IUCN

SINDH Biodiversity Strategy and Action Plan

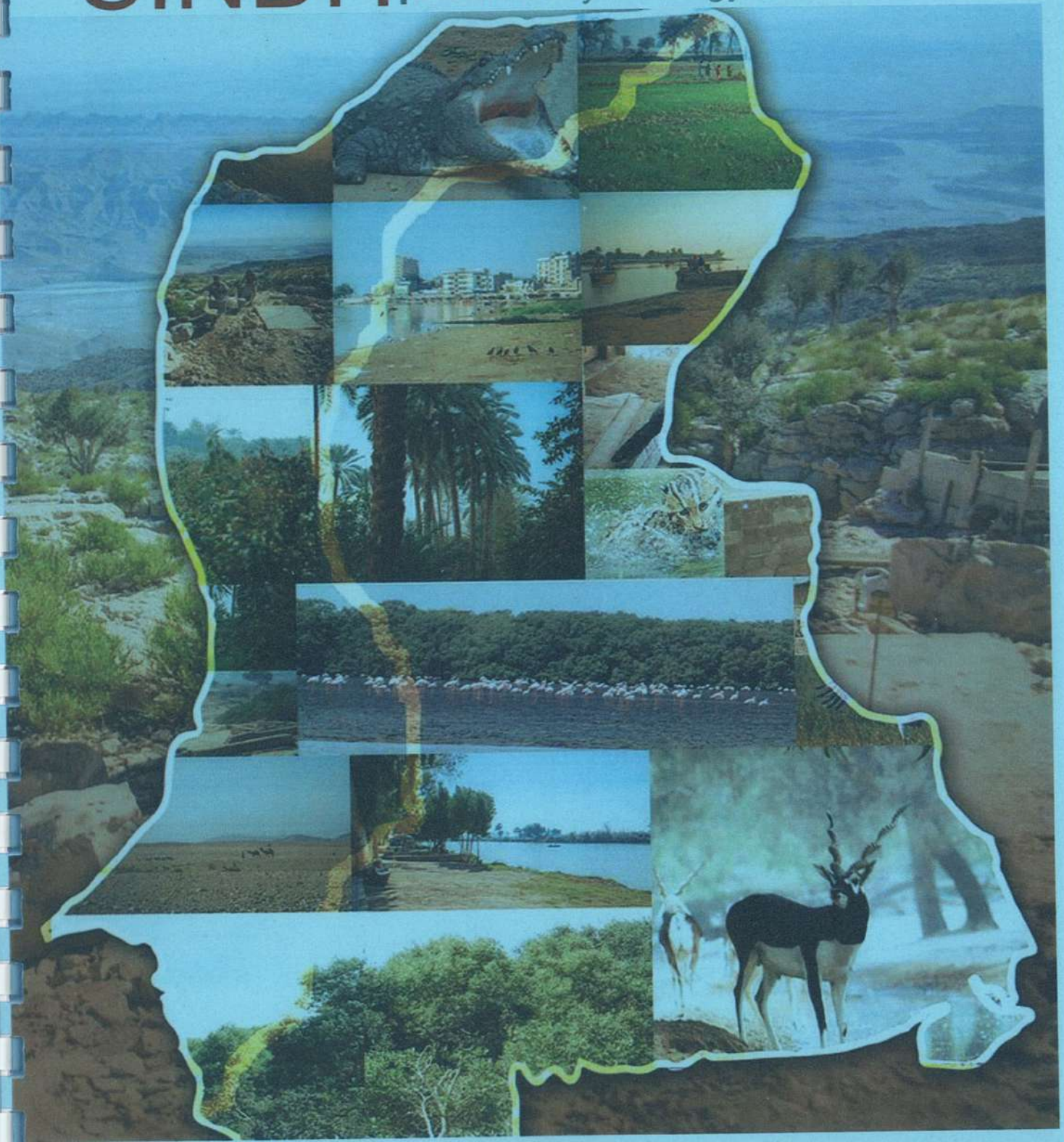

Image in the background is from Gorakh hill, Dadu district. Gorakh is famous for its scenic and biodiversity values, and is the highest point in Sindh at 5,688 ft. above sea level.
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Foreword

Sindh has been blessed with a variety of ecosystems and habitats ranging from beautiful beaches along the coasts of the Arabian Sea, the Indus delta, to the famous Thar Desert, offering a range of economic and scenic opportunities, as well as the Gorakh Hills in the north of the Khirthar range at an altitude of 5,688 feet, which has yet to reveal its potential.

The diverse topography and climatic conditions manifest themselves in a wide range of habitats and species. Most of the Sindh province is home to biodiversity of global significance. The marine ecosystem of the Arabian Sea is included in the 200 most biologically outstanding eco-regions in the world. Unfortunately, the existing land use plans were not appropriately reviewed and updated keeping in view factors affecting the ecological health of these lands. The vast majority of Sindh's natural habitat is generally degraded and has lost much of its productivity.

The worsening health of ecosystems and diminishing ecosystem service are a cause for alarm as they pose a threat to the livelihoods of the poor and marginalized communities who depend on ecosystem resources such as forage, fuel wood, and other natural products. It is neither feasible nor desirable for the government to manage vast areas of natural habitat, and therefore, institutions and the capacity of local communities must be strengthened for them to get actively involved in the sustainable management of natural resources.

Pakistan is among the ten most vulnerable countries to climate change, and colossal damage of life and property from recent floods are still fresh in our memories. Sindh is home to a large number of wild relatives of crops which, together with other threatened species of flora and fauna, are mostly at risk of extinction due to changes in habitat conditions; therefore, we need to establish and effectively manage representative areas of all of our natural habitats covering land, water and sea. In addition to the loss of nature's bounty, there has been a lot of erosion of traditional varieties of crops and breeds of farm animals due to the introduction of high yielding crop varieties and exotic breeds.

Although high yielding varieties have helped the province feed the rapidly growing population, it has been at a high cost – high incidence of cancer and other diseases due to high use of agrochemicals. We need to preserve our traditional crop varieties and breeds of farm animals both as a coping strategy against crop failures under changing climate and for improving the vigour of crop varieties and animal breeds. In addition, there is a need to develop, test and promote sustainable agricultural practices to improve water use efficiency, and minimise the use of environment friendly agro-chemicals.

Sindh has always shown strong commitment to the cause of environment and sustainable development. Unfortunately, the financial limitations far exceed the will of the province, and the progress to date on implementation of the Biodiversity Action Plan has been less than desired.

The Sindh Biodiversity Strategy and Action Plan (SBSAP) will provide a new vision, objectives, strategies and targets to meet the conservation challenges of the 21st century, and make a significant contribution to achieving the CBD strategic objectives and achieving the Aichi Biodiversity Targets 2011-2020. Active participation of the stakeholders who will be major players for its implementation will ensure their buy-in. The government will try its best to increase allocations for biodiversity, but the bilateral and multilateral development agencies will have to come forward to meet the financial needs of achieving the Aichi Biodiversity targets.

Syed Qaim Ali Shah
Chief Minister, Sindh

Acronyms & Abbreviations

ABT	Aichi Biodiversity Target
AJK	Azad Jammu and Kashmir
BAP	Biodiversity Action Plan
CBD	Convention on Biological Diversity
CBO	Community Based Organisation
CCA	Cultivated Command Area
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMS	Convention on Migratory Species
CoP	Conference of Parties
ESP	Economic Survey of Pakistan
EU	European Union
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoS	Government of Sindh
GIS	Geographical Information System
Ha	Hectare
IFAP	Indus for All Programme
ITPGRFA	International Treaty on Plant Genetic Resources for Food and Agriculture
IUCN	International Union for Conservation of Nature
KWSB	Karachi Water and Sewerage Board
KPAC	Khirthar Protected Area Complex
KPK	Khyber Pakhtunkhwa
LBOD	Left Bank Outfall Drain
MDGs	Millennium Development Goals
MGD	Million Gallons per Day
MFF	Mangroves for the Future
MOCC	Ministry of Climate Change
MT	Metric Ton
NA	Northern Area
NBSAP	National Biodiversity Strategy and Action Plan
NCS	National Conservation Strategy
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organisation
NEQS	National Environmental Quality Standards
NRM	Natural Resource Management
NSDS	National Sustainable Development Strategy
PEPA	Pakistan Environment Protection Act
PRSP	Poverty Reduction Strategy Papers
RBOD	Right Bank Outfall Drain
REDD+	Reducing Emissions from Deforestation and Forest Degradation
RF	Reserve Forest
SMART	Specific, Measureable, Attainable, Relevant, Time bound
SSSD	Sindh Strategy for Sustainable Development
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
WWF	Worldwide Fund for Nature

1. INTRODUCTION

1.1 Purpose of Sindh BSAP

Sindh is unique in its biodiversity due to its diverse range of landscapes and ecosystems and its location on the flyway of Central Asia, giving it the opportunity to host a multitude of migratory species. The variety of ecosystems is evident as Sindh is home to riverine, scrub, and mangrove forests, deserts, coastal areas, wetlands, and agro-ecosystems. The province is also rich in diverse species of flora and fauna. Migrating birds from the South Asian subcontinent, East Africa, Europe, and much of Asia use the wetlands as wintering grounds. Some fly in to stay for the winter and breed here, while the rest fly through. Therefore, besides Sindh's endemic species, these migrating birds also depend on these important wildlife habitats over the course of a year.

Sindh's biodiversity has been negatively affected by a multitude of factors, including the effects of unplanned industrialization (leading to the destruction of important natural habitats), the decreasing supplies of freshwater from the Indus River, and the lack of effective policies to protect and enhance biodiversity in the province. The government departments responsible for the conservation of biodiversity are unable to function effectively owing to the mismanagement of agencies, insufficient funding, lack of political will, and a dearth of trained and committed staff.

From its important array of medicinal plants, and its wetland sites, ten of which are protected under the RAMSAR Convention, the focus in Sindh has always been on exploiting biodiversity for short-term gains. A Biodiversity Action Plan (BAP) for Pakistan was completed in 2000. Since the formulation of the first Biodiversity Action Plan, significant changes did occur. The target set based on information gathered in BAP 2000 need a revision. Being an integral part of BAP 2000, Sindh has a role in redefining its biodiversity resources and targets.

Figure 1: The visiting bird of Sindh (Siberian Crane)

Pakistan being a signatory to the Convention on Biological Diversity (CBD), has been mandated to revise its BAP giving consideration to the targets set, keeping in view the Aichi Biodiversity Targets (ABT) 2011-2020. The Ministry of Climate Change (MoCC) is the national focal Ministry for the CBD. One of the priorities emerging from the Fifth National Report to the CBD is the need for sub-national Biodiversity Strategies and Action Plans (BSAP) for greater ownership and action at the provincial level. It is with this background that the Government of Sindh was requested by the MoCC to prepare its own BSAP, implement the CBD strategic objectives and the Aichi Biodiversity Targets, and establish coordination and implementation mechanisms at the provincial and regional levels to better mainstream biodiversity into all sectors of the economy.

The BSAP of Sindh has been prepared in consultation with all the stakeholders and is comprised of a set of SMART (specific, measureable, attainable, relevant, time bound) targets and indicators, showing linkages to Aichi Biodiversity Targets and clear, realistic costing, including key assumptions, unit costs, and estimated cost ranges (Annex 1).

2. A BRIEF OVERVIEW OF SINDH PROVINCE

2.1 Principle land use patterns in Sindh

Agriculture, followed by forestry, is the main land use in the central alluvial plain. Although more than 50 percent of the total geographical area is cultivable, only 26 percent of it is actually located in the central plain. The land inside the Indus embankments is almost equally employed by agriculture and forestry, while that outside the embankments is more extensively utilised for agriculture in the form of sparsely distributed irrigated plantations.

2.2 Climatic features

The climate of Sindh varies with geographical location and is further influenced by the province's physical features. The daily range of temperature is variable with the minimum range being in the coastal region.

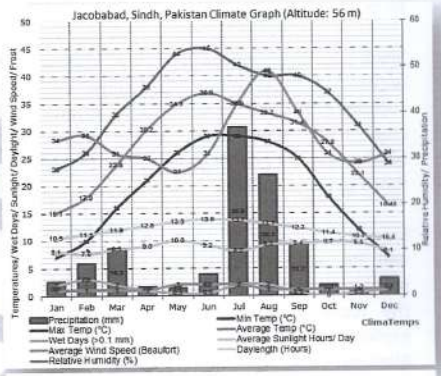


Figure 2: The climate graph of upper Sindh

The highest average humidity (75 percent) occurs in August, and the lowest in December in lower Sindh (58 percent) and in April in upper Sindh (47 percent). Thus the weather is drier and hotter in the north than in the south. The skies are generally clear and frost is not uncommon. While in upper Sindh it is generally calm for almost half of the year, the wind velocity in the coastal areas is about 24 km per hour during the monsoon season.

Dust storms and squally weather is common at the beginning of the two cropping seasons (*Rabi* and *Kharif*). The predominant wind direction in Karachi is westerly before the monsoon season begins, while in winter the direction is north east or northwest. In upper Sindh, it varies from southeast to northeast in summer and from northeast to northwest in winter. Rainfall in Sindh is scanty and, due to the orography of the province, also very variable.

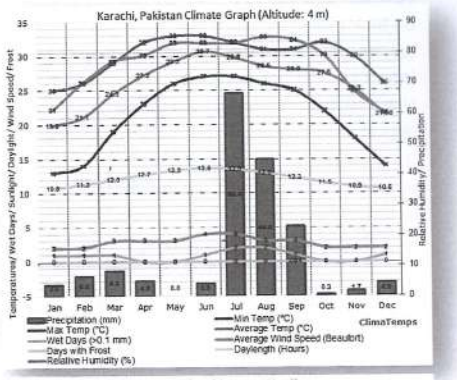


Figure 3: The climate graph of lower Sindh

Sindh lies between two monsoon zones (southwest and northeast). It misses the influence of the southwest monsoons, while the northeast monsoons do not extend much beyond the Ganges Basin. The mountains on the west of Sindh are not high enough to catch the southwest monsoon current in one part of the year and to prevent the cold blasts from the Iranian plateau from entering the region in the other.

