhel (near Kathmandu) Nepal from the 11-15 November was very successful. It met its objectives and the outcomes will help connectivity conservation and contribute to the PoWPA 2015 targets for ecological networks. A proposed new voluntary network of global connectivity conservation initiatives arising from the workshop and facilitated by IUCN WCPA is also anticipated to assist the PoWPA 2015 targets.

Acknowledgements

IUCN WCPA (Mountains Biome) would like to warmly express its thanks for the outstanding support of its partners, ICIMOD and WWF. In particular, the support of the former ICIMOD Director General (DG), Dr Gabriel Campbell in 2004, and the current DG, Dr Andreas Schild, and his staff, especially Dr Eklabya Sharma and Dr Nakul Chettri was appreciated. The support of Dr Ghana Gurung, WWF Nepal was especially helpful.

Direct financial contributions from our sponsors permitted the workshop to proceed and I would like to recognise their special contributions. My thanks are extended (in alphabetical order) to the Australian Alps Liaison Committee; ICIMOD; IUCN WCPA; IUCN Nepal; The Nature Conservancy; the United Nations Educational, Scientific, and Cultural Programme's Man and Biosphere programme (UNESCO – MAB); The World Bank and WWF. In particular, I would like to thank especially Kathy Mackinnon (The World Bank); Ian Dutton (formerly of The Nature Conservancy); Jon Miceler and Ghana Gurung (WWF); Thomas Schaaf of (UNESCO-MAB); Peter Jacobs (The Australian Alps Liaison Committee); and Eklabya Sharma and Nakul Chettri (ICIMOD) for their outstanding support.

A great many people worked behind the scenes, but special recognition needs to be extended to Rod Atkins and Nakul Chettri for their organisation work and to Trevor Sandwith, Jamie Ervin, Wendy Francis, Linda McMillan, Bruce Jeffries, Michael Lockwood, and Ashiq Khan who contributed in many different ways to the running of the workshop. Thanks also go to our outstanding speakers, our workshop facilitators and presenters, and our special presenters Tom Sengalama and Farooq Ahmad as well as our hosts at the Dhulikhel Lodge Resort.

Annex 1 Programme

Sunday 9 th	November 2008
	Various times – All delegates arriving at Kathmandu Airport will be picked up by ICIMOD and transferred to the Hotel Himalaya Patan. On arrival at the Hotel Himalaya, delegates will receive a detailed programme for the workshop. (Delegates' own arrangements for the evening and next morning)
5.30 pm	Introductions, welcoming and workshop and organisation meeting involving Dr Nakul Chettri, Dr Eklabya Sharma, Dr Graeme Worboys; Rod Atkins, and Linda McMillan. Venue: Lobby, Hotel Himalaya
Monday 10 th	
	Delegates: Free time to 11.00 am
10.00 am	Dr Graeme Worboys and Rod Atkins travel to ICIMOD HQ to assist Dr Nakul Chettri with final preparations for the meeting. Deputy Vice Chair Linda McMillan: Key WCPA contact person at the Hotel Himalaya for any assistance or guidance needed by workshop participants Delegates need to check out by 11.15 hours.
11.15 am	Buses arrive and collect luggage.
11.30 am	Buses with delegates and luggage transferred from Hotel Himalaya Patan to ICIMOD Headquarters.
12.00 Noon	Orientation for workshop participants at ICIMOD by Dr Nakul Chettri
12.30 pm – 2.00 pm	Lunch and welcome reception – ICIMOD Headquarters – Khumaltar
2.00 pm – 3.30 pm	Welcoming addresses at ICIMOD HQ Dr Madhav Karki, Deputy Director General, ICIMOD Dr Graeme Worboys, IUCN WCPA Vice Chair for Mountains Biome Mr Trevor Sandwith, Deputy Chair, IUCN WCPA Dr Uday Raj Sharma Secretary of the Ministry of Forestry and Soil Conservation, IUCN WCPA Vice Chair for South Asia Dr Ghana S Gurung, WWF-Nepal
3.30 pm – 3.45 pm	Refreshments at ICIMOD
4.00 pm	Depart from ICIMOD headquarters – coach transfer to workshop venue – Dhulikhel Lodge Resort, Dhulikhel
5.30 pm	Arrival at Dhulikhel Lodge Resort, Dhulikhel and check in
7.00 pm	Welcome dinner - Dhulikhel Lodge Resort [Graeme Worboys] Delegate introductions [Rod Atkins and Nakul Chettri] Orientation background information [Graeme Worboys] Background to IUCN WCPA's Connectivity Conservation Work; workshop objectives; an introduction to the workshop programme
Tuesday 11 th	WORKSHOP PART ONE: REVIEW OF THE (draft) CONNECTIVITY CONSERVATION MANAGEMENT FRAMEWORK AND KEY TOOLS Dhulikhel Lodge Resort
	BREAKFAST
8.45 am – 8.50 am	[Graeme Worboys] Introduction and objectives for the day CCM: SETTING THE SCENE
8.50 am – 9.00 am	[Trevor Sandwith] Establishing a context: Connectivity conservation as a critical part of the IUCN's strategic response to global change
9.00 am – 9.15 am	[Jamie Ervin] Developing The Secretariat of the Convention on Biological Diversity's new technical guide concerning "Integrating protected areas into the wider landscapes, seascapes, and natural resource sectors" The very latest
9.15 am – 9.35 am	[Harvey Locke] The Yellowstone to Yukon Connectivity Conservation Initiative 5-minute BREAK
9.40 am – 9.55 am	[Nakul Chettri] Work in progress: HKKH Transboundary protected area and connectivity conservation management. Guidelines, key tools, and key lessons
9.55 am – 10.10am	[Dr Gurung] Work in progress. The Terai Arc Landscape connectivity conservation. Guidelines, key tools, and key lessons

10.10 am – 10.25 am	[Bruce Jefferies] Work in progress: Association of South East Asian Nations (ASEAN) Transboundary protected area management. Guidelines, key tools, and key lessons
10.25 am – 10.50 am	TEA
	A (DRAFT) FRAMEWORK FOR CCM AND KEY TOOLS
10.50 am – 11.40 am	[Graeme Worboys] A (draft) management framework for connectivity conservation, and key tools which support this
11.40 am – 12.30 pm	Commence workshop groups: Review of the (draft) CCM Framework and selected tools and improvements suggested
12.30 pm – 1.30 pm	LUNCH
1.30 pm	Workshop groups continue: Review of the (draft) CCM Framework and selected tools and improvements suggested
3.30 pm	TEA
6.00 pm – 7.00 pm	End of day free time 14-minute film on A2A Connectivity Conservation. Film Premiered at the IUCN World Conservation Congress(WCC) Barcelona
7.00 pm – 8.00 pm	DINNER
8.00 pm – 10.00 pm	(Optional) Workshop groups continue: Review of the (draft) CCM Framework and selected tools and improvements suggested
Wednesday 12 th	WORKSHOP PART ONE: REVIEW OF THE (draft) CONNECTIVITY CONSERVATION MANAGEMENT FRAMEWORK AND KEY TOOLS (Continued) Dhulikhel Lodge Resort
? – 8.30 am	BREAKFAST
8.30 am – 10.30am	Workshop groups continue: Review of the (draft) CCM Framework and selected tools and improvements suggested
10.30am – 11.30am	TEA
11.30 am – 12.30 pm	Review of the (draft) Connectivity Conservation Management Framework and key tools: Workshop presentations from 4 Groups (Use of overheads or Power-points) 10.00 minutes per group, with 5-minute Question and Answer sessions
12.30 pm – 1.30 pm	LUNCH
	WORKSHOP PART TWO: REVIEWING CONNECTIVITY CORRIDORS AND DEVELOPING AGREED ACTION STATEMENTS
1.30 pm – 1.50 pm	[Graeme Worboys] Using the (improved draft) CCM Framework as a guide: 1) Break into working groups linked to specific connectivity corridors. 2) Review the current CCM action status for individual connectivity corridors. 3) Identify the agreed priority areas for CCM action for a connectivity corridor 4) If appropriate, prepare a brief statement of CCM action needed for each nation, and the process, within each government, to help achieve this. 5) Identify any further improvements to the (draft) CCM Framework and key tools as a consequence of the local review. Potential working groups <ul style="list-style-type: none"> • Albertine Rift Valley • Altai Mountains • HKKH • Terai Arc • A2A • Y2Y
1.50 pm – 3.30 pm	Connectivity corridor working groups TEA
6.00 pm	[Nakul Chettri and Rod Atkins] briefing on requirements for the protected area field trip on Thursday
6.00 pm – 7.00 pm	Free time
7.00 pm – 8.00 pm	DINNER
8.00 pm – 10.00 pm	Optional. Connectivity corridor working groups

