

**IUCN Pakistan Programme**

**Northern Areas Strategy for  
Sustainable Development**

**Background Paper**

# **Biodiversity**

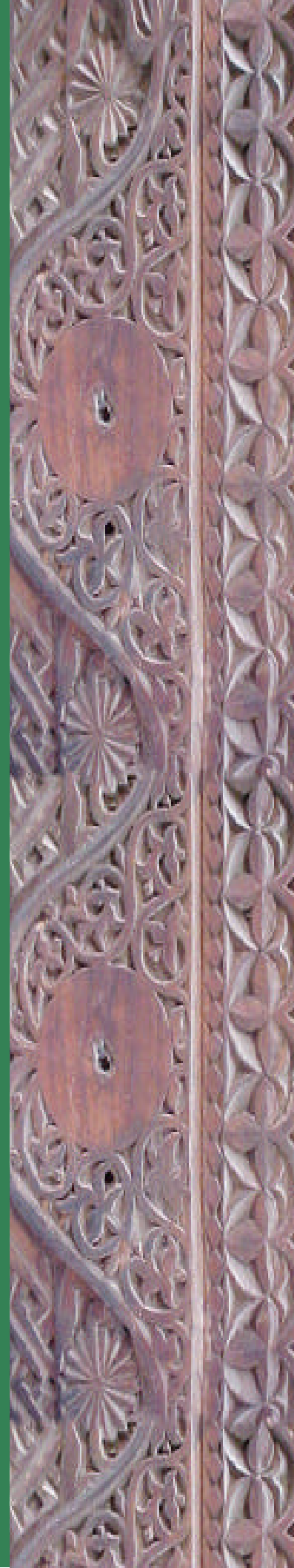
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The World Conservation Union





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Published by: IUCN, Northern Areas Programme.



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Citation: Dr. Amjad Tahir Virk, Dr. Kashif M. Sheikh and Abdul Hamid Marwat, 2003.  
*NASSD Background Paper: Biodiversity.*  
IUCN Pakistan, Northern Areas Programme, Gilgit. x+74 pp.

Series editor: Hamid Sarfraz

ISBN: 969-8141-43-X

Cover & layout design: Azhar Saeed, ECK Group, IUCN Pakistan.

Printed by: Rosette Printers, Karachi

Available from: IUCN-The World Conservation Union  
Northern Areas Programme  
Alpine Complex, Jutial, Gilgit  
Tel.: 05811-55 692  
Fax: 05811-55 799  
Website: [www.northernareas.gov.pk/nassd](http://www.northernareas.gov.pk/nassd)

# TABLE OF CONTENTS

List of Acronyms	vi
Foreword	vii
Executive Summary	ix
1. Introduction	1
1.1. What is biodiversity?	2
1.1.1. Why care about biodiversity?	3
1.2. People and Biodiversity	4
1.3. Mountain Biodiversity Conservation Significance	5
1.4. International and National Efforts to Conserve Biodiversity	6
1.4.1. International Efforts	6
1.4.2. National Efforts	6
1.5. Obligations and Commitments under MEAs	7
2. Current Situation	9
2.1. Ecological Zones	9
2.1.1. Montane Dry Sub Tropical Scrub Zone	9
2.1.2. Dry Alpine Zones and Permanent Snowfields	9
2.1.3. Alpine Meadows and Alpine Scrub Zone	10
2.1.4. Sub-alpine scrub zone	10
2.1.5. Dry Temperate Coniferous Forest	10
2.1.6. Dry Temperate Evergreen Oak Scrub	11
2.2. Floral and Faunal Diversity	11
2.2.1. Plant	13
2.2.2. Fauna	16
2.2.3. Agriculture Biodiversity	22
2.2.4. Alpine Wetlands and their Importance	27
2.2.5. Role of Irrigation Systems in Enhancing Floral and Faunal Diversity	28
3. Issues and Trends	29
3.1. Issues	29
3.1.1. Vegetative Cover and Habitat Loss	29
3.1.2. Depletion of the Population of Many Species	29
3.1.3. Degradation of Agro-ecosystems	30
3.1.4. Lack of awareness	31
3.1.5. Ineffective management of parks and protected areas	31
3.1.6. Lack of biodiversity inventories and monitoring systems	32
3.1.7. Limited resources and institutional capacity	32
3.1.8. Gaps in Knowledge	33

3.2.	Causes of Biodiversity Loss	33
3.2.1.	Direct Causes of Biodiversity Loss	34
3.2.2.	Indirect Causes of Biodiversity Loss	38
3.3.	Biodiversity Related Policies and legislations	40
<hr/>		
4.	Consequences of Inaction	43
<hr/>		
5.	Past and Present Interventions	45
5.1.	Conventional Approaches to Biodiversity Conservation	45
5.1.1.	Creation Parks and Protected Areas	45
5.1.2.	Establishment of Protected Forests	46
5.1.3.	Policing Forest and Wildlife Resources Outside the Protected Areas	47
5.2.	Current Initiatives	47
5.2.1.	Aga Khan Rural Support Programme (AKRSP)	48
5.2.2.	IUCN's Conservation Initiatives	48
5.2.3.	WWF's Community-based Conservation Initiatives	50
5.2.4.	Himalayan Wildlife Foundation's (HWF) Brown Bear Conservation Project	50
5.2.5.	Khunjerab Village Organization (KVO) Buffer Zone Project	51
5.2.6.	Community-based Fisheries Management in Ghizer Valley	51
5.2.7.	GEF/UNDP Small Grants Programme (SGP)	52
5.2.8.	Establishment of District Conservation Committees	52
5.2.9.	Establishment of Valley Conservation Funds (VCFs)	52
5.2.10.	Trans-boundary Efforts	53
5.2.11.	Research Projects	53
<hr/>		
6.	Stakeholders	55
6.1.	Local Level Stakeholders	55
6.2.	Conservation and Developmental Organizations	55
6.3.	Public Sector Institutions in NA	56
6.3.1.	NAPanning and Development Department	56
6.3.2.	Forest Department of NA	56
6.3.3.	Agriculture Department	56
6.3.4.	Livestock Department	56
6.3.5.	Fisheries Department	56
6.3.6.	Other Important Institutions	57
6.4.	Federal Government Institutions	57
6.4.1.	Ministry of Environment, Local Government and Rural Development (MELGRD)	57
6.4.2.	Ministry of Kashmir and Northern Areas Affairs	57
6.4.3.	Ministry of Agriculture	57
6.5.	Global Interest Groups and Institutions	58
<hr/>		
7.	The Way Ahead	59
7.1.	Options for Maintaining Biodiversity in NA	59
7.2.	Principles for Conserving Biodiversity in NA	59
7.3.	Important Ecological Considerations	60
7.4.	How Can We Maintain Biodiversity in NA?	61

7.4.1. Promoting In-Situ Conservation	61
7.4.2. Encouraging Ex-Situ Conservation	65
7.4.3. Adopting Ecosystem Management Approach	65
7.4.4. Developing and improving baseline information on Biodiversity of NA	66
7.4.5. Developing Enabling Policies and Legislation	67
7.4.6. Introducing Incentive Measures that Support Conservation and sustainable use of Biodiversity	67
7.4.7. Launching Conservation Education and Awareness Raising Programmes	68
<hr/>	
References	70

# LIST OF ACRONYMS

AKRSP	Aga Khan Rural Support Programme
AKDN	Aga Khan Development Network
AKCSP-P	Aga Khan Cultural Services, Pakistan
AKES	Aga Khan Education Services
AKHS	Aga Khan Health Services
AKU	Aga Khan University
BACIP	Building and Construction Improvement Programme
BAEJ	Baltistan Association of Environmental Journalists
BCF	Baltistan Cultural Foundation
DFID	Department for International Development
FWO	Frontier Works Organisations
GoP	Government of Pakistan
GCIC	Gilgit Information and Conservation Centre
HERP	Hunza Education Resource Project
HWF	Himalayan Wildlife Foundation
KADO	Karakoram Area Development Organisation
MoKANA	Ministry of Kashmir and Northern Areas Affairs
NACS	Northern Areas Conservation Strategy
NASSD	Northern Areas Strategy for Sustainable Development
NA	Northern Areas
NAA	Northern Areas Administration
NCS	National Conservation Strategy
NDO	Nounehal Development Organization
NGO	Non-Governmental Organization
NRM	Natural Resource Management
MACP	Mountain Areas Conservancy Project
PRIF	GEF – Pre- Investment Facility Project
SPCS	Sarhad Provincial Conservation Strategy
SAP	Social Action Programme
VCC	Village Conservation Committee
VC	Village Councils
VO	Village Organisations
WO	Women Organisation
WASEP	Water and Sanitation Extension Programme
WWF-P	World Wide Fund for Nature, Pakistan



# FOREWORD

The Northern Areas have a unique and critical role to play in the sustainable development of Pakistan. Although they span a relatively small geographical area, the Northern Areas serve as a vital catchment for the Indus River, upon which a majority of Pakistan's irrigated agriculture and hydroelectricity depends. The Northern Areas also contain the nation's most important natural forests, extensive mineral reserves, and a wealth of biodiversity. Dramatic scenery, some of the world's highest mountains, and a rich cultural and archaeological heritage make the Northern Areas one of the most visited tourist destinations in the country.

Over the last several decades, however, many of the Northern Areas' natural resources have come under increasing pressure, as a result of a growing human population and the opening of the Karakoram Highway. At the same time, it has become increasingly recognised that the isolated nature of many of the region's communities, coupled with the Northern Areas' high-altitude and fragile environment, poses special constraints and challenges to development. Perhaps more so than in any other part of Pakistan, there is a need in the Northern Areas to ensure that social and environmental considerations are fully integrated into the development process.

In response to these concerns, the Northern Areas Administration began the preparation of a Northern Areas Strategy for Sustainable Development in 1999, with the financial assistance of the Swiss Agency for Development and Cooperation, and the Norwegian Agency for Development Cooperation; technical support has been provided by IUCN–The World Conservation Union. The Strategy addresses a broad range of social, economic and environmental issues, and seeks to provide a comprehensive policy framework for the sustainable development of the region. It responds directly to the provisions and recommendations of the National Conservation Strategy, adopted by the Government of Pakistan in 1992.

In parallel, *The State of the Environment and Development in the Northern Areas* summarises in a single volume the key information gathered during the preparation of the NASSD. It is the first report of its kind to be produced for the Northern Areas, which provides a succinct, up-to-date and readily accessible analysis of the status of the most important environment and development sectors in the Northern Areas, including information on major trends and issues, the responses taken by both government and civil society to date, and strategic options for the future. It also provides a baseline against which future change can be measured and establishes the context and foundations for the Northern Areas Strategy for Sustainable Development.

During early consultations at the tehsil level, and with key governmental and non-governmental organizations 16 areas of intervention were identified as being critical for the NASSD. These include sectors like: water; agriculture; forestry; biodiversity; rangelands and livestock; the private sector; energy; urban

environment; and cultural heritage and sustainable tourism. In addition, some crosscutting themes were identified as crucial to each sector, including population, poverty and environment; communication for sustainable development; environmental education; NGOs; gender, environment and development; environmental health; and governance.

To address the needs of each of these areas, basic information was gathered through consultations and literature reviews. This data was analysed through background papers commissioned on each of the sectors and themes identified. The draft of each paper was shared with the larger community of stakeholders of the NASSD as well as experts in the relevant field of knowledge.

The papers follow a similar format: analysis of the current situation; issues; past and present initiatives in the sectors and thematic areas along with the lessons learnt; stakeholders; and recommended policy and action measures. The authors have also addressed cross-sectoral linkages and environmental concerns for the sake of more integration in planning for sustainable development.

There were constraints to developing these Background Papers and in some cases these hurdles were only partially overcome. These included the fragmented and scattered nature of information, the prevalent culture of not sharing information, contradictory and unreliable data, lack of thinking on cross-sectoral linkages and integrated planning, and lack of expertise in developing linkages with the environment.

Parts of the information of the papers were then incorporated into the State of the Environment and Development (SoED) and the main strategy, i.e., NASSD. However, since the Papers contain a wealth of extremely useful information, a decision was taken to produce a series of NASSD Background Papers.

Considering the need and importance of timely sharing information with the stakeholders, these papers are being produced without extensive editing. The authors have sole responsibility for the views expressed and data presented.

# EXECUTIVE SUMMARY

Northern Areas Strategy for Sustainable Development (NASSD) is being developed by the Planning and Development Department, NA as a strategic policy framework for sustainable development of the Northern Areas with technical assistance of IUCN-The World Conservation Union. This document is one of the series of NASSD background papers. Its main objective is to develop a background paper for the report 'State of the Environment and Development in Northern Areas' and the 'Northern Areas Strategy for Sustainable Development'. Other objective of this paper is to identify gaps in knowledge on biological diversity (BD) in NA that could lead to developing a biodiversity sub-strategy under the NASSD. The papers will also form a "stand alone" set of reference documents for the use of NASSD stakeholders.

Bio-geographic position of Northern Areas is very unique. There is a dramatic concentration of high mountains, which provide an ecological backdrop for the floral and faunal species adapted to rugged, high mountains. The most conspicuous feature in Northern Areas is the concentration of species diversity, i.e. the existence, along a vertical projection, of a number of compressed latitudinal life zones, which, in the tropics in particular, may encompass the full array of climatic conditions from the equatorial per humid lowland to the ice-dominated arctic. Three of the world's great mountain ranges- the Himalayas, Karakoram and Hindu Kush- meet at the confluence of the Gilgit and Indus rivers, while the Karakoram Range joins by the Pamir and Kun Lun ranges in the north. The landscape is dominated by some of the world's highest mountain peaks including 5 peaks over 8,000 m, which overshadows the biological richness of this region. According to geological experts that these mountains are young and are still growing. Monsoon rains are blocked by the high Himalayan Mountains as a result most of the valleys of NA receive little rainfall and are characterised, as a cold desert. Average rainfall is under 200 mm. Snowfall largely occur on areas above 4,000 m and increases with elevation. The NA has highest concentration of glaciers after the Polar Regions. Some of the longest glaciers of the world are found in these mountain ranges, for example the Siachin Glacier is 78 km long.

Northern Areas has a number of the world's rarest animals and plants but these are now endangered from habitat loss and overuse. A number of globally significant species of mammals are found in the area including some of the endangered species like the snow leopard, Himalayan brown bear, Marco Polo Sheep, Ladakh urial, flare-horned markhor, musk deer, and woolly flying squirrel. Similarly, a number of plant species of great economic and conservation values found in the area, including wild cumin, thyme, pine nuts, kuth, karru and several other species of medicinal values. While people are without doubt a valuable resource, a high population growth rate has put ever-increasing pressure on the regional natural resource base. Widened income disparities have forced people to exploit biodiversity at rates that are no longer sustainable. As a result, processes such as deforestation, firewood collection, overgrazing, over-hunting, over-harvesting of

medicinal plants, soil erosion, use of pesticides and insecticides, introduction of HYV, cross breeding, population growth, poverty and weak laws have become major threats to the remaining biodiversity in NA. The continuing loss of forest habitat, with its associated fauna and flora, will have serious implications for the NA's other natural ecosystems.

Several parks and protected areas have been created by NA Administration to protect biological resources of the region. This clearly shows their keenness in struggle for biodiversity conservation. Similarly some local and international NGO are also active to protect biodiversity wealth of the areas in collaboration of local communities. However, much needs to be done to safeguard the biological diversity of this region. This will require a three-pronged approach. First, an efficient system of protected areas will have to be created by evaluating the effectiveness of the existing PAs and where appropriate create new PAs to protect important ecosystems and the biodiversity they support. Second, the conservation efforts have to be expanded beyond protected areas to adjacent habitats and restorable multiple use areas to create biodiversity conservation landscapes. Third, the human and their livestock have occupied this area for centuries, so extension of conservation efforts to larger landscape will require active participation and incentives to the local communities. Therefore, collaborative efforts are imperative for the development and implementation of a sound biodiversity conservation strategy involving government functionaries, NGOs and local communities..

Information on the elements of biodiversity in NA is very sketchy and largely remained to be described. An attempt has been made here to put together a background paper on biodiversity of NA by evaluating the available information from both published and unpublished documents.

The background paper provides information on the status and trends in biological resources of NA and highlights issues and problems faced in conservation of these resources. It also looks into current initiatives, identifies key stakeholders, and provides options for future actions for conservation and sustainable use of biological diversity in NA.

This document has seven chapters. The first chapter is an introduction to the subject, puts light on international and national efforts to conserve biodiversity and obligations under Multilateral Environmental Agreements (MEAs). The second chapter attempts to discuss existing situation regarding ecological zones and floral and faunal diversity in the region. The third chapter presents issues and trends faced in dealing with biodiversity and also talk about direct and indirect causes of biodiversity losses and state about biodiversity related policies and legislations. The fourth and fifth chapters discuss in detail consequences of inaction, past and present intervention/ initiatives for protection and conservation of biodiversity. The sixth chapter of the paper tells about all possible stakeholders in protection and conservation of biodiversity of the Northern Areas. Finally, the seventh chapter describes options for maintaining biodiversity in NA, principles for conservation of biodiversity in NA, important ecological considerations and implementation mechanisms.

# 1. INTRODUCTION

Northern Areas (NA) of Pakistan occupy a unique bio-geographic position. Nature has gifted this region with high mountains, massive glaciers, magnificent rivers and splendid valleys. Nowhere else is such a dramatic concentration of high mountains, which provide an ecological backdrop for the floral and faunal species adapted to rugged, high mountains. Three of the world's great mountain ranges- the Himalayas, Karakoram and Hindu Kush- meet at the confluence of the Gilgit and Indus rivers, while the Karakoram Range joins by the Pamir and Kun Lun ranges in the north. The landscape is dominated by some of the world's highest mountain peaks including 5 peaks over 8,000 m, which overshadows the biological richness of this region. The geologists believe that these mountains are young and are still growing. Craggy peaks, cliffs and steep slopes characterize the topography of the area. The mountain valleys are usually narrow, deep and steep in appearance. The high mountains bar the monsoon rains to reach in NA. As a result most of the valleys of NA receive little rainfall and are characterised, as a cold desert. Average rainfall is under 200 mm. Snowfall largely occur on areas above 4,000 m and increases with elevation. The NA have highest concentration of glaciers after the Polar Regions. Some of the longest glaciers of the world are found in these mountain ranges, for example the Siachin Glacier is 78 km long.

The NA are rich in biological diversity. This is due to the extreme altitudinal differences and associated changes in climate and soil conditions, creating striking vertical zones in natural vegetation. This is further augmented by the variation in aspects and exposure of slopes to solar radiation. A wide diversity of fauna corresponds to the natural vegetation of the area. This includes hundreds of vertebrate and invertebrate species. A number of globally significant species of mammals are found in the area including some of the endangered species like the snow leopard, Himalayan brown bear, Marco Polo Sheep, Ladakh urial, flare-horned markhor, musk deer, and woolly flying squirrel. Similarly, a number of plant species of great economic and conservation values found in the area, including wild cumin, thyme, pine nuts and several other species of medicinal values.

NAAdministration has been struggling to protect biological resources of the region mainly by creating parks and protected areas. Recently, some NGOs have taken some initiatives for involving local communities in conservation efforts. However, much needs to be done to safeguard the biological diversity of this region. This will require a three-prong approach. First, an efficient system of protected areas will have to be created by evaluating the effectiveness of the existing PAs and where appropriate creating new PAs to protect important ecosystems and the biodiversity they support. Second, the conservation efforts have to be expanded beyond protected areas to adjacent habitats and restorable multiple use areas to create biodiversity conservation landscapes. Third, the human and their livestock have occupied this area for centuries, so that extending the conservation efforts to larger landscape will require active participation and incentives to the local communities.

Therefore, collaborative efforts will be needed to develop and implement a sound biodiversity conservation strategy involving government functionaries, NGOs and local communities.

Information on the elements of biodiversity in NA is very sketchy and largely remained to be described. An attempt has been made here to put together a background paper on biodiversity of NA by evaluating the available information from both published and unpublished documents as well as my knowledge of the region. The main objective of this paper is to identify gaps in knowledge on biodiversity in NA that could lead to developing a biodiversity sub-strategy under the NASSD. The background paper is based on the premise that is sub-strategy must help in: a) conserving a full range of distinct natural communities and ecological phenomena, b) maintaining viable population of species, c) sustaining important ecological process and services that maintain biodiversity, d) and providing tangible benefits to people of NA through sustainable use of components biodiversity.

The background paper provides information on the status and trends in biological resources of NA and highlights issues and problems faced in conservation of these resources. It also looks into current initiatives, identifies key stakeholders, and provides options for future actions for conservation and sustainable use of biological diversity in NA.

## 1.1. What is biodiversity?

Biodiversity- short for biological diversity- is the variety of life on earth. It includes all genes, species and ecosystems and the ecological process of which they are apart. The concept relates to all life form on earth; it goes beyond the organisms and includes their genetic make-up, and the invisible ecosystem processes and services of which individual species are a part (e.g. photosynthesis, soil formation and pollination). The Convention on Biological Diversity defines biodiversity in three inter-linked levels—genetic, species and ecosystem (see text box). Each of these levels is important, change at one level can cause changes at the other levels.

The Convention on Biological Diversity (CBD), 1992 defines biodiversity as *"the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems"*.

Species diversity refers to variety of living organisms (wild or domestic) within a geographic area. Species found in all shapes and size, from the tiny microscopic organism to huge walnut trees. They include microbial organisms, fungi, flowering plants, ants, beetles, butterflies, birds, and large animals such as snow leopard (*Uncia uncia*), Himalayan brown bear (*Ursus arctos*) and Himalayan ibex (*Capra ibex sibirica*).

Genetic diversity refers to variability in the genes that every individual inherits from it parents and passes on to the next generation. It is expressed as genetic variability both within and between populations. Genetic diversity is everywhere, from the variety of apples in our orchards to the variety of feather colours of the birds

found in these orchids. Genetic variation is extremely important for the survival of species. It is responsible for those traits of the species that help them to interact with local environmental conditions and determine the extent to which populations can adapt to environmental changes and survive exposure to new diseases. Genetic diversity is often lost with the spread of commercial agriculture, which encourages monoculture cultivations. New crop varieties, often associated with commercial agriculture have led to loss of traditional, highly variable farmer's varieties.

Ecosystem diversity refers to the variety of plant, animal, and microbial communities and the ecological processes that make them function, including their interaction with the non-living environmental components. Plant and animal communities make up the many kinds of ecosystems, for example forests, mountains, wetlands, rivers, meadows, deserts etc. Some ecosystems are very complex and host large number of species e.g. tropical rain forests and others like cold deserts (temperate regions) has less biodiversity, but both are equally important.

