

BIODIVERSITY – A STABLE ECOSYSTEM (A-REVIEW)

By:

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Introduction:

The dramatic geological history, broad latitudinal spread and immense altitudinal range of Pakistan spans a remarkable number of the world's ecological regions. These range from the mangrove forests fringing the Arabian Sea to the spectacular mountain tops where the western Himalayas, Hindu Kush and Karakoram ranges meet. These habitats support a rich variety of species which contribute to the overall biological diversity, or biodiversity, of the country. Pakistan has a number of the world's rarest animals and plants but these are now in danger from habitat loss and overuse. While people are without doubt a valuable resource, a high population growth rate has put ever-increasing pressure on the country natural resource base (Shukla & Chandel, 2006). Misguided economic policies have widened income disparities and forced people to exploit biodiversity at rates that are no longer sustainable. As a result, processes such as deforestation, overgrazing, soil erosion, salinity and waterlogging have become major threats to the remaining biodiversity in Pakistan. One stark reminder of the downslide is Pakistan's ranking as the country with the second highest rate of deforestation in the world. The continuing loss of forest habitat, with its associated fauna and flora, will have serious implications for the nations other natural ecosystems. Just as people may be part of the problem, they are also part of the solution (Anonymous, 2004).

Biodiversity can be defined as the "variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species, and of ecosystems" (Anonymous, 1992). Diversity within species, or **genetic diversity**, refers to variability in the functional units of heredity present in any material of plant, animal, microbial or other origin. **Species diversity** is used to describe the variety of species (whether wild or domesticated) within a geographical area. Estimates of the total number of species (defined as a population of organisms which are able to interbreed freely under natural conditions) range from two million to 100 million, though less than 1.5 million have actually been described. **Ecosystem diversity** refers to the enormous variety of plant, animal and micro-organism communities and the ecological processes that make them function. In short, biodiversity refers to the variety of life on earth.

WHY IS BIODIVERSITY IMPORTANT?

The richness of species in an area indicates the total biodiversity of that particular area. However, biodiversity increases with the complexity of an ecosystem and vice versa. All species display genetic variation among individuals and populations. This variation encourages natural selection and adaptability to changes in the environment, which ultimately ensures species survival. Genetic diversity in domestic species and their wild relatives enables researchers to develop improved varieties of animals and plants for human needs: which serves as an insurance for further food security. Diversity in wild plant species is a major medicinal resource in *yunani tibb* (traditional medicine) and 40% of allopathic drugs were originally made from wild medicinal plants.

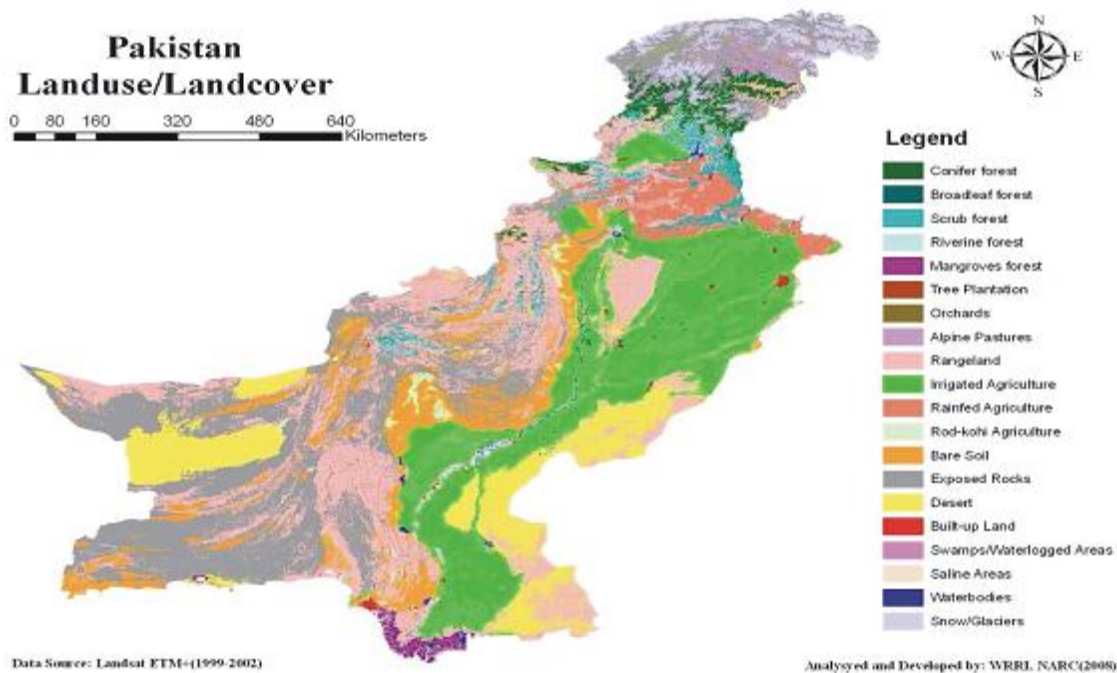
Biodiversity provides free of charge services worth billions of rupees every year that are crucial to the well-being of Pakistani society. These services include clean water, pure air, pollination, soil formation and protection, crop pest control, and the provision of food, fuel, fibers and drugs. As elsewhere, these services are not widely recognized, nor are they properly valued in economic or even social terms. Reduction in biodiversity (including local extinction of species) affects these ecosystem services. The sustainability of ecosystems depends to a large extent on the buffering capacity provided by having a rich and healthy diversity of genes, species and habitats. In this respect, biodiversity is like economic diversity in a city; it is essential for long-term survival and is a sound investment in the future. Conservation of biodiversity also makes good environmental sense. The air we breathe, the water we drink and the soil that supports crop production are all products of the complex interactions that occur among various living organisms on earth. If these vital ecological services are damaged, so are the physical conditions maintained by the world's species and ecosystems. Losing biodiversity is a bit like losing the life support systems that we, and other species, so desperately depend upon.