Thursday 13 th	FIELD TRIP
	BREAKFAST
8.30 am	<p>Bus departs for a full day field trip to Shivapuri National Park</p> <p>(Extract from the web site) "Shivapuri National Park lies on the north side of Kathmandu Valley, about 12km from Kathmandu City. It covers an area of 14,487ha, of which 11,200ha falls within the wildlife reserve and is demarcated by 114km-long boundary wall. This watershed area is a true representation of the Middle Hills in the protected area system, and it also provides over 40% of the drinking water to Kathmandu Valley. It has a high diversity of forest types (sal, Terai hardwood, lowerslopes mixed hardwood, chir pine, oak and upper slope mixed hardwood) which occupy 39% of the land where 16 endemic plants occur. A total of 129 species of mushroom, 150 species of butterflies with many endemic and rare, 151 species of birds, and 19 species of mammals have been recorded. This National Park is popular with tourists, many of whom camp overnight in order to see the Himalaya at sunrise."</p> <p>LUNCH PROVIDED</p> <p>Return to Dhulikhel Lodge Resort</p>
7.00 pm – 8.00 pm	DINNER
Friday 14 th	WORKSHOP PART TWO: REVIEWING CONNECTIVITY CORRIDORS AND DEVELOPING AGREED ACTION STATEMENTS (Continued)
	BREAKFAST
8.30 am – 1030 am	Connectivity corridor working groups continue to prepare their agreed action statements
10.30 am – 11.00 am	TEA
11.00 am – 12.30 pm	Connectivity corridor working groups finalise their agreed action statements
12.30 pm – 1.30 pm	LUNCH
1.30 pm – 3.00 pm	<p>Connectivity corridor working groups presentations</p> <ul style="list-style-type: none"> • Albertine Rift Valley • Altai Mountains • HKKH • Terai Arc • A2A • Y2Y
3.00 pm – 3.30 pm	TEA
3.30 pm – 5.00 pm	<p>[Graeme Worboys] Review of the workshop findings for the draft CCM Framework and Key Tools</p> <p>[Jamie Ervin] Overview of the Connectivity Corridor Action Statement presentations</p> <p>[Open Panel Discussion: Connectivity Conservation opportunities and possible initiatives]</p> <p>[Nakul Chettri and Rod Atkins] Logistics for dinner and Saturday's departure for Kathmandu</p> <p>[Dr Andreas Schild and Dr Graeme Worboys] Concluding words]</p>
5.00 pm – 6.00 pm	<p>Free time</p> <p>Preparation for Saturday's departure</p>
6.00 pm - ?	Celebratory Mountains Connectivity Conservation Dinner, Dhulikhel Lodge Resort
Saturday 15 th	DEPARTURE FROM DHULIKHEL LODGE RESORT
	BREAKFAST and Checkout
9.00 am	Depart Dhulikhel Lodge Resort – coach transfer to Kathmandu Valley travel terminals (airport, bus station etc)

Annex 2 List of Participants

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Linking Geodata with Biodiversity Information in the Himalayas

15-16 November 2008; ICIMOD, Kathmandu, Nepal

A workshop convened by the Global Mountain Biodiversity Assessment of DIVERSITAS and ICIMOD

The inventory and assessment of biodiversity resources have become essential for policy-making and management strategies as well as for developing and testing scientific hypotheses. There is an increasing need to compile mountain biodiversity databases and to make them available on-line. At the forefront of this work is an initiative lead by the Global Mountain Biodiversity Assessment of DIVERSITAS in cooperation with the Global Biodiversity Information Facility (GBIF). The aim of the workshop is to highlight the usefulness of geo-referenced biodiversity data for the integrated analysis and spatial visualization of biodiversity information in relation to climate, land use, physiography and other important parameters. The workshop will bring together national partners from the HKH region to explore the possibility of hosting a regional platform for mountain biodiversity data from the Hindu Kush-Himalayas. Ideally, such a platform would provide easy and open access to Himalayan biodiversity data and metadata, and make it available for wider dissemination both regionally as well as to the global change research community. The portal gateways under discussion include the GBIF/GMBA Mountain Biodiversity Portal and the ICIMOD Mountain Geo-Portal.

Report prepared by Dr Eva Spehn and Mr Basanta Shrestha

Introduction

It is estimated that about twelve per cent of the world's population live in the mountains. Fifty per cent of the world's population depends on goods and services provided by these mountains. While mountains cover one fifth of the terrestrial land area outside the Polar Regions, the alpine life zone alone (above the treeline) makes up only three per cent of the Earth's surface, but contains at least ten thousand or four per cent of all vascular plant species. This disproportionate richness in species is important for slope stability and key ecosystem services in the mountains. Mountain biodiversity is of prime conservation value, as mountains host half of all thirty-four global biodiversity hotspots.

The compression of thermal life zones and the fragmentation of the landscape into a multitude of microhabitats in the mountains, each inhabited by a suite of species, result in hotspots of biological diversity. Biological diversity is considered essential for the persistent functioning and integrity of mountain ecosystems, and this dependency is likely to increase as environmental conditions change. Steep terrain and the mountain climate together with severe land-use pressure cause mountain ecosystems to rank among the most endangered landscapes in the world (Agenda 21, Chapter 13 of the Rio Protocol).

Making an inventory and assessing mountain biodiversity are essential to improve understanding of, developing management strategies and conservation interventions for, and for predicting and testing scientific hypotheses related to the mountain environment. This has not been the case, however, especially in the context of the Himalayas due to the lack of data in the region. Hence the need for accessible, quality information on ecosystem dynamics in the Himalayas, both at species and ecosystem levels, for informed decision-making.

Given these challenges, the International Centre for Integrated Mountain Development (ICIMOD) together with the Global Mountain Biodiversity Assessment (GMBA) jointly organised a pre-conference workshop on 'Linking Geodata

with Biodiversity Information in the Himalayas' at ICIMOD's Headquarters in Kathmandu from the 15th to the 16th of November 2008. The aim of the workshop was to facilitate deliberations on ways of improving biodiversity databases at regional and national levels; the need for standardisation and harmonisation of data for exchange; and ways of facilitating easy and open access to geo-coded biodiversity information. The workshop was organised as a precursor to the International Mountain Biodiversity Conference and representatives from ICIMOD's regional member countries, Afghanistan, Bangladesh, Bhutan, China, India, Myanmar, Nepal, and Pakistan, attended.

Aims and Objectives

The aim of the workshop was to show the benefits of geo-referenced biodiversity data, for integrated analysis and spatial visualization of biodiversity information in relation to climate, land use, physiography and other important parameters. The workshop aimed to bring together national partners from the HKH region to explore the possibilities of hosting a regional platform for mountain biodiversity information for the Hindu Kush-Himalayas.

