Special Publication

Wetlands in the Himalaya: Securing Services for Livelihoods

ICIMOD

FOR MOUNTAINS AND PEOPLE

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Wetlands in the Himalaya: Securing Services for Livelihoods

Editors
Laxmi Dutt Bhatta, Wu Ning, Erica Udas, Nand Kishor Agrawal, Sunita Ranabhat and Deepa Basnet

Reviewers
Ram Prasad Chaudhary, Hem Sagar Baral, and Eklabya Sharma

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Christopher Butler (Senior editor)
Dharma R Maharjan (Graphic designer)
Asha Kaji Thaku (Editorial assistance)

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Foreword

The Hindu Kush Himalaya (HKH) region, which stretches across eight countries in Asia and covers an area of 3.5 million km^2, is home to spectacular lakes, rivers, aquifers and wetlands. They are a major source of freshwater indispensable to the lives of 230 million people living in the region. These ecosystems also play a vital role as regulators of water storage and ensure a wide range of goods and services such as drinking water, irrigation, hydro-energy, food-processing, recreation, habitats for biodiversity including rare and endemic species, water purification and buffering floods, among many others. Although these ecosystems provision such important goods and services, managing them wisely is challenging due to their remoteness and limited accessibility. Where they are accessible, local communities heavily depend on them for their livelihoods.

Furthermore, the wetlands in the HKH region are steadily declining and undergoing degradation with substantial impacts on ecosystem services, biodiversity and the livelihoods of people. The major driving forces, either natural or anthropogenic, include siltation, expansion of agricultural land, over harvesting of wetland resources, runoff from agriculture and industrial pollution, among many others.

Given the insufficient documentation of wetlands in the HKH and through witnessing the cascading effects of climate-glacier-water-livelihoods interface, there is an urgent need to- i) prepare a detailed wetland inventory underlining the current status, threats and challenges, and ii) explore future prospects of wetlands from a standpoint of sustainable development. Goal 6 of the 2030 sustainable development agenda stresses the need to "protect and restore water related ecosystems" and "implement integrated water resources management at all levels, including through transboundary cooperation", among the others. Beyond this, there are numerous inextricable linkages between other sustainable development goals too.

The International Centre for Integrated Mountain Development (ICIMOD) is pleased to join hands with the Kunming Institute of Botany (KIB) and Chengdu Institute of Biology (CIB) under the Chinese Academy of Sciences (CAS), the Yunnan Institute of Environmental Science (YIES) and the Ramsar Convention Secretariat to build a common platform to initiate discussions on existing wetland policies and frameworks in the HKH region as well as to improve the understanding of the current status and trend of wetlands for provisioning goods and services to local people and ensuring sustainable management.

This publication provides a summary of the Regional Expert Symposium on 'Managing Wetland Ecosystem in the Hindu Kush Himalaya: Securing Services for Livelihoods', along with several scientific papers presented by experts on diverse topics like wetland ecology, status and threats, economic valuation, policies, benefit sharing mechanisms and traditional knowledge prevalent in

the HKH region. The synthesis of the scientific papers clearly indicated that wise management of wetland ecosystems is essential not only for human health and economic prosperity of the HKH people, but also for the environmental sustainability.

I hope this will be a valuable addition to the existing literature as it provides insights and updates on the status of wetlands in the HKH region.

David Molden, PhD
Director General, ICIMOD

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We are very thankful to the reviewers of this special wetland publication, namely Prof Ram Prasad Chaudhary, Dr Hem Sagar Baral and Dr Eklabya Sharma. Furthermore, we appreciate all those who directly or indirectly helped us in the preparation of this publication.

Acronyms and Abbreviations

AD	Anno Domini
AIGAs	Alternative Income Generation Activities
AMS	Acute Mountain Sickness
BANP	Band-e-Amir National Park
BAPAC	Band-e-Amir Protected Area Committee
BCAS	Bangladesh Centre for Advance Studies
Ca.	Circa
CA/TS	Conservation Assured Tiger Standard
CAC	Central Ad hoc Committee
CAS	Chinese Academy of Sciences
CBAPU	Community Based Anti-poaching Unit
CBFM	Community Based Fisheries Management
CBOs	Community Based Organizations
CBRMP	Community Based Resource Management Project
CC	Carrying Capacity
CCC	Central Co-management Committee
CDCs	Community Development Councils
CE	Critically Endangered
CEs	Choice Experiments
CFUGs	Community Forest User Groups
CIB	Chengdu Institute of Biology
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMA	Collaborative Management Agreement
CMHA	Community Management Hunting Area
CNRS	Centre for Natural Resource Studies
CO_2	Carbon Dioxide
CSUWN	Conservation and Sustainable Use of Wetlands in Nepal
CVM	Contingent Valuation Method
CWBMP	Coastal and Wetland Biodiversity Management Project
DEM	Digital Elevation Model
DFCC	District Forestry Sector Coordination Committee
DFO	District Forest Office
DG	Director General
DNPWC	Department of National Parks and Wildlife Conservation
DO	dissolved oxygen
DoE	Department of Environment
DoF	Department of Fisheries
DSCWM	Department of Soil Conservation and Watershed Management
ECA	Ecologically Critical Area
EN	Endangered
ES	Ecosystem Services

ETM+	Enhanced Thematic Mapper Plus
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
GB	Gilgit-Baltistan
GDP	Gross Domestic Product
GIZ	German Society for International Cooperation
GLA	Ghodaghodi Lake Area
GoB	Government of Bangladesh
GoN	Government of Nepal
ha	hectare
HAWs	High Altitude Wetlands
HHs	Households
HICAP	Himalayan Climate Change Adaptation Programme
HKH	Hindu Kush Himalaya
HVRA	Hazard Vulnerability Risk Assessment
IBA	Important Bird Area
ICIMOD	International Centre for Integrated Mountain Development
ICS	Improved Cooking Stoves
IGSNRR	Institute of Geographic Sciences and Natural Resources Research
IK	Indigenous knowledge
ILO	International Labour Organization
IUCN	International Union for Conservation of Nature
KIB	Kunming Institute of Botany
KJ	Kilojoules
km	kilometre
km^2	square kilometre
KTWR	Koshi Tappu Wildlife Reserve
LIP	Livelihood Improvement Programme
LNP	Langtang National Park
LRP	Local Resource Person
m	metre
m^3	cubic metre
MACH	Management of Aquatic Ecosystems through Community Husbandry
masl	metre above sea level
MEA	Millennium Ecosystem Assessment
mgL^{-1}	milligrams per litre
mm	millimetre
MoEF	Ministry of Environment and Forest
MoFSC	Ministry of Forest and Soil Conservation
MoL	Ministry of Land
MSF	Multi-Stakeholder Forum
MSS	Multi-Spectral Scanner
NACOM	Nature Conservation Management
NBSAP	National Biodiversity Strategy and Action Plan
NEFEJ	Nepal Forum of Environmental Journalist
NEMAP	National Environment Management Action Plan

NEPA	National Environmental Protection Agency
NFMP	New Fisheries Management Policy
NGOs	Non-Governmental Organizations
NPR	Nepalese Rupee
NPV	Net Present Value
NT	Near Threatened
NWC	National Wetland Committee
OBIA	Object-Based Image Analysis
°C	degree centigrade
PES	Payment for Environment Services
PIC	Prior Informed Consent
PMSU	Project Management and Support Unit
PTT	Platform Transmitter Terminal
PWP	Pakistan Wetlands Programmes
RIS	Ramsar Site Information Sheets
SCM	Social Capital Management
SD	Standard Deviation
SDC	Swiss Agency for Development and Cooperation
SEMP	Sustainable Environment Management Programme
SRTM	Shuttle Radar Topography Mission
SWSH	Saving Wetlands Sky High
t	tonne
TDS	Total Dissolved Solids
TEEB	The Economics of Ecosystems and Biodiversity
TM	Thematic Mapper
UAC	Union-level Ad hoc Committee
UCC	Union Co-management Committee
UNDP-GEF	United Nations Development Programme-Global Environment Facility
UNEP	United Nations Environment Programme
USD	United States Dollar
VCC	Village Co-management Committee
VCGs	Village Conservation Groups
VDCs	Village Development Committees
VDRMPs	Village Disaster Risk Management Plans
VGF	Vulnerable Group Feeding
VU	Vulnerable
WBRP	Wetland Biodiversity Rehabilitation Project
WCS	Wildlife Conservation Society
WDCs	Wetland Dependent Communities
WII	Wildlife Institute of India
WIK	Wetland Indigenous Knowledge
WTP	Willingness to Pay
WWF	World Wide Fund for Nature
WWG	Wetland Watch Group
YIES	Yunnan Institute of Environmental Science
yr	Year

Summary

Wetlands cover 5–10% of the earth's terrestrial surface. They are important ecosystems that supply goods and services for human wellbeing. Despite their rich biodiversity, social and economic values, wetlands are in immense pressure, and are undergoing constant degradation due to several anthropogenic forces, such as urban development, expansion of agricultural land and industrial pollution. The global extent of wetlands in the 20th century is estimated to have declined by 64–71%, and losses and degradation of wetlands continue worldwide, which will eventually have significant impacts on the supply of ecosystem services and affect the livelihoods of people [Ramsar Secretariat 2015: *State of the World's Wetlands and their Services* (Task No. 18)]. In Asia alone, about 5,000 km^2 of wetlands vanish each year, with substantial impacts on ecosystem services, biodiversity and the livelihoods of people.

In the Hindu Kush Himalaya (HKH) region, there is only limited information available on the overall status of wetlands and resource exploitation because of the difficult geographic terrain and harsh climatic conditions. Thus, to generate a better understanding of wetlands in the region, a common platform was sought to exchange information, learnings and research findings. ICIMOD, in collaboration with the Kunming Institute of Botany (KIB) and the Chengdu Institute of Biology (CIB) under Chinese Academy of Sciences (CAS), and the Yunnan Institute of Environmental Science (YIES), organized a Regional Expert Consultative Symposium on 'Managing Wetland Ecosystem in the Hindu Kush Himalaya: Securing Services for Livelihoods' in Dali, Yunnan Province of China.

The symposium brought together 63 high-level government delegates, policy makers, scientists and researchers from Afghanistan, Bangladesh, Bhutan, China, India, Japan, Myanmar, Nepal, and Switzerland along with experts from ICIMOD. Altogether 13 scientific papers were presented at the symposium during three technical sessions, namely: (i) Sustainable wetland management: Drivers of change and impacts, (ii) Wetland ecosystem services valuation and livelihoods interface, and (iii) Wetland policies and cooperation.

The scientific papers presented in the first technical session focused on the ecological significance of wetlands in the HKH region. It provided an overview of the biophysical status of the wetlands, threats, and conservation measures undertaken in a participatory way. The development and successful implementation of wetland management plans have not only reduced illegal harvesting of the wetland resources, but also supported comprehensive scientific database management and recording of new species. Through a regulated access and control mechanism, the ecological integrity of wetland ecosystems showed gradual improvement, which is evident from the increasing wildlife and bird population, including

endemic and rare species. Moreover, wise management of wetlands in the HKH region has enhanced scientific knowledge that could be used in climate change risk reduction planning and have greater impacts on the socioeconomic development of the local people.

The second technical session focused on economic valuation of wetland ecosystem services and people's dependency on wetland resources for livelihood security. The economic valuation methods for marketed and non-marketed goods and services revealed that wetlands are one of the most productive and valuable ecosystems, and people are very much willing to pay for wetlands restoration activities including ecosystem services they obtained for their well-being. Further, the valuation of non-marketed wetland services provided a basis for establishing an ecological compensation mechanism and also prioritized wetland restoration programmes. Since most of the local people living around wetlands in the HKH region are highly dependent on wetland resources for their subsistence livelihoods, it also contributed to local economy and poverty reduction. On the other hand, several local communities used their traditional knowledge and indigenous practices to ensure sustainable wetlands management practices. Systematic documentation of such traditional knowledge is crucial to ensure the flow of wetland ecosystem services. Likewise, a holistic understanding of the dynamic nature of wetland ecosystems and their services could be highly beneficial for planning and implementing adaptive management.

The third technical session was related to wetland policies and cooperation between the partners to ensure sustainable co-management of wetlands and equitable benefit sharing. In general, wetland policies should address an integrated catchment plan for sustainable management and conservation of wetlands, but sometimes rigid and inflexible institutional settings may restrict the participation of relevant stakeholders in implementing an integrated management practice. In the HKH region, wetland conservation efforts are not adequately translated into integrated management practice despite the existence of sound policy instruments. One of the reasons for this could be the overlapping institutional responsibilities among different implementing agencies, which creates confusion regarding the lead role in coordinating wetland conservation activities and thus results to lack of a sense of ownership. To overcome some of these challenges, the jurisdiction of these agencies should be clearly defined to implement wetland conservation activities. Strong support from national and local governments as well as active community engagement is further instrumental for long-term conservation and management of the wetlands. It is thus crucial to identify who participates in what way and whose knowledge product adds value in the decision making process. Besides, site-specific conservation plans followed by an effective implementation strategy could also lead towards sustainable management and wise utilization of wetland resources. A collaborative approach with multi-stakeholder engagement in Tanguar Haor Lake, Bangladesh and Gosaikunda and Ghodaghodi lakes, Nepal are the good examples of cooperation for integrated wetlands management.

Key Challenges

Most of the wetlands in the HKH region are considered to be a common property. In his famous book *The Tragedy of the Commons* (1968), Garrett Hardin explained that in the absence of a stringent regulation, individuals would have a tendency to exploit common natural resources for his/her own advantage, typically without any limit, eventually depleting it. Such tragedy of the commons applies to many wetlands in the HKH region where ownership conflict exists as different institutions or stakeholders claim jurisdiction over the wetland and its resources, ultimately deteriorating its structure and functions.

Concurrently, despite the fact that wetlands are biodiversity hotspots that provision goods and services to both upstream and downstream communities, these ecosystems, particularly in the HKH region, are under-researched. There is limited information even for the wetlands listed as Ramsar sites of international importance, and the respective countries even do not provide regular updates on these sites.

Some key challenges to the wetlands in the HKH region are listed below:

- A clear data gap on wetlands in the HKH region, especially in the high altitude regions, for e.g., limited data available on the ecology, hydrological cycle, peatland distribution, and the possible impacts of climate change on wetlands and wetland resources.
- Complexity in integrating research into policy.
- Ownership issue with different government institutions claiming jurisdiction over the wetlands, resulting to lack of coordinated and strategic efforts for wetland management.
- Lack of engagement of local people and other stakeholders in the planning and decision making process.
- Poor understanding about the dependency of local communities on weltand resources, ecosystem dynamics and functions.
- Unplanned development activities, unregulated tourism, overharvesting of wetland resources, waste disposal and sedimentation.

The Way Forward

To address the above challenges and to ensure long-term conservation and sustainable management of wetlands in the HKH region, the following actions are recommended:

- Conduct a complete inventory and mapping of wetlands in the HKH region and integrate it into national level planning. For inaccessible areas in the HKH region, use of new technologies like radar, drones and remote sensing could be helpful.
- Conduct action research for wetland biodiversity assessment, stock assessment of commercial wetland commodities, water quality control, vulnerability and risk assessment for understanding climate change impacts, environmental economics (valuation of tangible and intangible resources).
- Develop a holistic understanding of the dynamic nature of wetland ecosystems for better planning and implementation of adaptive management.
- Design wetland based adaptation measures after modelling climate change impacts in both upstream and downstream.

- Implement integrated watershed management by linking upstream and downstream communities to protect the wetlands in the HKH region.
- Carry out long-term wetland monitoring under the close supervision of interdisciplinary experts.
- Strengthen regional cooperation for regulating wetland ecosystem services and conserving the transboundary wetlands through an integrated landscape approach and for sharing both technology and knowledge on wetland management to generate comparable data between the countries.
- Develop a comprehensive and participatory wetland management action plan with clear institutional arrangements, incorporating the local government's programmes and plans.
- Increase collaboration with local government authority for wetland restoration and management to upscale best practices.
- Encourage co-management efforts by involving local communities and all relevant stakeholders for sustainable management of wetland and its resources. This would be a more cost-effective way for sustainable management of wetlands and also creates a sense of ownership among the stakeholders.
- Institutionalize a benefit sharing mechanism e.g., Payment for Ecosystem Services scheme to incentivize local communities and encourage them to co-manage wetlands.
- Use an appropriate economic valuation tool for analysing tradeoffs and synergies between wetland ecosystem services to understand how the ecosystem value may change in future climate change scenarios. This will help policy makers to realize the importance of wetlands and ultimately take optimal management decisions.
- Strengthen communication between scientists and policy makers for integrating research findings into policy formulation.
- Undertake systematic documentation of traditional knowledge and/or indigenous/ customary practices and amalgamate it with scientific knowledge to ensure effective management and design adaptation plans.
- Promote outreach and awareness raising activities to encourage local participation.
- Revive the "Himalayan Wetland Initiative".

1

Wetland Management: Drivers of Change and Impacts

Himalayan High-Altitude Wetlands:
An Ecosystem beyond Habitats for Waterfowls – Experiences and Lessons from Northern Mountainous Areas of Pakistan

Babar Khan[a], Farasat Ali[a], and Fazal Karim[a]

[a] World Wide Fund for Nature - Pakistan
bkhan@wwf.org.pk

Abstract

Gilgit-Baltistan (GB) is home to freshwater bodies and unique wetlands biodiversity. This study aimed at documenting the socioeconomic and ecological significance of high altitude wetlands while discussing the conservation measures undertaken to mange these and their impacts on human habitation and ecology. In the initial phase of the project, WWF-Pakistan conducted socio-ecological surveys of 18 sites and developed 6 management plans. WWF-Pakistan established a 'watch and ward' mechanism in project sites and a strong lobbying and advocacy framework in the GB region. Climate change planning, awareness about wetlands' importance and pasture management interventions were other key components of conservation measures in the area. Changes or impacts of conservation measures were included; project team developed a comprehensive scientific database for surveyed sites and recorded distribution of new species. In order to conserve natural resources i.e., forests and associated resources, various alternative energy sources were provided to the local communities to overcome pressure faced by these resources. In addition to this, various measures were taken to reduce human-wildlife conflict by introducing improved cattle sheds, vaccination to reduce disease transmission and insurance scheme for predation casualties. Wildlife and bird population showed an increasing trend in project sites after project implementation, and was the main output of awareness given to locals about wetland functions and services. The government of Gilgit-Baltistan notified first wetlands based national park (Qurumbar), declared Gahkuch marshlands as a 'no hunting zone' and notified Ishkoman valley as a community management hunting area. It is not easy to distil effectiveness of conservation measures and their impacts from project documents or reports; however, wetlands conservation measures in Gilgit-Baltistan has great impacts on socioeconomic conditions, scientific knowledge, awareness, conservation and climate change risk reduction planning.

Keywords: wetlands, conservation, water birds, livelihood, Gilgit-Baltistan, Pakistan

Introduction

Wetlands are the most prolific and diverse ecosystems on earth, which offer several ecosystem services and benefits to people and biodiversity (Ambrose 2000). Although environmental pollution, illegal hunting, deforestation, overgrazing are some of the existing threats to

wetlands (Dudgeon 1992; Erwin 2009), climate change is an emerging issue affecting wetland ecosystems at large (Erwin 2009). The rapid degradation of wetlands directly and indirectly impacts the health and welfare of resident communities (MEA 2005). Until the recent past, wetlands were considered to be wastelands, but their socio-ecological services now justify the need for the protection and management of wetlands around the globe (Ambrose 2000). In this regard, the international community gathered in Ramsar, Iran, in 1971 to join hands for the conservation of wetlands and waterfowl (Chopra et al. 2001). Conservation of wetlands is a major challenge in Asia in light of climate change scenarios along with increasing exploitative activities of the human population due to increased dependency (WWF-India 2006). Leading conservation organizations like Wetlands International, WWF, and IUCN have long been active in the region to sensitize local governments and engage local communities and other relevant stakeholders in the protection and management of high-altitude wetlands (WWF-Pakistan 2011).

The Indus River is the fourth major flyway (also called Indus Flyway) for bird migration. High-altitude wetlands of Pakistan in general and of Gilgit-Baltistan (GB) in particular, being along the Indus Flyway, are ecologically very important. The lakes, marshlands, peatlands and streams adjacent to the flyway provide habitats, temporary and permanent staging, feeding and breeding grounds to migratory as well as resident birds. Majority of the winter visitors enter the subcontinent via the Indus River Valley and its northern tributaries. A significant number avoid the high mountains, like cranes, snipe and pelicans come by the Kurram River valley (Roberts 1992). However, of the total bird species recorded from the territorial limits of Pakistan, about 30% visit for a significant period as long-distance migrants and 28% are regular winter visitors to Pakistan (Ali 2005; Roberts 1992). Insect life and vegetation cover become abundant in this area after the monsoon and thus offer rich feeding ground to the wintering birds. Common wetland birds that visit Pakistan include grebes (*Podicipedidae*), ducks and geese (*Anatidae*), storks (*Ciconiidae*), pelicans (*Pelecanidae*), cormorants (Phalacrocoracidae), herons (*Ardeidae*), spoonbill (*Threskiornithidae*), rails and crakes (*Rallidae*), cranes (*Gruidae*), bustard (*Otididae*), gulls (*Laridae*), waders (*Calidridinae*) and plovers (*Charadridae*). The Utter, Hundrab, and Shandoor lakes harbor around 230 species of birds – one of the most diverse populations in the mountain regions of the world. Rare species like Lammergeier (*Gypaetus barbatus*) and Golden eagle (*Aquila chryseatos*) live and breed here while Demoiselle crane (*Grus virgo*), Marbled teal (*Marmaronetta angustirostris*) and Red-breasted merganser (*Mergus serrator*) use the lakes for wintering, staging and feeding (WWF 2011).

Sustainability of fragile high-altitude wetland ecosystems in GB face a number of threats, both immediate and proximate. These include illegal hunting and poaching of wild ungulates and shooting of birds mostly for meat and sale; excessive cutting of forests for fuelwood and timber; overgrazing of pastures by livestock; contamination of waters with chemicals and toxic wastes; unmanaged tourism; accelerated flash floods; glacial failures; landslides and river bank erosion. Causative factors include extreme poverty, lack of alternatives, weak

enforcement of law, lack of awareness, education and stewardship, and most prominently, the changing climatic patterns.

The "Saving Wetlands Sky High" (SWSH) project funded by WWF-Netherlands was initiated in July 2007 to mitigate some of the key threats to high-altitude wetland (HAW) ecosystems, their associated biodiversity and livelihoods through involvement of local communities, government agencies and non-government partners at the grassroots level. This paper is an attempt to record and share lessons from WWF-led initiatives under the SWSH programme for conservation and management of high-altitude wetlands in GB.

Material and Methods

Study area

The SWSH project focused on Gilgit-Baltistan Pakistan, which encompasses an area of about 72,696 km^2 and is home to 1.8 million people. The area is a transitional zone between South Asia and Central Asia and offers three great mountains ranges i.e., the Himalaya, Karakoram and Hindu Kush. GB contains rangelands, peaks, glaciers, wetlands and globally significant flora and fauna. The SWSH was an extension of the Conservation of High-altitude Wetlands Project funded by WWF-International from 2004 to 2007. The second phase of the SWSH programme (2007-2011) focused on the Handrab-Shandoor wetlands complex and Utter Ishkoman Lake, with funding from WWF-Netherlands. The third phase (2011-2014) covered the Handrab-Shandoor wetlands complex, Utter Lake, Qurumbar Lake, Gahkuch marshlands, Deosai wetlands, Jarbaso Lake and the Shiger River, Naltar, Gasho and Rash lakes with associated biodiversity (Figure 1.1), and was also funded by WWF-Netherlands (WWF-Pakistan 2011).

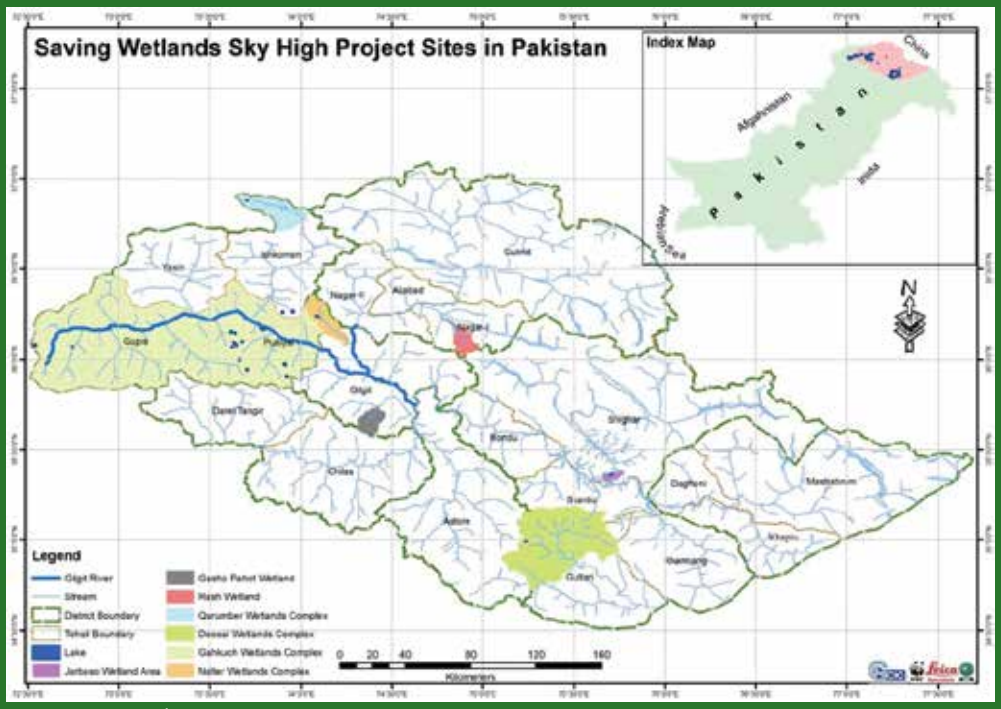
Data collection

An extensive literature review of national and international wetland conservation efforts was carried out. The study also included a detailed review of conservation measures under the SWSH programme in GB generally and in project sites specifically. The literature included academic publications such as journals, reports, books, project documents and websites. The final external evaluation report of SWSH phase III and biannual technical progress, activities and research reports were investigated in detail to document SWSH conservation measures, impacts, challenges, lessons learnt and adaptive management strategies in GB and project sites. Extensive field visits were also conducted to collect data and to determine the ground reality of each selected area. The final external evaluation report of SWSH phase III only provides information about SWSH phase III while other reports offered detailed information about the conservation measures of WWF-Pakistan in GB since 2004.

Results

Several wetland management interventions were implemented in Gilgit-Baltistan, Pakistan which are elaborated in below paragraphs and also summarized in Table 1.1.

Figure 1.1: **Project sites of Saving Wetlands Sky High Programme, Phase III**



Source: WWF-Pakistan

Scientific information and new species documentation

In the initial phase of the project, WWF-Pakistan was very much focused on biophysical, ecological and socioeconomic resources assessment of 18 potential high-altitude wetland sites and community-based wetlands resource management planning. The primary objective of these studies was to develop a scientific database of unexplored wetland sites for management, planning and conservation. Six wetland management plans were developed for potential sites such as Handrab, Utter, Naltar, Qurumbar, Rama and Gasho Lakes for effective implementation in collaboration with key stakeholders. Furthermore, during these socio-ecological studies, the survey team documented the socioeconomic condition of communities and the status of biodiversity, water, climatic hazards, wetland functions and services, etc. Two new species recorded in Gahkuch marshland and Qurumbar National Park include Dice snake (*Natrix tessellata*) and Chinese pond heron (*Ardeola bacchus*).

Watch and ward mechanism

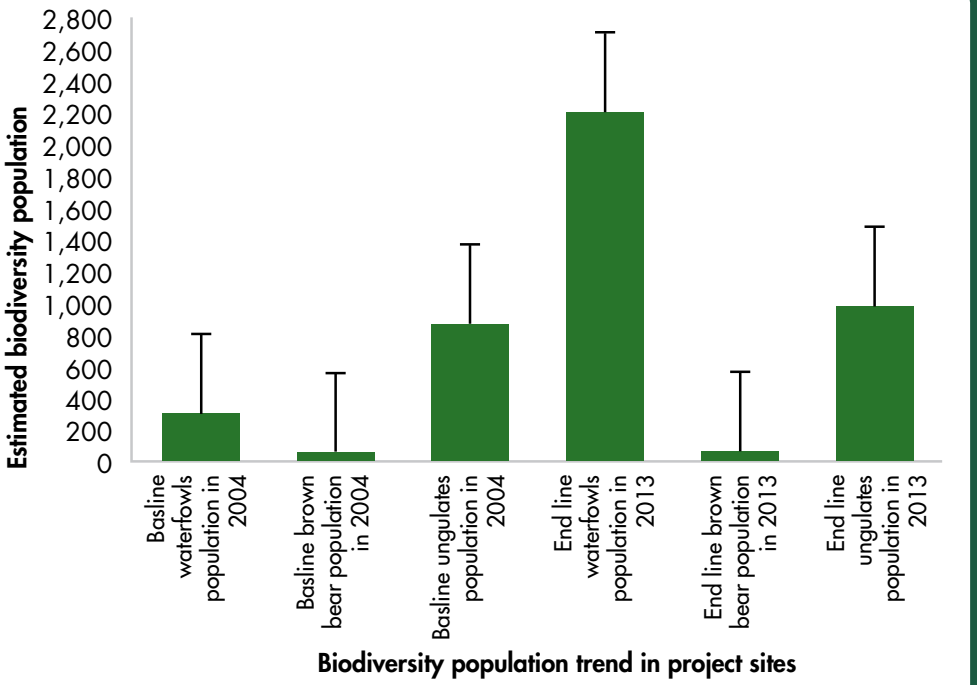
The project team, in collaboration with Gilgit-Baltistan Forest Wildlife and Environmental Department and local community-based organizations of Naltar, Qurumbar, Ishkoman, Handrab-Shandoor, Gahkuch, Singul, established community-based watch and ward

Table 1.1: **A summary of wetland management interventions in Gilgit-Baltistan**

Category of measures	Activity	Outputs	Changes and impacts
Scientific information	Conducted baseline surveys of 18 wetland sites	Developed a database for 18 sites and 6 management plans	Scientific wetlands database developed for the first time and two management plans implemented (Utter and Handrab-Shandoor)
New species	Documentation of distribution of new species	Distribution of two new species recorded in Gahkuch marshland and Qurumbar National Park	Distribution of dice snake (*Natrix tessellatea*) added to the list of Gahkuch marshland biodiversity & Chinese pond heron (*Ardeola bacchus*) added to the list of Qurumbar birds
Watch and ward system	Watch and ward	Established a watch and ward mechanism in projects sites	Illegal hunting and fishing controlled, water birds and ungulate population increased at least 5% from baseline
Advocacy and lobbying	Declaration of a Community Management Hunting area (CMHA) Ishkoman, Gahkuch marshlands as a 'no hunting zone' and declaration of a wetland-based national park	Government declared Ishkoman as a CMHA and Qurumbar National Park and Gahkuch marshland as a no hunting zone	Trophy hunting introduced in Ishkoman to generate funds for conservation and socioeconomic interventions in Ishkoman Valley; government removed Gahkuch marshland from game hunting areas; and planning for Qurumbar National Park started
Environmental awareness	Celebration of World Wetland Day and other significant environmental days	Project team established natural clubs and celebrated global environmental days	By 2014, 50% of communities in project sites had gained awareness about the importance of wetlands and associated biodiversity
Climate change planning	Village disaster risk management plans (VDRMPs) for project sites; trainings on how to respond to climate change hazards; and hazards vulnerability risk assessment (HVRA) studies	Three VDRMPs developed for Gahkuch, Qurumbar and Naltar; three training workshops organized for communities in project sites; and three HVRA studies conducted for Gahkuch, Qurumbar and Naltar	VDRMPs under consideration by district government for implementation; communities have tools and knowledge for responding to emergencies; and HVRAs provide vital information for hazard risk management planning
Pasture management	Planting of fast-growing multi-purpose trees on 15 ha of wasteland and fodder cultivated on 15 ha of wasteland	Planted trees on 15 ha of land and cultivated fodder on 15 ha of land	Pressure on pastures reduced by at least 25% from baseline

mechanisms to protect birds and wildlife, and monitor their status at the project sites. Figure 1.2 reveals that only 300 waterfowls were recorded in 2004 in project sites while a total of 2,205 waterfowls were recorded in 2013 during end line surveys. The baseline surveys in 2011 at Naltar, Gahkuch, Deosai and Qurumbar Valleys, recorded a total of 58 Himalayan brown bear (*Ursus arctos*), 864 ungulates including 840 Himalayan ibex (*Capra ibex himalayensis*), 24 Astore markhor (*Capra falconeri falconeri*) and 2 Himalayan musk deer (*Moschus chrysogaster*). During end line surveys of 2013, a total of 63 Himalayan brown bears, 980 ungulates including 935 Himalayan ibex and 42 Astore markhor and 3 musk deer

Figure 1.2: **Baseline and end line biodiversity population trend in project sites**



were recorded from the Naltar, Gahkuch, Singul and Qurumbar valleys (Figure 1.2). The overall population of birds and wildlife increased, and illegal hunting and fishing in the project sites was reduced by at least 50% against the baseline.

Advocacy and lobbying

The concerted advocacy and lobbying of the project team in collaboration with community-based organizations (CBOs) of project sites achieved three major successes during project period: declaration of a first wetlands-based national park "Qurumbar National Park", demarcation of Gahkuch marshland as a "No hunting zone" and declaration of Ishkoman Valley as a community management hunting area (CMHA). Owing to continuous concerted efforts of the project team, the government of Gilgit-Baltistan declared Ishkoman Valley as a CMHA in 2007 to improve the socioeconomic conditions of the area and community-based conservation efforts in the valley. The provincial government of GB notified some 740 km^2 of Qurumbar Lake and its immediate catchments as the first wetlands-based national park on 2 August 2011, to protect wetlands biodiversity. This was an outcome of the concerted efforts made by the project team and Pakistan Wetlands Programme (PWP) and CBOs for the previous two years. As a result of the project's endeavours, the Secretary of the Department of Forest, Wildlife and Environment of Gilgit-Baltistan demarcated Gahkuch marshland area on

6 August 2013 (one of the project sites) as a no-hunting zone and restricted all types of hunting and shooting in the area. WWF-Pakistan in collaboration with the GB's Department of Forest, Wildlife and Environment has been active in Qurumbar National Park planning since 2014. Trophy hunting in CMHA Ishkoman has been going on since 2007 and providing financial resources for conservation and socioeconomic interventions, and the territorial division forest officer of Gahkuch banned issuing licenses for hunting birds in the Gahkuch marshland area.

Environmental awareness

The project team continuously observed global environmental days including World Wetland Day from 2004 to 2014. The project team established natural environmental clubs in project sites and these clubs are still active in organizing environmental sessions on global environmental days in Qurumbar, Ishkoman, Shandoor and Gahkuch. These activities increased communities' awareness about wetland functions and services in all project sites. In 2004, it was found that people did not recognize wetlands as the most productive ecosystem and that the local communities and key stakeholders were unaware of the functions and services of high-altitude wetlands. Continuous efforts of the project team and natural clubs increased awareness about wetland functions and services, key threats to the wetlands ecosystem and associated biodiversity of project sites. In 2004, awareness about wetlands and associated services was found to be only 3–5%; by 2014 it had increased to approximately 50%.

Climate change planning

Climate change planning is one of the key components of the project. During the initial phase of the project, the communities in the project sites were trained to cope, mitigate and adapt to climate change and associated hydrometerological hazards. The project team organized three trainings on climate change and risk reduction planning in the project sites. The objectives of the training were to improve understanding of climate change and associated hazards and to build capacity to cope with, mitigate and adapt to the impacts of climate change induced hazards on life, livelihoods, infrastructures and ecosystems. During these training sessions, village disaster risk management plans of the Gahkuch, Naltar and Qurumbar valleys were also developed. Furthermore, the project team conducted a detailed hazard vulnerability risk assessment (HVRA) for Gahkuch, Qurumbar and Naltar to identify prominent natural and human caused events, assessed and documented vulnerabilities associated with the identified hazards, documented key capacities within the communities to cope with prevailing risks and provided viable risk reduction options to disaster risk management departments, decision-makers and communities in the project sites. The village disaster risk management plans (VDRMPs) are guidelines for local communities and district governments in the relevant project sites for coping with and mitigating the impacts of climate change and associated hazards. These HVRA studies will be really helpful for future climate change and risk reduction planning.

Pasture management

Pasture management is one of the project outputs for reducing pressures on wetland-associated pastures and rangelands in project sites. In this regard the project team, in collaboration with communities in project sites, planted fast-growing multi-purpose trees on 15 ha of wasteland and cultivated fodder trees on 15 ha of wasteland in project sites. Various activities were carried out to sustain pasture capacity for grazing. Carrying capacity (CC) of selected pasture areas was determined, as well as species composition and productivity of pasture was evaluated. After determining carrying capacity, various meetings were held with communities to introduce a scientific grazing system to combat overgrazing. In addition, 140 kg of alfa-alfa seed was sown on 0.6 ha of communal land to overcome pressure on pastures. Furthermore, the project team developed pasture zonation maps for Deosai National Park, the Naltar Wetlands complex and Qurumbar National Park, which were project sites under SWSH Phase III. The purpose of these maps was to identify pasture areas where all human activities are restricted and to document pasturelands where grazing is allowed. The success rate of plantation and fodder in project sites was recorded to be high (approximately 80%) and reduced pressure on pastures was recorded to be at least 25% from baseline.

Conservation of natural forest

Natural forest plays a vital role in maintaining a sustainable ecosystem and provisioning tangible and intangible resources to human beings. Due to lack of alternative resources, forests are facing heavy pressure from local dwellers, who use forest resources to meet daily needs. The project interventions were fruitful in reducing pressure on forests by providing some alternative sources to communities, like fuelwood plantation at different sites in the critical watershed catchments over an area of 15 ha and the tree species on communal lands were poplar (*Populus alba*), willow (*Salix tetrasperma*), mulberry (*Morus alba*), and seabuckthorn (*Hippophae rhamnoides*). Farmlands that were not in proper use were identified and local dwellers were engaged in farming cumin seed (*Cuminum cyminum*) on 1 ha of farmland – in Naltar (0.25 ha) and Qurumbar (0.75 ha). Alternate energy sources were provided to locals who were solely dependent on forests for meeting their daily needs. For this purpose, energy efficient technologies, water warming facilities, fuel efficient stoves and roof hatch windows were provided to 18 families.