The climatic conditions of Sindh differ in the upper, middle and lower regions. In upper Sindh, dry atmospheric conditions prevail due

to the orographic features of the Khyber Pakhtunkhwa (KPK). Rainfall is lowest and the temperature highest in this part of the province. The daily temperature range in winter is wide and frost is common. The climate resembles the continental type.

In middle Sindh, the south-west monsoon winds blow at an average speed of 18 km/hr in June and the rainfall is occasionally slightly higher than in Karachi. The temperatures are lower here than in upper Sindh and humidity is moderate. The range of temperature is also much narrower than in the upper part of the province. Dry hot days and cool nights in summer are characteristic of this region.

The winding coastline in lower Sindh affects the climate of the area to some extent. The coastal and deltaic regions are naturally damper, with smaller ranges of temperature and pressure. The prevailing air currents are due to the southwest winds in summer and northeast winds in winter. Rainfall at times is a little lower here than in middle Sindh. Humidity is the greatest here and the temperature is moderate throughout the year. High humidity causes muggy or oppressive weather in summer and the climate is classified as maritime.

2.3 Demographic Trends

As Pakistan's second largest province, Sindh plays an important role in the national economic and development agenda. The country's largest city, Karachi, which also houses two ports, is located here. The province comprises 17.7 percent of Pakistan's land area and contains 23 percent of the country's population. At 48.9 percent, it has the highest concentration of urban population as opposed to the overall average of 32.5 percent, making it the most urbanized province in the country. Sindh is also a cultural melting pot, where migrants from other provinces have settled in search of opportunities, and have brought along their own traditions and languages.

Table 1: Sindh at a Glance

Area and Population	1981	1998	2011
Geographical area (Km^2)	140,914	140,914	140,914
Population			
Pakistan (Total)	84,253	132,352	186,894
Percentage share of Sindh	22.59	23.00	23.32
Population Density per Km^2	135	216	309
Population Sindh (Total)	19,029	30440	43,587
Male	9,998	16098	23,049
Female	9,013	14342	20,538
Percentage Share of Rural Areas	56.68	51.25	
Literacy Rate	31.45	45.29	60.10

Source: Sindh at a Glance, Bureau of Statistics (GoS, 2011)

Sindh comprises of 23 districts, 160 towns and 1094 union councils. Owing to the migration of people from across the country its population has been increasing at a much faster pace than the

overall population of Pakistan. The population of Sindh is estimated to be 46.4 million (Census 2008). Within Sindh, growth patterns were substantially different.

Sindh comprises of the Lower Indus Basin. It is the second-most populous province after the Punjab and covers 140,914 square kilometres (km), with a north south length of about 540 km and a breadth of about 250 km. It lies between $23^0$and 28^0 North latitudes and 66^0 and 71^0 East longitudes.

2.4 Topography

Topographically, Sindh can be divided into four distinct parts with the dry and barren Khirthar Range in the west, a central alluvial plain bisected by the River Indus, a desert belt in the east, and the Indus delta in the south. Except for a small hilly tract (Nagarparkar), in the southeast corner of the Tharparkar District, western Sindh is the only region which is mountainous and includes the hill ranges of Khirthar, Pab, Laki, and Kohistan. There is little vegetation on these ranges due to scanty rainfall. The highest altitude known as Kutay-ji-Kabar (Dog's Grave) is in the Khirthar Range and is 2072.64 meters high. These ranges run north to south like a crescent turned towards the low lands and extend up to the northern extremity of the province. Khirthar has a simple, anticlinal structure with flanks gently dipping towards the west and south. The Laki Range, on the other hand, is mainly composed of tertiary rocks and contains a large number of thermal springs.

Figure 4: A View of Road Leading to Gorakh Hill, District Dadu

A large part of Sindh lies in the deltaic plain of the Lower Indus Valley. Most of this region consists of plains overlain by alluvium, trenched with river channels in some places and overridden by raised terraces in others. A few isolated low limestone hills are the only relieving features in the plains.
The plains may be subdivided into three parts: the western valley, the eastern valley, and the deltaic area.

The western valley section is distinguished from the eastern valley by the presence of old alluvium and seasonal *nallah* flowing from the Khirthar mountain range into the Manchar Lake. The deltaic area largely consists of mangrove swamps and sandbars. The chief characteristic of the region is the creeks that serve as the changing outlets of the Indus and as inlets for the sea. The lowland Indus plain merges into this region. The eastern part of Sindh consists of the Thar Desert which continues into Rajputana (India). The landscape is sandy and rough with sand dunes covering more than 56 percent of the area. The relief in the area varies between near sea level to more than 150 metres above sea level. The isolated hills of Nagarparkar on the northern border of the Runn of Kutch belong to quite a different system both geographically and geologically.

The hilly region of western Sindh consists almost entirely of rocks belonging to the tertiary system of geological nomenclature. With the exception of some volcanic beds associated with these Cretaceous strata along the Lakhi Range, all the rock formations of western Sindh are of sedimentary origin.

3. CURRENT STATUS OF BIODIVERSITY

3.1 Overview

Plant species play an integral role in the biodiversity of the province, are a source of fodder, and an important source of raw material. Sindh also has a variety of medicinal plants, which are used in healthcare products, traditional medications, dyeing, as culinary spices, and in natural cosmetics and perfumes.

Wildlife species diversity is also apparent throughout Sindh. Migratory birds from the South Asian sub-continent, East Africa, Europe, and much of Asia use the wetlands as wintering grounds. Some fly into stay for the winter and breed here, while the rest fly through. Therefore, besides Sindh's endemic species, these migrating birds also depend on these important wildlife habitats over the course of a year. Some significant wildlife species, which have come under threat due to loss of habitat, expansion of human settlements, lack of water supplies, and unregulated hunting, include the Houbara Bustard, the Sindh Urial, the Sindh Ibex, the Indus blind dolphin, the Marsh Crocodile, the Indian-Cobra and Python, and Marine Turtles, to name just a few.

Unfortunately, Sindh's biodiversity has been negatively affected by a multitude of factors including the effects of unplanned industrialization (leading to the destruction of important wildlife habitats), the decreasing supplies of freshwater from the Indus River, and the lack of effective policies to protect and enhance biodiversity in the province.

The government departments responsible for the conservation of biodiversity are unable to function effectively owing to the mismanagement of agencies, insufficient funding, lack of political will, and a dearth of trained and committed staff.

Figure 5: A Camel in Thar Area Feeding on Shrubs

From its important array of biodiversity resources, the focus in Sindh has always been on exploiting biodiversity for short-term gains. The results of this short sightedness among policy-makers and communities alike are becoming painfully clear as many species of plants and animals, as well as forests and wetlands, are struggling for survival in an environment where their value might only be realized after it is too late.

3.2 Threats to Biodiversity Resources

3.2.1 Upstream Diversion of Freshwater

Eight percent of Sindh's geographical area consists of forests. These forests are of three kinds: riverine forests, mangrove forests and irrigated plantations. The riverine forests have been degraded due to the building of dams and barrages on the Indus and the irrigation system. Mangroves are

most abundant in the Indus Delta, which constitutes 97% of the total mangrove cover found in Pakistan. Originally, eight species of mangroves were found in the Indus Delta during the fifties. This has now declined to four species due to increasing levels of salinity. The mangrove cover has also reduced from 345,000 ha during the fifties to approximately 110,000 ha at present. This is primarily due to the lack of fresh water from the Indus flushing the delta and the resulting sea intrusion. Irrigated plantations constitute a very small percentage (7.25 percent) of the forest area of Sindh and are not an ecological alternative to the natural forests.

3.2.2 Depletion of Tree Cover

Sindh is also experiencing a depletion of its floral resources at an increasingly high rate because of a rise in both the human and animal (domestic) population, which results in over-exploitation. The absence of affordable energy options is a major factor along with the decreasing freshwater to the Indus Delta. Sindh's wildlife is threatened by similar adversities faced by floral resources in the province.

Although proper legislations exist, like the Forest Act, NEQS and the Wildlife Protection Act, their implementation and enforcement is weak, hampered by political interests and feudal influences. The administrative set-up is run on an ad hoc basis, with limited budgets and few trained persons.

A number of important NGOs that work in close collaboration with the government agencies and the corporate sector have initiated pilot projects for the conservation of wetlands and wildlife resources.

3.2.3 Climate Change Impacts

Pakistan has been ranked 16th on the Climate Change Vulnerability Index (CCVI) developed by Maple Craft. German Watch also places Pakistan as the "most affected" country for 2010 and in the top 10 for 1990-2010 by climatic changes. Droughts and unprecedented floods in the past few years are clear manifestations. Climate change is costing the economy in millions a year. Climate change can be expected to have a major impact on Sindh's agriculture in the form of: (a) a shift in the boundary of crops in the hot regions because of the rise in temperature; (b) a rise in crop water requirement, again because of an increase in temperature (which will put further pressure on groundwater resources); and (c) reduced productivity in dry years, because climate change is likely to make droughts more severe and frequent (World Bank, 2013). Rise in temperatures and droughts will also adversely impact the productivity of rangelands and increasing overgrazing will exacerbate the land degradation in Sindh.

3.2.4 Invasive Species

Invasive species are mostly non-native species introduced accidentally or intentionally by humans in a natural or established habitat, where they threaten the environment, economy and/or health. This biological pollution is considered a second potential threat to natural biodiversity after habitat loss. Fortunately, the magnitude of invasive species in Pakistan is not as great as in some other countries, but unfortunately, there is a deficit in context of invasion biology literature.

A floristic survey of the Indus delta was conducted over ten years from 2001 to 2011. During this work, 31 alien or non-native species were collected for the first time from the study area, of which three species, viz. *Prosopis juliflora, Salvinia molesta,* and *Eichhornia crassipes* were found to be highly invasive; the first was found in the terrestrial habitats and the latter two in freshwater to brackish aquatic ecosystems. Another 3 species were also found to be invasive, while 10 showed a tendency to become invasive in future. Invasive species are recognized as a big threat to the native biodiversity. They also create many other environmental problems and even threaten the health of human beings and livestock.

3.3 Provincial Biodiversity and Environment Laws and Regulation

There are close to 60 separate legal instruments at the federal, provincial, regional and local levels that directly or indirectly influence biodiversity. Most of these laws establish and provide for the functioning of local governments, irrigation and drainage bodies, port authorities, urban and rural development agencies, and water and sewerage boards.

PEPA Regulations for environmental impact assessments focus on large-scale and medium-scale projects (between 10 and 50 million rupees mostly for IEEs, above 50 million for EIAs; it varies according to the sector). Highly polluting small-scale operations are not covered. Even more important are the issues and processes that are not mentioned in the law such as wetlands themselves, climate change, environmental flows, community participation, collaborative management etc. For these matters, new legislation is required.

There are not many on the list, however the following are a few known provincial legislations related to or influencing biodiversity directly or indirectly:

i. Forest Act, 1927
ii. Sindh Wildlife Protection Ordinance, 1972 (SWPO)
iii. Sindh Fisheries Ordinance, 1980
iv. Sindh Environmental Protection Act, 2014
v. Sindh Agriculture Policy (In preparation)
vi. Sindh Irrigation and Drainage Authority Act, 1997
vii. Sindh Land Acquisition Act, 1894

4. BIODIVERSITY STRATEGY AND ACTION PLAN

4.1 Ecosystems, Habitats, Species and Protected Areas

According to the Convention on Biodiversity (CBD), biodiversity refers to the variety of life on earth and is the variability among living organisms from all sources. This includes diversity within species, between species, and of ecosystems. Biodiversity provides goods and services such as clear air, clean water, soil formation and protection, food, fuel, and ingredients for drugs. All of these are crucial to

the wellbeing of any society. Therefore, the loss of biodiversity affects these ecosystem services and its conservation is necessary for the long-term sustainability and wellbeing of any country.

The natural habitats of Sindh can be classified as subtropical deserts and constitute 62 percent of the province. The central irrigated zone commanded by canal irrigation is flanked geo-morphologically by two different arid zones; on the north eastern side by Tharparkar and Nara deserts and on the south western side by the sub mountainous region of Mahal Kohistan. The importance of the biodiversity of arid and semiarid lands is recently being increasingly recognized as these dry lands occupy more than 40 percent of Earth's land surface and have to support more than one billion people (Hassan 2003, Donaldson 2003). The natural flora and vegetation, being the primary producers, play the most pivotal role in every ecosystem by providing food and shelter to the natural fauna and livestock. In arid ecosystems, one of the most important ecological services of natural vegetation is the control of erosion. The process of desertification is known to be associated with decreasing species diversity and habitat degradation.

Figure 6: Hog Deer Found in Sindh

Roberts (1991, 1997) described the vegetation zones of Pakistan, and the vegetation zones represented in Sindh are described here. Of the ecosystems found in Sindh, Run of Kutch Grasslands is included in the list of global 200 priority ecosystems of the Millennium Ecosystem Assessment.

Besides floral diversity, Sindh is also rich in faunal biodiversity that includes 80 species of large mammals, 42 species of small mammals, approximately 414 species of birds, about 65 species of reptiles, and an estimated 5 species of amphibians (foreverindus.org). Among the mammals of Sindh, the Ibex / Wild Goat, Afghan Urial / Asian Wild Sheep, Indian Desert Gazelle / Chinkara, Black buck, Hog deer, Blue Bull, Striped Hyena, Indian desert wolf, Indian desert fox, Red Lynx, Jungle Cat, Pangolin, Indus blind dolphin, Blue Whale, Mouse-like hamster and many other wildlife species are found in different areas of Sindh (IUCN, 2004).