The workshop deliberated on the available tools to facilitate the exchange of biodiversity and geoinformation worldwide e.g. GBIF, WMO/GTS and WorldClim. The workshop also aimed to introduce ICIMOD's initiatives on geo-information applications for biodiversity database development and sharing. The ultimate aim is to provide easy and open access to biodiversity information on the Himalayas via GBIF/GMBA Mountain Biodiversity Portal and the Mountain Geo-Portal of ICIMOD and to develop a framework and partnerships for standardized biodiversity databases and for their dissemination through standard metadata systems to the wider regional and global change research community.

Opening Session

Dr Andreas Schild, Director General of ICIMOD, welcomed the participants and emphasised the importance of geo-coded information for understanding the rapid environmental changes taking place in mountain ecosystems. He highlighted the central role that ICIMOD had been playing in the mountain agenda and the significant contributions it could make to promotion of regional approaches and a methodology for filling the data gaps in the Himalayas as the only mountain-specific, research based organisation working in the Hindu Kush-Himalayan (HKH) region at the regional level. In this context, he also added the important role that the Mountain Environment and Natural Resources' Information System (MENRIS) division of ICIMOD could play to bridge the data gap on biodiversity in the HKH region.

In his remarks at the opening session, Professor Christian Körner, Chair of the Global Mountain Biodiversity Programme, stressed the biophysical characteristics of the mountains which are endowed with immense biodiversity. He said that the information about locations is not only fundamental for understanding biodiversity but also helps us to explore the evolutionary processes of species. So, a 'corporate' community was needed to make information on mountain biodiversity available to a wider scientific community and to policy-makers.

The pre-conference was fortunate to have Professors Bruno Messerli and Yuri Badenkov present as observers. Professor Christian Körner, Dr Eva Spehn, Dr Falk Huettmann, and Dr Bernhard Wolf Dickoré from GMBA and Mr Basanta Shrestha, Mr Birendra Bajracharya, and Mr Sudip Pradhan from ICIMOD gave presentations to the workshop. Mr Basanta Shrestha, division head of MENRIS, presented ICIMOD's programme and activities on geographical information systems and remote sensing (GIS-RS) acted as moderator while Mr Paribesh Pradhan was the rapporteur.

GMBA Presentations

Introduction to the GMBA Global Biodiversity Information Facility (GBIF) project on geo-referenced databases on mountain biodiversity

Dr Eva Spehn, Executive Secretary, GMBA, Institute of Botany, University of Basel gave this presentation. Dr Spehn explained that the Global Mountain Biodiversity Assessment (GMBA) was inaugurated under the patronage of DIVERSITAS at the 1st International Conference on Mountain Biodiversity in Rigi-Kaltbad, Switzerland in September 2000 and is supported by the Swiss National Science Foundation (since 2004) and DIVERSITAS.

GMBA is a cross-cutting network of DIVERSITAS embracing issues of their four core projects bioGENESIS, bioDISCOVERY, ecoSERVICES, and bioSUSTAINABILITY. GMBA primarily aims to provide a scientific basis for the conservation and sustainable use of mountain diversity by encouraging and synthesising often hidden and fragmented results of research on high elevation organismic diversity, its regional and global patterns, its cross- and intercontinental comparisons, and its causes and functions. In other words, it aims to document and synthesise knowledge on the biological richness of the mountains of the world and the changes this richness is undergoing as a result of direct and indirect human influences. GMBA also investigates the mechanisms that create and maintain mountain biodiversity and the functional consequences in both pristine and inhabited high-elevation terrains. It also helps to stimulate new research activities with a comparative emphasis and give a 'corporate' identity to the global scientific community involved in work in mountain biodiversity. In this way, GMBA also helps to create a platform to communicate findings and engage in dialogues with national and international policy forums.

To identify mountain biodiversity, how it is changing and why, GMBA has initiated a project on geo-referenced electronic biodiversity databases on mountain organisms, in cooperation with the Global Biodiversity Information Facility (GBIF). Georeferenced biodiversity data will allow the combination of ecologically relevant information with biodiversity patterns and so facilitate the modelling of species distributions (niche models) and ecosystem boundaries, opening a new field of research (Körner et al 2007). GBIF has a mission to make the world's primary data on biodiversity freely and universally available via the Internet. More than 150 million single records of organisms are currently available at the GBIF data portal (<http://data.gbif.org>). GMBA will develop a thematic Mountain Portal in 2009, which will help to select mountain relevant data from GBIF. Thematic biodiversity portals like the Ocean Bio-Geographic Information System (OBIS) for sea organisms or the Mammal Networked Information System (MaNIS) are role models for the GMBA Mountain Portal.

There is an urgent need to increase the amount and quality of geo-referenced data on mountain biodiversity available online, especially for the Himalayas. There is also a need to develop a quality set for mountain specific data, such as precise georeferences, or additional altitude information.

Beyond data mining: The evolutionary and ecological usefulness of electronic biodiversity data in combination with geo-physical information systems

In his keynote lecture presentation, Professor Christian Körner, Institute of Botany, University of Basel, explained the importance of understanding biodiversity to understand the evolution of different organisms. He said that evolution is a process that requires time and space. Mountains restrict both, space (as area decreases with altitude) and time (as the length of the growing season also decreases with altitude) and are therefore great places to study evolution. Since mountains are present at all latitudes, they represent nicely replicated study objects for evolution and biodiversity.

Mountains host half of all 34 global biodiversity hotspots, therefore, data on mountain biodiversity is crucial for any kind of future research, analysis, hypothesis and prediction.

Georeferences provide mainly latitudinal and longitudinal information. However, in the case of mountains, information on altitude is crucial additional information; since, in very rugged terrain, a slight error in latitude or longitude changes altitude significantly. The great variation in regional spatial extent of mountain environments and duration of time supportive of life processes offers test conditions for evolutionary theories, but the quality of the data needs to fit the purpose of the study.

Description and definition of the subject is the first step in any scientific study. So, there should be a discourse on defining the subject of the data itself. For example: the term 'mountain' is itself vague for the purpose of developing any mountain biodiversity database. There is no standard and globally accepted definition of what constitutes a 'mountain' and what is 'alpine'. Definitions are often insufficient since not every land areas above 300 m elevation can be called either a mountain or alpine. Therefore, there is a need for a bioclimatic definition rather than 'per meter' definition of a mountain. The parameter of such a bioclimatic definition should include: minimum mean ruggedness (e.g. $\Delta > 200$ m per 30"); the altitudinal tree limit as it correlates with the seasonal mean temperature of 6.6 ± 0.8 °C worldwide; and the mean temperature (the upper limit of higher plant life correlates with a minimum period of 30 days with a mean temperature above 0°C).

Apart from understanding the geographical matrix in such a bioclimatic definition, there should also be detailed information on where these land area categories are, how steep they are to make a mountain, how big the remaining areas are in various latitudes and how much time per year the regional climate offers to higher plant life.

For pragmatic reasons, GMBA has defined the montane belt by its ruggedness (>200m across neighbouring 30" pixels and minimum elevation >300 m) and a climatic tree line algorithm.

The treeline ecology and a global climate and topography database have helped significantly in development of a thermal envelope of plant life in the mountains, across latitudes and altitudes. Altitude related phenomena of biodiversity and evolution are distilled by linking climate and topography.

In this way, Körner's main hypothesis stated that time and space provide the major explanation of global diversity, where disturbance and habitat diversity (geodiversity) are more regional (azonal) drivers and physiological constraints operate at boundaries and are generally overvalued.

The challenges to this hypothesis, however, include linking biodiversity data with 'space-for-life' data and 'time-for-life' data, combining the two, distilling global trends from 'noisy' regional trends, and testing biodiversity ratios across organismic groups and climates.

