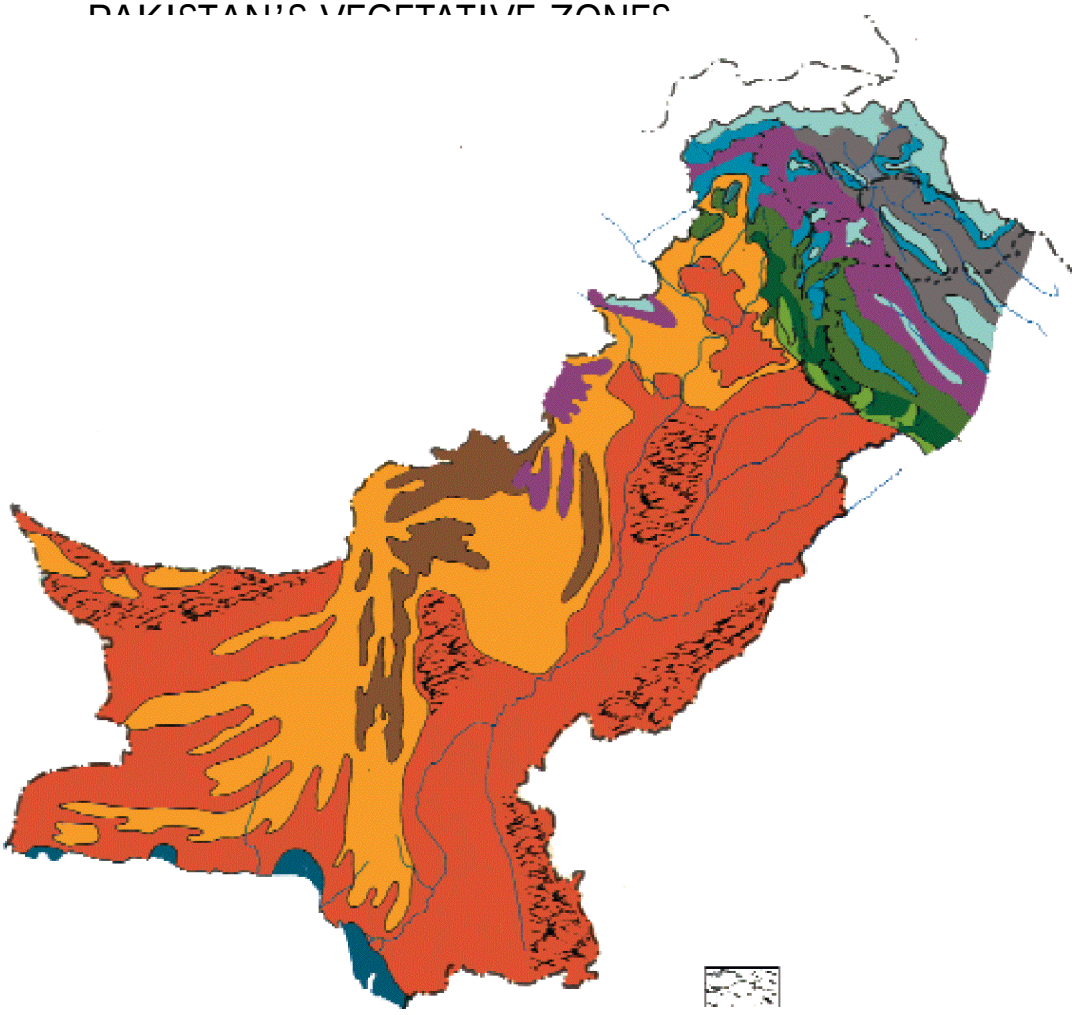
BIOLOGICAL DIVERSITY IN PAKISTAN

PAKISTAN'S VEGETATIVE ZONES



L E G E N D

- Permanent snowfields and glaciers
- Dry alpine and cold desert zones
- Alpine scrub and moist alpine
- Himalayan dry coniferous with ilex oak
- Himalayan moist temperate forest
- Sub-tropical pine forest
- Sub-tropical dry mixed deciduous scrub forest
- Balochistan juniper and pistachio scrub forest
- Dry sub-tropical and temperate semi-evergreen scrub forest
- Tropical thorn forest and sand dune desert
- Mangrove and littoral
- Sand dune desert

Protected Areas Management Proposal
IUCN, Islamabad.