Reducing human-wildlife conflict

In all parts of GB the people mostly depend on livestock to fulfil their household needs. To graze livestock they move their livestock to pasture areas, where conflict is initiated when predation occurs. To reduce such conflicts, some initiatives were taken through the project. Improved corrals were provided in areas where snow leopard predation risk was high, and local communities appreciated this. Breed improvement campaigns were held at different selected sites to reduce grazing pressure on pastures, as valuables are kept near the owner's house, reducing the risk of predation. Overall 25 successful births were recorded after breeding campaigns. Livestock vaccination was organized at study sites in order to control transmission of fatal diseases from livestock to wildlife on shared pastures. A total of 10,101

domestic animals were vaccinated and the results were satisfactory. To prevent hunting of predators, a livestock insurance scheme was introduced to compensate depredation losses, which showed fruitful results.

Capacity building of local communities

Various seminars and proper trainings were held to mobilize project communities for the conservation and management of natural resources. The local herders were trained by the experts to identify wildlife, build proper wildlife census or data and survey techniques. Additionally, few survey kits were also provided to them.

Discussion

The socio-ecological surveys were conducted to fill the data gap and collect socio-ecological information on some unexplored wetland sites. This information will not only be helpful for developing management plans but also serve as a key database for Ramsar Site Information Sheet (RIS). Further, it will be useful for documenting the distribution of new species in the area. Data from these surveys will help in biodiversity conservation planning and habitat management in other projects and in developing conservation measures. WWF-Pakistan has implemented only two wetlands management plans (Utter and Handrab-Shandoor) in the GB region as a demo for other communities, stakeholders and project sites. These participatory high-altitude wetland models of Handrab and Utter Lake are good examples that other communities and projects sites could adopt and implement for the protection of wetlands and associated resources at the GB level (Gujja 2007). The documentation of dice snake (*Natrix tessellatea*) and Chinese pond heron (*Ardeola bacchus*) expanded the inventories of birds and reptiles of GB and Pakistan. One of the achievement of SWSH programme surveys was the identification of dice snake in Gahkuch marshland (Mebert et al. 2013).

The increase in wildlife and bird population in project sites was probably due to continuous and effective monitoring and the curbing of illegal hunting and fishing by the community-based watch and ward mechanism. However, adequate financial resources and community's commitment are required to maintain an effective watch and ward mechanism. The awareness about the importance of wetlands and associated biodiversity raised by the project team may be another factor that changed hunters' behaviour and minimized illegal hunting in project sites.

Qurumbar National Park was notified in 2011, but the Department of Forest, Wildlife and Environment of GB is still preparing the management plan. Questions will also arise regarding financial resources for implementing the management plan because other national parks in GB are already in need of effective management plans and financial resources. Trophy hunting in the community-managed hunting area is an important source of income for Ishkoman community but the allocation of insufficient quotas and lack of proper wildlife surveys may pose major challenges. The removal of Gahkuch marshland from the hunting zone is a key achievement of the project team but implementation of the notification will be a challenge because the marshland is located in an urban area and thus already vulnerable.

The hazard vulnerability risk assessment studies and village disaster risk management plans are effective documents but the findings were not seen to be implemented properly in the Gahkuch, Qurumbar and Naltar valleys due to lack of funding and lack of ownership by local government and communities. Climate change planning and risk trainings were effective but providing emergency response kits in each project site was beyond the project capacity.

Pasture management is an important component of the project but the success rate of multi-purpose trees and fodder plantation depended on availability of water, soil fertility and proper care of nurseries. The success rate of plantation and fodder cultivation in project sites was not as high as the target set by the project team due to lack of water and proper care. Further, restricting the use of protected pasturelands was a key challenge for local community-based organizations because local herders are highly dependent on pasturelands and it was not possible to come up with alternatives during the short project period or through limited interventions of projects. Alternative energy-efficient sources were provided to reduce pressure on forest, but on a small scale. If provided on a large scale, such energy sources could be an efficient way to save and conserve our natural resources.

Conclusion

The success of wetland conservation measures and their impacts are difficult to distil from project reports and documents because their success can only be effectively documented through ground level assessment or field based studies. Implementing project interventions in difficult geographic locations and harsh climatic conditions within a limited timeframe is a key challenge for the project team. However, wetland conservation measures in Gilgit-Baltistan has great impacts on socioeconomic conditions, scientific knowledge and database, awareness, conservation and climate change risk reduction planning. Proper scientific database, hazard vulnerability risk assessment studies, and village disaster management plans are guiding documents for future management and planning. Controlling hunting in Gahkuch marshland is still challenging in GB region despite the implementation of VDRMPs, HVRA studies and development of Qurumbar National Park management plan. The awareness-raising programme could thus help protect and conserve the wetland project sites, and also promote other conservation practices. However, awareness-raising activities carried out during the project period are not sufficient. In addition, multi-purpose trees and fodder plantation are visible and beneficial interventions in project sites but the success rate of plantation depends on water availability and commitment from the community. It is therefore recommended that:

- Scientific databases are developed under the above wetland conservation projects and made available in the form of publications (scientific journals and policy briefs).
- Gilgit-Baltistan government needs to provide financial resources for Qurumbar National Park management planning and implementation.
- The scale of fodder cultivation and plantation could be increased because this activity was more visible and beneficial.
- Awareness raising activities could be continued with endowment funds; the amount of fund should be increased for further promotion of activities.

- Alternate sources should be provided to local communities, who are solely and wholly dependent on natural resources for their survival, in order to achieve conservation in a real sense.

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Ecosystem Services and Management of Band-e-Amir National Park

Nasaratullah Jahed[a]

[a] Wildlife Conservation Society, Afghanistan
njahed@wcs.org

Abstract

Band-e-Amir lake, the first national park of Afghanistan, is located in the western Hindu Kush mountains in Bamyan Province. The Band-e-Amir lakes (ca. 6 km^2) are the headwaters of the Band-e-Amir River, which flows west and then north feeding into the Balkh River. The livelihoods of Band-e-Amir's people depend on natural resource use, such as dryland farming for food supply, uprooting the shrubs for fuelwood and animal grazing on the pasterlands. Due to high dependency of local communities on natural reosurces, the Band-e-Amir landscape is heavily degraded. Besides, regular flow of tourists and visitors to the park has resulted in significant threats to the park's environment and corollary management challenges.

Afghanistan's environmental law grants the National Environmental Protection Agency (NEPA) authority in all aspects of protected areas. However, NEPA delegated management responsibility to the Ministry of Agriculture, Irrigation and Livestock through signing an Afghan ministerial ordinance called a *tarzulamal*. A joint community/government collaborative management body, the Band-e-Amir Protected Area Committee (BAPAC) was established in 2007 and has been successful in guiding management of the park. But many challenges still exist which need to be addressed as soon as possible, including receiving secure government funding for park activities, providing rangers with legal authority to enforce prohibitions, and channelling park revenue back to communities.

Keywords: Band-e-Amir National Park, Band-e-Amir Protected Area Committee, Bamyan, ecosystem services, park management

Introduction

The heart of Band-e-Amir National Park, in the Bamyan Province of central Afghanistan, is a series of six lakes separated by travertine dams located in the westward extension of the Hindu Kush Mountain of the Hazarajat Plateau. The crystal-blue water of the lakes and the surrounding rugged mountains provide a stunning sight of a unique natural landscape (Figure 2.1). Band-e-Amir is also recognized as a place of religious importance and is regularly visited by thousands of Afghan people. Few international tourists visit the site, but the destination is very popular among Afghan people who come for recreation and religious purposes.

Figure 2.1: **Band-e-Haibat Lake with the Shrine of Hazrat Ali on the left in Band-e-Amir National Park, Bamyan Province, Afghanistan, March 2014**

Band-e-Amir was declared as the first national park of Afghanistan in 1973 by the Afghan Tourist Organization (Shank and Larsson 1977), but could not be gazetted officially by the government because a war began that disrupted the civil institutions of the country for the following 30 years. In the mid-1970s, international organizations started work to develop Band-e-Amir as a legally established and well-managed conservation area (Shank and Alavi 2010). Unfortunately, this work remained on hold during the war against the Soviets and successive civil conflicts. Following a post-conflict mission in 2005 (Shank and Alavi 2010), conservation efforts initiated by Mag, NEPA and facilitated on the ground by NGOs including the Wildlife Conservation Society (WCS) led to the official declaration of the lakes and surrounding landscape as Afghanistan's first national park in 2009. A presidential decree legalized this status on August 2015. Band-e-Amir National Park (BANP) does not exclude sustainable human activities and natural resource management and aims for "*vibrant, healthy communities living in harmony with, and engaged in maintaining, an intact lake system, an environment rich in natural beauty, pure water and wildlife that provides high-quality visitor experiences*" (BAPAC 2011). This paper describes the ecological context, management system and approaches, and challenges associated with the conservation of BANP. It also provides some details on the physical and social environment of the park.

The Physical Environment of Band-e-Amir

Geography

Band-e-Amir National Park is 613.3 km^2 in size and lies 185 km northwest of Kabul and 55 km west of Bamyan town (Figure 2.2). The lakes are separated by natural travertine dams, extended east to west across the Band-e-Amir Valley at ca. 2,900 masl. The surrounding mountains rise up to 3,400 masl (Shank 2011). The six lakes are collectively known as Band-e-Amir and are named from east to west – Band-e-Zulfiqar, Podina, Panir, Haibat, Qanbar and Band-e-Ghulaman. The natural travertine dams that separate one lake from another are formed by mineral deposits, creating a staircase of calcium carbonate which hold back highly mineralized deep blue water. The park boundary (Figure 2.2) is determined on the basis of the lakes' upstream catchment area and downstream areas extending as far as villages that locals consider to be Band-e-Amir communities.

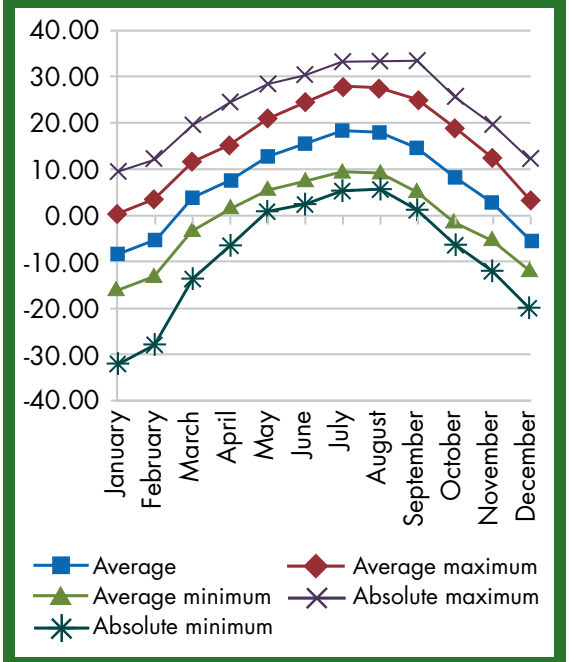
Climate

There is very little climatic information on BANP, but generally the climate of Band-e Amir is strongly continental, with low air humidity, high evaporation and wide temperature variations between summer and winter. There is heavy snowfall during winter and almost no summer precipitation (Shank and Larsson 1977). WCS installed an air temperature recorder at Jarukashan (nearest village from Haibat Lake at 2,900 m.) between June 2007 and August

Figure 2.2: **Band-e-Amir National Park boundary in Afghanistan (in red line)**

2010 (Figure 2.3). The absolute maximum temperature recorded at BANP was 33°C in July and August, and the absolute minimum temperature was –32°C in January (Shank 2011). Though the precipitation has not been accurately measured, the average annual precipitation was estimated at 450 mm with maximum fall in spring (March through May) and almost none during summer (June through August) (Freitag 1971; Dieterle 1973).

Figure 2.3: **Monthly average and absolute values for air temperatures (°C) measured at Jarukashan, Band-e-Amir, Bamyan Province, between June 2007 and August 2010**



Source: Shank 2011

Hydrology

The surface streams and groundwater feeding Band-e-Amir lakes are the headwaters of the Band-e-Amir River, which, as it leaves the lakes, flows to the west and then to the north to join the Balkh River. The Balkh River ultimately disappears into the sands near the Turkmen border north of Mazar-e-Sharif. The surface water flowing into the lakes system originates from numerous small springs within 20 km around the lakes (Shank 2011). Seasonal runoff may also contribute to the surface inflow of the lakes. There are also numerous springs detected by Terek (1983) flowing under the lakes, but no research has been done to measure the relative inputs from these two sources.

The surface and depth of the lakes have been measured by Jux and Kempf (1971). The deepest and largest lake is Band-e Zulfiqar, with 49 m maximum depth. The lakes' size, average depth and volume of water have been given by Jux and Kempf (1971) (Table 2.1).

Social Environment of Band-e-Amir

The population of the 14 communities within Band-e-Amir National Park was estimated to be about 5,000 in 2010 (Shank 2011). This number has probably increased during the past five years due to families returning from Iran and neighbouring areas to which they had fled to avoid conflicts. Also, the national park provides attractive facilities and opportunities for the local residents. The people of BANP are all Shi'a Muslims and ethnically Hazara. The Hazaras are Dari speakers and the dominant ethnic group in the Hazarajat Plateau, especially in Bamyan Province.

Table 2.1: **Size, depth and volume of Band-e-Amir lakes**

	Size (km^2)	Average depth (m)	Water volume (m^3)
Zulfiqar	4.875	28	136,500,000
Haibat	0.870	18	15,600,000
Ghulaman	0.130	2	260,000
Jedachel	0.050	2	95,000
Band-e-Panir	0.045	1	45,000
Small lakes between Jedechel and Zulfiqar	0.015	2	30,000
Total	**5.985**		**152,530,000**

Source: Jux and Kempf 1971

Most of BANP residents live in villages near the lakes. Jarukashan village is located near Haibat Lake and this is the first area visited by tourists entering the park from the main gate. It provides a major market and visitor facilities, and is the nearest village from the park headquarters, as well as a religiously important shrine (Shrine of Imam Ali) for Hazara people.

There are nine registered Community Development Councils (CDCs) in BANP. These councils were created primarily to receive development funds from governmental and non-governmental organizations. Moreover, there is Band-e-Amir Community Council, a community association that represents all nine CDCs of BANP. It was established to implement all projects and development programmes specifically related to national park communities, and to ensure a fair distribution of benefits among communities, and to make collective decisions on natural resource management on behalf of its constituent communities. The Band-e-Amir Protected Area Committee (BAPAC) was established in 2007 to carry out collaborative management of the park. More details about BAPAC are given in the management section of this paper.

Ecosystem Services

The livelihoods of most people in BANP depend mainly on livestock and farming with a very few of them running other businesses in and outside the park. About 1.4% of the BANP areas were part of irrigated lands, most of which were cultivated with wheat and barley, some potatoes and animal fodder; and ca. 3.4% of the areas were covered by drylands, e.g., non-irrigated, rain-fed (Mohibbi and Cochard 2014). In some areas people depend heavily on dryland farming to meet their needs of wheat and barley. This is an environmental concern because it damages the fragile rangelands by reducing plant diversity and soil fertility, and increasing soil erosion. For this reason, the Afghanistan Pasture Law (Shank 2011) prohibited the conversion of pastureland to dryland farming. Notwithstanding this, in the past the government granted licenses allowing dryland farming. Currently, the government accepts already established dryland farming in order to sustain food security (Shank 2011).

Livestock grazing is a major economic activity in Band-e-Amir. Mohibbi and Cochard (2014) estimated that free-ranging livestock population in BANP comprises about 19,900 goats, 2,500 cattle and, 2,100 donkeys and horses. Grazing impacts is evident, especially near villages. All the traditional pasture areas have been divided among the communities, with each community possessing exclusive grazing rights to certain areas. Heavy grazing pressure over thousands of years has completely altered the natural plant communities and significantly reduced the carrying capacity of the rangelands (Shank 2011). However, local people do not consider overgrazing to be a major environmental issue and it is difficult to convince them that new grazing management is needed (Bedunah et al. 2010).

Almost all local people uproot shrubs to use mostly as fuelwood for cooking and heating. Mohibbi and Cochard (2014) reported that families collect ca. 3.1 t of shrubs per year and ≥ 0.7% of BANP area was cleared of shrubs annually, and ca. 0.4 t of dried cattle dung is also collected and used as supplementary fuel for heating. Specific plant species are collected as winter fodder for livestock. Bedunah et al. (2010) reported that shrub availability had decreased significantly during recent times. Band-e-Amir residents were once able to collect shrubs near their village, but now they have to often travel about 7 km to find adequate size shrubs. The main reason for the decrease of shrubs was overharvesting of shrubs by outsiders who loaded shrubs into large trucks (Bedunah et al. 2010). This practice has been dramatically reduced in recent years thanks to more efficient enforcement activities. Bedunah et al. (2010) considered uprooting and overharvesting of shrubs to be the most critical rangeland issue as it significantly decreases vegetation cover, retards regeneration, causes soil erosion through runoff and wind, reduces soil organic matter, removes protection for rare grasses, and reduces snow retention capacity of the area.

The reeds *Phragmites australis* along the lakeshores, mainly concentrated in Band-e Ghulaman and in large wetlands between Deh Abkhana Payeen and Kotak villages in the main valley, provide excellent habitat for breeding waterfowl and other wildlife. The reeds are cut in the fall for fuel, fodder and livestock bedding. This is not considered to pose a major threat to birdlife as most breeding species have already completed their reproduction and have sometimes already migrated to the south.

Another major economic service of Band-e-Amir National Park is tourism. It has long been the destination of national and international visitors. Tourism is a revenue generating activity for the local communities and comprises recreational facilities, food, accommodation, local businesses, and religious and cultural activities. According to WCS tourist demography survey in BANP, the number of visitors from April to October 2015 was as high as 131,000. The maximum tourist influx into the park was during the months of July and August. Since the establishment of the park, domestic Afghan visitors to BANP have increased significantly. This is because the road to Band-e-Amir has been paved, security is excellent, and more park facilities are available in the park. However, very few international travellers visit largely, because of the generally poor security situation of the country.

BANP is BirdLife International's Important Bird Area with 152 species recorded in the WorldBirds Database (Mohibbi and Cochard 2014, BirdLife International 2015). A transect bird survey was done by Busuttil and Ayé (2009) at BANP. They found the Saker Falcon (*Falco cherrug*), a Globally Threatened species on the IUCN Red List which is threatened by illegal harvesting for international falconry in Persian Gulf states, and the Cinereous Vulture (*Aegypius monachus*), a Near Threatened species, and the Afghan Snowfinch (*Pyrgilauda theresae*), a breeding endemic species to central Afghanistan (Figure 2.4). The hunting of waterfowl and other birds, and fishing was common before 2007, but after the park rangers were hired, these illegal activities inside the park declined significantly.

The Lake System Services

The lakes are the primary reason for the establishment of the national park. The lakes provide water for irrigation and household use to downstream villages in Bamyan, Sar-e-Pul and Balkh Provinces. A hydropower project was constructed in Deh Abkhana village in 2008 along the main Band-e-Amir Valley and provides electricity to three adjacent villages in that valley (173 households). Another hydroelectric power plant, supplying power to two villages (227 households), has been constructed upstream of the lakes in Kupruk in 2014, the largest village east of Zulfiqar Lake. Another economic activity that the locals benefit from is renting plastic pedal boats to tourists (Figure 2.5). About 50 boats are rented to tourists on summer weekends for an average of USD 5 per hour.

Figure 2.4: **Afghan Snowfinch, a breeding endemic bird of central Afghanistan**

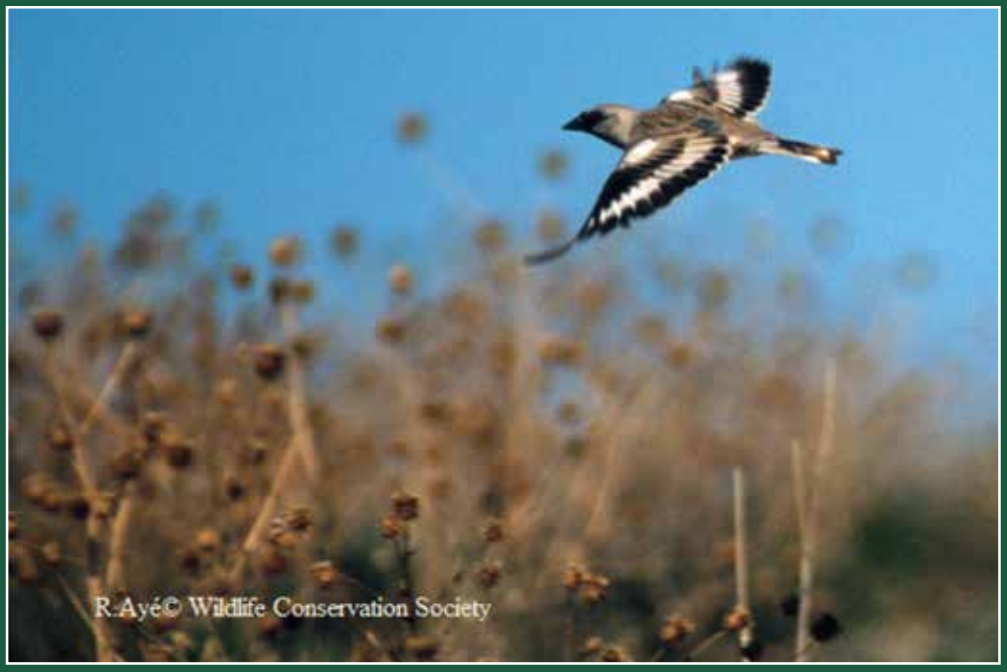


Figure 2.5: **Plastic pedal boats rented to tourists in Band-e-Haibat Lake, BANP, Bamyan Province, July 2013**

Park Management

Management bodies

According to the Environmental Law of Afghanistan (2007), the National Environmental Protection Agency (NEPA) is responsible for all aspects of the protected area planning and management. However, NEPA delegated management responsibility to the Ministry of Agriculture, Irrigation and Livestock through signing the Interim Protected Areas *tarzulamal*. One of the three objectives of the protected area system mentioned in Article 38 (3) of the Environmental Law is to involve the local communities in management of natural resources. This principle is also stipulated in the *tarzulamal*, which states that each protected area must have a Protected Area Committee that includes both government and community representatives.

The BAPAC was established through consultation with national, provincial and district level governments in 2007. The community representatives in the 14 communities of BANP were initially elected through a secret ballot process organized and monitored by WCS and the Ministry of Agriculture, Irrigation and Livestock, along with representatives from the Governor, NEPA and the Provincial Council (Shank and Alavi 2010). Unfortunately, in recent year's election deviated from the strict procedures initiated in 2007. The government representatives

in BAPAC are from relevant departments at the provincial level and the Provincial Governor is the Committee chairperson. In principle the *tarzulamal* grants communities absolute elective rights to retain significant influence over the management decisions; however, the ultimate decision-making authority rests with the collaborative management agreement (CMA).

The BAPAC generally meets once a month. It has an advisory role in park management. It provides advice to the CMA in order to ensure that management decisions will benefit from local knowledge and reflect the wishes of local people as well as the Provincial and District governments. Officially, all decisions made by BAPAC must be approved by the national office of the CMA. In practice, the CMA tacitly approves all BAPAC decisions (BAPAC 2011).

The park management office is the official representative of the CMA in BAPAC and is responsible for implementing day-to-day management activities on the ground. The park management office consists of one park warden and 10 rangers who are responsible for enforcing the rules and regulations of the national park. All rangers have been hired from the local communities.

Management plan

In 2008, the Wildlife Conservation Society assisted the BAPAC in developing a Preliminary Management Plan intended to provide a foundation for the legal establishment of Band-e-Amir as a provisional protected area. It was approved by the Ministry of Agriculture, Irrigation and Livestock and NEPA, and finally, in April 2009, Band-e-Amir was declared a provisional national park for a period of three years (Shank and Alavi 2010). This management plan was superseded by the current management plan, which built upon the preliminary management plan by incorporating the lessons learned during previous three-year period. This management plan was intended to provide directions to the park management over the next five years from 2011 to 2015 and to support the formal gazettement of the park (BAPAC 2011). The management plan is being updated for the next five-year period and is to be finalized in April 2016. These management plans are intended to be practical plans of action on topics that the plan signatories commit to addressing. The Collaborative Management Agreement in the Management Plan has been signed by all BAPAC members including communities, and the CMA and the General Director of NEPA. All the signatories in this agreement are committed to implement the terms of this Management Plan (BAPAC 2011).

Management successes and failures

The development and management of Band-e-Amir as a national park began in the 1970s. These efforts were interrupted for almost three decades due to conflicts in the country and resumed soon after the fall of the Taliban regime in 2001. Since the establishment of Band-e-Amir as a national park in 2009, there have been significant achievements, but also challenges facing the management process of the park.

The creation of BAPAC was an important step towards the effective management of the park. It took many difficult and effective management decisions during plenary sessions, such as a ban on plowing new drylands by tractor, a ban on leasing of pastureland to non-Band-e-Amir residents, development and approval of the management plans, bans on fishing and hunting. A social organization called Band-e-Amir Community Association was officially registered with the government of Afghanistan in late 2010 as a community organization authorized to receive contracts from the government to perform paid services such as renting the parking lot, campsites, etc. and disburse funds among the communities. However, due to various problems (e.g., unequal community representation, poor financial management), it was disbanded in late 2013 and superseded by the Band-e-Amir Community Council. The Band-e-Amir Community Council was created to oversee community projects as well as to implement national park projects. This is a community-based institution intended to involve all communities of BANP in the development programme of the national park. It is also an effective body for making decisions on natural resource management. No system has yet been established to collect revenue and spend it on park management and the development of communities. Consultations with relevant stakeholders are ongoing to build a proper system of revenue collection and its distribution for park management and communities.

Finally, almost 45 years after the start of the process, BANP was officially gazetted as a national park by a Presidential Decree in August 2015. The park headquarters is currently being built and 5 permanent community rangers and 15 contracted rangers have been appointed to record and deter illegal activities and implement management activities on the ground. Four women rangers have been supported by WCS since 2013. Rangers have been very effective in stopping waterfowl hunting and fishing, commercial harvest of shrubs by outsiders and the use of vehicles in restricted areas. Unfortunately, budget constraints at the government level resulted in reduction of contracted ranger forces in 2014.

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Peling-Tso, a Low-Altitude Wetland and Its Management Practices, Southern Bhutan

Pema Wangda[a] and Dorji Gyaltshen[a]

[a] Watershed Management Division, Department of Forest and Park Services, Ministry of Agriculture and Forests, Royal Government of Bhutan
pwangda@moaf.gov.bt or pemaparop@gmail.com

Abstract

Peling-Tso is a low-altitude wetland at an altitude of 900 masl, in the southern part of the Bhutan Himalayas, surrounded by hills with the highest ridge of approximately 1,400 masl. The wetland, which has an area of about 26 ha, is surrounded by low-lying hills covered by evergreen broad-leaved forest, mainly domi70

nated by *Salix tertrasperma*. Waterflows from Peling-Tso are used by more than 200 households clustered in the valley and on the slopes of surrounding hills. This water is mainly used for irrigation and livestock consumption. As this wetland is not fed by glaicers and snow, the broad-leaved forest that surrounds the wetland acts as a buffer and slowly filters the surface runoff rainwater and recharges the groundwater to maintain the hydrological cycle of the wetland as well as the critical ecological habitat of flora and fauna. A continuous supply of water in the stream even in the lean season is a result of good management practices, resulting in diverse life forms (endemic and rare species) in the wetland.

Keywords: buffer-forest, groundwater, Peling-Tso, recharge, wetland

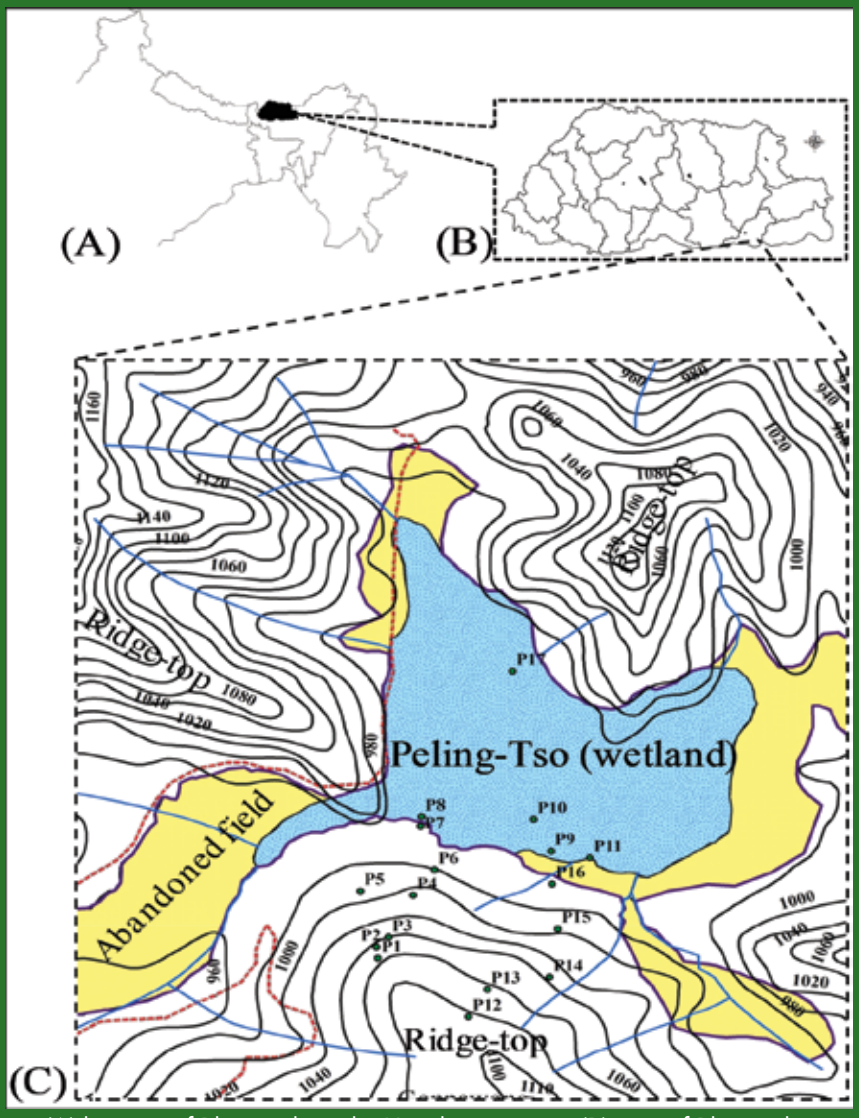
Introduction

The wetlands in the Bhutan Himalayas comprise high-altitude glacial lakes, alpine lakes, mid-altitude wetland (Phobjikha, khotokha etc), and low-altitude wetland (Peling-Tso) (Figure 3.1). Consistent with the global trend, wetlands in the Bhutan Himalayas, especially marshlands along the low-altitude wetlands, are also gradually seen to be shrinking, though no scientific observations have been conducted. Changes in land use, associated mainly with commercialization of agriculture and infrastructure development, also cause loses of the marshlands.

The main objective of the present study was to understand the impact of human activities on the sustainability of the wetlands. Specifically, the study was carried out with the following objectives:

- To select two study sites with different land use practices for understanding the impact of such practices;
- To understand the role of different vegetation strata in controlling soil erosion and recharging groundwater; and
- To clarify the importance of maintaining a buffer forest in managing the wetland.

Figure 3.1: **Map of the study area**



(A) location of Bhutan along the Himalayan range; (B) map of Bhutan showing 20 districts; (C) map of the study site and location of the sampling plots.

Materials and Methods

Study site

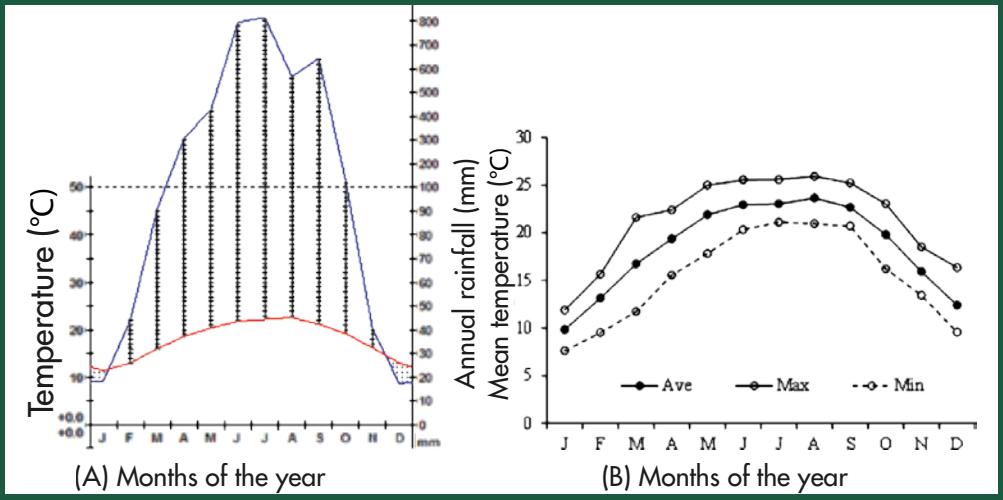
Peling-Tso wetland is located in Dechenling Gewog (Block) in the lower altitude of the Bhutan Himalayas. Specifically, the study site is located in Dechiling, under Pemagatshel Dzongkhag (District), Southern Bhutan (Figure 3.1B). The study site covers cultivated agricultural fields on the ridge-top, abandoned field, secondary forest of *Castanopsis-Lithocarpus* along the shifting cultivation sites, natural evergreen broad-leaved forest along the buffer forest, and finally *Salix tetrasperma* forest in the wetland.

Two study sites were selected for investigating the impact of human activities: (1) traditional land-use practice including shifting cultivation with the buffer forest along the altitudinal gradient from the ridge-top to the wetland; and (2) the site where farmers intensively used whole area from the ridge-top to the wetland.

Climate

Temperature and humidity conditions of the study area were downloaded from HOBO Onset (temperature and relative air humidity) automated digital data loggers installed in 2010. The average data of three years were analyzed to understand the climatic condition of the study area. In addition, rainfall data were also collected from the Meteorology Section, Hydromet Services Division of the Department of Energy. The results of the climatic data showed that a maximum temperature of 25.9°C was recorded in August and a minimum of 7.6°C in January. The mean annual temperature was 18.4°C (Figure 3.2B). The mean total annual rainfall was 3,916.6 mm with the highest rainfall recorded in the month of July (816.7 mm) and a minimum of 17.5 mm in December (Figure 3.2A).

Figure 3.2: **Climatic conditions of the study area: (A) Walter's climate diagram and (B) Temperature in the study area**

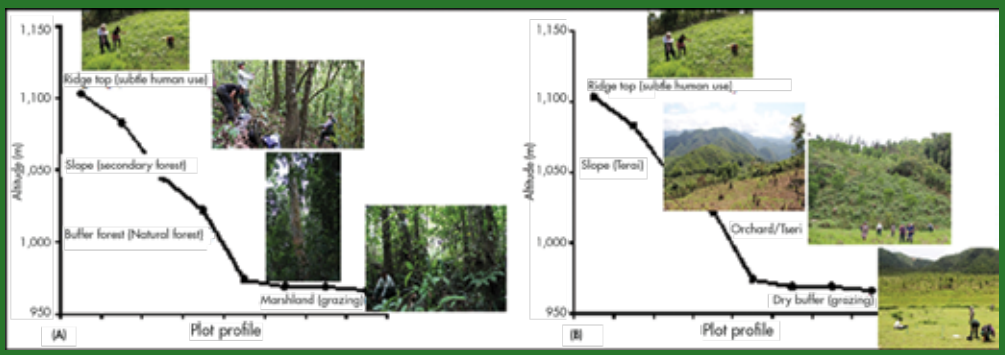


The analysis of climate data showed that the study site falls in the warm subtropical type of climate with relatively higher rainfall compared to other places in Bhutan. The climate diagram was drawn using Walter and Lieth's method (Walter and Lieth 1961-1967; Lieth et al. 1999).

Vegetation survey

Accordingly, the vegetation sampling plots were laid along the two sites to compare the impacts of land-use practices on the sustainability of the wetland (Figure 3.3A, 3.3B).

Figure 3.3: **Location of the study sites along two different land-use practices: (A) along the subtle (traditional use); (B) along the intensive cultivation sites**

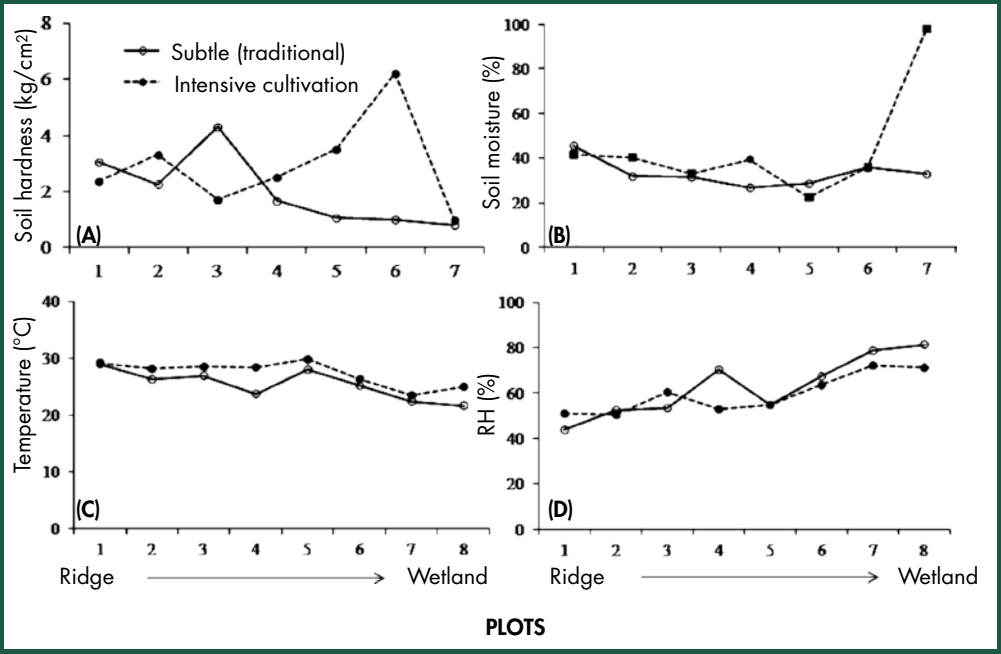


Results and Discussion

Environmental conditions

Environmental attributes like soil hardness (kg/cm^2), soil moisture content (%), air temperature (°C) and relative humidity (%) were measured by instruments (Push cone, hydro-sense, Viasala) that measure the instantaneous attributes of the environment. The soil hardness results revealed low soil compaction on the ridge-top at both sites. However, soil compaction increased along the disturbed site and decreased through the buffer forest of the subtle human use site (Figure 3.4A). Soil moisture content was found to be high at the base of the hill in the wetland of the disturbed site, indicating a higher runoff rate while the soil moisture content of the subtle human use site with a proper buffer forest showed a steady increase (Figure 3.4B). Air temperature measured during the survey was found to be slightly higher along the disturbed site compared to the site of subtle human use (Figure 3.4C). In contrast, the relative humidity was found to be slightly higher along the site of subtle human use compared to the disturbed site, indicating a relatively dry environment (Figure 3.4D).