Open access to biodiversity data and the GMBA/GBIF mountain biodiversity web portal

Dr Falk Huetmann of EWHALE laboratory, Biology and Wildlife Department, Institute of Arctic Biology, University of Alaska, discussed the GBIF web portal on mountain biodiversity. He introduced the concept of mega science, i.e. science projects which involve many scientists and institutions working on a common, often interdisciplinary goal. He gave as examples the International Polar Year (IPY), NCBI genbank, Ocean Biogeographic Information System (OBIS), Census of Marine Life, ITIS, NEON, GEOSS, FishBase, LTER, Group on Earth Observations, Mammal Networked Information System (MaNIS), Global Biodiversity Information Facility (GBIF) and Global Mountain Biodiversity Assessment (GMBA). Mega Science projects are huge, interdisciplinary research projects funded by institutions such as the International Council for Science (ICSU), WMO (UN), Organisation for Economic Cooperation and Development (OECD), the National Academies, ICSU CODATA, National Institutes of Health, National Science Foundation or the Environmental Protection Agency in United States. Mega science projects are centred around components of Data Information Service (DIS) with functionalities like open access, free raw data, spatial and temporal data, and metadata in ISO (International Organisation for Standardisation) format. The services also include public ownership of data, professional credit for data publication, and explicit use and sharing of data.

The Global Biodiversity Information Facility (GBIF) is such a mega science project, making biodiversity data from many different sources such as natural history museums collections' available online. GMBA is working on a thematic mountain portal using GBIF data, with the primary goal to harvest the internet and public biodiversity data sources relevant for mountains and additional databases such as the Flora Tibetica collection of B. Dickoré (next talk). Some of the key issues in this mountain portal project have been the definition of 'mountain' itself, along with getting a tree line formula, aspects of specific slope and building queries related with altitude.

The X, Y, and Z variables of biodiversity data currently available have been defined as latitude, longitude and species. Since altitude is an important factor for mountain research, as discussed in earlier presentations, to resolve the altitude problem is to provide X, Y, Z1 and Z2 variables online, with each variable representing latitude, longitude, species and altitude respectively. This problem has already been addressed in GBIF, so altitude was included in the search menu of the GBIF portal, and those data which provide the information can be extracted. This has helped the users to make a three dimensional searches.

The presenter gave insights into the technical aspects of the project such as databases, standardisation of data, interoperability issues and so forth. Apart from these, issues such as internet science, investment into knowledge, data mining, modelling and adaptive management, data creation and re-use, metadata, (online) data delivery, visualisation, analysis, and policy were also discussed.

GMBA pilot project: Flora Tibetica – A distributed database for the Vascular Plants of the Tibetan Plateau, Hindu-Kush, Pamir, Karakoram, Kunlun Shan, Himalayas, Hengduan Shan

Bernhard Dickoré of the Albrecht-von-Haller Institute of Plant Sciences, University of Göttingen, spoke about Flora Tibetica, a GMBA pilot project. He said Flora Tibetica is a distributed database on the vascular plants of the Tibetan Plateau, Hindu Kush, Pamir, Karakoram, Kunlun Shan, Himalayas, and Hengduan Shan. The presenter covered the background and history of 'Flora Tibetica'. The data structure was discussed along with tools, hypothesis, and evaluations of the project described in categories such as taxonomy, phylogeny, evolution, altitudinal zonation, and diversity of vegetation. The conclusion and outlook of the project were also discussed.

Flora Tibetica has 164,990 records in a distributed database out of which 144,618 are geo-referenced specimen records, 140,594 records are identified to species, and 82,757 records are seen or verified specimens.

The speaker concluded by stating that high-resolution spatial data of Tibetan and Himalayan flora are very crucial and these spatial data should reflect biogeography for 50 Mega-annum (Ma) and should be suggestive of large-scale glaciation and recent radiation. The presentation also concluded by discussing the need to place the 'Flora Tibetica' database online and feed it into the GBIF node. It also highlighted the need to work to fill the data gaps, improve taxonomy, geo-referencing, and links.

ICIMOD-MENRIS Presentations

Decision support tools and approaches to protected area management

Birendra Bajracharya, GIS Specialist, Mountain Environment and Natural Resources' Information System (MENRIS), International Centre for Integrated Mountain Development (ICIMOD) was the speaker on decision-support tools and approaches to protected area management.

He stated that decision makers today need to be able to find good solutions to increasingly complex socioecological systems. The complexity of making coherent, integrated, and interdependent decisions for ecosystem management demands sound scientific analysis based on reliable data and information. The tools used must be able to anticipate responses and feedback mechanisms on multiple temporal and spatial scales, accounting for biophysical, social, and economic considerations. Over the past decade or so, "interactive computer-based systems that help decision makers use data and models to solve unstructured problems" or decision support systems (DSS) have been developed with different forms and capabilities to facilitate this process. DSS have evolved as multi-component systems that include combinations of simulation modelling, optimisation techniques, geographical information systems (GIS), and associated databases and user interface components. The tools included in many systems developed as DSS are significantly wide-ranging in their levels of sophistication - from simple tools for integration of data and visualisation to extensive and complex integrated analytical tools and methods for modelling and simulation.

In the context of the HKH region, the development of DSS should be considered as part of a systemic process which invariably will become a platform for participatory consultations and analyses, resulting in improved understanding of the problems and tradeoffs of possible alternatives, as well as a framework for monitoring socioecological dynamics. The DSS should evolve over time and should address the process of decision-making and include the flexibility to review and change assumptions. The generic DSS framework is presented below in a diagram.

DSS for Protected Area Management – The HKKH Partnership Initiative

ICIMOD has been associated with the HKKH Partnership Initiative as an executing partner together with the International Union for the Conservation of Nature (IUCN), Everest, K2, and Council of National Research (Ev-K2-CNR), and Cooperazione e Sviluppo (Cooperation and Development) (CESVI). The project was developed in the framework of priorities defined in the World Symposium on Sustainable Development (WSSD) 2002 draft plan of implementation and considers the recommendations made for achieving successful implementation of the priorities identified in Agenda 21 and funded by the Government of Italy's Directorate General's Guidelines for Developing a Cooperative System (DGCS). The activities are focused on three national parks of the Hindu Kush-Karakoram-Himalayan (HKKH) Mountain Complex: the Sagarmatha National Park (SNP) in Nepal, the Central Karakoram National Park (CKNP) in Pakistan, and the Quomolongma Nature Preserve (QNP) in Tibet Autonomous Region of China.

The main objective of this initiative is to consolidate institutional capacity for systemic planning and ecosystem management in the Hindu Kush-Karakoram-Himalayan (HKKH) region. As a multi-scale initiative, the project worked together with local, national, and regional stakeholders on capacity building and developing decision support tools (DSTs) for ecosystem management on different temporal and spatial scales. The project activities support the exchange of data, knowledge, and experiences across the region and the development of a management-oriented research framework. Based on this research framework, a number of social and ecological processes have been analysed and modelled using a system dynamics' approach. Computer-based software tools are being developed to support the decision-making process by facilitating integrated analysis and modelling on a common GIS platform.

ICIMOD has been involved in the project to provide overall technical inputs and expertise related to the application of GIS, RS, and information and communication technologies (ICT) to systemic natural resource management and monitoring, and integration of relevant knowledge, data, and models useful for developing and setting up DST application for ecosystem management in the context of selected protected areas sites.

Decision support toolbox (DST): design and development

The project is developing a Decision Support Toolbox (DST) through a participative and adaptive approach to support ecosystem management processes. The DST is conceived of as a collection of both hard and soft system methodologies and provides a set of generic tools to address the needs of stakeholders and support them in the decision-making process for ecosystem management in selected protected areas. The soft system and participatory tools of DST include scenario planning, participatory 3D modelling, and so on. The computer-based tools are designed and developed in a modular fashion keeping in mind users at different levels, and they which can be used independently or in an integrated fashion as a decision support system. The software component of DST is developed progressively, starting with simple application modules such as visualising and querying geographic layers, environmental and socioeconomic data, and gradually integrating modelling and analytical components to support systemic planning and decision making.