Figure 7: Sindh Ibex in Found Khirthar Range

4.1.1 Arid Sub-tropical Thorn Forest ecosystem

This ecosystem is found in the rocky areas north of the sea coast, extending to Sindh Kohistan in the north. Major species of flora include *Euphorbia caducifolia, Zizyphus nummularia, Acacia senegal, and Commiphora wightii.* Major species of fauna include the Indian fox (*Vulpes bengalensis*), Desert Cat (*Felis silvestris*), Chinkara (*Gazella bennettii*), and Sindh Wild Goat (*Capra aegagrus*).

4.1.2 Indus Plains Ecosystem

This ecosystem is found on the deep alluvial soils found along the banks of the Indus in upper Sindh. Major plant species include *Prosopis cineraria, Tamarix articulata, and Salvadora oleoides.* Major species of fauna include the Jungle cat (*Felischaus*), Wild Pig (*Sus scrofa*), and Desert Wolf (*Canis lupus pallipes*).

4.1.3 Sand Dunes

Extensive areas of undulating sand dunes are called the Thar Desert. The common flora includes *Propospis cineraria, Tamarix articulata, Euphorbia, Zizyphus and Calligonum ploygonoides.* Common species of fauna include the Desert Fox, Caracal cat (*Felis caracal*), Red Lynx (*Lynx rufus*), Chinkara (*Gazella bennettii*), etc.

4.1.4 Marsh Lands

This includes areas of summer flooding (flood plains along river Indus) and some permanent swamps (Nara Area, and Manchar Lake). Dominant flora includes *Saccharum spontaneum, Phragmites communis, Tamarix dioica, and Typha spp.* Common species of fauna include the Wild Pig, Hog Deer (*Axis porcinus*), Smooth Coated Indian Otter (*Lutrogaleper spicillata*), and Fishing Cat (*Prionailurus viverrinus*, etc.

4.1.5 Riverine Forest Ecosystem

Forest on the areas of the banks of the river Indus are subject to annual flooding. Dominant species include Babul (*Acacia nilotica*), Bahan (*Populus euphraitca*), and *Tamarix dioica*. Common species of fauna include the Wild Pig, Hog Deer, etc.

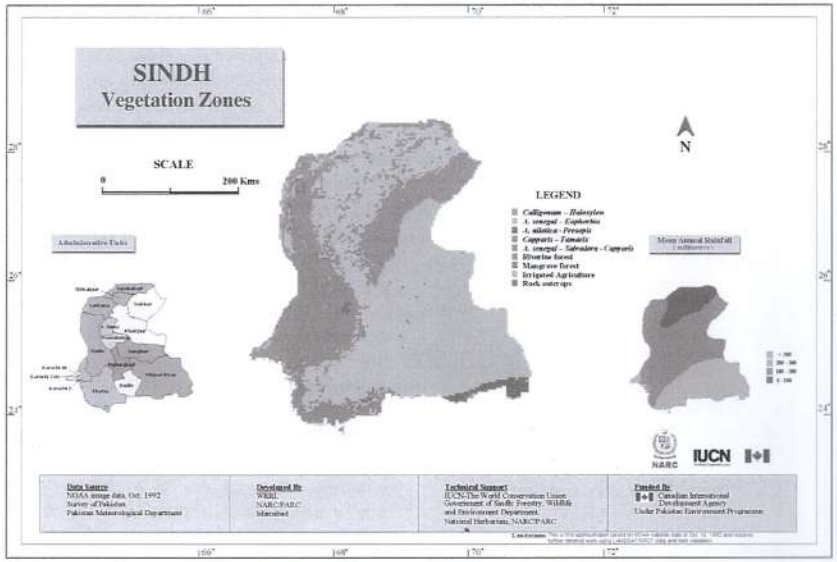
4.1.6 Littoral or Intertidal Zone

This includes the Indus delta, which is characterized by mangroves. The dominant tree species is *Avicinnia marina* with scattered *Rhizophora mucronata*. The dominant fauna includes the Smooth Coated Indian Otter, Fishing Cat, Plumbeous Dolphin (*Sousa plumbea*) and Finless Black Porpoise (*Neophocaena phocaenoides*).

4.1.7 Run of Kutch Seasonal Salt Marsh

This is an important refuge for the last population of the endangered Asiatic wild ass (*Equus hemionus)* and supports the one of the world's largest breeding colonies of the greater and Lesser Flamingos (*Phoenicopterus minor*). The vegetation consists of grasses and dry thorny scrub such as *Apluda aristata, Cenchrus spp., Pennisetum spp., Cymbopogon spp., Eragrostis spp., and Elionurus spp.* There are hardly any large trees. Seedpods from the *Prosopis spp* provide year-round food for the Wild Ass.

Plant species form an important component of the biodiversity of the province, are a source of fodder, and an important source of raw material. Sindh also has a variety of medicinal plants that are used in healthcare products, traditional medications, dyeing, as culinary spices, and in natural cosmetics and perfumes.



Map 1: Map of Sindh Showing Vegetation Zones

4.1.8 Conservation Issues and Management

The traditional communal management of natural resources has weakened over time, and consequently, many natural habitats have become open access common property resources. Uncontrolled grazing, collection of fuel wood, the breaking of land for cultivation, and indiscriminate hunting have caused large scale land degradation and loss of productivity. There has been no comprehensive national assessment of biodiversity, its status, and trends in Sindh. However, it is common knowledge that many species of wildlife are threatened with extinction. The conservation status of a few important species is given in Annex III.

The wildlife related laws have primarily focused on regulating hunting, shooting, and the protection of game species. There are also laws and rules made to regulate the harvesting of woody plants of economic importance, for example Gugul (*Commiphora wightii)*. In recent years, trade in wildlife species, particularly reptiles, turtles, Houbara bustard, and falcons has increased and many attempts have been made to smuggle these species. In addition, trade in skins and other body parts are common. In order to prevent the black market trade in flora and fauna, there is a need to formalize the sustainable use of biodiversity including those species on the CITES appendices that are abundant in Pakistan, and can be safely harvested under proper management.

The work on the establishment of a network of game reserves, wildlife sanctuaries, and national parks started in 1974 and since then, the numbers of such areas have steadily increased (Table2). The initial selection of sites for notification as game reserves and wildlife sanctuaries was not based

on any ecological considerations, but comprised of sites well known for game hunting. The total area under these protected areas comprises 9.27% of the total land area.

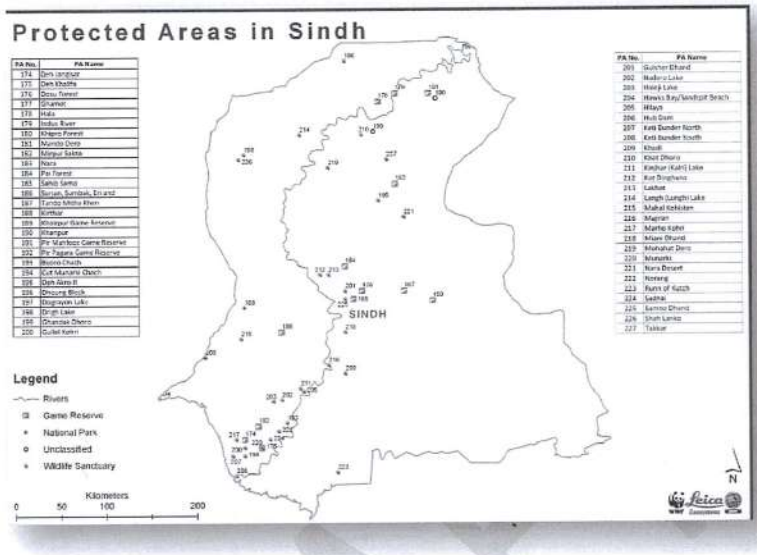
Table 2: Categories of Protected Areas in Sindh

Type of Protected Area	Number
National Parks	01
Wildlife Sanctuaries	33
Game Reserves	13
Unclassified	04
Total	**51**

Protected areas are established to achieve the long-term conservation of nature with associated ecosystem services and cultural values. The protected area list of Sindh is comprised of game reserves, wildlife sanctuaries, and national parks spread over approximately 12.5% of the area. The protected area system review of 2000 found that many of the protected areas of Sindh do not meet the globally accepted criteria, and a study undertaken in 2012 found many representation, ecological and management gaps in the protected area system.

Several initiatives were launched for the recovery of species, which include the captive breeding of endemic waterfowl species, hog deer, black buck, and marsh crocodile. In addition, biological studies of ungulates were undertaken in Khirthar National Park. The management plan for the Khirthar Protected Area Complex (KPAC) was revised covering Khirthar National Park, Mahal Kohistan, Hub Dam Wildlife Sanctuary and the Surjan, Sumbak, Eri, and Hothiano game reserves.

Two botanical gardens are presently operational, one at Karachi University and the other at Shah Abdul Latif University, Khairpur campus, for teaching purposes and for conducting research pertinent to flora species. Other organisations like Hamdard University and Horticultural Society of Pakistan also have their programme for developing botanical gardens for use by their members /students and communities.



Map 2: Location of Protected Areas in Sindh

4.1.9 Future Strategies and Actions

The following strategies and actions are planned for the conservation and sustainable use of ecosystems and habitats in Sindh, and contribute to the implementation of CBD strategic objectives and Aichi Biodiversity Targets.

Strategy 1. The network of protected areas and community conservation areas shall be expanded to ensure that all representative ecosystems, habitats, and threatened species are conserved.

Actions

1. By 2020, at least one Marine Protected Area will be identified and established.
2. By 2020, a district-wise study will be commissioned to determine the presence and abundance of species, potential and scope of conservation and sustainable use of natural habitats by local communities.
3. By 2018, the capacities of at least 2 communities shall be developed to conserve threatened game species under the sustainable sport hunting programme.

Strategy 2. The management of existing protected areas, including the buffer zones shall be improved so as to ensure that all critical habitats or species are moving towards a favourable conservation status.

Actions

1. By 2020, a monitoring, observation, and information system shall be established to detect and describe changes in the extent and condition of natural habitats and threatened species.
2. By 2020, management plans based on an ecosystem approach will be prepared and implemented in two major protected areas.
3. By 2020, recovery plans will be prepared and implemented for improving the conservation status of the three most threatened species.
4. By 2020, the Indus Blind dolphin and freshwater turtle will be protected in their distribution range through effective enforcement of laws.
5. By 2020, the Arabian Humpback whale and whale sharks will be protected through the adoption of effective protection measures.
6. By 2016, awareness programmes for the protection of vulnerable, threatened and protected wildlife species will be implemented.

Strategy 3. The regulatory and institutional framework will be improved to address the challenges of the 21st century for the conservation of biodiversity, its sustainable use and the equitable sharing of benefits by implementation of the Biodiversity Strategy and Action Plan.

Actions

1. By 2016, a policy or legal instrument for the conservation and sustainable use of natural habitats and wildlife will be formulated/updated and adopted.
2. By 2018, institutional effectiveness and the capacity of the Wildlife Department shall be enhanced to ensure effective management and monitoring of the biodiversity resources.
3. By 2020, at least 50 percent of the regular development budget will be dedicated to the implementation of the BSAP targets.
4. By 2017, at least two projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.

4.2 Forest Ecosystems

The Sindh Forest Department has control over 1.126 million ha (2.782 million acres) or eight percent of the area of which approximately 2.29 percent is forested, comprising of riverine forests and irrigated plantations. The remainder of the area consists of mangrove forests and rangelands.

Despite their vast importance to the ecological, economic, and social development of the province, forest sector needs are being side-lined in favour of other pressing concerns.

The forests are important sites that support a rich diversity of flora and fauna and supply the fuel wood and fodder needs of local communities. Forests are also important as grazing grounds for livestock and provide important non-timber products such as medicinal plants, spices, and honey. These areas have great potential in the development of ecotourism, which can generate income for the Forest Department to help with maintenance.

Table 3: Forest Types in Sindh

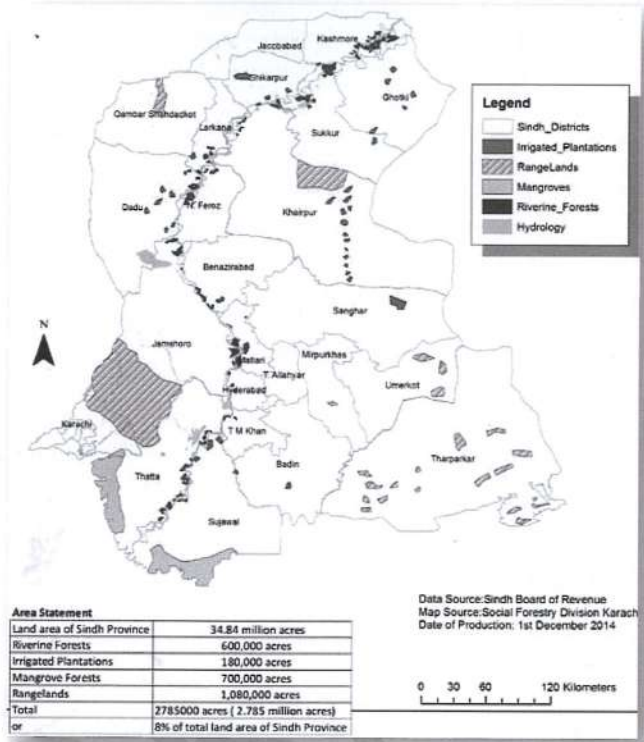
Forest Type	Area (ha)	Percent Area
Riverine forests	272,000	1.9
Irrigated plantation	95,000	0.7
Mangroves	281,000	2.0
Rangelands	437,000	3.1
TOTAL	**1,085,000**	**7.7**
Source: Forest and Biodiversity Information/Data Report , GoP 2012		

4.2.1 Conservation Issues and Management

Many important forest species are disappearing, owing to water deficiency, water-logging, and salinity, all of which induce severe land degradation. This will have far-reaching implications for other sectors including agriculture, wildlife, and wetlands, to name only a few. Water is the lifeline of the forest sector and this is a rapidly diminishing resource. Coupled with natural disasters related to climate change, and drought, the sustainability of the forests of Sindh is being threatened.