### **1.1.1. Why care about biodiversity?**

Biodiversity is our natural wealth. Its conservation is important in both economic and ethical reasons. It provides us goods and services fundamental to our survival, including clean air, fresh water, medicines and shelter. It enables us to adapt to changing needs and circumstances. For example, forested ecosystems provide us fuels, medicines, construction material and wildlife habitat; wetlands and riparian areas protect water quality and aquatic life; oceans provide food and regulate climate; and agro-ecosystems produce food. Biodiversity also provide people with recreational, psychological, emotional and spiritual enjoyment. Some people believe that we should protect and restore biodiversity because of it benefit to mankind, while others believe that it is our moral obligation to care about biodiversity simply because all species have right to live and have value in the nature, whether or not we understand their benefits to human (Alonso et al. 2001).

Maintaining biodiversity is a prerequisite for sustainable development. People depend on goods and services provided by many ecosystems. The inter-relationships of biodiversity and human are complex and close. Besides other factors, different cultures in the world evolved due to biodiversity around them. Hence, loss of cultural diversity and loss of biodiversity are related (UNEP 1995). Therefore, conservation of biological diversity is a key test for sustainable development. If biodiversity is disappearing because of human actions, we are then not living sustainably. Therefore, it is important to link biodiversity conservation plans with other national and provincial plans, such as poverty reduction strategies and national strategies for sustainable development; defining priority species, sites, habitats and preparing green action plans with clearly defined objectives and targets.

Almost entire population of NA depends upon directly or indirectly on natural resources to meet their daily needs. Vegetables, fruits, nuts, honey, spices and many other food items that people use every day come from natural ecosystems. Similarly, timbers for construction of houses and furniture, fuel woods (an important source of energy), come from natural forests. Indeed, conservation of biodiversity is fundamental to achieving sustainable development in NA. Maintaining biodiversity

in NA is not only crucial for the sustainability in agriculture, forestry, fisheries, wildlife, tourism, health, irrigation and power sectors in NA, but is also life line for the down stream people in other provinces in Pakistan.

## 1.2. People and Biodiversity

Biological diversity is an important natural resource base for the people of NA. For centuries, plant and animal communities supported the development of early inhabitants of this region, providing the basis for the evolution from hunting and gathering to agriculture, animal husbandry, forestry and now trade and tourism. People have domesticated wild species e.g. wheat, barely, buckwheat, yak and wild goats and many other species and have depended on natural resources for survival and to meet their basic needs. Majority of the people in NA are engaged in agriculture, animal husbandry, and forest related works. Continuing use and maintenance of biological diversity are, therefore,

" The high altitudes are a special world. Born of the Pleistocene, at home among pulsating glaciers and wind-flayed rocks, the animals have thrived, the harshness of the environment breeding a strength and resilience which the lowland animals often lack. At these heights, in this remote universe of stone and sky, the fauna and flora of the Pleistocene have endured while many species of the lower realms have vanished in the uproar of the elements. Just as we become aware of this hidden splendor of the past, we are in danger of denying it to the future. As we reach for the stars we neglect flowers at our feet. But the great age of mammals in the Himalaya need not be over unless we permit it to be. For epochs to come the peaks will still pierce the lonely vistas, but when the last snow leopard has staked among the crags and the last markhor has stood on a promontory, his ruff waving in the breeze, a spark of life will have gone, turning the mountains into stones of silence."

George B. Schaller. Mountain Monarchs

particularly important to the people of NA. Economic development of NA will depend on sustainable use of biological resources, maintaining high diversity of crops, management of high pastures, raising fodder trees in diverse mountain environment, and development of medicinal plants and livestock biodiversity. These will be the viable options for ensuring food security and generating cash income by the people of NA.

The high mountains and narrow valleys kept NA physically isolated until quite recently. It forced people to rely on local biodiversity for food and other essential needs. Indeed, plants and animal diversity has served as the food security for the mountain dwellers and supported the development of early societies, providing the basis for the evolution from hunting gathering to agriculture, animal husbandry, forestry and now to tourism industry. There are many historic sites in NA where rock carving by the early inhabitants shows that these people were mainly hunter-gathers, and they had strong affiliation with wild animals and plants. Many of these carvings are of mountain mammals and trees, for example ibex, snow leopard, markhor and pine trees are the main figures depicted in these carvings. Hunters are shown pursuing ibex with bow and arrows and many figures depict snow leopard chasing ibex. Besides hunting for meat, people benefited from wild species to meet their basic needs; for example ibex and makhor skins were used for making winter



coats for men, shoes, caps, grain storage sacs, and to collect wool for making ropes, rugs, and vests. Ibex horns were used for ploughing and excavating soil for constructing irrigation channels (Kreutzmann 1992, Virk 1999). During the early days people entirely depended on traditional medicine and wild plant species were major medicinal source to cure common diseases.

Historically, human has played a major role in shaping biodiversity of our planet and the ways in which biodiversity is perceived, maintained, conserved, used, and appreciated. It has been documented that in the past high level of cultural diversity have been dependent on high level of biological diversity, which supported them (UNEP 1995). Therefore, understanding of the many aspects of human influences on biodiversity and the underlying driving forces, is of crucial importance for setting priorities and directing conservation and sustainable use of components of biodiversity. It is important to recognize that how people have used and valued biodiversity and the resources the obtained from it (UNEP 1995).

Since majority of the people in NA are engaged in agriculture, animal husbandry, and forest related activities, continuing use and maintenance of biodiversity will be important to them. This will provide basis for the long-term sustainable development of the region. However, this will depend on sustainable use of components of biodiversity and maintaining high diversity of mountain ecosystems, crop farming systems, viable populations of wild species, and managing high pastures efficiently.

### **1.3. Mountain Biodiversity Conservation Significance**

The most conspicuous feature in mountain areas is the concentration of species diversity, i.e. the existence, along a vertical projection, of a number of compressed latitudinal life zones, which, in the tropics in particular, may encompass the full array of climatic conditions from the equatorial pre-humid lowland to the ice-dominated arctic. Mountains of NA are fragile ecosystems, which are globally significant as vital watershed of the world, rich in biodiversity, popular destination for tourists, and are important for the cultural diversity. These mountains provide a direct life-support base for about one million inhabitants. A wide range of species and genetic resources of the region has the potential to provide greater benefits to not only the people of NA, but also to the down stream inhabitants, particularly the people in plains. Biological resources like medicinal plants, aromatic plants, forage in the high pastures, and wild relatives of crops and fruit genetic resources of the region are the primary means of improving agro-pastoral systems in the area. The diverse ecological zones provide broad opportunities for the people to develop this unique landscape for agriculture, forestry, animal husbandry, fisheries, eco-tourism and sustainable use of wild species of flora and fauna.

Moreover, NA are home to a range of globally threatened species of animals including the snow leopard, Himalayan lynx, Marco polo sheep, Blue sheep, Ladakh urial, markhor, musk deer, and woolly flying squirrel. The resident avifauna includes monal pheasant, snow partridge, Himalayan snow cock, and several birds of prey species. The flora of the region is very diverse, with a number of economically important species of wild plants, including wild cumin, thyme, pine nuts, and hundreds of medicinal plants with useful pharmaceutical values.

## 1.4. International and National Efforts to Conserve Biodiversity

### 1.4.1. International Efforts

Since the publication of World Conservation Strategy in 1980, the world community has put considerable efforts in promoting conservation of biodiversity. The UN Conference on Environment and Development (UNCED-also known as "Earth Summit") adopted a comprehensive agenda, named "Agenda 21" at Rio in 1992. The aim of this agenda was to promote sustainable development and environment protection at the global level and provide an action plan for the world community to address the social, economic and environmental issues. Out of the 40 chapters of the non-binding recommendations of the plan, one chapter is devoted to the conservation of biodiversity, In addition, biodiversity concerns are discussed through out the plan.

International community has adopted a number of international treaties and Multilateral Environmental Agreements (MEAs), which directly or indirectly deals with the biodiversity issues. These MEAs include: the Convention on Biological Diversity (CBD); the World Heritage Convention (WHC); the Ramsar Convention on Wetlands of International Importance (Ramsar); the Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES); the Convention on Migratory Species (CMS); the Convention to Combat Desertification (CCD) and United Nation Framework Convention on Climate Change (UNFCCC). Pakistan is a party to all these MEAs.

Out of these agreements, the CBD is a landmark international treaty, dealing with not only conservation and sustainable use of biological diversity, but also equitable sharing of benefits arising from the use. The Article 6 of the CBD calls upon the parties to develop National Biodiversity Strategies and Action Plans (NBSAP) and to integrate conservation and sustainable use of biodiversity into sectoral and cross-sectoral plans, programmes and policies (CBD 1992). This unprecedented global accord focused directly on conservation of world's genetic resources. The treaty recognizes that the conservation of biodiversity is a "common goal" of humanity and emphasises on incorporating biological, social and economic values in conservation efforts.

The convention provides enabling mechanisms for proper implementation of the treaty and enhancing understanding of the parties about the biodiversity conservation issues. These mechanisms include Conference of Parties, SBSTTA, and Clearing House Mechanism. In addition, funding mechanisms like Global Environment Facility has been created to finance the conservation of biodiversity of global significance.

### 1.4.2. National Efforts

Pakistan has prepared a number of strategies and plans, which address biodiversity conservation issues. Of these, the National Conservation Strategy (NCS) adopted in 1992 provides the broad policy framework for conserving Pakistan's biodiversity. The strategy recognizes the need for integrating development and environmental conservation in the national decision making process and using a holistic approach

in addressing environmental conservation issues. Following the recommendations of the NCS, provincial level conservation strategies have been developed for the NWFP and Balochistan provinces, and the NA Strategy for Sustainable Development (NASSD) is under preparation. Pakistan has also taken conservation-planning agenda at the district level. District conservation strategies for Chitral and Abbottabad districts are in the final stages of development. These strategies put significant emphasis on conservation and sustainable use of biodiversity. The 1992 Forestry Sector Master Plan for Pakistan and NA also considers biodiversity conservation as integral part of the forestry development. However, integrating biodiversity concerns into national forestry planning is yet to be achieved.

Pakistan has also prepared a national Biodiversity Action Plan (BAP) to meet commitments under Article 6 of the CBD. The BAP calls for government agencies, NGOs, and local communities to work together as partners in biodiversity conservation. It integrated three processes called for by the CBD: country study, national strategy and action plan. The BAP outlines strategic goals, sets 25 separate objectives and proposes 143 specific actions by addressing all the important articles of the CBD. It also outlines mechanisms for implementation of these actions including establishment Biodiversity Steering Committees at the federal and provincial levels including NA (GOP/WWF/IUCN 2000). Pakistan has also developed National Environment Action Plan (NEAP), which was approved by Pakistan Environment Protection Council in February 2001. NEAP takes a holistic view for environmental conservation by focusing on ecosystem management approach and addresses issues like deforestation, desertification, rangeland degradation and conservation of species.

At NA level, a range of protected areas including national parks, wildlife sanctuaries, game reserves, and protected forests has been established for in-situ conservation of biodiversity. Several laws also exist relating to conservation of various components of biodiversity. In addition, several species have declared as protected under the NA Wildlife Preservation Act of 1975. Recent initiatives for creation of Community Conservation Areas have further promoted in-situ conservation of NA biodiversity. Under these initiatives, the involvement of local communities in conservation and sustainable use of biodiversity is considered key to protecting biodiversity in NA.

## **1.5. Obligations and Commitments under MEAs**

As party to several Multilateral Environmental Agreements (MEAs), Pakistan is obliged to ensure that these agreements are implemented in the line of their objectives right from the federal, provincial and district levels. The existing policies and laws, with the exception of Pakistan BAP, do not properly reflect Pakistan's obligations under these MEAs. For example, NA wildlife, fisheries and forestry laws mainly focus on regulating use and do not reflect Pakistan's commitments to the international agreements, as most of these laws were enacted well before these MEAs are ratified by Pakistan. Therefore, there is need to update all the existing policies and legislations to accommodate Pakistan's obligations and commitments under the MEAs.



## 2. CURRENT SITUATION

This section summarises the current state of NA biodiversity based on the available qualitative and quantitative information and identifies major gaps in the information base. More specifically, it provides an overview on NA biodiversity and its current status.

### 2.1. Ecological Zones

The vegetation types of Pakistan have been described by various authors including Schweinfurth (1957 in Beg 1975), and Champian et al 1965. Beg (1975) described the wildlife habitats of Pakistan. However, no systematic attempt has been made to define ecological zones of Pakistan. Roberts (1991 and 1997) provided some initial classifications of major vegetation zones of Pakistan. Based on these classifications, the following key ecological zones can be identified in NA along with the species of flora and fauna they support:

#### 2.1.1. Montane Dry Sub Tropical Scrub Zone

This zone comprises of lower reaches and southern slopes of mountains especially along Indus, Gilgit and Hunza Rivers especially in southern and central parts of NAs. This area is mainly located along the main Indus River up to Raikot and Bunji. The altitudinal range is between 750 – 1219 meters. Only scrub vegetation occurs in this zone, which, include Dodonaea scrub, Monotheca scrub, Reptonia scrub, Pistacia scrub and sub-tropical streambed scrub. Montane dry sub tropical scrub is characterise by Capirs, Spinosa, Pistacha, Artemesia, Sacaharum, Dodonia, Berberis, Rosa muschata, and Daphne oleoides (Manzoom Ali, 2000).

Large mammal species found in this zone are flare-horned markhor, black bear, Himalayan lynx, stone martin and forest dormouse. Common game birds are chukar partridge, koklas pheasant, and rufous turtle dove. Other bird species include golden eagle, lammergier, common kestrel (*Falco tinnunculus*), and alpine chough.

#### 2.1.2. Dry Alpine Zones and Permanent Snowfields

This zone predominates high altitudes around major peaks of the Karakoram Mountains and occurs in the northern most regions. It covers most of the upper Hunza and the northern parts of Baltistan. The landscape is characterised by the vast glaciers, a desolate waste of boulders and sheer cliffs. Moist areas are found beneath glaciers and snowfields and along stream banks. The vegetation is largely xerophytic. The vegetation in the valley bottoms and along streambeds includes species such as Hippophae rhamnoides, Myricaria elegans, Capparis spinosa, Tribulus tenestris, and Peganum bannala. Major tree species include Salix denticulate, Juniperus communis, Mertensia tibetica, and Potentilla desertorum. On the fringe of this zone, mammals such as Himalayan ibex (*Capra ibex sibirica*),

golden marmot (*Marmota caudate*), Altai weasel (*Mustela altaica*), blue sheep (*Pseudois nayaur*), Himalayan lynx (*Felis lynx*), snow leopard (*Uncia uncia*), migratory hamster (*Cricetulus migratorius*) and high mountain vole (*Alticola roylei*) are found. Typical bird species include golden eagle (*Aquila chrysaetos*), Himalayan griffon vulture (*Gyps himalayensis*), and common kestrel (*Falco tinnunculus*), while game birds include Himalayan snowcock (*Tetraogallus himalayensis*), snow partridge (*Lerwa lerwa*), and snow pigeon (*Columba leuconota*) and a number of other passerines and non-passerines birds.

### **2.1.3. Alpine Meadows and Alpine Scrub Zone**

This zone covers areas between high valleys and permanent snowfield. Lush green and well-watered alpine meadows occur between 3,500 and 3,800 m on valley bottoms or high plateaus surrounding the main watercourses. These plateaus provide habitat to many endemic species of plants including two of the CITES Appendix-I species (*Picrorrhiza kurro* and *Saussurea lappa*) (GOP/Lead-Pakistan 2000). Alpine meadows occur in almost all the higher regions of Gilgit, Baltistan, Ghizer, Diamer and Astore, particularly where mountains extend above the treeline. Deosai plateau is one of the typical alpine meadows harbouring many plant and animal species including Himalayan brown bear (*Ursos arctos*). In spring these meadows are covered with wildflowers such as *Iris*, *Anemone*, *Primula* and a variety of wild roses. These meadows are enclosed in drier mountain slopes. Soils are rich and moist, but become dryer towards the transition zone toward the mountain slopes. Many species of grasses of the genus *Poa* and sedges, artemisia and clover are found in these meadows. Other plant species include *Draba trinervia*, *polygonum affine*, *Saxifraga sibirica*, and *Euphorbia kanaorica*. Large mammal species found in this zone include snow leopard, Himalayan brown bear, Himalayan ibex, golden marmot, high mountain vole, lesser shrew, and Chinese birch mouse. Alpine meadows provide an important habitat for many breeding Himalayan migrant birds. Typical bird species include Himalayan griffon vulture, lammergier, Himalayan snowcock, snow pigeon and many other passeriformes.

### **2.1.4. Sub-alpine scrub zone**

Sub-alpine scrub zone is widespread throughout higher mountains of Himalayas-Hindu Kush-Karakoram, including Gilgit (Naltar), Skardu, Ghizer and Astore regions, but often confined to small ravines on upper slopes. Sub-alpine scrub is important for both livestock and mountain ungulate species like markhor, Himalayan ibex, and Ladakh urial and is considered important summer grazing grounds for these species. Vegetation of this zone consists of small deciduous species like *Betula utilis*, *Berberis* spp., *Lonicera korolkovi*, and evergreens like *Contoneaster* spp., *Juniperus communis*, *Juniperus squamata*, *Rhododendron hypenanthemum* and *poa* grass with many *Primula*, *Ranunculaceae* and *Anemone* species. In Naltar valley, some remains of *Salix denticulata* could also be seen. Mammals associated with this zone include True's vole, Chinese birch mouse, musk deer, snow leopard, Himalayan ibex and markhor. Bird species found in this scrub zone include species like monal pheasant, chukor partridge, common rosefinch, and Hodgson's mountain finch.

### **2.1.5. Dry Temperate Coniferous Forest**

These forests are usually found in the inner or northerly slopes of the Himalayas with less monsoon influence. It occurs between 1500 to 3400 meter elevations. These

forests are characterized by much fewer deciduous tree species and are mainly single species stands of conifers. In NA these forests occur in parts of Gilgit, Diamer, and Skardu districts. In Gilgit Region it occurs in patches of both Karakoram and Hindu Kush mountains in valleys like Naltar (Sheikh, 2002), Bagrot, Haramosh, Minapin, Chaprot, Jutial Nullahs, while in Skardu District mainly in Basho Valley of Randu Tehsil (Schickhoff 1993). Diamer District is rich in these forests, where they occur in many valleys of Darel, Tangir, Chilas and Astore tehsils. Typical tree species found in these forests are *Picea smithiana*, *Cedrus deodara* and *Pinus willichiana* as predominant tree canopy with under story of *Quercus ilex* and *Junglus regia* and scattered shrubs of *Artimesia maritima*, *Ephedra intermedia*, *Indigofera gerardiana*, *Sambucus ebulus*, *Sorbaria tomentosa*, and *Plectranthus rugosus*.

Mammals found in these forests include Royle's pika, Kashmir flying squirrel, Himalayan black bear, yellow-throated marten, long-tailed mouse, and Turkestan rat. Typical bird species found are long-legged buzzard, black-throated joy, nutcracker, jungal crow, red-fronted serin, white-winged grosbeak, Eurasian goldfinch, white-cheeked nuthatch, slaty-blue flycatcher and white-cheeked long tailed tit.

### **2.1.6. Dry Temperate Evergreen Oak Scrub**

This is an intermediate zone passing behind the moist temperate zone, which covers lower valleys of Diamer District mainly areas adjacent to Kohsitan District of NWFP. It lies between 1500 to 2500 m and there is very small stretch of this ecological zone. Dry Oak Forest (*Quercus ilex*) dominates the vegetation of this area. Other plant species include *Daphne oleoides*, *Sophora griffithii*, *Cotoneaster numularia*, *Artimesia martima* and *Berberis lycium*. Occasionally individual stands of *Pinus gerardiana*, *Pinus wallichiana*, *Cedrus deodara* and *Juniperus spp.* are also found (Beg 1975).

Large mammal species found in this zone are flare-horned markhor, black bear, Himalayan lynx, stone martin and forest dormouse. Common game birds are chukar partridge, koklas pheasant, and rufous turtle dove. Other bird species include golden eagle, lammergier, common kestrel, and alpine chough.

## **2.2. Floral and Faunal Diversity**

Udvardy (1975) classified the world into 8 bio-geographic realms, of which the southern part Palaeartic realm penetrate into the mountain ranges of Himalaya, Hindu Kush, and Karakoram. Hence, the floral and faunal diversity in NA has affinities largely to Palaeartic bio-geographic realm of the world. According to the global classification of the major terrestrial biomes of the world presented by Cox and Moore (1993), the area falls under the mountain ecosystem (biome). Biogeographically, the NA are very important as the area falls under four bio-geographic provinces of the Palaeartic Realm: Hindu Kush highlands, Himalayan highlands, Pamir-Tain-Shan highlands, and Tibetan Plateau (Udvardy 1975). The inter-penetration of four bio-geographic provinces into NA is marked with high floral and faunal diversity, which is the most interesting and charismatic on the earth. The mountains in the south and east of the Indus River (Astore and Chilas sub-divisions of Diamer District and part of Skardu and Randu Tehsils of Skardu

District) falls under Himalayan highlands, while north-western and western part (Ghizer District and Darel and Tangir areas of Diamer District) of NA falls under Hindu Kush highlands. Northern and north-eastern part of NA (upper areas of Hunza Sub-division and Ghanche District of Baltistan) are more of an overlap between Pamir-Tain-Shan and Tibetan bio-geographic regions. The diversity in large mammal species exhibits inter-penetration of these bio-geographic provinces. For example, around nine large mammal species including markhor, Himalayan ibex, Ladakh urial, blue sheep, Marco Polo sheep, snow leopard, Himalayan brown bear, black bear and Himalayan lynx are found in NA. Nowhere in Pakistan has such a concentration of large mammal species.

Similarly, NA have rich and varied flora, largely because NA sits on the junction of four major bio-geographic regions. Ali and Qaiser (1986) recognize four phyto-geographic regions in Pakistan, which help in explaining richness and diversity of the flora. Out of these four, two regions falls into NA: the Irano-Turanian (central Asiatic sub-region) and Sino-Japanese. The upper parts of Gilgit District (Hunza, Shimshal etc.) and upper part of the Baltistan region include in the Central Asian Region, while lower Gilgit (Naltar, Bagrot valleys etc.) District and Astore region comes under Sino-Japanese. Floristically, the Eastern Irano-Turanian or Central Asiatic comprises majority of NA flora, including several endemic species, while Sino-Japanese covers only part of the NA (Ali and Qaiser 1986, Nasir and Rafiq 1995).