The software is designed in four distinctive modules which can be used collectively or independently as per the decision-making needs of the end users and the protected area to be managed. The first module is a 'Knowledge Base' which contains spatial and bibliographic metadata. This is an offline version of the project's 'Knowledge Base' for users without Internet connections; and it can be synchronised with the online version. The second module, 'Spatial Analysis', provides basic GIS tools for visualisation and analysis of spatial information. The third module, 'Scenario Analysis' provides tools for viewing qualitative models and running quantitative models built in Simile (an external software for modelling System Dynamics). Tools have been developed for inputs to the model from spatial layers and for writing the outputs back to spatial layers. This important development was carried out by ICIMOD by adding a spatial component to modelling of system dynamics. The fourth module, Decision Analysis, provides tools for multi-criteria analysis of various management options and resulting performance indicators to identify the most desirable decisions. The modules on System Analysis and Decision Analysis have been developed to run in an ArcGIS environment for those users who have access to it. The DST in the ArcGIS environment will be provided with additional customised tools with spatial models for habitat analysis and land-cover change analysis.

Regional knowledge hub for biodiversity information for the HKH region

Basanta Shrestha, Division Head, Mountain Environment and Natural Resources' Information System (MENRIS), International Centre for Integrated Mountain Development (ICIMOD) introduced ICIMOD by saying that it is a regional mountain learning and enabling centre devoted to sustainable mountain development in the HKH region and information and knowledge are its prime commodities.

Mountains possess typical geographical settings that give rise to diverse physical, cultural, and socio-ecological conditions these are the most dominant factors influencing sustainable mountain development. Addressing the needs of sustainable development in mountain areas demands special attention because of remoteness, widely varying socioecological conditions, and distinct spatial and temporal characteristics. He said unprecedented growth of geo-information and earth observation technologies and emergence of geographic information science now provide a viable institutional and technological framework to support informed decision-making by integrating many

disciplines. Integrated and innovative solutions based on modern decision-support tools and methods are considered crucial elements to improve scientific understanding, support policy decisions, and devise appropriate development interventions. ICIMOD is one of the first and foremost regional institutions promoting geo-based solutions (tools, technologies, and methodologies) for sustainable development in the region, and geo-based solutions have been the trademark of ICIMOD. It is an internationally recognised resource centre for geo-information and earth observation applications. ICIMOD pursues its goal through innovation and customisation of international knowledge, capacity building and by upscaling, and development of mountain-specific applications and decision-support systems: it acts as a clearing-house mechanism within ICIMOD and among agencies involved in sustainable mountain development.

Mr Shrestha pointed that biodiversity is one of key resources in the Himalayas and there are many issues left to address with regard to biodiversity information.

- The need for spatial and temporal aspects of biodiversity information
- The need for standardisation and harmonisation of biodiversity information
- The need for an integrated platform to combine biodiversity information with other socioeconomic and biophysical parameters
- The need to strengthen regional and national capacities and networking
- The need for an innovative and systematic approach to customise international experience and knowledge for mountain-specific situations.

The speaker described the MENRIS programme and its activities over the last several years and suggested how ICIMOD could be a regional knowledge hub in the Himalayas by working closely with national partners and international agencies. Such a knowledge hub would entail a four-pronged approach by:

- strengthening the capacities of national partners and providing a network for biodiversity information in ICIMOD member countries;
- customising data harmonisation and standardisation adhering to international practices and disseminating to national partners;
- working on a pilot project on geo-referenced biodiversity information in ICIMOD member countries; and
- establishing a web-based platform to build, share, and disseminate biodiversity information from the Himalayas.

Mr Shrestha also illustrated the principles of data sharing with an example of the conservation commons to promote open access to information. He then outlined the topics for group discussions and deliberations.

Demonstrations

ICIMOD and GBMA gave live demonstrations of portals relevant to the work of workshop participants.

- Mountain GeoPortal <http://menris.icimod.net>
- Nepal Biodiversity Portal <http://www.biodiversityofnepal.org>
- GBIF Web Portal <http://data.gbif.org>

Group work and plenary discussions

Group work took place after the end of this two-day presentation to devise a way forward for linking geo-data with biodiversity information in the Himalayas. Participants and resource persons were divided into three working groups of 8 to 10 people. Each group was given a separate question to address. Brief accounts of the group sessions are given below.

Group 1: How to design a GBMA-ICIMOD mountain biodiversity portal?

Step 1- Identify the potential users of the mountain biodiversity portal.

Step 2 - Search criteria or query features in the database could be in terms of names of species, collectors and contributors, according to location and time, protected areas, administrative units, altitude, country or region, life zones, and so on.

Step 3 - The database could be compatible with those of the following organisations: GMBA, GBIF, Global Earth Observation Systems (GEOSS), IUCN, Ramsar Sites, Important Bird Areas (IBA), WWF, United Nations Environment Programme (UNEP), Critical Ecosystem Partnership Fund (CEPF), Food and Agriculture Organization (FAO), WESCOM (a software corporation), National Geographic, and others.

Step 4 – There should be a metadata system in a uniform format and adhering to ISO standards. The metadata should be on a local or public server and be accessible globally.

Step 5 - The goal of the portal should be to provide the most recent, time-referenced data.

Step 6 - Pilot studies to upscale the Mountain Biodiversity Portal that this workshop envisions will be essential. Hence, the group proposed that ICIMOD establish a Biodiversity of Nepal portal in collaboration with IUCN and the Department of National Parks and Wildlife Conservation (DNPWC). The group also suggested that 500 records of information on species could be added to make it a GBIF-GMBA standard pilot project.

The group also discussed the need for a regional hub for the GBIF-GMBA portal. It was agreed that, in the case of the HKH region, ICIMOD should take the lead as the regional hub for the GBIF-GMBA portal.

Step 7 - The participants discussed the technical requirements for such an initiative. Hardware and software requirements include servers and the Digital Imaging Information Resource's (DIGIR) / Biodiversity Information Standards Access Protocol (TAPIR), personal computers (PCs), Linux operating system, File Transfer Protocol (FTP) services, Microsoft's web application framework (ASP.NET), Java, database management system (MySQL), object relational database management system (PostgreSQL), Excel, Microsoft (MS) Access, Apache, Map Server, Arc Geographical Information Systems (ArcGIS) Server, University of Minnesota's (UMN's) Map Server, Arc Internet Map Server (ArcIMS), and so on.

Step 8 - The web services and facilities that the portal should deliver would be a web map service (WMS), a web feature service (WFS), Google Earth, data downloading and mining facilities for predictive modelling, adding and merging other data sources (National Aeronautics and Space Administration [NASA] and Topography dataset), and linking with GenBank, Species 2000 and Bar Code of Life.

Step 8 - The need for data policy, embargo, and a white paper were also discussed. GBIF has a data policy, and GMBA has a data policy which is more mountains specific.

Step 9 - The project should have a timeline and business mode: whether it should be a short-term or long-term initiative should be discussed and finalised.

Group 2: How to promote geo-referenced data on biodiversity?

The participants in this discussion group discussed the need for accessible data with linkages to other databases on national and global scales to promote geo-referenced biodiversity data. During the discussion, questions such as 'promotion to whom?' were raised. For promotion of geo-referenced biodiversity data, the participants of this group highlighted a number of key points.

Adoption of standards

There are three elements to be considered in adopting standards according to the group participants. They are standard methods such as Darwin Core, information elements like species, taxonomy, geographical coordinates; metadata; and the responsibility of providing a mechanism to control the quality of the data.