WRRI-NARC/PARC
Islamabad, April 1997.

Adapted from: Roberts, T.J. 1991. The Birds of Pakistan, Vol.1. Oxford University Press, Karachi.

BIOLOGICAL DIVERSITY IN PAKISTAN

Being a transitional zone between three zoogeographical regions — the Palearctic, the Oriental and the Ethiopian — and a country with rapid changes in altitude that affect vegetation and wildlife, Pakistan has some of the world's rarest animals and plants. In the mountainous regions of the north, lives the endangered snow leopard, *Uncia uncia*, famous for its spotted coat and survival skills. Further south, the Indus dolphin, *Platanista minor,* is an endemic mammal, whose survival has been threatened by the building of barrages along the Indus River. There are the Indus wetlands, critical for the waterfowl population that visit the area in winter — the Indus flyway is globally considered the fourth major bird migration route. Among plants, *Saussurea lappa*, locally known as kut, is endemic to the alpine regions and is considered an endangered species. Another important medicinal plant is *Ephedra procera*, used as a cardiac stimulant and an antidote for bronchial asthma and hay fever.

Pakistan has a long history of human settlements. Evidence of early civilizations dating from 3000 BC have been found in Harappa and Mohenjodaro. However, while man lived in relative ecological harmony until the beginning of the 20th century, human development has had a negative impact on the environment in recent years. Many species that were common at the turn of the century have disappeared. With a sharp rise in population in the past 50 years, more and more land has been cleared for human settlements, agriculture and industry. Major irrigation systems and dams have been built, tapping the waters of the Indus and its tributaries. The control of monsoon flooding has resulted in the shrinking of thorn scrub, riverine swamps and forested areas in the flood plain.

A large number of species are under threat due to overuse, loss of habitat and pollution. In an effort to limit this loss and to conserve species, an extensive protected area system was developed. But this system needs to be revised to ensure that all the ecosystems in Pakistan are represented and that steps are taken to protect these areas from habitat degradation.

Pakistan's National Conservation Strategy, a joint effort of the Government of Pakistan and IUCN-The World Conservation Union, recognises this problem and sets out a comprehensive and ambitious conservation agenda. However, the key to protecting the biological heritage of the country lies in the involvement of local people in maintaining their natural resources through a sustainable use programme. Such a programme, reinforced by information and education about biological diversity, can provide a sense of stewardship to the local people and encourage them to maintain a healthy ecosystem.

WHAT IS BIOLOGICAL DIVERSITY?

The term biological diversity, often shortened to biodiversity, refers to the diversity of life on earth. It includes all species of plants, animals and micro-organisms, their genetic material and the ecosystems in which they live. The many different forms of life have taken millennia to develop through a process of natural selection and evolutionary change. It is estimated that the number of species on earth may be as high as 15 million. Of this, only 1.7 million life forms are known to science with thousands of species still waiting to be discovered and classified.

But these centuries of evolution are in danger of being wiped out. In an effort to safeguard biodiversity, particularly in the developing countries, the Convention on Biological Diversity was signed at the 1992 Earth Summit in Rio de Janeiro, Brazil. The Convention lays immense importance on biological diversity and the need to preserve it for future generations.

To facilitate understanding, global diversity is usually divided into three categories: genetic diversity, species diversity and ecosystem diversity.

Blue rock thrush / Naseer Tareen

GENETIC DIVERSITY

Every living organism contains information that determines what type of creature it will become. This information is packaged in its genes. Different genetic combinations are responsible for the variations within a single species (e.g. each snow leopard's individual coat) and between species (e.g. leopards and snow leopards).

Genes determine the ability of an organism to survive in a particular habitat under special conditions. They also increase the ability of species to adapt to changes in the environment.