Biological diversity in NA has never been evaluated systematically, although floral and faunal diversity of some areas has been explored and a partial picture of biodiversity in NA exists. For example, biological studies of the Deosai plateau revealed presence of high level of biological diversity on the plateau. About 342 species of plants belonging to 36 families and 142 genera have been recorded from the area. Faunal diversity on the plateau includes 1 frog, 3 fish, 1 (or 2) reptiles, 108 birds and 18 mammalian species. This high level biodiversity on the plateau (with elevations mostly above 4000 meters) is due to several reasons including topography, location of the plateau (junction of 4 major mountain ranges) and local adaptation of its plant and animal species (Woods et al. 1997). Based on literature review (Roberts 1991 & 1992, Roberts 1997, Sheikh, 2001, Rafiq 1999, and Baig 2001), an estimated numbers of species of some major taxon group are provided in Table 1. The number of bird species estimated for whole NA includes breeding birds,

**Table 1: Estimated Species Diversity in NA**

Taxon	Reported For Pakistan*	Estimated For Northern Areas	Endemic To Northern Areas
Mammals	174	54	2
Birds	668	230	-
Reptiles/ Amphibians	177/22	23/6	4/2
Freshwater Fish	198	20	4
Insects	>5000	?	?
Plants	>5700	?	?

\* Reported in Biodiversity Action Plan for Pakistan. However Roberts (1997) has reported 188 mammalian species



passing migrants, vagrants and few accidental migrants . Detailed zoological studies are further needed to evaluate the recent status of many resident and migratory species.

### **2.2.1. Plant**

About 5,700 species of flowering plants have been reported from Pakistan, and almost 400 of these are endemic species (Nasir and Ali 1970) and around 1,000 species of vascular plants are known to occur in northern mountain regions of Pakistan (Stewart 1972). Most of the endemic plants are found in the northern and western mountains of Pakistan (Ali and Qaiser 1986). NA harbour some of the richest plant communities in the region. Particularly, the transition zone between alpine and moist temperate biomes of the western Himalayan highlands (upper Diamer District) is considered rich in plant diversity and endemism. The plant communities are diverse, with a number of progenitors of economically useful crops including wild cumin, thyme, pine nuts, apricots, and walnuts, and a host of medicinal plants with potentially useful pharmaceutical values.

The total number of plant species occurring in NA is not known. However, several studies suggest high richness in plant communities. The richness in flora is due to the great variation in light, elevation, climate, water, terrain and soil, which creates a variety of micro-climate that support a tremendous diversity of flora. In western Karakorums, less than three months of summer drought and precipitation totals between c. 400 and 500 mm p.a occur in those montane areas where closed coniferous forests grow on shady slopes and open juniper formations on sunny ones. (Miehe & Miehe 1998). Patterns of species richness show a general trend of increased richness in plant species from north to south and from west to east. For example, 134 species belonging to 35 families and about 90 genera of plants have been recorded from Khunjerab National Park (WWF 1996). Almost at the same elevations of Deosai National Park in the western Himalayas 342 species of plants belonging to 36 families and 142 genera have been listed (Woods et al. 1997). In total 153 plant species belonging to 38 families and 113 genera have been recorded after extensive field research in the area (Sheikh, 2002).

The plant diversity in NA is yet to be explored fully. Therefore, there is great possibility of discovering new species of plants during field expeditions. For instance, in a joint expedition of Oxford University Museum of Natural History of UK and the Pakistan Museum of Natural History to the upper Hunza during summer of 2000, about 100 species of shrubs, trees and herbaceous plants were recorded. Twenty percent of these were new records to the Pakistan Museum of Natural History's collection (Preliminary Expedition Report 2001).

The people of NA largely depend on wild plants for fuel, as food supplements, medicine, construction material, farm nutrients and livestock feed. Many of these plants are now threatened by a number of factors. Most pervasive one is loss or degradation of habitat due to overgrazing of fragile alpine meadows and collection of firewood and shrubs to meet the fuel wood requirement. Collection of medicinal plants with commercial value and for local use has also pushed some populations of rare plants into threatened category. A number of plants found in NA have listed on the appendices of the CITES. For example, *Saussurea lappa* (Kuth) a plant of commercial and medicinal values has been listed in the CITES Appendix I.

Existing information on the flora of NA is very limited, scattered and confined to the flowering plants and gymnosperms only. Incomplete data on plant diversity and endemism hotspots limits broad generalizations. More detailed studies are needed to prepare a comprehensive list of plants species found in NA.

#### **2.2.1.1. Medicinal and Aromatic Plants**

Medicinal plants continue to be an important source of drugs for the treatment of various ailments of human kind. Out of about 5,700 plant species in Pakistan, 400-600 species are considered to have medicinal uses in unani, allopathic and homeopathic medicines. Out of these, 300-400 species are used in traditional medicines (Haq 1998). These medicines are prescribed by Hakims, which provide healthcare for the most people in rural areas. According to an estimate about 80% of the rural population of Pakistan depends on a traditional medicinal system called Unanni.

Medicinal and aromatic plants are the valuable components of NA biodiversity. These resources are to be examined with a view that they could bring tangible benefits to the local communities, particularly through sustainable use of these resources. Although some botanical and medicinal plant surveys were conducted in the past, most of these surveys were restricted to the accessible valleys only. Rasool (1998) provided a detailed account of NA economically important plants. He described about sixty plants of medicinal and economic value including their commercial importance, mode of collection and important uses. Sheikh (2002) gave a detailed account of the local, medicinal as well as indigenous uses of the plant species of the Naltar, lower Hunza and Gilgit valleys. He provided detailed account of the species that are used for local medicinal purposes and commercial uses. 24 species emerged as ethnobotanically significant including *Saussurea* sp., *Onosma* sp. and *Thymus serpyllum*. Few studies conducted by the researchers of the Pakistan-German Research Project listed 136 species of medicinal plants with their local names, distribution and current uses from different part of the northern areas. (Unpublished reports of Cultural Areas Karakoram Project). More ethnobotanical surveys are needed to explore the wealth of plants of medicinal and commercial importance. Such surveys are also needed to determine the current status of key species of medicinal plants, which were over-exploited in the past.

NA' ecological landscape provides suitable environment for the natural growth of medicinal plants and there are two ecological zones where several species of economically important plants are exploited commercially. These are—dry temperate mountain forests and alpine and high altitude meadows. Since majority on NA falls under these two zones, they offer an enormous opportunity for conservation and sustainable harvest of medicinal plants. Particularly, upper Astore, Guraze Valley, and Baltistan region are important for medicinal plants where extraction of medicinal plants has been reported. Similarly, Rattu Valley in upper Astore is famous for artimesia, Kuth and cumin seeds. Mostly the local traders and nomadic graziers (Gujers) have extracted large quantities of medicinal and aromatic plants from the forests of Astore and Guraze valleys since independence. Another important species of medicinal value, *Picrorhiza kurroa* (Karru), occur around Qamri and Burzil passes and in Deosai plains above 2,743m altitude. This species was exploited heavily in the past and now believed to have vanished from many of its natural habitats due to uncontrolled exploitation and

destruction of habitat (Rasool 1998). A number of other economically important plants occur in NA including wild thyme and a rich variety of medicinal plants such as sea buckthorn, ephedra and the endangered costus roots. Some of the important medicinal plants of NA are listed in the Table 2. All these plants are now commercially collected without any consideration for their conservation and sustainable use. At present medicinal plants are faced with several threats: (1) habitat degradation due to increased human activities (grazing of domestic livestock, farm encroachment), (2) over-exploitation of rare and endangered species, and (3) loss of regeneration potential of the degraded forests. Forest areas are the main source of medicinal plants, particularly the undisturbed natural forests. These forests are now increasingly coming under pressure from increased human population. Unless concrete steps are taken for promoting in-situ conservation of medicinal plants in NA, many important species of economic value may be lost. In-situ conservation of economic plants can be accomplished through the active participation of local people in resource assessment, planning, decision-making, implementation of management plans, and marketing of the medicinal plants. This could be done by designating some of the important valleys in Astore and Baltistan regions as Medicinal Plant Conservation Areas. Whereas, ex-situ

**Table 2: Important Medicinal and Aromatic Plants of NA**

Scientific Name	Local Name	Distribution in NA
<i>Artemisia maritima</i>	Afsantin	Sub Alpine regions in most part of NA
<i>Saussuria lappa</i>	Kuth	Astore, Naltar and Minimurg areas and around Kalapani & Kamari
<i>Picrorhiza kurroa</i>	Karru (Katki)	Alpine meadows around Kamari & Burzil passes and Deosai Plateau
<i>Podophyllum emodi</i>	Bankakri	Naltar, Bar, Astore and Minimurg
<i>Glycyrrhiza glabra</i>	Mulathi	Gilgit region, Punyal
<i>Aconitum heterophyllum</i>	Atees	Sub-alpine and alpine zones of upper Astore
<i>Ferula foetida</i>	Hing	Upper Astore, Bunji and Harcho area
<i>Onosma</i> spp.	Goazaban (Ratanjot)	Naltar, High altitude regions in upper Astore
<i>Rheum emodi</i>	Revand-chini	Upper Astore, Naltar, Gilgit and Nagar areas
<i>Thymus serpyllum</i>	Tumuro	Upper Astore, Gilgit and Baltistan
<i>Valeriana wallichii</i>	Mushbala	Nagar and Astore regions
<i>Hippophae rhamnoides</i>	Buru (Sea Buckthorn)	Naltar, Baltistan, upper Gojal & Gilgit region
<i>Ephedra</i> spp.	Som (Asmani buti)	Upper Gojal, Astore and Gilgit region
<i>Carum</i> spp.	Zeera Saffed	Rattu Valley Astore and Shigar Valley Baltistan
<i>Cuminum cyminum</i>	Kamsal Zeera	Astore, Kargha, Naltar and Harcho

Source: Rasool 1998, Sheikh 2002

conservation can be achieved by cultivating rare species of medicinal plant at suitable locations and through long term preservations of plant propagules in gene banks and through tissue culture.

## **2.2.2. Fauna**

### **2.2.2.1 Mammals**

The mammalian fauna of NA mainly belongs to Palaearctic region, which may have spread southwards from Central Asia. Fifty-four species of mammals are estimated for NA on the basis of published information and the distribution maps and discussion contained in Roberts (1997). These species comprise 1 shrew, 10 bats, 18 carnivores, 6 artiodactyls, 3 lagomorphs, and 16 rodents. There is only one species of mammals, which is endemic to NA i.e. woolly flying squirrel, while Astore markhor (flare-horned markhor) can be considered near endemic, as its distribution is restricted to a few valleys mainly because of rugged terrain and geographic barrier like rivers. The distribution of many small mammal species is very patchy and restricted to the certain watersheds due to the physical barriers like high mountains and rivers. The most diverse groups are carnivores and rodents. The rodents have a high breeding capacity and they constitute the food base for many carnivores. Species like shrews provide food base to foxes, weasels and stone Motrens (Z.B. Mirza, 2001 and 2002)

Large mammal species richness is higher in NA as compared to other parts of Pakistan. Two areas are considered as a "hot spot" for large mammal diversity. These are the upper Hunza and the triangle between Indus and Astore rivers. Several large mammal species found in NA are either threatened or endangered. These include snow leopard, Marco Plolo sheep, Himalayan brown bear, black bear, musk deer, flare-horned markhor, Ladakh urial, blue sheep and Himalayan lynx. Most of these species require large habitat areas to maintain viable populations. Particularly, the species like markhor and Ladakh urial constitute much of the remaining global populations. Both of these species are considered as endangered and are listed in CITES Appendix –I. The current status of Marco Polo sheep and musk deer is also uncertain as both of these species have been persecuted heavily in the past. The population of musk deer is very low and fragmented. Its status in NA is endangered and it is listed both on IUCN Red Data Book and in CITES Appendix-I. Marco Polo sheep is not a permanent resident to Pakistan territory but occasionally migrates into the Khunjerab National Park (KNP) and adjacent areas through three border passes: the Khunjerab, the Killick, and the Mintaka. The area around the Khunjerab Pass provides the suitable summer habitat for this species, but they have not been sighted at this location in the recent past probably due to regular disturbance on Khunjerab Pass from traffic and presence of Chinese and Pakistani border forces in the area. Chinese has now erected fence along the Khunjerab Pass, which has diminished any chances of crossing this species into Pakistani side of the pass. The only possibility where this species can cross into Pakistan is through the Killick and Mintaka passes. The sighting of this animal around these passes has also reduced in the recent years. Only, a herd of 46 animals was sighted in the area during July 1997 by the local herders and the Game Watchers of KNP (KNP staff, Pers. Comm.).

Schaller (1977) and Roberts (1997) provided the most extensive accounts of the large mammal species. However, the occurrence of some of the species such as red dog or Indian wild dog (*Cuon alpinus*) and Tibetan wild ass (*Equus kiang*) is still a controversy and requires further investigations. There are reports that these species occur in Shimshal Pamir, the area next to the border region with Xinjiang, China (Rasool 1998). Earlier accounts suggest occasional crossing of these species from China into Pakistan around the Broldu and Oprang rivers in Shimshali Pamir, but there is no confirmation of recent sightings of these species. Blumstein (1993, 1995, 1998) has given some new records of *Mustela* sp. from Khunjerab National Park as well as detailed sightings and studies on Red fox and Golden Marmots. Detailed zoological surveys are further needed to establish their occurrence in NA. A list of threatened mammals and their distribution in NAs is given in the Table 3.

<b>Table 3: List of Threatened Mammals and their Distribution in NA</b>		
<b>Common Name</b>	<b>Scientific Name</b>	<b>Distribution in NA</b>
Snow leopard	<i>Uncia uncia</i>	Whole NA with strongholds in Baltistan and Hunza regions
Himalayan lynx	<i>Felis lynx</i>	Associated with alpine slopes above the tree line in both Gilgit and Baltistan regions
Indian wolf	<i>Canis lupus</i>	Gilgit, Upper Hunza and Baltistan regions
Himalayan black bear	<i>Ursus thibetanus</i>	Astore, Chilas, Darel and Tangir areas of Diامر District
Himalayan brown bear	<i>Ursus arctos</i>	Fragmented populations associated with alpine meadows and alpine zones; the main strongholds are Deosai Plateau, KNP, Astore and areas around Nanga Parbat
Musk deer	<i>Moschus chrysogaster</i>	Lower Hunza, Naltar, Astore region, lower Baltistan region; associated with birch and Juniper scrubs
Flare-horned Markhor	<i>Capra falconeri</i>	Randu Valley in Baltistan, Lower Astore, Tangir, and Gilgit region
Ladakh urial	<i>Ovis vignei vignei</i>	Thalay valley, Nar Gorro, Sarfranga and Karrpochu mountains in Baltistan
Marco Polo sheep	<i>Ovis ammon poli</i>	Killick and Mintaka area adjacent to KNP
Blue sheep	<i>Pseudois nayaur</i>	Shimshal Valley, Sokhitribad nullah near KNP, Baltoro Glacier Valley and Braldu Valley in Baltistan region
Woolly flying squirrel	<i>Hylopetes cinereus</i>	Upper Diامر District, Sai Nullah, Lower Astore
and Kashmir flying squirrel	<i>Hylopetes fimbriatus</i>	Upper Diامر District, Astore, Sai Nullah, Barmas

There is need to establish priority conservation area by focusing on the habitat requirement for the key species such as snow leopard and mountain ungulates. These wide-ranging species can serve an umbrella role for conservation of the overall biodiversity (Wikramanayake et al 1998). This approach has been adopted under the Mountain Areas Conservancy Project being implemented in NA over the much larger landscape of this temperate region.

#### **2.2.2.2. Avifauna**

NA have one of the most diverse avifauna of the mountain regions of the world, but unfortunately little information is available on the distribution, status and ecology of many of the bird species. The comprehensive account on the avifauna of Pakistan comes from Roberts (1991 and 1992). Very limited data is available on the bird diversity in NA. Some researchers have documented details of bird diversity of certain parts of NA. These include studies on avifauna of Khunjerab National Park (WWF 1996, Blumsetin 1995), Deosai Plateau in Baltistan (Woods et al. 1997, Khan and Rafiq 1998) and in Naltar Wildlife Sanctuary (Sheikh 2001) Much of the information contained in this section is derived from these publications.

The Karakoram and Himalayan ranges separate the uplands of Central Asia from the Indian Sub-continent, thereby forming an effective barrier between two large areas of Asia which are different climatically: cold high Asia and tropical south and Southeast Asia. Geographic location of the NA makes it a paradise for many bird species. The area serves as a staging, transitory, breeding, migratory and otherwise native grounds for many bird species.

In total, about 230 species of birds have been estimated for NA. These include passage migrants, vagrant, resident, breeding and irregular visitors. Many of these species breed in NA and found over a large range. The estimated number of bird species in NA is based on published records, and the distribution range maps and discussions in Roberts (1991 and 1992), as the quantitative information on the bird diversity of this region is very limited. The lack of reliable and consistent published data on the avifauna of NA indicates the need for long-term ornithological studies to determine the distribution and abundance of the bird species. Site-specific studies suggest that the area is rich in avifauna. For example, 109 bird species have been recorded from Deosai Plateau, the area largely comprised of alpine meadows and sub-alpine scrubs (Khan and Rafiq 1998). Similarly, 87 species have been reported from Khunjerab National Park (WWF 1996). Naltar valley in particular and lower Hunza valley, Gilgit and Astore valleys in general have been studied by Sheikh (2001) describing the ecology, breeding biology, distribution and species diversity of about 110 species. A large number of warblers, buntings, redstarts have been found to be breeding in this landscape.

There are some rare species of raptors, which not only occur on the area but also breed in NA. These include species like Lammergeyer and golden eagle. There is possibility that the species like peregrine falcon also breed at some high altitude valleys, particularly in Ghizer District. Few sightings of Lesser kestrel have also been reported in lower Hunza near Hunza river by Sheikh (2001). The main diverse group of birds in NA is the passeriformes species. These are mostly warblers, tits, flycatchers, and buntings. Some of the restricted range species like snow partridge

and Himalayan monal pheasant are extremely rare and may be at the verge of extinction from many of their earlier strongholds.

Birdlife International (2001) reported 27 species of Pakistan, which are threatened internationally. Out of these, 7 species are found in NA. There may be several more species, which are threatened nationally or facing local extinction. For example, snow partridge and Himalayan monal pheasant are facing local extinction from many valleys. Similarly, Large-billed bush warbler and Tytler's warbler are the rare species, but not included in the report of the Birdlife International. A list of threatened species is given the Table 4. These species have small and fragmented populations and are threatened by loss and fragmentation of their habitat.

Common Name	Scientific Name	Recorded From
Snow partridge	Lerwa lerwa	Upper Hunza and Baltistan region
Himalayan monal pheasant	Cophophorus impejanus	Diamer district
Lesser kestrel	Falco naummani	Lower Hunza, adjacent to Naltar valley
Ferruginous duck	Aythya nyroca	Naltar lakes
Kashmir flycatcher	Ficedula subrubra	Gilgit region
Long-billed bush warbler	Bradypterus major	Naltar Valley
Tytler's warbler	Phylloscopus tytleri	Naltar and adjacent valleys
Indian skimmer	Rynchops albicollis	Baltistan region
Sociable lapwing	Vanellus gregarius	?

Sources: Derived from Sheikh (2001) and Roberts (1991 and 1992).

Threats to the avifauna in NA include habitat loss, habitat alteration, (especially breeding habitat), loss of edges especially forest edges, deforestation, expansion of agriculture, use of pesticides and direct persecution by human. Direct persecution involves hunting, trapping, shooting from agriculture fields and poisoning. Use of pesticides on crops and fruit trees has reduced the population of many species, particularly of magpies, crows, yellow-billed chough and rock dove.

### 2.2.2.3. Reptiles and Amphibians

Herpetofauna in NA represented by 3 families of amphibians (Ranidae, Bufonidae & Megaphrydae) and 8 families of reptiles (Gekkonidae, Agamidae, Scincidae, Varanidae, Boidae, Colubidae, Elaphidae and Viperidae). About 23 species of reptiles and 6 of amphibians have been reported from NA. Among reptiles 9 species are of lizards and 14 of snakes, while among amphibians 2 species of frogs and 4 of toads (estimated from Baig 2001). Given the cold-blooded nature of herpetofauna, one should not expect high diversity of reptiles and amphibian in the high mountains of NA. Therefore, NA have relatively fewer species of reptiles and amphibians as compared to lower mountains and plains, but the endemism may be higher than other parts of the country (Baig 2001). Despite efforts of some early herpetologists, NA' herpetofauna remained largely un-described. Most of the herpetological explorations are concentrated in and around protected areas (e.g.

KNP and Deosai national parks). For example, one species of frog (*Scutigera occidentalis*) and two species of skinks, Himalayan ground skink and glacier skinks have been recorded from Deosai Plateau. *Scutigera occidentalis*, the Kashmir Mountain toad (or Deosai frog) is a restricted range species found only at extraordinary high elevations. A number of reptilian species are either endemic to the region or have restricted range distribution. These species include 2 amphibians and 4 lizards (Table 5). Most of these species are restricted to their type locality requiring more detailed work to understand the composition of herpetofauna in NA. Lower herpetofauna diversity in NA is probably due to extreme climatic conditions, rugged terrain, and rapid rivers, which have acted as barrier to the species like turtles and tortoises.

**Table 5: Endemic species of herpetofauna of the region**

Species	Scientific Name
Amphibian	
Deosai Frog	<i>Scutigera occidentalis</i>
Batura Toad	<i>Bufo pseudoraddi batuae</i>
Reptiles	
Pakistani Rock Agama	<i>Laudakia pakistanica pakistanica</i>
Auffenberg's Rock Agama	<i>Laudakia pakistanica auffenbergi</i>
Khan's Rock Agama	<i>Laudakia pakistanica khani</i>
Batura Bent-toed Gecko	<i>Cyrtodactylus baturensis</i>

Source Baig (2001)

#### 2.2.2.4. Freshwater Fish

NA are blessed with great water resources comprised of rivers, streams, and alpine lakes fed by the snowmelt and glacier waters. These freshwater resources harbour several fish species, which are the important component of NA's biological diversity. The fish fauna in NA is relatively poor due to high turbidity, low water temperature, high water speed, low benthic productivity, and long stretches of narrow gorges of rivers (Rafiq 2000).

The fish species in NA are predominantly Palearctic having elements of Central Asian Highlands with some mix of Oriental Region. The fish diversity in NA is yet to be described with more detail despite its biogeographical and evolutionary significances. However, some recent studies report there are about 17 species of native fish and 3 of exotic fishes, belonging to five families (Table 6). Out of these 17 native species, 4 are endemic to NA; while several others have restricted range confined to one or two localities. For example, species *Triplophysa stoliczkai*, *Ptychobarbus conirostis* and *Schizopygopsis stoliczkai* are only found in eastern water heads up to Kachura close to Skardu Town (Rafiq In Press).