Metadata

The participants argued that there should be a standard format for metadata to facilitate linkages with the original databases in the HKH region. Like Darwin Core, a new common method for mountain-specific situations should be developed for the HKH region to enable linkages with regional and global initiatives.

Geo-referencing tools

Geo-referencing tools such as BioGeomancer should have a high-resolution data capacity and should be adopted by regional institutions.

Mountain-specific situation

Geo-referenced biodiversity data should have information that caters to mountain-specific needs. These should include mountain-specific needs or attributes, GIS layers, bioclimatic zones, aspects, slope, canopy cover, land use, and social structure – vertical dimension, glaciers, permafrost, and so forth.

Capacity building

To standardise and harmonise databases using an interoperable metadata system, there should be capacity building initiatives as well. These capacity-building programmes should be done to match local data with the standards of international data.

Linkages with regional and global initiatives

All the points mentioned above should match regional and global initiatives. One question that was constantly asked about this group's presentation was about Darwin Core, whether it is an ISO standard that should be followed or adapted in this context. To this, Dr Eva Spehn replied that the Darwin Core format was recommended, and that, although Darwin Core is an open source and perfect in this case, a customised version is needed to harmonise it with historical data for practical purposes: otherwise, it would be too tedious a task to change those data.

Group 3: How to improve the biodiversity database on the HKH region?

The participants in this group had a brainstorming session to discuss ways of improving the biodiversity database in the HKH region. Firstly, the status and assessment of mountain biodiversity were discussed and participants presented the names of the databases available in their respective countries. These included Eflora of Nepal, Flora Tibetica, Flora of China, Bhutan Flora, Myanmar Flora, Flora of Pakistan, Flora of India, Flora of Bangladesh, and Afghanistan (Flora Iranica). Nakul Chettri from ICIMOD commented that the information on fauna and lower plant groups is fragmentary in all of the eight countries of the HKH region and it was very difficult to compile these studies. MENRIS and the Environmental Change and Ecosystem Services (ECES) of ICIMOD both agreed to provide more information on the 3,500 flora and 200 fauna available on the current portal by mid 2009.

As a complementary approach to inclusive partnership, the participants also gave the names of key institutions and stakeholders in their respective countries. These are listed below.

Afghanistan

- Ministry of Agriculture, Irrigation and Animals (MoAIA)
- National Environment Protection Agency (NEPA)
- Provincial Area Development Ministry (PADM)
- Provincial Agricultural Department (PAD)
- Provincial Environment Department (PED)
- Kabul University
- Afghanistan Academy of Sciences (AAS)

*Bangladesh**Flora:*

- Bangladesh National Herbarium
- Bangladesh Forest Research Institute
- Department of Botany, Dhaka University

Fauna:

- National Museum Natural History Section
- Zoology Department, Dhaka University
- Zoology Department, Chittagong University
- Marine Science Institute, Chittagong University

Management:

- Department of Forests
- Asiatic Society of Bangladesh
- IUCN Bangladesh Country Office
- Department of Fisheries

Bangladesh Fisheries Research Institute
Bangladesh Agricultural Research Council
Bangladesh Agricultural Research Institute
Arannayak Foundation

Bhutan

National Biodiversity Centre (NBC)
Department of Forest, Nature Conservation Division

China

Kunming Institute of Botany
Chinese Academy of Sciences (CAS)
Tibetan Plateau Research Institute
Xinjiang Institute of Ecology and Geography
Tibetan Academy of Agriculture Sciences (TAAS)

India

Botanical Survey of India
Zoological Survey of India
Wildlife Institute of India
Indian Council for Forestry, Research and Education
GB Pant Institute of Himalayan Research and Development

Myanmar

Ministry of Forestry (MoF)
Department of Agricultural Research (DAR)
Department of Botany, Ministry of Education
Department of Zoology, Ministry of Education

Nepal

Ministry of Forest and Soil Conservation
Department of Natural Park and Wildlife Conservation (DNPWC)
Department of Forest
Natural History Museum
Department of Plant Resources

Pakistan

Ministry of Environment
Provincial Wildlife Departments
Provincial Forest Departments
Natural Herbarium, National Agriculture Research Council
Pakistan Forest Institute
Pakistan Agriculture Research Council
Natural History Museum
IUCN Pakistan
WWF Pakistan
Himalayan Wildlife Foundation

Other Institutions

Edinburgh Botanical Garden
Natural History Museum, London
Natural (National) History Museum, Vienna
Munich Botanische Staatssammlung
Kew Botanical Gardens

To improve the biodiversity databases in the HKH region, participants also stressed the need for base maps providing information about the vegetation types, digitisation of information on herbarium and museum specimens along with land-use maps, local-level information, recent data set integration, designing formats for future surveys, and so forth. Participants also discussed the possibility of having a national- or regional-level networking mechanism like Mountain Forum for the global mountain community. One more question raised by participants from the other groups was how GBIF was dealing with biodiversity. GBIF representatives explained that GBIF was more focused on the biodiversity aspect than on the economic aspect which is directly linked to agriculture. Also in the case of agrobiodiversity, other issues such as rights and patents arose which raised a different set of issues entirely.

Recommendations

Participants from all eight regional member countries of the HKH region made some important recommendations and supported the suggestion that ICIMOD act as a regional knowledge hub for biodiversity information in the Himalayas. The recommendations made were as follows.

- It is recommended that ICIMOD become a regional node of GBIF and that a memorandum of understanding (MoU) or some kind of letter of agreement with GBIF be signed to this effect. To this effect, GMBA will provide the necessary guidance and information for ICIMOD.
- ICIMOD shall facilitate or encourage key national partners in regional member countries (RMCs) to become national nodes for GBIF. ICIMOD and GMBA will promote a common methodology and databases with regard to geo-coded biodiversity information.
- ICIMOD and GMBA shall work together with national partners towards standardisation and harmonisation of information on biodiversity in the Himalayas. It is suggested that Darwin Core - an international, standardised metadata system on biodiversity be used by ICIMOD and its partners.
- ICIMOD and GMBA will try to promote capacity-building initiatives by organising a workshop cum training programme for national partners in RMCs on geo-referencing biodiversity information.
- Together with national partners, ICIMOD and GMBA will also develop concept proposals-initiatives to promote open access to biodiversity information in the Himalayas.

Annex 1 Programme

November 15th, Saturday

14:00	Opening	
14:10	Introduction to the GMBA/GBIF project on datamining of georeferenced mountain biodiversity databases	Eva Spehn, GMBA, Institute of Botany, University of Basel
14:30	Exploring the evolution and ecology of mountain biodiversity by linking organismic data bases with geophysical information systems	Christian Körner, Institute of Botany, University of Basel
15:30	Open Access to biodiversity data and the GMBA/GBIF mountain biodiversity webportal	Falk Huettmann, EWHALE lab- Biology and Wildlife Dept., Institute of Arctic Biology
17:00	GMBA pilot project: Flora Tibetica	Bernhard Dickoré Albrecht-v.Haller Institute of Plant Sciences, University of Göttingen,

November 16th, Sunday

09:00	Decision support tools for protected area management	Birendra Bajracharya, GIS Specialist, MENRIS, ICIMOD
09:20	Regional knowledge Hub for biodiversity information for the HKH region	Basanta Shrestha, Division Head, MENRIS, ICIMOD
09:45	Demonstrations - Mountain Geo-Portal - Nepal Biodiversity Portal - GBIF web portal	Sudip Pradhan, DSS Programmer / ICIMOD Eva Spehn, GMBA,
10:30	Tea break	
11:00	Group work on common goals of GMBA and ICIMOD: 1) how to improve biodiversity database in the Himalaya 2) how to use geo-referenced biodiversity data for better management decisions 3) how to design the GMBA data portal / Mountain Geoportal on mountain biodiversity	
12:00	Group Presentations (I, II and III)	
12:30	Discussion and Closing	
13:30	Lunch	

Annex 2 List of Participants

Linking Geodata with Biodiversity Information in the Himalayas

15-16 November 2008

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Research Strategy on Global Change in Mountain Biosphere Reserves

19 Nov 2008, ICIMOD Headquarters, Kathmandu, Nepal

This one-day workshop discussed the research strategy developed by the Global Change in Mountain Regions (GLOCHAMORE) Project to guide scientists and managers of mountain biosphere reserves in the planning and implementation of global change research. Protected area managers and scientists were invited to attend the workshop to discuss how the strategy could be implemented at various sites around the world. The discussion also encompassed how these sites could be used to test, monitor and assess the impacts of global (and climate) change on the biophysical environment and the livelihoods of mountain people. The following themes were discussed: biodiversity in mountain protected areas; how water systems affect mountain protected areas; and the livelihoods of people living in mountain biosphere reserves or in the vicinity of protected areas.