Figure 3.4: **Environmental attributes along the two study sites**



(A) soil hardness; (B) soil moisture content at 20 cm depth; (C) instant temperature measured; (D) relative humidity measured during the study period

Vegetation

Floristically the study site is located in the moist climatic habitat and accordingly the study revealed diverse life forms. The site under intensive cultivation showed more diverse life forms compared to the site of subtle human use (Figure 3.5). Subtle human use site is dominated by evergreen broad-leaved shrubs or evergreen broad-leaved trees along the slopes followed by deciduous broad-leaved trees in the wetland, mainly *Salix tetrasperma* (Figure 3.5). Interestingly the buffer forest surrounding the forest was mainly dominated by *Altingia excelsa* belonging to Hamamelidaceae, a primitive plant group. In contrast, the intensive cultivation sites surrounding the wetland (Peling-Tso) were dominated by evergreen and deciduous shrubs along the slopes followed by Phragmites and other grasses in the core wetland zone with scattered deciduous and evergreen broad-leaved trees (Figure 3.5).

Structurally the two study sites showed different forest types. Along the subtle human use sites, the forest structure followed the natural successional pattern from early-seral stage (shrub dominated), mid-seral stage (pioneer mixed shrubs), late-seral stage to trees (climax forest) which act as buffer surrounding the wetland (Peling-Tso). Total basal area (biomass equivalent)

was found to be very high along the subtle human use sites while it was very low along the intensive cultivation site (Figure 3.6A). In contrast, the floristic diversity was found to be higher in the intensive cultivation site and relatively lower along the subtle human use site (Figure 3.6B). The result clearly indicates that intensive cultivation leads to the introduction of diverse species and vice versa along the subtle human use site. This indicates that subtle human use helps to conserve the natural diversity of forest.

Figure 3.5: **Comparison of life-form distribution of vegetation along the two sites of Peling-Tso**

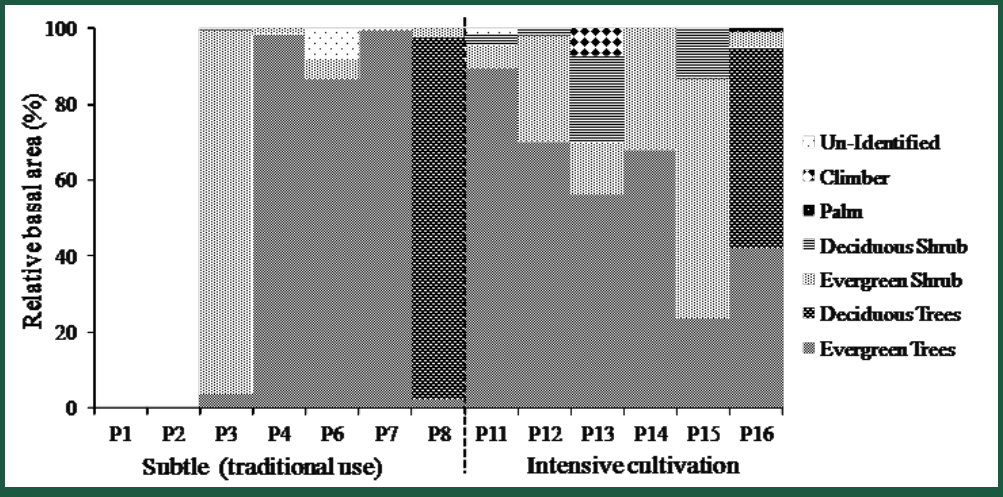
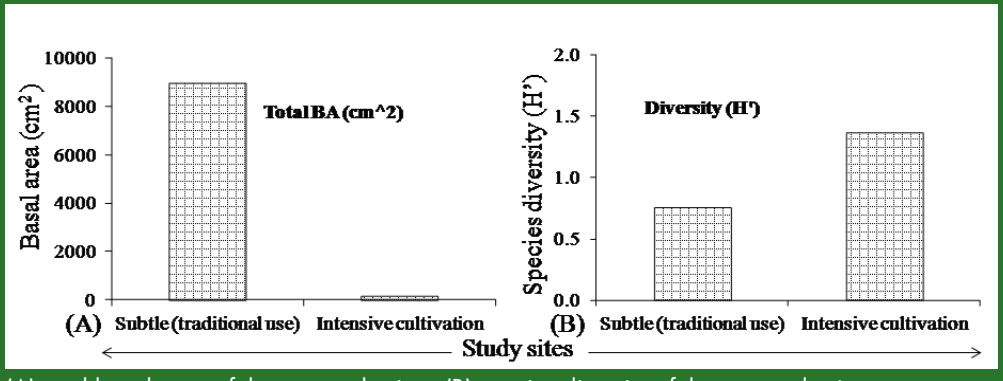


Figure 3.6: **Comparison of vegetation traits in the two study sites**



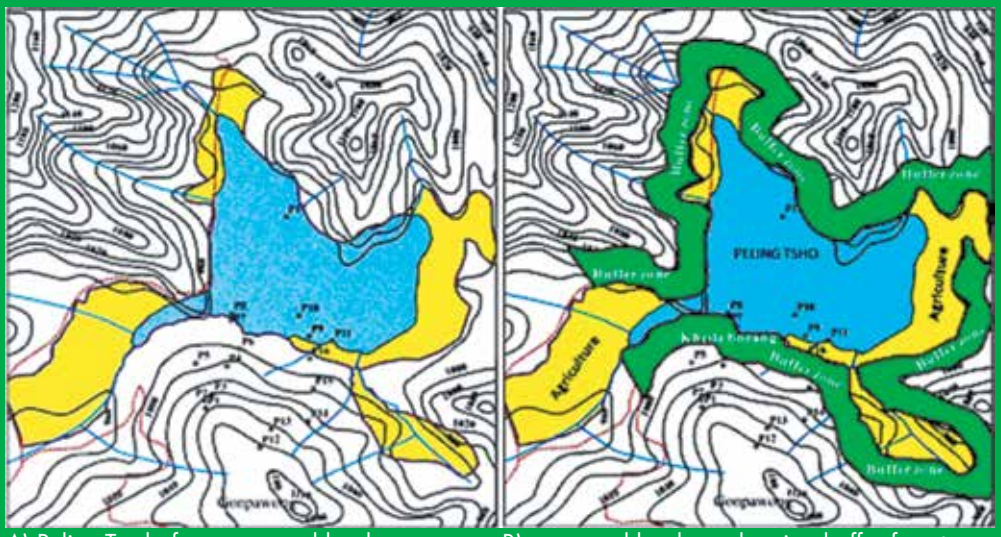
(A) total basal area of the two study sites; (B) species diversity of the two study sites

Discussion and Conclusion

Bhutan has diverse wetland types ranging from glacial lakes in the northern High Himalayas, mid-altitude wetlands along the inner mid-mountain valleys (Bumdeling, Gaytsa, Phobjikha, Khotokha and Nob-Tsonapata) to low-altitude wetlands (Peling-Tso, Kalikhola Tso, Buli-Tso, etc). These wetlands exist in the form of marshes. Marsh lakes are facing several challenges including developmental activities, climate change and pollution. Headlines in national newspapers, e.g., "Depleting water sources reported in 12 gewogs of Trashigang" (Kuensel 2014) and "Shrinking Kharul Lake saddens locals" (Wangdi 2014) indicated threats to mid- and low-altitude wetlands in the country.

Similarly, the condition of Peling-Tso wetland faces a similar situation of decreasing water discharge. The intensive study including social and vegetation investigation was carried out to understand the cause of sediments in the wetland that led to drying up of the wetland. The study found that intensive cultivation from the ridge-top to the wetland leads to significant surface runoff with little or no impact on groundwater recharge through seepage. However, along the subtle human use of the forest, the finding showed infiltration supported by buffer forest. This type of land-use practice helped to recharge the wetland by sustaining water discharge even during the lean season. One of the significant findings of the study was that a buffer forest acts as a filter during the rainy season, thereby recharging groundwater (Figure 3.7). The study thus recommends maintaining a 10 m wide buffer forest belt around the wetland. The buffer forest dominated by deciduous trees like *Altingia excelsa, Schima*

Figure 3.7: **Proposed land-use management of Peling-Tso**



A) Peling-Tso before proposed land-use

B) proposed land-use showing buffer forest around Peling-Tso

wallichii, Lithocarpus fenestratus, Salix tetrasperma and *Phragmites* (Graminae) along the Peling-Tso was found to be very important as it acts as a filter during the rainy season and helps to prevent surface runoff. It was also found that subtle human activities such as grazing including other traditional farming practices (shifting cultivation) and fuelwood collection may not have significant impact if a proper buffer forest is in place.

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Wetlands of the Indian Himalayas: Status and Conservation Initiatives

Syed Ainul Hussain[a], Neeraj Mahar[a], Chongpi Tuboi[a] and Ruchi Badola[a]

[a] Wildlife Institute of India, Uttarakhand, India
hussain@wii.gov.in

Abstract

Globally, wetlands are vital elements of the ecosystems and economies and occur extensively in all climatic zones. Himalayan wetlands harbour rich biodiversity and numerous ecosystem services. High-altitude wetlands in the Himalayas include lakes, swamps and seasonal marshes. They are the source of major rivers like the Indus, Brahmaputra and tributaries of the Ganga. India has a great diversity of wetlands owing to its location at the junction of three biogeographic realms. The Indian Himalayas harbour some of the most spectacular and biologically rich wetlands in the world. Some of these wetlands are extensively explored, but most of them are still unknown. At present, these wetlands are under immense pressure due to increasing anthropogenic pressure and underlying natural causes. An assessment on location, characteristics, functions, values, threats and status of wetlands is necessary to develop fundamental knowledge and sustainable wetland conservation programme. Current review discusses the conservation status of wetlands in the Indian Himalayas, particularly the states of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and Arunachal Pradesh, with the objective to consolidate the status of the Indian Himalayan wetlands for conservation prioritization.

Keywords: Himalayas, wetlands, conservation, threats, biodiversity

Introduction

The Indian Himalayas harbour some of the most spectacular and biodiversity rich wetlands in the world. While some of these wetlands have been extensively explored, most of them remain little known. Wetlands in the Himalayas are the product of climate, precipitation, geology, geomorphology, drainage and soil condition of the region (Wadia 1960). All the drainage in the region passes through newly emerged deep gorges that have very little area of inundation and, consequently, have little riverine marshes, except in large valleys and plateaus. Apart from lakes, the Himalayan wetland system comprises networks of rivers with associated floodplain marshes and swamps, glaciers and hot springs, seasonal waterlogged areas and manmade reservoirs (Upadhyaya et al. 2009). High precipitation in the eastern Himalayas has produced more extensive seasonal waterlogged areas, marshes and swamps than in the western Himalayas.

Distribution of Wetlands in the Indian Himalayas

Through a literature review and examination of toposheets from the Department of Survey of India, we compiled approximately 8,536 wetlands in the Indian Himalayan region, covering 55 administrative districts (NWA 2011). Of these, 3,265 wetlands are in the eastern Himalayan states of Arunachal Pradesh and Sikkim, and 5,271 wetlands are in the western Himalayan states of Uttarakhand, Himachal Pradesh, and Jammu and Kashmir. Jammu and Kashmir has the maximum number of wetlands followed by Arunachal Pradesh, and Sikkim has the minimum (NWA 2011) (Table 4.1). The total area of wetlands covering the five states of India, including small (<2.25 ha) and large (>2.25 ha) wetlands was 756,501 ha (Table 4.2). Of these, the wetlands of Jammu and Kashmir covered the maximum area (391,501 ha) followed by Arunachal Pradesh (155,208 ha), and Sikkim (7,477 ha) has the minimum area (NWA 2011) (Table 4.2).

Wetland ecosystems such as rivers, lakes, marshes and coastal estuaries provide many benefits for human well-being. People living in proximity to wetlands depend partially or entirely on wetland ecosystem services. These include water supply, water purification, flood regulation, coastal protection and cultural and recreational services (Table 4.3).

Arunachal Pradesh

There are 1,593 wetlands in Arunachal Pradesh with area >2.25 ha, covering a total area of around 154,609 ha (Tables 4.1 and 4.2). There are around 1,119 wetlands with area <2.25 ha. Due to lack of data, it is difficult to estimate the exact number of wetlands in the

Table 4.1: **Number of wetlands in the Indian Himalayas based on remote sensing data**

Types	Jammu & Kashmir	Himachal Pradesh	Uttarakhand	Sikkim	Arunachal Pradesh	Total	Percentage
NATURAL WETLANDS							
Lakes/ponds	36	8	12	1	3	60	0.7
Marshes	1,143	42	29	259	1,231	2,704	31.68
Waterlogged	0	10	1	0	107	118	1.38
Riverine	88	0	0	0	88	176	2.06
River/stream	138	67	81	12	128	426	4.99
MAN MADE WETLANDS							
Reservoir	4	13	10	0	4	31	0.36
Tanks/ponds	2	27	21	0	32	82	0.96
Waterlogged	0	3	9	0		12	0.14
Sub Total	**1,411**	**170**	**163**	**272**	**1,593**	**3,609**	**42.28**
WETLANDS (<2.25 ha)	2,240	471	816	281	1,119	4,927	57.72
Total	**3,651**	**641**	**979**	**553**	**2,712**	**8,536**	**100**

Source: NWA 2011

Table 4.2: **Extent of wetlands (ha) in the Indian Himalayas based on remote sensing data**

Types	Jammu & Kashmir	Himachal Pradesh	Uttarakhand	Sikkim	Arunachal Pradesh	Total	%
Lakes/ponds	13,762	52	2,081	15	18	15,928	2.11
Marshes	109,170	387	142	3,050	11,422	124,171	16.43
Waterlogged	0	47	9	0	8,146	8,202	1.09
Seasonally flooded	9,594	0	0	0	0	9,594	1.27
River/stream	231,597	55,558	80,133	4,131	134,244	505,663	66.91
Reservoirs	25,132	41,817	20,319	0	164	87,432	11.57
Tanks/ponds	6	134	108	0	95	343	0.05
Waterlogged	0	30	211	0		241	0.03
Sub Total	389,261	98,025	103,003	7,196	154,089	751,574	99.46
Wetlands (<2.25 ha)	2,240	471	816	281	1119	4927	0.65
Total (ha)	**391,501**	**98,496**	**103,819**	**7,477**	**155,208**	**756,501**	**100**

Source: NWA 2011

Table 4.3: **Ecosystem service value of the wetlands of Indian Himalayas**

Trans Himalayas – Tibetan Plateau, North Sikkim, Northwestern Arunachal Pradesh	• Source of water • Major pasture for domestic & wild ungulates • Cultural & aesthetic value
Northwestern Himalayas – Jammu and Kashmir	• Source of water • Recharge groundwater • Cultural & aesthetic value
Western Himalayas – Jammu and Kashmir, Himachal Pradesh, Uttarakhand	• Source of water • Recharge groundwater • Flood control and maintain regional stream • Cultural & aesthetic value
Central Himalayas – Sikkim	• Source of water • Recharge groundwater • Maintain regional stream • Cultural & aesthetic value
Eastern Himalayas – Arunachal Pradesh	• Source of water • Recharge groundwater • Maintain regional stream flow • Cultural & aesthetic value

state. However, by excluding the wetlands in the Tirap district, which is mostly plains, the estimated wetlands of the state includes the wetlands in Lohit, East, West and Upper Siang, and Changlang districts. Of the total wetlands >2.25 ha, majority (1,231) are marshes, followed by river/stream (128), waterlogged (107) and riverine (88) (Table 4.1).

Arunachal Pradesh is a biodiversity rich state owing to its unique climatic conditions and its location at the junction of the Afro-tropic, Indo-Chinese and Indo-Malayan realms. As far as aquatic species are concerned, fish fauna is zoo-geographically rich and connects the Indo-China, Indo-Malayan and Indian sub-region. Around 200 species of amphibians have

been reported from the state. Small flocks of endangered black-necked crane (*Grus nigricollis*) have also been reported during winter from Sangti Valley in West Kameng district, Zimithang Valley in Tawang district (Singh 2000), Apatani Valley in Lower Subansiri district (Betts 1954) and Gandhigram Valley in Changlang district (Neog and Bhatt 1990). The state is also home to all the three Indian species of otter viz., Eurasian otter (*Lutra lutra*), smooth-coated otter (*L. perspicillata*) and oriental small-clawed otter (*Aonyx cinerea*). The Brahmaputra River and its tributaries harbour endangered gharial (*Gavialis gangeticus*) and river dolphin (*Platanista gangetica*) (Chaudhury and Hussain 1992).

Sikkim

There are approximately 272 wetlands >2.25 ha in Sikkim, with an area of around 7,196 ha (Table 4.2). There are approximately 281 wetlands <2.25 ha in area (Table 4.1). Of the total 553 wetlands identified at present, majority are marshes (259), followed by river/stream (12) and lakes and ponds (1) (Table 4.1). North Sikkim has the highest number of wetlands followed by East Sikkim and West Sikkim.

In Sikkim, most of the wetlands are situated at higher altitudes and rugged terrain and are hence unexplored. Of the identified wetlands, 147 wetlands have rich wildlife, 54 have religious value, 16 have domestic use value and 7 have recreational value. Of the 123 wetlands in North Sikkim district, 41 have religious value and 96 have wildlife value (Roy and Thapa 1998). The Lhonak valley in North Sikkim is perhaps one of the richest Trans-Himalayan biodiversity areas in Sikkim (Lachungpa 1998). There is a good breeding population of the ruddy shelduck (*Tadorana ferruginea*) and the common redshank (*Tringa tetanus*). The number and frequency of arrival of the small population of less than 10 black-necked cranes that regularly visited Lhonak Valley dropped down to less than 5 due to defense-related activities in 1980 (Lachungpa 1998). The lower altitude wetlands are home to all the 3 species of otters, viz. Eurasian (also occurs at higher altitudes), smooth-coated and oriental small-clawed otter.

The Trans-Himalayan part of Sikkim is home to herbivore species like Tibetan gazelle (*Procapra picticaudata*), southern kiang (*Equus kiang polydon*), blue sheep (*Pseudois nayar*), nayan (*Ovis ammon hodgsoni*), Royle's pika (*Ochotona royeli*) and woolly hare (*Lepu oiostolus*). It also harbours carnivores like red fox (*Vulpes vulpes montana*), wolf (*Canis lupus chanco*) and snow leopard (*Uncia uncia*) (Shah 1994). The streams and marshes harbour the endemic Himalayan Salamander (*Tylototriton verrucosus*), found in the eastern Himalayas at an altitude of 1,500–2,500 m (Roy 1999). Apart from having conservation significance, most of the lakes are culturally significant as well.

Himachal Pradesh

Of the 641 wetlands in the state, 170 are >2.25 ha with an area of 98,025 ha and 471 are <2.25 ha (Table 4.1 and Table 4.2). Kullu district has the highest number of wetlands (28) and most of these lakes freeze during winter. Chamba and Kangra districts have large areas

under wetlands because of Pong and Govind Sagar reservoirs. Of the 170 wetlands >2.25 ha, most exist in the form of river/stream (67) followed by marshes (42) and manmade tanks and ponds (27) (Table 4.1).

The Pong reservoir (a Ramsar site) and Govind Sagar have been identified as major waterbird refuges. Pong Dam harbours a major wintering population of the bar-headed goose (*Anser indicus*) in India (Li et al. 2009). Situated at the southern edge of the Tibetan plateau, wetlands in Lahul and Spiti have Tibetan elements. Little is known about the conservation value of the wetlands in this district except Chandra Tal. Most of the wetlands in Himachal Pradesh are small in size with little conservation value with respect to waterbirds but have high aesthetic value.

Jammu and Kashmir

At present 3,651 wetlands have been identified in the state, of which 1,411 are >2.25 ha with an area of 389,261 ha and 2,240 are <2.25 ha (Tables 4.1 and Table 4.2). Majority of the natural wetlands are marshes (1,143) followed by river/stream (138) (Table 4.1). Previously the Directorate of Environment and Remote Sensing, Government of Jammu and Kashmir, identified 1,248 wetlands as small as 0.25 ha in the state with an area of 21,880 ha (Ahmedullah 1997).

The wetlands of the state are important staging grounds for migratory waterbirds; at least 24 species of Anatids are prominent. Around 85 species of waterbirds have been recorded from the state (Ahmedullah 1997). The Trans-Himalayan wetlands are an oasis of productivity in an otherwise arid steppe environment and have significant conservation value, particularly as breeding grounds for the bar-headed goose and the globally threatened black-necked crane. Other key waterbird species breeding in the area include ruddy shelduck, common redshank, brown-headed gull (*Larus brunnicephalus*), lesser sand plover (*Charadrius mongolus*) and great crested grebe (*Podiceps cristatus*) (Anon 1997). At least 34 species of birds are using the wetlands of Ladakh (Humbert-Droz 2000, Hussain and Singh 2001, Hussain and Pandav 2008). The key mammals of the area are snow leopard, Tibetan wolf, bharal and kiang (Chundawat and Qureshi 1999).

The wetlands in Jammu and Kashmir provide livelihood and play a significant role in the socioeconomic status of local communities. Catchment areas of many lakes are extensively used for paddy cultivation and fishery. Trout angling in the riverine wetlands is a major tourist attraction. Large wetlands like Dal and Wular are part of the local culture and the unusual and serene landscape of the Changthang region is a popular tourist destination. The lake basins are grazing grounds for both domestic livestock and wild ungulates such as kiang (Hussain and Singh 2001).

Realizing the great ecological and aesthetic value of the wetlands, the Department of Wildlife Protection, Jammu and Kashmir, has identified 15 wetlands across the three regions of the

state to be protected as Wetland Reserves in accordance with the Jammu & Kashmir Wildlife (Protection) Act, 1978. The Government of India has notified Wular, Hokersar and Tso Moriri as wetlands of national importance.

Uttarakhand

The state of Uttarakhand, created in November 2000 from the northern Himalayan region of the erstwhile Uttar Pradesh state, is bordered by Uttar Pradesh in the south, Himachal Pradesh in the west, Tibet Autonomous Region of China in the north, and Nepal in the east. A total of 979 wetlands have been identified (NWA 2011), of which 163 are >2.25 ha and 816 are <2.25 ha. Majority of natural wetlands are river/stream (81) followed by marshes (29) (Table 4.1). The total area of wetlands >2.25 ha is 1,03,003 ha and that of <2.25 ha is 816 ha (Table 4.2). Of the 13 districts, Chamoli district has the maximum number of lakes; most of them are glacial in origin and remain frozen from November to March. Nainital district has nine lakes and most of these lakes are situated in the Lesser Himalayan zones at altitudes below 2,000 m (Garg et al. 1998).

The wetlands, owing to their smaller size, have little significance for waterbirds. However, there are reports of sporadic use by waterbirds such as gadwall (*Anas stripera*) and northern pintail (*Anas acuta*) from Deoria Tal (low altitude lake) (Sathyakumar 1994). Three species of Indian otter have been reported from the lower altitudes of the Garhwal Himalayas, which are rapidly becoming rare in the state (Hussain 1998). The lakes of the Kumaun Himalayas form one of the most remarkable and beautiful features of the Lower Himalayas (Atkinson 1882) and are major tourist destinations.

According to *Skanda* Purana, all 66 lakes in the Garhwal Himalayas are spiritually and culturally significant. Some of these lakes have significant hydrologic value i.e., maintenance of regional stream flow. The wetlands and the streams have significant domestic as well as medicinal value as local people believe that water from some of these lakes can cure several diseases.

Biodiversity and Its Changes of the Wetlands in Ladakh

Ladakh represents the Trans-Himalayan region of the Indian Himalayas. The Changthang region is the extension of the Tibetan Plateau towards the southwest into Ladakh. The area is characterized by a barren and rugged landscape interspersed with several lakes and marshes in the upper Indus River valley. The area receives <100 mm of annual rainfall with little snow, and is therefore recognized as a cold desert. Most of the lakes and streams of Ladakh are of glacial origin and remain frozen during winter (November-April). Around 13 major lakes and several marshes are found along the Indus River and its tributaries.

In Ladakh, tourist access is restricted to summer months, which is also the peak period of breeding season and other biological activities for several avifaunal species. The wetlands of Ladakh are fragile and various anthropogenic activities resulting from unprecedented human

population growth, faulty rangeland management, livestock grazing and increased tourism threaten the wetlands and breeding waterbirds (Geneletti and Dawa 2009).

Water quality

Hussain et al. (2008) examined the physio-chemical properties of water and found significant variation in seven lakes of Ladakh. Among inorganic non-metal constituents, except dissolved oxygen (DO), ammonia as a form of nitrogen (NH_4-N) and sulfite (SO_3-S) differed significantly ($p<0.05$). Both the quantified metallic constituents (calcium and magnesium) were found to differ significantly among the lakes. Based on the Total Dissolved Solids (TDS) concentration (Tilzer and Serruya 1990) the system of lakes in the Changthang region can be grouped into three types – first, the fresh water lakes with TDS <2,000 mgL^{-1}, such as Statsapuk Tso, Kyon Tso-I and II, and Tso Moriri; second, the brackish water lakes with TDS >2,000-20,000 mgL^{-1}, such as Thatsangkaru, and Pangong Tso; and third, the saline lakes with TDS >20,000-40,000 mgL^{-1}, such as Tso Kar.

Biodiversity value of the lakes and their catchments

Hussain et al. (2008) recorded 16 species of water birds from the Changthang region, of which 7 species were breeding at Statsapuk Tso, 6 species at Tso Moriri and Tso Kar, 5 species at Pangong Tso, 4 species at Kyon Tso II, and 2 species at Thatsangkaru (Figure 4.1). The great-crested grebe and black-necked crane were recorded from Statsapuk Tso and Tso Moriri, and common merganser (*Mergus merganser*) was found at Pangong Tso and the Indus River. Another study by Hussain and Pandav (2008) recorded 44 species of waterbirds, of which 19 species were breeding in various wetlands of Ladakh.

The encounter rate of six common breeding waterbirds was calculated for various wetlands of Changthang (Hussain et al. 2008). Bar-headed geese were found to be nesting at all the lakes except Kyon Tso I. The mean encounter rate of bar-headed goose varied from 3.5 to 17 per km. It was lowest for Thatsangkaru and highest for Kyon Tso II. Previously, Tso Moriri and Tso Kar had been identified as important breeding grounds for both the bar-headed goose and the ruddy shelduck, perhaps because of their large size and gentle shelving shorelines. During the survey, presence of six species of carnivores, seven species of ungulates and three species of other mammals was recorded based on direct and indirect evidence. The most common species were snow leopard, Tibetan wolf, bharal, Tibetan argali (*Ovis ammon hodgsonii*) and kiang. The other animals of conservation significance were Tibetan antelope (*Pantholopos hodgsoni*) and wild yak (*Bos gruinniens*), which were reported from the Changchenmo valley (Chundawat and Qureshi 1999).

Movement pattern of flagship waterbird species

Modern satellite tracking techniques can be used to study precise migration paths and stopover sites. Bar-headed goose is a long-distance migrant to the Indian subcontinent with major breeding population in China and small breeding population in Ladakh (India).

Figure 4.1: **Different breeding waterbird species in high-altitude wetlands**

a) Black-necked crane, b) Bar-headed goose, c) Common tern, d) Ruddy shelduck

However, India harbours major wintering population in the states of Jammu and Kashmir, Uttar Pradesh, Assam and Rajasthan (Ali and Ripley 1987). But there is a lack of information on the migration pattern of bar-headed goose in India unlike in other central Asian countries (Mahar et al. 2014). To have a better understanding of their movement pattern and home range, Mahar et al. (in press) monitored two Platform Transmitter Terminal (PTT) tagged bar-headed geese in March-August 2012 from the Gharana Conservation Reserve, India. The origin of the tagged birds, whether from Ladakh or extralimital, could not be ascertained as both the PTTs functioned only for 5–6 months. The geese, also, did not move to their possible breeding sites in Ladakh (India) and other central Asian countries during the tacking period. The PTT fitted geese used the Tawi River floodplains of India and Pakistan in Jammu and Sialkot districts respectively. Post winter, the two geese used several small wetlands in the Tawi River floodplains, moving between India and Pakistan intermittently, indicating the need for transboundary efforts for long-term conservation of the species in this region (Mahar et al. in press).

During a further study carried out to generate information on the migration pattern of waterbirds in Ladakh, four geese were captured at Chushul area of the Changthang Wildlife Sanctuary using nooses in 2013 (WII 2014). Two of them were fitted with PTT and conventional neck bands and rings and two were collared with only conventional neck bands and tagged with tarsus rings. Two black-necked cranes were also fitted with PTT and tarsus bands. The cranes moved towards the Chinese territory and showed lateral migration, while PTT fitted bar-headed geese moved towards the Himachal Pradesh border till early winter (December) and the two geese fitted with only neckband and rings were reported from Gharana Wetland, Jammu. This study was able to track the migration of bar-headed geese from breeding site (Ladakh) to wintering site (Gharana wetland) via Himachal Pradesh (probably Pong Dam) (WII 2014). However, results are preliminary and more telemetry based studies are needed to track migration route.

Human use and resultant disturbance

The Changthang region has around 41 villages with a population of 9,500 people. They have approximately 140,000 domestic livestock, 90% of which are sheep and goat and the remaining 10% are domestic yak, ponies and dzo (hybrid between yak and cattle). People and livestock depend on the lakes and marshlands of the region for grazing pastures and associated livelihood options (Hussain et al. 2008). The study also found that the overall disturbance score was highest for Tso Moriri followed by Tso Kar, Statsapuk Tso and Pangong Tso. Both Kyon Tso I and II were least disturbed. The human use parameters that pose threats to the lakes and their catchments are: presence of villages in their vicinity, army camps, grazing by livestock and unregulated tourism. The resultant impacts are: extraction of biomass from the catchments, diversion of stream waters for agricultural purposes, problems of solid waste disposal and increasing pollutant load in the lakes (Figure 4.2).

Discussion

The great geomorphological, climatic and altitudinal variations in the Himalayas has ensured rich diversity of wetlands such as large and small lakes, seasonally flooded marshes, hot springs and some of the most important river systems in the Indian subcontinent. Most of these wetlands have significant conservation values attached to them. Climate change studies have shown the vulnerability of wetlands to their stochastic changes in recent times. The change in temperature can affect aquatic ecosystems of high-altitude lakes (Sammaruga-Wograth et al. 1997). There is evidence of shift in range and distribution of waterbirds owing to change in temperature (Lehikonin et al. 2013). Many changes such as changes in the breeding cycle, migration timing and population size are visible in the current scenario (Crick 2004).

In recent years, efforts, though minimal, are being made to prepare inventories of these wetlands for conservation prioritization. Of the 8,536 wetlands in the entire Himalayan region, only 6 wetlands, 3 each in Jammu and Kashmir (Wular, Tso Moriri, Tsigul Tso) and Himachal Pradesh (Renuka, Chandra Tal and Pong Dam), have been formally identified as wetlands of national importance and conservation inputs have been extended. Conservation

Figure 4.2: **Different anthropogenic activities in the wetlands of the Himalayas**

a) Livestock grazing, b) Free ranging dog in Changthang, c) Resource extraction, d) Tourist camps near Tso Moriri Wetland

efforts for the Himalayan wetlands have largely been concentrated in the two western Himalayan states of Jammu and Kashmir and Himachal Pradesh. The eastern Himalayas, which contains around 38.2% (3,265) of the total Himalayan wetlands, are grossly neglected though they have equal conservation value as the wetlands of the western Himalayas. These wetlands are important wildlife habitats and have significant socio-cultural values. Around 83.1% of the wetlands in Arunachal Pradesh and 16.9% in Sikkim warrant immediate conservation measures. Conservation programmes for the wetlands in the Himalayas should take into consideration transboundary issues that affect conservation in the border region of India, Nepal, China and Bhutan. Regional cooperation is essential for effective management of artificially divided ecological units. The Ramsar Strategic Plan actively supports the identification of transboundary wetlands of international importance including those with shared catchment/river basins.

A study by Hussain et al. (2008), which obtained limnological estimates different from those obtained by Hutchinson (1937), confirmed that the character of the lakes has changed. These changes may be attributed to human water use in the basins. At the onset of summer, large

numbers of *Rebos* (tents) are pitched along the streams and people use stream water for domestic purposes. These *Rebos* contribute to the large amount of nitrogenous compounds in the lakes, resulting in unusually high concentrations of Ammonium-N and Nitrate-N, particularly in Tso Moriri.

Conservation and development issues in Changthang are primarily due to high population growth in Ladakh; the population increased by approximately 30% between 1971 and 2001 (Hussain and Badola 2003). It has led to resource crunch leading to conflict between the indigenous communities and the refugees, and between domestic livestock and wildlife, especially near wetlands. Large herds of goats and sheep disturb nesting birds and trample their eggs while shepherd dogs predate eggs, chicks and fledglings (Chandan et al. 2005). Furthermore, tourist influx to Ladakh, which was predicted to reach 94,762 per annum by the year 2016 (Kichloo 1997), already crossed this limit in the year 2011 (William-Oerberg 2014). The increasing pressure on camping grounds will lead to further degradation of catchments and the pastures.

Recognizing the conservation significance of the area, the entire Indian Changthang was declared a protected area (Chundawat and Qureshi 1999). However, due to lack of alternatives, local people are forced to depend on the scarce natural resources and the designated protected area status has been ineffective. From our synthesis we conclude that instead of developing conservation measures for individual lakes, an integrated landscape approach is required to conserve the complex system of lakes and marshes in Changthang. Declaring the area as a Biosphere Reserve would be a welcome step. Studies to assess the carrying capacity of the proposed Biosphere Reserve in terms of livestock density, biomass productivity, negative human-wildlife interaction and number of tourists, needs to be conducted and incorporated in the decisions pertaining to its management. Local level institutions need to be established to resolve the conflict over resource use between the communities in the region. Studies on the movement pattern of waterbirds would be helpful for transboundary collaboration as species like bar-headed goose and black-necked crane migrate between India and China, and other countries as well (WII 2014; Mahar et al. in press). Eventually, developmental activities ensconced within conservation ethos is the only way to secure the long-term conservation of this fragile ecosystem.

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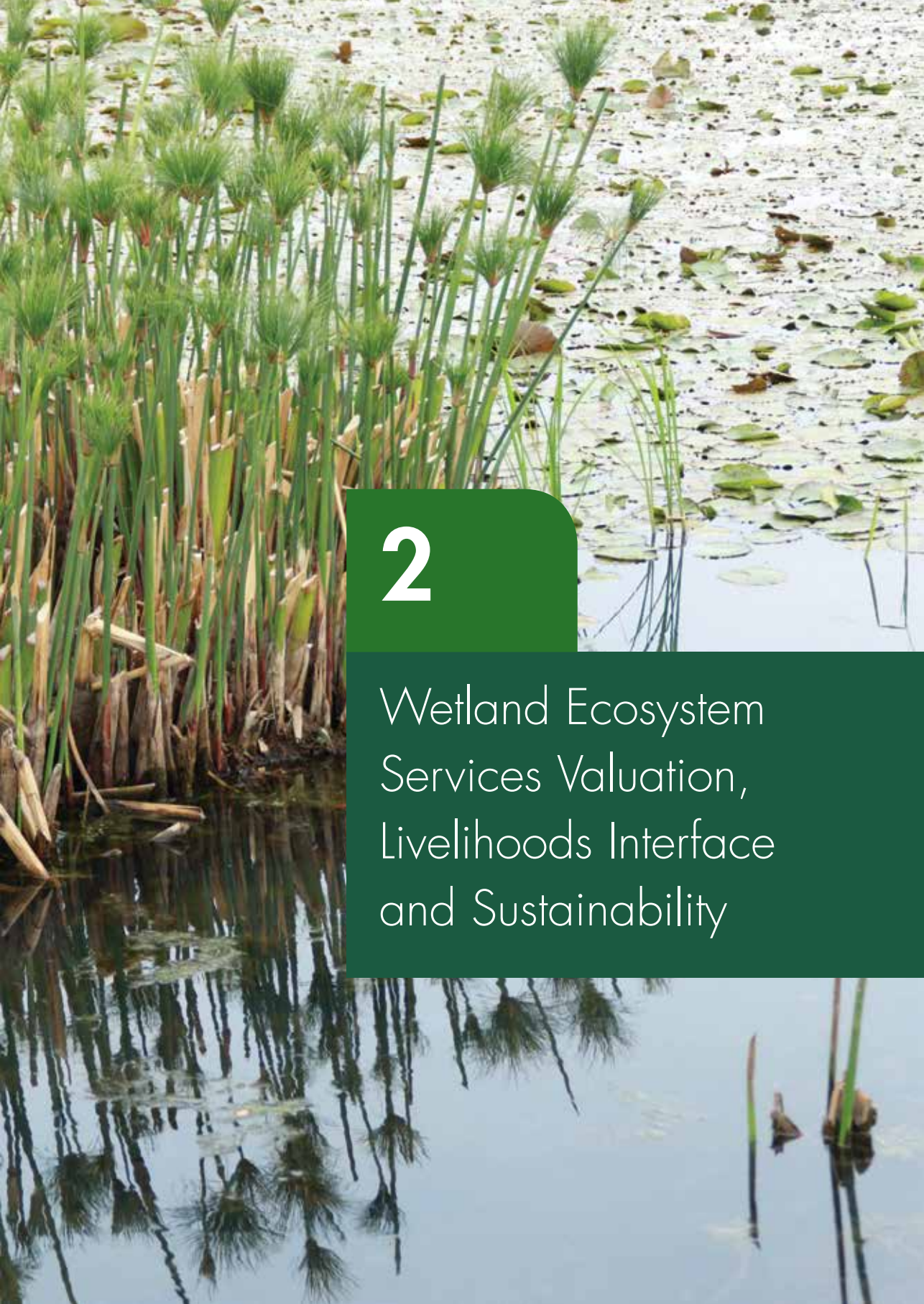

2

Wetland Ecosystem Services Valuation, Livelihoods Interface and Sustainability

The Economic Value of Ecosystem Services from Cangshan Mountain and Erhai Lake in Yunnan Province, China

Kentaro Yoshida[a] and Ke An[a]

[a] Graduate School of Fisheries and Environmental Sciences, Nagasaki University, Japan
ykentaro@nagasaki-u.ac.jp

Abstract

The purpose of this study is to evaluate ecosystem services from Cangshan Mountain and Erhai Lake in Yunnan Province. Stated preference approaches, contingent valuation method (CVM) and choice experiments were applied to elicit individual willingness to pay (WTP) and marginal WTP for conservation programmes at the area. An entrance fee for a protected area is one of the payments for the ecosystem services. Also, an ecological compensation programme in China is similar to the concept of payments for ecosystem services. The programme has been implemented for the restoration of wetlands and other ecosystems. In this study, an entrance fee for the Cangshan Mountain and Erhai Lake area, and protected area management and the ecological compensation programme were valued using two types of stated preference methods.

