

# Environment

Pakistan continued to face challenges in achieving environmentally sound development. This has become increasingly difficult in the backdrop of the consecutive floods and rains across the country as well as other exogenous and endogenous factors.

The quality of the natural environment is not only an extremely important issue from the point of view of individual survival but it will also emerge as one of the principal human security issues in Pakistan. The environmental challenges include climate change impacts, loss of biological diversity, deforestation and degradation of air and water quality. The fast growing population poses a significant challenge for Pakistan. The existing environment management capacity cannot sustain such a large population with a good quality of life.

This chapter discusses the various environment related issues and challenges faced by Pakistan, and the initiatives taken by the government to address and combat those challenges. The first section provides a review of government policies and programs intended to put a focus on environmental issues in Pakistan and actively combat the adverse impacts of climate change. The second section describes the state of the environment in Pakistan, and identifies key challenges and shortcomings in terms of air and water pollution and forestlands. Mangrove ecosystems and coastal resources are discussed next, followed by an overview of the 2011 floods and institutional responses to the disaster. The final section concludes the chapter.

## **Climate Change: The Evolution of Policies and Programmes**

As a result of concerted efforts of the government, the word “environment” has been gradually achieving a greater and wider audience and acceptance in the country. Awareness about environmental issues has been rising and institutions have been built to address these issues. Civil society institutions working on environmental issues are strengthening and their influence has increased. The government, therefore, has effectively engaged to arrest the processes of environmental degradation through various programmes during the last three years. Some highlights of the government’s efforts to combat the adverse effects of climate change are listed below.

- ▶ The National Climate Change Policy 2011 has been developed which provides a framework for addressing the issues that Pakistan face or will face in future due to the changing climate.
- ▶ With the devolution of Ministry of Environment, Provinces now have more powers in policy formulation and implementation.
- ▶ Improvements in weather forecasting which helps in sound and timely decision making in agricultural practices and better management of natural resources and disaster response.
- ▶ The National Marine Disaster contingency plan was implemented by the Maritime Security Agency (MSA) by carrying out Barracuda-I and Barracuda-II exercises.
- ▶ EURO - II standards for vehicle emissions were adopted for new manufacturing vehicles

industries. Drinking water quality standards, Ambient air quality standards and Noise standards were also adopted..

- ▶ 17 Laboratories have been adopted with Provincial Agencies/Departments under Pakistan Environmental Protection Agency, (Certification of laboratories) Regulation 2000 for carrying out analysis of the industrial effluents, waste waters and other analytical research requiring Lab facilities in the country.
- ▶ The Cartagena Protocol on bio safety was ratified.
- ▶ Swiss Model of Vertical Shaft Brick Kiln (VSBK) was identified as an environment friendly and energy efficient brick manufacturing technology. Demonstrations for the model were held in collaboration with Bricks Manufacturing Associations.
- ▶ Pakistan Clean Air Programme (PCAP) has been approved.

A National Impact Assessment Program (NIAP) is being jointly implemented by the Planning Commission/Planning and Development Division (Environment Section), Ministry of Disaster Management (Pakistan Agency and Environment Wing), Provincial EPAs and IUCN Pakistan. The Netherlands Commission for Environmental Assessment is providing technical support for NIAP and it is funded by the Embassy of the Kingdom of Netherlands. The objective of the program is to contribute to sustainable development in Pakistan through strengthening of the Environmental Impact Assessment (EIA) process and introducing Strategic Environmental Assessment (SEA) in the national development planning. The NIAP is housed in the Planning Commission of Pakistan since the Program Coordination Unit is primarily responsible for creating ownership for the program within the public sector, coordinating amongst the Program partners and ensuring post-program sustainability of the efforts.

The NIAP has achieved the following targets for SEA and EIA:

- ▶ Formulation of SEA task force where SEA pilots are under consideration.

- ▶ Awareness raising workshops for the policy and decision makers in order to make grounds for SEA
- ▶ Capacity building through trainings on SEA.
- ▶ Case studies on SEA from Pakistan were presented at international forums.
- ▶ EIA regulation were reviewed and revised.
- ▶ Extensive training programmes were held to build capacity; seminars and workshops were organized to raise awareness.