Genetic diversity plays a vital role in agriculture as well. Wild species are a storehouse of genetic material that has been used throughout human history to develop new crops and different breeds of animals. With the cultivation of plants, which started about 10,000 years ago, wild species were crossed to produce high-yielding grains. Later, crossing domesticated crops with their wild relatives also increased crop diversity. In traditional Mexican farming, for instance, a flow of genes between cultivated plants and wild crops is encouraged by allowing wild relatives of maize to grow in a cornfield. As a result, natural cross-fertilization occurs and the most suitable cross-breeds are then

used to improve the genetic characteristics of cultivated maize. Through this process of selective breeding, different varieties of plants have been developed that can flourish in particular environments, are high-yielding and resistant to diseases.

SPECIES DIVERSITY

A species is the basic unit of classification for organisms. It refers to a population or a series of populations that freely interbreed with one another in natural conditions. Species diversity, measured in terms of the variety of species within a given region, is immense and ranges from between 5 to 100 million, with 15 million being a conservative estimate. A region containing many different plants and animals has a greater species diversity than a region in which an abundant number of a few species are found.

Himalayan ibex / Saeed uz Zaman

Himalayan moist temperate forest / Khushal Habibi

Mangroves — Korangi Creek / Peter Hogarth

Most of the earth's species are insects and micro-organisms but only 3-5% are known to science. This is because there is a bias toward describing large organisms. In recent years, however, efforts to study species-rich groups and areas have begun in order to understand the immense richness of species before they disappear.

ECOSYSTEM DIVERSITY

Land and water environments on earth have been classified into a number of ecosystems such as wetlands, grasslands, hot deserts, cold deserts, tropical rain forests, temperate forests, coral reefs, mangroves and tundra zones. These ecosystems are different land forms with various ecological niches and communities and their own species. Regions containing a great variety of ecosystems are rich in biodiversity. Individual ecosystems containing endemic species are also important and make a significant contribution to global biodiversity.

GEOGRAPHICAL PROFILE

From the desolate deserts of Thar to the forested valleys of Dir and Kohistan Pakistan, covering a land area of 803,940 sq km, is rich in biological diversity. Three great mountain masses — the Karakoram, Himalaya and Hindu Kush — form the watershed of the Indus River. Starting in the mountains of Ladakh, the Indus flows through Baltistan, bending southward through the mountains into the vast plains of the Punjab and toward the Arabian sea near Karachi. To the west, the rocky mountains which start from Chitral and extend through the Safed Koh in the North West Frontier Province, converge with the semi-arid Suleiman range in Balochistan. Torrential monsoon rains cause flash floods in some of these mountains. Their eastern drainage flows into the Indus. In the heartland of the country lies the flat alluvial flood plain which forms the drainage basin of this mighty river. This basin supports 80% of the national agricultural production.

Summers are hot and dry, even in the lower mountain regions. The hot spell is interspersed by the monsoons which sweep into Pakistan from the Indian Ocean during early July to late September. The monsoon season is of immense importance to the entire plant and animal community of the country as well as to its largely agrarian economy. The moisture-laden winds culminate in heavy rainfall which is concentrated along the outer foothills of the great northern mountain barrier. The effect of this rainfall is seen up to Chilas. The monsoon currents are blocked by the Nanga Parbat, after which a cold mountain desert emerges some 1,200 metres above sea level.

Butterflies at a mudpool / Khushal Habibi

The direction of the monsoon largely bypasses the Balochistan highland region, in particular the south-western corner of the province. This area is comprised of a vast desert plain called the Chaghai, which is an extension of the great Seistan depression, extending all the way into the Arabian Sea.

Rainfall in the country is highly erratic ranging from 30 mm annually in the Chaghai and Sibi deserts to as high as 1,350 mm in the Murree hills. In the Indus plain, the rain falls mainly during the monsoon season while the NWFP is influenced by a Mediterranean climate with up to 60% of the rainfall occurring in the winter months. In the foothill regions of the Hazara district and the Punjab, rainfall is more evenly distributed with a pronounced monsoon influence and only a quarter of the precipitation taking place during the winter months.

As a consequence of these geographical and climatic factors, Pakistan has been divided into 10 major ecological or vegetative zones.