Figure 8: Mangroves of the Indus delta

A number of development projects in the Indus Delta are being implemented by the Sindh Forest Department for large scale rehabilitation of degraded mangrove forests. In addition, the IUCN is implementing a regional programme, Mangroves for the Future (MFF), for the restoration of coastal ecosystems; meanwhile, WWF Pakistan implemented the Indus for All Programme and Climate Change Adaptation Project with funding from international donors. The UNDP-GEF Small Grants Programme is also under implementation in the coastal areas of the Sindh province.



Map 3: Map Showing Forest Types in Sindh

Rangelands provide two-thirds of the forage for livestock feed in the arid zone. Rangeland management is a necessary supplement to livestock development, especially in the arid region. The rangelands in Sindh are mostly state property and it is necessary that they are managed in an integrated manner to ensure productivity in a sustainable manner. The arid regions of the province possess a large population of livestock and rangeland resources that hold great potential for development.

4.2.2 Future Strategies and Actions

The following strategies and actions are proposed to implement the CBD Programme of Work on Forest Biological diversity and contribute to the implementation of the Aichi Biodiversity Targets 2011-2020.

Strategy 1. Create an enabling institutional environment to mainstream biodiversity considerations in policy and planning processes to provide a sound basis for the conservation and sustainable use of forest biodiversity.

Actions:

1. By 2018, a current and updated assessment of flora in all forest types will be undertaken.
2. By 2018, the stakeholders, especially local, political, influential and communities etc. will be made aware and sensitized regarding the importance of Biodiversity in Forest areas.
3. By 2018, a forest classification map will be prepared using agreed international standards compatible with remote sensing technologies that include broad indicators of forest biodiversity.
4. By 2019, a baseline will be established using a GIS system to monitor, at five year intervals, the extent of deforestation and levels of forest degradation and their impact on forest biodiversity and ecosystem services.
5. By 2019, policy tools like incentives on retaining trees on farmlands and carbon credit payments for avoided deforestation will be devised and the potential for their introduction will be assessed through a survey. (Private sector engagement).
6. By 2018, a study will be commissioned to assess the economic and environmental value of riverine forests and irrigated plantations.
7. By 2018, the Code for the preparation of management plans shall be revised to incorporate the ecosystem approach for sustainable management of forests for their environmental and biodiversity values.
8. By 2018, the forest and forest-related policy, laws, and planning systems will be reviewed, updated and implemented to provide a sound basis for conservation and the sustainable use of forest biological diversity.
9. By 2016, the revised BSAP will be adopted as a strategy, and implementation and monitoring mechanisms will be in place.
10. By 2020, at least 50 percent of the regular development budget will be dedicated to the implementation of the BSAP targets.

Strategy 2. The forest biological diversity, including ecosystem services, shall be protected and restored through the adoption of an ecosystem approach for the management of all types of forests.

Actions:

1. By 2016, a guide will be developed for the application of ecosystem approaches suitable for specific forest ecosystems.
2. By 2017, workshops will be held to train and familiarize forest managers with the foundations, principles and modalities of the ecosystem based approach.
3. By 2017, a study will be commissioned on the potential and scope of managing riverine forests and irrigated plantations for their environmental and biodiversity values.
4. By 2018, the Code for the preparation of management plans shall be revised to incorporate the ecosystem approach to the sustainable management of forests and biodiversity.
5. By 2020, incentives will be introduced for raising energy plantations on marginal farmlands, and the development of mechanisms for incentivizing community based forest conservation actions will be encouraged.
6. By 2019, at least one hotspot representing all forest types, including rangelands, with particular importance for biodiversity, shall be given appropriate conservation status and effectively managed in an equitable manner, and integrated into the wider landscape.
7. By 2019, at least 5 landscapes (2 Coastal, 2 Riverine, and 1 Irrigated plantation) that contribute to the health, livelihoods and well-being of local communities will be restored and safeguarded.
8. By 2020, reforestation of mangroves, irrigated plantations, and degraded rangelands will be undertaken.
9. Projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.

Strategy 3. The threats to loss of forest biodiversity shall be reduced, and their impacts mitigated by reforming the rights and concessions of local people, and developing alternative resources to satisfy the *bona fide* needs of local communities.

Actions:

1. By 2019, local communities will be engaged in the sustainable use of NTFPs, like Apiculture, seed collection and sale, tourism and associated activities.
2. By 2020, co-management regimes will be promoted in forest areas to enhance participatory forest management.
3. By 2020, community incentive payment schemes will be introduced to support retention of tree cover.
4. By 2020, incentives for raising energy plantations on marginal farmlands will be introduced.

4.3 Inland Waters, Coastal Areas and Marine Ecosystems

Wetlands are amongst the most productive ecosystems in the world, with extensive and rich food webs and biodiversity. Due to their location on the flyway to Central Asia and South Asia, Pakistan's wetlands serve as the breeding and wintering grounds for migrating birds from Central and Northern Asia.

Wetlands are important sites of biodiversity in Sindh; nine protected wetlands under the RAMSAR Convention are located here: the Indus Dolphin Reserve, Kalri Lake, Drigh Lake, Haleji Lake, Jubho Lagoon, Nurruri Lagoon, DehAkro, Runn of Kutch, and the Indus Delta. Sindh's coastal and estuarine wetlands serve as critical breeding, rearing, staging, and wintering grounds for migrating birds and

house a number of globally important fish and shellfish species. During the migration season, thousands of water fowl belonging to 108 species use this habitat. Freshwater wetlands also host a vast array of flora and fauna endemic to Sindh.

Wetlands have significant economic importance for local communities, who harvest several wetland species of fauna and flora for food and for economic gain. Sindh's wetlands feed an ever-increasing human population and a substantial dependent population of wetland species, both plant and animal. If wetlands are degraded the people dependent on them are also adversely affected, along with the interconnected ecosystem.

The inland water ecosystems of Sindh comprise of wetland complexes of the Indus River, Indus River Delta, numerous natural lakes, and manmade reservoirs. The Indus River Wetlands Complex consists of a continuum of braided and meandering river channels, oxbow lakes and seasonally flooded depressions. The GEF wetlands project recently implemented in Pakistan identified 30 major wetlands in Sindh (Annex IV). There is no accurate assessment of the total area of all the wetlands; however, estimated surface area of the wetlands in Sindh is shown in Table 4. The wetlands are not only the lifeline for agriculture, they also provide livelihoods to thousands of people through artisan fisheries, and serve as a refuge for large numbers of wintering migratory birds.

Table 4: Major Wetland Types in Sindh

Type of Water Body	Surface Area (ha)
Indus Wetland Complex	1,160,000
Canals and Drains	32,000
Abandoned Canals & Drains	98,000
Natural lakes	
Reservoirs	
Water logged areas	3,000,000
Indus Delta	385,000
Total	3,385,000
Source: WAPDA	

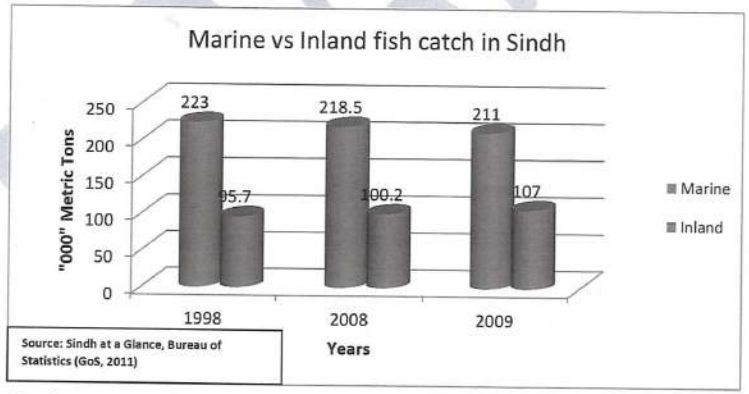
The marine ecosystems are comprised of the Arabian Sea (Map 4), sandy and rocky beach ecosystems, estuaries, coastal lagoons, and backwaters. The mangrove vegetation, which covers over 86,727 ha (IUCN, 2005) is mainly restricted to river estuaries with scattered patches along the coast. Although mangroves play a useful ecological role, their economic value is not well documented. Pakistan's sea-coast lying between Sir Creek in Sindh and Jiwani in Baluchistan measures 1098 km, with 768 km in Balochistan and 330 km in Sindh province. The marine fisheries are a direct source of livelihood for over a million people comprising more than 125,000 households.

Map 4: Map Showing Arabian Sea

The role of fisheries in the country's economy is important and it is the principal source of livelihoods for the dependant fishermen communities living along the coast as well as rivers, lakes and dams. Both the inland and marine fisheries are a very important source of animal protein. Nevertheless the share of fisheries in GDP is small, but it contributes substantially to the national income through export earnings. During 2007-08, around 135,000 metric tons of fish and fishery products were exported, earning US$ 213 million.

Sindh holds a premier position in the fisheries sector of Pakistan. It commands almost 100 percent of brackish, 65 percent of freshwater, and 71 percent of the marine fish resources of the entire country. The exploitation of inland and marine resources (up to 12 nautical miles) in a judicious and sustainable manner to ensure conservation and development has been the responsibility of the Fisheries Department of Sindh. These resources constitute about 350 species of marine, over 120 species of freshwater and 15 species of commercially important marine shrimps.

Fishing rights on about 1202 public waters in Sindh are given on a yearly lease through an open auction and licensing system. The local fishermen are allowed to bid and participate in it. Sindh Fisheries Ordinance, 1980 governs fishing. Besides the above fishing waters, there are five main waters where fishing rights are given through individual licensing to fishermen. These are: Manchar Lake in Dadu District, Lake Bakarin Sanghar district (now Chotiari reservoir), Sindh Dhoro in Jacobabad district and River Indus below Kotri Barrage. There is no consistent policy regarding this and it is always open to changes by vested interests and political influence.



Graph 1: A Comparison of Marine and Inland Fish Catches in Sindh

International Agreements and Protocols in Fisheries

UNCED Agenda 21, 1992: the protection and preservation of highly diverse marine ecosystems and the problems that degraded ecosystems pose to marine fishing activities.

The **1995 UN Fish Stocks Agreement**, the need to maintain the integrity of ecosystems and to consider problems posed by fishing and degrading ecosystems.

The **1995 FAO Code** of Conduct for Responsible Fisheries, an ecosystem-based approach to fisheries management. Artisanal and small-scale fisheries are accorded special recognition and it is the only fisheries subsector specifically mentioned in the Code.

Source: Briefing Note on Legal Framework for Managing Land-based Activities that Impact the Coastal and Marine Environment in Pakistan, IUCN Report for GPA-UNEP (2005

The fisheries sector plays an important role in the alleviation of poverty and the achievement of food security in many parts of the world. In many economies, fisheries exports generate more foreign exchange than the revenues earned from any other traded food commodity such as rice, cocoa, coffee or tea (FAO 2004). According to the Economic Survey of Pakistan 2006-2007 (ESP 2006-2007), fisheries are the principal source of livelihoods for many rural communities inhabiting the coastline of Sindh, as well as inland along the major rivers, and in the vicinity of lakes and dams. The fisheries sector is estimated to provide direct employment to about 379,000 fishermen and 400,000 people in ancillary industries (State Bank of Pakistan).

Marine fisheries make a significant contribution to the national economy through export earnings and play an even more important role in the livelihood of coastal fisher folk who rely on this activity as their sole source of income.

Figure 9: Artisanal Fishing Practices in the Coastal Sindh

In Sindh, fishing is an important source of livelihood as the entire southern end of the province is lined by 350 km of coastline. In 2000, 84 693 MT, valued at Rs.7.9 billion, of fish and fish products were exported, accounting for 48 percent of the total export of the country (out of a total estimated at 665 000 MT). This makes marine fisheries a key livelihood source for the people of Sindh. The total number of people engaged in the fisheries sector during 2000 and 2001 was estimated at 360,000. Out of this figure, 135,000 people (37.5 percent) were engaged in marine and 225 000 (62.5 percent) in inland fisheries. In terms of marine productivity, Sindh is considered to be the most productive area. This area is marked by a broader continental shelf, extending 110 km from the coast, which is indented by a number of creeks in the Indus Delta. This particular area has been subject to overexploitation of its resources by unchecked and uncontrolled fishing practices.

4.3.1 Conservation and Management Issues

Today, Sindh's wetlands are being adversely impacted because of the decreasing discharge of water and sediment downstream of the Kotri Barrage. This is especially true of the coastal and estuarine wetlands, which need a certain amount of freshwater to be sustainable. As no sediment nourishment takes place, the rate of erosion increases, coupled with seawater intrusion due to low environmental flows.

There are approximately 15,000 fishing vessels of various sizes ranging from small to medium-sized boats, large launches and trawlers engaged in fishing. The boats are used for fishing in creeks and within the 12-mile territorial limit which falls under provincial jurisdiction. The larger launches go into deeper waters on extended fishing excursions. Most of the fish catch is exported with little value addition. The species exported are mainly shrimp (65%) and the rest are Indian mackerel, ribbon-fish, tuna, sole and crab. Over-fishing, including during the breeding season (June–August), has led to a steep decline in shrimp catches. Sardines are caught as trash fish and converted into chicken feed.

The flora of Pakistan has reported eight species of mangroves; however, *Avicennia marina* is the most predominant among the mangroves of Pakistan. Anthropogenic influences include excess nutrient input resulting in eutrophication, anoxic conditions and fish kill events. The Indus Delta is heavily polluted by a variety of industrial effluents, sewage, solid waste and nutrient-enriched irrigation water. The mounting pressure of the rapidly increasing population has also led to the clearing of mangrove areas for industrial and agricultural purposes as well as for urban expansion.