During the Hunza/Gojal expedition 2000 undertaken jointly by Oxford University Museum of Natural History and the Pakistan Museum of Natural History, specimens of 3 species of fish were collected; one of these reported as endemic to the NA (M. Rafiq, Pers. Commun.). The number of fish species found in high altitude streams and lakes is low. For example, only three fish species have been documented from the streams and lakes of Deosai Plateau. These include *Triplophysa stoliczkai*, *Diptyichus maculatus*, and *Ptychobarbus conirostis*



(Woods et al. 1997). These species are well adapted to clear and shallow streams in Deosai Plateau.

Among exotic species, brown trout was introduced in Gilgit Agency during the early 1900s. This species has now well established itself and is found in most of the rivers and lakes of Gilgit and Ghizer districts. Particularly, upstream of the Ghizer River and its tributaries contain large number of brown trout (AKRSP/DFID 2000). Other two exotic species include North American rainbow trout and Chinese carp introduced for aquaculture. However, it is not clear whether these exotics breed naturally. One thing is clear that their distribution is very limited and these are found only in those water bodies where they were stocked.

The role of fish in supporting the livelihood of rural communities has not been well documented. Exploitation of fisheries resource is relatively small, but it is an important source of food protein and vitamin A for many of the mountain

<b>Table 6: Fish diversity in Northern Areas</b>	
<b>Species</b>	<b>Common/Local Name</b>
<b>Indigenous Species</b>	
Family Cyprinidae	
Schizothorax plagiostomus	Gahi Cheemo
Schizothorax NAus	Chochan
Schizothorax esocinus	Chakhat
Schizothorax skarduensis*	Khaduk
Schizothorax longipinnis	Damnian
Schizopygopsis stoliczkai	?
Schizocypris curviforms	?
Ptychobarbus conirostris	Sianian
Diptychus maculatus	?
Racoma labiata	?
	Snow carp
Family Sisoridae	Konozobo
Glyptostnum reticulatum	Jungli chemo
	"
Family Noemacheilidae	"
Triplophysa stoliczkai*	"
Triplophysa gracilius	
Triplophysa yasenensis*	
Triplophysa trewavasae*	
Triplophysa tenuicauda	
Triplophysa microps	
<b>Exotic Species</b>	
Family Salmonidae	
Salmo trutta fario	Brown trout
Oncorhynchus mykiss	Rainbow trout
Family Cyprinidae	
Cyprinus carpio	Chinese carp/Gulfam

\* Species endemic to Northern Areas.  
Source: Rafiq (1999).

communities. Most of the fish caught by the local people is consumed in the household, but it is also sometimes offered for sale. Recent trend of fishing with explosives has reduced the population of many species to alarming level. Several species of Cyprinids are rare or vulnerable. The other threat to fish fauna is from introduced species. Indigenous trout has a limited range distribution, is facing competition from exotic trout, and should be a special concern. Local people have reported competition between trout and snow carps, because trout eat the juvenile of snow carp and snow carp eat trout eggs. Though a lot is available on the subject but under local environment i.e. NA, very little is known about the ecology of these fish species beyond the fact that they found in both clear and turbid streams. Moreover, human activities such as logging, use of pesticides, construction of roads, and diversion of water to irrigation channel are threatening the fish fauna and its habitat. A few studies have been carried out to identify the fish and their natural distribution. More detailed investigations are needed to determine the taxonomic status, population size, distribution and habitat requirement of the fish species found in NA.

#### **2.2.2.5. Insect and Butterflies Diversity**

Of the 1.4 million living species on earth, over 53% are insects. In Pakistan, more than 5000 species (BAP, 2000) of insects are reported. Though, Pakistan Forest Institute, Peshawar has good collection of insects, including those from NA, but still very little information is available on the insect diversity in NA. However, some biologists have made individual efforts to identify butterfly species, and to document their distribution and status. Pakistan Museum of Natural History (PMNH) and the Oxford University Museum have been studying insect diversity from Gilgit along the Karakoram Highway to the Sino-Pakistan border on Khunjerab Pass and several selected valleys. During the last five years, they recorded a range of species of insects. Some of them are new records to Pakistan and even some species may be new to science. By the 1999, they have recorded about 100 species of butterflies, with new taxa being added on each visit. For example, about 40 butterfly species were recorded during the Hunza 2000 expedition (Smith 2001), four of these were new records to Pakistan.

The role that insects play in the human environment as beneficial and harmful creatures is well recognised by the society. However, the present level of information on insect biodiversity remains very low and the scope of new discoveries and useful knowledge regarding insect diversity remains very high, particularly to find out endemic species of insects. There is need to document invertebrate fauna of NA, for which local expertise can be developed by involving local research institutions who can facilitate collection of samples. Recent increase in the use of pesticides on agriculture crops and orchards may have the negative impact on many useful insects, which helps in pollination of fruit trees. This must be kept in mind, while making efforts for conserving biodiversity in NA.

#### **2.2.3. Agriculture Biodiversity**

Agro-biodiversity refers to genetic variability in cultivated plants and domesticated animals including their closely related wild species growing and evolving under the natural conditions (Thrupp 1997). Agro-biodiversity not only directly contributes to national economies, but it also provides employment and livelihood to a large section of the society. However, there are growing concerns that the modern commercial agriculture has had a direct negative impact on biodiversity at

all levels: ecosystem, species and genes, and on both natural and domestic diversity (UNEP 1995). There is need to carefully blend the modern agriculture techniques with traditional practices to assure that agro-biodiversity is maintained.

The main cause of loss of agro-biodiversity is the spread of commercial agriculture (cash crops), which encourages monoculture cultivations. New crop varieties associate with commercial agriculture often lead to the replacement and loss of traditional, highly variable farmer varieties (Biodiversity in Development project 2001; BB19). ). Loss of traditional varieties means loss of valuable genes, which have resistance to local pests and disease and adaptation to the local abiotic stresses.

NA lies in close proximity to the two major centres of agro-biodiversity—Central Asia and China. Moreover, diversity in agro-ecological zones, crops, fruit, domestic animals, farming systems and cultural diversity make this area rich in agriculture biodiversity. Particularly, NA is considered the centre of diversity for several nut fruits. Over the centuries, local communities have evolved strategies for harnessing local agro-biodiversity for food and nutrition. It involves diverse cropping patterns suited to local ecological, social and cultural systems. They have adopted management practices that ensure sustainable use of agricultural resource. Classic examples include harvesting of snowmelt and glacier waters through construction of sophisticated (lengthy and under difficult physical condition) irrigation channels for irrigating agriculture fields and mixing of crops to maximise the productivity.

Agricultural and livestock production provide the main source of livelihood for the people of NA. It employs majority of the local workforce. Crops, fruit and livestock diversity found in NA is briefly discussed in the following sections.

### **2.2.3.1. Crop Diversity**

Crop diversity refers to the biological diversity found in crops used for food and agriculture. It exists at three levels in the farming system: at the ecosystem, species and variety level. Generally, it refers to the agro-ecosystem, the diversity in the number of crop species grown, and diversity of different varieties of these crops (Long et al. 2000).

Why care about crop diversity? Maintaining crop diversity is important, because it contributes to peoples' livelihoods. Therefore, it must be conserved in order to attain sustainable living. Over the last three decades, plant breeders have introduced many high yield varieties of crops, now we rely heavily on the new modern varieties. These varieties are very uniform and often contain less genetic diversity than farmers' varieties. They do not resist diseases, and they require good land and lots of fertiliser in order to give good yield. These crops have little value for the farmers with marginal land holdings (Long et al. 2000). Other reasons for maintaining crop diversity are to provide different dishes to eat, to ensure harvest at different times of year, and to simply safe guard for the future.

NA have diverse agro-ecological zones, which harbour a wide range of crop genetic resources. There is considerable altitudinal variation between lower parts of NA and high lands of upper Hunza, Ghizer District, and the Baltistan Region, which provides three distinct cropping zones—double cropping (up to 1850 m),

transitional (up to 2300 m) and single cropping zones (right up to 3300). These zones provide diverse physical factors for growing a range of crops adapted to different environmental conditions. The climate and soil types are such that a very wide range of alternative crops could be grown (Whitemen 1985). Moreover, the area falls on the historic trade route between Central Asian states, China and the Indian Sub-continent, where traders had brought many varieties of crops and fruits bartered with local produces.

No systematic effort has been made to document the crop genetic resources of NA. Only the sporadic information is available on the crop diversity, which indicates that the area is rich in crop diversity. A variety of crops and vegetables are grown. The principal crops in NA are wheat, barley, triticale, maize, millet, potato, pulses, buckwheat, and several fodder crops. Wheat is the most important crop and the staple diet of the people of NA followed by the maize and barley. There are several recognized varieties of wheat, differing in maturity, grain quality and rust resistance. Some of these varieties are known to have originated in Badakhshan (Afghanistan), Ladakh (Indian held Kashmir) and Kashgar, China. Potatoes were introduced to the area at the end of 19th century and are now considered as a cash crop. Pulses grown in the area include lentils, black gram, lathyrus, peas, chickpeas, broad beans, Mothi bean (a wild type of soya bean) and beans. The fodder crops grown are Lucerne, shaftal, vetch, berseen (introduced), rye, white clover and sweet clover (also occur in the wild) and Onobrychis. There are about 500 wild relatives of cultivated crops documented from Pakistan, most of these are found in NA (A. Qutab pers. Com.). Wild relatives of crop and fruit plants recorded from NA are given in the Table 7.

**Table 7: Wild Relatives of some Crop and Fruit Plants in NA**

Common Name	Scientific Name	Distribution in NA
Wild relatives of wheat	<i>Aegilops squarossus</i>	Mountain valleys in NA
	<i>Aegilops triuncials</i>	Mountain valleys in NA
	<i>Elymus russelii</i>	Endemic to Karakoram Range
	<i>Elymus longe aristatus</i>	Highlands of Hindukush-Himalaya and Karakoram
Wild relatives of barley	<i>Hordeum bogdanii</i>	Karakoram mountains
	<i>Sorghum halepense</i>	Common weed throughout in NA
Wild relatives of millet	<i>Pennisetum flaccidum</i>	Alpine slopes of Karakorum-HinduKush and Himalaya
Wild relatives of chick pea	<i>Cicer macranthum</i>	Sub-alpine slopes of Karakoram and Himalaya
	<i>Cicer microphyllum</i>	Sub-alpine slopes of Karakoram and Himalaya
Wild relatives of grape	<i>Vitis Jacquemontii</i>	Sakardu region of Himalaya
Wild relatives of fruits	<i>Pyrus pashia</i>	Temperate Himalaya
	<i>Prunus prostrata</i>	Temperate Himalaya

Source: Flora of Pakistan

Until recently, many valleys in NA were isolated from the outside world, where subsistence farmers cultivated local varieties of centuries and where traditional farming practices thrived. After the construction of Karakoram Highway, modern agriculture and the agricultural development programmes have introduced many high yielding crop varieties that has replaced indigenous low yielding and disease resistant varieties. The traditional varieties are slowly disappearing, as there is no programme to conserve germplasm in NA.

### 2.2.3.2. Fruit Diversity

NA lies close to the major centres of fruit diversity—the central Asian states and China. The ancient trade route from China to west Asia and India passed through this area. Many of the fruit species were brought by the traders and are grown here for centuries. Moreover, NA is agro-ecologically very well suited for the production of deciduous fruit and nut crops, both of which have been traditionally cultivated in the area (Doolan 1993). They now represent unique genetic resources for selection purposes and horticulture development in the area. They possess genetic basis for tolerance to extreme cold, heat, frost, drought, diseases and pests. NA fruit forests are located in the valleys and the lower slopes. In summer fruits are delights of NA, with apricot an important food staple, especially in Hunza Valley, where steep valley sides and narrow terraces favour tree crops, compared with other agriculture crops. Formerly, only apricot, grapes, mulberry and walnut were the common fruit trees, but over the last century other kinds of fruit trees have been introduced. There are no commercial orchards as such, though surplus production is locally sold, serving a multipurpose role providing fodder, fuel as well as fruit, nut and oil. Fruit trees prevent desertification of the area, soften the climate, control drainage regime and provide favourable conditions for agriculture in the valleys. No detailed study has been conducted to document varieties of various species of fruit and their status in NA. However, there is a possibility that many traditional varieties and their genetic resources are under threat of disappearance. The major threat seems to be from unchecked introduction of the western fruit varieties by horticulture development programmes. This rapid introduction of western cultivars is replacing the old established ones, and in many areas farmers are abandoning the local varieties (Thomson et al. 1988). The extent of this problem can be judged from the fact that in 1983 and 1984, about 33 different new varieties of apple were imported from England and introduced as mother trees on eight different government nurseries in NA (Whiteman 1985).

Over the last two decades a number of attempts have been made to promote propagation of orchards and to introduce new varieties of fruits. One of the prominent project was "production of seeds and planting material in NA" funded by the FAO projects implemented in the early 1990s. Under this project introduced and locally propagated cultivars were planted at the various government nurseries in NA. The selected varieties of 8 species of fruit, covering 95 different cultivars were grown and successful varieties were recommended to the local farmers. The number of cultivars established at the project nurseries is given in the table 8, which indicates a very high diversity among the fruit species. More systematic studies are needed to document varieties / cultivars of different fruit species and to identify the varieties at risk.

**Table 8: Diversity in Fruit Species (both indigenous and introduced)**

Fruit Species	Number of Varieties/Cultivars
Apple	17
Apricot	28
Pear	14
Plum	8
Cherry	13
Grape	8
Peach	5
Almond	3
Walnut	15
Mulberry	4
Olive	6

Source: Doolan (1993) and Mr. Juma Khan, Agric. Dept. Pers. Comm.

### 2.2.3.3. Livestock Diversity

Livestock is an important component of agro-biodiversity and for centuries has been a part of livelihood strategies of the rural communities. It has been estimated that livestock contribute to the livelihood of at least 70% of the world's rural population. Livestock and their products supply at least 30 % of human needs for food and agriculture production in the form of meat, milk, milk products, eggs, fibre, dung, and draught power. Livestock is also a source of manure for soil fertility inputs in developing countries (Biodiversity in Development Project 2001;BB10).

FAO/UNEP (2000) reports that domestic animals diversity is being lost as human population and economic pressures accelerate the pace of change in traditional agriculture systems. This is happening because of wholesale transfer of breeds suited to high production systems from developed to developing countries. Loss of livestock biodiversity is caused by the replacement of the existing breeds with small selection of specialised improved breeds, which are often developed under comparatively high input and low-stressed production environments.

Livestock diversity in NA constitutes many breeds of sheep, goats, and cattle. Sheep (*Ovis aries*) breeds include Baltistani, Gojali, Kaghani, and Koh-i-Ghizer. Kaghani breed is found mainly in upper area of Chilas Tehsil close to the Babu Sar Pass next to the Kaghan-Naran Valley of NWFP. While goats (*Capra hircus*) breeds include Baltistani, Pamiri, Gojali, Koh-I- Ghizer, Jarakheil, Gaddi, and Kaghani. Farmers also keep cattle (*Bos taurus*), yak (*Bos grunniens*) and various cross-breeds between cattle and yak. Yaks are mainly kept at the higher regions like in Gojal, Baltistan, and in part of Ghizer District. They are highly valued animal and very important to local economy as they provide milk, wool, draught power, and manure to farmers. Yak is physically well adapted to higher altitudes. Their heavy wool and other thermo-regulator mechanisms keep them alive in extreme weather conditions at high

altitudes (Seim 1999). Cross-breeding between yak and local cattle is commonly practiced. Cross-bred animals (Zo/Zomo) constitute a chunk of livestock population in NA. The status of livestock biodiversity is given in the Table 9.

Species	Breeds in Pakistan	Breeds in NA
Yak	1	1
Cattle	12	1
Goats	32	7
Sheep	37	4
Horses	4	2
Donkeys	4	1
Camel	?	1
Chicken	3	1

#### **2.2.4. Alpine Wetlands and their Importance**

Wetlands are very important for the ecological stability and have great values for human. They regulate water levels within the watersheds, improve water quality, reduce flood and storm damages, provide important fish and wildlife habitat, and support hunting, fishing and other recreational activities.

S. No.	Wetland	Status	Conservation Value
1.	Deosai Plateau Wetland Complex/ Sheosar Lake	National Park	Habitat for fish and waders, recreation
2.	Naltar Wetland Complex	Not protected	Waterfowl and waders' habitat and recreation. A breeding habitat at the edges.
3.	Borith Lake	Not protected	Waterfowl habitat
4.	Shimshal Lake	Not protected	Watershed value
5.	Satpara Lake	Wildlife Sanctuary	Irrigation, fish, waterfowl habitat and recreation
6.	Shandoor Lake	National Park	Waterfowl habitat, Watershed, fish and recreation
7.	Kachura Lake	Not protected	Fish and recreation
8.	Pandhar Lake	Not protected	Watershed, fish and recreation
9.	Hundrup Lake	National Park	Fish, waders and recreation
10.	Rama Lake	Not protected	Watershed and recreation
11.	Jutial Lake	Not protected	Watershed
12.	Baghsar Lake	Not protected	Watershed
13.	Gasho Lake	Not protected	Watershed

There are about 25-33 wetlands of different size in NA. These wetlands are mainly freshwater and glacial lakes, which are fed by streams, snowmelt, glacial and spring water. Most of the alpine wetlands exist between 2800 and 4000m of elevation. The important wetlands are listed in Table 10.

Sheikh (1999) has studied the Naltar wetland complex for its ecology and as a habitat for breeding birds. Species of leaf warblers, bush warblers, tits and buntings breed at the edges of these wetlands at the height of 2,800 to 3,100 meters.

### **2.2.5. Role of Irrigation Systems in Enhancing Floral and Faunal Diversity**

NA has a unique irrigation system. Almost the entire irrigation is done through irrigation channels (Kuhls) constructed and maintained through the communal efforts of the villagers. These channels are constructed along the contour and fed by snowmelt, glacial melt, and/or spring water coming down with gravity force and distributed through watercourses to traced fields planted with crops, vegetables, fodder, orchards, and forest plantations. There is generally scarcity of agriculture land in NA and for centuries these channels have played an important role in development of land close to the human settlements. The development of land and irrigation system below the irrigation channels indeed enhances the floral and faunal diversity, particularly of domesticated plants and animals. Land development also enhances the establishment of the soil fauna (microbes), whereas irrigation systems contribute to the diversity of aquatic flora and fauna. The traditional irrigation system also create a mosaic of agro-ecosystems in NA, which are beneficial to insect and seed-eating birds and to mammals such as foxes and other small mammals (Driver 1994). Forest plantations and trees along the irrigation channels and agriculture fields also contribute to the maintenance of biodiversity. The agricultural development on previously uncultivated land does result in reduction of those species adapted to dry and arid environment. However, the net loss of species is relatively small, as the agriculture development is severely limited by the availability of arable land and irrigation water. Detailed studies are needed to understand whether or not channel based irrigation system enhances floral and faunal diversity.



## 3. ISSUES AND TRENDS

This section presents the major issues and trends faced biodiversity conservation in NA. The efforts are made to gather both qualitative and quantitative information to describe biodiversity issues and to establish ecological trends in NA. The major issues include continuing loss of natural habitat, depletion of native species of animals and plants, and degradation of agro-ecosystems and the accelerating loss of genetic diversity in crops and domestic stock. It is also important to look into the direct and indirect causes of biodiversity loss and to suggest measures to mitigate these causes.

### 3.1. Issues

#### 3.1.1. Vegetative Cover and Habitat Loss

Habitat loss is considered as the leading cause of loss of world's biodiversity. Most species need undisturbed habitat to find food, water, shelter, and mates. But people are altering habitats all over the world. In NA, the activities causing habitat loss include commercial logging (not based on technical and sustainable basis), land development, over-grazing, fuel wood collection, construction of roads, and building new settlements. All these actions change landscapes, natural water flows, and the species composition in the area. Moreover, changes in climate and land use patterns also reducing the amount of snowfall and rain upon which the habitat depends. Another reason for habitat loss is the fragmentation of habitats into smaller patches. In fragmented landscape, many populations become isolated, resulting in inbreeding, loss of genetic diversity, and local extinctions. It also increases the vulnerability of species and populations to diseases, hunting, and random population change. There is no study to this effect, but generally perception is that the rate of vegetative cover loss is much higher in Diamer District than other districts of NA, mainly due to high rate of deforestation. With the destruction of the forests, fertile soil, associated fauna and natural habitats of many species are shrinking. Many associated species, such as the woolly flying squirrel, musk deer, black bear and monal pheasant have become rare in NA. Expert opinion is that deforestation, over-grazing and habitat fragmentation are some of the key anthropogenic causes that are contributing to habitat loss and degradation in NA.

#### 3.1.2. Depletion of the Population of Many Species

The biggest challenge faced today is the over-use of natural resources, the use of resources in a way and at a rate that lead to depletion of populations of many species. People use some plants and animal species at a much greater rate that the species can reproduce, which often result into local extinctions. The 2000 IUCN Red List of Threatened Species (Hilton-Taylor 2000) lists 45 species of internationally threatened animals occurring in Pakistan. Of these, 4 are critically endangered, 12 endangered, and 29 vulnerable. Out of these 45 species, 18 are mammals, 17 birds, 9 reptiles and 1 fish species. There are 2 species of plants listed as internationally threatened. Several endangered and threatened species are found in NA.

Endangered mammals include snow leopard, flare- horned markhor, Marco Polo sheep, Ladakh urial, mask deer, brown bear, and woolly flying squirrel. Moreover, population of many birds species like snow cock and monal pheasant is severely depleted, which is resulting into local extinctions. No systematic study has been conducted to evaluate the status of many of these species, however, some site-specific studies indicate that populations these species are very low and in some areas close to the biological threshold. Badly suffered are the large mammal species like markhor, Marco Polo sheep, blue sheep, Ladakh urial, musk deer and Himalayan ibex. All these species are prey species of key predators like endangered snow leopard. The main reasons for depletion of their populations are over-hunting and habitat loss. In addition, habitat fragmentation and isolation of small populations imply that many populations of these species were severely depleted in the past. Astore Markhor and Ladakh urial were found at the lower elevations and were vulnerable to heavy hunting pressure both for meat and trophies. The local hunters because of high value of its scented pod have persecuted musk deer extensively. Now, this species is considered endangered and its Pakistan population is listed under CITES Appendix-I. Among medicinal plants, species like Kuth (Saussria lappa) and Karru (Picrorhiza kurroa) are severely depleted due to over-harvest and now these are found only in a few alpine meadows in Astore region.