Keywords: Cangshan Mountain and Erhai Lake, stated preference, ecological compensation, payments for ecosystem services

Introduction

The economic valuation of ecosystem services has become an important issue for better environmental policy making practices. Most of the ecosystem services are not traded in actual markets, and then they are defined as non-market goods. In order to make their value visible for policy and business decision making, non-market valuation techniques are often employed (Ninan 2014). According to de Groot et al. (2012), one of the most common approaches to value non-market goods is the contingent valuation method (CVM). CVM is used to elicit an individual willingness to pay (WTP). Choice experiments (CEs) can also elicit an individual marginal WTP. CEs are a generalization of CVM. A referendum CVM is the two-alternative format but CEs are a multi-alternative and multi-attribute format. Thus CEs can elicit marginal WTP in accordance with the change in quantity and quality of ecosystem services provided.

One of the advantages of CEs is that it allows us to evaluate and compare a number of different attributes by one question. On the other hand, CVM can evaluate only one scenario for these attributes in one questionnaire. Due to this advantage, CEs have been drawing attention in environmental economics since the mid 1990s. An entrance fee for a protected area is a typical hypothetical payment vehicle for CVM. However, it is better to value protected area management and ecological compensation with CEs because of the complex and multi-attribute nature of services. Since CEs have the advantage of producing per-unit benefit of policy effects, it makes the connection with cost-benefit analysis easy. In this study, by conducting CVM and CEs with different hypothetical scenarios, the results of the economic valuation of Cangshan Mountain and Erhai Lake are demonstrated in terms of use and non-use value.

Methods

Stated preference approaches

Environmental valuation techniques are divided into two categories: revealed preference and stated preference. The revealed preference, like travel cost method and hedonic price method, is a method for revealing the environmental value reflected in existing market data, such as travel costs and land prices. The stated preference, as represented by CVM and CEs, is a method for revealing environmental value based on the valuations stated by beneficiaries in a questionnaire survey. However, CVM has its limitations. It can evaluate only a combination of single attributes or levels per question. For example, when evaluating ecosystem services from wetlands, CVM allows examination of only one kind of scenario, such as "implementing a programme to restore 10% of wetland vegetation over the next 5 years". Therefore, in order to compare different kinds of policy alternatives, it is necessary to develop several kinds of questionnaires. Cangshan Mountain and Erhai Lake can be divided into several attributes, such as wetland restoration, Erhai Lake core zone, and Cangshan core zone. CEs not only allow direct comparison of various policy alternatives by using only one questionnaire but also reveal the value of each attribute.

Contingent valuation

In CVM, respondents are directly asked through an interview or questionnaire about their WTP for environmental improvement. A hypothetical situation is presented to respondents. The most crucial part in CVM is the design of the hypothetical situation. The following is the main part of the questionnaire.

"Cangshan Mountain and Erhal Lake are rich in the natural environment. Currently, visitors enjoy the natural environment without paying an entrance fee. Suppose you are asked to pay an entrance fee at the gate when you visit there – would you want to enjoy the natural environment even if you have to pay the fee? Revenues from the entrance fees paid by visitors are used for the maintenance of recreational facilities and conservation of wildlife and ecosystems, excluding fees for sightseeing bus and cruising."

Double-bounded dichotomous choice was employed to reveal respondents' WTP. In a dichotomous choice questionnaire, the respondent would say yes or no to a value arbitrarily chosen by the researcher. Respondents encountered two steps of dichotomous choice. This study adopted a model developed by Hanemann et al. (1991) to estimate individuals' WTP from the double-bounded dichotomous choice questionnaire. The logarithm-logistic distribution was employed as the probability distribution function. Threshold values (bid), i.e., amount of a hypothetical entrance fee, ranged from 10 to 150 RMB (USD 1.14 to 21.67).

Choice experiments

CEs involve selecting one alternative from among several kinds of policy alternatives. A profile design is important in conducting CEs. Attributes and levels should be presented as policy alternatives to respondents. The CE questions were designed around four attributes: wetland restoration, Erhai Lake core zone, Cangshan Mountain core zone, and a contribution to a conservation fund. Respondents are asked to select one policy alternative to conserve the protected areas.

Wetland restoration and expansion of the core zone in the protected area was a hypothetical scenario but based on an actual ecological compensation programme and protected area management. The attribute of wetland restoration indicated the conversion of farmland to wetland and the expansion of the area. The levels of restored wetlands were status quo (7 km^2), 9, 11, 13, and 15 km^2. The levels of the area of Erhai Lake core zone were status quo (5 km^2), 20, 35, 50, 65 km^2. The levels of the area of Cangshan Mountain core zone were status quo (165 km^2), 235, 305, 375, and 445 km^2. The levels for the amount of contribution were 0, 20, 40, 60, 80, 100, and 120 RMB (i.e. USD 0, 2.89, 5.78, 8.67, 11.56, 14.45 and 17.34). Table 5.1 shows an example of a choice set presented to respondents. Different options were presented eight times to each respondent. The respondents were asked to select only one option for each plan. Combinations of profiles were determined on the basis of the orthogonal factorial design.

Study area and survey administration

Cangshan Mountain and Erhai Lake are becoming a popular tourist destination with an increasing number of visitors. The total area of Erhai Lake is 257 km^2, and 251 km^2 of the area is designated as a protected area. About 5 km^2 of Erhai Lake is designated as the core zone of the protected area. In the core zone, visitor access is restricted for wildlife protection.

Table 5.1: **Example of a choice set for choice experiments**

Attribute	Plan 1	Plan 2	Plan 3	Status quo
Wetland restoration	15 km^2	15 km^2	13 km^2	7 km^2
Erhai Lake core zone	35 km^2	50 km^2	50 km^2	5 km^2
Cangshan Mountain core zone	445 km^2	305 km^2	375 km^2	165 km^2
Contribution to a fund	40 RMB	40 RMB	20 RMB	0 RMB

The total area of Cangshan Mountain is 840 km^2, out of which 546 km^2 of the area is a protected area and a total of 165 km^2 is designated as the core zone. Since Erhai Lake is surrounded by sightseeing spots and urban districts, the core zone of lake area is smaller than that of the mountain area. A variety of species inhabit Cangshan Mountain and Erhai Lake natural protected area with a unique and key fauna and flora. There are 2,330 seed plants, and 15% of them are endemic to Yunnan Province. There are 433 animals, and 23 of them are protected species. Around Erhai Lake, restoration programmes (ecological compensation) have been implemented in 7 km^2 of the wetland.

We developed a web-based questionnaire survey to gather responses from residents of Yunnan Province, China. The online survey was carried out in March 2015 in association with Macromill, Inc. Finally, we obtained 496 responses.

Main demographics are as follows. The gender ratio, male and female, was fixed to 50% each in advance. A percentage of each age group was 20–29 (27%), 30–39 (29%), 40–49 (24%), 50–59 (10%), and over 60 (10%). Place of residence was Kunming (56%), Dali Bai Autonomous Prefecture (11%), Lijiang (7%), and others (26%).

Results and Discussion

Table 5.2 is a statistical summary of variables used for CVM. Table 5.3 shows an estimation result of CVM. It is noteworthy that "Ecotourism abroad" and "Compliance with tourist rules and regulations" were statistically significant. It means that WTP of respondents who had ecotourism experience abroad and positive attitude toward compliance with rules and regulations at natural parks were likely to be higher. It was also demonstrated that

Table 5.2: **Statistical summary**

Variable	Description	Mean (SD)
Threshold value (bid amount)	Chinese yuan (RMB)	–
Age	Age (years old)	39.0 (12.5)
Place of residence	1=Dali; 0=others	0.116 (0.321)
Ecotourism abroad experience within a year	1=yes; 0=no	0.495 (0.500)
Use of collected fees for tourist facility	5= very important; 4=important; 3=neutral; 2=not so important; 1=not important at all	4.42 (0.644)
Use of collected fees for wildlife conservation	5= very important; 4=important; 3=neutral; 2=not so important; 1=not important at all	4.55 (0.586)
Use of collected fees for congestion alleviation	5= very important; 4=important; 3=neutral; 2=not so important; 1=not important at all	4.12 (0.847)
Compliance with tourist rules and regulations	1=should comply with rules and regulations; 0=others	0.595 (0.491)

*SD=Standard Deviation

respondents who thought enriching and maintaining tourism facilities and promoting wildlife conservation were important ways to use the collected fees had higher WTP.

Table 5.4 estimated coefficients and marginal WTP of CEs. The result showed that each parameter estimation of CEs was significant at 1% level. Marginal WTP for wetland restoration was 11.9 RMB/km^2/person/annum (USD 1.72 /km^2/person/annum) and the highest. Marginal WTP for the expansion of Erhai Lake core zone was 1.19 RMB (i.e. USD 0.17) and the expansion of Cangshan Mountain core zone was 0.364 RMB (i.e. USD 0.05). The amount of WTP may correspond to the difference in the size of each attribute.

Table 5.3: **Estimation results of CVM**

Variable	Coefficient (*t* value)	
Intercept	2.33	(2.48)
Log. of threshold value	-1.70	(-14.5)
Age	-0.00674	(-0.908)
Place of residence	-0.375	(-1.24)
Ecotourism abroad	0.757	(3.80)
Tourist facility	0.595	(3.63)
Wildlife conservation	0.501	(2.73)
Congestion alleviation	0.189	(1.66)
Tourist rules & regulations	0.557	(2.86)
# of observations	481	
Log likelihood	-511.5	
Median WTP (RMB)	143	
90% confidence interval	[129 - 162]	
Mean WTP (RMB)	276	
90% confidence interval	[224 - 374]	

Table 5.4: **Estimation results of choice experiments**

Variable	Coefficient (t value)	Marginal WTP (RMB/km^2)
Wetland restoration	0.112 (13.2)	11.9 [10.1 – 13.8]
Erhai Lake core zone	0.0112 (9.93)	1.19 [0.976 – 1.39]
Cangshan Mountain core zone	0.00343 (13.5)	0.364 [0.317 – 0.417]
Contribution to a fund	-0.00945 (-12.1)	–
# of observations	3,968	–
Log-likelihood	-5,107.4	–
Note: Figures in [lower bound – upper bound] are 90% confidence interval.		

Conclusion

In this paper, we applied the stated preference approach to elicit WTP and marginal WTP for ecosystem services from Cangshan Mountain and Erhal Lake in Yunnan Province. The result of CVM evaluated the use value of recreational and cultural services from Cangshan Mountain and Erhai Lake. An average respondent was willing to pay RMB 276 (USD 38.64) as an entrance fee, which is a form of payment for ecosystem services. On the other hand, CEs evaluated the non-use value of Cangshan Mountain and Erhai Lake, and the surrounding restored wetlands. Respondents were willing to pay for wetland restoration programme, and the expansion of core zone for wildlife protection and conservation. CVM result also suggested that ecotourism experience abroad and positive attitude toward compliance with rules and regulations were likely to increase individual WTP.

In China, ecological restoration programmes and payments for ecosystem services have been drawing attention (Yin and Zhao 2012). This case study of economic valuation will provide useful information while planning and implementing payments for ecosystem services and similar schemes for nature conservation.

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Peatlands Valuation and Livelihoods in Zoige Plateau, China

Xiaohong Zhang[a]

[a] Wetlands International-China, Beijing, P.R., China
zxh@wetwonder.org

Abstract

The Earth's ecosystems are the natural foundation of human civilization. A robust, healthy and sustainable ecosystem is a prerequisite to social and economic development. Mountain peatlands in the temperate zone represent a small proportion of the global peatland resource, but play a unique role in the regional water and biogeochemical cycles; however, their role is not adequately recognized. Zoige marshes, situated in the east edge of Qinghai-Tibet Plateau, straddles Gansu and Sichuan Provinces, consisting of the world's largest contiguous peatlands in the high-altitude region. However they are being degraded by human interventions. As a result, carbon dioxide (CO_2) stored in the peat for thousands of years would release into the atmosphere, causing the temperature to rise. Therefore it is important to evaluate the functions and services delivered by the peatland ecosystem. This study will provide a basis for supporting policies or conservation strategies. Market and non-market monetary methods and a literature review were conducted to assess the values of the ecosystem and biodiversity based on current data and annual statistical records. The valuation showed that the regulation function plays a more important role than the provisioning, supporting and cultural functions. Peatlands conservation or restoration in Zoige Plateau would enhance the provision of ecosystem services and be beneficial to local livelihoods.

Keywords: ecosystem functions, evaluation, peatland restoration, Zoige Plateau

Introduction

Northern China peatland ecosystems are usually characterized by relatively low soil temperatures and anoxic soil conditions, as water saturation limits oxygen diffusion throughout most of the peat profile (Gorham 1991, Turunen et al. 2002). Peatlands cover 3% (some 4 million km^2) of the Earth's land area (Global Peatlands Initiative 2002) and store a large fraction of the world's terrestrial carbon resources: up to 528,000 megatonnes (Gorham 1991; Immirzi and Maltby 1992), equivalent to one-third of global soil carbon and to 70 times the current annual global emissions from fossil fuel burning. However, some 80% of the earth's surface shows evidence of human intervention (Ellis and Ramankutty 2008). This implies great losses of biodiversity (Butchart et al. 2010) and of the variety and amount of all ecosystem services except certain provisioning services (MEA 2005). Ecosystems have been profoundly degraded over the last 50 years and pressure on them continues unabated. Some

of the key ecological processes have exceeded their thresholds, which may lead to the collapse of some vulnerable ecosystems. A large part of such environmental degradation is due to the expansion of the agricultural frontier in many parts of the world together with intensification of farming practice (Mulitza et al. 2010; Birdlife International 2008). For instance, Ellis and Ramankutty (2008) results indicated 14 of the world's 21 major biome types related to agricultural use. Predictions suggest that people's footprint will expand in the future (Hockley et al. 2008; FAO 2010; Pereira et al. 2010; WWF 2010). History tells us that failure to understand and appreciate the value of nature leads to the downfall of cultures and kingdoms. Since the industrial revolution, depletion of natural resources and destruction of the ecosystems have affected the global environment and resources. Natural disasters including those caused by global warming and loss of ecosystem services, remind us that the world needs smarter and more effective strategies to secure our future. Since the release of the Millennium Ecosystem Assessment in 2005, United Nation Environment Programme (UNEP) has driven a global push to value and account for the services provided by ecosystems natural capital in development planning. This is essential to build sustainable and resilient economies, and protect the glorious biodiversity of our planet, by conserving the natural resources upon which human well-being depends.

The many global initiatives in place have led to an impressive groundswell at the national level. UNEP now works in 58 countries, including through the Economics of Ecosystems and Biodiversity (TEEB) and the valuation of ecosystem services and natural capital accounting. Currently, a number of European Union (EU) member states have already started to implement TEEB (2010) inspired processes to assess, map and value ecosystem services and to stimulate related actions to maintain, restore and develop these services. Furthermore, the European Commission is supporting the implementation of TEEB in a number of developing countries in line with Target 6 of the Biodiversity Strategy: helping avert global biodiversity loss. Wealth Accounting and Valuing Ecosystem Services is an initiative of the World Bank to implement green accounting in a critical mass of countries, both developed and developing. The partners want to take natural capital accounting, such as timber and minerals to include ecosystem services and other natural resources that are not traded or marketed and are therefore harder to measure. That includes the "regulating" services of ecosystems, such as forests for pollination and wetlands for reducing the impact of floods.

The Chinese government, working with EU, has trailed the TEEB in the selected landscapes and sites at different levels from the policy making and site test perspective to mainstream ecosystem valuation into the national natural capital accounting system. Apart from that, some Chinese national researches have also been undertaken to evaluate marshes and freshwater lakes, as these wetlands are strategically important for ensuring water supply; they provide habitats for species and livelihood options; they are vulnerable to natural disasters; and they face degradation due to development activities. The national wetland economic loss inventory and assessment (2008) defined by the land reclamations indicated that in 2006 the economic loss from natural wetlands accounted 0.49% of national gross domestic production.

The coastal wetland ecosystem services and functions assessment is still under way with an aim to determine ecosystem evaluation methodology and estimate the total values delivered by the coastal wetland services.

As part of the Qinghai-Tibetan Plateau, the Zoige Plateau contains the world's largest high-altitude peatlands (Chai et al. 1965; Sun et al. 1987) and they are playing an important role in water regulation, carbon sequestration and biodiversity preservation. Being a major water source of the Yellow River and functioning as natural sponges through either buffering water resulting from rainfall and snowmelt events or slowing down the release of water to the downstream areas (Parish et al. 2008; Zhang and Liu 2009), the Zoige peatlands reduce the severity of flood and drought in the upper Yellow River watershed, which has millions of residents, and sustain the unique biodiversity, particularly as a breeding site for black-necked crane (*Grus nigricollis*) (Scott 1993; Zhang and Luo 1991), and support some endemic and endangered Himalayan species (Tsuyuzaki et al. 1990). The local Tibetan pastoralists have been using the peatlands and the ambient uplands for livestock grazing over thousands of years, which has become a unique Tibetan cultural heritage.

Methods

This peatlands evaluation study was carried out with an expectation that it would help local policy makers better understand the value of peatland ecoystem and further take some actions to protect the remaining intact peatlands and make commitment to restore the degraded peatlands. The results clearly indicated that the regulation function is significant as peatlands have a key role in regulating climate, buffering floods and droughts and carbon sequestration (Zhang et al. 2011). Realizing the problems in the Zoige Plateau, international organizations working with local government have taken some approaches to halt its further degradation. Approximately 1,500 ha of degraded peatlands have been rewetted using the damming approach with very little expense (Zhang et al. 2012). Local government has allocated 0.2% of each fiscal year budget to continue the restoration of the peatlands.

Results

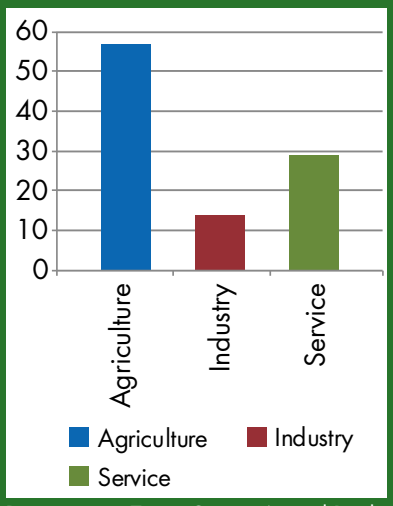
Peatlands in Zoige Plateau are severely degraded

Peatlands cover an area of 473,348 ha; 23% of them are still in good condition and 77% are in various stages of degradation (Zhang et al. 2012). Comparison with older satellite images indicates that the area of degraded peatland has almost doubled in the last 30 years. Peatland degradation, habitat fragmentation, and land use changes have been attributed to many factors such as overgrazing, mining, drainage, and logging activities with enormous social-economic consequences (Joosten et al. 2008) while global climate change may also play a role. Peatlands degradation would have some negative impacts on their functions and services they deliver for water supply, productivity, and mitigation of natural disasters. The provisioning, regulation, supporting and cultural services were evaluated by direct and indirect pricing.

Livestock population and their value

Taking an example from livestock husbandry, the statistical data indicates 87% of local people practice grazing. The major income source of these people comes from agriculture which is 57%; and other sectors account only small proportion (Figure 6.1). In terms of local market price of livestock (yak, sheep) and their by-products (fur, dairy products), the annual total value goes up to RMB 6.09×10^8 (USD 0.85×10^8).

Figure 6.1: **Percentage of the different industry in Zoige County**



Data source: Zoige County Annual Book

Value of climate regulation

The value of climate regulation is estimated based on evaporation of water surface. The average evaporation was 5.19×10^9 m^3 in the Zoige Plateau. The total amount of heat absorbed was 11.7×10^{15} KJ and the total value of temperature regulation is estimated RMB 56.3×10^{10} (USD 7.88×10^{10}) based on the refrigerator cooling energy consumption and local electricity price. Likewise, the total value of increased air humidity is estimated RMB 33.7×10^{10} (USD 4.71×10^{10}).

Value of gas regulation

The annual carbon storage is measured according to the biomass and carbon content of the Zoige Plateau (Tian 2005). Carbon emissions from soils and grazing are calculated based on the studies of Tian (2005), Wang et al. (2001), Wang and Li (2007). Finally, the economic values of carbon storage of the Zoige Plateau are calculated based on the carbon tax method. The total value of carbon storage in the Zoige Plateau amounts to RMB 7.27 billion (USD 1.01 billion).

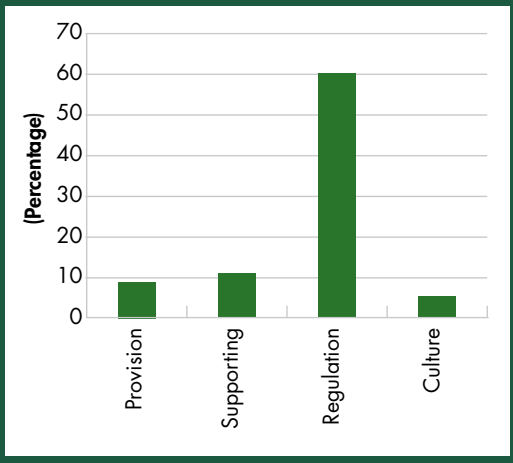
Value of water regulation

Water storage capacity of the Zoige Plateau is calculated according to data from the Water Resources Bureau of the A'ba Prefecture in Sichuan Province, the per unit storage capacity cost in this area is 1.39 RMB/m^3 (USD 0.19/m^3). The value of water storage of the Zoige Plateau is calculated to be RMB 5.164 billion (USD 0.722 billion). Multiplying the water retention capacity of the Zoige Plateau and the industrial water pricing of Chengdu (1.70 RMB/m^3), an estimated value of water of retention is RMB 3.516 billion (USD 0.49 billion).

Value of tourism industry

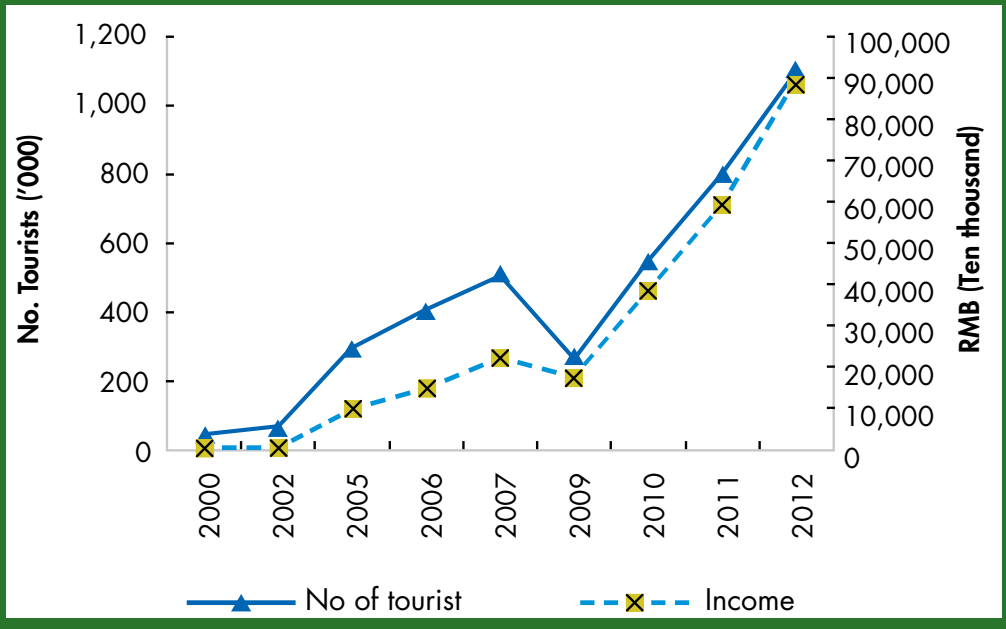
The Zoige Plateau as a remote area, it was not accessible in the past. With road improvement and people's income increasing, tourism has become an emergent and prosperous industry. The Zoige Plateau has attracted a number of tourists because of its wildness, picturesque landscapes and unique culture and provides several ecosystem services (Figure 6.2). Based on the calculation of travel cost, a total 847,600 person/time visited the Zoige Plateau in 2011 and the total recreational value amounted to RMB 730 million (USD 102.2 million) while the tourism industry has steadily increased. The total value of wetland ecosystem services provided by the Zoige ecosystem is estimated to be RMB 9.72 billion (USD 1.36 billion) (Figure 6.3).

Figure 6.2: **The percentage of total ecosystem services values in Zoige Plateau**



Source: Ruoergai County Annual book

Figure 6.3: **Annual tourism industry income and numbers of tourists in Zoige Plateau**



Discussion

The different methods for land use and land cover change and the hierarchical structure model for social welfare weight were used for wetlands valuation in the Zoige Plateau (Li et al. 2010; Zhang and Lu 2010). Final results showed that regulation is significant in valuation processing.

The livestock population increased sharply in the last century and maintained an increasing trend (Figure 6.4). But in recent years the numbers of livestock began to decrease slightly (Figure 6.5), and this implies that the grasslands could not hold such amount of livestock in this region. However, the tourism income apparently increased. This trend indicates that herders are aware of the problem caused by overgrazing and they have to change their income sources. Although overgrazing is a major cause of environmental degradation, ecological restoration of peatland offers opportunities to reconcile grazing production with enhancement of biodiversity and ecosystem services other than production. Restoration has the potential to enhance livestock production, other ecosystem services and biodiversity at both the pastureland and landscape scale. Therefore, overgrazing has been restricted to recover wetlands and grasslands at the local level.

Scientists have been aware of the link between peatlands management and CO_2 emissions, but policy makers and peatland managers are still insufficiently aware of the global implications of local and national peatlands management strategies and actions. As a result,

Figure 6.4: **Livestock population in different periods of time in Zoige Plateau**

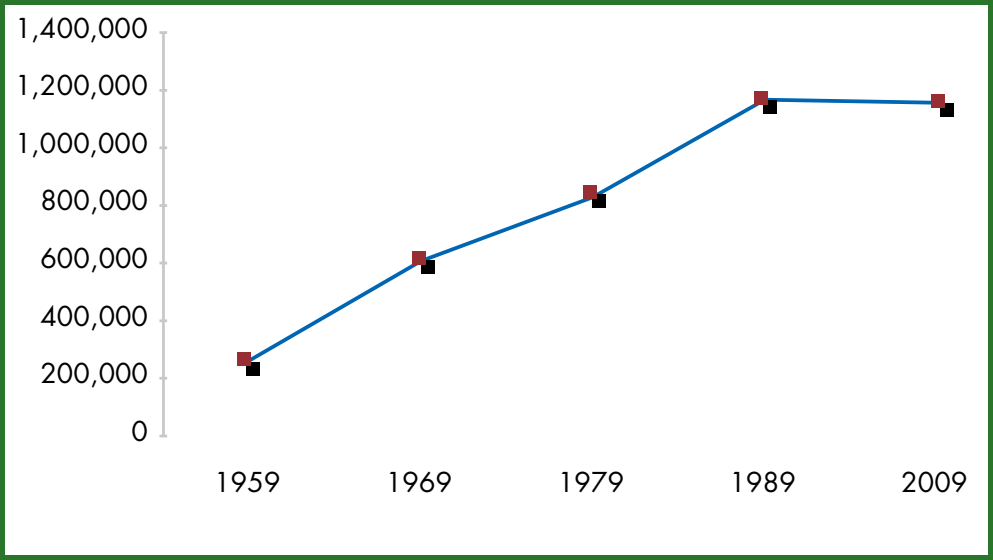
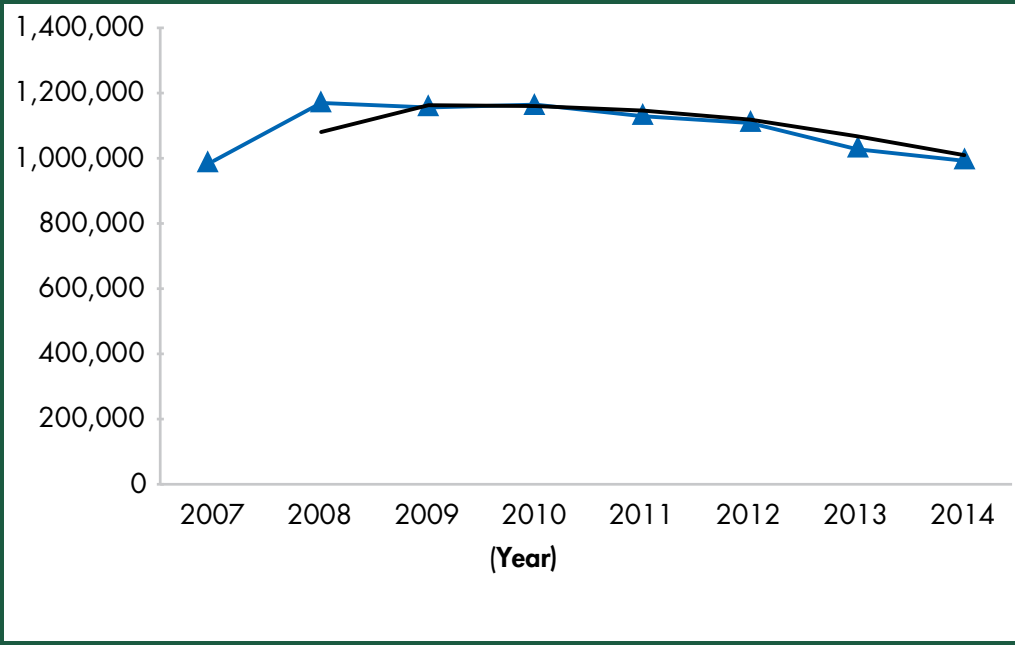


Figure 6.5: **Livestock population trends in recent year in Zoige Plateau**



CO_2 emissions from the drained peatlands are not yet recognized in the global climate change debate, and coordinated international action required to support better management of the peatlands has yet to start.

Conclusion

We need wide expansion of peatlands management based on ecological knowledge: biodiversity-based practices, learning from traditional grazing practices, highly specific actions to benefit biodiversity and especially ecosystem services, and conversion of some grassland into wetland ecosystems. Financial support, public awareness, and education and training, particularly of herders, are necessary to accomplish such objectives. Restoration actions can act as an engine of green economy development and a source of livelihood so policy makers have an extra incentive to restore degraded peatland habitats. The economic valuation could help provide a basis for establishing an ecological compensation mechanism and prioritizing wetland restoration programme.

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(Note: 1 RMB= USD 0.14)

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Understanding Coupled Human and Natural Systems in the Koshi Tappu Wildlife Reserve, a Ramsar Site in Nepal

Nakul Chettri[a], Sunita Chaudhary[b], Kabir Uddin[a], Bikash Sharma[a], Pratikshya Kandel[a], Top Bahadur Khatri[c], Maheshwar Dhakal[d], Wu Ning[a] and Eklabya Sharma[a]

[a] International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal
[b] Department of Geography and Planning, Macquarie University, Sydney, Australia
[c] Department of Hydrology and Meteorology, Nepal
[d] Ministry of Forests and Soil Conservation, Kathmandu, Nepal
nakul.chettri@icimod.org

Abstract

Despite local, national, and global efforts to mitigate undesirable ecosystem change, anthropogenic impacts on Earth's systems are intensifying. However, the understanding of coupling of ecological and social sciences is limited. Focusing on Koshi Tappu Wildlife Reserve (KTWR) of Nepal, we assessed biophysical, socio-cultural and economic values to understand the coupling of local inhabitants with the surrounding ecosystems. We rationalize the importance of KTWR through assessment of biophysical values as a habitat for 15 globally significant species, socio-cultural values based on dependency on ecosystem services and economic values of some selective services, related with ongoing land use and cover change results of the past 34 years. In the matrix analysis, swamps/marshes scored highest in terms of the number of species (15), followed by forest (14), river and lake (13), grassland (12) and, finally, agriculture (2). Among the forest services, fuelwood is the topmost product for which 91% of the local population are dependent for cooking. In addition, wetland is a source of many commodities such as fish (38%), driftwood (31%) and snails (23%). The overall economic benefit generated from the selected services was estimated to be approximately USD 16 million per year (NPR 1.38 billion), equivalent to a net present value (NPV) of around USD 444 million. However, over the last 34 years, significant changes in land cover and ecosystem types have been observed. The forest ecosystem was reduced by 94% compared to 1976 whereas the grassland has increased by 79%. It is also interesting to note that rivers/streams, which cover 10% of the total area, and swamps/marshlands, which cover 5%, provide many important services. Therefore, understanding the values in both monetary and non-monetary terms, including people's dependency on the ecosystem services and the dynamics of the ecosystems, could be important for improving the flow of ecosystem services and management of the reserve.

Keywords: ecosystem services, values, land use and cover change, coupling, Nepal

Introduction

Despite local, national, and global efforts to mitigate undesirable ecosystem change (COP 2011), anthropogenic impacts on Earth's systems are intensifying (MacDougall et al. 2013). This widespread failure to steer human behaviour has brought with it a growing recognition that solutions to environmental challenges need to transcend disciplinary boundaries and, specifically, incorporate social considerations (Mlambo 2012; Hicks et al. 2015). Ecosystem services are defined as the conditions, processes, and components of the natural environment that provide both tangible and intangible benefits for sustaining and fulfilling human life (Daily et al. 2009). They are also considered products of coupled and nested social-ecological systems and they should be measured in the complex context of those socio-ecological systems (Fisher et al. 2009; MEA 2005; Reyers et al. 2013). Although there is an explicit focus on steering human behaviour toward a more sustainable path, the concept of ecosystem services (ES) has to date largely come from the ecological or economic sciences (e.g., Balvanera et al. 2006; Mace et al. 2011; Bateman et al. 2013) and lacked integration with the broader social science literature about people's choices and behaviour (Bryan et al. 2010; Milner-Gulland 2012). In response, the Millennium Ecosystem Assessment (MEA 2005) endorsed an ES approach that explicitly recognizes the benefits people gain from nature. By describing how nature is a benefit to people, the ES approach aims to align environmental sustainability with human well-being and thus build support for conservation and sustainable resource management (Daw et al. 2011; Hicks et al. 2015). ES depend on the interactions and feedbacks from multiple social and ecological factors (Scholes et al. 2013). However, there is limited understanding of coupling of ecological and social sciences (Castro et al. 2014). Therefore, assessments and sustainable management of ES require an understanding of both supply and demand considering the qualities, quantities, spatial scales and dynamics that bridge ecological and social systems (Nahlik et al. 2012).

The MEA (2005) conceptual framework states that people's dependence on an ecosystem is directly linked to its ability to provide the desired services. A number of ecosystems are important for local community. Several studies emerging from the Himalayan region suggests that people have high dependency on wetland (Lamsal et al. 2014; Sharma et al. 2015) and forest ecosystems (Chettri et al. 2013). These wetland ecosystems are facing numerous threats such as over extraction of resources, land use change and climate change, to name a few (Romshoo et al. 2011; Gopal 2013; Rashid et al. 2013; Davidson 2014). It is therefore necessary to understand the role of ecosystem services to ensure human wellbeing in order to justify conservation and improve ecosystem management in the region. To rationalize the value of wetland ecosystem and its services, we conceptualized a research framework to link natural and social interaction and made an attempt to (a) understand the value of ecosystem services based on ecological (biophysical), socio-cultural and economic values based on people's dependency on various types of ecosystem services; and (b) assess spatial and temporal changes of ecosystem and its impacts.