In response to the environmental and climate change related policies, a number of projects have been funded by the government to improve the capacity of relevant institutions to deal with increasing environmental degradation. In addition, there are number of projects funded by the donors in which the government is a partner. These are being currently implemented to improve overall environment of the country. These projects include the National Environmental Information Management System, National Impact Assessment Program and the Pakistan Wetlands Program. After, the devolution of the Ministry of Environment on 28<sup>th</sup> June, 2011 the Ministry of Disaster Management took over the responsibilities of the environment sector at the federal level. Due to the limited resources at its disposal, government efforts alone are not sufficient to address challenges resulting from climate change. A much larger participation and support from other stakeholders including industry, civil society, and the public at large as well as the donors is needed to effectively respond to climate issues.

Pakistan is a signatory to major environmental conventions and protocols. As signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and a member state of the World Bank, Pakistan qualifies for financial and technological assistance. At the UNFCCC Cancun conference the developed countries have committed to create a sizable “Green Climate Fund” with fast start finance. In order to benefit from international financial mechanisms, the Government of Pakistan expects to take the following measures:

- ▶ Continue to assess how best to position Pakistan vis-a-vis other groups of developing countries in order to secure adaptation funding;
- ▶ Ensure the access and effective use of the opportunities available internationally for adaptation and mitigation efforts e.g. through Global Climate Fund (GCF), Clean Development Mechanism (CDM), Adaptation Fund (AF), Global Environment Facility (GEF), World Bank's Forest Carbon Partnership Fund (FCPF), etc.;
- ▶ Establish a Pakistan Climate Change Trust Fund for financing climate change related projects;
- ▶ Continue to push for transparent delivery of new and additional fast start funding by developed countries;
- ▶ Develop public-corporate-civil society partnership for financing and implementation of climate change adaptation and mitigation projects;
- ▶ Create domestic carbon market opportunities by introducing appropriate investment framework linked with regional banking institutions.

The Millennium Development Goals (MDGs) are the centerpiece of development efforts of the Government of Pakistan. The status of the MDGs with reference to environment sector indicators is presented below, (Table 16.1).

**Table 16.1—The MDG targets and achievements**

Name of Sector/Sub-Sector	Year		MDG Targets 2015
	2004-05	2010-11	
Forests cover including State and private forests/farmlands (%)	4.9	5.17	6.0
Area protected for conservation of wildlife (%)	11.3	11.3	12.0
No. of petrol & diesel vehicles using CNG fuel (000)	380	2740	920
Access to sanitation (national)%	42	48@	90
Access to clean water (national)%	65	92@	93
Number of continuous air pollution monitoring stations.	0	10	--
Number of regional offices of Environmental Protection Agencies	0	4	--
Functional Environmental Tribunals	2	3	--

Source: Environment Section, P&D Division, @ = Source (WHO/UNICEF)

### Box-1 Climate Change

Climate change is an area that has become increasingly important in recent years and raises issues of global justice and equity. Whereas the richer industrialized countries are primarily responsible for greenhouse gas emissions, it is the poorer developing countries who would most heavily bear the costs of climate change. It is major concern for Pakistan because of its large population and economic dependence on primary natural resources. Pakistan's agrarian economy is heavily dependent on river water provided by melting glaciers

Pakistani cities are facing problems of urban congestion, deteriorating air and water quality and waste management while the rural areas are witnessing rapid deforestation, biodiversity and habitat loss, crop failure, desertification and land degradation. In this regard, the National Climate Change Policy 2011 provides a framework for addressing the issues that Pakistan faces or will face in future due to the changing climate. The policy provides a comprehensive framework for the development of an action plan for national efforts on adaptation and mitigation. The goal of the policy is to ensure that climate change is mainstreamed in the economically and socially vulnerable sectors of the economy and to steer Pakistan towards climate resilient development

The main objectives of Pakistan's climate change policy 2011 include

- ▶ To pursue the sustained economic growth by appropriately addressing the challenges of climate change

- ▶ To integrate climate change policy with other related national policies
- ▶ To facilitate and strengthen Pakistan's role as a responsible member of the international community in addressing climate change challenges
- ▶ To focus on pro-poor gender sensitive adaptation while also promoting mitigation to the extent possible in a cost effective manner
- ▶ To ensure water, food, and energy security of the country in the face of challenges posed by climate change
- ▶ To minimize the risks arising from expected increase in frequency and intensity of extreme events: floods, droughts, tropical storms, etc.
- ▶ To strengthen inter-ministerial and inter-provincial decision making and coordination mechanism on climate change
- ▶ To facilitate effective use of the opportunities, particularly financial, available both nationally and internationally
- ▶ To foster the development of appropriate economic incentives to encourage public and private sector investment in both adaptation and mitigation measures
- ▶ To enhance the awareness, skill and institutional capacity of relevant stakeholders
- ▶ To promote conservation of natural resources and long term sustainability