A 20 km stretch of beaches in Hawkes Bay and Sandspit are nesting grounds of the green turtle (*Chelonia mydas*) and the olive ridley turtle (*Lepidochelys olivacea*). Nesting and hatching of green turtles takes place all year round, with peak nesting in September and peak hatching in October. Marine turtles in Pakistan face multiple threats, of which the major threats are egg predation and incidental catch in fishing craft. Turtles have also died due to oil pollution from vessels. Other threats include depredation on green turtle hatchlings by sea gulls, crows, foxes, jackals and stray dogs. The development of Gwadar as a port city and the operation of the Gwadar port is likely to take away many of the small beaches that serve as nesting habitats for the turtles in the locality.

The following wetland and marine ecosystems of Pakistan are included in the list of global 200 priority ecosystems of the Millennium Ecosystem Assessment (Table 5).

Table 5: Global 200 Eco-regions represented in Pakistan

Global 200 Eco-region	Conservation Status	Representation in PA System
Runn of Kutch Flooded Grasslands	Critical or endangered	Adequate
Indus River Delta	Critical or endangered	Inadequate
Arabian Sea	Critical or endangered	No representation

The coastal and marine biodiversity faces numerous threats, some of which require action at a national level while others require global action. The national level actions include control of pollution to levels that are not detrimental to biodiversity, sustainable fisheries, and establishing

protected areas. The political economy and the socio-economic problems cannot be dealt with laws alone and experience has shown that a ban on fishing to promote conservation is not a feasible option. The communities who depend on fishing for their livelihoods traditionally had open access rights to the fisheries. Therefore policy measures to address the problem of loss of biodiversity must integrate access rights and community-based management in the fishery management and conservation plans. The fisher folk usually have the knowledge of the resources and their use and can take measures to perform the necessary management functions such as limiting entry, fishing gear regulation, collection of resource rent, and benefit distribution. Marine protected areas that are off limits to fishing and limit local pollution may help raise the resilience of local ecosystems to climate change and ocean acidification. Protected areas can benefit both fisheries and tourism by preserving important spots of marine biodiversity and fish spawning grounds.

Various conservation initiatives related to reforestation of mangroves and wetland biodiversity have been taken by the government and civil society organisations. Some of the significant initiatives include the GEF funded wetlands project, the Indus for All Programme by WWF and the Mangroves for the Future programme under the IUCN. However, efforts need to be scaled up to prevent further loss of biodiversity and to ensure adaptations for the impending impacts of climate change, especially to protect the poor and marginalized.

The system of leasing out yearly fishing rights to individual contractors who later employ fishermen at an exploitative wage, has not been in the interest of the fishermen and is the cause of low production and damage to the already fragile ecosystem in the wetlands. The lessees (contractors) buying fishing rights on a yearly lease comb out the entire biomass, including sub adult and juvenile fish, from the waters. Neither the contractor nor the Fisheries Department keeps any record and statistics of fish production and stock of fish. Fishermen often complain of no credit facilities and non- participation in fishing lease auctions. If this process continues, marine life in Sindh will be drastically depleted.

4.3.2 Future Strategies and Actions

The following strategies and actions are proposed to implement the CBD Programme of Work on Wetlands Biological diversity and contribute to the implementation of the Aichi Biodiversity Targets 2011-2020.

4.3.2.1 Freshwater Wetlands

Strategy 1. Conservation of fish and other aquatic organisms, and equitable sharing of benefits shall be ensured through sustainable management of fisheries by incorporating biodiversity considerations in the legal, regulatory and policy frameworks of inland sectors.

Actions:

1. By 2016, develop management guidelines for sustainable aquaculture in coastal and inland areas will be developed.
2. By 2016, a policy will be formulated and adopted for controlling the introduction of any alien species.
3. By 2018, a biodiversity reserve shall be established in a major water body in Sindh.
4. By 2018, a policy will be developed for sustainable fisheries and aquaculture, incorporating biodiversity considerations.

Strategy 2. Appropriate measures shall be taken to prevent the introduction of freshwater invasive species and control their spread to other areas, and where feasible, invasive alien species will be eradicated in habitats of significant biological diversity.

Actions:

1. By 2018, an assessment of the damage wrought to three selected inland aquatic bodies and marine ecosystem by alien species will be carried out, and a plan for the eradication and elimination of alien species will be developed.
2. By 2019, at least 1 alien species will be eradicated from waters of Sindh (e.g. Tilapia – Manchar).

Strategy 3. Measures will be adopted to promote the sustainable management of fisheries resources and to recover depleted fish stocks.

Actions:

1. By 2020, at least 2 closed fishing areas will be established.
2. By, 2017, hatcheries and demonstration ponds will be established to produce fish larvae to replenish stocks in depleted water bodies.

4.3.2.2 Coastal Wetland and Marine Areas

Strategy 1. The coastal and marine biodiversity shall be conserved through specific measures aimed at making coastal communities resilient to the impacts of climate change.

Actions

1. By 2017, a Climate Change Adaptation Plan for Coastal areas will be prepared.
2. By 2019, the interests of women, indigenous and local communities will be safeguarded through the sustainable management of major wetlands.

Strategy 2. The coastal and marine biodiversity resources will be conserved and used in a

sustainable manner through awareness and capacity development of coastal fishing communities and other organisations.

Actions

1. An awareness programme for the protection of vulnerable, threatened and protected fish species will be implemented in coastal areas.
2. The institutional capacity of relevant organisations will be strengthened for the effective enforcement of fisheries laws against illegal fishing, and especially destructive practices.

Strategy 3. The coastal and marine fisheries regulatory and institutional framework will be improved to address the challenges of the 21st century for the conservation of biodiversity, its sustainable use and the equitable sharing of benefits.

Actions:

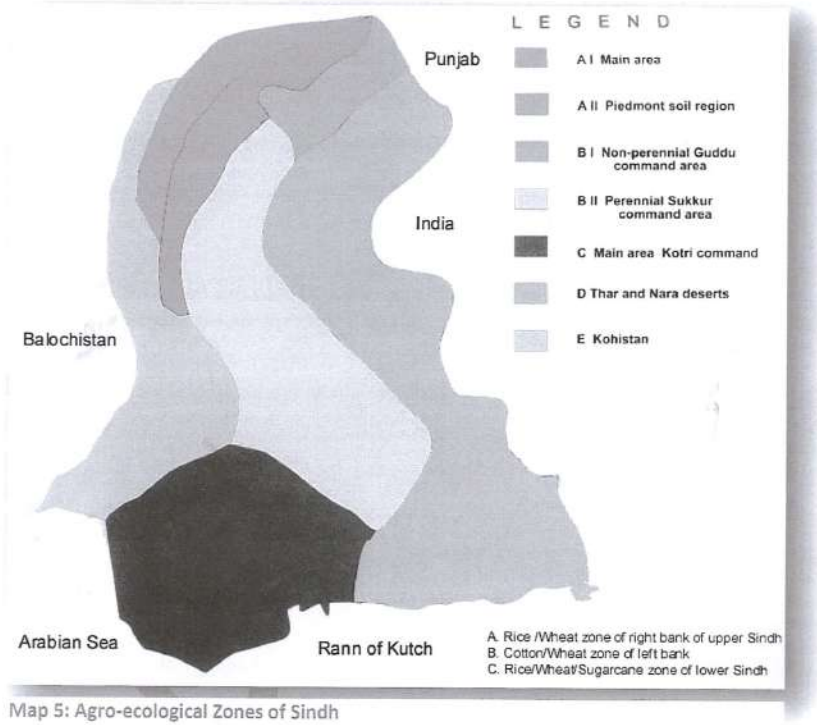
1. By 2017, policy/legal instruments will be developed to regulate operating fishing fleets (shrimp trawlers) on the basis of sustainable use limits.
2. By 2019, the numbers of operating shrimp trawlers and fleets along the Sindh coast will be capped at existing levels.
3. By 2019, 1,500 existing boats will be modified to incorporate better fishing methods.
4. By 2020, measures will be adopted for the protection of threatened species through the effective enforcement of fisheries legislation.
5. By 2018, 2 % of the annual developmental budget will be dedicated to biodiversity conservation.
6. By 2018, a federal funded project should be developed for the major allocation of biodiversity related issues.
7. By 2019, protection and restoration of vulnerable ecosystems (Coral reefs and Mangroves) from anthropogenic factors will be undertaken to promote the wellbeing of the coastal community.

4.4 Agrobiodiversity

The backbone of the economy of Sindh, agriculture, is a multifaceted sector with far-reaching implications on issues ranging from rural poverty, food security, water resource management, infrastructure development, employment opportunities, and export earnings. The policies of this sector thus have a great influence on those of other related sectors in Sindh. Agriculture is one sector where the necessity of a multidisciplinary approach is very clear in order to develop, and promote sustainable agriculture, conserve agrobiodiversity, and ensure the equitable sharing of benefits.

It is estimated that the agricultural sector in Pakistan contributes 24 percent to the overall GDP, employs 42 percent of the labour force of the country, and is the main means of livelihood for 68 percent of the rural population. The major field crops sown consist of wheat, cotton, rice, and sugarcane, which utilize 68 percent of the total cropped area. Sindh also produces a vast variety of horticultural crops of which mangoes, bananas, and chillies predominate. Many prominent industries like the textile and sugar industries depend on raw materials from the agricultural sector.

Based on these figures, the funds allocated to this sector are not proportionate, making it difficult



Map 5: Agro-ecological Zones of Sindh

for it to reach its potential. As they are major players in alleviating rural poverty in the province, policy-makers need to rationalize funding and policies to stimulate growth opportunities while simultaneously ensuring that this growth does not affect long-term environmental sustainability in the agro-zone.

4.4.1 Conservation and Management Issues

Rapid socio-economic development, climate change effects, the introduction of high yielding crops, exotic fruit varieties, the growing use of pesticides, and artificial insemination and cross breeding are the common factors that are eroding the natural heritage of agro biodiversity. There are no policies and laws for the conservation of agro biodiversity or to regulate the introduction of new varieties

and breeds in the area. Furthermore the Agriculture and Livestock departments lack the capacity and financial resources to effectively manage biodiversity resources.

The government is also considering amendments to laws related to the agricultural sector including the Fertilizer Law, Plant Breeders Rights Act, and the Land Act to incorporate current trends and issues in these fields. Work is also being done on drafting legislation for the protection of Intellectual Property Rights, due to be sent to the National Assembly for approval shortly. The Sindh Seed Corporation is being revived to work in public/private partnership. In addition, the government has notified the biosafety rules to check the movement of harmful Genetically Modified Organisms (GMOs). These rules will apply to all GMOs and will allow their import only after risk assessment according to global standards. The government will establish a national biosafety committee, a technical advisory committee, and institutional biosafety committees. Institutions and organizations engaged in biotechnology or genetic manipulation will appoint or designate biosafety officers. These officers will assist and coordinate with the biosafety committees to review, on a regular basis, the operating procedures and biosafety records, and to assess the integrity of containment facilities and safety equipment/utilities. These rules will enhance food security, improve existing crops, and protect them from attacks by pests and diseases.

4.4.2 Future Strategies and Actions

In order to address these issues and to contribute to national actions for achieving the strategic objectives of the CBD and the Aichi Biodiversity Targets 2011—2020, the following strategies and actions are proposed.

Strategy 1. Adopt appropriate policy and legal measures that promote the positive and mitigate the negative impacts of agriculture on biodiversity, and enhance productivity and the capacity to sustain livelihoods.

Actions:

1. By 2016, a study will be commissioned on the incentives that promote unsustainable agriculture, and will suggest ways and means for sustainable agriculture so as to increase the benefits for, and the wellbeing of people.
2. By 2017, the legislation to prevent and regulate the use of toxics and harmful chemical sprays on crops will be prepared/ updated.
3. By 2019, biological means of pest control in agroecosystems will be demonstrated to promote organic food production, support the diversity of beneficial insects and prevent contamination of the food chain.
4. By 2018, a management protocol will be developed and implemented to contain / eradicate the identified alien and invasive species from the agroecosystem.
5. By 2017, an agriculture policy will be prepared and adopted to promote sustainable agriculture, incorporating considerations for the conservation of the genetic diversity of crops, fruits and farmed animals, and for the control and eradication of invasive alien species.
6. By 2020, at least 50 percent of the regular development budget will be dedicated to the implementation of the BSAP targets.

7. By 2018, projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.

Strategy 2. A comprehensive assessment shall be undertaken of the status and trends of the local varieties of crops and breeds of farm animals, including the traditional/ local knowledge of management of agro biodiversity, and measures initiated for *in-situ* and *ex-situ* conservation.

Actions:

1. By 2017, pilot projects will be developed and implemented to test and develop models of sustainable agriculture and conservation of agrobiodiversity in three different agro ecosystems.
2. By 2018, an action plan will be prepared for the implementation of adaptation techniques for sustainable agrobiodiversity ecosystems.
3. Assistance will be provided to small scale farmers for the establishment of models of sustainable agriculture.
4. By 2017, an updated assessment of local crop varieties will be prepared in collaboration with relevant research institutes like the Centre for Plant Conservation at Karachi University and Agriculture University Tando Jam to determine their existing status.
5. By 2016, the diversity of local varieties of crops, fruits, and local knowledge of their management will be documented.
6. By 2016, an assessment of the diversity of breeds of livestock and poultry and local knowledge of their management will be documented.
7. By 2017, a pilot project will be prepared and implemented for *in-situ* and *ex-situ* conservation of crop biodiversity.
8. By 2017, a pilot project will be prepared and implemented for *in-situ* and *ex-situ* conservation of livestock and poultry biodiversity.
9. By 2020, the traditional knowledge, innovations and practices in six different geographical areas relevant for the conservation and sustainable use of biodiversity will be documented and promoted.

Strategy 3: Allocate and mobilize appropriate resources for the implementation of the Sindh Biodiversity Strategy and Action Plan for the agriculture sector

Actions:

1. By 2016, at least 25 percent of the regular development budget will be dedicated to the implementation of the BSAP targets.
2. By 2017, projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets. Rs. 5.0 million.