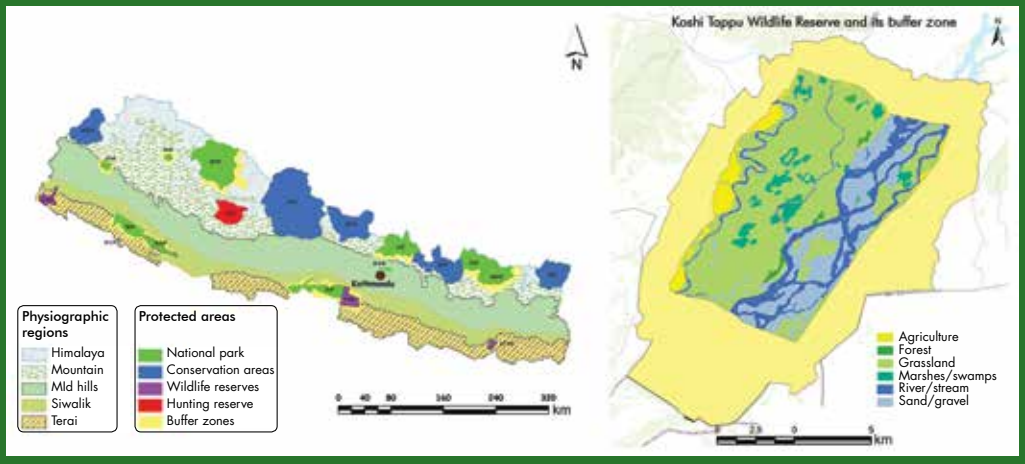
Materials and Methods

Study area

Situated between 86° 91′-87° 08′ E and 26° 72′-26° 56′ N, Koshi Tappu Wildlife Reserve (KTWR) is one of the most important wildlife reserves of Nepal (Figure 7.1). The reserve, a protected area established in 1976 under IUCN category IV, spreads over an area of 175 km^2 (IUCN 1990). It is the habitat for the last remaining population of Wild Water Buffalo (*Babalus arnee*), and was also designated as a wetland of international importance by the Ramsar Convention in 1987 for its special value in maintaining the genetic and ecological diversity of the region (Sah 1997). Located in the floodplains of the Sapta Koshi river, KTWR is a freshwater, natural and permanent river system. The reserve is rich in biodiversity with 670 species of vascular plants (Siwakoti 2006), 21 species of mammals (Chhetry and Pal 2010), 23 species of herpetofauna (Chhetry 2010), 77 species of butterflies (DNPWC 2009), 494 species of birds (BCN 2011) and provides a habitat for a large number of globally and nationally threatened species (CSUWN 2009). The reserve is also designated as one of the Important Bird Areas of Nepal and serves as a habitat for a number of threatened bird species such as Swamp Francolin (*Francolinus gularis*) and Bengal Florican (*Houbaropsis bengalensis*), etc. (Baral and Inskipp 2005). The wetland is also home to Ganges River Dolphin (*Platanista gangetica*), Gharial (*Gavialis gangeticus*) and Smooth-coated Otter (*Lutrogale perspicillata*). These globally important species play a vital role in maintaining the ecological integrity of the area.

Before its declaration as a reserve by the Government of Nepal, the area was accessible to local communities for fishing, hunting, grazing, livestock, and collecting fodder, fuelwood, and other resources (CSUWN 2009). However, their access was completely denied with the

Figure 7.1: **Protected areas of Nepal and map of Koshi Tappu Wildlife Reserve**



Source: ICIMOD and MoFSC 2014

declaration of the reserve, resulting in illegal harvesting of resources (Heinen 1993). To halt illegal harvesting and meet the basic needs of people, the KTWR established a buffer zone of 173.5 km^2, encompassing 16 village development committees (VDCs) from Sunsari, Saptari, and Udayapur districts with a total population of 93,000 people from 16,280 households (CSUWN 2009). The overall literacy rate is 44.6% and agriculture is the dominant mode of production for 87.3% of households. Only 20% of households are food secure. Livestock density is very high with 1.5 cattle per household. Harvest and use of resources from this important floodplain has a prominent role in local people's occupations and way of life. Besides subsistence farming, livestock rearing is a major economic activity, and income from livestock contributes a substantial proportion of local household income (Sah 1997; CSUWN 2009). A large proportion of communities still directly or indirectly depend on KTWR for various goods and services (ICIMOD and MoFSC 2014).

Ecosystem services valuation

It is high time that ecosystem service valuation incorporate the values perceived by those who benefit from the services and not be limited to economic values (Carpenter et al. 2009). This is important for decision-makers to assess the full range of ecosystem values including the socio-cultural, ecological, and intrinsic in addition to utilitarian values (MEA 2003) and to be informed by analysis of integrated socioeconomic and biophysical data (De Lange et al. 2010). With this realization, we referred to the valuation approach of Castro et al. (2014), where the values were based on biophysical (biodiversity), socio-cultural (benefits received from the ecosystems) and economic (monetary) considerations.

Biophysical values

To show the significance of the mosaic of ecosystems of KTWR as a biophysical value (biodiversity), we considered the IUCN Red List and CITES list and included 19 globally significant species in terms of their conservation values such as Endangered (EN), Vulnerable (VU), Critically Endangered (CE) and Near Threatened (NT). We also included the representative species of migratory birds at KTWR, which is one of the most important habitats for migratory birds. In the matrix, six broad land cover types or ecosystems such as Grassland, Swamps/Marshes, Forest, Rivers/Lakes, Sand and Gravel, and Agriculture were considered for habitat mapping. Based on the habitat preference and use pattern, species were assigned presence in a particular habitat (+) or absence (-). For instance, if a certain species such as Wild Water Buffalo uses a certain land cover of ecosystems such as grassland, swamps/marshes or rivers/lakes, then a point (+) is given to those specific land uses. If a certain land use (such as gravel and sand) is not used by the Wild Water Buffalo, then (-) is given to that particular land use or ecosystems. The categorization was then validated through experts' judgement in a focus group discussion among the experts. At the end, the use and non-use values were weighted as one (1) for use and zero (0) for non-use and the values of 19 enlisted species were added. More details on the methodology can be found in Chettri et al. (2013).

Socio-cultural values

The second set of values considered were the socio-cultural values (benefits received by local people from the ecosystems), which are values assigned to services that support the well-being of human societies (Chiesura and Groot 2003; Plieninger et al. 2013). To collect the required information, we relied primarily on a socioeconomic baseline sample survey of 432 households residing in the buffer zone around KTWR commissioned by the Conservation and Sustainable Use of Wetlands in Nepal (CSUWN 2009) project, and was complemented by the recent economic valuation studies (Sharma et al. 2015; CSUWN 2011); and two research studies by Rayamajhi (2009) and Joshi (2012). Initially, an exhaustive list of ecosystem services used by the local people from KTWR was prepared. While preparing the list, emphasis was placed on the services that are widely used by a higher proportion of communities living in the buffer zone of the reserve. These services were then quantified and presented (ICIMOD and MoFSC 2014).

Economic values

The economic valuation was done using market-based and benefit transfer valuation methods (Wilson and Hoehn 2006) to estimate the economic value of major direct and indirect uses of the wetland ecosystem services provided by KTWR. The method is based on the underlying assumption that the economic value of ecosystem goods or services at a study site can be determined with sufficient accuracy by analyzing existing valuation studies at other sites. Following the enlisted services, the main ecosystem services considered for valuation included ten provisioning services (including flood plain agriculture, livestock fodder, fish, domestic water supply, fuelwood, timber, and non-timber forest products), two regulating services (flood protection and carbon sequestration), and one cultural service (tourism). Supporting services were not considered independently for valuation to avoid double-counting, as the literature suggests that they are either biophysical processes or intermediate benefits which contribute to the provision of a range of final benefits from the first three categories (Turpie et al. 2010). The present assessment did not measure the economic value of non-use values and some components of indirect use (regulating services) such as water purification and micro-climate stabilization due to lack of information and the fact that transfer of values from other contexts might not be sufficiently reliable (Sharma et al. 2015).

Land cover change analysis

The Remote Sensing data from 1976 to 2010 covering the KTWR core area were used for the periodic spatio-temporal land cover change over a period of 34 years (Table 7.1). Medium spatial resolution Landsat Multi-spectral Scanner (MSS) of 1976; Thematic Mapper (TM) of 1989; Enhanced Thematic Mapper Plus

Table 7.1: **List of Landsat imagery considered for analysis**

Satellite	Senior	Path	Row	Acquisition date
Landsat	MSS	150	42	13 November 1976
Landsat	TM	140	40	17 January 2010
Landsat	ETM+	140	40	28 October 1999
Landsat	TM	140	40	4 February 2010

(ETM+) of 1999 and TM of 2010 was used to generate a land use/land cover map and change analysis (Table 7.1). Landsat MSS, TM and Enhanced Thematic Mapper Plus (ETM+) imagery were accessed from http://glovis.usgs.gov/ whereas Shuttle Radar Topography Mission (SRTM) Digital Elevation Model was accessed from http://srtm.csi.cgiar.org. eCognition developer software was used for object-based image analysis (OBIA). For details on the method of land use and cover change analysis, refer to Chettri et al. (2013).

Results

Biophysical values

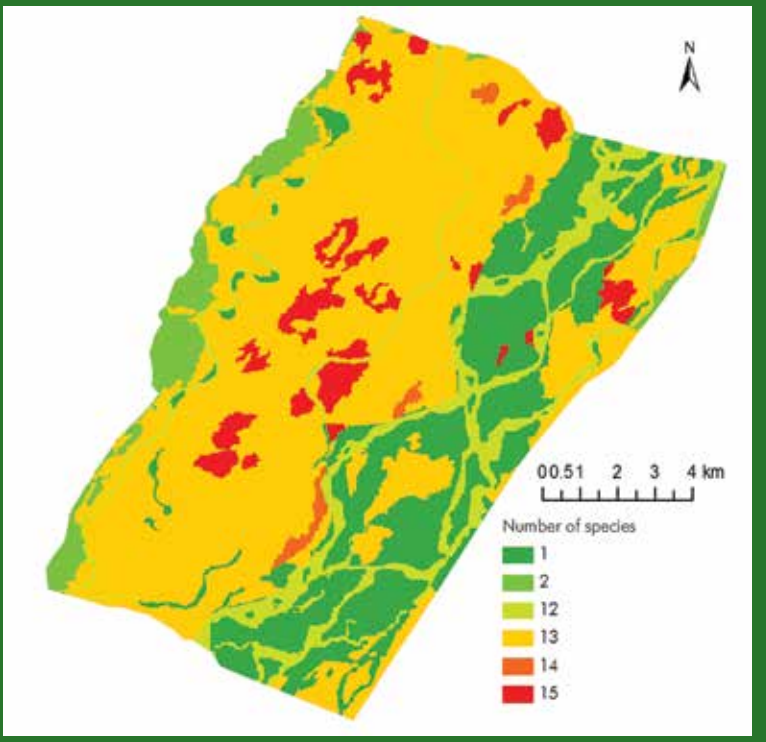
The land cover/ecosystem and habitat matrix showed that majority of species use a wide variety of land cover or ecosystems and in many cases they are overlapping. For example, Rock Python (*Python molurus*), Red-crowed Roofed Turtle (*Kachuga kachuga*), Elongated Tortoise (*Indotestudo elongate*), Greater Adjutant Stork (*Leptoptilos dubius*) and Swamp Francolin were reported from more than three land cover types or ecosystems. On the other hand, there were many species with narrow habitat choices. Gharial Crocodile and Mugger Crocodile were restricted to swamps/marshes and river/lakes. Likewise the Wild Water Buffalo and Bengal Florican showed a narrow habitat choice. In the matrix analysis, swamps/marshes scored the highest (15) for species number, followed by forest (14), river and lake (13), grassland (12), agriculture (2), and finally sand/gravel (1). It was observed that forested ecosystems of KTWR are one of the most important habitats of 15 globally significant species followed by river and lakes and grassland. These matrix ranking values were then converted to the raster maps prepared for land cover of 2010 to show their potential richness (number of species) in each of the ecosystem types defined earlier (Figure 7.2).

Socio-cultural values

The literature review showed high dependency of local people on the ecosystem services of KTWR. Among the forest products in the reserve, fuelwood is the top product on which 91% of the local population is dependent. The dependency for thatch is the second highest (82%) followed by timber (54%), grasses (51%), etc. (Figure 7.3). Likewise, people are also dependent on wetland ecosystems such as rivers/streams and swamps/marshes for a variety of goods and services such as fish (38%), driftwood (31%) and snails (23%), etc. The dependency chart (Figure 7.3) clearly shows how much the local people are dependent on the products of the reserve. Collection of these products not only contributes to their subsistence livelihoods, but also to the local economy, thus reducing poverty in the area, as reported by Rayamajhi as well (2009).

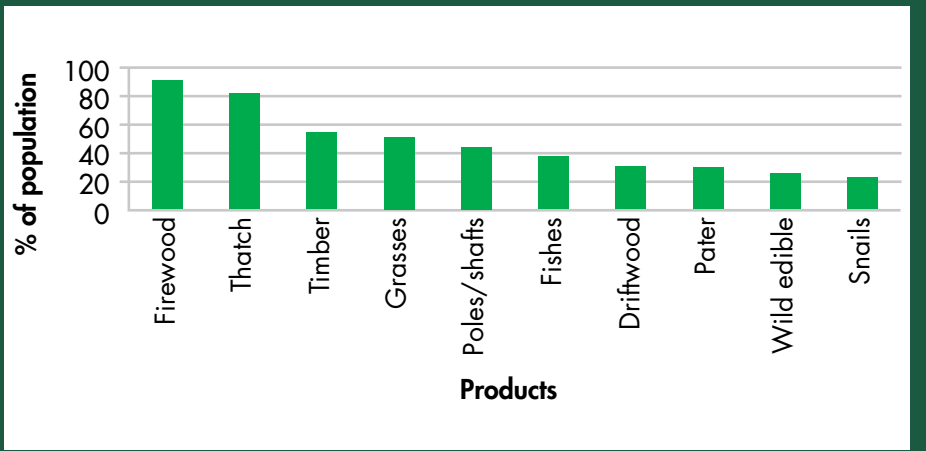
The list of ecosystem goods and services which were categorized into two major types revealed that swamps and marshes, forest, river/lakes and agriculture are sources of a range of ecosystem goods and services on which the local people are highly dependent. River/lakes and swamp/marshes are the most productive ecosystems for provisioning services with a 24% score each, followed by forest (21%), grassland (13%) and agricultural land (11%)

Figure 7.2: **Distribution and habitat use pattern of 20 threatened and endangered species in KTWR**



Source: ICIMOD and MoFSC 2014

Figure 7.3: **Dependency on natural resources from KTWR**



(Figure 7.4a). It is also interesting to note that the river/lakes, which cover 10% of the total area of KTWR, and swamp/marshland, which cover 12% of the total land, have high capacity to provide social services to the people (Figure 7.4a). Similarly, forestland with about 8% coverage offer equally high capacity of social services compared to other land uses. This means that the land use with less area coverage faces intense pressure from the people due to higher dependency as well as due to high production capacity. Similarly, local people's dependency on cultural services of the reserve has also been analyzed and similar results were found, as presented in Figure 7.4b. For the local people, the forested areas, swamps/marshes and grassland are the most valuable in terms of these services. However, it was observed that the scores obtained for cultural and supporting services are lower than other services mainly due to fewer variables used to score these services.

Figure 7.4: **Services being provided by each ecosystem of KTWR**

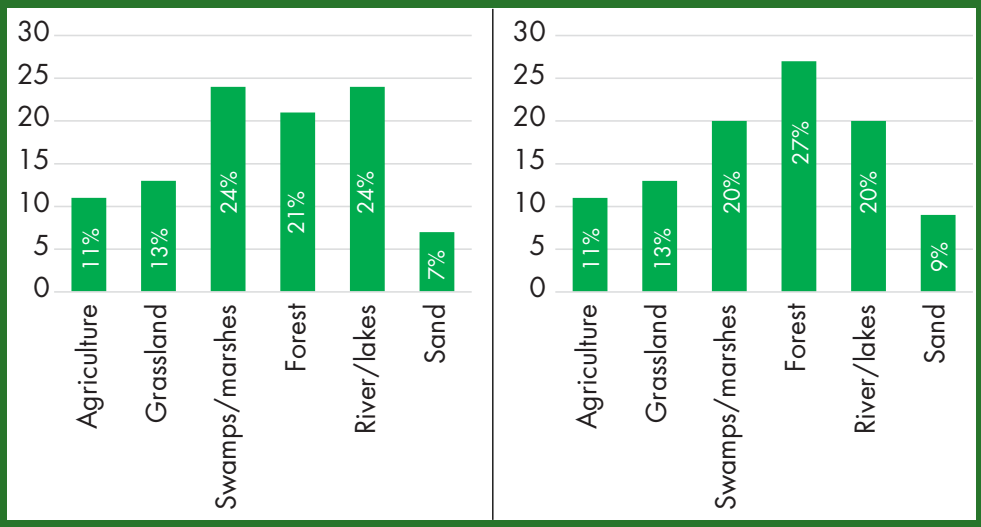


Figure 7.4a: Social services

Figure 7.4b: Cultural services

Economic values

The overall economic benefit generated from the major types of provisioning, regulating, and cultural services assessed was estimated to be approximately USD 16 million per year (NPR 1.38 billion) (Table 7.2), equivalent to around USD 959 per household per year (based on a total of 16,710 households residing in the buffer zone) or about USD 916/ha (based on the total KTWR area of 17,500 ha). This translates to a NPV of around USD 444 million, estimated from the future benefit over a period of 60 years at an assumed discount rate of 3% and constant flow of current benefit (i.e. no degradation and depletion of current benefit). This

Table 7.2: **Aggregate economic value of wetland ecosystem services provided by KTWR**

Ecosystem services	Total value (USD/yr)	Average value/ hh/yr (USD)	Value/ha/yr (USD)	% share of total ES assessed
1. Provisioning services	13,675,225	818.4	781.4	85.3
3. Regulating services	1,152,003	68.9	65.8	7.2
Flood control/prevention	952,075	57.0	54.4	5.9
Carbon sequestration	199,928	12.0	11.4	1.2
3. Cultural services-ecotourism	1,201,216	71.9	68.6	7.5
Total economic value	**16,028,444**	**959.2**	**915.9**	

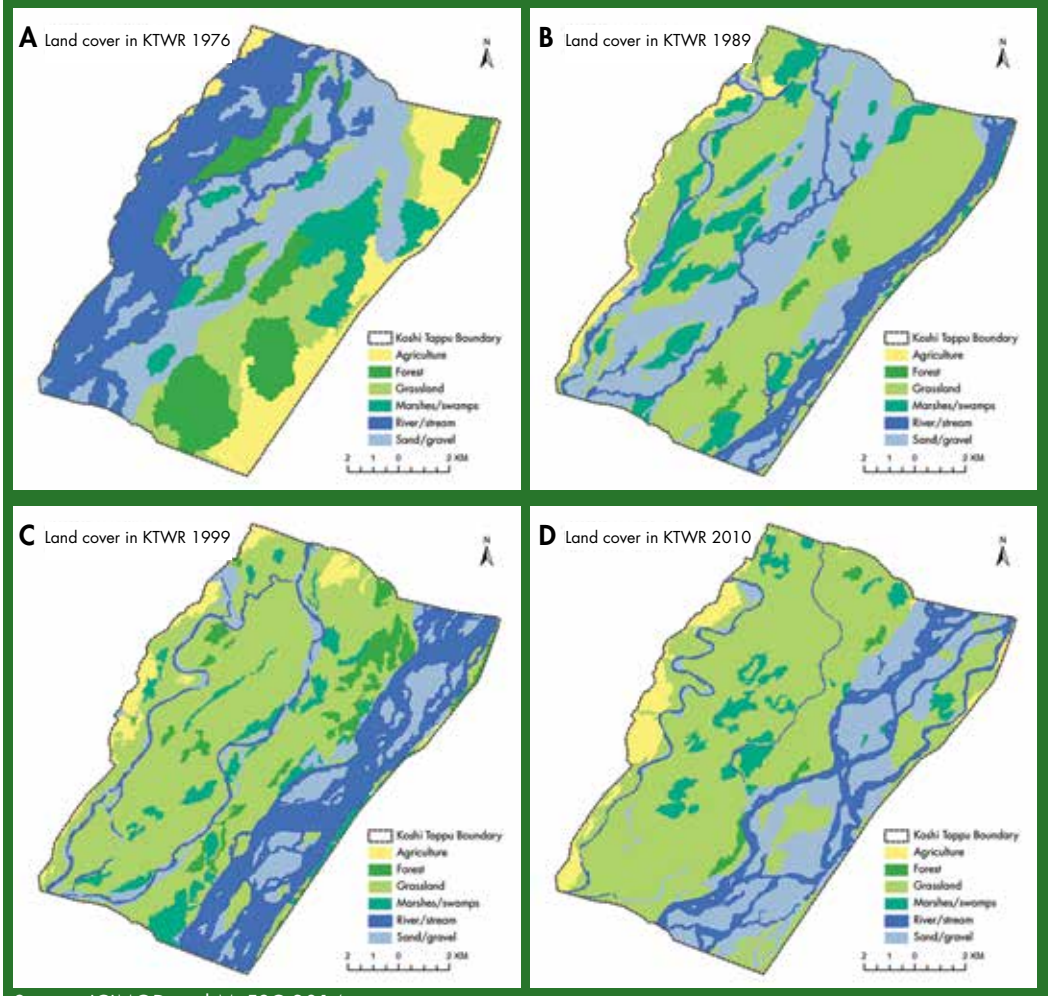
Source: Sharma et al. 2015.

estimation demonstrated the long-term economic value of KTWR. Clearly, the economic benefit generated from provisioning services ranks first in terms of contribution to estimated total economic value (85%), followed by recreational services from tourism (7.5%), and regulating services from flood control and carbon sequestration (7.2%). The benefits of different services accrue to different stakeholders. For example, the benefits of provisioning services accrue entirely to the local people, while the benefit of the regulating services such as carbon sequestration goes to the global communities. Even though many of the ecosystem services do not translate directly into household income, the finding that a large part of the estimated total value of the wetland ecosystem services accrues locally is a clear manifestation of the vital importance of these wetland ecosystem services for the livelihoods of the local people. Ensuring a sustainable flow of these ecosystem services is therefore critical for supporting local livelihoods and maintaining the global significance of KTWR as a Ramsar site.

Land cover change

As per the 2010 data analysis, KTWR showed six major land cover types with some predominant ecosystems such as grassland, forest, freshwater, marshes, etc. (Figure 7.5). The time series land use and cover change analyses (1976-2010) brought some interesting facts about the dynamic ecosystems of KTWR. The first observation was on course change of the river from west to east (Figure 7.5). During the shift over the last 34 years, significant changes in the land cover and ecosystem types have been observed. In 2010, the forested ecosystems have reduced by 94% compared to 1976, covering only 150 ha of its original state (1,853 ha) whereas the grassland has increased by 79% compared to its original state (1,716 ha). On the basis of total land cover, forests, river and stream, swamp and marshes decreased by 16%, 14% and 3% respectively over the last 34 years whereas the grassland has increased by 45%. It is also interesting to note that the river/streams covering 10% of the total area of KTWR, and swamp/marshlands, which cover 5% of the total land, provides a higher number of provisioning services to the people. Similarly, forestland with just 1% coverage is also important for a wide number of goods and services compared to other ecosystems. This means that the ecosystems with less coverage face intense pressure from the people due to higher dependency.

Figure 7.5: **Sets of maps showing land use and cover changes in Koshi Tappu Wildlife Reserve during 1976-2010**



Source: ICIMOD and MoFSC 2014

Discussion

Today, the rationale for protected area conservation has gained new momentum by linking biodiversity with ecosystem services and human well-being (MEA 2005; Cardinale et al. 2011) and many of these studies have emphasized the importance of effective conservation for continuous provision of ecosystem goods and services. Moreover, the momentum has also enabled scientists from various disciplines to think about integration of ecological, economic, and social factors by defining dependencies between natural systems and human societies (Burkhard et al. 2010; Tenberg et al. 2012; Wolff et al. 2015).

As a wetland of international importance, KTWR has been supporting and protecting natural systems and processes of the area which is supporting directly and indirectly to the benefit of local communities. It is evident from this analysis that the reserve offers a wide range of services to local communities such as fuelwood, fodder and food, as well as irrigation, water storage, carbon sequestration, pollution control, etc. to the population of the buffer zone. This is directly contributing to subsistence livelihoods of people living in the buffer zone and helping reduce poverty (Shrestha and Alavalapati 2006; CSUWN 2009). Past analysis shows that dependency of the local people on KTWR, particularly on provisioning services and cultural services, is extremely high (CSUWN 2009; Sharma et al. 2015). A similar situation was found in Cambodia, where a large proportion of people in rural areas (80–90%) depend on continued supply of local ecosystem services such as fish, wild foods, timber, wood and forest biomass and wild crops for primary source of income (Persson et al. 2010). Some of the African nations (Botswana, Mozambique, Namibia, South Africa, Swaziland, and Zimbabwe) also reported dependency on ecosystem services for one-quarter to one-third of household income, especially provisioning services (Shackleton et al. 2008).

In KTWR, sources of socio-cultural services are mostly rivers, swamps and forest ecosystems. This is obvious as forest and wetland ecosystems are the most productive ecosystems in terms of providing services (Biswas et al. 2010; Gopal 2013; Lamsal et al. 2014). This is highly relevant to KTWR as dependency of local people on forest and wetland ecosystems are substantial as other alternatives for energy and livelihood options are limited (ICIMOD and MoFSC 2014; Sharma et al. 2015). It is also evident that local people have higher dependency on wetland ecosystems in any human dominant landscape (Lamsal et al. 2014).

However, the spatio-temporal changes induced by natural and human activities are bringing various management challenges in the reserve, as also reported by others in the region (Chettri et al. 2013; Lamsal et al. 2014). The forest ecosystem is strongly linked to wetland ecosystems and plays an important role as interface (Kollár et al. 2011). It was observed that some of the critical ecosystems such as forest have significantly changed during the past three decades. The land use cover change, either through anthropogenic or natural processes, brings visible changes in ecosystem functions of a given ecosystem, leading to decrease in the capacity to provide services (Crossmann et al. 2013; Baral et al. 2014). A dynamic and mosaic of ecosystems area important, but if any of the ecosystems is lost beyond the threshold level, then it will have irreversible impact on the society that depends on such ecosystems (Gopal 2013; Davidson 2014). Unfortunately, this is a common challenge that wetland ecosystem faces in thriving under human use with changing patterns in providing the services (Yan and Wu 2005; Deka et al. 2011; Romshoo and Rashid 2014). In the context of spatio-temporal change, geospatial tools have been instrumental in helping us understand the dynamic nature of ecosystems (e.g. Rebelo et al. 2009; Chettri et al. 2013). Though the Government of Nepal has been proactively working with the local communities for participatory conservation and management of KTWR (CSUWN 2009, 2011), the dynamic nature of ecosystems needs special attention for management interventions. Therefore,

understanding the values, both monetary and non-monetary, including people's dependency on the ecosystem services and the dynamics of the ecosystems itself could be highly useful for implementing adaptive management measures. This may further improve the flow of ecosystem services and management of the reserve.

Conclusion

To conclude, change assessment is a primary prerequisite for various management and planning activities at the regional or global level. It has assumed greater importance in view of the shrinkage and degradation of wetland ecosystems, which are the last bastion of biodiversity and human sustenance. Use of remotely sensed data for mapping is a cost-effective method and Landsat images are capable of identifying wetland cover and its rate of change. Present study revealed that in the past 34 years, significant loss of important ecosystems have occurred in KTWR, eastern Nepal due to change in river course, over-exploitation of resources resulting from poverty and limited alternative options for people living in the buffer zone of the reserve. Spatio-temporal characteristics of KTWR in terms of change detection could serve as a guiding tool in conservation and prioritization of ecosystem management. Considering the change pattern in the area, the study recommends that planners and managers take urgent and necessary measures for the conservation of KTWR in order to prevent detrimental consequences for the remaining biodiversity of the reserve.

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Indigenous Knowledge for Wetland Conservation and Resource Utilization: A Case Study of Ramsar Sites, Nepal

Shalu Adhikari[a] and Amir Poudel[b]

[a] WWF Nepal, Kathmandu, Nepal, [b] NARMA Consultancy Pvt. Ltd., Nepal
salusharma@hotmail.com

Abstract

Wetlands in Nepal support an agrarian socio-economy and form the religious-cultural foundation of various communities. There are about 21 indigenous communities in the country that depend on wetland resources for their livelihoods. These communities have been using their traditional knowledge and practices from time immemorial. However, due to economic changes and rapidly changing natural environment, their knowledge is becoming lost. An effort was made to document wetland indigenous knowledge in Ghodaghodi Lake Area (GLA) and Koshi Tappu Wildlife Reserve (KTWR), Ramsar sites of Nepal in 2012 based on the methodology developed by the Ministry of Forests and Soil Conservation in terms of resource (plants and animals) utilization and practicing different wetland management techniques. A total of 44 different wetland products were utilized by Chaudhary/Tharu communities in GLA while in KTWR, a wide range of products were utilized by five different indigenous communities. Similarly, 14 and 25 different types of indigenous knowledge contributed to sustainable wetland management in GLA and KTWR respectively. Most importantly, indigenous communities conserve the wetlands and some of their resources as religious symbols which significantly contributes to sustainable wetland management. Indigenous knowledge is largely limited to the older generation, and the younger generation is less motivated to practice such knowledge. The problem can be addressed by supporting such communities to derive economic benefits from their knowledge.

Keywords: indigenous community, indigenous knowledge, resource utilization, wetland management

Introduction

'Indigenous knowledge' (IK) has been defined in many ways in literature. It is the accumulated knowledge and traditional skills and technology of a people, culture, sub-culture (Brokensha et al. 1980). IK encompasses both technical and non-technical knowledge including worldviews, social and religious customs and taboos, vegetation, climate, ecology, communication pattern and music. IK is unique to a particular culture and society (World

Bank 1998). Whereas IK possessed by any indigenous community is unique and different from the IK possessed by another community with respect to the utilization of even the same resources (IUCN 2005). The International Labour Organization (ILO) Convention on Indigenous Knowledge and Tribal People, 1989 (No. 169) provides linkages between indigenous knowledge and natural resources management. It has also duly recognized the importance of indigenous knowledge and the rights of the indigenous people to use, manage and conserve natural resources including wetlands. Long-term sustainable use of biological resources can only be achieved if the benefits are shared fairly and equitably, and the knowledge of indigenous peoples and local communities is respected (NBS 2002).

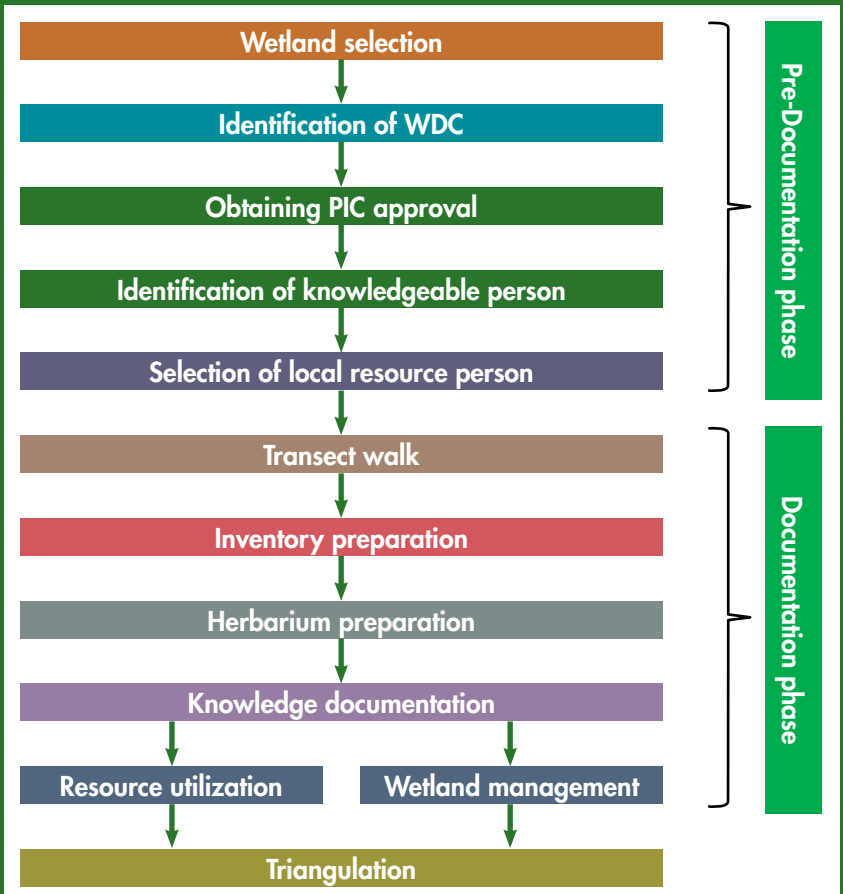
In Nepal, there are about 21 indigenous and ethnic communities that are dependent on wetland resources for their livelihoods (Bhandari 1998). Indigenous communities have been utilizing wetland resources as part of their livelihood activities for many generations. However, loss and degradation of these wetlands during the last few years has severely affected those relationships (GoN/MoFSC 2014). They extract resources such as forage, fuelwood, fibre and medicinal plants using their indigenous knowledge. Their knowledge is associated with wetland resource harvesting, utilization and management as well as other social and cultural beliefs, taboos and religion. On the other hand, local people hesitate to reveal their knowledge, skill and practices for documentation purposes, and this may be attributed to the risk of bio-piracy (MoFSC 2006). Therefore, this study particularly aimed to document wetland indigenous knowledge (WIK) in two Ramsar sites namely Koshi Tappu Wildlife Reserve (KTWR) and Ghodaghodi Lake Area (GLS) to prevent the loss of knowledge resulting from rapid changes in the natural environment.

Methods

The study was based on the methods of WIK Documentation Methodology and Application Guidelines (CSUWN 2011). The documentation was based on two approaches: i) resources utilization – knowledge associated with utilizing different wetland products as medicine, food, fibre, fodder, fuelwood, equipment, housing materials, etc.; and ii) wetland management – knowledge that contributes towards species conservation, reducing wetland degradation, management of catchment areas, sustainable harvesting, etc. In KTWR, there are indigenous wetland dependent communities (WDCs) such as Bantar, Jhangad, Musahar, Mallaha and Chaudhary. KTWR was established in 1976 and spread over three districts of eastern Nepal along the floodplains of the Koshi River. The reserve is the only remaining habitat of Asian Wild Water Buffalo (*Bubalus arnee*) in Nepal. The existing vegetation of the reserve consists of diverse physiographic types, which harbours 658 species of plants including submerged, aquatic, floating and tall reed grasslands. In GLA, Chaudhary (Tharu) is the only indigenous WDC. GLA, situated in the far southwestern Terai, is an association of 20 different freshwater lakes of various sizes. The lake harbours an estimated 1% of South Asian biogeographic population of Cotton Pygmy Goose (*Nettapus coromandelianus*). The lake is surrounded by subtropical broad-leaved trees including *Sal* and *Saj* and other associated species.

Broadly speaking, WIK documentation was carried out in three phases: pre-documentation, documentation, and post-documentation. The steps of each phase are schematically shown in Figure 8.1.

Figure 8.1: **Schematic presentation of the steps followed for WIK documentation**



Step 1: **Identification of wetland sites:** Wetland sites for IK documentation were selected based on their importance, people's dependency on them, and vulnerable bio-resources and associated IK.

Step 2: **Identification and mapping of WDC:** WDC in both sites were selected based on the dependency level of communities on wetlands, i.e., communities who largely depend on wetland resources for their livelihood were selected; communities indigenous to the locality; communities that have successfully preserved their social and cultural values associated with wetlands; and communities whose occupation is based on wetland products and services.

Step 3: **Obtaining Prior Informed Consent (PIC) approval form:** Standard PIC approval was obtained from the indigenous community members for undertaking the documentation.

Step 4: **Identification of knowledgeable persons:** Indigenous community members with good knowledge of wetland resources and management practices, especially local healers or elderly people, were selected.

Step 5: **Selection of local resource person (LRP):** In order to make documentation easier, local individuals were hired as they were more familiar with the social, cultural and religious values of the community.

Step 6: **Transect walk:** Transect walk with LRP and knowledgeable person was done to collect, identify and record plants and animals found in that particular season. Documentation can be done in all seasons provided the resources are available.

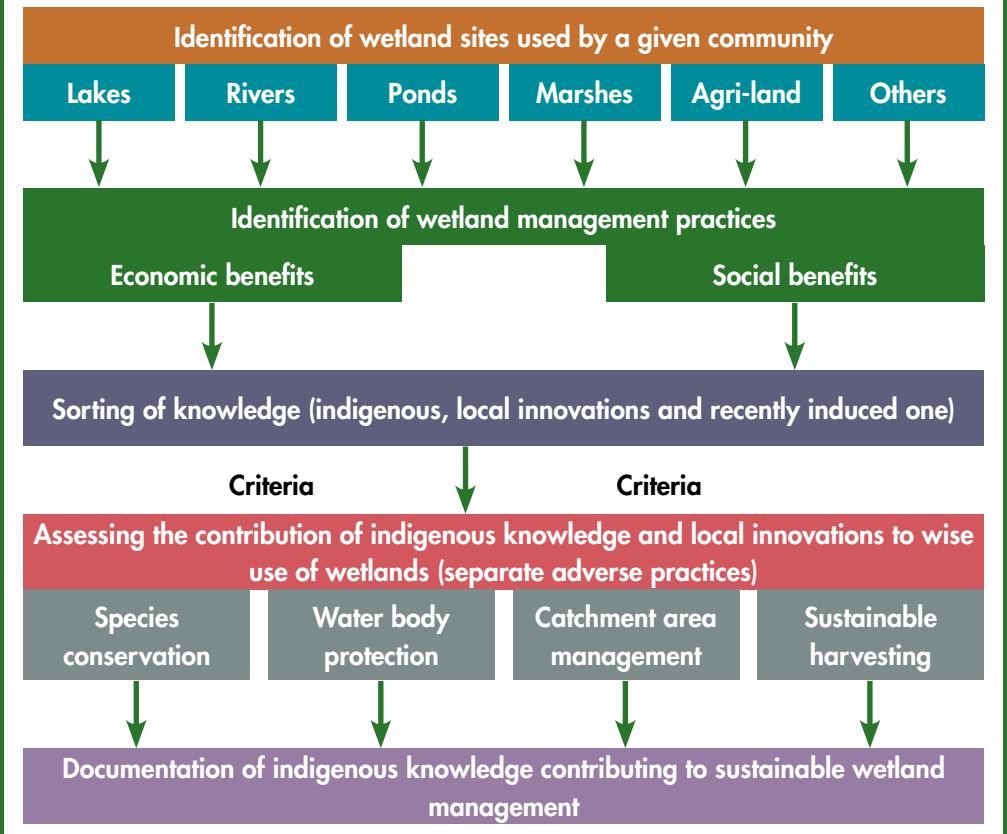
Step 7: **Inventory preparation:** An inventory was then prepared to list the products utilized by the local community for various purposes. It was ensured that the products that are highly vulnerable to extinction, products with high economic and social values, and products unique to the particular community were included.