The climate change threats to Pakistan are:

- ▶ Considerable increase in frequency and intensity of extreme weather events, coupled with erratic monsoon rains causing frequent and intense floods and droughts
- ▶ Projected recession of Hindu Kush-Karakoram-Himalayan (HKH) glaciers due to global warming and carbon soot deposits from trans-boundary pollution sources, threatening water inflows into Indus River System (IRS)
- ▶ Increased siltation of major dams caused by more frequent and intense floods
- ▶ Increased temperature resulting in enhanced heat- and water-stressed conditions, particularly in arid and semi-arid regions, leading to reduced agricultural productivity
- ▶ Further decrease in the already scanty forest cover from too rapid change in climatic conditions to allow natural migration of adversely affected plant species
- ▶ Increased intrusion of saline water in the Indus delta, adversely affecting coastal agriculture, mangroves and breeding grounds of fish
- ▶ Threat to coastal areas due to projected sea level rise and increased cyclonic activity due to higher sea surface temperatures
- ▶ Increased stress between upper riparian and lower riparian regions on sharing the water resources
- ▶ Increased health risks and climate change induced migration
- ▶ The above threats are the cause of major survival concerns for Pakistan, particularly in terms of the country's water, food, and energy security considerations

## State of the Environment

### Air

With an estimated 37 percent of its population living in cities, Pakistan is the most urbanized country in South Asia. Rapid urbanization has been accompanied by environmental problems such as pollution, waste management, congestion and the destruction of fragile ecosystems. Urban air pollution remains one of the most significant environmental problems facing cities. A substantial body of research demonstrates that high

concentrations of suspended particulate matter adversely affect human health; prolong a wide range of respiratory diseases and increases the probability of heart ailments.

The higher concentration of Suspended Particulate Matter (SPM) in the air is a major issue in Pakistan. The main sources of SPM are vehicular emission, industrial emissions, burning of solid waste, pollens, brick kilns and natural dust.

SPM can originate through natural phenomenon, such as unpaved roads and places uncovered by

green grasses or trees. Fine sized particles of soil may be raised in the form of dust cloud by driven motor vehicles and by strong wind. Another origin of fine particles is anthropological activities. These include emissions from the motor vehicle and industrial activity. Climatic and geographical conditions also affect the level of SPM in ambient air. These include the type of soil, temperature, wind speed, relative humidity and quantity of precipitations.

Several studies of air, water and noise pollution have been carried out by the Pakistan Environmental Protection Agency (Pak-EPA). In June 2011, Pak-EPA conducted a study to monitor the vehicular emissions in Islamabad. Vehicles were examined at 13 different locations of Islamabad. A total of 576 diesel, petrol and CNG driven vehicles were tested in 13 days. Nearly 43.5 percent of the total vehicles tested were found non-compliant of National Environmental Quality

Standards (NEQS). During this study, noise level was also monitored and found within safe limit except at two places where the noise level was recorded to be over the safe limit for a short period of time.

Ambient air quality data recorded by real time automatic monitoring stations in the five capital cities confirmed the presence of high concentration of suspended particulate matter. The level of PM (Particulate Matter size below 2.5 micron), which is mainly due to the combustion source, was reported to have reached an alarming level (2-6 times higher than the safe limit). The National Environmental Quality Standards (NEQS) for PM 2.5 is 25 micron/m<sup>3</sup> annual average. The table and figure below show annual mean value of PM 2.5 in five capital cities.