4.5 Environmental Protection

4.5.1 Conservation and Management Issues

Seventy-three percent of the farms in Sindh use fertilizer and 23 percent of the farm areas are provided with pesticide cover. The irrigation drainage channels carry these toxic pesticide and fertilizer residues drained from the fields. Since LBOD and RBOD have not been effective in discharging the drainage effluent into the sea, the toxic effluent has been accumulating in the soil and moving slowly into the groundwater sources. Unless this is prevented, water will become a severe danger to health conditions in the province.

Figure 10: Pollution in Indus River at Sukkar

In the absence of proper disposal and treatment facilities, municipal and industrial effluent in Sindh is discharged into the nearest drainage canals, depressions, water channels, rivers, or the sea. The wastewater from Sukkur is released directly into the River Indus, which from Hyderabad is discharged into the Phuleli Canal, and sewage water from Kotri is discharged into the Kalri Baghar canal that brings water to Karachi. Karachi's effluent goes directly and mostly untreated into the sea.

Sewage collection and disposal is available in Sindh to approximately three million of the urban population, a mere 28 percent. The neglected population includes *katchi abadis*, the industrial areas, as well as the informal manufacturing sector located in residential areas and commercial areas. A part of the untreated, discharged wastewater is used for farming purposes. The produce of this wastewater is a major health hazard. However, as wastewater increases, so does the area using it for cultivation.

In Karachi, there is provision for the treatment of only 80 MGD of the over 250 MGD of sewage generated by the residential and industrial areas of the city. Only 25 percent of this 80 MGD capacity is utilised since the sewerage system to carry it to the treatment plants is not in place. The untreated sewage is discharged as a raw mix of sewage and industrial waste into the seasonal Lyari and Malir Rivers. These two streams were dry *nalas* in the past but are now perennial sewage streams that discharge into the Manora Channel and the Phitti Creek. Due to this, seawater in the Manora Channel as well as the Phitti Creek is highly contaminated and has resulted in the loss of biodiversity in aquatic life.

Figure 11: Effluent Pouring Directly in Seawater

The management of municipal solid waste in all the urban centres of Sindh comprises neighbourhood garbage dumped at a *kachra kundi* from where it is taken by trucks and dumpers and hauled to distant landfill sites. In the small towns, only an estimated 30 to 40 percent of solid waste is picked up. Out of this, only 50 to 70 percent is transported to a dumping site, which in most places is undeveloped. Most municipalities undertaking collection and removal activities do not have proper transportation fleets, nor do they have the finances for the regular operation and maintenance of vehicles. The remaining solid waste is picked up by scavengers for sale to middlemen who then transport it to the recycling industry in the larger cities.

Karachi generates a very large volume of solid waste and also has a large recycling industry. There is an urgent need to formally integrate the recycling industry into the solid waste management strategy for Karachi, for without their participation, it will be increasingly difficult to develop an efficient system of waste disposal.

Karachi has only two official dumping sites located to the west and north of the city. These are rather difficult for the southern and eastern parts of the city to access. Since these sites are underdeveloped a large number of informal sites (many of them along creeks and beaches) have cropped up recently, creating immense environmental hazards for the natural and the constructed environment. In addition, residents and municipal authorities are forced to burn solid waste in neighbourhoods where waste cannot be lifted. This causes further deterioration to the environment.

Traffic volume in Sindh has escalated tremendously over the last 55 years and so has the level of air pollution on the main roads of Karachi and in other urban centres. For instance, according to reports, the vehicular traffic of Karachi city has increased by a factor of 32 in 40 years. Statistics illustrate that the number of vehicles in the city has risen from 20,000 in 1948-49, to 646,582 vehicles in 1988- 89. There may be close to a million vehicles on the streets of Karachi in the daytime. This amounts to over 50 percent of the vehicles in the province as a whole. The natural consequence of the increase in vehicular population is congestion and an increase in the level of air and noise pollution.

4.5.2 Future Strategies and Actions

In order to address these issues and to contribute to national actions for achieving the strategic objectives of the CBD and the Aichi Biodiversity Targets 2011—2020, the following strategies and actions are proposed.

Strategy: Biodiversity considerations will be integrated into the environmental laws and regulations and strictly enforced to ensure major economic development projects do not contribute to loss of biodiversity.

Actions:

1. By 2016, biodiversity considerations will be integrated in the EIA guidelines.
2. By 2017, EIA guidelines will be translated into local languages and disseminated for public awareness.
3. By, 2017, a study will be commissioned to assess and incorporate biodiversity values in existing EIA legislation and relevant policy instruments.
4. By 2017, a study will be commissioned to identify the sources and magnitude of pollution that can have a negative impact on biodiversity, and propose control measures and incorporate the findings in environmental laws.
5. By 2017, a policy for clean environment in Sindh incorporating biodiversity considerations will be prepared, adopted and implemented.
6. By 2016, at least 50 percent of the regular development budget of the environment department will be dedicated to the implementation of the BSAP targets.
7. By 2017, projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.

5. PROPOSED IMPLEMENTATION OF BIODIVERSITY STRATEGIES AND ACTION PLAN

5.1 Introduction

A strategic plan, no matter how good it is, will not achieve the desired results if it sits on a shelf, and failing to implement it is not only waste of time in planning, but also hurts the organization, the team, and individuals. Implementation of the Convention on Biological Diversity is not only our international obligation but it also represents the need to preserve the natural heritage and ecological integrity of the environment we live in, and well-being of our people. Therefore the Biodiversity Strategy and Action Plan (BSAP) must be considered as part of the whole process of results, and all the efforts made in its preparation will go to waste if not implemented. Effective implementation will require working with and building the capacity of stakeholders, communicating, reaching out to mainstream biodiversity values in the policy and planning processes for people to conserve and use it sustainably; and mobilizing resources for its implementation.

5.2 Communication and Outreach Strategy

The overall responsibility for raising the awareness of people and integrating biodiversity considerations into the national policy, planning and accounting mechanisms shall rest with the federal government. The federal government will use mass and informal communication means for raising awareness and mainstreaming biodiversity. This will include the formation of a cadre of environmental journalists who will act as 'biodiversity champions' for print media and contribute articles, produce audio messages for radio, and video clips for TV. The informal communications will focus on organizing a focus group comprising of 'opinion leaders' drawn from amongst the policy makers, planners and politicians, who will spread the message in informal settings such as in the corridors of the workplace, or at social functions.

5.3 Actions to Achieve the Strategy

A review of BAP implementation undertaken during the process of preparation of Pakistan's Fifth National Report to the CBD in 2014 revealed that after 14 years of BAP approval, the BAP had not been fully implemented and many recommendations were either partially implemented or not implemented at all. Among other reasons, lack of political will, insufficient financial resources, and weak implementation contributed to less than satisfactory progress on the BAP. Keeping in view the lessons learnt, and based on discussions with stakeholders during the planning process, the following actions will be taken for effective implementation of the Biodiversity Strategy and Action Plan in Sindh.

1. The BSAP, prepared in consultation and with the active participation of the stakeholders, shall be approved at the appropriate level of government as a policy document;
2. A Steering Committee shall be established in the Planning and Development Department to ensure mainstreaming of the BSAP in the policy and planning processes, coordination among different sectors, and its integration in the poverty reduction and climate change plans;

3. A Coordination Committee shall be established for cross-sectoral coordination, monitoring progress on the implementation of the BSAP, and providing a mechanism for the sharing of experiences among stakeholders.

5.4 Sectoral Actions

The strategies, principles and SMART targets have been organized separately for different thematic areas of biodiversity and are managed by different sectors. The agencies responsible for different sectors will develop project proposals, and get approvals and required financial allocations to start implementation by the suggested dates. The project proposals will define indicators and set milestones for achieving the targets.

The Biodiversity Strategy and Action Plan will require the concerted effort of all the stakeholders for achieving the targets in an effective and timely manner. In addition, from time to time, the stakeholders may require administrative and technical support. Therefore, a Biodiversity Coordination Committee comprising of all the stakeholders shall be set up to provide technical guidance and monitor progress on the implementation of the BSAP. The Committee shall meet at least on a bi-annual basis and shall be comprised of the following members:

Secretary, Forests and Wildlife Department	Chairman
Chief Conservator Forests	Member
Conservator of Wildlife	Member
Director General, Fisheries	Member
Director General, Agriculture	Member
Director General, Livestock	Member
Director General, EPA	Member
Representative, IUCN	Member
Representative of WWF	Member

The functions of the Committee shall include but are not limited to the following:

- Review of BSAP progress of implementation, including the monitoring of outputs, and outcomes.
- Facilitation of inter-departmental communication and coordination.
- Identification of ways and means to build the professional and financial capacities of the stakeholders for achieving BSAP targets.
- Preparation of input for the steering committee meeting.
- Ensure adequate financial and human resource allocations for implementation of the BSAP.
- Ensure adequate policy support for implementation of the BSAP.

5.5 Mainstreaming BSAP in Poverty Reduction and Climate Change Plans

Biodiversity is a multidisciplinary subject and effective implementation of the various articles of the CBD and decisions of the Conference of the Parties (COP) requires coordination among various stakeholders in Sindh on one hand, and liaison with the federal government on the other hand. So far there has been no designated focal point for the CBD in Sindh and consequently, there has been a complete lack of information flow between the national focal point for the CBD and the province.

In view of the above, a provincial focal point for Sindh needs to be designated for coordinating with the Ministry of Climate Change in all matters related to the CBD and reporting progress.

Effective implementation of the BSAP requires addressing the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society (CBD strategic objective 1) and integration of biodiversity values into national and local development and poverty reduction strategies and planning processes (Aichi Biodiversity target 2). Therefore, in order to achieve these objectives and ensure support to the implementation of BSAP at the highest level, it is proposed to establish a BSAP Steering Committee headed by the Additional Chief Secretary (Dev)

The proposed constitution of the Steering Committee shall be as follows:

Additional Chief Secretary (Dev)	Chair
Secretary Forests, Wildlife & Environment	Member
Secretary Agriculture and Supplies	Member
Secretary Fisheries and Livestock	Member
Secretary Irrigation Department	Member
Director Biodiversity, Ministry of Climate Change	Member
Representative of IUCN Pakistan	Member
Representative of WWF	Member
Chief Environment P&D Department	
Chief Agriculture, P&D Department	Secretary

The Steering Committee shall meet at least once every year and its functions shall include but are not limited to the following:

- Suggest ways and means to ensure that biodiversity considerations are integrated in the policy and planning processes and poverty alleviation programmes of the Government of [GB] Sindh;
- Ensure that the needs for conservation of biodiversity receive due consideration during the process of allocation of financial resources;
- Provide guidance to the stakeholders for effective implementation of the decisions of the CBD Conference of Parties;
- Review the plans and progress of stakeholders for implementation of the BSAP within their available financial resources;
- Provide guidance and assistance in securing new sources of funds from bilateral and multilateral donors for achieving the targets of the BSAP;
- Deliberate on all emerging issues related to conservation, the sustainable use of biodiversity and equitable sharing of benefits, and provide appropriate advice to the government for policy decisions.

5.6 Plan for Resource Mobilization for NBSAP Implementation

Financial constraints have been a key issue in the implementation of the BAP and are likely to be a constraint during the implementation of the BSAP. However, every effort will be made to incorporate biodiversity considerations in the ongoing projects and make the best use of available financial resources to implement the high priority actions identified in the BSAP. In addition, proposals shall be developed to seek additional funds from national and international sources for achieving the CBD strategic objectives and the Aichi Biodiversity Targets.

5.7 Monitoring

The progress on the implementation of the BSAP shall be monitored on an annual basis through a flexible framework of indicators, keeping in view the provincial circumstances and priorities. An indicative framework with suggested indicators for monitoring progress on the Aichi Biodiversity Targets is given in annex 1. The monitoring will not only measure progress towards the achievement of BSAP and provincial targets, but also help in the identification of implementation issues, and in adaptive management for effective implementation of the BSAP. The monitoring reports will be presented to the Provincial Steering Committee for their help in overcoming the obstacles to successful achievement of the targets. It will also form a basis for national reporting obligations as well as guide the provincial planning process. The monitoring mechanism will be established within the first year of the adoption of the BSAP.