Step 8: **Herbarium preparation:** In order to prevent the collected samples from decaying and also to keep a proper record, a herbarium was prepared after the collection of products.

Step 9: **Knowledge documentation:** This is one of the important steps in the overall documentation process. For resource utilization, two different types of forms based on the WIK documentation methodology were used. The first form was used to acquire information about the selected wetland site and indigenous community. Information included the name and area of wetland, adjoining VDCs, name of dependent communities, major products found in the wetland, threats to the wetland, land use type etc. Both primary and secondary sources of data were used. The second form was used to acquire more in-depth information on knowledge associated with the products collected from the wetland site by the indigenous community. Information included the name of the bio-resource, its local/common/scientific name, resource availability status and trend, utilization, processing, usage and storage technique, economic value of the product and other associated knowledge, among others. For wetland management, information was acquired through steps shown in Figure 8.2.

Step 10: **Triangulation and reporting:** This step belongs to the post-documentation phase where the collected information is validated through focus group discussion with other members of the indigenous community. It was noted that information collected from only one knowledgeable person in the community was validated through review and interaction with other knowledgeable persons of same indigenous tribe around the wetland site or from elsewhere.

Figure 8.2: **Schematic diagram for WIK related to wetland management**



Results and Discussion

WIK related to resource utilization

A total of 44 different wetland products were found to be utilized by the Tharu/Chaudhary community in GLA (Table 8.1, Annex 8.1). In KTWR, the total number of products being utilized by the different indigenous communities ranged from 32 among the Musahar to 54 among the Sardar community. The Jhangad were found to be utilizing a total of 42 products while Mallaha were found to be utilizing a total of 41 products (Table 8.2, Annex 8.2). A total of 40 products were used by the Chaudhary community and a total of 42 products were common to at least two of the indigenous communities. These products were being used for various purposes such as food, fodder, fuelwood, medicine, livestock feed, equipment and poison in both the areas. This paper does not include detailed information on specific bio-resources (e.g., unique characters, habitat, status of availability, resource availability trend, uses of parts, processing techniques, harvesting time, methods, harvesting quantity, economic value, etc.) for either of the sites.

Table 8.1: **Total number of products and usage by the Chaudhary community in GLA**

Community	No. of products	Uses					
		Food	Medicine	Livestock feed	Equipment	Poison	Fuelwood
Chaudhary/Tharu	44	22	36	14	22	2	1

Table 8.2: **Total number of products and usage by different indigenous communities in KTWR**

Name of the community	Total products	Areas of indigenous usage			
		Medicine	Food	Fodder	Equipment
Sardar/Bantar	54	22	23	16	4
Mallah	41	21	22	5	5
Jhangad /Urau	42	13	14	13	6
Musahar	32	8	12	9	4
Chaudhary/Tharu	40	18	12	9	7

WIK related to wetland management

A total of 21 different wetland management practices were collected for different types of wetlands found in GLA. These types of knowledge were sorted and categorized as a) indigenous, b) local innovation, and c) recently induced. Out of these 21 types of knowledge related to wetland management, 14 types of WIK that contributed to sustainable wetland management were identified in GLA (Table 8.3). Similarly, for KTWR, a total of 25 types of indigenous knowledge related to wetland management were collected (Table 8.4). It should be noted that much of the indigenous knowledge focused on minimizing over-

Table 8.3: **WIK related to sustainable wetland management in GLA**

Categories	Wetland management practices
Species conservation	• 'Hareri', a religious day when fishing is prohibited • 'Bhaunka Jhar' is spread on the water surface where fish prefer to lay eggs and take shelter • Sacrificing seven pairs of fish before starting paddy plantation during monsoon. This special variety of fish is not eaten. • 'Raini' fish worshipped as the king of fish
Water body protection	• Diversion of water from streams and rivers into agricultural land • Water flow channels are blocked to retain water for jute cultivation, especially if rainfall is low
Catchment area management	• Certain patches of forests along the wetland sites are worshipped, and grazing and felling is prohibited in such areas
Sustainable harvesting	• 7–8 stalks of Jharanga Dhan are tied after they ripen to prevent bending and falling • Size of the fishing net has been maintained such that very small fish can escape during fishing • Adjustment of harvesting season of Khar • Collection being carried out by knowledgeable person such that young and tender plants are not harvested • Tender parts of 'Khar' are protected from livestock grazing • Change in the type of fishing tool from 'spear' to 'Helka'

Table 8.4: **WIK related to sustainable wetland management in KTWR**

Categories	Wetland management practices
Species conservation	• Birds such as '*Nilkantha*' Indian Roller (*Coracias benghalensis*), Garud (stork species) are protected as sacred symbols and not killed. • Fishing is not done during festivals like Ashare puja, Shivaratri, Chhat parba, Sankranti, Teej, Jitiya, Ananta Chaturdashi, and Rakshyabandhan. • Killing of snakes such as '*Harhara*', Python is prevented. • '*Ganguer*' is not killed for religious reasons. • Most women do not eat fish on Sundays. • Tortoise is worshipped as a symbol of god Vishnu so it's not killed. • A bird named '*Khadan Chidiya*' is not killed because it has beautiful colours. • Birds like Koili, Parakeets and Myna are not killed owing to their docile nature. • Lotus plant is protected as a symbol of god Brahma. • '*Kauwa fish*' is not eaten because it is believed to be the messenger of a sacred crow. • Grass carp helps maintain grass in fish ponds. • The practice of making '*Birae*' where different types of plants are collected and laid on the water surface to clean the water and provide a good place for laying fish eggs. • Water is allocated in key areas for Chinga fish ('*Hille machha*').
Water body protection	• Some ponds are totally protected for the purpose of worshipping. • Ridges are maintained in agricultural land to prevent soil erosion. • Millet is planted along the edges of the fish ponds to prevent soil erosion. • The Koshi river is worshipped during Ashare puja. • Minimum water is maintained by making dykes for jute cultivation. • Use of organic manure and compost on agriculture land.
Catchment area management	• Reed and sugarcane are planted along ponds to prevent siltation process. • Certain forest patches are protected for religious purposes, thus reducing soil erosion. • Grazing of livestock on the banks of fish ponds is prohibited to prevent soil erosion.
Sustainable harvesting	• Harvest of Pater is sequenced to ensure that the resource can be harvested for the long time. • Reduced fishing during egg laying season.

extraction and unsustainable harvesting techniques of wetland resources. Most of the knowledge contributed to species conservation, mainly for religious reasons. Local communities regard wetlands and the different plants and animals found in the wetlands as sacred symbols, which largely contributes to their protection.

Conclusion

It can be concluded that there is a rapid decline of wetland related traditional knowledge among the indigenous communities. Degradation and loss of wetlands, which is also accelerated by the effects of climate change, poses a threat to communities whose livelihoods are derived from wetland-based products. Not all types of indigenous resource harvesting and wetland management related knowledge are sustainable in the long run. While some contribute towards over harvesting, those that contribute towards sustainable harvesting and utilization should be preserved as a source of learning and for future promotion and development. Moreover, WIK can be preserved if it is utilized in future for economic gains.

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Annex 8.1: **Details of plants and animals used by the Chaudhary community along with their usage in GLA**

Local name	Nepali name	English name	Scientific name	Uses					
				F	M	LF	E	P	FW
Gon	Pater	Cat-tail	*Typhaelephantina*		√		√		
Teluniya		-		√	√				
Purain	Kamal	Sacred lotus	*Nelumbonucifera*	√	√√√√		√		
Goha	Gohi	Muggar/Ghariyal	*Crocodiluspulustris/ Gavialisgangeticus*	√	√				
Jal Kumbhi	Jal Kumbhi	Water hyacinth	*Eichhorniacrassipes*		√				
Jhingua Machha	Jhinghe Machha	Prawn	*Paenussp*	√	√				
Banarapat/ Bandra	Dabali Jhar	-	*Setariaglauca*		√	√			
Gyangta	Gangato	Land crab	*Potamon sp.*	√	√				
Rahu Machha	Rahu Machha	Indian carp	*Labeorohita*	√	√				
Karammuwa Sag	Karmi Sag	Swamp cabbage/ Water spinach	*Ipomoea aquatica*	√	√				
Biriya Jhar	-	-	-		√			√	
Mangoor Machha	Mangoor Machha	Clarias	*Clariasbatrachus*	√	√				
Singayar	Singhada	Water chestnut	*Trapabispinosa*	√					
Khechhuhi	Kachhuwa	Soft-shelled tortoise	*Trionyxgangeticus*	√√	√√√√√				
Machhakul Bird	-				√				
Ajgar	Ajingar	Indian python	*Python molurus*		√				
Sirish Jhar	-	-	-			√	√		
Chatiya	Mothe	Nut sedge	*Cyperusiria*			√			
Baksa	ThuloDubo	-	*Pennisetumclandestinum*			√			
Churki	Siru	Cogon grass	*Imperatacylindrica*			√	√√		
Bhorwa	-	-	-			√	√		
Perra	-	-	-	√√					
Bond	-	-	-			√	√		
Besharam	Besharam	Morning glory	*Ipomoea carnea*		√		√√		√
Bhomara	-	-		√	√	√			
Seuthe	-	-				√			
Ghodtapre	Ghodtapre	Indian pennywort	*Centellaasiatica*		√				
Jungali Barsim	Barsim	Egyptian clover	*Trifoliumalexandrinum*			√			
Kansutali	-	-	-		√√				
Guiji	-	-	-			√	√		
Katkuiya	-	-	*Amaranthusspinosus*	√					
Sanwa Ghans	Sanwa Ghans	Barnyard millet	*Echinochloacolona*			√			
Baisa	Baisa	-	*Salix tetrasperma*		√	√			
Baj	Bojho	Sweet flag	*Acoruscalamus*		√√√√			√	
Sutahi	Sipi	-		√			√√		
Ghonghi	Ghonghi	Snails	*Macrochlamystugurium*	√	√				
Bet	Bet	-	*Calamustaneus*				√√√√√√		
Karmo Sag	Dhodhi Sag	Joint vetch	*Aeschynomeneaspera*	√					
Lerghut	Narkat	Common reed	*Phragmiteskarka*				√√√		
Kochiya Sag	Nigro	-	*Diplaziumesculentum*	√	√				
Jharanga Dhan	Jungali Dhan	Wild rice	*Oryzarufipogon*	√		√			
Machha	Machha	Fish	*Pisces*	√√					
Sedri Machha	Sedri		*Puntius sp.*		√				
Gor Katla	-	-	-		√				

F: Food; M: Medicine; LF: Livestock Feed; E: Equipment; P: Poison; FW: Fuelwood

Annex 8.2: **Details of common bio-resources used by the indigenous communities in KTWR**

Local name	Nepali name	English name	Scientific name	Uses					
				F	M	LF	E	P	FW
Achheni	Bojo	Sweet flag	*Acoruscalamus*		√√				
Anai Machha	Anahai	Eeel fish	*Mastacembelusarmatus*	√	√				
Aurighans						√			
Bhangdaiya	Bhringaraj		*Ecliptaprostrata*		√				
Bishnair	Bisnar/Pire	Joint weed	*Polygonumbarbatum*		√				
Chirkanti	Kuro	Love Thorn	*Chrysopoganaciculatus*				√		
Dabighans						√	√√		√
Datkira Machha					√				
Dattighans						√			
Dhakiya Sag	Nigro		*Diplaziumesculentum*	√					
Doka	Doka			√					
Dolphin	Dolphin	Gangetic Dolphin	*Platonistagangetica*		√				
Gangata	Gangato	Land crab	*Potamon sp.*	√					
Ghonghi	Ghonghi	Snails	*Macrochlamystugurium*	√	√				
Gurulati	Gurulati		*Tinosporasinensis*		√				
Hada						√			
Iodine ghans					√				
Jhila Chara				√					
Kannaghans						√			
Karautighans						√			
Karmi Sag	Karmi Sag	Swamp cabbage	*Ipomeaaquatica*	√					
Kechu	Karkalo	Co-co Yam	*Colocasiaesculenta*	√	√	√			
Khar	Khar	Thatch grass	*Saccharumspontaneum*			√	√√		
Khechuwi	Kachhuwa	Soft-shelled tortoise	*Trionyxgangeticus*	√					
Koka/Thuru	Kamal	Sacred Lotus	*Nelumbonucifera*	√					
Lajwanti Jhar	Lajwanti Jhar	Touch-me-not	*Mimosa pudica*		√				
Machha	Machha	Fish	*Pisces*	√					
Makhan	Makhan	Gorgon Nut	*Euryale ferox*	√					
Motha	Motha		*Cyperusrotundus*			√			
Mothighans	Mothi		*Cyperuscorymbosa*				√ √		
Munj	Munj		*Saccharummunja*				√		
Narkat	Narkat	Common reed	*Phragmiteskarka*				√		√
Pater	Pater	Cat-tail	*Typhaangustifolia*	√			√		
Pudina	Pudina		*Menthaspicata*	√	√				
Rahu Machha	Rahu Machha	Indian Carp	*Labeorohita*	√	√				
Samor						√			
Sangohi	Sungohoro	Barred Monitor	*Varanusbengalensis*				√		
Sarauchiya Sag		Alligator weed	*Alternantherasessilis*	√					
Singhada	Singhada	Water chestnut	*Trapabispinosa*	√					
Sinuwar	Simali		*Vitexnegundo*		√				
Situwa	Sipi			√					
Telair						√			

F: Food; M: Medicine; LF: Livestock Feed; E: Equipment; P: Poison; FW: Fuelwood

3

Wetland Policies and Cooperation

Policy and Practices with Respect to Wetland Conservation in Nepal

Maheshwar Dhakal[a] and Bishwa Nath Oli[b]

[a] Department of National Parks and Wildlife Conservation, Nepal,
[b] Ministry of Forests and Soil Conservation, Nepal
maheshwar.dhakal@gmail.com

Abstract

This paper focuses on assessing the wetland conservation efforts, analyzing the underlying causes of wetland resources degradation and recommending possible options for conservation and wise use of these resources of Nepal. This assessment is largely based on policy review and direct field observations. Small to large wetlands, distributed across the country harbour around 25% of biological diversity in Nepal. These wetlands provide various kinds of goods and ecosystem services that are instrumental in sustaining plant and animal life. For wise use of wetland resources, the Government of Nepal formulated the National Wetland Policy in 2003, which was revised in 2012. The National Biodiversity Strategy and Action Plan 2002 and its updated version in 2014 have given utmost importance to the protection of wetlands. Despite the sound policy instruments, wetland conservation efforts are not adequately translated from policy into practice. Wetlands provide multiple goods and services but their role in improving the livelihoods of local people is indispensable. However, these wetlands are severely affected by both anthropogenic and natural threats. The major threats are siltation, alien invasive species, and conversion to other land use, pollution, drying up and extraction of wetland resources, mainly by fishing. The institutional responsibilities related to wetland conservation and management are scattered among different agencies and there is inadequate funding for this sub-sector. Given the paramount importance of wetlands in Nepal, conservation and wise use of these resources with active engagement of the local people is needed.

Keywords: wetlands, livelihood, local people, wise use, Nepal

Introduction

Wetlands are the most productive ecosystems, producing both tangible goods and intangible environmental services (MEA 2003). Wetlands serve as a lifeline for both plants and animals by maintaining environmental quality and food security on perpetual basis (Shrestha 2011). Scientists claim that wetlands are a biological supermarket as they produce multiple goods and services, mainly provisioning, regulating, cultural and supporting (MEA 2005). That is why scientists have come up with a broader definition of wetlands based on their type, size and nature. Over the past 50 years, humans have brought changes to ecosystems, including wetland ecosystems, more rapidly and extensively than in any other period in human history, largely to meet rapidly growing demands for food, freshwater, timber, fibre and fuel (MEA 2005). This has resulted in substantial and largely irreversible loss of biodiversity of the earth.

The rate of loss of wetlands is rapidly increasing in developing countries like Nepal owing to political unrest, urbanization, migration, and over-exploitation of forests; it is believed that 64–70% of wetlands have been lost globally since 1900 (Ramsar 2015). Worldwide, especially in developing countries, local people who live near the wetlands use the wetland resources for livelihood, drinking water, irrigation, fishing, and other purposes. The rate of use and dependency of the poor and marginalized people on wetland resources is comparably higher as they produce multiple goods and services. Despite the various conservation efforts of the government, non-government organizations and local people, most of the wetlands were threatened by various anthropogenic activities. Construction of hydropower dams, construction of rural roads, deposition of domestic and industrial waste in the river, and use of pesticides and insecticides have resulted in sedimentation in most of the river basins and wetlands in Nepal (IUCN 2004). In addition to that, invasion of alien species, over harvesting of wetland resources, especially fishing, overgrazing, water and industrial pollution, excessive use of agro-chemicals that flow into nearby streams, and discharge of industrial effluents are major problems in wetland conservation and management.

In this study, we assessed the wetland conservation and management policies and identified their gaps with reference to field level implementation in Nepal. The study focused on wetlands policy and programmes and their importance. This study also assessed wetland conservation efforts and underlying causes of the degradation of wetland resources, and recommended possible policy measures.

Wetlands in Nepal

Nepal is rich in wetlands and their resources though the country is landlocked. Major wetland types are rivers, lakes, reservoirs, ponds, marginal swamps, glacier lakes and irrigated paddy fields (Table 9.1). These wetlands cover 5.6% of the total land area of the country, which is more or less equal to wetlands of the world. Similarly, wetlands harbour 25% of the total biodiversity of Nepal (MoFSC 2012). Four major river systems (Koshi, Gandaki, Karnali and Mahakali) originate from the High Mountain region and their tributaries perform micro watershed to large watershed functions. Though Nepal is rich in wetlands, their distribution is not even across the country. Around 45% of wetlands in Nepal are located in the Himalayan region and another 3% are located in the High Mountains region (Figure 9.1). All rivers and river systems flow from the upstream Himalayan ranges to downstream lowland and provide various environmental services, particularly drinking water, irrigation, hydropower generation and means of transportation. Similarly, around 17% of wetlands are located in the Terai, Mid-Mountains and Siwalik. These wetlands provide drinking water to the general public and

Table 9.1: **Wetlands in Nepal**

Wetland types	Estimated area (ha)	Coverage
Rivers	395,000	48.2
Lakes	5,000	0.6
Reservoirs	1,500	0.2
Ponds	7,277	0.9
Marginal swamps	12,500	1.5
Irrigated paddy fields	398,000	48.6
Total	**819,277**	**100.0**

Source: GoN 2014

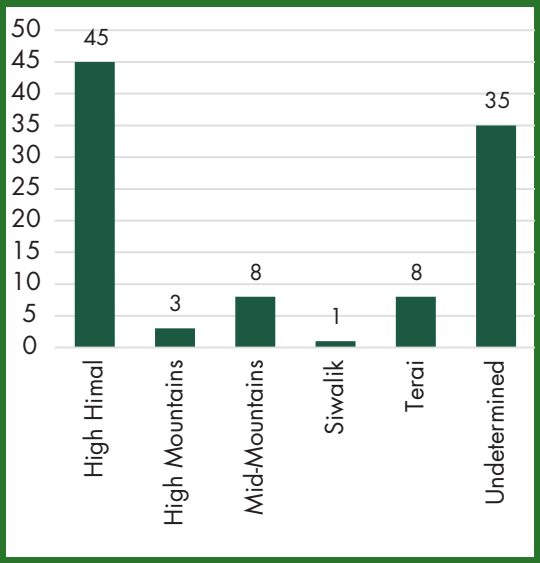
irrigation to farmers; fishing and livelihood support to poor and marginalized people who live near the wetlands (GoN 2014). Wetlands not only provide a habitat to wildlife and endemic plants, but also support the livelihood of local communities (Siwakoti 2006).

Wetland Policies in Nepal

The National Conservation Strategy (1988) has emphasized the need for sustainable use of land and natural resources. The Master Plan for the Forestry Sector (1989) emphasized the need to involve people in natural resources management. Though the wetlands are perennial sources of water that exist in the form of pond, lake, river, glacier or costal areas, these policy documents rarely mention the need to pay special attention to wetlands conservation, management and wise use of the resources.

The Government of Nepal has promulgated various wetland related acts, policies and also signed some international treaties related to biodiversity conservation (Box 9.1). However, there is no specific legislative provision to deal with wetlands and their resources. Even though water and wetlands provide healthy wildlife habitats and ecosystem services, none of the policy documents pays special attention to wetlands. Wetlands are not defined as a separate category of ecologically important areas in the National Parks and Wildlife Conservation Act 1973 even though wetlands maintain water quality, its freshness and neutrality.

Figure 9.1: **Location of wetlands of Nepal**



Source: NBSAP 2014

Box 9.1: **Wetland related polices and international conventions in Nepal**

Acts
- Constitution of Nepal 2015
- National Parks and Wildlife Conservation Act 1973
- Forest Act 1993
- Environmental Act 1997
- Self Governance Act 1999
- Soil Conservation and Watershed Act 1982
- Electricity Act 1992
- Water Resource Act 1992

Policies
- National Conservation Strategy 1988
- National Wetland Policy 2012
- Forest Policy 2015

International treaties and conventions
- Ramsar Convention 1971
- United Nations Convention on Biological Diversity 1992
- United Nations Framework Convention on Climate Change 1992
- United Nations Convention to Combat Desertification 1992

Wetlands, as part of ecosystem-based adaptation areas, ensure restoration, maintenance and enhancement of ecosystem values in the face of climate change. Similarly, other acts like the Aquatic Animal Protection Act 1961, Soil and Watershed Conservation Act 1982, Water Resources Act 1992, Electricity Act 1992, Forest Act 1993, Environmental Protection Act 1996, Local Self Governance Act 1999 and many other policy documents lack specific provisions related to wetlands.

The National Parks and Wildlife Conservation Act 1973 has emphasized the role of wetlands in wildlife conservation. Wetlands inside the protected areas are regarded as additional values for making water available to both fauna and flora and for making the ecosystem functional. However, the Forest Act 1993 does not spell out the importance of wetlands inside the forest areas though some of the forest management regimes aim to protect the environment and generate various environmental services. It is largely believed that wetlands inside the forests have special significance in terms of combating the effects of climate change.

Wetland Conservation Efforts in Nepal

Though Nepal became a party to Ramsar Convention in 1987, the conservation trend showed slow progress (Box 9.2). A National Lake Conservation Committee was formed under the jurisdiction of the Ministry of Tourism and Civil Aviation to promote tourism in and around the wetlands, but little priority has been given to the wetlands sector even though many Nepalese people depend on these resources for their lives and livelihoods. Majority of the activities are focused on awareness generation and capacity building. Lakes and ponds face formidable threats to their survival because of the conversion of wetlands for other purposes, over-exploitation of resources, pollution of water, invasion of alien species, encroachment on the area and sedimentation of the water body (Paudel 2009).

Box 9.2: **Trend of wetland conservation in Nepal**

1987 - Koshi Tappu Wetland Reserve (KTWR) included in the Ramsar List
1993 - National Workshop on Wetland Management in Nepal
1998 - Revision of Aquatic Life Protection Act of 1961
2003 - Endorsement of the National Wetlands Policy
2003 - Three wetlands (Bishazari Lake, Jagdishpur Lake and Ghodaghodi Lake) designated as Ramsar sites
2006 - Publication of monographs on high-altitude wetlands
2007 - Four high-altitude wetlands (Gokyo Lake, Gosaikunda Lake, Shey Phoksundo Lake and Rara Lake) designated as Ramsar sites
2008 - Mai Pokhari designated as the 9th Ramsar site
2012 - Nepal selected as an Alternative Member of the Standing Committee of Ramsar Convention
2012 - International Wetland Symposium 2012
2013 - Revision of National Wetlands Policy 2012
2015 - Nepal nominated as a Standing Committee member
2016 - Lake Cluster of Pokhara Valley (Phewa, Begnas, Rupa, Dipang, Maidi, Khaste-Nyureni, Kamal Pokhari and Gunde lakes) designated as Ramsar site

In order to implement the National Wetland Policy 2003 and its revised version 2012 (MoFSC 2012), the policy envisages a two-tier wetland conservation committee. The central level committee comprises of 12 members led by the secretary of the Ministry of Forests and Soil Conservation. The district level committee comprises of more than 16 members and the District Forestry Sector Coordination Committee (DFCC) is supposed to coordinate all wetland stakeholders.

Ramsar Sites of Nepal

Though the Ramsar Convention was negotiated in 1971, Nepal became a party to the Convention in 1987 along with the declaration of Koshi Tappu Wildlife Reserve (KTWR) as first Ramsar site. This is the oldest convention related to the multilateral environmental agreements. Initially, it was negotiated in the 1960s by countries and non-governmental organizations concerned about the increasing loss and degradation of wetland habitat for migratory water birds though it was adopted in the Iranian city of Ramsar in 1971, and came into force in 1975. This convention has three values namely i) wise use of wetlands, ii) list internationally important wetlands, and iii) cooperation. The concept of regional initiative has been initiated and many countries are doing their best on issue and interest basis. An example of this is the South East Asia Regional Initiative, which coordinates four countries of the Mekong River, namely Myanmar, Thailand, Vietnam and Lao PDR.

Ten wetlands of Nepal listed on the Ramsar List cover 60,561 ha, which is about 0.004% of the country's total land. The KTWR, first Ramsar Site of Nepal covers an area of 17,500 ha, the entire protected area is a Ramsar site. The protected area provides habitat to thousands of migratory and residential birds on one side whereas fishing serve as a means of livelihood to local communities. The study carried out in Nepal and Bhutan showed that though wetlands are important for mitigation and adaptation measures to combat climate change effects; several anthropogenic activities have negative impacts on the productive services of wetland ecosystem (ICIMOD 2013; ICIMOD 2014). Following the KTWR, the Government of Nepal listed three more wetlands on the Ramsar List in 2003, namely Bishazari and associated lakes, Jagdishpur reservoir, and Ghodaghodi and associated lakes. These three lakes are beautiful bird watching sites and deserve ample ecotourism opportunities (Siwakoti 2006). In 2007, the Government of Nepal focused on high-altitude wetlands and declared four wetlands as Ramsar sites, namely Gokyo and associated lakes of Sagarmatha National Park, Gosaikunda and associated lakes of Langtang National Park, Rara Lake, the largest lake of Nepal, and Phoksundo Lake of Shey Phoksundo National Park (Table 9.2). However, the Ramsar Site Information Sheet (RIS) is yet to be updated though it is mandatory that contracting parties update the RIS every six years.

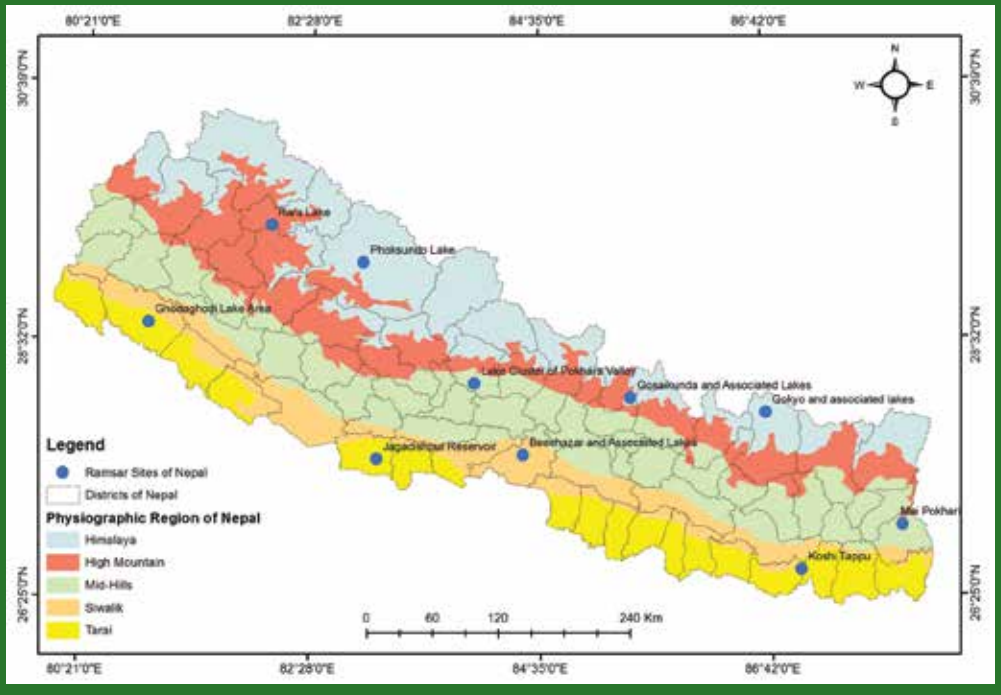
It is estimated that there are around 5,000 wetlands in Nepal (small to large by size, ox-bow to river bank by shape and private to public by ownership). Out of ten Ramsar sites, four are located in the lowland; another four in the High Mountain areas and two are located in the Mid-Hills (Figure 9.2).

Table 9.2: **Ramsar sites in Nepal**

Ramsar site No	Name	Location	Designation date	Area (ha)	Elevation (masl)
380	Koshi Tappu	Koshi	17.12.1987	17,500	75–81
1313	Bishazari and associated lakes	Chitwan	13.08.2003	3,200	286
1314	Ghodaghodi Lake Area	Kailali	13.08.2003	2,563	205
1315	Jagadishpur Reservoir	Kapilvastu	13.08.2003	225	197
1692	Gokyo and associated lakes	Solukhumbu	23.09.2007	7,770	4,700–5,000
1693	Gosaikunda and associated lakes	Rasuwa	23.09.2007	1,030	4,000–4,700
1694	Phoksundo Lake	Dolpa	23.09.2007	494	3,612
1695	Rara Lake	Mugu	23.09.2007	1,583	2,990
1850	Mai Pokhari	Ilam	28.10.2008	90	2,100
2257	Lake cluster of Pokhara valley	Kaski	02.02.2016	26,106	622–2,403

Source: https://rsis.ramsar.org/ris-search/?f[0]=regionCountry_en_ss%3ANepal&pagetab=1

Figure 9.2: **Location of Ramsar sites of international importance in Nepal**



Wetland and ecosystem services

Though wetlands of Nepal are small in size, they produce all types of ecosystem services (Figure 9.3). A large number of wetlands are located in high altitudes, far from human settlements; these wetlands have a more important role in producing regulating and supporting services than cultural and provisioning goods. Gosaikunda Lake has a special cultural value as thousands of pilgrims visit this lake during the festival season.

Wetlands Conservation Status in Nepal – A Case of Chitwan National Park

Chitwan is the oldest national park located in the central lowland of Nepal. The park was established in 1973 and covers a core area of 932 km^2 and a buffer zone area of 751 km^2. The park is rich in biodiversity and popular for some of the iconic and umbrella species namely tiger, rhino, elephant and gharial crocodile. Because of the unique and important ecosystems, the park has been designated a UNESCO World Heritage Site, listed in the Conservation Assured Tiger Standard (CA/TS), and Bishazari and associated lake is designated as a Ramsar site (CNP 2014). It is believed that abundantly distributed wetlands are the underlying cause behind the rich biodiversity of the park. An assessment carried out in 2013 revealed that 58 different sized wetlands are found in the park, 38 are located inside the core areas while the remaining 20 are located in the buffer zone (Table 9.3).

Figure 9.3: **Wetland-produced ecosystem services**

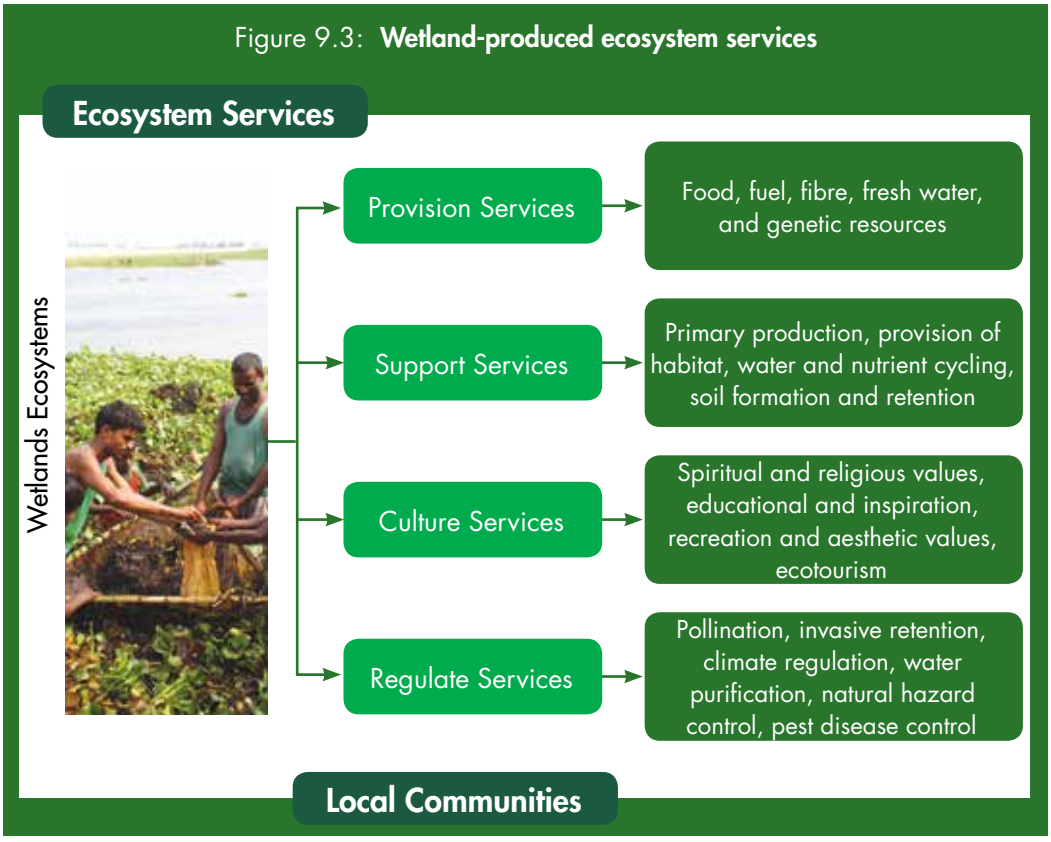


Table 9.3: **Wetland status of Chitwan National Park**

Location	Wetland types				Wetlands condition			
	Ghol	Lake	Waterhole	Other	Excellent	Good	Fair	Poor
Buffer Zone	3	16	1	-	2	13	4	2
Core Area	10	14	7	7	3	7	15	12
Total	13	30	8	7	5	20	19	14

Source: CNP 2015

The study found that only five wetlands are in excellent condition and safe from threats, while 20, 19 and 14 wetlands are in good, fair and poor condition respectively. The wetlands that are fair and poor condition are largely affected by siltation, invasive species, conversion to other lands, mainly grassland, drying up, pollution and fishing and other extraction problems (Table 9.4). In general, wetlands in protected areas and buffer zone area are water sources for animals. The ecosystem-based wetland management could help prevent animals from extinction, and produce multiple ecosystem services as livelihood sources for local communities. However, these wetlands are severely affected by anthropogenic and natural threats and have gradually deteriorated (Table 9.4).

Table 9.4: **Major threats to wetlands in Chitwan National Park**

Threat types	Siltation	Invasive species	Conversion to grassland	Drying	Pollution	Fishing and other extraction
High	36	14	36	34	3	5
Medium	3	8	4	2	3	10
Low	10	26	7	9	1	5
No threat	9	10	11	13	51	38

Source: CNP 2015

Discussion and Conclusion

Though issues related to conservation and management of forests and wildlife resources are regularly discussed at policy and executive level, wetland issues are rarely discussed and are overlooked in both national and local policy debates. Policy-makers usually treat wetlands as part of water resources though the values of wetlands go beyond this. In Nepal, the Forest Act 1993, National Parks and Wildlife Conservation Act 1973, and Self Governance Act 1999 do not emphasize wetland conservation and management or the use of wetland resources even though these resources have multiple roles in enhancing the livelihood of local communities. In some instances, wetlands have contributed to both local and national economy through ecotourism and other uses. Wetlands are also interrelated to agriculture, forestry, wildlife,

ecotourism, irrigation, drinking water, transportation and livelihood of local communities. Wetlands can store carbon twice as much as forests worldwide (Ramsar 2015). Therefore, it is essential to assess the role of wetlands and find a way forward to develop policy that treat wetlands as a separate unit for conservation and management, so that wetland resources can be used for the benefit of the local communities and national economy on one hand and for maintaining the ecological functions on the other.

Once the wetland is designated as a Ramsar site, the Ramsar Site Information Sheet (RIS) should be updated every six years against the biophysical, socioeconomic and other changes that have taken place. However, the Government of Nepal has been passive in updating the RIS though various wetland conservation efforts have been implemented on an annual basis. The national policy was designed in 2003 and was substantially amended in 2012, but there has been little progress in terms of policy ownership and implementation. One of the reasons behind the poor implementation of the policy is that the wetland itself is a crosscutting issue where multiple agents and actors are interrelated and working concurrently. The National Biodiversity Strategy and Action Plan (2014) and Forest Policy 2015 have also placed due emphasis on wetland conservation and wise use of wetland resources. However, these policy documents do not mention about any implementing agencies for sustainable management of the wetlands.

Wetlands are a main source of drinking water for people in Nepal. Natural water spring and river water are the major sources of water in the Mid-Hills and Mountains while lowland people mostly depend on underground water. Nepal has a long history of wetland conservation. Planting seedlings in and around the water source, constructing a pond along with a resting place (popularly called *Chautara*) and planting Bar (*Ficus begalensis*) and Pipal (*Ficus religiosa*), cleaning and removing weeds from the lake are some common examples. Wetlands are also a source of irrigation for paddy fields. Despite this, wetland issues are rarely reflected in various conservation policies of Nepal.