**Table 16.2: Annual Mean Value of Suspended Particulate Matter (PM 2.5) from June 2011-March 2012**

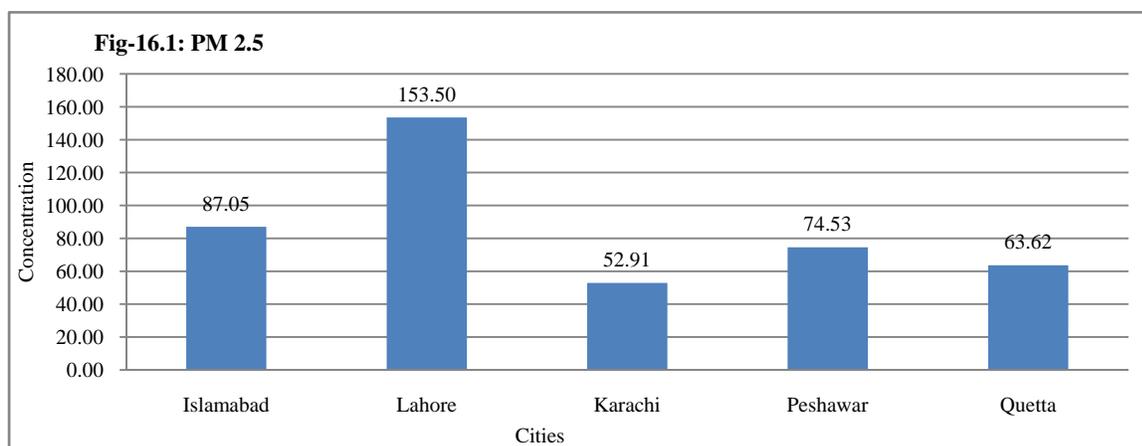
Sr. No.	City	Level ( $\mu\text{g}^*/\text{m}^3$ )
1.	Islamabad	87.05
2.	Lahore	153.5
3.	Karachi	52.91
4.	Peshawar	74.53
5.	Quetta	63.92

Source: Pakistan Environment Protection Agency.

\*  $\mu\text{g}$  =  $\mu\text{g}$  stands for microgram

The level of other pollutants in the ambient air like carbon monoxide (CO), Sulphur dioxide (SO<sub>2</sub>), Oxides of nitrogen (NO<sub>x</sub>), Ozone (O<sub>3</sub>) and Hydrocarbons (HC) are within safe limits according to National Environmental Quality

Standards (NEQS) for ambient air. Sometimes the concentration of NO<sub>x</sub> and SO<sub>2</sub> goes higher than the safe limit at Lahore and Peshawar, but this happens for short periods of time and represents a short time exposure to the public.



Motorcycles and rickshaws, due to their two stroke (2-strokes) engines, are the most inefficient in burning fuel and contribute most to emissions. 2-stroke vehicles are responsible for emission of very fine inhalable particles that settle in lungs and cause respiratory diseases. The 2-stroke vehicles

industry is fast growing in Pakistan and has increased by 117 percent in 2010-11 when compared with the year 2001-02. Rickshaws have grown by more than 11.1 percent while motorcycles and scooters have posted a growth of 120.4 percent over 2001-02, (Table 16.3).

**Table 16.3—Motor Vehicles on the Road** (000 Nos.)

Year	Total	Motorcycles/Scooter	Rickshaws
2001-02	2561.9	2481.1	80.8
2002-03	2737.1	2656.2	80.9
2003-04	2963.5	2882.5	81.0
2004-05	3146.4	3064.9	81.5
2005-06	3868.8	3791.0	77.8
2006-07	4542.9	4463.9	79.0
2007-08	5126.3	5037.0	89.3
2008-09	5456.4	5368.0	88.4
2009-10	5501.2	5412.1	89.1
2010-11	5558.6	5468.8	89.8

Source: National Transport Research Centre

The use of coal in the power sector has been decreasing. This may be due to the fact that a number of plants have now been converted to natural gas. Likewise, there has been a reduction in coal usage for domestic purposes. Bricks kilns are

another source of pollution in many areas. Use of low-grade coal and old tyres in bricks kilns generate dense black smoke (soot) and other kind of emissions. The use of coal has increased by 64.2 percent for bricks kilns in 2010-11 when compared with year 2001-02 (Table 16.4).

**Table 16.4: Consumption of Coal** (000 M/Tons)

Year	Power	Brick Kilns	Household
2001-02	249.4	2577.5	1.1
2002-03	203.6	2607.0	1.1
2003-04	184.9	2589.4	1.0
2004-05	179.9	3906.7	-
2005-06	149.3	4221.8	-
2006-07	164.4	3277.4	1.0
2007-08	162.2	3760.7	1.0
2008-09	112.5	3274.8	0.8
2009-10	125.5	3035.2	-
2010-11	96.5	4231.5	-

Source: Hydrocarbon Development Institute of Pakistan

- : Not Available

In the past few years, the CNG Sector has seen tremendous growth. 3,331 CNG stations are currently operational making Pakistan one of the largest users of CNG in the world. The use of CNG as an alternate fuel in the transport sector has helped to reduce air pollution to a considerable

extent including reduction of suspended particulate matter (SPM) emitted from the public transport as well as private vehicles. Since the country is facing a shortage of CNG, other alternative sources such as LNG are being considered as a part of environment friendly component.