Report prepared by Dr Thomas Schaaf and Dr Michael Kollmair

Introduction

The International Workshop on Global Change in Mountain Biosphere Reserves, which was jointly organised by UNESCO-MAB and ICIMOD, took place in Kathmandu on the 19th of November 2008 as a post-conference workshop following the International Mountain Biodiversity Conference. The workshop was divided into two sessions. The morning session was devoted to presentations from experts on global change and mountain biosphere reserves and the afternoon session focused on discussions about general and specific themes, sites, research, monitoring, data management, dissemination, and collaboration. Some 45 participants attended the workshop.

Aims and Objectives

The one-day workshop aimed at discussing how the GLOCHAMORE research strategy for mountain biosphere reserves and other mountain protected areas could be implemented. Protected area managers and scientists alike were invited to attend the workshop to discuss how the GLOCHAMORE Research Strategy could be implemented at various sites around the world, with the intention that these sites could also serve as testing and monitoring sites to assess the impacts of global (and climate) change on the biophysical environment and the livelihoods of mountain people. There was a special focus on the following themes: (a) biodiversity in and around mountain protected areas; (b) water systems deriving from and affecting mountain protected areas; and (c) livelihoods of mountain people living in and around mountain biosphere reserves or other protected areas.

Morning Session

The first part of the workshop consisted of several presentations: these are listed below. Key points have been covered in this workshop report, but the full presentations are available in pdf format on request for those who wish to go through them in detail. The presentations were given in the following order.

- GLOCHAMORE – Results from the Workshops and Open Science Conference: presented by Martin Price, Centre for Mountain Studies, University of the Highlands and Islands (currently UHI Millennium Institute) -Perth College, UK

- Implementing the GLOCHAMORE Research Strategy in Mountain Biosphere Reserves: presented by Thomas Schaaf, Man and the Biosphere (MAB) Programme, United Nations Educational, Science, and Cultural Organisation (UNESCO).
- (Global Change in Mountain Regions (GLOCHAMORE) and Global Observation Research Initiative in Alpine Regions (GLORIA) Synergies: presented by Harald Pauli, University of Vienna (Austria).
- Success Factors of Mountain Biosphere Reserve Management under Global Change: presented by Susanne Stoll-Kleemann, Greifswald University (Germany).
- Katunsky Biosphere Reserve as a GLOCHAMORE and GLORIA Site: presented by Tatjana Yashina, Katunsky Biosphere Reserve (Russian Federation).
- Global Change Research in Russian Mountain Biosphere Reserves: presented by Yuri Badenkov, Russian MAB Committee and Russian Academy of Sciences (Russian Federation).
- Nanda Devi Biosphere Reserve in India: presented by P.S. Ramakrishnan, Jawaharlal Nehru University, India and R. K. Maikuri, GB Pant Institute of Himalayan Environment and Development (GBPIHED), (India).

Key points raised by the presentations and discussions

The key points that emerged from these presentations and intervening discussions were as follows.

- Future activities within the context of GLOCHAMORE should include long-term monitoring as well as shorter-term research projects.
- Future GLOCHAMORE research should focus on a limited number of themes; a minimum set could be themes 4 (water), 6 (biodiversity), and economies (9): it was also suggested that land use (theme 2) was a key linkage between these.
- Through GLOCHAMORE, mountain biosphere reserves (BRs) could be places to integrate knowledge from monitoring and research into sustainable development on a regional scale.
- Links should be developed (if not already existing) between BRs and universities: research for MSc and PhD dissertations.
- UNESCO can provide limited funding to support activities, preferably to stimulate national funding.
- UNESCO will develop a proposal for resources to support work in 20 sites over five years: \$2million, including funding for meetings, limited hardware supplies, and so forth.
- UNESCO would be willing to support the nomination of new BRs in Himalayan countries. These proposals must come from governments, but should originate at local level (e.g., Bhutan, Myanmar, and Pakistan).
- BRs with GLORIA sites already exist in Australia, Canada, Chile, Colombia, Germany, Peru, Russia, Spain, Sweden, Switzerland, and the USA, and there are other relevant projects in the Andes and Austria (not only in BRs).
- Projects based on the GLOCHAMORE Research Strategy, or on very comparable themes, are already being implemented in Australia, India, Russia, and Switzerland. With the exception of GLORIA work, however, these were all developed individually and do not use standard or harmonised methodologies and protocols.

Afternoon Session

The session started with a general discussion about the following points.

Themes: general

- To fulfil the GLOCHAMORE Research Strategy on one site, significant resources would be required. Already, some BRs are trying to cover many of the themes. So how realistic is it to try to implement the entire strategy? How many people and disciplines are required? Should some themes be left out?
- It is unlikely that the entire strategy could be implemented anywhere. The first action is to establish research partnerships and identify key themes for the BR.
- The central issue is to create a platform for information sharing. Land use influences biodiversity. Climate change includes both increasing temperature and changes in precipitation and the availability of water – which may be more critical in the short term. Impacts depend on climatic area; e.g., dry, humid, so the approach must be adapted to specific situations.
- A key objective should be to use BRs to understand trends, based on analysis at specific sites.

Themes: specific

- Support for the proposal regarding the three themes was expressed. Work on biodiversity must consider ecosystems, not just species. Water – or more generally ecosystem services, which is linked also to biodiversity – should also be included.
- There was support for biodiversity as a priority theme, but it was suggested that any data resulting from research should be geo-referenced and its use agreed upon and data quality should be standardised for use in monitoring and conservation planning. GMBA had proposed a training workshop on standards for the HKH – this could also be done for BRs in general.
- In the context of flora, abundance of and amount of cover of species are needed. Species' lists alone do not give very useful information.
- Monitoring of climatic data is essential to provide the context for changes in other systems.
- Linkages between livelihoods and biodiversity are important. In the Tibetan area, human and animal health (theme 8) would be a good theme.

Research and monitoring

- It is critical to define what is needed: monitoring (biodiversity and climate) = extractive research; the results provide a longer-term context 2) and problem-solving research on management and livelihood-related problems related to global change (climate change and other aspects of global change, e.g., population dynamics).
- The concept of three levels of implementation, as developed in the GLOCHAMORE workshops, is important, but this was not included in the research strategy.
- A hierarchy of monitoring and research themes should be determined, with common protocols.

Data management

- Greater clarity about the reporting framework at global level is needed. For protected area managers, a real-time continuous flow of data (as well as compilation at the end of a research project) is needed to assist day-to-day decision making.
- Some key issues to resolve: 1) the data management strategy: one (comprehensive) or more databases 2) the data-sharing policy outside GLOCHAMORE; lessons can be learned from GLORIA and GMBA.