The Government of Nepal formulated the National Wetland Policy in 2003 and it was revised in 2012 (MoFSC 2012). This policy aims to involve local people in the conservation and management of wetland resources and their wise use on perpetual basis. The NBSAP (2014-2020) emphasized integrated management of wetlands and their international recognition through Ramsar Site declaration. The Forest Policy 2015 also aims to conserve wetlands as a micro-watershed and link wetland resources to the upstream and downstream linkages. These policy documents treat wetlands as a crosscutting issue and call for concerted and coordinated efforts by agencies concerned. However, there is still confusion among the implementing agencies regarding the lead role in coordinating wetland conservation activities. The overall analysis reveals that wetland as a functional ecosystem produces multiple environmental services. However, these wetlands are largely affected by anthropogenic activities as well as natural phenomena. Both direct and indirect causes are equally responsible for the degradation of wetland resources (Table 9.5). The human population and

rapid migration has created huge demand for wetland resources. Migration has led to an increase in economic activities, use of wetland products and environmental services. Similarly, socio-political, technological and socioeconomic changes have also affected wetland resources indirectly (Table 9.5). Expansion of agricultural land, development infrastructure, introduction of alien species, use of technology, use of fertilizer and pesticides, over-use of wetland resources, climate change effects and natural disasters are major reasons behind wetland degradation and loss.

Table 9.5: **Direct and Indirect Drivers of Loss of Wetlands in Nepal**

Nature	Drivers	Impacts
Indirect drivers	Demographic	Population growth and rapid migration and urbanization
	Economic	Economic growth, trade and consumption pattern
	Socio-political	Governance/collective action; institutional settings; and gender attitudes
	Science and technology	Information technology; technological use in agriculture and rural development
	Cultural/religion	Beliefs, consumption choices
Nature	Drivers	Impacts
Direct drivers	Agriculture expansion	Lack of demarcation and wetlands mapping, quantity and quality
	Development infrastructure	Rural road construction affected to fragment the wetlands and sedimentation. Over usage of wetland resources for irrigation, transportation and drinking water
	Introduction of alien invasive species	Invasive species like Parthenium (*Parthenium hysterophorus*) and Mikania (*Mikania micrantha*) severely affected rhino habitats
	Pesticide and insecticide	Pesticide use in agriculture, advanced fishing technologies leading to depletion of fish stocks, use of pesticides
	Over-harvesting of wetland resources	Fishing, extraction of stone, sand and gravel
	Climate change	Glacial retreat, glacial lake outburst flood (GLOF), change water cycle and nutrient cycling
	Natural disasters	Earthquake and desertification, landslides, pest and diseases

Source: ICIMOD 2009

As wetlands produce multiple tangible goods and environmental services, they are a matter of concern for all segments of the society. Nepal is ecologically diverse and culturally rich and this is reflected in wetlands across the Terai, Hill and Mountainous regions. But because of poorly implemented conservation activities, these wetlands are in a critical condition. Due to continuous human activities on one hand and lack of awareness among local people on the other, wetlands are losing both their quality and quantity. Clear jurisdiction and institutional setup are prerequisites for implementing wetland conservation activities on an annual basis. Moreover, site-specific conservation plans followed by an effective implementation strategy can lead to sustainable conservation and wise use of wetlands. Wetland policy that provides a common ground to all segments of the society for initiating wetland conservation is indispensible for addressing wetland issues and producing desired outcomes.

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How Power can play a Role in making an Integrated Wetland Management Practice to Disintegrate

Yang Shuo[a], Li Zhuoqing[a] and Song Fuqiang[a]

[a] Yunnan Institute of Environmental Science, Kunming, China
965991518@qq.com

Abstract

In Lake Erhai catchment, its northern wetlands are playing important roles. The integrated catchment plan is crucial for the management of resources in it, particularly the wetland. But the merely labelling the catchment plan as "integrated" is not enough for an integrated management practice. Semi-structured interviews and focus group discussions were held with key government agencies to find out what makes an integrated catchment plan lose its meaning. It shows that the rigid and inflexible institutional settings under the current political system hamper the possibility of social learning, which is assumed to be an inclusive and deliberative process. In this closed hierarchical system, little space is opened for the participation of non-government actors in the catchment. In the whole planning process of the catchment, the produced knowledge is biased and prejudiced due to the lack of a participatory and consensus-oriented decision-making process, and absence of a skillful facilitator. Power, as an encoded element in this unbending hierarchical system, entails changing power relations under different situations. It plays a powerful and cardinal role in the decision-making process, and decides who participates in what way, and whose knowledge is counted in.

Keywords: catchment, integration, participation, planning, power

Introduction

Wetland conservation in China started in the early 1990s, particularly after China joined the Ramsar Convention in 1992. The number of Chinese wetlands on the Ramsar List of Wetlands of International Importance increased from 7 in 1992 to 45 in 2015. Over 40% of the natural wetlands have been conserved through the establishment of nature reserves and wetland parks at different levels from the national to local (Wang et al. 2012).

All types of wetlands classified in the Convention are found in China. But there is variation in their geographical distribution. For example, the riverine wetland is mostly located in the eastern part of the country, and the swamps and marshes are more common in the northeast and southwest. Wetlands are less common in the arid northwestern part of China.

While we have witnessed great efforts by the Chinese government in wetland conservation, we also see big challenges confronting the wetland managers and conservationists with rapid economic development and increasing population. The shrinking of natural wetlands, ecological degradation, pollution of water and the impact of climate change are often-addressed common issues faced by the wetlands in China (Wang and Wang 2000; Sun et al. 2006; Yang 2014).

To tackle these problems, the Chinese government has invested a large amount of money in making and implementing different wetland conservation plans such as the visional engineering plan, the action plan, and the five-year implementation plan. Under the overall guidance of the national plan, the local governments make their local plans. These tasks are the responsibility of the government's forestry department, which is the major governmental agency with the authority to manage natural resources.

In view of the lower status of State Forestry Administration compared to the ministries of land, hydraulics and environmental protection, it is a big challenge to ensure effective coordination between these administrative actors. It could be more difficult in the absence of a catchment-wide integrated plan in a real sense. In most cases, the so-called "integrated" is no different from a "sectoral" plan.

Studies (Lu et al. 2011; Huang et al. 2012; Chen et al. 2014) show that change in the area and pattern of wetlands is drastic and driven by both natural forces and human activities in the catchment. It calls for an extended view of the wetland beyond its boundary. Both Yin and Ni (1998) and Wang et al. (2006) consider that viewing the wetland comprehensively through the lens of the catchment is crucial as opposed to viewing it in isolation from the network.

If we adopt such a holistic method, we would notice more stakeholders apart from administrative actors in the management of the catchment and the wetland in it. The current administrative practice in China of guarding or protecting natural resources like the wetland is called "command and control" management. Each agency focuses on the achievement of its working goals or objectives. They are not absolutely mutually exclusive, and some are helpful for reaching the ultimate goal of nature conservation.

But, these departmental efforts in the catchment are patchy and fragmented due to weak coordination. As Armitage et al. (2012) pointed out, such efforts involve high social and environmental costs owing to asymmetric information, incapability and unwillingness to understand the integral components of the catchment. We would assume that some of the unnecessary costs would be avoidable if the environmental management is shifted to environmental governance.

In the new ecological thinking, the environment is non-equilibrium and dynamic product of complex, nonlinear interactions between humans and nature. Such perspectives require us to solve environmental issues from a stance beyond the pure functionalist and deterministic way

of thinking (Scoones 1999). It implies the need for co-production of knowledge from different sources and even contested views. Different actors, such as state actors, non-state actors, and other social actors need to be engaged in the decision process to find solutions. This is particularly important for making an integrated catchment plan.

The participatory and consensus-oriented decision-making process might be the most distinctive characteristic of environmental governance. But the question is who participates, who has power, and how the knowledge is produced. They are the defining elements of an inclusive and transparent process for making a responsive and integrated plan in its essence.

In this article, we are going to use the example of the catchment plan for Lake Erhai Catchment to analyze whose knowledge is counted in the plan, and how open the planning process is and the power relations reflected in the plan. In addition, wetland resources are of significance to the lake catchment however, they are not addressed appropriately in the catchment plan.

Our attention to above mentioned problems arise from our experiences on co-management of the wetland in Lake Erhai catchment, the mismatch of the plans in achieving shared goal for improving the environment of the catchment, and the observation that local conservation efforts are not well coordinated to attain optimal results and hence, accompanied by conflict of interests and overlapping investment of limited financial resources.

Methods

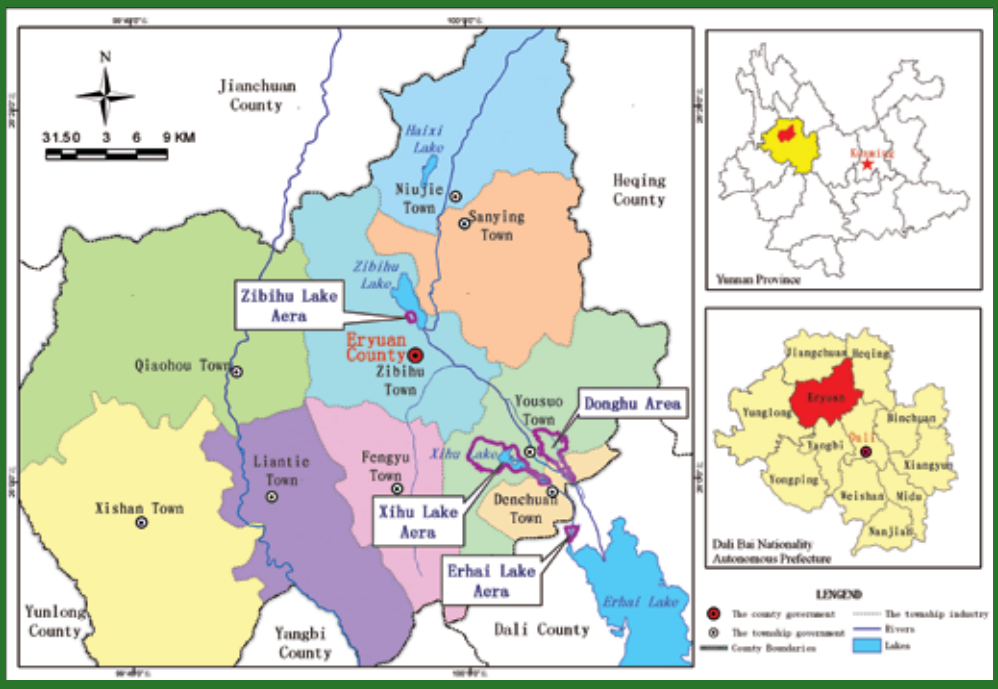
Lake Erhai catchment

Lake Erhai is located in Dali Prefecture of Yunnan Province (Figure 10.1). The lake has a catchment area of 2,565 km^2, belonging to the Lancang (Mekong) River system. It is the second largest freshwater lake on the plateau of Yunnan Province. Since, Lake Erhai acts as a lifeline for local social and economic development, the local people call it “Mother Lake”.

Local development has led to degradation of water quality of Lake Erhai. In 1996 and 2003, the “algae bloom” broke out in the lake. The lake is mainly polluted by wastewater from domestic, agricultural and industrial sources. With the implementation of a series of water treatment engineering and pollution control measures, the water quality of the lake has been maintained at Grade III of the National Standards of Surface Water Quality since 2006. But the current water quality is still lower than the target of Grade II.

Of the 117 rivers flowing into Lake Erhai, three are major rivers, namely the Miju River, Luoshi River and Yong’an River. Because they are located in the north of the Erhai Lake catchment, they are called Three North Rivers. Every year, these three rivers carry a huge amount of water into Lake Erhai, accounting for almost half of its total inflow. Several natural wetlands and two constructed wetlands are connected directly or indirectly to the Three North Rivers. Nearly all of them are functional in treating the water quality of the rivers that flow through them.

Figure 10.1: **Regional location map showing Erhai Lake**



Methods used in case study

In this case study, interviews were held with key government agencies involved in the lake catchment management. These agencies are responsible for environmental protection, forestry, wetland management, catchment management, agriculture, lake management and tourism. Further, publications and documents were also collected. Because of the time limit and the absence of some interviewees, we could not discuss with all of them. But, the key persons were contacted, and the collected materials provided us a lot of useful information.

Results

From lake management to catchment management

According to the Chronicle of Lake Erhai Management (2006), the descending of Lake Erhai Management Bureau from the prefectural level to the municipal level in 2004 marked the transformation of lake protection from the lake boundary to catchment wide. The Lake Erhai Catchment Protection Bureau of Dali Prefecture was established in 2013. Among its many coordinative and directive roles, one is to "organize the preparation of Lake Erhai Protection Master plan, its thematic plans and annual implementation plan to coordinate, guide and supervise the relative government departments for its implementation."

But the stated powerful role of the prefectural catchment bureau is hard to exercise to its full extent, because it is inhibited by the bureau's location on the political power line. Ideally, it might be better if the bureau is at least aligned and levelled with the other administrative departments at the prefectural level. Unfortunately, it is subordinate to the Environmental Protection Bureau of Dali Prefecture. This kind of institutional setup would make the catchment management bureau more dependent on the government's leadership in fulfilling its coordinative role.

It is like the embarrassing situation of Eryuan County Wetland Management Bureau, which made efforts to pull together the actions of different county-level agencies, with its affiliate relation with the county forestry bureau. From its name, the county wetland bureau seems to be independent of the county forestry bureau. But the investigation reveals that it is reliant on the forestry bureau. Some of its official documents must be presented in the name of the county forestry bureau to the county government. Therefore, the subordination characteristic of both institutions, the catchment and wetland bureaus, has been built in from their birth.

Interviews revealed that the institutional setup of these two bureaus is not complete. It means there is only one catchment management bureau at the prefectural level, with the corresponding set-up missing at the municipal and county levels. But for wetland management, it merely exists at the county level. Where it is missing, the work is delegated to the other offices. Forestry officials said they often face inconveniences due to their heavy workload.

There are also some other problems with these two institutions. One is they are young compared with the other long-established government departments. Since the strategic change of Dali Prefectural Government from lake-wise to catchment-wise management in 2004, it has taken almost ten years to devise an administrative body accordingly. The county wetland bureau was formed in 2014. The other is the composition of staff. Many of them are not familiar with the new work.

The leadership of the prefectural catchment bureau is mainly composed of officers from the environmental protection bureau. This partly explains why the 12th Five-Year Water Pollution Control and Prevention Plan (2011-2015) for Lake Erhai Catchment had a prestige status for comprehensive catchment management. It did little harm seemingly because the treatment of the water quality of Lake Erhai was the top environmental concern of the local governments. It will remain the top agenda of the government in the future, particularly with the visit of Chairman Xi Jinping to Dali in 2015.

Knowledge production in catchment planning

The prefectural government has identified the overriding goal of lake water protection in the face of increasing water pollution, and also in response to the national call for an ecological urban development. The goal-based catchment management reflects the political will and

focus on the water quality of Lake Erhai. The whole catchment planning process has been politicized from the starting point of setting the goal to the step-by-step implementation, as was evident during the high-level launch workshop held by the prefectural government this year for developing the 13th Five-Year Catchment Plan.

At such meetings the seats are usually occupied by the heads of important government agencies or their delegates. The messages are taken and the tasks are broken down based on the responsibilities of the agencies. Interviews with the staff of the prefectural catchment bureau showed that after drawing up their own plans, each administrative agency submitted it to the catchment bureau according to the strict administrative codes. Then the bureau consolidated them into one so-called integrated report.

Along this hierarchical line of administration, the information is produced, carried up and down, and processed back and forth. It is a closed circle of powerful actors like politicians, administrators and government staff. But, one fact that could not be neglected is that professional experts and scientists are invited to this planning process. They are either contracted to formulate the report or consulted intermittently. During the process of finding solutions to the pre-identified environmental issues, these actors largely cooperate with each other, despite some conflicts among them.

It can't be denied that mechanically, this is a highly efficient process. The massive achievements in protecting water quality are updated every year in all sorts of working reports of the governments. The problems and challenges amount to clichés accompanying the positive results. The deterioration trend of the lake water quality has been curbed, and the water quality is kept at Grade III.

But it is questionable that the 12th Five-Year Water Pollution Control and Prevention Plan of Lake Erhai Catchment has been used as a guideline document for the overall management of the whole catchment. The study conducted for this report and the Wetland Conservation Plan of Dali Prefecture (2015-2025) prepared by the forestry bureau revealed the different perceptions of the wetlands. In the former report, the wetland is seen as a tool for treating wastewater; but in the latter report, the wetland is treated as a valuable resource to be conserved and utilized. When asked about the wetland, the tourism department spoke more about tourism development. No doubt more dissimilar views are held by other interest groups. But, the guideline document for the lake catchment shows little effort to balance the different interests as it is supposed to do. Though there is a process of feeding information from different administrative actors, the contents of the plan are more or less manipulated by the final producer. In the end, the cacophony of the dissent will be muted down by powerful actors. Without a participatory and consensus-oriented decision-making process, even the administrative actors with certain power have an unproductive supply of information. Those being excluded from this closed circuit can hardly voice their concerns. The experiential knowledge of the local people is neglected, even though their knowledge is embedded in the real environment with which they interact in their daily life.

In this sense, the catchment plan is not an integrated one, but is biased and based on the knowledge of those who dominate the planning process. In this process, the hard system approach (Cundill et al. 2011) is adopted; the recipe for solving the environmental issues of Lake Erhai is overwhelmed with engineering measures.

Power relations

Knowledge production is the result of power struggle among those who are included in the decision-making process. But their power is not evenly distributed. Some have power over others. Those at the top of the hierarchy have more power than those at the bottom. The government holds supreme power, so that it could play an arbitrary role in resolving conflicts. Non-government actors like experts and other social actors take an advisory role if they are invited, but without decision-making power.

Generally, there is not much communication among these administrative actors in their routine work. They exercise their power in parallel; each government agency works within the boundary of its own administrative sphere. In such circumstances, the prescribed line of division between them is carefully guarded or defended. In a clearly dichotomous situation, the dividing line can be easily perceived. But, for complex interrelated natural environments like- lake catchment and wetland ecosystem, the line is blurred.

There is need for them to communicate and exchange views and information for a holistic diagnosis of the lake catchment. At this critical point, the lack of a good facilitation process would mostly likely lead to the prevailing defensive reaction, consciously or unconsciously. Each is trying to maximize its own benefits in this battlefield.

The prefectural catchment bureau should have played a facilitative role in the negotiation of different interest groups. But because it is a newly established institution, its institutional capacity at both organizational and individual levels (Clouting et al. 2014) is not developed well enough to do so. Far from synchronizing resources and efforts of all the participating agencies, the existing catchment plan contains a strong accent of the environmental protection bureau. It is easy to understand this rigid hierarchical system. The prefectural catchment bureau is subordinate to the environmental protection bureau, but it is the final producer of the plan.

The conventional procedures for making decisions related to the catchment plan have generated complaints from some government agencies that were heard during interviews. They said their interests were not represented or misplaced in the plan. However, there is a good sign that most of them have shown willingness to cooperate for better catchment management. In the absence of an enabling institutional environment, they could not talk openly and bargain with each other for an optimized catchment plan, even though each of them has a good departmental plan, like the Wetland Conservation Plan of Dali Prefecture from the prefectural forestry bureau.

By now, we could see that the power relation has been encoded in the current institutional arrangement, with a rigid and inflexible procedure. Experienced actors could even predict the result of the decision-making process after the calculation of power. In most cases, this confidence makes them participate in a passive way. Those with seemingly equivalent power will finally see their power grow or abate, depending on who has the final say on the issue. Therefore, the outcome of the planning process is predetermined by power relations rather than being a real struggle of interest groups with different views, conceptions and knowledge.

Discussion

Who participates in the decision making process depends on what type of power the actor has and the actor's closeness to the political circle. As discussed earlier, the administrative actors are nearly all involved in this process of developing the lake catchment plan, no matter how much power they have in the catchment management. The technocratic group of actors is allowed in based on the invitation and contract to provide advisory services and technical assistance. Their contribution to the decision-making process is limited by how much power they have.

The knowledge in the current catchment plan is partial and prejudiced as it only represents the most powerful actor(s). Insufficient participation of a diversity of actors in the lake catchment, and the lack of modulation of various interests and knowledge of all the actors could barely make the current plan an authentically "integrated" one.

The intention of the catchment management is to manage the different resources in the catchment in an efficient way. The notion "integrated" clearly indicates that the resources management should be approached from a broad perspective (Pahl-Wostl 2007), including all stakeholders, to reach a compromise-based agreement through a deliberative process.

Various interpretations of the issues are possible, because the decision-making process involves purposeful actions taken by people that are meaningful to them (Checkland and Poulter 2010). Therefore, it might be problematic to have one goal identified by a single or a minority of actor(s) and then come up with solutions accordingly.

Studies show that cycles of knowledge sharing and joint action to co-create knowledge (Ensor and Harvey 2015) in a continued process of social learning among stakeholders at different scales are needed to develop their capacity and build trust to collaborate, and take collective actions in the management of natural resources (Mostert et al. 2007, Pahl-Wostl et al. 2007).

Conclusion

An integrated catchment management plan, as its name suggests, is an organic product of a deliberative process involving different stakeholders in the catchment. As a guideline document with high authority, it takes into account different actions in the catchment, and harmonizes various interests and aspirations of the stakeholders.

The analysis of the case in this article showed that rigid and inflexible institutional settings fail to provide an open platform for the confrontation, negotiation and dialogue between the actors in the catchment. Poor integration of the plan is inevitable when the power of the wetland management bureau is weak, and when there is an absence of a powerful and skillful facilitator in the decision-making process. Thus, the facilitation role should have been performed by the prefectural catchment management bureau.

On the other hand, a closed circle of political administrators hampers the possibility of creating an enabling environment for social learning, because little space is opened for non-governmental stakeholders. Therefore, the ground does not exist for a reliable integrated catchment plan.

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Management and Governance System of Wetlands in Bangladesh:

A Case Study on Co-management of Tanguar Haor

Ishtiaq Uddin Ahmad[a]

[a] International Union for Conservation of Nature (IUCN), Bangladesh
Ishtiaq.AHMAD@iucn.org

Abstract

Wetlands, which occupy two-thirds of Bangladesh, have great conservation value along with ecological, economic and aesthetic importance. With the political transformation, the management of wetlands has been transferred to a different entity in Bangladesh. When the governance concept in the field of biodiversity conservation and wetland management became significant and traditional wetland management failed to find a balance between conservation and development, the Bangladesh government explored different decentralized, site-specific and community-led approaches. One of them is community-based sustainable management of Tanguar Haor. The objective of this project is to conserve biodiversity of the wetland and to ensure the livelihood of people who live around the wetland. This paper discusses the institutional setup, benefit sharing and community involvement in effots to build climate resilience in Tanguar Haor, Bangladesh.

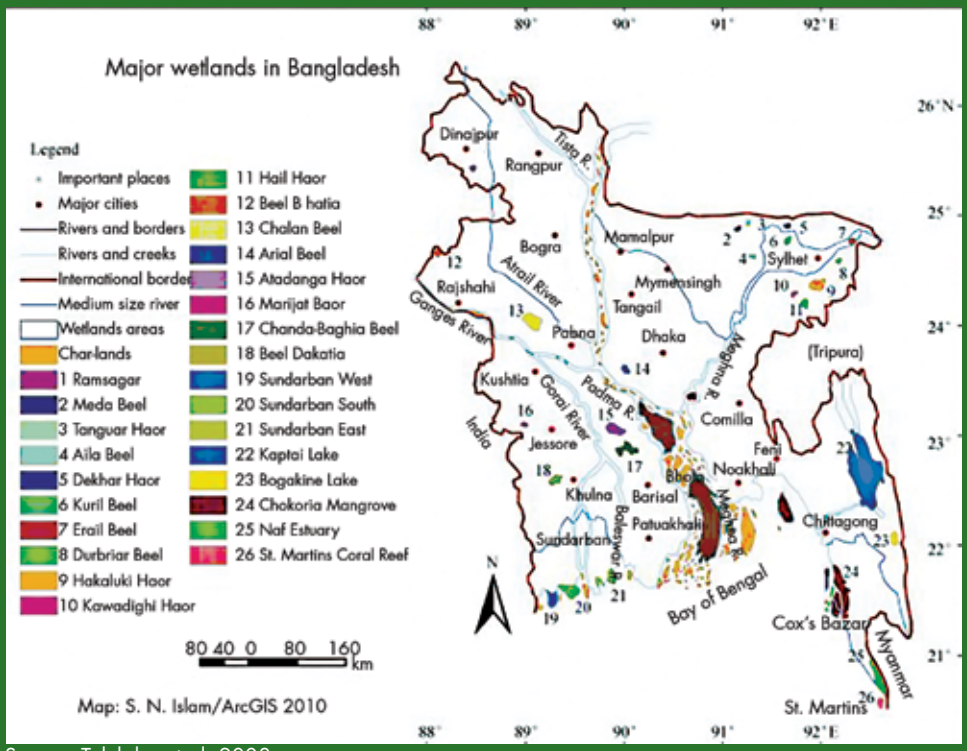
Keywords: community-based management, benefit sharing, decentralized, Tanguar Haor

Introduction

The total area of wetlands in Bangladesh has been variously estimated at 7.5 to 7.8 million ha (Rahman 2005), which is 50% of the total land surface. Currently there are 43 sites identified as wetlands and protected areas in Bangladesh, and most of them are ecologically sensitive sites (Figure 11.1) (Talukdar et al. 2008). The greater part of the northeast region of Bangladesh is taken up by the wetland basin, which comprises the floodplains of the Meghna River tributaries, and is characterized by the presence of numerous large, deeply flooded depressions, between the rivers known as haors e.g., Tanguar haor, Hakaluki haor, Hail haor, etc.

Wetlands in Bangladesh have strong seasonality dimensions and hydrological regimes. Seasonal expansions (flooding) and contractions (dry season) of wetlands promote nonlinear and dynamic ecosystems that enrich their productivity and biodiversity including aquatic and terrestrial biotic assemblage. The dynamic and multiple production systems of these wetlands captivate diverse livelihood options here.

Figure 11.1: **Designated wetland areas and their location in Bangladesh**



Source: Talukdar et al. 2008

Present Status and Trends of Wetland Resources and Services

Wetlands of Bangladesh have great conservation value along with ecological, economic and aesthetic importance. Thousands of birds, fish, reptiles and other animals make wetlands of Bangladesh an ecological goldmine. Moreover, it contains very rich components of biodiversity of all valuable ecosystems. Many of the wetlands that are partly dry in the lean season support different types of terrestrial, riparian and aquatic vegetation. According to Ramsar definition, two-thirds of Bangladesh land area can be classified as wetlands.

About 260 species of freshwater fish are found in the inland water bodies of Bangladesh. Wetland ecosystem serves as a habitat for a variety of resident and migratory waterfowl and endangered plus commercially important species of national and international importance. Around 400 species of migratory birds visited the wetlands in Bangladesh. About 0.96 million tonnes of inland capture fish contributes 28.19% of the total fish production (3.41 million tonnes in 2012-13) in the country (FRSS 2014). Wetland serves as main reserve for freshwater fish brood. Almost 50% of the population of Bangladesh is directly dependent on wetland resources for food, nutrition and livelihoods.

Moreover, four categories of wetland values have been identified in Bangladesh: environmental values, economic values (direct, indirect, option, existence, and bequest values), social and cultural values (Table 11.1). In keeping with these categories, wetlands ecosystem offers different types of services to the communities.

Table 11.1: **Wetland values and ecosystem services**

Wetlands values	Wetlands ecosystem services
Environmental	Hydrological cycle maintenance, water storage and discharge, flood control and regulation, transport of sediments, reduce salinity intrusion, purification of water, reduce erosion, soil formation, maintaining food chain and habitat, biodiversity protection, protect ecosystems, pollution control, maintenance of landscapes and balance of ecology, etc.
Economic	
Direct values	Agricultural production, forestry, hunting, fishing, production of wild food, grazing field for livestock, supply of fuel, fodder, honey, fruits and wood (mangrove), supply of raw materials, and field for primary economic activities.
Indirect values	Benefits from improvement of water quality, flood prevention, pollution control, provision of medicinal plants, land for industrial location, primary economic activities, etc.
Option values	Benefits from ensuring options for future use
Existence values	Benefits from conserving or willingness to forgo a part of one's income in order to conserve a resource, especially natural amenities or species.
Bequest values	Benefits from ensuring that certain goods will be preserved for future generations.
Social	Navigation and social network, provision of settlement places for the indigenous community, extension of urbanization, inspiration place for education and research, employment opportunity for the poor, empowerment of destitute groups, and social events.
Cultural	Ecological tourism and recreation, tangible and intangible cultural heritage, cultural values, natural heritage, aesthetic values, religion values, spiritual values, ethical values, scenic values, sense of place, cultural landscapes, etc.

Source: Islam 2010

Wetlands shape, influence and mould the existence and philosophy of the community people. Historically these ecosystems have contributed significantly to livelihoods of the rural people of Bangladesh by providing various goods and services. Among many other resources, fish and fisheries are important components of wetland ecosystems. Wetlands are used for rice and vegetable cultivation, cattle grazing, duck rearing, and fuel collection. Over 70 percent of households catch fish from floodplains for food and household income. In Bangladesh 10 million people depend on wetland ecosystems for their livelihoods (Nishat 1993). Overall, the fisheries sector of Bangladesh accounts for 3.47% of GDP, 4.04% foreign exchange earnings and 58% of animal protein intake (DoF 2009).

Wetland Management in Bangladesh

Historical background

Traditionally, local communities in Bangladesh used to manage wetland resources to secure their livelihoods with the support of local institutions. With the start of the British colonial regime, local communities were systematically excluded from taking part in the management system due to a top-down and command-and-control management system. After

independence, jurisdiction over wetland resources lie with the Land Ministry of Bangladesh, and access to and control over wetland resources are determined by the existing top-down, command-and-control, bureaucratic management regimes. Grounded solely in the economic aspects of wetland resources, the management objective of the government focuses on rent seeking to maximize revenues and other economic benefits.

Against this backdrop, the modern concept of governance originated worldwide in the late 17th century. Although ensuring governance in the field of natural resource management is the foremost priority for a developing country like Bangladesh, it has only been 20 years since the concept of governance started being used in the development sector.

Governance is a key concept in the field of biodiversity conservation and determinant of wetland resources management. In the context of Bangladesh, it carries more significance as the traditional wetland management failed to find a balance between conservation and development, which is the essence of sustainable development. In 1986, the Bangladesh government began exploring the decentralization of wetland resource ownership to the local resource-dependent users. This experimental management regime resulted in the first 'National Fisheries Policy' in 1998. Although the existing laws in Bangladesh are not specific to the needs and problems of wetland management and conservation, there are some sectoral laws that have a bearing on wetland issues. These are: National Water Policy 1999, National Jalmahal Policy 2009, Bangladesh Environmental Conservation Act 1995, East Bengal Protection and Conservation of Fish Act 1950, Bangladesh Wildlife (Preservation) (Amendment) Act 1974 etc.

However, in recent decades there has been a noticeable shift in the governance of wetland resources in Bangladesh whereby decentralized, site-specific and community-led management activities are gradually replacing the centralized 'classical approach' to governance. Bangladesh has recently changed policy direction and recognized the need to devise community-led management approaches to ensure sustainable conservation and development of forest and wetland biodiversity. Over the last two decades, several initiatives to manage natural resources have been carried out by government, non-government and community-based organizations. The conventional top-down approach of governance has increasingly been replaced by a people-centred management regime in different forms and subsequently more recognition, support and collaboration have been noticed from the government side. Over the last two decades, a number of donor-supported Government of Bangladesh (GoB) projects [viz. Community Based Fisheries Management (CBFM), Management of Aquatic Ecosystems through Community Husbandry (MACH), Sustainable Environment Management Programme (SEMP), Coastal and Wetland Biodiversity Management Project (CWBMP), Community Based Resource Management Project (CBRMP), Tanguar Haor and Wetland Biodiversity Rehabilitation Project (WBRP)] demonstrated various methods and approaches towards establishing community based co-management of wetland resources.

New fisheries management policy (NFMP)

In 1986-87, the Government of Bangladesh began with the 'Experimental Project for New and Improved Management of Open Water Fisheries in Bangladesh', which aimed to implement the New Fisheries Management Policy (NFMP). The main objectives of the NFMP are: a) to divert maximum benefits arising out of inland water fisheries to the true fishermen; and b) to take measures to ensure the sustainability of fish productivity in the inland open waters. Essentially, leased water bodies (Jalmahals) were handed over from the Ministry of Land (MoL) to the Department of Fisheries (DoF) for administration. By 1993, more than 150 fisheries had been handed over, and by 1996 this had increased to a total of more than 300 water bodies. Reportedly, however, the deregulatory measures of the NFMP have fallen far short of the mark, as new middlemen have appeared on the scene, using local fishermen as a front. In the later instances, fishermen co-operatives have been established as a cover for commercial companies and exploiters. In practice, all large Jalmahals have remained under lease to commercial companies, and NFMP is criticised for having been used a political tool for campaigning purposes.

Community based wetland management initiatives

In 1994-96, the 'Community based Fisheries Management and Habitat Restoration Project' was carried out by the Centre for Natural Resource Studies (CNRS), a leading national NGO, Proshika NGO, and Ford Foundation (private foundation) at Singaharangi Beel in central Bangladesh. The site was selected on the basis of manageable size (10 ha, 990 households), local community interest, and the possibility of implementing minor interventions (e.g., desilting) to restore the wetland (Rahman et al. 1996). Habitat restoration and establishing sustainable resource management practices were regarded as successful interventions.

The GEF-funded 'Bangladesh Coastal and Wetland Biodiversity Management Project' began in 1999 in Hakaluki Haor and was managed by the Department of Environment (DoE)-UNDP. It aims to restore local involvement in the management of important fisheries, and has a capacity-building programme to achieve this. At the same time, it seeks an interim solution to management, to bridge the gap between commercial exploitation and community-based management.

Community based Haor resources management under Sustainable Environment Management Programme

The Sustainable Environment Management Programme (SEMP) is the first follow-up activity in the implementation of the National Environment Management Action Plan (NEMAP). It was executed by the Ministry of Environment and Forest (MoEF) from October 1998 and completed in December 2006. The objectives of SEMP were to build and strengthen capacity for environmental management at the community level, to prevent and reverse the present trend of environmental degradation, and to promote sustainable development and reduce existing poverty and raise the quality of life.

Community based Haor and Floodplain Resource Management Projects, under the broader theme of participatory ecosystem management, officially comprising SEMP components, have been implemented by IUCN's Bangladesh country office with support from the MoEF and UNDP from 1998 to 2006. The CNRS worked for Haor, while Nature Conservation Management (NACOM) and Bangladesh Centre for Advance Studies (BCAS) worked for Padma-Jamuna, Brahmaputra-Sitalakha floodplains and the Madhumati floodplains respectively.

Community based fisheries management including fish sanctuary, swamp forest plantation, and green funding mechanism were developed under the project. The project aimed to reverse the deteriorating tend of floodplain ecology as well as to ensure sustainable use of wetland resources, which include water, soil, rainfall, fish, wildlife and plants.

Management of aquatic ecosystems through community husbandry (MACH)

Management of Aquatic Ecosystems through Community Husbandry (MACH) is a Government of Bangladesh project supported by USAID. MACH's goal is the promotion of ecologically sound management of floodplain resources for a sustainable supply of food to the poor of Bangladesh. The project has established community based co-management and helped restore and increase sustainable productivity in three large wetland ecosystems: Hail Haor in Sreemongal, the Turag-Bangshi River and wetlands in Kaliakoir and the Kangsha-Malijee basin in Sherpur. The project was implemented by Winrock International, USA, BCAS and CARITAS Bangladesh (a national NGO). The partners have worked closely with the department of fisheries since 1989. The project included realistic activity packages covering household level livelihood planning and intervention, training needs assessment, awareness and institution building, habitat rehabilitation, afforestation, wise use of fish and other wetland resources, establishment of sanctuaries, community development and local level institution building and social and biological monitoring.

Community based fisheries management (CBFM)

The Community Based Fisheries Management (CBFM) project was implemented from 1996 to 2006 by the international research organization the WorldFish Centre, in partnership with the Department of Fisheries (DoF), Government of Bangladesh, and local NGOs, in an action research project which has developed a series of community based fisheries management approaches (fisher-led, community led and women-led) for ensuring equitable access to fisheries resources for community based management groups. Over a ten-year period, the CBFM project established community control over 116 water bodies. Over 130 officially recognized, poverty-focused community based organizations (CBOs) were involved in the management of these water bodies. One of the main actions of CBFM-2 was to establish fish sanctuaries – no fishing zones where a proportion of fish in the water body are allowed to stay safely even when the surrounding water levels are at their lowest.

Coastal and wetland biodiversity management project (CWBMP)

The Coastal and Wetland Biodiversity Management Project (CWBMP) aims to implement the ECA (Ecologically Critical Area) legislation through the participation of local community and alternative livelihood options. The project has been implemented since 2006 in Hakaluki Haor, Cox's Bazar Beach, Sonadia Island and St. Martin's Island. Village Conservation Groups (VCGs) formed to fulfil the objectives of the project implement different activities including alternative income generation, swamp plantation, mangrove plantation, no fishing zone, etc.