**Table 15.5—Growth in CNG Sector**

As on	CNG Stations (No.)	Converted Vehicles (No.)
December 2000	150	120,000
December 2001	218	210,000
December 2002	360	330,000
December 2003	475	450,000
December 2004	633	660,000
December 2005	835	1,050,000
December 2006	1,190	1,300,000
16 <sup>th</sup> May, 2007	1,450	1,400,000
February 2008	2,063	1,700,000
December 2009	3,051	2,000,000
June 2011	3,331	2,740,000

Source: OGRA, Ministry of Petroleum & Natural Resources

### Water and Sanitation

Although 70.9 percent of earth's surface is covered with water nearly 97 percent of this is saltwater. Most of the remaining 3 percent are in the polar ice caps, glaciers, atmosphere or underground reservoirs and hard to reach. Only 0.4 percent is available for direct use. Freshwater is a precious natural resource and fundamental to the survival of humans and most other land-based life forms.

### Water Pollution

Water pollution has been a serious concern affecting not only humans but also plants and animals. The ecosystem of rivers, lakes, streams, and seas are deteriorating due to contamination of water from various sources. This situation is leading to many health problems including serious illnesses transmitted by polluted drinking water such as cholera, typhoid fever, hepatitis A and B, dysentery, etc. Dumping of solid and liquid industrial waste, improper disposal of human and animal waste, and residues of agriculture practices like fertilizer and pesticides are all major contaminants of drinking water. These pollutants are discharged directly into rivers and irrigation canals and also transmitted by rain water runoff and get mixed with ground water aquifer.

### Drinking Water and Sanitation

Globally, access to drinking water was at 87 percent in 2011. In order to meet the MDG target, an additional 2 percent is needed by 2015. In Pakistan, statistics on access to drinking water is

impressive; according to the Pakistan Bureau of Statistics (PBS) report Pakistan Standard Living Measurement (PSLM) 2010-11, access to drinking water to urban and rural population of Pakistan is 94 and 84 percent respectively, with an average of 87 percent in 2011. Hence access to the source of drinking water is satisfactory.

According to Pakistan Council of Research in Water Resources (PCRWR), the majority of the population in the country is exposed to the hazards of drinking unsafe and polluted water from both surface and ground water sources. As derived from the National Water Quality Monitoring Programme carried out by the PCRWR, the 4 major contaminants in drinking water sources of Pakistan were bacteriological (68 percent), arsenic (24 percent), nitrate (13 percent) and fluoride (5 percent). Similarly, the five years trend analysis has revealed that out of a total 357, only 45 water sources (13 percent) were found "safe" and the remaining 312 (87 percent) were "unsafe" for drinking purpose. In Pakistan about 68 percent of the drinking water consumption is from groundwater for both urban and rural areas.

Pak-EPA has conducted a 4 month study to monitor the water quality of Rawal Lake and its tributary. Samples were collected on monthly basis and analyzed at the Central Laboratory for Environmental Analysis and Networking (CLEAN). Parameters like biological oxygen demand (BOD), conductivity and total suspended solid were found to be higher than surface water standards. BOD was found to be 2 to 8 times and

TSS 1.2 to 6.2 times higher than surface water guidelines.

Globally, improved sanitation coverage was just above the 60 percent mark in 2008, up from 54 percent in 1990, with over 2,500 million people still without access. Half of the people living in developing regions have no access to improved sanitation<sup>1</sup>.

Municipal sewage is a major source of surface water pollution. About 2 million wet tons of human excreta are annually produced in the urban sector of which around 50 percent go onto pollute water bodies. The National Conservation Strategy states that almost 40 percent of all disease related deaths are connected to water borne diseases. Other sources of water pollution are industrial effluents, solid waste, hospital waste, chemical fertilizers and pesticides.

In Pakistan sanitation facilities are improving. However, much improvement is needed for rural areas sanitation facilities. According to PBS Pakistan Standard Living Measurement 2008-09, 14 percent of all garbage collection facilities provided to the population are executed through municipalities, 7 percent through privately managed collection systems, and the remaining 79 percent have no system.

The most basic requirement for proper sanitation is safe disposal of excreta away from a dwelling unit, by using a sanitary latrine. There is a great variation in latrine coverage between provinces. Urban Sindh has the best coverage followed by urban Khyber Pakhtukhwa.

In most of the urban and rural population water is supplied from the ground water except for the cities of Karachi, Hyderabad, and part of Islamabad, which mainly uses surface water. Therefore, deteriorating ground water quality in Pakistan has serious implications for the environment and health of Pakistan's population.