The conservation of biodiversity is fundamental to achieve sustainable development. It provides flexibility and options for our current (and future) use of natural resources. Almost 70% of the population in Pakistan lives in rural areas, and a large part of this population depends directly or indirectly on natural resources. Conservation of biodiversity is crucial to the sustainability of sectors as diverse as energy, agriculture, forestry, fisheries, wildlife, industry, health, tourism, commerce, irrigation and power. Pakistan's development in the future will continue to depend on the foundation provided by living resources, and conserving the nation's biodiversity will ensure that this foundation is strong.

Biomes of Pakistan

A wide array of ecosystems occur in Pakistan, however, the natural ecological zones of Pakistan have been so drastically modified by human activity

that very few truly natural habitats remain. To date, no systematic attempt has been made to define the ecological zones of Pakistan. Roberts (1992) provided an initial classification of natural terrestrial ecosystems. The extent of area in each zone together with corresponding CBD thematic area is given in Table 1. A land cover map (map 1) of Pakistan using NOAA satellite imagery was developed in the year 2000. The map shows 20 land use and land cover classes of Pakistan. This is by far the most detailed map of Pakistan that shows distribution of various ecosystems and habitats and provides a sound basis for future work on ecosystems and habitat classification.



(Source WWF, Pakistan)

TABLE 1: THE EXTENT OF ECOZONES / HABITAT TYPES IN PAKISTAN

S. No.	Ecozone/Habitat Type	CBD Thematic Area	Area (ha)	% of total Area
1	Mangrove & Littoral	Marine & Coastal	550,186	<1%
2	Tropical Thorn Forest	Dry lands, Agriculture	38,146,635	43.5%
3	Arid sub-tropical forest	Dry lands, Agriculture	30,035,234	34.2%
4	Steppe forest & alpine dry steppe	Mountain	9,305,417	10.6%

S. No.	Ecozone/Habitat Type	CBD Thematic Area	Area (ha)	% of total Area
5	Dry sclerophyllous & tropical deciduous forest	Dry sub humid lands	471,561	<1%
6	Sub- tropical pine forest	Mountain	2,163,320	<1%
7	Dry temperate coniferous	Mountain	1,831,506	<1%
8	Himalayan moist temperate forest	Mountain	1,070,736	<1%
9	Permanent snow, alpine meadows & sub-alpine scrub	Mountain	4,220,152	<1%
Total			87, 794,747	100%

Status, Trends and Threats to Biodiversity:

The natural ecosystems of Pakistan have been widely and badly affected by human activity that very few truly natural habitats remain. Nine major ecological zones are recognized in Pakistan. Pakistan has 195 mammal species (including 13 sub-species) of which six are endemic. There are 668 bird species, of which 25 are endangered. The reptile species are 177 in number of which 13 are endemic species. The reptiles include 14 turtles, one crocodile, 90 lizards and 65 species of snakes. There are 22 amphibians of which 9 are endemic. Fresh water fish species are 198 with 29 endemics. So far more than 5000 species of invertebrates have been identified. There are over 5700 species of flowering plants with over 400 species endemic to Pakistan. Pakistan is rich in indigenous crop diversity with an estimated 3000 taxa and around 500 wild relatives of crops as shown in Table 2. The civilization of Taxila, Harappa, and Mohenjo-Daro domesticated species such as wheat, eggplant, pigeon pea, and cucumber. Many wild and local cultivars survived up to the era green revolution. However, the agrobiodiversity has suffered serious erosion due to the introduction of higher yielding varieties and use of agrochemicals.

The Indian sub-continent was the first to domesticate cattle, water buffalo, and chicken. Pakistan now has two breeds of buffalo, eight of cattle, one yak, 25 goat, 28 sheep, one horse, four camels, and three poultry breeds. The forest biodiversity includes Alpine tundra, cold conifer, temperate conifer, and warm conifer mixed forests. The vegetation in dry and sub humid lands are comprised of xerophytic shrubs and small trees, grasslands, and steppe. Riverine forests grow along the banks of rivers and mangrove forests are found in Indus delta and along the coast. Pakistan has a long coast line with sandy beaches providing nesting sites for turtles. Corals have recently been discovered along the

Baluchistan coast. The major threats to terrestrial ecosystems are from overgrazing and deforestation due to high population pressure and increasing poverty. The diversion of water for irrigation has adversely impacted the ecology of the mangroves and riparian ecosystems. Game birds and animals are heavily hunted using modern technology and some species are persecuted for their depredation of livestock and crops. The fisheries from inland and marine ecosystems are harvested to the full limit and pressure is growing as the population grows. Pollution and disposal of untreated sewage and industrial affluent in the rivers and sea are major threat to the biodiversity.

Plant Conservation Strategy:

Systematic collection and documentation of the flora of Pakistan started in 1968. An annotated catalogue of vascular plants was published (Stewart, 1972). The flora of Pakistan is available in an electronic data base maintained by the Missouri Botanical gardens (eflor.org). There is no lead institution in Pakistan with a mandate for plant conservation, therefore the country was not able to make and implement a Plant Conservation Strategy. However, many targets of the global plant conservation strategy have been met indirectly under the work plan for protected area. Protected Areas Pakistan has designated 23 national parks, 97 game sanctuaries and 104 game reserves covering 9,852,006 hectares of land area. A protected area system review carried out in 2000 and an action plan was prepared. The review revealed that many of the areas did not meet the international criteria for the protected areas. Of the 227 PAs listed at the time, 58 were considered to be satisfying the IUCN criteria whereas 169 PAs were considered to have been established mainly to control hunting. The Plan included elements for filling ecological gaps, securing financial resources, and capacity-building, and addresses policy, legislative and institutional barriers.

TABLE 2: BIODIVERSITY OF PAKISTAN

Taxa	Total reported in Pakistan	Endemic	Threatened
Mammals	195	6	20
Birds	668	?	25
Reptiles	192	13	6
Amphibians	22	9	1
Fish (Fresh Water)	198	29	1
Fish (Marine)	788	-	5
Echinoderms	25	-	2

Taxa	Total reported in Pakistan	Endemic	Threatened
Mollusks (Marine)	769	-	8
Crustaceans (Marine)	287	-	6
Annelids (Marine)	101	-	1
Insects	>5000	-	-
Angiosperms	5700	380	?
Gymnosperms	21	-	?
Algae	775	20	?
Fungi	>4500	2	?

Conclusion:

Ecologically sensitive and fragile areas of Pakistan like that of northern areas are sporadic and incomplete in terms of the knowledge system of the native people of those areas. So, to overcome this constraint the indigenous knowledge of the flora and fauna of a particular area should be given and awareness campaigns should be started in order to combat the problems of the conservation at local level. As the phenomenon of urbanization is the key to create all the other hazardous aspects in the depletion of the biodiversity, there must be a system to check the over population of Pakistan so as to minimize the factors like landslides, volcanoes, floods, earthquakes, cyclones, hurricanes, deforestation, industrialization, water and air pollution and rapid increase in the utility of the medicinally important plants and animals.

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