Tanguar Haor and community based sustainable management project – A case study on co-management

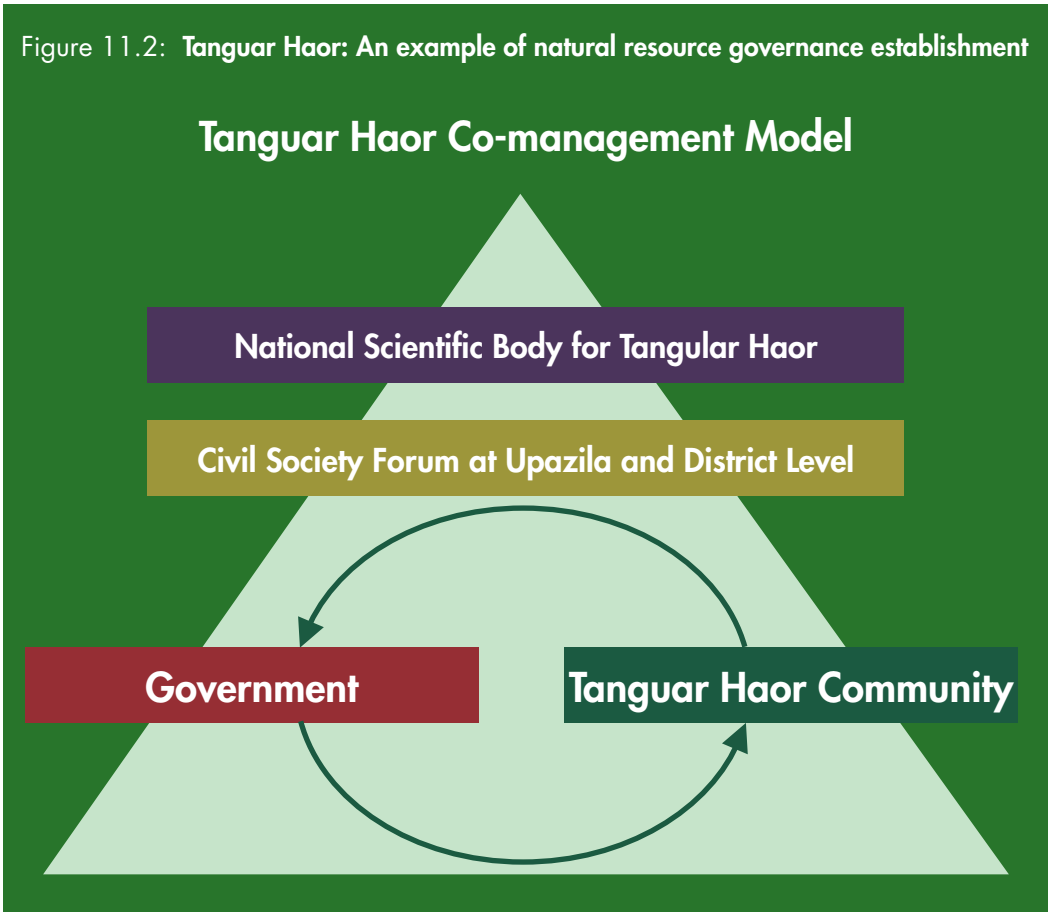
Tanguar Haor is a wetland ecosystem covering an area of 9,727 ha and located at the northeastern district of Sunamganj close to the Indian border in the Meghalaya hill region. Due to its designation as an ECA in 1999 and a Ramsar site in 2000, the government, represented by the MoEF, put in place a project titled 'Community Based Sustainable Management of Tanguar Haor', to which IUCN's Bangladesh country office is assigned to provide technical support. The project is funded by the Swiss Agency for Development and Cooperation (SDC). The project was designed with three phases, namely preparatory (2006-2009), development (2009-2012) and consolidated phase (2012-2015).

This unique project was implemented to conserve the biodiversity of the wetland and to ensure the livelihood of people around the wetland. Different institutions have been established with clear mandates, to ensure that people's opinions are reflected in development initiatives. Representatives from communities have been included in committees at all levels and a bottom-up approach has been followed in decision making, thus ensuring participation and transparency in all kinds of decision making. To ensure equity, engagement of women and other professionals have been guaranteed in all level of decision making. To share the benefit from fish harvesting, a benefit sharing mechanism has been established through consultation with community and other stakeholders where 40% of the money from fish sale goes to fishermen, 36% goes to Central Co-management Committee (a community based committee) for the development of the community and 24% goes to government. Representatives from different committees have been selected through a democratic process where community people have chosen their representatives through election. Democratically elected representatives are accountable to the community in taking any decision.

Natural resource governance

During the three consecutive phases, the initial mechanisms for communities and government for managing and controlling the natural resources of Tanguar Haor were put in place (Figure 11.2). At the national level, formation of the Project Steering Committee assures general oversight and provides the necessary policy environment and political support to the project. The building blocks of a co-management system are being put in place. The first of

Figure 11.2: **Tanguar Haor: An example of natural resource governance establishment**



these is a structured system for community participation in different co-management bodies in the form of community based committees in village, union and upazila levels. The Tanguar Haor Management Committee at the district level was formed and is operating under the chairmanship of the Deputy Commissioner, Sunamganj to coordinate technical, law enforcement and community initiatives under the new, still developing, co-management scheme. At the union level a Central Ad hoc Committee (CAC), which was later christened the Central Co-management Committee (CCC), was formed with elected union leaders who review the progress of the project activities. A union level ad hoc committee (UAC), whic was later named the union co-management committee (UCC), was formed to make decisions on resource acquisition at Tanguar Haor.

Completing the recipe for the governing dish, there are 48 village organizations called the Village Co-management Committee (VCC) and elected representatives from 88 villages that have a strong voice in the co-management regime. IUCN Bangladesh through its Project Management and Support Unit (PMSU) coaches and brings in local NGOs that are relevant to the management process. Starting from the national level to the community level, there is dissemination and sharing of opinions and information in a pyramidal framework with a set

hierarchical standing. This intricate governance structure has made major headway in the management of Tanguar Haor. The formation of committees at the village level encourages the participation of locals in the co-management of the Haor.

Considerable effort has been made by the District Administration in explaining the long-term objective of sharing the benefits of management with concerned communities, with special attention to the needs of the marginalised, landless and women-headed households. However, the communities developed capacity to negotiate, manage and use the natural resources for better livelihoods.

The communities widely accepted the traditional non-commercial fishing practices to secure their fishing rights and to ensure sustainable fish harvesting in this wetland for a specific period of the year. The income generating activities, which have reduced stress on the Haor, include small businesses, agriculture, poultry, livestock and handicrafts. Among small businesses, men dominate the fishing and fishing boat related activities while women dominate the grocery shops. Moreover, various activities like plantation of native tree saplings to restore fish habitat and reed land, establishment of five fish and two bird sanctuaries have been carried out for the rehabilitation of the Tanguar Haor ecosystem. The district administration is providing political and operational support to Tanguar Haor through Tanguar Haor Management Committee and such measures as the reinforcement of the Law Enforcing Officers.

Community engagement and social benefits

The maximum benefits are received by Tanguar Haor communities through their engagement in different types of project activities. These activities include commercial and non-commercial fishing where they receive a percentage through the benefit-sharing mechanism; active involvement in various plantation, restoration and conservation activities; receive supports from the Livelihood Improvement Programme (LIP), Social Capital Management (SCM), Alternative Income Generation Activities (AIGAs), receive Vulnerable Group Feeding (VGF) for poor fishermen during the fishing ban period; participate in different training year around; appoint a number of community guards with monthly wages for wetland resource protection; and arrange training for eco-tour guides to develop tourism and generate income.

Resilience against climatic disaster

The community of Tanguar Haor has been extensively involved in climate resilient activities. These may include ecosystem-based village protection, introduction of high yield early crop varieties, crop-dam maintenance, large-scale *Barringtonia acutangula* (Hijal) and *Pongamia pinnata* (Koroch) plantation, homestead fruit species plantation, floating gardening, awareness raising on disaster risk reduction.

The governance system for Tanguar Haor natural resources still stands as a big challenge to maintaining its ecological services and values. Observations from existing co-management

system for natural resources management in Bangladesh show that the elite class dominates the decision making process and the voice of the primary target group gets less attention. In the case of Tanguar Haor, there is a gap of inclusiveness in the lower tiers of the structure that affects natural resources governance. With the institutional setup at the local level, the grassroots community members have been organized and have regained usufruct access to natural resources. However, expert opinions emphasize the engagement of potential civil society members, professionals and local government institutions in the structure for attaining the outcomes of the co-management system in Tanguar Haor resources management.

Conclusion

The union level administration helped to set-up the beel (water bodies in the Haor) based fishing practices as well as no fishing zones to help the ecosystem recover. The community administration initiated an outreach programme to increase community involvement and set-up alternative modes of income generation, and was in direct control of the Tanguar Haor resources. The national level administration was in favour of 'wise use' Ramsar principles and aided the project through nationwide support. Every single tier in the governing system was instrumental in the management of the Haor. True to its word the project is a great example of how to create a co-management system of natural resource governance.

It is common knowledge that highly diversified ecosystems are more resilient to stochastic events. The sheer size of the governing body is necessary to adapt the unforeseen problems and build resilience for long-term wetland management. The problems related to corruption at lower tiers of the system will have to be monitored with greater vigilance in future. Moreover, the livelihoods of the people were improved and, through the access control mechanism, the overall ecological integrity of the fragile system experienced gradual improvement.

The daunting size and diversity of the project requires that the management responsibility be shared among different stakeholders. The governing system established at the site has had many successes but further effort is required to fill the remaining gaps in management. The governance system is sound and will hopefully persist in the future to preserve one of Bangladesh's most significant natural resources, a biodiversity hotspot for fish and birds.

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Community Involvement in the Management of High-Altitude Wetlands in Nepal: A Case of Gosaikunda

Rajendra Khanal[a], Bishnu Bhandari[b], and Sony Baral[a]

[a] International Union for Conservation of Nature (IUCN), Nepal, [b] Nepal Wetlands Society, Nepal
Rajendra.Khanal@iucn.org

Abstract

Wetlands that lie above 3,000 masl in the Himalayas are generally known as high-altitude wetlands in Nepal. Many people, particularly Hindus, attach high religious significance to these wetlands because of their high religious and spiritual values. Gosaikunda is a high-altitude Ramsar site where more than 35,000 pilgrims come to pay their tribute to, and worship, Lord Shiva by bathing in the holy lake, specifically on the full moon days of June and August. However, pollution has been a major environmental problem due to the large number of pilgrims. Solid waste management and destruction of the natural environment are the main causes of pollution. In this context, the study explores how local communities are managing pollution around the lake during the time of heavy pilgrimage. Langtang National Park has been supporting religious tourism with the help of local communities. A local NGO, Gosaikunda Area Development Committee, has been formed with the responsibility of managing and developing the wetlands. The Committee not only provides services to pilgrims to help control pollution, but also provides opportunities to local communities for generating additional income and local employment. Since the lake is within a protected area, the local communities are only allowed to build temporary, makeshift camps for the pilgrims. The Committee repairs and maintains the trails, builds temporary toilets and provides drinking water to the pilgrims. First aid and emergency services including rescue operation, especially for the treatment of people suffering from high-altitude sickness, are provided during the high season for pilgrimage. Special arrangements are also made to manage rites and ritual activities at the lake. Local people are managing the pressures and problems created by excessive religious tourism. The involvement of local communities, including representatives from local governments and other organizations, have provided support not only in controlling pollution, but also in securing the livelihoods of local communities.

Keywords: communities, high-altitude wetlands, Gosaikunda, livelihoods, pilgrimage

Introduction

High Altitude Wetlands (HAWs) occur approximately at or above 3,000 masl In Nepal they occur in the high Himalayan region. These Himalayan wetlands play an important role in the hydrological, ecological and socioeconomic security of the entire region and therefore they demand special emphasis in conservation planning and management (Trisal and Kumar

2008). These HAWs are not only spectacular in their scenery, but are also sacred to Hindus and Buddhists alike. People attach great values to these wetlands and go on pilgrimage to these sacred spaces on certain occasions of the year, especially in the monsoon season. The biological diversity of these wetlands is immense as they are the habitats of many globally threatened species of flora and fauna. Apart from being rich in biological resources, HAWs also have immense cultural significance as people attach great spiritual significance to both the Himalayas and their wetlands.

Most mountain lakes are sacred. People go on pilgrimage to such lakes for a variety of activities (bathing in sacred waters, worshipping, completing a circuit and the *Darshan* of Hindu deities and Lord Shiva in the case of Gosiakunda). However, during these trips, pilgrims often litter the lake and its surroundings with human waste. The water is polluted through their bathing rituals and offering of rice, flowers, oil-immersed wicks, fruits, vermillion powder, incense, etc. Pasture runoff also ultimately pollutes the waters of the lake.

Using the case study of the Gosaikunda area, a high-altitude wetland of Nepal, this paper seeks to explain how communities have initiated activities to manage the impacts of environmental, biological and cultural stressors in this high-altitude wetland while supporting the livelihoods in the Himalayan region of Nepal. This paper also discusses how local people have established a non-governmental organization (NGO) to oversee the overall development of the area and the efforts initiated by the committee to clean up the area (such as its lakes, shores and trails) after the festivals of *Ganga Dashahara* and *Janai Purnima*, and how they prevent the further degradation of water quality. Finally, the paper makes some practical recommendations for both HAWs in general, and Gosaikunda in particular, with a view to promoting the sustainable management of such areas while supporting local livelihoods.

Methodology

Study area

Gosaikunda, a sacred lake in Nepal, lies inside Langtang National Park in Rasuwa district. It covers an area of about 13 ha with the altitude of 4,380 m at its water surface. Its mean depth is about 26 m. Physiographically, the lake is in the high Himalayan region of Nepal with the latitude of 28°05′ 21.3″ N and longitude of 85° 24′ 96″ E. The lake is more or less in the U-shaped valley in the lap of Mount Gosainthan. Therefore, the area is also called Gosainthan. It is surrounded by naked mountains and rock cliffs.

Gosaikunda is believed to have been created by Lord Shiva as his residence and a site of meditation of his consort, Gauri. According to religious scriptures, a person can earn a thousand times more *Punya* (merits) by taking a holy bath in Gosaikunda Lake than by bathing in all other sacred sites such as Badrinath, Kedarnath, Gaya, Haridwar, etc. in India. That is why many Hindus and Buddhists make at least one pilgrimage to Gosaithan during their lifetime (Bhandari 2005; Bhandari and Joo 2007a & 2007b).

Study methods

This paper is based on a review of documents, stakeholder consultations and the in-depth knowledge of the authors about the site. The study reviewed available secondary sources of information to gain a better understanding about Gosaikunda, such as the times of visitor influx and its importance to local livelihoods as well as the impact of such pilgrimage tourism on the surrounding wetlands. The study draws on information from different sources including observations and reflections of local residents, local NGOs, group discussion with producers and surveys of pilgrims. Apart from different case studies, consultations with experts who were working in that area were also carried out. The study team also conducted assessments at different time intervals through consultations with the local communities as well as local organizations that are responsible for the management of the lake.

Results

Pilgrimage and its impact

The Gosaikunda Lake is considered sacred as it was created by Lord Shiva to suppress the excruciating pain he experienced after swallowing '*Kalkut Bish*', a fatal poison that was created after a collaboration between deities and demons in the Golden Era. Shamans also make an annual trip to the sites to reinvigorate their strength and energy.

Thousands of people gather at Gosaikunda on full moon days, particularly on the days of *Ganga Dashara* in June and *Janai Purnima* in August. The *Janai Purnima* festival is bigger than *Ganga Dashahara*; over 25,000 pilgrims gather to have a sacred bath in the lake on *Janai Purnima*. Shamans from around the area come to worship the lake, to see the sleeping posture of Lord Shiva, and to regain their inner strength and energy. Besides, tourists also use the route to make a circuit of the Kathmandu-Dhunche-Gosaikunda-Thulo Ghopte and Kathmandu trail.

In addition to the pilgrimages and tourism, local communities also use the water of the lake for drinking purposes, running their water mills downstream, grazing their animals and collecting herbs and aromatic plants. All these activities might bring about: (1) pollution of the lake; (2) accumulation of solid waste; and (3) heavy pressures on lake resources.

The arrival of a huge number of pilgrims to Gosaikunda causes enormous pressure on the valuable fauna and flora. Major damages due to pilgrimage are (LNP 2013):

- Large-scale littering of non-degradable wastes, causing various kinds of pollution.
- Collection of threatened plants by pilgrims to offer to Lord Shiva during *Janai Purnima* festival.
- Cutting of poles for erecting temporary sheds by vendors.
- Horses/juppa kept around Gosaikunda Lake.
- Improper physical construction in Gosaikunda areas; pressure for devotees to construct *Chhapro/Paati* (temporary shelter) and other monuments in memory of their ancestors.

- Overcrowding of tourists in limited space.
- Low level of participation of indigenous people and marginal communities in tourism related activities.

People's dependency

Existing hotels and lodge facilities are too small to accommodate all pilgrims during the *Janai Purnima* festival. The park administration allows construction of more than 300 temporary sheds in different places from Ghatekhola to Gosaikunda and Ghopte-Maginigoth areas. These temporary sheds produce a lot of garbage during the festival and the park has the onerous task of clearing the garbage along the trekking route (LNP 2013). The park has declared Gosaikunda Valley as a protected religious site and killing animals and keeping horses and Juppas are banned, because killing animals in sacred areas is considered sacrilegious in Tamang culture. There is pressure from outsiders to construct *Paati* (small houses where pilgrims can take rest and shelter). There is no possibility of constructing *Paati* for all pilgrims on *Janai Purnima*. The park should take the initiative to provide tents and other temporary shelters around Gosaikunda through the *Gosaikunda Chhetra Bikas Samiti* (Gosaikunda Area Development Committee). Allocating land for construction of pilgrims' shelters will cause degradation of the sacred landscape (LNP 2013).

Tourism has created a local niche market for herders, small farmers, vegetable producers, apple producers, curio vendors and cheese factories. Cheese from Lantang is very popular among trekkers, and is also supplied to the Kathmandu and Tibetan markets. However, due to limited kitchen gardening and fruit orchards, most of the vegetables are imported from Kathmandu (LNP 2013).

Waste accumulation is another problem created by tourism activities. The problem is severe in Kyangjin Valley, Gosaikunda and Langtang Village. Now the park has registered the Gosaikunda and Langtang Kyangjin Hotel as well as the Lodge Management Sub-committees, which are now fully responsible for maintaining and cleaning the trekking route (LNP 2013).

The widened socioeconomic schism between tourism-exposed areas and tourism-shadowed areas is another important matter of discussion for biodiversity conservation and socioeconomic development of local communities (LNP 2013). Extreme seasonality of visitors has created the problem of overcrowding and a lack of smooth flow of income for local communities, making the potential economic benefits difficult to fully realize (LNP 2013).

Emergence of local community organization

The gravity of these problems has created a unique opportunity for local communities to come together in order to manage the region's pilgrimage tourism and to keep the lake as clean and free from solid waste as possible. As a result, local stakeholders established an NGO

named Gosaikunda Area Development Committee, which is entrusted with the responsibility of managing the overall development of Gosaithan along with well-informed, active and responsible participation of local communities and relevant partners in festival management. This Committee was officially registered with the Chief District Office in 2001.

Community involvement

Major activities of the Committee for the management of the festivals as well the development of the area are summarized as follows.

Health camp

The Committee organizes health camps during the festivals (both *Ganga Dashahara* as well as *Janai Purnima*) in cooperation with stakeholders such as the Nepal Army, Nepal Red Cross Society, District Health Office and Himalayan Rescue Operation. Camps that are set-up at strategic locations along the trail provide first aid medication and advice to the pilgrims, if necessary. The pilgrims are also advised not to walk fast, yet some continue to ascend too quickly and, as a result, may suffer from acute mountain sickness (AMS). A makeshift first aid clinic is set-up near the lake to provide emergency services to those who require immediate medical attention, including oxygen. Also volunteers are assigned to manage rescue services. Volunteers are on "stand-by" to help people who require immediate evacuation. This service has helped save the lives of some people suffering from AMS.

Management of amenities and public utility

For the pilgrims, makeshift camps (called *Tharpu* in the Tamang language) are temporarily constructed along the trail for their accommodation; food is also provided at these camps at a reasonable price. Porters, horses and palanquins are provided for physically challenged people to go to the lake and have sacred baths. Kerosene is made available for pilgrims to cook their food. Safety and comfort of the pilgrims is overseen by volunteers. Special police forces are deployed to prevent and immediately stop any kind of disturbances in the area. Special arrangements are made around the temple for entertainment, chanting and singing at night. Dances such as *Shey-Gompa* and *Syaphru* are quite common among local people, mainly the Tamangs and Sherpas respectively. These dances, which are inclusive of both males and females, are performed in a wide circle.

Management of solid waste

Special groups of park staff and volunteers stand on the shore of the lake with long staffs and remove any solid waste or floating garbage from the lake. Even flowers and garlands are collected and put into waste-baskets. Likewise, solid waste on the banks of the lake is collected and put into waste-baskets. Waste baskets are also placed in strategic locations for pilgrims along the trail. Billboards are erected to advertise where pilgrims may put the plastic waste and other trash.

Conclusion

Arrival of a huge number of pilgrims to Gosaikunda puts enormous pressure on the valuable fauna and flora. Major damages caused by these pilgrims include large scale littering of non-degradable wastes, causing various kinds of pollution; collection of threatened plants by pilgrims to offer to Lord Shiva during Janai Purnima festival; cutting of poles for erecting temporary sheds by vendors; overcrowding of tourists in limited space; and low levels of participation of indigenous people and marginal communities in tourism related activities. However, the gravity of these problems has opened an empowering opportunity for local communities to come together to manage these pilgrimages and keep the lake as clean and free from solid waste as possible. As a result, the local stakeholders established an NGO named Gosaikunda Area Development Committee, which is entrusted with the responsibility of managing the overall development of Gosaikunda along with well-informed, active and responsible participation of local communities and relevant partners in festival management.

Local people have been actively engaged in the management of religious tourism under the general guidance of Langtang National Park. The involvement of local communities, including representatives from local governments and other agencies, presents an example of how pollution can be prevented or mitigated immediately. Through the local NGO Gosaikunda Area Development Committee is managing the lake area and trying to balance pressures and problems created by excessive religious tourism. The Committee mobilizes resources to provide services to the pilgrims and provides opportunity for local communities to generate additional income. The local communities are allowed to build temporary makeshift camps for the pilgrims during the pilgrimage.

Way Forward

The Himalayas are the "water tower" of Asia. They play an important role in maintaining the hydrological cycle of the region. Any change in its ecosystem impacts not only the environment of the region but also the livelihoods of millions of people living downstream along the rivers and their floodplains and catchment areas. Therefore, regardless of their inaccessibility and constraints, they are on the priority list of any management and conservation activities. Based on the experiences and lessons drawn from the management of Gosaikunda, the following are put forward for the wise use of the Himalayan wetlands and their resources in Nepal.

- Special efforts should be made for raising the profile of HAWs, not only in Nepal but also in the region impacted by the Himalayas and the rivers emanating from them.
- There is a great need for documenting best practices and indigenous knowledge in the Himalayan region and disseminating them as much as possible to other areas and synergies of efforts to catalyse the sustainable development of the Himalayas and Himalayan people.
- Concerning Gosaikunda, an autonomous full-fledged Gosaikunda Development Committee should be established and support should be given to the Committee to build

their overall capacity for managing the lakes and their resources for both festival-related as well as long-term development. Social marketing as well as participatory action research should be simultaneously promoted, strengthened and implemented at the grass-roots level.

- Any activities undertaken now will have long-term impact on the resources, not only in and around the lake but also in its vicinity, such as its watershed. Therefore, the foremost priority is to develop a master plan for the lake complex involving all the relevant stakeholders, including local communities, and to receive the endorsement of the local communities so that any activity that is undertaken in the area is meaningful for, and owned by, the local community for its sustainability and their unconditional support in the future.

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Conservation and Sustainable Use of Ghodaghodi Lake Area: Lesson from CSUWN Wetland Project in Nepal

Top B. Khatri[a]

[a] Community Based Flood and Glacial Lake Outburst Risk Reduction Project (CFGORRP), Department of Hydrology and Meteorology, Nepal
khatri.top@gmail.com

Abstract

Ghodaghodi Lake Area (GLA), a Ramsar site of international importance, was chosen as one of the project demonstration sites based on its ecological, biological, economic and cultural values. In the last few years, government agencies, conservation partners and local communities jointly felt the need to extend the GLA beyond the lake boundary and manage it through an integrated and holistic approach at the catchment level. A host of interventions ranging from livelihood promotion to collaborative management of wetlands were undertaken during the five-year period from 2008-2013. Since wetland conservation is a crosscutting sector and thus requires a collaborative approach, a multi-stakeholder forum was launched for the very first time in GLA to promote multi-stakeholder engagement for the conservation and management of wetland resources. A catchment level management plan was also developed to address contemporary issues related to wetland conservation and wise use of local resources.

Keywords: livelihood interventions, collaborative management, multi-stakeholder forum, wetland restoration, payment of ecosystem services, biological monitoring.

Introduction

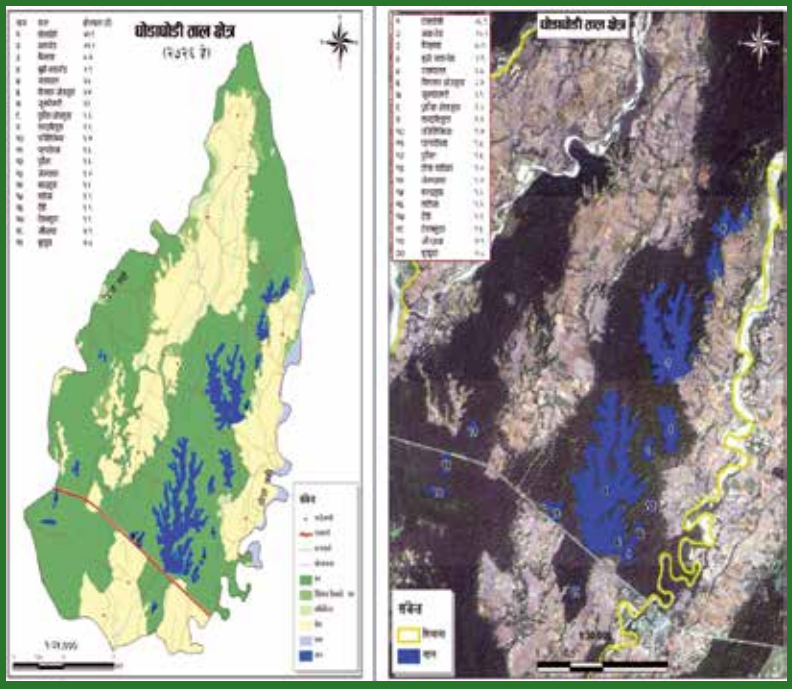
The Conservation and Sustainable Use of Wetlands in Nepal (CSUWN) was a joint undertaking of the Government of Nepal/Ministry of Forests & Soil Conservation (MoFSC) and the United Nations Development Programme-Global Environment Facility (UNDP-GEF). The project was executed by the MoFSC. The Department of National Parks and Wildlife Conservation and the Department of Forests were the main partners. The project started in January 2008 and ended in July 2013. Two Ramsar sites, Ghodaghodi Lake Area (GLA) and Koshi Tappu Wildlife Reserve (KTWR), were the project demonstrations sites. The project was designed to address the root causes of wetland degradation and loss of wetland habitats by integrating wetland management and conservation issues into national policies and plans; and to strengthen the capacity by linking national actions with the activities. The project was the first of its kind in the area of wetland conservation in Nepal, which has provided support to the Ministry of Forests and Soil Conservation to create an enabling policy environment and

to achieve enhanced technical, economic and institutional capacity so that all relevant sectors recognize the values and importance of wetlands. The project was designed to address policy gaps, build capacity (both human and technical resources) and promote collaborative management of wetlands, ensuring continuous provision of environmental goods and services for improved local livelihoods.

Case Study Site – Ghodaghodi Lake

Ghodaghodi Lake is the largest natural freshwater lake of the Terai region of Nepal. With an area of 2,727 ha, Ghodaghodi Lake Area (GLA) is spread over Darakh, Ramshikarjhala and Sandepani Village Development Committees (VDCs) of Kailali district at an altitude of 205 masl in western Nepal (Figure 13.1). The GLA extends over two physiographic regions: the Siwaliks and the Terai. There are 20 interconnected lakes within the catchment area. A total of 57,064 people directly depend on the local resources of Ghodaghodi Lake. Of the total population, 34% are local indigenous Tharus who make up totally Wetland Dependent Communities (WDCs). Hill Brahmin and Chhetri comprise about 37% of the total population followed by hill Dalits 11.4%, hill Janajatis 2.8%, Muslims 0.2% and others 13.6%. The land cover type of the area includes forests 52.5%, degraded forest 3%, grassland 1.8%, agricultural land 34.5%, sand/riverbed 1.6% and lakes 6.1%. The area hosts a rich array of floral and faunal diversity. A total of 450 plants, 226 birds, 29 fish, 32 butterflies, 10 amphibians, 34 mammals and 6 species of tortoises have been recorded.

Figure 13.1: **Previous area covered by GLA 2,726 Ha. (Left), Current catchment level area by GLA 9,650 Ha. (Right)**



Major Interventions and Outcomes

Key issues related to conservation and wise use of resources in GLA include: land encroachment, over-extraction of natural resources, overgrazing by livestock, siltation, eutrophication, poaching, inadequate conservation awareness, upstream-downstream interaction, multi-jurisdictional issues and lack of livelihood opportunities.

Major interventions undertaken to address the above issues to promote collaborative management include: building institutional and personal capacity; raising conservation awareness and outreach; strengthening habitat management and restoration, biological monitoring and soil conservation; developing eco-tourism and alternative energy; improving livelihood, community-based anti-poaching unit (CBAPU) and payment for environment services (PES). Some outcomes have been archieved after the implementation of CSUWN.

Institutional strengthening

CSUWN provided support to the District Forest Office (DFO) through the construction of a site office at Sukhad. The office, which was initially housed in a temporary shed, is now a full-fledged office with a compound wall. Likewise, through DFO, support was provided to Community Forest User Groups (CFUGs). A total of 38 CFUGs were formed out of which 18 are exclusively managed by women. The total coverage of community forest is 1,385 ha with 3,245 households. The total number of beneficiaries is 20,737. The project also supported the CFGUs to construct 13 community halls (Figure 13.2) and provided sustainability funds to 4 CFUGs to give continuity to their regular work. The biggest milestone was the preparation of the Catchment Level Management Plan for GLA, which would provide technical guidance for long-term management of the catchment.

Capacity enhancement

Under the institutional capacity development component, the project provided support to conduct training in the areas of forest management, account/bookkeeping, leadership, gender and social inclusion, wetland management and forest fire control. A total of 984 members, mostly women, have been trained on the above themes and their capacities enhanced. Thirteen local resource persons (LRPs) have been developed.

Conservation awareness and outreach

A total of 15 school wetland clubs including 2 school teacher networks were formed to spearhead conservation education and outreach tasks across the GLA. Likewise, FM radio/ jingles, street drama, event celebration were widely used to educate and raise the awareness of local people on the importance of wetlands (Figure 13.3). Seventy-six episodes of Simsar Sandesh were aired through local FMs.

Figure 13.2: **Sukhad Forest Range Post**

Figure 13.3: **Street Drama for Wetland Awareness**

Habitat management and restoration

Five critical wetlands sites – Ghogaghodi, Nakhrodi, Tendi, Tengna and Tinchatiya (Figure 13.4) – were identified, mapped and restored through the construction of four earthen bunds, five sluice gates, weeding and cleaning of alien invasive species, construction of eight basking sites and maintenance of floating islands for migratory birds and crocodiles. Due to habitat management, breeding of Asian cotton pigmy goose (*Nettapus coromandelianus*) was recorded in 2009. Likewise, breeding of common Moorhen (*Gallinula chlropus*) was recorded in 2010 for the first time in Nepal (Figure 13.5).

Figure 13.4: **Habitat management and restoration**

Figure 13.5: **Breeding of Common Moorhen recorded at GLA in 2010** (Left), **Breeding of Asian Cotton Pigmy Goose recorded in GLA in 2009** (Right)

Biological monitoring

GLA is an Important Bird Area (IBA) as it provides a unique habitat for birds, including for a number of threatened species. Three species, cotton pygmy goose (*Nettapus coromandelianus*), wild rice (*Oryza rufipogon*) and crocodile (*Crocodylus palustris*), were chosen to represent GLA for biological monitoring and annual monitoring of key indicator species was were carried out to keep track of the population trend (Table 13.1). Limnologic monitoring was also undertaken on a fortnightly basis. A local bird watching club was formed and supported with monitoring equipment. There has been a marked increase in the population of indicator species in GLA.

Soil conservation measures

Soil conservation measures (Figure 13.6) in five CFUGs covering 25 ha of erosion-prone land were carried out with the river training (spurs and embankments) and reinforced by vegetative measures. Reforestation and afforestation activities were carried out by mobilizing the school wetland clubs and community forestry user groups.

Table 13.1: **Population of key indicator species increased**

Species	2009		2010		2011		2012		2013	
	W	S	W	S	W	S	W	S	W	S
Cotton pigmy goose		139	188	135	243	175	290	254	300	
Marsh mugger	3		12		12		13		15	
Wild rice ha.	3.6		12.42		15.27		14.07			

Figure 13.6: **Soil Conservation work at Kawa Khola**

Eco-tourism promotion

Promotion of local tourism was carried out extensively by mobilizing the local forest user group so that revenue generated would be circulated for the maintenance and upkeep of the infrastructure developed. Project supported the construction of a stretch of 1.5 km of foot trails interspersed with five vantage points for bird observation along the lake area. A permanent view tower (Figure 13.7) was also built close to the entry point of the lake. Specific areas were designated picnic spots and signage/information boards were put up. A small Tharu museum housing local artifacts and costume were put on display.

Figure 13.7: **View tower for eco-tourism promotion**

Alternative energy

As local people were extracting forest resources for fuelwood needs, alternative energy such as biogas and Improved Cooking Stoves (ICS) were introduced to needy people. A total of 200 units of biogas plants (Figure 13.8) and 1000 ICS were provided to reduce dependency on forests, which also contributed to carbon offsets.

Livelihood improvement

As majority of the local Tharu people were wetland dependent, 215 households (HHs) of poor WDCs were tagged to provide targeted livelihood interventions to increase household income. Fisheries (387 HHs), goattery (162 HHs), piggery (24 HHs), leaf plate making (86 HHs, Figure 13.9), fibre based (22 HHs) and technical skill enhancement (25 HHs)

Figure 13.8: **Bio-gas with attached toilet**

Figure 13.9: **Leaf plate making machine**

support was provided to increase household income by at least 15% from their baseline income by the end of project tenure.

Community Based Anti-Poaching Unit (CBAPU)

A total of 30 Community Based Anti-Poaching Units comprising 430 members were formed for surveillance and monitoring of wildlife across GLA. As a result a drastic reduction in poaching incidences was reported (Figure 13.10).

Payment for environment services (PES)

As a pilot to educate and build awareness on the role of forest ecosystem in providing goods and services, six CFUGs representing upstream and downstream were mobilized. Two orientation and sensitization meetings were held to appraise them. After much discussion and deliberation, it was agreed that downstream communities would pay a small fee for using Ghodaghodi Lake.

Figure 13.10: **Confiscated poaching materials (Left), Community Based Anti-Poaching Unit's meeting (Right)**

Institutional mechanism for collaborative management

A Multi-Stakeholder Forum (MSF) for inter-sectoral coordination and collaborative management of wetland resources at the local level has been operational at GLA. The MSF is chaired by the Local Development Officer. It is an eleven-member body representing district line agencies; irrigation, agriculture, fisheries, teachers' network, students' wetland clubs, CFUGs, community-based organizations, Village Development Committees–chairperson, Water User Association and the District Forest Officer. The DFO serves as the member secretary of the Forum. This body is responsible for overall coordination and collaboration for the conservation and wise use of GLA. This mechanism was formed and launched in January 2011. Major achievements of GLA include:

- Formation and launch of an MSF to promote collaborative management of GLA.
- Creation of five capitals (natural, physical, human, financial and social) for institutional sustainability.
- Preparation and rolling out of a Catchment Level Management Plan for GLA covering an area of 9,650 ha to address contemporary issues. The plan has been approved by the Department of Forests.
- 13 Local Resource Persons (LRPs) on wetland conservation and management have been developed.
- A new checklist of birds for GLA was prepared. A dedicated local bird watching club was established.

Conclusion

The overall achievements of CSUWN project include:

- A National Wetland Committee (NWC), an eleven-member apex body for inter-sectoral coordination and collaboration, formed and operational.
- Revised National Wetland Policy, 2012.
- Draft of a new Wetland Bill.
- A total of 15 technical knowledge based products have been developed and disseminated.

More than 4,500 individuals received institutional and capacity development training. Seventy-three wetland related sensitization programmes were organized for various stakeholders. Thirty government planning officials were trained on Economic Valuation, and Wetland Inventory and Monitoring Assessment Tool. A total of 350 government officials were sensitized on wetland related issues under various ministries. Likewise, 28 wetland related international exposure visits were organized for government and partner institutions. The Wetland Watch Group (WWG) at the Nepal Forum of Environmental Journalists (NEFEJ) has been formed as a dedicated group of journalists to deal with wetland issues at the central level. International Wetland Symposium 2012 was organized as a knowledge sharing event for the first time in Nepal.

Few lessons were learnt from the implementation, including:

- Building community capacity for conservation and sustainable livelihoods is a long-term process. Hence, long-term commitment is required for this to happen in a sustainable manner.
- Creating alternative and environmentally sustainable economic opportunities is critical for long-term resource conservation.
- The most urgent action required is to take inventory, identify and map wetlands and wetland species that are at risk from climate change within a locality or a particular region, and then prioritize wetlands for their management and adaptation to prevent further loss and degradation of wetlands through a right mix of management prescriptions.
- Demonstration projects are an essential way to test new approaches (technical and institutional). The broader impacts of these demonstrations occur when such models are extended to other regions in a sustainable manner and when they influence national policies.
- Operating at macro and micro levels lends credibility to policy recommendations. Working at the meso level means we can create sustainable institutions to implement national policies.
- Integrating crosscutting issues such as gender equality, poverty alleviation, capacity building and governance in all programming leads to more sustainable and equitable development.
- Effective social change requires the right balance between diversity and uniformity while the project introduced valuable tools to implement its activities, produced useful guidelines and conducted various training and orientation programmes.

- It is a challenge to demonstrate the effects of positive economic and social change in the course of a short-term project. Therefore, it is very important that processes and procedures get institutionalized to ensure that short-term programme results do not get lost or diluted.
- Enabling local stakeholders to take on as much responsibility as possible increases their sense of ownership of the programme and results in greater accountability.

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International Centre for Integrated Mountain Development
GPO Box 3226, Kathmandu, Nepal
Tel +977 1 5275222 **Fax** +977 1 5275238
Email info@icimod.org **Web** www.icimod.org

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