Different national and international reports have identified Pakistan as one of the most 'water stressed' countries in the world, facing lack of

water availability for irrigation, industry and human consumption. According to a World Bank report, water supply in Pakistan fell from 5000 cubic meters to 1000 cubic meters in 2010, and is likely to further reduce to 800 cubic meters per capita by 2020 due to growing population pressure, rapid urbanization and industrialization.

The government is committed to provide safe drinking water through clean drinking water initiatives and installation of water filtration plants. However, the execution and monitoring of government efforts are being hindered by limited resources, increasing population, fast growing urban development, industrialization, high operational and maintenance and poor cost recovery, lack of private sector participation, and low institutional capacities.

#### **Strategy and Action Plans (Water & Sanitation)**

- ▶ Develop legal and policy frameworks regarding promotion of safe drinking water in Pakistan. This promotion would include desalinization of sea water.
- ▶ Develop a water quality database to assist in decision making.
- ▶ Establish a water quality monitoring and surveillance system based on enforceable water quality guidelines and standards. Conduct cyclic 4 seasonal water quality monitoring for major rivers and water reservoirs.
- ▶ Address arsenic pollution of groundwater in Sindh and Punjab through specific initiatives including investigative studies and awareness raising programmes.
- ▶ Develop legal and policy frameworks regarding promotion of safe drinking water in Pakistan.
- ▶ Make installation of water treatment plants an integral component of drinking water supply schemes.
- ▶ Develop an integrated approach that will guide the allocation of water, allocation of investment and pricing of water services, both in rural and urban areas.

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<sup>1</sup> UN-2011

- ▶ Promote and devise methods for harvesting rain water using low-cost structures.
- ▶ Clarify national sanitation policy in order to make it explicit and consistent.
- ▶ Encourage and promote public toilets in all urban centres.
- ▶ Develop systems for safe sewage disposal.
- ▶ Awareness raising and bringing an attitudinal change.
- ▶ Generate resources (locally and nationally) and ensure participation of stakeholders.
- ▶ Guide appropriate technical choices.
- ▶ Establish public-private-civil society collaborative arrangements.

According to a report released by the WHO/UNICEF Joint Monitoring Program (JMP) 2012, in Pakistan 92 percent people had gained access to source of drinking water by 2010 while this ratio was 85 percent and 89 percent in 1990 and 2000 respectively. The MDG target is to achieve the ratio of 93 percent by 2015. Moreover, 48 percent people have been using improved sanitation by 2010 while this ratio was 27 percent and 37 percent in 1990 and 2000 respectively. The MDG target for access to sanitation is 90 percent by 2015.

### Forest

Currently Pakistan has only 5.17 percent of total land area covered with forest placing Pakistan among countries with low forest cover. The country's forest area is divided into state-owned forests, communal forests and privately owned forests. Major forest types existing in Pakistan are temperate and subtropical conifer forests, scrub forests, riverine forests (irrigated plantations), liner plantation (roadside, canal-side) and mangrove forests. The existing forest resources in the country are under severe pressure to meet the fuel-wood and timber needs of a rapidly growing population. In addition to this, the wood based industries including housing, sports, matches and furniture are continuously growing.

### Forests and REDD+ (Reducing Emissions from Deforestation and Degradation plus)

Increasing GHG emissions are contributing to global warming and leading to accelerated climate change. The REDD+ initiative facilitates trade between developed countries who are net emitters of GHG and the developing countries who are net non-emitters, since they do not have heavy industry that produce carbon but have forests that can stock excess carbon in the air. Under REDD+ mechanism, the emitters may trade their carbon to be consumed/stocked by forests in developing countries at a per ton cost to be calculated as per Certified Emission Reduction (CER). This process builds a nexus between climate change and forest carbon credits. Therefore, the concept of REDD+ was developed as an incentive based mitigation response from the Montreal Climate Change Negotiations (COP 11) in 2005 to address 17-25 percent reported global share from deforestation and forests degradation. This will involve enhancing existing forests and increasing forest cover. This concept has three important phases:

- ▶ **Readiness phase (2010-2012):** enacting national strategies supported by appropriate capacity building
- ▶ **Pilot phase or Investments phase:** 'learning by doing' through pilot projects. This is underway in some countries, before the enactment of international rules.
- ▶ **Implementation or Operations phase (2013-2020):** performance-based payments are made, either by direct funding or via links to the global carbon market, leading to the global implementation of REDD+.