### **3.1.3. Degradation of Agro-ecosystems**

Agro-ecosystems in NA are faced with degrading trends. These include loss of topsoil, intensive agriculture, reduced productivity, increased use pesticides, introduction of high yield crops, loss of local varieties, loss of local and indigenous knowledge and climate change affects. Soil degradation reduces productivity of already scarce agriculture land and decreases the capacity of the land to sustain micro organisms and moisture retention qualities of the land. Intensive agriculture reduces floral and faunal diversity in crops. This is particularly the case after the introduction potato as cash crop.

Many crops are facing with erosion in genetic diversity mainly because of introduction of genetically uniform varieties (uniform cultivars) and in-field hybridisation between modern and local varieties. Spread of genetically modified varieties make them less able to adapt to changed environmental conditions (e.g. shortage of water) or to perform well in marginal lands. Moreover, high yield crops are often more responsive to fertiliser and pesticide application than the local varieties putting heavy burden on already marginal communities in mountains of NA. These practices also encourage over-exploitation of water resources and use of agriculture chemicals, which results in eliminating beneficial insects and micro-organisms.

Degradation of local agro-ecosystems is also prompted by market and policy failure, such as subsidies and agriculture loans, which encourage agriculture intensification and agro-chemical use. Increasing use of herbicides and pesticides adversely affects non-target species and contributes to food chain contamination and water pollution. Similarly, breakdown of traditional grazing systems and pasture management is leading to unrestricted grazing, hence degradation of many high pastures.

### **3.1.4. Lack of awareness**

Local people in NA are generally aware of the surrounding environment and have knowledge of animal and plant species occurring in the valleys and adjacent mountains (Virk 1999). However, they are unaware of value of these resources and the consequences of the loss of biodiversity and degradation of ecosystems. Indeed, conserving biodiversity requires an understanding of: what is biodiversity and why should we conserve it? It also requires understanding of costs and benefits of conservation and sustainable use of biodiversity. People are also unaware how conservation of biodiversity can contribute to local economic development and help in poverty alleviation among the rural communities of NA.

Generally, there is very limited knowledge of above issues among general public, planners and policy makers and even those who are responsible for protection of animal and plant species. Indeed, a good general understanding of biodiversity is required in all sectors of the government to ensure that biodiversity concerns are recognized and integrated in the course of development and implementation of the development projects.

IUCN, WWF and some local NGOs have initiated programmes to create awareness among school children and the general public about the importance of biodiversity and use its components sustainably. However, in the community controlled hunting areas awareness about significance of biodiversity conservation is quite commendable. But overall, these programmes are slow in making an impact mainly because these activities target only a small section of the population.

### **3.1.5. Ineffective management of parks and protected areas**

A number of protected areas have been created including 4 national parks, 3 wildlife sanctuaries, and 9 game reserves. Similarly, several forest areas are designated as protected forests. Management of these areas remains ineffective largely due lack of resources, shortage of protective and professional staff, and lack of capacity to carry out management operations effectively. Moreover, the existing wildlife and forestry laws do not provide adequate framework for the management of these areas. Almost all of these areas are subject to human use in one-way or the other. Indeed, the adjacent communities depend heavily on the resources of these areas, which directly conflict the management objectives of the protected areas. The best way to protect parks and protected areas is through establishment of collaborative management regimes by involving local communities in day to day management of these areas. However, the NA Wildlife Preservation Act of 1975 does not have provision for introducing collaborative management of protected areas. Recently, some areas have been designated as Community Managed Controlled Hunting Areas by combining several clauses of the Act, but effectiveness of this arrangement is yet to be achieved.

There is also a lack comprehensive management plans for most of these protected areas, and where plans do exist, they never got implemented mainly because of lack of funds and shortcomings in their effective planning. For example, a management plan was prepared for the Khunjerab National in 1996. Although the federal government approved the plan, this plan never got implemented due to shortage of funds and inability of the concerned agencies to mobilize resources for this very important national park of the country. Similarly, a management plan has been

drafted for Deosai and Central Karakoram national parks, other important biodiversity area; effective implementation of these plans will require considerable efforts and strategic planning as well as funding.

### **3.1.6. Lack of biodiversity inventories and monitoring systems**

Though wildlife survey and monitoring is a regular feature in all community controlled hunting areas under MAC Project, but at present there is no institution in NA responsible for preparing inventories of components of biodiversity and there is no system for monitoring trend in species populations, their genetic richness, and their complex habitats. Most of the statistics are gathered by the line departments and they are mostly based on secondary information. They are of limited use for the effective planning and management of component of biodiversity. Generally, there is lack of qualitative and quantitative information on biodiversity of NA. At present, we know very little about animal and plant species that inhabit the rugged mountains of NA, and how these species are affected by human activities. We also know little about diversity of insects, arthropods, fungi, bacteria and other soil micro organisms.

Whatever information available on wildlife, fisheries, forests and on agriculture biodiversity is not readily available to those who need it. In part, this is because the institutions and individuals concerned do not widely share the published and unpublished information they possess. Often unpublished information remains in files as raw data and may eventually be lost. Some information is published abroad, and few people other than the authors know the existence of these publications. Clearly, there is need to have a well established biodiversity assessment and monitoring system in NA, with a mechanism of sharing information with all the relevant agencies and conservation NGOs. This will help managers, planners and policy makers to make the best-informed decisions regarding the challenges associated with natural resource conservation and development.

### **3.1.7. Limited resources and institutional capacity**

Conservation and management of various components of biodiversity is mainly the responsibility of fisheries, forestry, agriculture and livestock departments of NA. These agencies are under funded and have limited resources at their disposal. They lack appropriate equipment and transportation necessary to operate in the difficult terrain in NA. Unfortunately, these agencies have not kept the pace with changing scenario and developments in the field of conservation biology. For example, Fisheries and Forestry departments still consider policing resource their main responsibility. There are little efforts on the proper management and regulating sustainable use of fisheries, forestry, and wildlife resources. There is no research section in these agencies, which could focus on studying different aspects of biodiversity. Consequently, very little is known about the ecology of plants and animals species or conservation and sustainable use of components of biodiversity. Moreover, these agencies have limited capacities in effective planning and management of various components of biodiversity.

However, some conservation and development organizations such as AKRSP, IUCN and WWF-Pakistan, and Himalayan Wildlife Foundation (HWF) have taken

steps for promoting conservation and sustainable use of biodiversity. These organizations now assist the government agencies in management planning and implementing conservation projects.

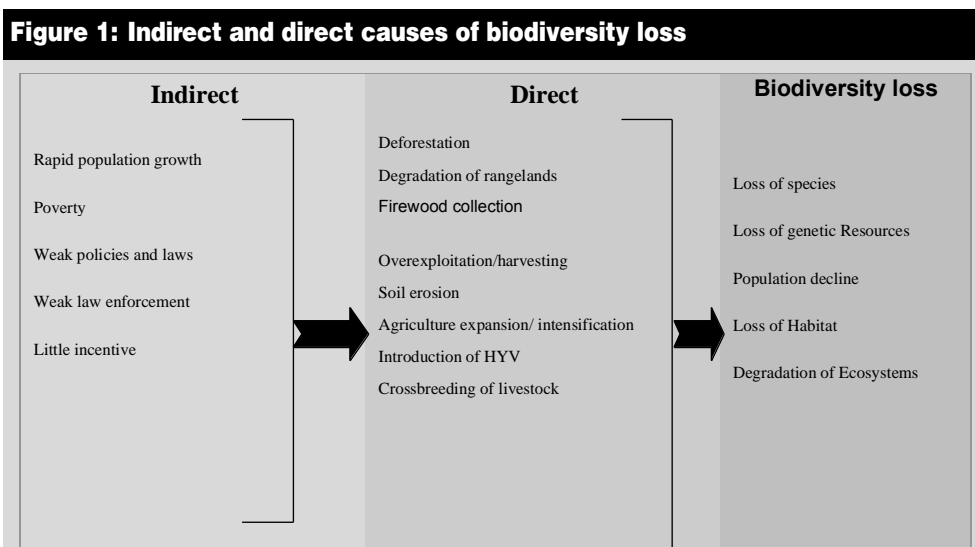
### 3.1.8. Gaps in Knowledge

Despite some efforts of exploration, the distribution and status of biological diversity in NA remain largely unknown. The rugged and inhospitable terrain throughout NA impeded these efforts from detailed study and inventory. Only a few localities are subject to detailed studies (e.g. KNP and Deosai N.P.). Plant and animal communities over much larger landscape remained un-explored. Whatever information is available only in the form of checklists based on limited fieldwork, a few of which are recent. Most of the NA's remote valleys remained under-explored for floral and faunal diversity.

The areas where some floral knowledge is available include: KNP, Deosai park, Astore region and several localities around Hunza. The distribution of mammal and bird species can only be inferred from extrapolations of known range distributions and preferred habitats of most common or charismatic species (Schaller 1977, Roberts 1991& 92 and Roberts 1997) and to some degree speculations of the knowledgeable persons. Even less is known of other vertebrate taxa, such as amphibians, reptiles, and fishes. The Oxford University Museum and Pakistan Museum for natural History have recently undertaken some joint expeditions to study the floral and faunal diversity in upper Hunza Region (Oxford Expedition Preliminary Report 2000). Such coordinated efforts for the systematic surveys to assess the biodiversity in NA could be the bases for filling in the gaps in knowledge are necessary.

## 3.2. Causes of Biodiversity Loss

The long-term future of biodiversity conservation in NA will be strongly influenced by dynamic forces such as population growth, livestock grazing pressure, resource demand, and commercial timber extraction that will intensify the rates of habitat loss, habitat degradation, and wildlife exploitation. There are several indirect and



direct causes of biodiversity loss. The causes most relevant to NA situation are given in the Figure 1:

### **3.2.1. Direct Causes of Biodiversity Loss**

#### **3.2.1.1. Deforestation**

The total area under forest cover was estimated at 666,000 ha, 9.5% of the total landscape (7.04 million ha) of NA. This includes both coniferous forests and farmland trees (GoP 1992). However, the experts believe that at present the area under natural forests is much less than it was 10 years ago and it is further declining due to anthropogenic pressures.

The main causes of deforestation are commercial logging and over-exploitation by growing population for fuel wood, fodder, and local consumption of timber and non-timber forest products, coupled with unrestricted livestock grazing that prevents regeneration of natural forests. The rate of deforestation is particularly higher in Diamer District due to commercial logging operations in many valleys. This high rate of deforestation is leading to disappearance of many tree and shrub species, together with the associated flora and fauna. The loss of forest cover from many parts of NA will have severe impact on forest biodiversity and serious implications for already fragile mountain ecosystems.

Many forested areas in the mountain landscape of NA protect watersheds that serve millions of people. The loss of forest cover in these areas will have a drastic impact on downstream people. They are also vitally important for maintaining biodiversity and serving as a natural mean of flood control. Scarcity of agriculture land is another cause of forest loss. This is particularly the case in Astore and Chilas sub-divisions of Diamer district.

#### **3.2.1.2. Degradation of pastures/rangelands (un-managed grazing)**

About 1.601 million ha area is classified as rangelands. Out of these, 896,000 ha are considered as degraded rangelands and 705,000 ha are alpine rangelands (GoP 1992). These rangelands are important not only for rearing livestock by the local communities, but also for the watershed protection. There are more than 2.0 million heads of livestock in NA and their numbers are believed to be increasing with the increase of human populations. Most of these rely on rangeland. Rangelands of NA are under stress and some of them are heavily degraded (Dr. Fazil Bari, Pers. Comm.). The main reason of degradation of rangelands is over-grazing due to overstocking and repeated grazing.

Over-grazing leaves soil barren and triggers water erosion and land sliding. Hard hit are the rangelands close to the villages. As they become unusable, a greater pressure is placed on high pastures. Over-grazing reduces the diversity of flora and fauna, and changes species composition, by removing palatable species. It also increases competition between domestic stock and wild herbivores (ungulates and rodents), thus reducing the prey base of many predators (IUCN/WCMC 1991).

#### **3.2.1.3. Firewood collection**

Firewood collection is common in NA. The scarcity of firewood forces local inhabitants to clear indigenous vegetation to meet their energy needs, which

constitutes the cheapest and the most accessible source of energy. Due to extreme cold during the winter months, the majority of households use firewood for cooking and space heating. The main source of firewood is the natural forests. With the increasing demand, the mountain slopes near the human settlements are now devoid of vegetation. The slopes once covered with scattered patches of pine trees and juniper woodlands are now taken over by shrubby vegetation (Virk 1999). This phenomenon has negative impact on the local floral diversity. However, trend in some big cities like Gilgit, Skardu, and Hunza is slowly changing as many people are reportedly using electricity, and LPG for cooking and space heating in addition to firewood. This may take some pressure off from natural forests. Some projects have introduced fuel-efficient stoves to reduce consumption of firewood. The impact of such interventions is yet to be studied.

#### **3.2.1.4. Over-hunting**

Indiscriminate hunting is believed to be the major cause of population decline of many species of birds and animals, particularly of mountain ungulates due to illegal hunting for trophies, skin and meat. Species thought to be declined due over-hunting include Astore markhor, Ladakh urial, Marco Polo sheep, and Himalayan ibex (for meat and trophies), and musk deer (for scent pod) and brown and black bears (for fat and body parts). Some species are ruthlessly persecuted for their depredations on livestock, for example snow leopard and wolf.

Mountain communities in NA are decedents of hunting gatherers and there is a strong tradition of hunting in the area. The impact of hunting has increased further with the spread of modern firearm and greater mobility due to construction of roads deep into valleys. This allows professional and paid hunters to operate in remote areas, which were difficult to access in the past. Paid hunting is a serious threat for species like markhor, urial and ibex. This has to be encountered sternly if populations of these species are to be recovered.

A number of game birds (e.g. snow cock and chukar partridge) and waterfowls are hunted for meat, while pheasants are hunted for feathers. Similarly, falcons are trapped and sold for the falconry trade. Over-hunting poses a serious threat to many wildlife species, and therefore to biodiversity of NA. There is need for effective law enforcement and regulation of hunting on the basis of sustain yields. This will only be possible with the involvement of local communities in conservation efforts.

#### **3.2.1.5. Soil erosions (including land sliding and avalanches)**

Large-scale removal of vegetation and cutting of green trees leaves soil vulnerable to water erosion. It also makes land unstable and susceptible to land sliding and avalanches. Both of these phenomena are common in NA and have direct affect on plant and animal species. It has been noticed that many large mammals become victim of avalanches. Carcasses of ibex, snow leopard and black bears have been observed near the sites of avalanches (personal observations).

Water erosion is particular problem in NA. It results from agriculture activities on the steep slopes, overstocking of pastures and poorly managed irrigation channels. The impact of water erosion on native biodiversity has not been studied. However, it is a fact that water erosion washes away topsoil and increases sedimentation in

streams and rivers, and results in degradation of both terrestrial and aquatic habitats. The loss of soil means loss of micro-organisms, plant diversity and associated animal species. This problem can be gauged from the reports that the Hunza and Gilgit rivers contribute as much sediment to the upper Indus basin as the entire eastern flanks of Karakoram Mountains that is four times bigger than Gilgit and Hunza regions. The erosion rate for the entire Karakoram region is very high by the world standard (i.e. 1,000 tons/km<sup>2</sup>/yr) (Goudie et al. 1982 cited in Ahmed 2001).

#### **3.2.1.6. Over-harvesting of medicinal plants**

NA are rich in medicinal plant diversity. However, over the years the demand for plant based drugs and products have increased manifold. It increases large-scale extraction of medicinal plants and degradation of their natural habitats. As a result, a number of valuable medicinal plant species are eliminated from the wild. Many species like kuth, karru, bankakri, malathi, and hing have been over-exploited by the contractors and local traders that now these species have been put on the endangered species list. If appropriate measures were not taken, some of these species may be lost forever.

#### **3.2.1.7. Over-use of pesticides and insecticides**

Like chemical fertilisers, pesticides and insecticides are now commonly used in NA. Fruit trees and vegetables are sprayed to control pest infestation. For example, apples are sprayed three times a year against codling moth. Similarly, insecticides are used to clean up soil before planting and are extensively used on potato plants and vegetables such as peas. Most pesticides are expensive, which force farmers to use cheaper chemicals with greater environmental consequences. Although government has banned sale of environmentally hazardous pesticides, some unauthorized pesticides are still available in the market. For example, dieldrin an officially banned insecticide is still being used. This is an organo-chlorine insecticide, which can adversely affect animals at the top of the food chain (Driver 1994).

Moreover, the increased use of pesticide sprays on fruit trees and vegetables also results into spray drift. This could have a direct impact on non-target (potentially beneficial) insect species, e.g. bees.

#### **3.2.1.8. Agriculture expansions/intensification**

Biodiversity in NAs is also suffering from expansion of agriculture to previously un-occupied land. At present, land development is a major craze in NA. Everyone wants to increase his or her landholding, as land is a precious commodity. Over the last 20 years AKRSP has encouraged local communities to develop barren lands and expand agriculture by financing hundreds of new irrigation channels. As a result, mountain slopes and riverbeds are brought under agriculture. This takeover of previously un-occupied land has a negative impact on the local flora and fauna mainly from habitat loss. Many species have retreated to remote and un-productive locations due to increasing threat from humans. Most of these mountain slopes were the winter habitat for many species of animals and birds.

Agriculture intensification is another cause for the loss of native biodiversity. The spread of commercial agriculture (cash crops) encourages monoculture and



cultivation of the same crop again and again. To maintain the production, farmers have to rely heavily on the use of chemical fertilizers and frequent watering, which pollute agro-ecosystems including streams and rivers, and eliminate beneficial insects and micro-organisms. Moreover, subsidies for agriculture development encourage agriculture intensification, which lead to further depletion of local production system and replacement and loss of traditional, highly variable local varieties. Loss of traditional varieties means loss of valuable genes, which have resistance to local pests and disease and adaptation to the local abiotic stresses. For example, introduction of potato as cash crop in most part of NAhas forced farmers to adopt intensive agriculture strategies. This will have impact over local crop diversity and associated species of flora and fauna.

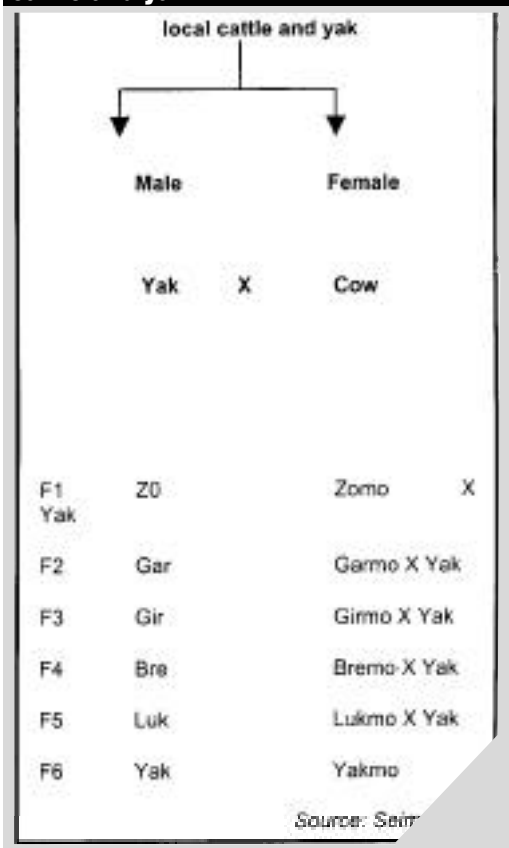
### 3.2.1.9. Introductions of high yielding crops

Introduction of High Yielding Varieties (HYVs) is one of the main causes of the loss of crop genetic diversity. The HYVs are responsive to water and fertiliser, but pose threats to indigenous crop varieties and often reduce biodiversity. AKRSP and Agriculture Department of NAhave introduced high-yielding strains of wheat and fruit trees. Most of these varieties are now commonly grown all across NA. As a result traditionally grown indigenous varieties may be lost, along with their contribution to the local genetic diversity. This issues has to be addressed by documenting indigenous varieties and maintaining their genetic material through ex-situ conservation e.g. in green houses, gene banks, storing germplasm etc.

### 3.2.1.10. Crossbreeding of livestock

Loss of livestock biodiversity is caused by the replacement of the native breeds with exotic breeds. This process is further accelerated by crossbreeding exotic breeds with native breeds of sheep, goats and cattle, as the repeated crossbreeding lead to erosion of genetic diversity. The crossbreeding is often encouraged by the Livestock Department without realising the negative impact on the local breeds. The most serious threat is from multiple crossing between local cattle and yak. Both have 30 pairs of chromosomes, hence hybridisation is possible and widely practiced in NA (Seim 1999). Their cross-breeding cycle is very interesting, which starts from a cross between cow and yak, and with every successive F1, milk production of females continues to decline. There is need to study the impact of this cross-breeding practice on the local breeds of cattle.

**Figure 2: Crossbreeding between local cattle and yak**



### **3.2.2. Indirect Causes of Biodiversity Loss**

There are several indirect causes creating conditions, which trigger the loss of biodiversity. Some of the indirect causes of degradation of biological resources in NA are discussed below:

#### **3.2.2.1. Rapid population growth**

The expanding human populations puts more pressure on natural resources (McNeely 1997); more people need more land to grow crops and more wood for fuel and housing, which could have a great impact on biodiversity. Rapid growth of human population and distribution are the most significant reasons for environment degradation. Growing human population could have a direct impact on use or conversion of natural ecosystems and indirect impact through increased consumption of natural resources. As consumption of natural resources grows, we are likely to see loss of biodiversity around the world (Alonso 2001). UNFPA's report on the State of World Population 2001 Report "Footprints and Milestones: Population and Environment Change" reported that more people are using more resources with more intensity than this Earth can afford. The report suggested that growing population causes considerable damage to environment and is one the root causes of threats to biodiversity.

The human population in NA is almost doubled over the last 20 year with population of 870,000 people in 1998 and annual population growth rate of 2.7 % (IUCN 1999), which is higher than overall population growth for Pakistan. This increase in human population has increased demand for land to grow more crops. New lands, including even some scree slopes and boulder fields, have been brought under cultivation to meet the needs of the growing population. This takeover of previously unoccupied lands by human have forced many species to retreat to remote and less productive locations, consequently reducing their breeding capacity and survival.