ENDEMIC & ENDANGERED SPECIES

There are six endemic mammal species in Pakistan. Among them two — the little known woolly flying squirrel, *Eupetaurus cinereus*, found in the northern mountains of Gilgit and Chitral, and the Indus dolphin — are endangered. Other threatened species include the Balochistan black bear, *Ursus thibetanus gedrosianus*, the snow leopard and four ungulates: markhor, *Capra falconeri*, Marco Polo sheep, *Ovis ammon polii,* goitred gazelle, *Gazella subgutturosa,* and urial, *Ovis orientalis* .

Pakistan does not have a fully endemic bird species. Two species of pheasants, the western tragopan, *Tragopan melanocephalus,* and the cheer pheasant, *Catreus wallichii,* together with the great Indian bustard, *Ardeostis nigriceps*, are listed as endangered. Two significant populations of the western tragopan are found in the Pallas Valley of Kohistan and the Neelum Valley of Azad Kashmir. Although numbers have declined in recent years, Pakistan remains the second most important wintering ground for the white-headed duck, *Oxyura leucocephala.*

Green turtle / Fehmida Asrar

Of the 174 species of reptiles recorded in Pakistan, 18 are endemic: 13 lizards and 5 snakes. The most distinctive heptrofauna is found in the Chaghai desert where 6 endemic species occur. Four species are listed as endangered: the green turtle, *Chelonia mydas*, the olive ridley turtle, *Lepidochelys olivacea,* the gharial, *Gavialis gangeticus*, and the Central Asian cobra, *Naja oxiana.*

The amphibian fauna of the country is impoverished with only 16 recorded species. Two species of frogs, *Rana hazarensis* and *Tomopterna strachani* are endemic. Fish diversity is highest in the Indus river plain and the Himalayan foothills. Of the 156 native fresh water fish species, 17 are endemic. Among the 700 species of marine invertebrates, the crustaceans and molluscs are the best known groups because of their economic importance.

The Karakoram, Himalayan and Hindu Kush mountains are home to 41 species of endemic butterflies with a notable variety of Apollo butterflies of the genus *Parnassius*.

Of the nearly 5,600 species of vascular plants recorded in Pakistan, around 400 species — 7.1% of the total flora — are endemic. Centres of endemism are in the northern and western mountains at altitudes above 1,200 m where 90% of the endemics are found. Deforestation and overgrazing are threatening the flora of Pakistan and the tree *Ulmus wallichiana* is listed as an endangered species. There are an estimated 2,000 medicinal plants that could play an important role in the country's economy.

THREATS TO BIODIVERSITY IN PAKISTAN

A rise in population coupled with the demand for economic growth is putting ever-increasing pressures on the country's natural resource base. Wrong economic policies have led to the widening of inequalities, forcing the poor to depend more heavily on natural resources. Lack of facilities, such as adequate electric supply and natural gas in the rural areas, has resulted in the exploitation of fuelwood at an unsustainable rate. The result: deforestation, overgrazing, soil erosion, salinity and waterlogging, non-sustainable agricultural practices and hunting have become major threats to biodiversity.

DEFORESTATION

Although only 5.7% of the total land area of Pakistan is covered with forests, the rate of depletion continues to be high. Commercial logging and over-exploitation of forests by a growing population for fuel, fodder, building materials, resin and charcoal has resulted in crippling the meagre forest resources of the country.

The effects of deforestation on biodiversity are critical since whole forest ecosystems are destroyed. The disappearance of trees and shrub means that the associated flora and fauna, dependent on the forest, are also lost. Species such as markhors, squirrels, woodpeckers, snails, moths, ferns and mushrooms are also likely to become extinct once tree cover is removed. Deforestation is having particularly grave effects on Balochistan's juniper forests, the riverine areas of the Indus basin and the coastal mangroves.