### REDD+ Potential and Pakistan:

Pakistan has a low forest cover with diversified forest types from coastal mangrove and riverine ecosystem to alpine Chir Pine forests within placed diversified community. There is a decline in overall forest cover in Pakistan, with the amount of forests declining by just under 2 percent in the 1990s, but by more than 2 percent in just five years, from 2000 to 2005. This decline needs to be taken into account to get maximum benefits from

REDD+. The government is striving to reverse these negative trends and aiming to increase Pakistan's forest cover to 6 percent by 2015.

The total carbon stock of conifer forests could be estimated as 58 mega tons on the basis of biomass estimations by Asia Least cost Greenhouse Gas Abatement Strategy (ALGAS). On the bases of FAO Deforestation data 1990-2005 and ALGAS, 389 mega tons of carbon potential could be estimated for all types of forests in Pakistan with an estimated annual return of US\$ 54 million at a rate of US\$ 15 per tonne of carbon credits<sup>2</sup>. Other estimates by Leadership for Environment and Development (LEAD) 2010<sup>3</sup> points to potential earnings of between \$94.74 million and \$315.8 million per year if deforestation is halted completely. This estimate reflects the limited data available and provides only an indicative estimate. The actual potential could be far greater, depending on the carbon price and the sectors included under REDD+.

Pakistan's efforts with regard to the REDD+ initiative need to be significantly enhanced on a priority basis in order to achieve the global target and meet the basic requirements of REDD+ readiness phase. As Pakistan faces a high rate of deforestation and aims to reverse this trend, the active engagement in REDD+ is a unique opportunity to support this national priority. However, this needs to be driven by a focused strategic plan and supported by a scaling up of national technical and institutional capacity to deal with REDD+ mechanism.

### **Mangroves Ecosystem and Coastal Resources**

The coastal belt of Pakistan extends up to 1,050 km along Sindh and Balochistan provinces. The total population in and around mangrove forests on the coast of Pakistan is estimated to be around 1.2 million people, nearly 900,000 of whom reside in the Indus Delta<sup>4</sup>. At least three quarters of the Delta's rural population depend, directly or

indirectly on fishing as their main source of income.

Pakistan's commercial marine fisheries operate in and around the mangrove creeks on the coast of Sindh province. The annual value of fish caught from mangrove dependent fish species in the Indus Delta is estimated at around \$20 million. Shrimps are also particularly important, with a domestic value of \$70 million and an export value of about one and a half times this figure, and the export of mud crabs contributes an additional \$3 million to the regional economy.

Beside these economic benefits, the mangrove forest benefits the ecosystem by providing nurseries for many species of fish and shrimp, stabilize shorelines and reduce coastal erosion, and protect coastal habitations from storm damage. It provides grazing grounds to at least 8,000 camels, 5,000 buffaloes and over 1,000 goats, in addition to providing other forest products like fuel wood, honey, and medicinal plants to local communities. It is estimated that one hectare of properly managed mangroves can yield 100 kg of fish, 25 kg of shrimp, and 15kg of crab meat annually.

### **Mangrove Forest Degradation**

The most prominent and most sensitive ecosystem of the region is characterized by mangroves forest that form a number of direct and indirect linkages with the socioeconomic status and occupations adopted by the community. The figures from Sindh Forest Department (SFD) and IUCN-Pakistan estimated that 196,000 ha of mangrove forest in Pakistan has been lost up to 2007. According to the change analysis done by WWF-Pakistan at Keti Bunder site through satellite imaging, the mangrove cover has experienced a drastic decline of 20 percent, from 1992 to 2007.

Moreover, the creeks are also perceived to widen in future due to exacerbation of soil erosion along the Arabian Sea, which forces the mangrove forest towards instability and this instability trend has been continuous from 1992 to 2007, with a very nominal percentage of dense mangrove forests remaining stable during this time period. Similarly WWF-Pakistan also reported that the 0.5 million

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<sup>2</sup> Iqbal. K.M.J., and Ahmad. M., (2011) SDPI, Policy Paper Series # 38 September 2011

<sup>3</sup> LEAD (2010) REDD+ Policy Brief 4. LEAD-Pakistan

<sup>4</sup> (Salman 2002), and Sindh Forest Department 2012.

hectares of fertile land in Thatta district alone is affected by sea intrusion.

The other major threats to mangrove ecosystem includes shortage of fresh water and resultant silt depositions, industrial and municipal pollution, dumping of waste, oil spills and leakages, and encroachment of settlements around mangrove forests. The Government of Pakistan has taken steps to halt the deforestation of mangroves by establishing protected areas and new plantations by forest department with the help of non-governmental organizations like WWF-Pakistan and IUCN.