Annex 1: Matrix showing Aichi Biodiversity Targets and National Actions

Thematic Area	Actions	Target date	Cost $ (millions)	Targets	Responsible Agency
Strategic Goal A: Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society					
Target 1: By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably					
Forest ecosystems	1.1 The stakeholders, specially local political influential, communities etc. are made aware, and sensitized regarding importance of Biodiversity in Forest areas	2018	10million	Trends in communication programmes and actions	Sindh Forest Department
Environmental protection	1.2 EIA guidelines are translated into local languages and disseminated for public awareness	2017	5 million	EIA guidelines Developed	Sindh Environment Department
Wildlife and protected areas	1.3 Awareness programme for protection of vulnerable, threatened and protected wildlife species to be implemented.	2016	5.0 millions		Sindh Wildlife Department
Fisheries	1.4 Awareness programme for protection of vulnerable, threatened and protected fish species to be implemented in coastal areas.	2016	2.0 millions		Sindh Fisheries Department
Target 2: By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems					
Environmental protection	2.1 Biodiversity considerations are integrated in the EIA guidelines	2016	1.0 million	Numbers of opinion leaders and active and trends in biodiversity knowledge of decision makers.	Sindh Environment Department
Mainstreaming Biodiversity	2.2 Commission a study to assess and incorporate biodiversity values in existing EIA legislation and relevant policy instruments	2017	7 million		Sindh Environment Department
Inland Fisheries	2. 3. The inland fisheries laws and regulations will be updated and appropriate policy instruments formulated to incorporate biodiversity considerations, and equitable sharing of benefits from sustainable fisheries.	2017	0.1	The number of laws, regulations; and policies updated or formulated.	Sindh Fisheries Department

Forest ecosystems	2.4 Commission a study to assess economic and environmental values of riverine forests and irrigated plantations.	2018	25 millions		Sindh Forest Department
Target 3: By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent with the Convention and other relevant international obligations, taking into account national socio economic conditions.					
Agriculture And Livestock	3.1 Commission a study on the incentives that promote unsustainable agriculture and suggest ways and means for sustainable agriculture so as to increase the benefits for, and wellbeing of the people.	2017	5.0 millions	Number and kind of positive incentives provided and their impact	Sindh Agriculture Department
Agriculture And Livestock	3.2 Prepare/update the legislation to prevent and regulate use of toxics and harmful chemical sprays on crops	2017	6 million		Sindh Agriculture Department
Agriculture and livestock	3.3 Demonstrate biological means of pest control in agroecosystems to promote organic food production, support diversity of beneficial insects and prevent contamination of food chain.	2019	10 million		Sindh Agriculture Department
Forest ecosystems	3.4 Engaging local communities in sustainable use of NTFPs like apiculture, seed collection and sale, tourism and associated activities	2019	150 millions		Sindh Agriculture Department; Sindh Forest Department
Forest ecosystems	3.5 Give incentives for raising energy plantations on marginal farmlands and encourage development of mechanisms for incentivizing community based forest conservation actions.	2020	100 million		Sindh Forest Department
Target 4: By 2020, at the latest, Ggovernments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits					
Forest ecosystems	4.1 Policy tools like incentives on retaining trees on farmlands and carbon credit payments for avoided deforestation devised, and potential for introduction assessed through a survey. (Private sector engagement)	2019	10 million		Sindh Forest Department

Forest ecosystems	4.2 Community incentive payment schemes introduced to support retaining of tree cover	2020	100 million		Sindh Forest Department
Strategic Goal B: Reduce the direct pressures on biodiversity and promote sustainable use					
Target 5: By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.					
Forestry	5.1 The forest and forest-related policy, laws, and planning systems will be reviewed, updated and implemented to provide a sound basis for conservation and sustainable use of forest biological diversity.	2018	5.0 millions		Sindh Forest Department
Wildlife and Marine Protected Area	5.2A policy or legal instrument for conservation and sustainable use of natural habitats and wildlife will be formulated/updated and adopted.	2016	5.0 millions		Sindh Wildlife Department
Target 6: By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems, and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.					
Fisheries	6.1 Policy/legal instruments developed to regulate operating fishing fleets (shrimp trawlers) on the basis of sustainable use limits.		5.0 million		Marine Fisheries Department
Fisheries	6.2 Capping the numbers of operating shrimp trawlers/fleets to existing levels along the Sindh coast	2019	5.5 millions		Marine Fisheries Department
Fisheries	6.3 Modification of 1,500 existing boats to improve fishing methods.	2019	155 millions		Marine Fisheries Department
Fisheries	6.4 Hatcheries and demonstration ponds established (Inland and Marine) to produce fish larvae to replenish stocks in depleted water bodies	2017	550 millions		Sindh Fisheries Department
Fisheries	6.5 Institutional effectiveness and efficiency of the Sindh Fisheries Departments and Directorate of Marine fisheries shall be enhanced by 2020 to ensure effective management and monitoring of the coastal and marine biodiversity.	2020	1.0	Trends in proportion of utilized stocks outside safe biological limits.	Sindh Fisheries Department; Marine Fisheries Department

Fisheries	6.6 Measures adopted for protection of threatened species through effective enforcement of fisheries legislation	2020	10.0 millions		Sindh Fisheries Department; Marine Fisheries Department
Target 7:By 2020, areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity					
Agriculture	7.1 Develop and implement pilot projects to test and develop models of sustainable agriculture and conservation of agrobiodiversity in three different agro ecosystems.	2017	7.0 millions	Trends in proportion of products derived from sustainable sources	Sindh Agriculture Department
Agriculture	7.2 Prepare an action plan for implementation of adaptation techniques for sustainable agrobiodiversity ecosystems	2018	5.0 million		Sindh Agriculture Department
Agriculture	7.3 Provide assistance to small scale farmers for establishment of models of sustainable agriculture	2020	500 million		Sindh Agriculture Department
Fisheries	7.4 Development of management guidelines for sustainable aquaculture in coastal and inland areas.	2016	5.5 millions		Sindh Fisheries Department
Inland Fisheries	7.5 A mechanism will be created for coordination among agencies responsible for managing water, fish, and wildlife resources in wetlands.	2016	0.05	Trends in coordination and cooperation among various agencies.	Sindh Fisheries Department
Inland Fisheries	7.6 A procedure shall be designed and implemented for sustainable harvest of inland fish stock for minimizing impacts on threatened species and vulnerable habitats.	2017	0.1	Safe ecological limits determined for harvest of species	Sindh Fisheries Department
Fisheries	7.7 A policy will be developed for sustainable fisheries and aquaculture incorporating biodiversity considerations	2018	10 millions		Sindh Fisheries Department
Target 8: By 2020, pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity					
Environmental protection	8.1 A study will be commissioned to identify the sources and magnitude of pollution that can have a negative impact on biodiversity; control measures will be proposed, and the findings will be incorporated in the environmental laws.	2017	7.0 million	Number of studies completed and measures adopted to prevent pollution.	Sindh Environment Department

Environmental protection	8.2 Prepare, adopt, and implement a policy for clean environment in Sindh, incorporating biodiversity considerations.	2017	5.0 million		Sindh Environment Department
Target 9: By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment					
Agriculture and Livestock	9.1 A management protocol to be developed and implemented to contain / eradicate the identified alien and invasive species from the agro ecosystem.	2018	5.0 millions		Sindh Agriculture Department; Livestock Department
Fisheries	9.2 Assessment of damage to three selected inland aquatic bodies and marine ecosystems by alien species, and development of plan for eradication and elimination of alien species.	2018	50 millions		Sindh Fisheries Department
Fisheries	9.3 At least 1 alien species will be eradicated from waters of Sindh (Tilapia – Manchar)	2019	100 millions		Sindh Fisheries Department
Fisheries	9.4 A policy will be formulated and adopted for controlling introduction of any alien species.	2016	3.0 millions		Sindh Fisheries Department
Agriculture	9.5 An agriculture policy will be prepared and adopted to promote sustainable agriculture, incorporating considerations for conservation of genetic diversity of crops, fruits and farmed animals, and for prevention of introduction, establishment, and control and eradication of invasive alien species.	2017	5.0 millions		Sindh Agriculture Department
Target 10: By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.					
Climate Change	10.1 Capacity of coastal communities developed to cope with the impacts of climate change, pollution, and overexploitation.	2018	5.0 million	Trends in pressures, pollution, climate change, and overexploitation.	Environment Departments; Sindh Coastal Development Authority
Climate Change	10.2 A Climate Change Adaptation Plan for Coastal areas will be prepared.	2017	5.0 millions		Sindh Coastal Development Authority

Strategic Goal C: To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity					
Target 11. By 2020, at least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.					
Protected Areas	11.1 A national list of protected areas comprised of only those sites that meet the internationally recognized definition of a protected area shall be prepared.	2016	0.05 million	The revised list of PAs	Sindh Wildlife Department
Forestry	11.2 Representative forest areas of special importance for biodiversity will be designated as Forest Biodiversity Reserves and effectively managed and integrated with the wider landscapes.	2016	1.5 million	Trends in extent of forest protected areas, coverage of key biodiversity areas and management effectiveness	Sind Forest Department
Forestry	11.3 At least one hotspot, representing all forest types, including rangelands with particular importance for biodiversity, shall be given appropriate conservation status and effectively managed in an equitable manner, and integrated into the wider landscape.	2019	100 million		Sind Forest Department
Forest ecosystems	11.4 Co-management regimes promoted in forest areas to enhance participatory forest management.	2020	100 millions		Sind Forest Department
Protected Areas	11.5 The protected areas network shall be expanded by 2018 to represent all ecosystems and habitats, especially areas of particular importance for biodiversity.	2018	1.0	Trends in extent of representative natural habitats coverage in protected areas, and management effectiveness.	Sindh Wildlife Department
Protected Areas	11.6 At least seven major inland wetlands of national biodiversity significance shall be declared protected areas, and together with the surrounding terrestrial areas, shall be managed effectively.	2019	1.0	Trends in extent of wetland protected areas, coverage of key biodiversity areas and management effectiveness	Sindh Wildlife Department
Protected Areas	11.7 At least three major coastal and marine protected areas will be established, integrated in the wider landscapes and seascapes, and managed effectively in an equitable manner on an ecosystem based approach.	2017	0.5	Trends in extent of marine protected areas, and management effectiveness.	Sindh Wildlife Department
Wildlife and protected areas	11.8 At least one Marine Protected Area identified and established.	2020	100 millions		Sindh Wildlife Department; Sindh Fisheries Department

Wildlife and protected areas	11.9 At least a 10% additional area of natural habitats of particular importance for biodiversity will be conserved though a representative network of protected areas to fill in all ecological gaps.	2017	50millions		Sindh Wildlife Department
Wildlife and Protected Area	11.10 Management plans based on an ecosystem approach will be prepared and implemented in two major protected areas.	2020	65 millions		Sindh Wildlife Department
Fisheries	11.11 A biodiversity reserve shall be established in a major water body in Sindh.	2018	2.0 millions		Sindh Fisheries Department
Fisheries	11.12 Establishment of at least two closed fishing areas.	2020	220 million		Sindh Fisheries Department
Target 12:By 2020, the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained					
Wildlife	12.1 Recovery plans are prepared and implemented to improve the conservation status of at least six selected threatened faunal species.	2018	1.5	Trends in population of selected species	Sindh Wildlife Department
Fisheries	12.2 Plans will be prepared and implemented for recovery of depleted freshwater fish species.	2017	1.0	Trends in population of selected species	Sindh Fisheries Department
Fisheries	12.3 The population of known threatened marine species, particularly of those most in decline, shall be monitored regularly and remedial measures taken to improve and sustain their population.	2016	0.5	Trends in population of selected species	Directorate of Marine Fisheries
Wildlife and protected areas	12.5 Recovery plans will be prepared and implemented for improving conservation status of three most threatened species.	2020	50 millions		Sindh Wildlife Department
Wildlife and protected areas	12.6 Indus blind dolphin and freshwater turtles protected in their distribution range through effective enforcement of laws.	2020	8.0 millions		Sindh Wildlife Department
Wildlife and protected areas	12.7 Arabian humpback whale and whale sharks protected through adoption of effective protection measures.	2020	20 millions		Sindh Wildlife Department

Wildlife and protected areas	12.8 The capacities of at least two communities shall be developed to conserve threatened game species under the sustainable sport hunting programme.	2018	5 millions		Sindh Wildlife Department
Wildlife and protected areas	12.9 A monitoring, observation, and information system shall be established to detect and describe changes in extent and condition of natural habitats, and threatened species.	2020	50 millions		Sindh Wildlife Department
Target 13: By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding genetic diversity.					
Agriculture	13.1 The diversity of local varieties of crops, fruits, and local knowledge of their management will be documented.	2016	2.0 millions	Trends in review of integration of biodiversity considerations in of agriculture policies.	Sindh Agriculture Department
Livestock	13.2 An assessment of the diversity of breeds of livestock and poultry and local knowledge of their management will be documented.	2016	2.0 millions	Trends in assessment of agrobiodiversity. Trends in *in-situ* and *ex-situ* conservation	Livestock Department
Agriculture	13.3 A pilot project is prepared and implemented for *in-situ* and *ex-situ* conservation of crop biodiversity.	2017	2.0 millions	Trends in use of traditional varieties and breeds	Sindh Agriculture Department
Livestock	13.4 A pilot project is prepared and implemented for *in-situ* and *ex-situ* conservation of livestock and poultry biodiversity.	2017	2.0 millions	Trends in replication of bio diverse agriculture	Livestock Department
Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services					
Target 14: By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.					
Forest and fisheries	10.3 Protection and restoration of vulnerable ecosystems (Coral reefs and Mangroves) from anthropogenic factors to promote wellbeing of coastal communities.	2019	300 millions		Sindh Forest Department Sindh Fisheries Department; Marine Fisheries Department,
Fisheries	14.1 The interests of women, indigenous and local communities safeguarded through sustainable management of major wetlands.	2019	10 millions		Sindh Forest and Fisheries Departments

Target 15: By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification					
Forestry	15.1 Initiate a project for reforestation of mangroves, irrigated plantations, and degraded rangelands.	2020	400 million		Sind Forest Department
Forestry	15.2 At least 5 landscapes (2 Coastal, 2 Riverine and 1 Irrigated plantation) that contribute to the health, livelihoods and well-being of local communities will be restored and safeguarded.	2019	200 million		Sind Forest Department
Target 16: By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation					
Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building					
Target 17: By 2015 each party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.					
Forestry	17.1 The revised BSAP will be adopted as a strategy and implementation and monitoring mechanisms will be in place.	2016	2.0 million		Sindh Forest Department
Wildlife	17.2 Institutional effectiveness and capacity of Wildlife Department shall be enhanced to ensure effective management and monitoring of biodiversity resources.	2018	50 million		Sindh Wildlife Department
Fisheries	17.3 Strengthen the institutional capacity of relevant organisations for effective enforcement of fisheries laws against illegal fishing, especially the destructive practices.	2016	5.0 millions		Sindh Fisheries Department
Target 18: By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.					
Agriculture, livestock and Fisheries	18.1 The traditional knowledge, innovations and practices in six different geographical areas relevant to the conservation and sustainable use of biodiversity will be documented and promoted.	2020	5.0 millions	Trends in farming with traditional knowledge and use of local varieties and breeds.	Sindh Agriculture, Livestock and Fisheries Departments