#### **3.2.2.2. Poverty**

Poverty shapes the resource use patterns. Poor people, especially those occupying marginal land and with small landholdings, depend heavily and directly on genetic, species and ecosystem biodiversity to support their livelihoods (Biodiversity and Development Project 2001; BB1). This support contributes to their health, nutrition, crop and stock development, and off-farm resource use. With limited livelihood opportunities owing to lack of skills, market opportunities, access to financial resources and without secure land tenure, they have no incentive to invest in sustainable harvest practices. Therefore, poor people themselves are often causing biodiversity degradation and loss, particularly if lack of incentives drives them to over-exploit the resources. They cannot afford to take risks in making resource use decisions, whereas many sustainable use options are untried, risky, and thus unattractive to local communities. The over-exploitation can only be reduced when people see tangible benefits from sustainable use of components of biodiversity.

Mountain people in NA are relatively poor, where Per Capita Income is about Rs.7500 per annum (IUCN 1999). Their main livelihood depends on agriculture and livestock production systems. Therefore, they depend heavily on natural biodiversity to meet their requirement e.g. use of high pastures and firewood collection, which often results in over-exploitation of resources at the local level.

### 3.2.2.3. Weak laws and policies

Pakistan has developed policies and laws (e.g. forestry, fisheries, and wildlife laws). These policies and laws relates to the conservation of different components of biodiversity. However, most of these policies and laws were adopted well before the concept of biodiversity advanced in 1980s and 90s. Therefore, these policies and laws are relatively weak and do not encompass the elements needed to reflect the need for biodiversity conservation. Forest, wildlife, and fisheries disciplines are considered as provincial subjects, where management and regulation of use of these resources is the responsibility of the provincial governments. Most of the provincial laws governing the use of biological resources were enacted about 25 years ago. These laws have not kept the pace with changing political, social, economic and ecological realities as well as meeting the obligations under the international treaties to which Pakistan is a signatory. The legislative and regulatory response to these changes has been in piecemeal meeting only urgent needs through amendments in the existing policies and laws. For example, NA Wildlife Preservation Act was enacted in 1975. After then, there has been a little change in this Act. The existing provisions of the Act do not provide room for community participation and collaborative management of protected areas. Similarly, forest Acts applicable in NA deals primarily with the exploitation of forests and they do not properly address the biodiversity concerns. Recently, NA Fisheries Act was revised to accommodate community participation in management of fisheries resources. These measures are still inadequate, both in terms of biodiversity issues and enforcement of the Fisheries Act.

### 3.2.2.4. Weak law enforcement

There is no single comprehensive legislation in NA, which covers all aspects of biodiversity conservation and management as whole. However, legislations for the protection of forests, wildlife and fisheries exist in the form of Forest Act of 1927, NA Wildlife Preservation Act of 1975, and NA Fisheries Act of 1975, and the amendments made under these Acts. These Acts provide protection to certain species of flora and fauna and regulate use of forests, wildlife and fisheries resources. They prescribe management tools such as creation of protected areas like national parks, wildlife sanctuaries, game reserves and protected forests. Penalties for violators and strict codes against poaching of wild animals have been described. However, enforcement of these laws remained weak due to lack of resources, insufficient staff, lack of proper equipment and non-cooperation of judicial authorities. Moreover, offenders are usually influential people or high-ranking civil officers or even their paid hunters. They often get away from persecution by manipulating the system. Protection of forests, wildlife and fisheries is a task of Guards and Watchers, the lowest rank in these departments. They have no means of transportation and are woefully under paid. Thus, they often try not face wealthy and resourceful hunters or timber dealers. Though the situation is improving with recent drive for involvement of local communities in conservation efforts by establishing forest committees and appointing villagers as Honorary Wildlife Officers, there is still lot to be done for effective enforcement of the existing laws.

### 3.2.2.5. Little incentives for sustainable use of biodiversity

Under the existing options, there are little incentives and opportunities for the local communities for sustainable use of biodiversity. There is dearth of appropriate

strategies for introducing sustainable use measures suited to local ecological and socio-economic conditions. The local communities in NA do not have ownership rights of key natural resources like wildlife, forestlands, and fisheries. By law, these resources belong to state, which leaves little incentive for the local people to defend these resources or to make investments that might have ensured sustainable use. Indeed, the policy of government ownership of wild resources has created incentives for over-exploitation of wild species and in many cases an "open access" situation in which government has no resources to control access and over-exploitation. This situation can only be reversed by introducing incentive measures that will provide the best means for transforming local exploiters into conservationists (McNeely 1993). The lack incentives for farmers to conserve local varieties of crops and native breeds of livestock is also the reason for loss genetic diversity in agro-biodiversity.

### **3.3. Biodiversity Related Policies and legislations**

At the national level a National Conservation Strategy (NCS) was adopted in 1992. The document addresses a range of issues relating to the environment. The goals of NCS were to promote conservation of natural resources, sustainable development, and efficient use and management of resources. There are 14 core areas covered under the NCS, and one of them deals with biodiversity and many others barely touch the biodiversity related issues. The NCS considered biodiversity as a discipline covered under wildlife, forestry and agriculture. It did take it as a concept cutting across many disciplines and ministries. Moreover, there was no integration of biodiversity concerns in sectoral and cross-sectoral strategies and actions. Indeed, NCS did not cover biodiversity issues comprehensively and the actions proposed for mitigating biodiversity loss were inadequate.

A Forestry Sector Master Plan for NA was developed in 1992, which prescribed measures for management of coniferous forests, protecting and developing watersheds, planting on farmlands, protecting and managing wildlife and biodiversity conservation, and institutional strengthening. This plan also did cover the biodiversity issues adequately and largely focused on forestry issues and protection of wildlife. In fact, the NCS and Forestry Sector Master Plan were developed at the time when biodiversity issues were poorly understood and Pakistan was not yet a party to the CBD.

Many of the shortcomings of NCS have been filled with the adoption of the BAP for Pakistan in 1999. This comprehensive document covers all the important articles of the CBD and provide a framework for government agencies, NGOs, and local communities to work together as partners in biodiversity conservation. The document sets 25 separate objectives and proposes 143 specific actions for conservation Pakistan's biodiversity. It also provides a mechanism for implementation of these actions at the federal and provincial levels including NA.

Recently, a draft National Forest Policy has been developed, which deals with biodiversity issues a very superficial way. It does not cover issues like agro-biodiversity, access to genetic resources, benefit sharing, introduction of exotic species, and bio-safety. Pakistan's Agricultural Policy also covers some issues

concerning biodiversity, including increasing primary production, reducing land degradation, improving irrigation and drainage, soil conservation, and expanding integrated pest management. It does not, however, adequately address the issues of agro-biodiversity, intellectual property rights, and traditional knowledge per se. Fisheries policy focuses on aquaculture and makes no reference to conserving indigenous aquatic biodiversity. The national policies are broad-based and cannot, therefore, address the specific needs of NA. Presently, NA Conservation Strategy is being prepared. It is expected that this strategy will cover the biodiversity conservation issues more comprehensively.

Legislative support is essential to implement the CBD at the regional and local levels. The term biodiversity does not appear in the earlier legislations, as these were enacted before our understanding of the biodiversity concept. There are, however, a number of legislations in NA, which deals with different components of biodiversity. These include: Northern Areas Wildlife Preservation Act, 1975, Forest Act of 1927 (adopted in NA), Gilgit Private Forest Regulation of 1970, and NA Fisheries Act of 1975, with amendments and additions in 1999. These Acts and regulations rely heavily on protection of natural resources through policing and creation of protected areas and declaring certain patches of coniferous forests as protected forests. These legislations deal primarily with exploitation of forests, fisheries, game animals and birds and have no provision for conservation of non-game species and protection of threatened and endangered plant species. Moreover, they are largely ineffective mainly due to social, economic and political factors. The principles of sustainable use, incentive measures, and participatory management of natural resources are not included in these laws, except in recently amended fisheries Act. There are no provisions for community involvement in conservation of species and management of protected areas. Indeed, key to protecting biodiversity in NA lies in hand of local communities and without winning their support it would be difficult to promote conservation and sustainable use of biodiversity. There have been some initiatives mainly by the NGOs to involve local communities in conservation biodiversity mostly through project specific interventions. However, the concept of community participation in conservation efforts is yet to be incorporated in the existing legislations.



## 4. CONSEQUENCES OF INACTION

The continued loss of biodiversity in NA will greatly impact not only the mountain communities of NA, but also the people living in plains and the economy of the country. It will also impact the mountain ecosystems and the valuable services they provide. By looking at the goods and services we get from biodiversity, and the difficulty we face in their replacement, gives us an idea of the magnitude of consequences we will face if we do not conserve biodiversity of the high mountain regions in NA.

Biodiversity loss will severely limit the quality of life in the rural landscape, particularly the potential to feed, clothe and shelter for the future generations. It is difficult to estimate cost of losing undiscovered species that may be the source of foods, medicines, fuels, timber and even inspiration for human. Moreover, the loss of ecosystem services such as pollination, clean air and water, climate regulation, flood control, soil protection, pest control, and nutrient recycling will impact all species of plants and animals, not just human.

The forces like population growth, high level of poverty, over-exploitation, agriculture expansion, national strategies and obligations, as discussed in the previous sections, will guide the actions needed to promote conservation and sustainable use of biodiversity. The conservation of biological resources is of special significance to NA in the context of there predominantly agro-pastoral based economy and the high level of dependency on plant biodiversity for food, fodder and many other domestic products. There has to be a multi-dimensional approach that ensures balancing the immediate needs, rights, and desire of the local communities with protection of species and ecosystems. This will include creating and managing a system of protected areas, involving local communities in conservation efforts, increasing knowledge base on biodiversity, restoring degraded habitats, making enabling policies and laws, and creating awareness and education among the masses about environmental issues and consequences of biodiversity loss.

The inability or inaction to mitigate the issues faced to biological diversity in NA would result in serious threats to the biological wealth in terms of food security, health, economic prosperity, and ecological stability of already fragile environment of this region. Ultimately, this will lead to loss of jobs and poverty as well as emotional and spiritual well being that will result from ruined forests, degraded pastures, and depleted populations of beautiful wild animals and birds found in this area. Some of the consequences of inaction are summarized below:

- m **Reduced food security:** Rural communities in NA obtain a range of products every day from nature. In foods alone, wild plants yield vegetables, fruit, nuts, spices, and natural medicines. The loss of plant biodiversity will deprive people from these products.
- m **Loss of productivity:** Mountain agriculture entirely depends on water coming down from glaciers, snowmelt and springs. Loss of vegetation cover will lead

to loss of fertile soil, leading to reduced productivity of agricultural land. This will also increase runoff and results in silting of irrigation systems and drying up of natural springs. This may reduce the water availability for agriculture, and hence shortfalls in food production leading to more imports of food items from plains of Pakistan. This would ultimately put more burden on the government exchequer for higher subsidies for food items.

- m **Reduced timber and firewood supplies:** Different sort of timbers are collected from natural forests, not all of them legally or sustainably. Loss of natural resource of timber and fuel wood resulting in failure to meet the future demand of the growing population. Without forests, people will have to import timber and other forest products from the down country.
- m **Ecological integrity:** Depletion of natural capital will lead to loss of ecological integrity by threatening ecosystem services and functions. Disruption of these functions will have many consequences not only for the people of NA, but also for the entire country. For example, this will increase chances of land sliding, avalanches, soil erosions and consequently depletion of fisheries resources.
- m **Loss of species of international and national significance:** NAharbour several species, which are of national and global importance e.g. snow leopard, markhor, brown bear, woolly flying squirrel and several species of rare plants. Losing these species would mean loss of important components of the mountain ecosystems and loss source of inspirations and cultural values for the next generations. This will be a big embarrassment for the government of Pakistan for not being able to meet its obligations under the CBD.
- m **Increased human and wildlife conflicts:** Several species large and small mammals constitute prey base of large predators like snow leopard and wolf. Loss of prey species or depletion of their populations will force these predators to prey on domestic stock. This will lead to increase in human and wildlife conflict, and consequently the killing of predators, which are the key stone species of the mountain ecosystems.
- m **Loss of economic opportunities:** Most of the economic activities in NA are associated with agro-ecosystems and pastorolism. Degradation of high pastures and agro-ecosystems would lead to loss of economic opportunities, and consequently unemployment and poverty. Loss of economic opportunities in the form of money from trophy hunting and tourism resulting in greater poverty and creating law and order situation for the government.
- m **Endangered Watershed:** Almost entire Northern Areas fall in the watershed of Tarbella Dam with the exception of Minimergh Tehsil, which drains into Neelum River. The mountains in the areas are very fragile. The soil is susceptible to rapid erosion if the vegetative cover is denuded. The floral and faunal biodiversity especially the floral biodiversity have vital importance for the watershed value at local and national levels. Besides enhancing the life span of Tarbella Dam, they prevent floods, maintain water supply and conserve soils. Loss of the vegetative cover will lead to enhanced floods, resulting in damages to lives and property of communities that are socially and economically vital.



## 5. PAST AND PRESENT INTERVENTIONS

This section describes past and present interventions made by the government agencies, international NGOs, local NGOs, and CBOs for conservation of biodiversity in NA. An assessment of the effectiveness of these interventions has been made and factors contributed or contributing toward success and failure of these interventions are analysed.

### 5.1. Conventional Approaches to Biodiversity Conservation

#### 5.1.1. Creation Parks and Protected Areas

Several protected areas (Table 11) have been created over last 25 years. These include 4 national parks, 3 wildlife sanctuaries and 9 game reserves covering an area of about 2.07 million hectares (about 28 percent of total area of NA). In addition to these, eight Controlled Hunting Areas (CHAs) covering 518,200 hectares of mountain landscape are established outside of these protected areas. The local communities and the Government jointly manage these CHAs and technical assistance for managing these areas is provided by the conservation NGOs like WWF and IUCN. The total area under the protected areas system looks impressive. However, many of these areas do not have effective management system and present approach to managing these PAs is confined only to protective measures.

Under the existing laws wildlife sanctuaries provide greater protection than national parks, while game reserves afford no protection to habitat but merely regulate hunting. It is clear that these categories of protected areas are inadequate to conserve biodiversity of NA. Most of the remaining landscape of biodiversity significance are currently used and managed by the local communities in one way or the other. Therefore, there are still several large habitats remaining outside of protected areas, where creation of new categories (e.g. IUCN categories V and VI) of protected areas with the collaborative management efforts of the community is possible.

Mostly alpine meadows and alpine scrub zones are represented by the existing PAs, though domestic stock heavily grazes parts of these areas. The lower sub-alpine scrubs and dry temperate coniferous forests are not adequately representing the PAs system, for example some important areas of Gilgit and Diamer districts. These ecological zones are subject to heavy grazing and fuel wood collection. These areas are rich in mountain biodiversity, containing many rare plant and animal species and are vital for the altitudinal migrants.

Overall PAs management in NA is inadequate. Thus, it is imperative to take steps to manage the existing PAs under the proper management plans keeping in view the international standards and needs of the local people. This will require instituting collaborative management regimes for PAs (Borrini-Feyerabend 1996)

and strengthening capacity and infrastructure of the NAForest Department, NGOs and the surrounding communities.

**Table 11: Protected Areas in Northern Areas**

Name	District	Area (ha)	IUCN Category	Established in	Current Status
<i>National Parks</i>		1,730,620			
Khunjerab	Gilgit	227,143	II	1975	Managed by NA Admin
Deosai Plains	Skardu	363,600	II	1995	Jointly managed by HWF and NAAdmin
Shandur-Hundrap	Ghizar	165,000	UN Assigned	1995	Notified but not managed
Central Karakoram	Gilgit/ Skardu Ghanche	973,845	II	1996	Notified but not managed
<i>Wildlife Sanctuaries</i>		102,607			
Naltar	Gilgit	27,206	IV	1975	Only protective measures
Satpara	Skardu	31,093	IV	1975	Only protective measures
Kargah	Gilgit	44,308	IV	1975	Only protective measures
<i>Game Reserves</i>		238,640			
Tangir	Diamir	14,251	UN Assigned	1975	Notified but not managed
Nazbar Nullah	Ghizar	33,425	UN Assigned	1975	Notified but not managed
Pakora	Ghizar	7,515	UN Assigned	1975	Notified but not managed
Sher Qila	Ghizar	16,842	UN Assigned	1975	Notified but not managed
Danyor Nullah	Gilgit	44,308	UN Assigned	1975	Notified but not managed
Kilik Mintaka	Gilgit	65,036	UN Assigned	1975	Notified but not managed
Chassi Baushdar	Gilgit	37,053	UN Assigned	1975	Notified but not managed
Askor Nullah	Skardu	12,955	UN Assigned	1975	Notified but not managed
Nar-Ghoro	Skardu	7,255	UN Assigned	1975	Notified but not managed
	Total	20,71,867			

Sources: IUCN (1990) and IUCN (2001)

### 5.1.2. Establishment of Protected Forests

NA Administration has also designated certain patches of coniferous forests as protected forests. Most of the coniferous forests of Gilgit and Baltistan region are

protected forests. However, the emphasis is the protection of trees and regulation of extraction of timber. It does not involve management of other elements of biodiversity. Under the existing forest laws governing protected forests, certain rights and concessions are given to the local inhabitants. Therefore, most of these forests are subject to other human uses (e.g. grazing and collection of firewood by local inhabitants), which may have negative impact on other component of biological diversity. The Forest Department with extremely limited staffing and resources cannot make substantial investments for the management of these forests with larger objective to conserve forest biodiversity found in these areas.

### **5.1.3. Policing Forest and Wildlife Resources Outside the Protected Areas**

The present strategy to safeguard the biodiversity outside the protected area relies heavily on protection of wildlife, fisheries, and forests through policing these resources and implementation of wildlife, fisheries and forest acts and rules in NA. A network of protective staff has been established under these disciplines, for example territorial forest and wildlife divisions in Forest Department and fisheries beats in Fisheries Department. However, simply relying on policing the resource has not been so effective largely because of limited staffing and resource available to these agencies. There have been many shortcomings with this approach: inadequate protection of species, insufficient safeguards against degradation and destruction of habitat, weak enforcement of the laws, low public awareness, lack of coordination between various agencies, lack of involvement of local communities in mitigating threats to these resources and so forth. An effective policy reform is needed to over-come these problems in conservation of biological diversity of NA.

## **5.2. Current Initiatives**

Over the last decade or so there have been a number of initiatives, which diverge from traditional approach of policing natural resources and alienating local communities who traditionally depend on these resources to meet their subsistence needs. The government agencies, conservation NGOs, donor agencies and local communities have now realized that these resources will probably not survive, if conservation and management of biological diversity of this region remained only in the hand of government functionaries. A number of organizations have been active in promoting participatory conservation and sustainable development in NA. The organizations include the Aga Khan Rural Support Programme (AKRSP), The World Conservation Union (IUCN), World Wide Fund for Nature (WWF) and Himalayan Wildlife Foundation (HWF). Both IUCN and WWF have played a significant role in introducing conservation of biodiversity with involvement of local communities and have been active in building capacity of the government agencies and rural communities in conservation and sustainable use of biodiversity. In addition, there are some local NGOs, CBOs and Welfare Committees, which have been active in conserving wildlife, fisheries and forest resources of this region.

All these initiatives have had varying degree of success in terms of winning the support of local communities and maintaining biodiversity of the area. It is not possible to list every single initiative, but some of the prominent initiatives/projects are discussed here on the basis of their input in conserving biodiversity in NA.

### **5.2.1. Aga Khan Rural Support Programme (AKRSP)**

AKRSP was the pioneer in mobilizing local communities and implementing sustainable development agenda at the grass root level through collective actions. The objective of their programme is to improve the lives of the mountain people of this remote region. Presently, AKRSP covers most of the NA and has established more than 1592 Village Organizations (VOs) and 930 Women's Organizations (WOs) (IUCN 1999). It has built managerial and technical skills of the villagers to enhance agriculture productivity through natural resource management activities by focusing on agriculture, livestock, forestry, and fisheries. Though the focus of AKRSP has been on sustainable development, many of its programmes are contributing to raising environmental conservation awareness among the masses and enhancing biodiversity of the area, particularly agriculture biodiversity. For example, development of land, agriculture, forest plantations, collaborative management of fisheries, and maintaining irrigation systems below the irrigation channels contribute to the diversity of fauna and flora by providing new ecological niches for the species associated with farming, especially insects, butterflies, fruit and seed-eating birds, and small mammals.

More importantly AKRSP has helped other organizations and NGOs to initiate biodiversity conservation projects in partnership with the local communities and NA Administration. NA Forest Department, IUCN, WWF, and HWP, all have benefited from the social infrastructure created by the AKRSP and have started various biodiversity conservation and sustainable use programmes with assistance and support from the AKRSP, particularly in introducing these organizations to VOs and WOs in NA. The contribution of AKRSP in maintaining biodiversity of NA is indeed far more than one can perceive in a short visit to this rugged landscape of the country.

### **5.2.2. IUCN's Conservation Initiatives**

IUCN Pakistan has been active in promoting environmental conservation in NA since 1986, first working with the AKRSP on introducing community forestry and later implementing field projects for biodiversity conservation in collaboration with NA Administration, AKRSP, Forest Department, WWF, HWP, and local communities. Three of the IUCN's important initiatives are described here briefly:

#### **5.2.2.1. Biodiversity Conservation Project**

IUCN implemented a GEF/UNDP funded pilot project "Maintaining Biodiversity in Pakistan with Rural Community Development." between January 1995 and April 1999. The project was designed to demonstrate the Community Based Conservation (CBC) approach for the conservation of renewable natural resources. The main objectives of this project were to: a) demonstrate how conservation of biodiversity can be enhanced by providing rural people with technical skills; b) illustrate how local institutions can manage wild species and their habitat for sustainable use; and c) assess the effectiveness of rural management of natural resources.

The pilot project was spread over 15 valleys in Northern Areas (NA) and North West Frontier Province (NWFP) of Pakistan covering more than 6700 km<sup>2</sup> of Karakoram, Hindu Kush, and Western Himalayan mountain ranges. It covered different ecological zones included permanent snowfields, alpine meadows and dry alpine habitats, dry temperate coniferous forests, alpine scrub, and moist alpine

zones. The local communities involved in the project included 65 villages comprised of 5,800 households and 56,000 people. The major focus of the project remained on wildlife, though conservation of natural forests, medicinal plants, and introduction of ecotourism were also addressed where deemed appropriate.

The project was largely successful in promoting community-based conservation particularly in valleys where Village Conservation Committees (VCCs) were based on a single village. A number of factors contributed to this initial success including: (1) participatory and flexible approach adopted by the project, (2) working through the existing local institutions e.g. VOs (3) instituting local level conservation funds, (4) building local capacities, (5) devolving control over natural resources to VCCs, and (6) providing community-based economic incentives for conserving wild species e.g. trophy hunting. Moreover, regular interactions between the project staff and the VCCs helped build trust and provided a mean for dissemination of information to the villagers. Success of CBC project lies on stable local institutions; project, therefore, focused on building local-level capacity to a village-based conservation programme. This was important to enhance local people's skills, so that they can manage their own biological resources.