### **Floods of 2011 and Policy Responses**

In a Damage and Need Assessment Report jointly prepared by the Asian Development Bank and the World Bank, it has also been pointed out that in addition to causing loss of life, displacement of millions, and huge losses to the economy, the floods in 2011 have resulted in environmental damages, heightened environmental health risks and affected forests, wetlands and other natural systems. The floods have also caused contamination of drinking water, proliferation of disease vectors caused by stagnant water ponds, and accumulation of solid wastes – factors that would further exacerbate health risks for the affected population, particularly women and children. Environmental degradation and its effects on human health was already a significant development challenge in Pakistan, which has some of the highest prevalence rates in all of South Asia for child mortality, diarrhea and acute respiratory illnesses associated with environmental factors. The conditions created by the floods could result in a significant increase of these and other illnesses. No estimates are available for damages to other environmental resources such as wetlands and mangroves at this stage. To fill such damage data gaps, follow-up environmental studies have been proposed to address safe disposal of debris, leakage/spillage of hazardous and/or toxic substances and assess damage to cultural heritage sites.

The floods were initiated by a natural phenomenon; however, anthropogenic interventions exacerbated them, particularly as

destruction and degradation of natural ecosystems reduced their capacity to protect from flood. Also, development of settlements and croplands in floodplains as well as blocking of natural drainage routes created the conditions for the current human tragedy. To avoid such disasters in the future, strengthening the resilience of the Indus Watershed is urgently needed, involving an approach that combines structural and non-structural measures that are strategic, feasible, and affordable to minimize vulnerability to extreme weather events. Such an approach also calls for improved management of the Indus Basin's major natural resources through strengthened coordination of flood-related actions within and among the provinces. Towards this end, the following priority actions are proposed to be undertaken:

- ▶ Addressing environmental health priorities, including drinking water, sanitation, hygiene and indoor air quality
- ▶ Reviewing/updating the flood protection strategy and master plan, and preparing a storm water drainage master plan; and
- ▶ Preparing land use plans and building regulation, and strengthening legal and institutional frameworks.

The environmental damage caused by floods has been estimated at Rs. 2,762.7 million (US \$ 31.8 million) and environmental recovery / reconstruction needs has been estimated at Rs. 2,873.6 million (US \$ 33.02 million).

### **Environmental Considerations in Policy Response**

The 2011 floods have caused wide-ranging damage to different sectors of the economy. The reconstruction and recovery needs are diverse and multi-faceted and work has to be undertaken on an urgent basis. However, these interventions, particularly those related to irrigation, agriculture, transport, health, education, housing, and water supply and sanitation are likely to cause negative environmental impacts. In order to ensure the sustainability of the reconstruction and recovery process, these negative environmental impacts ought to be addressed as an integral part of all sectoral plans.

The national environmental legislation (Pakistan Environment Protection Agency 1997), as well as the international financial institutions' (IFIs) safeguards require that environmental and social assessments are carried out and management plans/frameworks are prepared prior to undertaking the interventions such as those recommended in the floods Damage and Need Assessment. However, details of the specific activities associated with the individual reconstruction and recovery plans in the majority of sectors are not currently known, hence the potentially adverse environmental and social impacts of these activities cannot be identified. Instead, it is proposed that a broad Environmental and Social Screening and Assessment Framework (ESSAF) be prepared for the overall reconstruction and recovery needs.

The ESSAF will define the environmental and social screening and assessment requirements of individual projects or interventions, and will guide the implementing agencies in identifying the appropriate type and level of environmental and social assessment to be carried out prior to undertaking each project or intervention in compliance with national as well as IFI's safeguard requirements. The ESSAF will also define the

requirements for preparing appropriate environmental and social documents, and obtaining approvals/clearances of these documents from the relevant agencies. To ensure implementation of ESSAF, it is further proposed that each line agency (Provincial Disaster Management Authority / District Disaster Management Authority) appoints an environmental and social focal person within the department.

### **Conclusion**

The Government of Pakistan has undertaken various steps to combat the negative impacts of climate change. This chapter provided an account of institutional change, including raising awareness, developing strategy and policies, and implementing programmes to actively address and reverse adversities faced due to global warming and the resultant climate change. The state of Pakistan's atmosphere, including air and water quality, state of forestry, and coastal resources were described, identifying the key challenges that remain in these areas as well as new strategies that have been adopted (REDD+) by the government. The chapter identifies that it will be crucial to carefully evaluate disaster response and rebuilding strategies to make sure that they are environmentally sustainable.