Timber logging / Khushal Habibi

Hypericum oblongifolium / Khushal Habibi

OVERGRAZING

Large numbers of livestock, increasing at a rate of 20% every 7 years, have burdened the carrying capacity of Pakistan's rangelands. In fact,

the situation is so serious that most rangelands produce less than 30% of their capacity. Overgrazing results in the loss of topsoil and water and wind erosion, leaving the soil vulnerable to loss of nutrients and desertification. Land degradation not only reduces production capacity but also results in a decrease in palatable species. Wildlife populations are also at risk when vegetation is reduced; as prey species such as lagomorphs, ungulates and rodents become fewer, the land is unable to support predator populations.

SOIL EROSION

Soil erosion has seriously affected agricultural output, reducing agricultural acreage and grazing areas. It has also led to the siltation of dams, canals, and watercourses which are the lifeline of agricultural production in the country. The storage capacity of the dams has decreased and the desilting of water channels is draining an already impoverished economy.

Terraced fields / Khushal Habibi

Geranium wallichianum / Khushal Habibi

Codonopis clematidea / Khushal Habibi

SALINITY & WATERLOGGING

Continuous surface irrigation has raised the water-table in the Indus basin, as a result of which large tracts of agricultural land, particularly in Sindh and southern Punjab, are being lost to salinity and waterlogging. Natural forests, which are rich in biodiversity, could also be affected as a result of this waterlogging, through clear felling to make more land available.

NON-SUSTAINABLE AGRICULTURAL PRACTICES

The introduction of high-yielding varieties of crops, chemical pesticides and heavy water application has increased

agricultural production in recent years. But this may have a negative impact on agricultural biodiversity. The use of new crop strains hampers the use of local varieties (which are better suited to the environmental conditions of the country) and may even lead to the loss of indigenous strains. Increased use of control agents such as herbicides, fungicides and pesticides inadvertently affects non-target species and contributes to food-chain contamination. Moreover, runoff from fields heavily fertilized with chemicals adds to water pollution and waterlogging.

HUNTING

Hunting has a long tradition in Pakistan. However, unregulated hunting has resulted in the dwindling of many species of game animals. Some species such as the goitred gazelle and Marco Polo sheep, are on the verge of extinction. The houbara bustard, *Chlamydotis undulata*, continues to be hunted by large parties from the Gulf despite the fact that its hunting is prohibited to the locals. Such parties not only vastly exceed the bag limit but also destroy large tracts of vulnerable desert habitats due to off-road driving. Migratory birds are shot for target practice, while other species are hunted for their pelt or meat. As a result, the range of all large mammals has been reduced and they have been forced to live in the most isolated parts of their habitat. Large scale hunting is a threat to biodiversity in Pakistan and will remain so until hunting practices are made compatible with sustainable resource use.

Houbara bustard / WWF-Pakistan

Trophy: Marco Polo sheep / Ayesha Vellani

Gentianodes marginata / Khushal Habibi

MEASURES FOR CONSERVING BIODIVERSITY

Today, the aim of biodiversity conservation is through people's participation: by seeking to meet human needs from biological resources, while ensuring the long-term sustainability of these resources. Beside conserving wild species, it involves the protection of the genetic diversity of cultivated and domesticated wild species and their relatives. Both *in situ* and *ex situ* methods are used to ensure the survival of as many species as possible. It is important to assess the relative importance, in terms of diversity, of different habitats and ecosystems. An area of low species diversity, for instance, may contain rare species which will contribute more to the overall diversity of the region.

Biodiversity conservation has been highlighted in the National Conservation Strategy (NCS). The programme focuses on areas and species which are under severe threat. For example, the hunting and trade of endangered species such as the Indus dolphin, markhor, Marco Polo sheep, snow leopard, western tragopan and the green turtle, are banned by law. Different areas throughout the country have been designated to conserve endangered species and ecosystems. Plans are underway to designate a Central Karakoram National Park, as a World Heritage Site to preserve unique alpine habitats, magnificent glaciers and their associated plant and animals communities.

Markhor / Khushal Habibi

PROTECTED AREAS

The country's 14 national parks, 101 wildlife sanctuaries and 96 game reserves are run by the game departments of different provinces, each with its own jurisdiction. The area covered by these three categories totals 11.4% of the total area of the country. The Lal Suhanra National Park in Punjab has been declared a biosphere reserve and there are eight wetlands internationally recognised under the Ramsar Convention.