Target 19: By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.					
Forest ecosystems	19.1 Current and updated assessment of flora in all forest types.	2018	200 million	Trends in awareness and attitudes Trends in public engagement with biodiversity	Directorate of Biodiversity
Wildlife and protected areas	19.2 A district-wise study will be commissioned to determine the presence and abundance of species, and the potential and scope of conservation and sustainable use of natural habitats by local communities.	2020	100 millions		
Forest ecosystems	19.3 A forest classification map will be prepared using agreed international standards, compatible with remote sensing technologies that include broad indicators of forest biodiversity.	2018	20 millions	Report on the assessment of health and condition of forests.	Forest Departments, all provinces, regions
Forest ecosystems	19.4 A baseline is established using a GIS system to monitor, at five year intervals, the extent of deforestation and levels of forest degradation and their impact on forest biodiversity and ecosystem services.	2019	50 millions	Trends in condition and vulnerability of mangroves.	Forest Department, Sindh & Baluchistan
Forest ecosystems	19.5 A guide will be developed for the application of ecosystem approaches suitable for specific forest ecosystems.	2016	2.0 millions		
Forest ecosystems	19.6 Workshops held to train and familiarize forest managers with the foundations, principles and modalities of ecosystem based approaches.	2017	5 million		
Forest ecosystems	19.7 The Code for the preparation of management plans shall be revised to incorporate ecosystem approaches for sustainable management of forests for their environmental and biodiversity values.	2018	10.0 millions		
Agriculture and livestock	9.8 An updated assessment of local crop varieties to be prepared in collaboration with relevant research institutes like the Centre for Plant Conservation at Karachi University and Agriculture University Tando Jam to determine their existing status.	2017	3.0 millions		

Target 20: By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization, should increase substantially from the current levels. This target will be subject to changes in resource needs assessments, to be developed and reported by Parties.					
Agriculture	20.1 At least 75 percent of the regular development budget dedicated for the implementation of the BSAP targets.	2016		Trends in mobilization allocation of resources for NBSAP.	All Provinces, AJK, GB
Agriculture and livestock	20.2 Projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.	2017	5.0 millions	Trends in mobilization of additional resources	Office of Inspector General of Forests, All relevant sectors in the provinces, AJK, GB.
Environmental protection	20.3 At least 50 percent of the regular development budget of environment department dedicated for the implementation of the BSAP targets.	2016			
Environmental protection	20.4 Projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.	2017	5.5 millions		
Forestry	20.5 At least 50 percent of the regular development budget will be dedicated to the implementation of the BSAP targets.	2020			
Forestry	20.6 Projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.	2017	5.5 millions		
Wildlife and protected areas	20.7 At least 50 percent of the regular development budget dedicated to the implementation of the BSAP targets.	2020			
Wildlife and protected areas	20.8 Projects shall be prepared to seek bilateral and multilateral donor support for fully achieving the NBSAP targets.	2017	5 millions		

Fisheries	20.9 2% of the annual developmental budget dedicated for biodiversity conservation.	2018			
Fisheries	20.11 A federal funded project should be developed for major allocation for biodiversity related issues.	2017			

Annex II. International obligations related to biodiversity

#	Treaties	Established at	Year	Signed by Pakistan	Known as
1	Convention on the Conservation of Migratory Species of Wild Animals	Bonn	1979	1987	CMS- Bonn Convention
2	Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES)	Washington	1973	1976	CITES
3	Convention on Wetlands of International Importance especially as Waterfowl Habitat	Iran	1971	1976	Ramsar
4	Convention concerning the Protection of the World Cultural and Natural Heritage	Paris	1972	1972	World Heritage Convention
5	United Nations Convention on the Law of the Sea	Montego Bay	1982	1982	UNCLOS
6	UNESCO Man and Biosphere (MAB) programme	Paris	1968	Supports	MAB
7	International Convention for the Prevention of Pollution from Ships		1973/ 78		MARPOL
8	UN Convention to Combat Désertification	Bonn	1994	1997	UNCCD
9	Convention of Biological Diversity	Montreal	1992	1994	CBD
10	UN Framework Convention on Climate Change	Bonn	1994	2005	UNFCC

Source: (R.Rajagopalan and A. Lakshmi 2003) and (Pernetta, 1993), NSAP- MFF Pakistan 2010.

Annex III. Conservation Status of Some Major Species of Wildlife

	Common and *Vernacular Name*	Biological Name	Conservation Status
1	Hog Deer (*Para)*	*Axis porcinus*	Vulnerable
2	Desert fox (*Sahrai Loomar*)	*Vulpes vulpes pusilla*	Threatened
3	Fishing cat (*Mash Billo*)	*Prionailurus viverrinus*	Vulnerable
4	Indian Otter (*Ludher*)	*Lutrogale perspicillata*	Near Threatened
5	Small Indian Civet (*Mushk Billa or Kasturi Billa*)	*Viverricula indica*	Near Threatened
6	Indus Dolphin (*Burhan*)	*Platanista minor*	Endangered
7	Chinkara or Indian Gazelle (*Chitka Hiran*)	*Gazella bennettii*	Vulnerable
8	Indian Pangolin (Silu)	*Manis crassicaudata*	Near Threatened
9	Asiatic jackal (*Geedarh*)	*Canis aureus*	Near Threatened
10	Bengal fox (Lumar)	*Vulpes bengalensis*	Near Threatened
11	Caracal or Desert Lynx (Siva gush)	*Felis caraca*	Critically Endangered

Annex IV. Major Wetlands of Sindh

	Wetland	Conservation Status	District
1	Badin and Kadhan Lagoons	Not Protected	Badin
2	Beroon Khirthar Canal	Not Protected	Larkana
3	Charwo Lake	Not Protected	Badin
4	Clifton Beach	Not Protected	Karachi
5	Drigh Lake	Wildlife Sanctuary	Larkana
6	Ghauspur Jheel& Sindhi Dhoro Lake	Not Protected	Jacobabad
7	Hab Dam	Wildlife Sanctuary	Karachi
8	Hadero Lake	Wildlife Sanctuary	Thatta
9	Haleji Lake	Wildlife Sanctuary	Thatta
10	Hamal Katchri Lake	Not Protected	Larkana
11	Hawkes Bay / Sandpit	Not Protected	Karachi
12	Indus Dolphin Reserve	Game Reserve	Kashmor
13	Keti Bunder North	Wildlife Sanctuary	Thatta
14	Keti Bunder South	Wildlife Sanctuary	Thatta
15	Khango (Khowaj) Lake	Not Protected	Badin
16	Khinjar (Kalri) Lake	Wildlife Sanctuary	Thatta
17	Khipro Lakes	Not Protected	Sanghar
18	Korangi and Gharo Creeks	Not Protected	Karachi
19	Langh (Lungh) Lake	Wildlife Sanctuary	Larkana
20	Mahboob Lake	Not Protected	Sujawal
21	Manchar Lake	Not Protected	Dadu
22	Nara Canal	Game Reserve	Sanghar
23	Phoosna Lakes	Not Protected	Badin
24	Pugri Lake	Not Protected	Larkana
25	Runn of Kutch	Wildlife Sanctuary	Thatta
26	Sadhori Lake	Not Protected	Sanghar
27	Sanghriaro Lake	Not Protected	Sanghar
28	Shahbunder& Jafri Lake	Not Protected	Thatta
29	Soonhari Lake	Not Protected	Sanghar
30	Tando Bago Lake	Not Protected	Badin

Annex V. Ramsar Sites In Sindh

1. **The Indus Dolphin Reserve** is spread over 135 km from the Sukkur upstream to the Guddu Barrage. In 1974, the entire area was declared the home of the endangered Blind Dolphin (IUCN Red Data Book). The major threats it faces include split populations of the dolphins due to dams and barrages on the River Indus, reduction in habitat size during the dry season, high turbidity, pollution, and hunting. The number of dolphins at the site has increased from 150 in 1974 to 620 in 2001.
2. **Keenjhar (Kalri) Lake** is a large freshwater lake providing drinking water to Karachi. It is located in Thatta district. It was declared a Ramsar site in 1976 and later became a wildlife sanctuary under the Sindh Wildlife Protection Ordinance. An annual Waterfowl Census has been carried out since 1971. Some baseline information indicates 65 species of fauna whose numbers had increased from 50,000 to 150,000 in the 1970s to 205,000 in [19886 - 1986 or 1988?]. Major threats to the lake include illegal fishing operations, an excessive number of motorised fishing boats, and the use of synthetic nets in the lake. The grazing of domestic animals and unchecked recreational activities are other significant threats.
3. **Drigh Lake** is a small, slightly brackish lake with extensive marshland. The lake was declared a wildlife sanctuary in 1972, and became a Ramsar site in 1976. Threats include diversion of water, and overgrown *Typha* and *Tamarix*, resulting in increased grazing pressure. The number of wintering birds visiting the site has decreased over the years from 32,000 in 1973 to 17,400 in 1987-88.
4. **Haleji Lake** is a perennial freshwater lake with marshes and a brackish seepage lagoon. Considered a game reserve in 1971, this lake was declared a wildlife sanctuary, and in 1976, the lake proceeded to become a Ramsar site. Haleji serves as an important source of water for Karachi besides being a popular recreational destination. Threats to the site include the overlapping of the management of the lake by the Karachi Water and Sewerage Board (KWSB) and the Sindh Wildlife Department; the unauthorised and illegal fishing, hunting and cutting of trees and siltation, as well as eutrophication. The number of birds visiting the site was 60,000 to 100,000 in the 1970s. In 1988, the figure was 103,000.
5. **Jubho Lagoon** is a shallow, small, brackish water lagoon with mudflats and marshes that support a large concentration of migratory birds including flamingos and endangered Dalmatian pelicans, a rare species in the world. This was declared a Ramsar site in 2001 because of the efforts made by IUCN Pakistan.
6. **Nurruri Lagoon** is also a brackish, privately owned lagoon with barren mudflats that is visited by large concentrations of migratory water birds. It was also declared a Ramsar site in 2001. Increased salinity, sea intrusion, population pressures, and agricultural and industrial pollution are major threats to this site.
7. **Deh Akro** is a wildlife sanctuary consisting of four major habitats; desert, wetland, marsh, and agriculture. Located 330km northeast of Karachi, it is a natural inland wetland ecosystem, which supports a variety of rare and endangered wildlife species. This area hosts a considerable number of rare fauna. Many indigenous fish species are also found here. Water scarcity during a persistent dry spell is adversely affecting this area.
8. **Runn of Kutch** is part of the great Thar Desert and comprises of stabilized sand dunes, with broad interdunal valleys of alluvial soil, connected across the frontier with India, which includes permanent saline marshes, coastal brackish lagoons, tidal mudflats, and estuarine habitats. The site supports many locally and globally threatened species, including the Great Indian bustard (*Choriotis nigriceps*), Houbara bustard (*Chlamydotis undulata*), Sarus crane (*Grus antigone*), and hyena (*Hyeana hyaena*) and supports more than 1% of the bio geographical population of flamingos.
9. **The Indus Delta** is the fifth largest delta in the world. The fan-shaped delta consists of creeks, estuaries, mud flats, sand dunes, mangrove habitat, marshes and sea bays. It shelters 82,669 mangroves, mostly Avicenna marina, which comprises 97% of the total mangrove area in the country and is said to be the largest coastal mangrove forest in the world. A large number of species of birds (including the threatened Dalmatian pelican), fish and shrimps, and of dolphins (Plumbeous dolphin, Finless porpoise, and Bottlenose dolphin), humpback whales and reptiles are found here. The area is rich in archaeological and religious heritage.
10. **Hub Dam** (shared with Balochistan).

Source: foreverindus.org (WWF –Pakistan)

Annex VI. List of Endemic Flora of Sindh with Their Conservation Status

#	Taxon	Families	Distribution	Conservation Status
1	*Justicia vahlii* subsp. *Scindica* Malik & Ghafoor	Acanthaceae	Karachi and Dadu Distt	Rare
2	*Asparagus deltae* Blatter	Asparagaceae	Thatta	Extinct
3	*Asparagus gharoensis* Blatter	Asparagaceae	Southern Sindh	Probably extinct
4	*Asparagus dumosus* Baker	Asparagaceae	Coastal areas of Sindh	Vulnerable
5	*Commiphora stocksiana* (Engl.)	Burseraceae	Lasbela District, Karachi, Thatta & Sanghar Districts	Rare
6	*Atriplex stocksii* Boiss.	Chenopodiaceae	Coastal areas of Sindh and Sindh.	Fairly common
7	*Pulicaria boisseri* Hook.f.	Compositae	Sindh, southern Sindh, Punjab	Fairly common
8	*Convolvulus scindicus* Stocks	Convolvulaceae	Sindh (Sibi) and Sindh (Dadu and Thatta)	Rare
9	*Abutilon alii* Abedin	Malvaceae	Karachi Division and Lasbela District	Critically Endangered
10	*Abutilon karachianum* Husain & Baquar	Malvaceae	Karachi Division and Lasbela District	Critically Endangered
11	*Abutilon sepalum* Husain & Baquar	Malvaceae	Karachi Division and Lasbela District	On the brink of extinction
12	*Hibiscus scindicus* Stocks	Malvaceae	Sindh and southern Sindh	Rare
13	*Pavonia glechoma efolia nf.karachiensis* Abedin	Malvaceae	Karachi	Rare
14	*Sidas pinosavar.kazmii*	Malvaceae	Sindh and Southern Punjab	Rare
15	*Acacia nilotica* subsp.*hemispherica* Ali & Faruqi	Mimosaceae	Karachi	Vulnerable
16	*Tamarix alii* Qaiser	Tamaricaceea	Karachi, Thatta Dist. Nagar Parker) Coastal Sindh.	Fairly common
17	*Tamarix salina* Dyer	Tamaricaceea	Khairpur, Mirpur khas, Sukkur and Karachi	Rare
18	*Tamarix sarenensis* Qaiser	Tamaricaceea	Tharparkar district, Keti bunder and Keenjhar	Rare
19	*Tamarix sultanii* Qaiser	Tamaricaceea	Southern Sindh	Rare