#### **5.2.2.2. Mountain Areas Conservancy Project (MACP)**

IUCN is currently implementing this GEF/UNDP and GoP funded project with total cost of US\$10.35 million over the period of seven years (1999-2006). This project is built upon successful implementation of the pilot project "Maintaining Biodiversity in Pakistan with Rural Community Development". The project covers important ecological landscapes of the Karakoram, Hindu Kush and Western - Himalayas mountain ranges in both NWFP and NA. In NA, it will cover two large conservancies—Gojal and Nanga Parbat. Collaborative partners of this project include NWFP Wildlife Department, NA Forest Department, WWF, AKRSP, and HWF. MACP is based on the promise that conservation of biodiversity is unlikely to be sustainable over the long term unless local communities are actively involved in the conservation activities. Therefore, the aim of the project is to mitigate threats to biodiversity and ensure its sustainable use through community-based conservation approach. The project has the seven broad objectives or outputs: 1) develop and strengthen capacity of the local communities to conserve biodiversity; 2) impart conservation values and provide mechanisms for sharing information on management of wild resources; 3) monitor effect of the project on biodiversity and socio-economic indicators; 4) assist communities in securing long term support for eco-development; 5) develop a knowledge base about the components of biodiversity; 6) assist government in policy and legislation reforms to support participatory conservation; and 7) develop endowment funds to meet the on-going costs for conservancy management. The most important component of the project is to demonstrate sustainable uses of wild flora and fauna through community run demonstration projects. It is expected that if implemented successfully, this initiative will help in conserving many globally significant species of flora and fauna.

#### **5.2.2.3. NACS Support Project**

IUCN is also assisting the NA Administration in preparing the Northern Areas Strategy for Sustainable Development (NASSD) with funding from the SDC and NORAD. This project intends to develop a comprehensive sustainable

development strategy for NA by focusing on enabling policies and legislations for the environment conservation, and strengthening the institutional capacity of the NA Administration to support environmental conservation and developmental issues.

### **5.2.3. WWF's Community-based Conservation Initiatives**

WWF-Pakistan has been pioneer in introducing community-based wildlife conservation project starting from Bar Valley in 1991. Now it has expanded its work to 5 different valleys in NA with funding from WWF-UK, DFID, EU and other donors. One of its current projects is "Sustainable resource use and biodiversity conservation at key sites in NA. This 3 years project aims to conserve globally significant wildlife species through sustainable resource use in Bar, Karambar, Shinaki, Gulkin and Bulashbar valleys. These valleys provide habitat to Himalayan ibex, musk deer, snow leopard, flare-horned markhor, woolly flying squirrel, and brown bears. The project aims to conserve these species by improving socio-economic condition of the local communities. This broad-based project encourages the development of links and partnerships with other stakeholders in sectors like public health, environmental educations, ecotourism, social forestry, infrastructure development, institutional strengthening and even promotion of handicrafts (WWF 2000).

WWF has also been involved in creating awareness for conservation of snow leopard in NA. As part of its efforts for saving this species, it has held a training workshop on snow leopard survey techniques for the staff of NA Forestry Department, IUCN and WWF-Gilgit. It has also established a Conservation and Information Centre at Gilgit to promote conservation and environmental education activities and to provide training facility for the conservation workers. This organization was also instrumental in developing a Management Plan for the Khunjerab National Park and has played an active role in piloting community-based trophy hunting programme in NA.

### **5.2.4. Himalayan Wildlife Foundation's (HWF) Brown Bear Conservation Project**

This project aims at protecting biodiversity of Deosai Plains, particularly threatened Himalayan brown bear. Deosai Plateau is rich in biodiversity, especially plant and animal species adapted to high elevation. Due to its biodiversity significance, the area was declared a national park in 1995 and a management plan for protecting its ecological integrity was developed in 1998 under the HWP. The focus of this project is on strengthening management of Deosai National Park, conservation advocacy, education and awareness, and research on the flora and fauna of the park, particularly on ecology and management of Himalayan brown bear. The project works very closely with NA Forestry Department, District Administration of Skardu, local communities, and the other conservation initiatives in the area e.g. MACP. The project had received funding from the GEF/UNDP small grants programme, WWF, and technical assistance from the US Fish and Wildlife Service, Kruger National Park, South Africa. More recently, it has received funds from NORAD for implementation of the management plan of the national park and for strengthening this initiative for conservation of biodiversity of this alpine region.

## 5.2.5. Khunjerab Village Organization (KVO)

### Buffer Zone Project

A syndicate of 7 VOs in upper Gojal, KVO has been implementing a wildlife conservation and sustainable use project in the buffer zone of Khunjerab National Park. This has been a locally initiated and internally motivated project managed on self-help basis by the KVO since 1995. The local community has employed its own community guards, established wildlife check posts, and assessed local wildlife resources with the technical assistance of IUCN and WWF. First, KVO received some funding from the GEF/UNDP small grants programme and a donation from the President of Pakistan for the conservation activities. Later they generated their own funds through community-based trophy hunting programme. Under this programme, KVO receives 80% of the trophy hunting fee and 20 % goes to the government exchequer. Income from trophy hunting was a powerful incentive for the community to manage wildlife biodiversity. So far, the community has earned a considerable amount from both foreign and local hunters under the controlled hunting programme. The number of poaching incidents in the areas declined substantially and the impact of this initiative on the wildlife populations is positive. Recently, KVO has joined the MACP project under its Gojal conservancy and has planned number activities for conservation and sustainable use of biodiversity of the area, including establishing Valley Conservation Fund, fisheries resource management, wildlife viewing, ecotourism, and village level education and awareness programme. It is expected that these activities will have positive impact on the biodiversity of the area.

## 5.2.6. Community-based Fisheries Management in

### Ghizer Valley

This was a joint initiative of the AKRSP and Fisheries Department, NA for the community-based management of wild fish stocks in Ghizer Valley. AKRSP has been working on this pilot initiative since 1997. The NA Administration has notified a policy for participatory management of fisheries resources. Under this policy, Terms of Partnership has been signed among the local community, AKRSP and NA Fisheries Department with specific role for the each partner for the implementation of the project. The main objectives of this initiative are to: 1) encourage village-based income generating activities; 2) conserve biodiversity of the area; 3) promote ecotourism; 4) generate employment opportunities; and 5) improve nutrition of the rural people. The first community to embrace this project was the people of Hundrap. As per terms of the partnership, the local community restricted access to Handrup Nullah and Hundrap Lake in 1998, started charging fee for angling, and banned all other forms of fishing. The community set their own management fee for anglers, Rs.25, Rs.100 and US\$5 per day for NA residents, Pakistani and foreigners respectively. The management fee is retained by the community to pay the community fish watchers as well as to meet other socio-economic development needs of the community. The community is also authorised to collect the Government license fee, which is to be forwarded to the government treasury and is obliged to enforce the normal conditions of the NA Fisheries Act, 1975. The initiative has been quite successful; the fish population has increased, and the local community has earned Rs.15,000/-, the community's share from the management fee (AKRSP/DFID 2000). The project is popular among the local communities and AKRSP wants to promote this programme to other parts of the Ghizer Valley. For

this purpose, they have also negotiated a pilot project with IUCN to be funded under the NASSD project. Soon, six more communities will become part these collaborative efforts for conservation and sustainable use of fisheries resources. This new project also includes establishing local level conservation funds to be used by the local communities to support community fisheries management programme. It is expected that the success of this initiative would help in conservation of freshwater biodiversity in NA.

#### **5.2.7. GEF/UNDP Small Grants Programme (SGP)**

The SGP provides small grants of up to US\$50,000 to local NGOs and CBOs to implement small-scale projects in the GEF focal areas, including biodiversity. To date a number of grants have been provided to local NGO/CBOs working in NA for biodiversity conservation and developing alternative livelihood resources. One of the current projects under this programme is "Biodiversity conservation in sites of the unique habitat of the woolly flying squirrel in NA". This project aims to save the woolly flying squirrel from extinction by conserving its habitat and reducing human induced impacts on this endangered species by creating awareness about conservation, alternative income generating activities, and promoting fuel wood plantations in the valleys.

#### **5.2.8. Establishment of District Conservation Committees**

One of the important outcomes of the implementation of the Biodiversity Conservation Project was the establishment of the District Conservation Committees (DCCs) in all the five district of NA. This is the first time in the history of Pakistan that a common forum has been created at the district level, where community representative can voice their issues and participate in the decision making process. Though DCCs are in their infancy stage, these institutions could provide a great opportunity to address the biodiversity conservation issues at the local level. These DCCs could even be more effective, if some how they institutionalised under the new devolution of power system.

The purpose of these DCCs was to provide institutional and administrative backing to the village-based conservation programmes. The functions of the DCCs are to extend full support to local communities, coordinate implementation of the local level Biodiversity Conservation Plans among government agencies, NGOs and local communities. The DCCs offer an effective mechanism for linking government institutions and local communities, strengthening law enforcement, and monitoring implementation of the district level conservation programmes.

There is still long way to achieve sustainability in this initiative, but these DCCs are certainly a useful forum to address the biodiversity conservation and sustainable use issues at the local level. Under the new system of local governance, district assemblies could select their own priorities for conservation of natural resources of the district. Therefore, there is need to build upon this initiative and strengthen these DCCs further.

#### **5.2.9. Establishment of Valley Conservation Funds (VCFs)**

The establishment of local level conservation funds was another innovation evolved during the implementation of the Biodiversity Conservation Project. The



purpose of these endowment funds was to help local communities pay for the conservation costs. These funds are being operated under an agreement signed between the Valley Level Conservation Committees (VCCs). The main objectives of the VCFs are to: (1) provide a self-supporting revolving fund for village level conservation activities, (2) develop partnerships between the local communities and biodiversity conservation initiatives, and (3) create a sense of community ownership of the conservation programmes.

So far, about 10 VCFs have been established in NA. These funds are managed jointly by the VCCs and the conservation projects to guard against any misuse of funds. However, the decisions to use these funds rest with the communities. Initial response to the VCFs from the local communities has been encouraging and some communities have beefed up their VCFs to a reasonable level. For example, the people of Khyber have increased their VCF to more than Rs.500,000/-. The introduction of local level conservation funds provides a strong economic incentive for the local communities to develop self-supporting biodiversity conservation programmes at the village/valley levels. These funds serve as a catalyst to encourage local communities to participate and secure long-term benefits from conservation and sustainable use of biodiversity. This has been another useful initiative and there is need to promote this approach at much larger scale and link these funds with the conservancy level funds being established under the MACP.

#### **5.2.10. Trans-boundary Efforts**

WWF-Pakistan has been trying to initiate the trans-boundary conservation programme for the last several years. The purpose of this initiative is to establish an "International Peace Park" along the border areas of China and Pakistan for the protection of endangered snow leopard, Marco Polo Sheep and other elements of biodiversity of this high altitude region. The idea is to forage trans-boundary collaboration for the effective management of the Khunjerab National Park and Taxkorgan Nature Reserve complex. In this regard several meeting have been taking place, but concrete break through has yet to be achieved. In December 2000, a delegation from NA Administration visited the Xinjiang Autonomous region and held meeting with the Chinese authorities for taking this initiative forward (WWF-2000). This is an important initiative and could provide an opportunity for NA to secure a joint investment from Pakistani and Chinese Governments for conservation of biological diversity in Khunjerab National Park and its adjacent areas.

#### **5.2.11. Research Projects**

There are three exclusive projects, which focus on research on natural resource management and have relevance to biodiversity conservation efforts.

Pakistan-German Research Project 'Culture Area Karakorum': This project worked between the year 1989 and 1998 and has been a joint collaborative effort between the Government of Pakistan and Germany. It has involved various German universities and the universities of Pakistan to carryout extensive field research in the areas of geography, environment, Climate, Sociology, Archaeology. Several field studies and dissertations by many German and few Pakistani researchers were completed during the life of this research project. This project has highlighted the various dynamics of change over the last decade in the northern mountain societies and has also carefully analysed the role of projects Karakorum Highway to the life upnorth.

High Altitude Integrated Natural Resources Management project: This is a collaborative research programme between the AKRSP and the Agriculture University of Norway (NLH) to conduct studies on alpine resource management systems (pasture and natural forests) in the Basho watershed of Skardu District. The project was started in 1998 and is funded by NORAD. Several field studies have been conducted including on local institutions, pasture, livestock, biodiversity, natural forests, and local livelihood strategies. The findings this research project will be useful in understanding local level resource conservation issues.

Agri-Karakoram Project: This collaborative research project was initiated in 1998. The project is funded by the European Union and several organizations are collaborating on this project including AKRSP, ICIMOD, The Macaulay Institute of Aberdeen University in UK and NARC. The objectives of this research project are to study the transhumance-based system of livestock management. The findings of this project will be used to improve livestock-based livelihoods while sustaining the ecologically-fragile ecosystems of the region.

Besides above research projects, Karakoram Agricultural Research Institute for Northern Areas (KARINA) is involved in research on artificial propagation and commercial cultivation of medicinal plants and fish culture.

## 6. STAKEHOLDERS

There are many stakeholders in maintaining NA biodiversity. The major stakeholders are rural communities, local institutions and CBOs, urban dwellers, conservation and development organizations, public sector institutions including line departments and research institutions, and the global interest groups and institutions, who have indirect interest in maintaining biodiversity of Karakoram-Hindu Kush-Himalaya. These stakeholders can be considered at different levels based on their interests and stakes in conservation of biodiversity. They could be placed at four different levels, including local, provincial, national and global.

### 6.1. Local Level Stakeholders

Rural communities and their local institutions are the primary stakeholders as these people entirely rely on natural ecosystems for life and livelihood. They could be pastoralists, farmers, nomads, local shopkeepers, school teachers etc., whose life is dependent on local biodiversity by one way or the other. They would like to see plants and animal diversity around.

There are many CBOs and village organisations, which are involved in biodiversity conservation activities through many different ways. These include CBOs, Village Conservation Committees, Forest Committees, VOs, WOs, Welfare/Zaito Committees and local Jirgas in many valleys of NA. These local institutions are often involved in local decision making for protection and use of natural resources, hence they have direct stake in conservation of biodiversity of their respective areas. Some cluster organisations, like Khunjerab Village Organization and Shimshal Nature Trust, have been active in environmental conservation issues at much broader level. Such organisations can be the important players in promoting biodiversity conservation in NA.

### 6.2. Conservation and Developmental Organizations

Several conservation and development agencies are playing an active role in conservation of biodiversity in this region. These include AKRSP, IUCN-Pakistan, WWF-Pakistan, Himalayan Wildlife Project and Belour Advisory and Social Development Organization (BASDO). These organisations are important stakeholders in conservation and development arena. Their role and initiatives for conservation of biodiversity have been discussed in the earlier sections, except of BASDO, which is a local NGO involved in environmental conservation activities. It has implemented a number of field projects and has been involved in advocacy work for the conservation of forests and wildlife resources. Presently, BASDO is implementing a GEF/UNDP funded small grant project for the conservation of endangered woolly flying squirrel and its habitats. BACIP is another key stakeholder as it is involved in designing and promoting fuel-efficient cooking stoves, housing structure and designs and other interventions for efficient use of energy in NA.

## **6.3. Public Sector Institutions in NA**

There are several public-sector institutions in NA, which directly or indirectly responsible for conservation and regulating uses of biodiversity. These institutions include:

### **6.3.1. NA Planning and Development Department**

The Planning and Development Department of NA is responsible for preparation of annual and perspective plans for development in NA in collaboration with the line departments. All the natural resource conservation projects are evaluated and approved by this department. They also recommend allocation and distribution of funds to various line departments for the conservation and developmental activities. The department is also responsible for monitoring implementation of the field projects and ensuring sustainability in the conservation initiatives.

### **6.3.2. Forest Department of NA**

The Forest Department is headed by a Conservator of Forests and is mandated to manage government forests, national parks and protected areas, wildlife, and wetland resources of the region. They are also responsible for promoting farm forestry, soil conservation, watershed management, and community-based conservation. A separate directorate has been created for the management of Khunjerab National Park, which is responsible for the management of this park. The Forest Department directly deals with many components of biodiversity, hence is key stakeholder for maintaining natural capital of NA.

### **6.3.3. Agriculture Department**

This department is responsible for maintaining crop and fruit biodiversity in NA. Their mandate is to provide extension services to farmers for the development agriculture and horticulture including provision of seed and fruit plants to the farmers. The department maintains many fruit nurseries all across NA, hence responsible for maintaining genetic diversity among crop and fruit varieties, promoting in-situ and ex-situ conservation of local varieties of crops and fruit trees.

### **6.3.4. Livestock Department**

Presently, a Deputy Director heads the Livestock Department and it works under the Agriculture Directorate and is responsible for maintaining livestock diversity, controlling diseases, and providing veterinary services to the farmers.

### **6.3.5. Fisheries Department**

A Deputy Director heads this department and it also works under the Agriculture Directorate. Fisheries department is responsible for managing fisheries resources found in rivers, streams, and lakes of NA. It also has the mandate to promote aquaculture and regulate fishing in the region. The department maintains a number of fish farms, hatcheries, and provide fingerlings to the farmers. The department can play the key role in maintaining freshwater biodiversity in NA.

### **6.3.6. Other Important Institutions**

Other important stakeholders include Northern Areas Tourism Development Board (NATDB) due to its role in Ecotourism, Karakoram University for its role in biodiversity related education and research, Karakoram Agricultural Research Institute for Northern Areas (KARINA) due its role in artificial propagation of medicinal plants, promotion of agricultural products e.g. off season vegetables, etc. These departments can also play their important role in preservation of biodiversity and promotion of knowledge regarding biodiversity.

## **6.4. Federal Government Institutions**

At the Federal level several ministries have a stake in maintaining biodiversity in NA. The most relevant ministries include: Ministry of Environment, Local Government and Rural Development (MELGRD), Ministry of Kashmir and Northern Areas Affairs (KANA) and Ministry of Agriculture.

### **6.4.1. Ministry of Environment, Local Government and Rural Development (MELGRD)**

MELGRD is the focal ministry for implementation of all the biodiversity related international conventions and agreements except the World Heritage Convention. It would like to:

See mountain ecosystems intact and their flora and fauna conserved, thus minimizing down stream detrimental impacts.

Ensure implementation of international biodiversity-related conventions to which Pakistan is a party, For example, CBD, CITES, Bonn Convention, Ramsar Convention, Convention on Combating Desertification, Cartagena Protocol on Biosafety, and Convention on Persistent Organic Pollutants.

### **6.4.2. Ministry of Kashmir and Northern Areas Affairs**

Its main stake would be maintaining natural capital of NA for development, well-being and security of the people of NA including for poverty alleviation and improving living standard of the rural communities.

### **6.4.3. Ministry of Agriculture**

Its stake is to implement agriculture policy of Pakistan and work for the food security of people of NA by conserving agriculture biodiversity of the area. A number of agriculture research institutes work under this Ministry for raising agriculture productivity through research e.g. NARC, KARINA. These institutes have been involved in ex-situ conservation of genetic material of many local varieties of crops and fruit trees.

Pakistan Tourism Development Board (PTDC) is also important for its role in promotion of Ecotourism and broadening resource base by creating employment opportunities though at seasonal level but bring more money than other regional activities. Thus its direct role in Ecotourism and indirect role in diverting pressure from natural resources is outstanding.

## 6.5. Global Interest Groups and Institutions

Many international interest groups and institutions would like to maintain biodiversity goods and services in this unique landscape of the world. A number of international agencies and multilateral donors have been involved in biodiversity conservation activities in the region. Some of these organizations are listed below:

- m International Fund for Agriculture Development (IFAD)
- m GEF/UNDP funded conservation projects (MACP, NADP, etc.)
- m European Union financed projects
- m NORAD funded projects
- m DFID financed projects
- m Aga Khan Development Network

# 7. THE WAY AHEAD

## 7.1. Options for Maintaining Biodiversity in NA

This section suggests a number of possible options for maintaining biodiversity in NA. The stakeholders could pursue these options individually or through collaborative efforts based on the "vision" that what NA should look like in the future. Such a vision has to be defined through a consultative process involving all stakeholders and keeping in view needs and aspirations of the people of NA. This would mean sharing responsibilities for conservation and sustainable use of biodiversity.

The people of NA live in a region rich in cultural diversity, landscapes, and watersheds ranging from dry temperate scrubs to coniferous forests, to sub alpine zones, to alpine meadows; from streams to rivers, to alpine wetlands all supporting biodiversity, which is a lifeline for the people of NA. Therefore, it is their responsibility "to conserve biological diversity and ensure that its components are used in a sustainable manner for the benefit of present and future generation." The principles that could guide the future actions for conservation and sustainable use of NA biodiversity are discussed below:

## 7.2. Principles for Conserving Biodiversity in NA

**Shared Responsibility:** People in NA depend on biodiversity for physical, economic and cultural needs and have a responsibility to contribute to biodiversity conservation and its sustainable use. All stakeholders including rural communities, CBOs, all levels of governments, public institutions, interest groups, NGOs, and donors must work together to identify problems and opportunities, and find common solutions for maintaining biodiversity in NA.

**Effective Participation of the Local Communities:** Biodiversity conservation requires understanding and appreciation of its values by the local people. Therefore, the role of rural communities in conservation and sustainable use of biodiversity must be recognised and any benefit arising from the use of components of biodiversity should be shared with the local communities to ensure their effective participation in the conservation drive.

**Adopting Ecosystem Management Approach:** Maintaining ecosystem and ecosystem process are the prerequisites for conservation and sustainable use of biological resources. The Ecosystem Management approach is a strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way. Therefore, ecosystem management approach should be central for implementing any biodiversity conservation project in NA.

**Balanced and Consistent Research:** NA requires research and its compilation in all disciplines of mountain life by the active involvement of the local communities. In biodiversity reference all types of mountain ecosystems and their respective components may be assessed with priority. The leading subjects for research would be ecology, conservation biology, ecosystem ecology, aquatic ecology, wildlife biology, integrated mountain research studies, development studies etc.

**Following Balanced Approach:** Use of components of biodiversity must consider and balance the ecological as well as social, economic and cultural values of the region.

**Knowledge Based Decisions:** Conservation of biodiversity and sustainable use of its components must be based on sound science, ecological principles, and local knowledge.

**Leadership:** NA Administration will have to play leadership role in biodiversity conservation. The government, with assistance from NGOs and other agencies, must work effectively and efficiently to harmonize policies and programmes to ensure long-term integrated management of the environmental, economic, and social benefits of biodiversity.

**Public Awareness and Education:** The awareness and education of the general public, planners, and policy makers would be essential for ensuring conservation of biological diversity and sustainable use of its components.