However, while most habitats are represented within the current protected areas, their boundaries have not been drawn according to the ecological criteria of the habitats they represent — the ecosystems or the plant and animal communities dependent on them. Additionally, law

enforcement to safeguard against habitat degradation or hunting in the protected areas remains weak.

LEGISLATION & POLICY

There are many laws covering areas such as forestry, wildlife protection, grazing rights, soil conservation and discharge of effluents. A Wildlife Enquiry Committee, set up in 1968, drafted conservation legislation which was adopted by different provinces through provincial acts and ordinances. The Committee also recommended the setting up of a National Council for Conservation of Wildlife which was established in 1974 within the Ministry of Food, Agriculture and Co-operatives and currently comes under the Ministry of Environment, Local Government and Rural Development. The agency has an advisory board that is responsible for formulating and implementing wildlife policies at the federal and provincial level.

Woodpecker / Naseer Tareen

The first piece of legislation to consider the environment as a whole was the Environment Protection Ordinance of 1983. This is in the course of being succeeded by the Pakistan Environmental Protection Act 1997, which has been passed by the National Assembly and is shortly due for consideration by the Senate. On the policy front, Pakistan's National Conservation Strategy was aimed at evaluating the economic policies of the country for their impact on the natural resource base and to merge environmental concerns with the matrix of decision making. The NCS looks at the opportunities for improvements in various sectors of the economy with a view to steering the country towards a sustainable future. At the provincial level, the Sarhad Provincial Conservation Strategy is being implemented while the Balochistan Conservation Strategy and the Northern Areas Conservation Strategy have just begun.

GOVERNMENT DEPARTMENTS & RESEARCH ORGANIZATIONS

Wildlife management is the responsibility of the provincial wildlife or forest departments. Sindh, Balochistan, the Punjab, the NWFP and Azad Jammu and Kashmir have separate wildlife departments while in the Northern Areas, the forestry department administers and manages

wildlife. An Inspector-General of Forests, within the Ministry of Environment, Local Government and Rural Development, is responsible for coordination and international liaison.

The Ministry of Food and Agriculture and provincial government departments are responsible for the agricultural sector. Within the Ministry of Food and Agriculture, the Soil Survey of Pakistan and the National Fisheries Development Board are operated. The Water and Power Development Authority, under the Ministry of Water and Power, is responsible for flood control, drainage, irrigation, water supply, salinity control and the barrages.

The Pakistan Forest Institute trains foresters and wildlife managers. The Institute has carried out wildlife management training programmes with international organizations — IUCN, the Food and Agricultural Organization, the United Nations Development Programme — and through bilateral agreements with the US, Australia and New Zealand. The Pakistan Agricultural Research Council is the foremost organization for agricultural research and has several research establishments in different areas of the country. Other academic and research institutions concerned with biodiversity conservation and environmental protection include most universities in the country; the Pakistan Council for Scientific and Industrial Research; the National Institute of Oceanography and the National Institute for Biotechnology and Genetic Engineering.

Alpine meadow / Khushal Habibi

Ferns — sub-tropical forest / Khushal Habibi

Monitor lizard / Naseer Tareen

NON-GOVERNMENT ORGANIZATIONS

A large number of non-government organizations are also involved with biodiversity conservation. Among them are IUCN, which focuses on sustainable development and covers the entire spectrum of conservation and development issues. The

World Wide Fund for Nature, Pakistan (WWFP) has also carried out a number of field projects aimed at protecting ecosystems and species in various parts of the country. The Pakistan Wildlife Conservation Foundation, the World Pheasant Association and the Pheasant Conservation Forum are other NGOs involved in wildlife conservation.