GLOCHAMORE sites

- Individual BRs must express interest in participating. Starting with the original 26 sites, other sites can join if they are suitable and have an existing research structure. To the extent possible, GLOCHAMORE sites should also be GLORIA sites.
- Appropriate sites for GLOCHAMORE activities exist in the Karakoram, but they are not BRs. With regard to farming communities and livelihoods, land tenure (small holdings) is a key issue. The influx of alien species, high-yielding crops, and climate change are jointly influencing populations of some species.

Collaboration

- Many scientists, from different disciplines, should be involved in a research consortium; leadership is crucial for coordinating this.
- A participatory approach is needed for both science and development.
- Cross-cutting research is needed to link changes in the physical environment to social and economic changes. This implies that interdisciplinary (natural and social science) research is needed.
- Collaborations, both international and national, are essential for both research and training.
- The possibility of involving students from the Global Biodiversity (GoBi) project (Greifswald University) in GLOCHAMORE activities could be considered.

Dissemination

- BR managers should disseminate monitoring and research outputs locally. UNESCO could assist with dissemination beyond the local level.
- Mountain Forum could provide targeted information and communication services to facilitate GLOCHAMORE: reports, e-conferences and dialogues, advertising research possibilities, and others.
- With regard to communication and sharing information and data, the Food and Agriculture Organization (FAO) could provide specific expertise on crops and forest fires. Mountain Partnership could assist with lessons learned from BRs in general – how to find ways to address conservation and livelihoods in a comprehensive way: i.e., scaling up and replication not only for BRs.

Conclusions

The participants came to the following conclusions after an afternoon of deliberations.

- Although individual mountain BRs should be free to work on as many of the GLOCHAMORE themes as they wish, the priority themes for future implementation should be: changes in land use (theme 2), water availability (theme 4a), 6 (biodiversity, including the GLORIA approach), and mountain economies (theme 9).
- To provide relevant data on trends, climatic variables should also be monitored.
- Where possible (data and other resources permitting), climate scenarios should be sought or developed.
- Standard protocols for monitoring and research should be developed, building on the concept of 'essential' (maximum priority), 'improved', and 'optimum' variables developed at the GLOCHAMORE workshops.
- Clear policies for data management and sharing are needed.
- Initially, the main sites for implementing the GLOCHAMORE Research Strategy should be mountain BRs where GLORIA sites are implemented. A general principle should be that sites implementing the strategy should be those with a tradition of research (existing data sets and active research institutes and/or collaboration) that can be built on.
- UNESCO will be able to provide limited support for ongoing development and implementation of activities in these sites, and will also develop proposals for funding together with M. Price, T. Yashina, and T. Scheurer (to be confirmed), Mountain Research Initiative (MRI) (to be confirmed), and a nominee from ICIMOD. Such proposals should mention the work based on the GLOCHAMORE Research Strategy (and GLORIA) that is already being carried out at a number of sites.

Summary of closing comments from Dr Andreas Schild, Director-General, ICIMOD

In his closing comments the Director General of ICIMOD stated that he thought the focus on three to four themes was good. The themes match ICIMOD's strategic objectives, and ICIMOD would like to play a role. He said that ICIMOD has a regional agenda, and is concerned to see what is happening on the ground. The Trans-Himalayan transects are a key concept with which to link global programmes, to ensure comparability within and between regions. There are only a few BRs in the region and they are not all easily accessible: BRs situated close to transects would be useful. The Director General thought that consideration should be given to the designation of BRs within the transects for future inclusion in GLOCHAMORE. Local institutions should be involved in this process.

ICIMOD's level of commitment depends on the potential for a regional approach and involvement of regional institutions. In concluding, the Director General affirmed that ICIMOD is willing to host future events.

The workshop was closed.

Annex 1 Programme

19th November 2008 (WEDNESDAY) ICIMOD Conference Hall

10:00-16:30	POST-CONFERENCE WORKSHOP "Research Strategy on Global Change in Mountain Biosphere Reserves"
10:00-11:30	<u>Moderators:</u> Michael Kollmair and Thomas Schaaf <u>Introduction:</u> GLOCHAMORE – Results from the Workshops and Open Science Conference <u>Martin Price</u> (10 minutes) Implementing the GLOCHAMORE Research Strategy in mountain biosphere reserves <u>Thomas Schaaf</u> (10 minutes) GLOCHAMORE and GLORIA Synergies <u>Harald Pauli</u> (10 minutes) Katunsky Biosphere Reserve as a GLOCHAMORE and GLORIA site <u>Tatjana Yashina</u> (10 minutes) Discussion
11:30-12:00	TEA/COFFEE BREAK
12:00-13:00	Kavkazskiy and Sikhote-Alinskiy biosphere reserves in the Russian Federation <u>Yuri Badenkoy</u> (10 minutes) Nanda Devi Biosphere Reserve <u>P.S. Ramakrishnan</u> (10 minutes) Discussion
13:00-14:00	LUNCH BREAK
14:00-16:30	Discussion on implementation modalities of GLOCHAMORE Research Strategy and future steps: <u>Bruno Messerli</u> and <u>Thomas Schaaf</u>

Annex 2 List of Participants

Rod Atkins, Australian Alps national parks Co-operative Management Program, Australia
 Yuri Badenkoy, Russia
 Muhammad Bashir Butt, MINFAL-AJK, Pakistan
 Karma Jigme, Ministry of Agriculture, Bhutan
 Colin Kaiser, UNESCO
 Sudibya Kanti Khisha, CHTRDP, Bangladesh
 Ruijun Long, International Centre for Tibetan Plateau Ecosystem Management, P.R.China
 RK Maikhuri, G.B. Pant Institute of Himalayan Environment and Development, India
 Bruno Messerli, University of Bern, Switzerland
 LMS Palni, G B Pant Institute of Himalayan Environment and Development (GBPIHED), India
 Harald Pauli, GLORIA, University of Vienna, Austria
 Martin Francis Price, Centre for Mountain Studies, UK
 RK Rai, Ministry of Environment & Forests, India
 Palayanoor S. Ramakrishnan, Jawaharlal Nehru University, India
 GS Rawat, Wildlife Institute of India, India
 SV Reddy, Ministry of Environment and Forest, India
 Thomas Schaaf, UNESCO's MAB Programme, France
 Eva Spehn, University of Basel, Switzerland
 Susanne Stoll-Kleemann, University of Greifswald, Germany
 Zahoor A. Swati, Institute of Biotechnology & Genetic Engineering (IBGE) NWFP, Pakistan
 Naw May Lay Thant, Ministry of Forestry, Myanmar
 Win Naing Thaw, Ministry of Forestry, Myanmar
 Tatjana Yashina, Katunskiy Biosphere Reserve, Altai Republic, Russian Federation
 Zhang Yuanming, Chinese Academy of Sciences, P.R.China

ICIMOD
 Nakul Chettri
 Ambika Gautam
 Michael Kollmair
 Franciscus Neuman
 Andreas Schild
 Bandana Shakya
 Eklabya Sharma
 Robert Zomer

About ICIMOD

The International Centre for Integrated Mountain Development, ICIMOD, is a regional knowledge development and learning centre serving the eight regional member countries of the Hindu Kush-Himalayas – Afghanistan , Bangladesh , Bhutan , China , India , Myanmar , Nepal , and Pakistan  – and based in Kathmandu, Nepal. Globalisation and climate change have an increasing influence on the stability of fragile mountain ecosystems and the livelihoods of mountain people. ICIMOD aims to assist mountain people to understand these changes, adapt to them, and make the most of new opportunities, while addressing upstream-downstream issues. We support regional transboundary programmes through partnership with regional partner institutions, facilitate the exchange of experience, and serve as a regional knowledge hub. We strengthen networking among regional and global centres of excellence. Overall, we are working to develop an economically and environmentally sound mountain ecosystem to improve the living standards of mountain populations and to sustain vital ecosystem services for the billions of people living downstream – now, and for the future.

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