**Biodiversity as Natural Capital:** Biological resources of NA are natural capital and their conservation is an investment that will yield benefits locally, regionally and nationally.

**Stakeholders Participation:** Securing participation of all the stakeholders in conserving and sustainable use of biodiversity should be key thrust for implementing any biodiversity conservation project in NA.

### 7.3. Important Ecological Considerations

Top predators play critical roles in maintaining the ecological integrity of natural communities. A conservation approach designed to ensure long-term survival of these large carnivores could help in: a) maintaining the ecological integrity of the natural ecosystems and b) serving as a "conservation umbrella" to protect many of the smaller, less charismatic species. In NA, the snow leopard fills the niche of a top predator, its range overlap with several threatened species of mountain ungulates such as blue sheep, markhor, Ladakh urial, Marco Polo sheep and musk deer. Taking measures for the conservation of these species would certainly help many other components of biodiversity.

Several mammal and bird species in the mountain ranges of Himalayas, Karakoram and Hindu Kush exhibit altitudinal migration. For instance, Marco Polo sheep, blue sheep, Himalayan ibex, markhor, the important prey species for snow leopard, migrate from alpine meadows to alpine and sub-alpine scrubs during the winter. Similarly, many bird species exhibit altitudinal and seasonal migration.



Conservation measures, targeting both summer and winter ranges of these species, would help in maintaining viable populations of these altitudinal migrants. NA do not have permanent resident population of Macro Polo sheep, but it migrates into NA during summer from Chinese Xingiang autonomous region across the border passes: Killik, Mintaka and Khunjerab. Probably, at present the Killik and Mintaka are the only areas where this species still visits. Therefore, this area is very important and requires special attention for the conservation of this magnificent wild sheep.

Pakistan's largest river, the River Indus pass through the NA and many of its tributaries and other rivers originate from NA. If the watersheds of these rivers and streams are destroyed, the consequences will be far-reaching and wide-ranging. This will affect not only animal and plant communities found in these watersheds, but also the local economies and the lives of those people living in the plains irrigated by the River Indus. Therefore, conservation and sustainable use of the components of mountain ecosystems in NA is critical.

## **7.4. How Can We Maintain Biodiversity in NA?**

Maintaining biodiversity in NA will require concerted efforts by all the stakeholders to take appropriate measures, and find ways and means for mitigating threats to NA biodiversity keeping in view local social, ecological, and environmental conditions. Institutional sustainability would be key to achieving this and implementing any conservation initiative successfully. The possible options for actions are discussed below:

### **7.4.1. Promoting In-Situ Conservation**

In-Situ conservation, the conservation of species in their natural habitat, is considered the most appropriate and primary approach for biodiversity conservation. That is why protected areas form a central element of international, national and provincial policies for conserving biodiversity. However, it has been recognized by the conservation practitioners that relying alone on establishment of national parks and protected areas will not save many species from extinction. Indeed, most of biological diversity still lies outside the protected areas. Hence, fate of many wild species and their habitats lies in the hands of the rural people, who share land with them and who managed these habitats for food and other material needs. Therefore, promoting in-situ conservation in NA will require a three-prong approach: 1) strengthening existing protected areas system and creating new protected areas where appropriate, 2) initiating community-based conservation and sustainable use programmes outside the protected areas, and 3) building capacity of the line agencies, local NGOs and CBOs.

#### **7.4.1.1. Strengthening Existing Protected Areas System**

A network of protected areas have been created covering about 28% of the area of NA, including 4 national parks, 3 wildlife sanctuaries, and 9 game reserves. Most of these protected areas were created in the 1970s, mainly to protect wildlife populations and their habitats. There is need to reassess these protected areas to determine whether they are serving the purpose for which they were created and whether they should continue to be the part of the system, reclassified or deleted.

Such an exercise should also explore whether these areas have any negative or positive impact on the socio-economic condition of the people living in and around these protected areas.

Presently, there is no management regime for 2 of the national parks in NA, Central Karakoram and Shandur/Hundrap national parks. Similarly, regulatory systems to regulate access to existing wildlife sanctuaries and game reserves either do not exist or not working properly. Almost all of the protected areas are subject to human use one way or the other. This situation demands a thorough review for creating an effective management system for the existing protected areas. Furthermore, it has been recognised that key to improvement in management of protected area in developing countries like Pakistan is the involvement of local communities in all steps—from planning to management and monitoring implementation of the management plans.

Ideally, each protected area should have management plan. This has not been the case for many of protected areas in Pakistan. Management plans have been developed for the Khunjerab, Deosai, and Central Karakoram national parks, but these plans have not yet been implemented mainly because of lack of funds. Efforts should be made for securing funding for implementation of these plans and developing new plans for all the existing protected areas. Indeed, present management of PAs system in NA is inadequate for number of reasons, including lack of resources, shortage of trained staff, non-involvement of local communities in PAs management, inadequate legislation, and insufficient baseline information on ecological, social and economic values of these areas. These aspects have to be looked into for strengthening and rationalizing existing PAs management regimes.

Strengthening protected areas system and its contribution to biodiversity conservation is one of the objectives of the BAP for promoting in-situ conservation in Pakistan. Most of the actions proposed under this objective are very much valid for NA. However, NA Administration will have to take some of these actions on priority bases in collaboration with all the stakeholders to establish an effective, efficient and representative PAs system in NA. The priority actions will include:

- m Developing a comprehensive plan of action to strengthen existing PAs system;
- m Ensuring involvement of local communities and other stakeholders for collaborative management of the protected areas;
- m Enhancing the capacity of communities living in or adjacent to PAs to participate in management of these areas through appropriate training and education, and through recognizing local expertise and traditional institutions;
- m Re-defining protected areas boundaries based on species range and corridors requirement to optimise viability and connectivity;
- m Examining the status of all the game reserves in NA and re-classifying these under category VI of IUCN, the sustainable use areas;
- m Exploring possibility for establishing a trans-boundary "peace park" along the Chinese border by making collaborative efforts with Chinese Authorities for managing Khunjerab National Park and Taxkorgan Nature Reserve complex in Xinjiang Autonomous region as the "International Peace-Park";
- m Building Capacity of Northern Areas Forest Department in PAs management through staff training, sufficient funding, and provision of necessary equipment; and

- m Sharing responsibility for managing some PAs in collaboration with the NGOs and other interest groups. Precedent for such a management regime already exists in case of management of Deosai National Park.

#### **7.4.1.2. Creating New Protected Areas**

During review of Pakistan's Protected Areas System, IUCN (2001) noted that currently listed PAs of Pakistan are unevenly distributed, created without consideration of ecological criteria, and many of these areas are too small and isolated to be effective for conservation of biodiversity in the long run. This is also the case in NA, as most of the PAs are located in Gilgit and Ghizer regions. There are only few PAs in Diamer, Ganche and Skardu districts, the very important areas for biodiversity conservation point. Moreover, there seems to be emphasis on establishing national parks. Nowhere in Pakistan has as many national parks as in NA. Probably, NA does not need any more national park. Establishing more national parks will make local communities uncomfortable and will create conflicts between government agencies and local people, as many of these people are dependent on natural ecosystems for their livelihood. Therefore, NA Administration will have to explore the possibility of creating new types of protected areas by making amendments in the NA Wildlife Preservation Act of 1975 and keeping in view other categories of PAs recommended by IUCN, for example, category V and VI, protected landscape and sustainable use areas (IUCN 1994). Possible actions will include:

- m Making amendments in the existing legislation for including new categories of PAs;
- m Expanding PAs system to ensure protection to all nationally and internationally threatened species of flora and fauna;
- m Establishing new protected areas under PAs' categories V and VI to provide corridors and connectivity to the existed protected areas.
- m Creating new PAs in broad consultation with all the stakeholders, in particular with local communities.

#### **7.4.1.3. Supporting community-based conservation and sustainable use programmes outside the protected areas**

Protected areas serve as natural warehouses of biodiversity, but these warehouses would never be able to prevent extinction, habitat fragmentation, ecological isolation, edge effects, and other forces that will greatly impoverish these isolated biological islands (Western and Wright 1994). In fact, most of the biodiversity still lies outside of parks and protected areas. Conservation and sustainable use of this biodiversity will largely depend on rural communities whose livelihood is associated with many components of biodiversity. Therefore, totally relying on PAs for in-situ conservation of biodiversity will not serve the purpose. Realizing these limitations of the PAs approach, a number of initiatives have been taken in NA to involve local communities in conservation and sustainable use of biodiversity outside the PAs. Some of these programs have been discussed above. However, most of these initiatives are still in their infancy stage and will need considerable support from the government, NGOs, and donors as well as from the local communities to be successful in the long run. NA Administration is supporting the community-based conservation and sustainable use programmes. Nevertheless, these initiatives are still without legal backing and lack appropriate policy environment and enabling legislation for involvement of local communities in

conservation and sustainable use efforts. A number of actions are needed to further strengthen these initiatives and to bring new areas under community-based conservation regime. These actions will include:

- m Developing a policy and legal framework to encourage community-based conservation and sustainable use of the components of biodiversity;
- m Devolving resource tenure and management authority to local communities;
- m Integrating biodiversity conservation with local development projects;
- m Encouraging community-based conservation and sustainable use projects;
- m Developing mechanisms for regulating sustainable use of biological resources;
- m Enhancing capacity of local communities, CBOs, and local NGOs by providing technical assistance and training for implementing biodiversity conservation and sustainable use projects;
- m Designating community conservation areas for sustainable use of certain components of biodiversity;
- m Encouraging local communities to adopting agricultural, fisheries and forestry practices that enhance conservation of biodiversity; and
- m Enhancing local awareness about benefits and values of biological resources.

#### **7.4.1.4. Building capacity of the line agencies, local NGOs and CBOs**

Almost all the line agencies concerning conservation of biodiversity in NA have limited capacity for effective management of protected areas and promoting community-based conservation and sustainable use of biological diversity. They are faced with shortage of funds, technical expertise and equipment, and are not in position to all handle challenges faced with in-situ conservation of biodiversity, unless capacity of their staff is built in resource assessment, planning, management and monitoring of the conservation projects. Similarly, most of the local NGOs and CBOs are not familiar with biodiversity conservation issue and actions needed to mitigate threats to biological resources. They need technical assistance and financial help to implement community level conservation projects in the buffer zones of PAs and in the larger ecological landscape. NA Administration, national and international conservation NGOs active in NA will have to find ways and means for building capacity of the line agencies, local NGOs and CBOs for the effective management of natural resources. Existing conservation projects being implemented in NA have provisions for the capacity building of the stakeholders and training of the conservation professional. These should be tapped and new programmes should be initiated to build the capacity of key partners for biodiversity assessment and managing conservation projects. Priority actions will include:

- m Assessing current capacity and the biodiversity-related training needs of the staff of Forestry, Fisheries, Agriculture and protected areas managers;
- m Exploring opportunities for in-service training to address immediate needs and priority requirements;
- m Integrating biodiversity concerns into training manuals of the extension staff of the agriculture, fisheries, and forestry departments;
- m Building capacity of the local NGOs and CBOs, particularly the larger cluster organizations to play an effective role for conservation and sustainable use of biological resources;
- m Organising special workshops for the training field staff of the line agencies in biodiversity assessment techniques, particularly in data collection and reporting findings; and

- m Providing necessary equipment and field gears to the protected areas staff to perform their duties efficiently and effectively.

#### **7.4.2. Encouraging Ex-Situ Conservation**

Ex-situ conservation is the conservation of components of biodiversity outside their natural habitats: in zoos, botanic gardens and gene banks etc. Ex-situ conservation measures can be complementary to in-situ efforts. Moreover, ex-situ conservation provides excellent research opportunities on the rare and threatened species. The CBD recommends taking ex-situ measures to safeguard against extinction. These measures are often applied to conserve agriculture biodiversity by employing techniques like seed banks, gene banks and captive breeding. Ex-situ measures are also adopted for conservation of threatened species, wild relatives of cultivated plants, medicinal plants, ornamental plants etc. Captive breeding of wild animals can also be used to restore endangered species populations. Presently, very limited work is being done in Pakistan for in-situ conservation threatened and endangered species of flora and fauna. The Plant Genetics Resource Institute of NARC has collected genetic material of some local varieties of crops and fruits from NA and stored in their gene bank. However, there is no such facility in NA. There is a need to encourage in-situ conservation of threatened medicinal plants, rare varieties of local crops and fruits, and endangered species of animals e.g. Ladakh urial. There is great opportunity for the government agencies, NGOs, and local communities to take initiatives for starting in-situ conservation of threatened species of medicinal plants like Kuth (*Saussuria lappa*) and Karru (*Picrorhiza kurroa*). This will also contribute to implementation of the objective 8 of the BAP. Actions needed for encouraging ex-situ conservation of components of biodiversity include:

- m Identifying priority species of wild plants and animals as well as local cultivars that need conservation through ex-situ efforts;
- m Conducting feasibility studies for captive breeding programmes for endangered animal and plant species for the recovery and restoration of their populations;
- m Encourage government agencies (e.g. KARINA), local NGOs, and CBOs for initiating ex-situ conservation measures for indigenous plant genetic resources, local livestock breeds and horticultural varieties;
- m Facilitating establishment of a seed bank and germplasm collection programme for local fruit trees and medicinal plants by the NAAgriculture department;
- m Regulating and managing the collection of biological resources from natural habitats for ex-situ conservation to minimise threats to ecosystems and in-situ populations;
- m Supporting federal government's ex-situ programmes to optimise conservation of the NA' genetic diversity.

#### **7.4.3. Adopting Ecosystem Management Approach**

Ecosystem management is relatively new concept and now increasingly being adopted for conservation of natural resources. It is the "integrated management of ecological systems and human activities to maintain or enhance the health and integrity of an ecosystem including ecosystem function and structure" (Pirot et al. 2000). Ecosystems sustain biodiversity and the wealth of our natural, renewable resources. They provide services to humanity—clean air and water, food items, and control erosion and floods. Biodiversity conservation could benefit from this approach immensely and there is an opportunity for NA to try ecosystem based

management approach to promote conservation of biological diversity, at least at the pilot level. To apply this approach at broader level will require ecological land classification system, which will provide a foundation for starting ecosystem based management and planning in NA. Therefore, it is important to take some priority actions to fulfil preliminary requirements for introducing ecosystem-based management for conservation of biological diversity. These will include:

- m Developing ecological classification systems for NA based on both land ecological classification approach and vegetation communities classification approach;
- m Identifying priority ecosystems for introducing community-based ecosystem management projects on pilot bases; and
- m Building capacity of the line agencies and enhance their knowledge about ecosystem-based management of biological resources.

#### **7.4.4. Developing and improving baseline information on Biodiversity of NA**

A key obstacle to biodiversity conservation in NA is the lack of information about the various components of biodiversity. There is no database or basic biological inventory information about species diversity and distribution. Many research institutions, government agencies, NGOs and individuals are doing valuable work on different components of biodiversity, but most of the information is scattered with different organisations, published aboard or held by individuals. There has not been any concerted effort to collate information on biodiversity to develop a database on biological resources of NA and the related conservation issues. Furthermore, what has been done is not readily available to biodiversity planners and managers. Presently, PMNH is working on establishing a nation wide database on biodiversity. It is expected that this will help to access whatever information are available on NA. However, there is urgent need to conduct biodiversity assessment at NA level that would identify the ecosystems, species, and genome for which special conservation measures could be take. Finally, this would not be possible unless involving all the line agencies, conservation NGOs, research institutions, and universities make the coordinated efforts. WWF-Pakistan has established a Conservation and Information Centre at Gilgit to develop a database on biodiversity conservation issues. There is need to strengthen this initiative in cooperation with all the stakeholders. Specific actions needed to establish a database on biodiversity of NA will include:

- m Reviewing existing information and identifying gaps for establishing priorities for biological inventories;
- m Soliciting support and cooperating with other agencies involved in biodiversity assessments (e.g. international institutions, NGOs, and federal government agencies like ZSD, PMNH, PFI, & NARC);
- m Supporting WWF-Pakistan for strengthening Gilgit Conservation and Information Centre;
- m Developing a mechanism for information exchange among all the government agencies, research institutions, conservation NGOs and local CBOs active in biodiversity conservation in NA;
- m Launching a special programme for collection and archiving of information on indigenous knowledge pertaining to biodiversity; and
- m Conducting priority inventories of important taxon groups of plants and animals, as well as crop varieties and livestock breeds.

#### **7.4.5. Developing Enabling Policies and Legislation**

Enabling policies and an effective legal framework are key to promoting conservation and sustainable use of biological resources. The existing policies and legislation of NA are inadequate to meet the current challenges in biodiversity conservation. Moreover, the existing laws do not adequately cover Pakistan's obligations for the implementation of the CBD and other biodiversity related international conventions. There is need to review all the existing sectoral policies and legislations to identify the gaps. Some of this work has already done under the NASSD and MACP. There is need to build upon this initiative and develop appropriate policies and an effective legal framework for promoting conservation and sustainable use of biodiversity. There is also need to integrate biodiversity concerns into sectoral plans and programmes being implemented in NA. Priority actions for improvement existing policies and legislations will include:

- m Reviewing adequacy of all the sectoral policies and laws;
- m Identifying areas where new legislation or major enhancements to existing legislation are needed for:
  - m Commitments under the CBD and other MEAs,
  - m Conserving threatened or endangered species and populations,
  - m Introduction of alien species, and regulating and managing sustainable use of biological resources.
- m Preparing a biodiversity policy for NA (by focusing on wildlife, forestry, fisheries, agriculture and tourism sectors);
- m Developing a Biodiversity Strategy and Action Plan for NA based on the biodiversity policy for NA;
- m Taking measures for integrating biodiversity concerns in to sectoral and cross-sectoral plans in NA;
- m Improving the effectiveness of existing laws by creating awareness of conservation regulation and by stricter law enforcement; and
- m Devolving resource management authority to local communities and empowering them to enforce regulations of the existing biodiversity related legislation.

#### **7.4.6. Introducing Incentive Measures that Support**

##### **Conservation and sustainable use of Biodiversity**

There is need to pursue innovative approaches to prevent further loss of biological diversity in NA. Though regulatory approaches are essential, they have been insufficient to capture declining trend of biological resources in NA. Article 11 of the CBD requires that incentive measures be adopted to promote conservation and sustainable use of biodiversity, and stresses that these incentives should be economically and socially sound. The use of economic instruments and non-fiscal incentives such as social, institutional, and service-oriented incentives are now considered an important tool for the conservation of biological diversity. Some of the initiatives are already underway for introduction incentive measures through implementing the community-based conservation programmes in NA. For example, GEF/UNDP funded MACP project currently being implemented in NA have the provision for adopting incentive measures to seek support of the local communities for implementation of the project. Similarly, WWF-Pakistan and the line agencies have started using incentive measures for promoting conservation and sustainable use of biodiversity.

There is need to build upon these initiatives and further promote incentive measure for conserving wild species. While doing this NA Administration will have to consider two things—a) the need to use site specific incentives, based upon biological and social characteristics of the area as well as the nature of threat to biodiversity; and b) the need to remove perverse incentives that discourage biodiversity conservation e.g. special grants for introducing high yield crops, and grants for land development in biodiversity rich areas.

Applying incentive measures to ensure that it contributes to conservation and sustainable use of biodiversity will require a long-term strategy and concerted efforts by the government agencies, conservation NGOs, and the donor community. Implementation of this strategy will contribute to implementing the objective 14 of the BAP. The priority actions will include:

- m Identifying and expanding upon existing and potential economic instruments and other incentives which encourage biodiversity conservation;
- m Providing grants for the protection of threatened species and their habitat, and restoration of degraded watersheds;
- m Encouraging ex-situ cultivation of medicinal and other economic plants, in order to reduce pressure from wild populations;
- m Introducing a system of indirect incentives (fiscal, social, and service-oriented) to encourage conservation and sustainable use of biodiversity;
- m Identify and progressively remove incentives that encourage loss of biodiversity;
- m Investigating and instituting innovative mechanisms for raising funds for biodiversity conservation, e.g. local conservation funds, regional trust funds, royalties, levies, fees for financing biodiversity conservation project; and
- m Enhancing capacity of the line agencies and conservation NGOs implementing incentive measures approach for conservation of biological resources.

#### **7.4.7. Launching Conservation Education and Awareness Raising Programmes**

Education and awareness are closely linked to achieving success in conservation initiatives. Therefore, if national and provincial efforts to conserve biological diversity are to succeed, policy makers, planners, communities, and individuals must understand and appreciate the value of biodiversity, and the causes of its decline. Generally, there is lack of awareness among these people about the social and economic consequences of the loss of biodiversity. Other avenue to pursue is the increase of environmental literacy in local communities of NA. This could be done through both formal and informal education, which will improve public understanding of the links that biological diversity has with every aspect of daily life, and how our individual actions can lead to depletion of biological resources.

Given the low literacy rate in many parts of the NA, informal education will be a vital component for any strategy for conservation education and awareness. This could be tailor made to address local issues, and help find suitable responses to questions and issues. Similarly, there is need to include biodiversity-related topics in the teaching curriculum from primary school to college levels. The interdisciplinary nature of biodiversity means that it can be incorporated into many different topics of daily classroom discussion. This will require training school



teachers in local environmental issues and the possible actions for addressing those issues individual or collectively.

Although several organisations such as WWF and IUCN have taken steps to incorporate environmental education into in-service teacher training, but these initiatives still fall short in incorporating all the key biodiversity concerns. Presently, IUCN and WWF are implementing conservation education and awareness programmes under the MACP and European Union funded projects for creating awareness among the local communities, religious leaders, local school teachers, and policy makers. It is expected that these steps will have positive impact on the public attitude toward biodiversity and its conservation. However, there is need to build upon these initiatives and make concerted efforts for education and awareness among the people of Naby involving government agencies, NGOs, and other interested groups. This will contribute to implementation of the objectives 18 and 19 of the BAP and will require following priority actions:

- m Developing and implementing strategy and action plan for public education and awareness about the conservation and sustainable use of biodiversity in NA by targeting politicians, decision makers, businessman, school teachers, students, rural and urban communities;
- m Integrating biodiversity conservation and sustainable use themes into training programmes for school teachers in NA;
- m Supporting federal governments initiatives for linking environmental education with basic literacy and poverty alleviation drives;
- m Encouraging both print and electronic media to distribute information on biodiversity conservation issues through their publications and programmes;
- m Strengthening coordination between those involved in increasing awareness about biodiversity conservation including government departments, educational institutions, conservation NGOs, CBOs and other local interest groups; and
- m Encouraging organizations engaged in research, management and protection of biodiversity to publicise their work, to disseminate information about biodiversity and benefits of its conservation.

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