BIODIVERSITY CONSERVATION PROJECTS

IUCN field programmes aimed at promoting sustainable use of natural resources include the project Maintaining Biodiversity in Pakistan with Rural Community Development which aims to demonstrate how conservation of Pakistan's biodiversity can be enhanced by providing rural villagers with the technical skills to manage wild species and habitats. The first phase of the project has focused on the mountain regions of the Northern Areas and the NWFP. Other projects in which IUCN has been involved include developing a national Biodiversity Action Plan, a Protected Areas Management Proposal and several provincial conservation strategies. Integrated resource management projects include one on Ziarat's juniper forests and an urban social forestry component for the Orangi Pilot Project. A Coastal Zone Management Programme, aimed at protecting the creek ecosystem in the Korangi-Phitti Creek area, is also proposed.

Mulberry bush / Ayesha Vellani

Yak / Ayesha Vellani

WWFP has been involved in conservation programmes, conflict resolution and management of the Khunjerab National Park and other ecologically important areas of Pakistan.

Provincial wildlife and forest departments are engaged in surveying and monitoring work. While blackbucks, *Antilope cervicapra*, have been reintroduced to protected areas in Sindh and the Punjab, the World Pheasant Association has been involved in reintroducing the cheer pheasant to the Margallah Hills area and parts of the NWFP, managing the wild cheer pheasant population in Azad Kashmir, and the conservation of the western tragopan. The Tragopan Programme is run in collaboration with Birdlife International and the NWFP Wildlife Department.

GLOBAL BIODIVERSITY STRATEGY

Biodiversity conservation at the government level started with the establishment of national parks, wildlife sanctuaries and reserves in different parts of the world. Most countries now have national parks and legislation promoting conservation. A large number of countries participate in international conservation conventions and have evolved strategies to conserve their natural resources.

The World Resources Institute, IUCN and the United Nations Environment Programme (UNEP), in consultation with FAO and the United Nations Education, Scientific and Cultural Organization, developed a Global Biodiversity Strategy in 1992 that deals with all aspects of biodiversity. The strategy recommends that:

Village meeting, NWFP / Ayesha Vellani

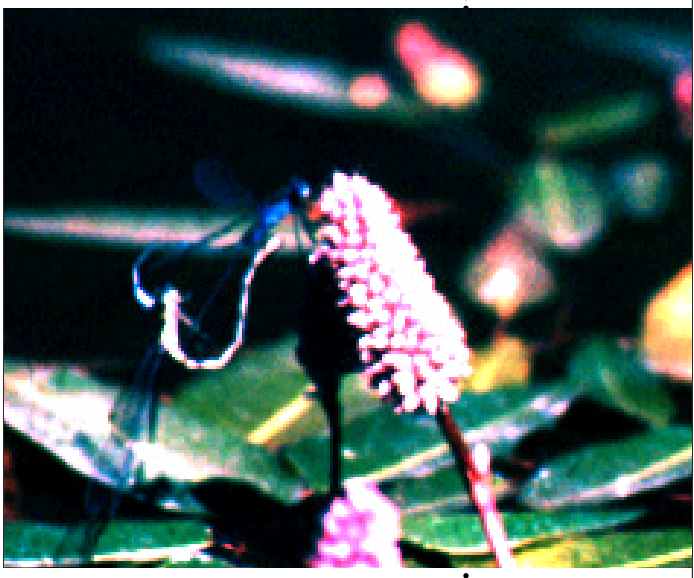
Demoiselle crane / Ayesha Vellani

- national and international policies are developed to encourage the sustainable use of biological resources and the protection of biodiversity, enabling gene-rich countries to benefit from developments in biotechnology;
- local communities are involved in conservation programmes and benefit from sustainably managing their indigenous resources and providing local genetic resources for use in biotechnology;
- governments strengthen national conservation efforts by providing more funding for protected areas and by encouraging other departments, such as forestry and fisheries, to make biodiversity conservation one of their management objectives; and,
- the number of skilled personnel working on biodiversity conservation including biologists, economists, lawyers, resource managers and taxonomists is increased, particularly in developing countries.

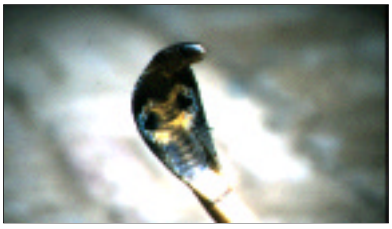
CONVENTION ON BIOLOGICAL DIVERSITY

The Convention on Biological Diversity started as a document drawn up by IUCN on the *in situ* conservation of biodiversity. The document was submitted to the UNEP Governing Council, which accepted the need for an international biodiversity convention and accepted responsibility for its drafting. The draft convention was broader than the IUCN document and covered conservation, wild species of commercial crops, and the transfer of technology, biotechnology and expertise to developing countries. Formal negotiations, involving representatives from 75 countries, started in November 1990 and a final version of the convention was signed in 1992 by 156 nations (including Pakistan) at the UN Conference on Environment and Development, the Earth Summit, in Rio de Janeiro. The convention aims to save animal and plant species from extinction and restore their habitats. The convention stipulates that parties must:

- develop national strategies for the conservation and sustainable use of biological resources;
- establish protected areas, resuscitate degraded ecosystems, control alien species and establish conservation facilities;
- establish training and research programmes for the conservation and sustainable use of biodiversity and support such programmes in developing countries;
- promote public education and awareness regarding conservation and sustainable use of biodiversity;
- carry out an environment impact assessment prior to any proposed project that may reduce biodiversity;
- recognize the right of governments to regulate access



Dragon fly / Khushal Habibi



Cobra / Ayesha Vellani

Calotropis procera / WWF-Pakistan

to their own genetic resources, and wherever possible, grant other parties access to genetic resources for environmentally sound uses;

- encourage technology and biotechnology transfer, particularly to developing countries;
- establish an information exchange between the parties on all subjects relevant to biodiversity;
- promote technical and scientific cooperation between parties, particularly between developing countries, to enable them to implement the convention;
- ensure that countries that provide genetic resources have access to the benefits arising from them; and,
- provide financial resources to developing countries in order to enable them to carry out the requirements of the Convention.

Children in Hunza Valley / Ayesha Vellani

Ficus benghalensis / WWF-Pakistan

SUGGESTED READING LIST

Ahmed, M., Ahmed, M.F. and Zikria, Khanum. 1986. The Ungulates of Pakistan (in Urdu). Zoological Survey of Pakistan, Karachi.

Blumstein, D.T. 1995. An Eco-tourist's Guide to Khunjerab National Park. WWF, Lahore.

Glowka, L., Burhenne-Guilmin, F. and Synge, H. 1994. A Guide to the Conservation of Biological Diversity. IUCN, Gland.

Hume and Marshall. 1995. The Game Birds of Pakistan. Vanguard Books, Lahore.

IUCN, UNEP and WWF. 1980. World Conservation Strategy. IUCN, Gland.

IUCN, UNEP and WWF. 1991. Caring for the Earth. IUCN, Gland.

IUCN and WCMC. 1991. Biodiversity Guide to Pakistan. IUCN, Gland.

Nasir, Y. J. and Rafiq, R. A. 1995. Wild Flowers of Pakistan. Oxford University Press, Karachi.

Roberts, T. J. 1991. The Birds of Pakistan. Oxford University Press, Karachi.

Roberts, T. J. 1977. The Mammals of Pakistan. Ernest Benn, London.

Ward, G. 1994. Islamabad Birds. Asian Study Group, Islamabad.

Wilson, E. O. 1992. The Diversity of Life. W. W. Norton, New York.

Woodcock, M. 1980. Birds of the Indian Sub-continent. Collins, London.

WRI, IUCN and UNEP. 1992. Global Biodiversity Strategy. WRI, Washington D.C., IUCN, Gland and UNEP, Nairobi.

Donor:
This publication has been made possible by funding from UNDP under the Pre-Investment Fund of the Global Environment Facility.
Author:
Khushal Habibi
Cover photo:
Lathyrus sativus / Khushal Habibi
Inset cover photo:
Snow leopard / WWF- Pakistan
Editors:
Dhunmai Cowasjee & Saquib Hanif

IUCN-The World Conservation Union, Pakistan
1, Bath Island Road, Karachi 75530

ISBN 969-8141-22-7

Design:
Creative Unit (Pvt.) Ltd.
Printing:
Hamdard Press (Pvt.) Ltd.