

The Environment and Climate Change Outlook of Pakistan



Foreword

The Environment and Climate Change Outlook of Pakistan is a review of the environmental conditions, the impacts of climate change and the status of national response to the changing situation in the country. Its objective is to provide a general evaluation of the quality of environment and emerging sustainable development trends in the country. While providing data and information on environmental conditions and trends and emerging problems, particularly climate change, the document also analyses critically the policy response to these issues in the country. It also illustrates successful initiatives and best practices, some of which may be replicated. Finally, the report identifies key challenges and areas in which urgent action is needed.

The principal challenge identified is to promote growth in the country while safeguarding natural resources, promoting eco-efficiency, and enhancing public participation while empowering communities to become custodians of the environment. It also notes that although Pakistan contributes very little to GHG emissions, yet the country faces the worst environmental challenge in the form of climate change and dealing with it is no longer an option for the country; it has become an unavoidable reality in the wake of increasing symptoms exhibited through cataclysmic floods and droughts. The potential impacts of climate change identified are wide-ranging and are likely to affect all dimensions of development with impacts across many sectors and ecosystems.

The report highlights that a number of environmental problems of the country are the result of failure to consider the environmental implications of development. It also identifies poverty and difficulties in meeting basic need as another important factor responsible for aggravating environmental degradation. The report underscores that these interdependent and interconnected environmental challenges contain an important message of broadening the vision of economic growth to the holistic perspective of sustainable development.

A number of national and international institutions helped in the preparation of this report. Among national institutions, help was extended by the Ministry of Industries, Ministry of Agriculture, Ministry of Finance, Planning Commission, Federal Bureau of Statistics, GCISC, WAPDA, SUPARCO, NARC, NIO, Pakistan Forest Research Institute, Pak EPA and provincial EPAs, Pakistan Meteorological Department, NDMA, PCRWR, and several other organizations. UNEP, UNESCAP, and international NGOs such as IUCN and WWF also extended assistance in the preparation of the study.

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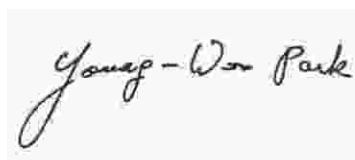
Secretary, Climate Change Division

Preface

The United Nations Environment Programme (UNEP) has the mandate to keep the state of the global environment under review. As highlighted in the Rio+20 outcome document *The Future We Want*, this calls for the provision of scientific information and building national and regional capacity to support informed decision-making. This mandate is implemented by working with partners to help countries develop scientific assessments and identify emerging issues, based on credible data and information, monitoring and earth observation.

The Pakistan Environment and Climate Change Outlook (ECCO) 2013 is one of the outcomes of this mandate. It uses an integrated environmental assessment methodology developed as part of UNEP's Global Environment Outlook assessment process, to present and analyze data and information on the state, trends and outlook of the environment. The Pakistan ECCO report has a particular focus on climate change, and is expected to guide environmental policy, strategy development and planning in the years to come.

The report presents concrete evidence that food, freshwater and the livelihoods of the Pakistani people are under threat due to climate change and environmental degradation. It reveals that inadequate capacity, unsustainable consumption and production, poverty and inequity are primary factors that undermine progress towards environmental sustainability in Pakistan.



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List of Acronyms

ADB	Asian Development Bank
ADP	Annual Development Programme
AEDB	Alternative Energy Development Board
AR	Attock Refinery
ASICTP	Abdus Salam International Centre for Theoretical Physics
BAU	Business as Usual
BC	Biological Capacity
BOD	Biological Oxygen Demand
CAI	Clean Air Initiative
CBD	Convention on Biological Diversity
CBOs	Community Based Organization
CBR	Crude Birth Rate
CDA	Capital Development Authority
CDGL	City District Government Lahore
CDR	Crude Death Rate
CIESIN	Centre for International Earth Science Information Networking
CITES	Convention on International Trade in Endangered Species
CLEAN	Central Laboratory for Environmental Analysis and Networking
CMS	Convention on Migratory Species
CNG	Compressed Natural Gas
CO	Carbon monoxide
COD	Chemical Oxygen Demand
CPI	Cleaner Production Institute
CRU	Climate Research Unit
DALYs	Annual Disability Adjusted Life Years
DSC	Data Surveillance Centre
ED	Ecological Deficit
EEZ	Exclusive Economic Zone
EF	Ecological Footprint
EIA	Environmental Impact Assessment
EKN	Embassy of the Kingdom of the Netherland
ENERCON	Energy Conservation Centre
ENSO	EL Nino Southern Oscillation
ENT	Ear-Nose-Throat
EPD	Environmental Protection Department
EPO	Environmental Protection Order
ER	Ecological Reserve
ERWDA	Environmental Research and Wildlife Development Agency
EPA	Environmental Protection Agency
ESAs	Environmentally Significant Areas
ESI	Environmental Sustainability Index
ET	Environmental Tribunals

List of Acronyms

FAO	Food and Agricultural Organization
FDI	Foreign Direct Investment
FERTS	Fuel Efficiency in Road Transport Sector
FVGCM	Finite Volume General Circulation Model
GCISC	Global Change Impact Studies Centre
GCMs	Global Circulation Models
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Green House Gas
GLOFs	Glacial Lake Outburst Floods
GOP	Government of Pakistan
GTZ	German Agency for Technical Cooperation
HS Rules	Hazardous Substances Rules
HSD	Hi Speed Diesel
HYT	Hayat Abad
HYV	High Yield Variety
IBRD	International Bank for Reconstruction and Development
ICM	Integrated Coastal Management
IEE	Initial Environmental Examination
IMF	International Monetary Fund
IMR	Infant Mortality Rate
INAA	Instrumental Neutron Activation Analysis
IPCC	Intergovernmental Panel on Climate Change
IRIN	Integrated Regional Information Network
IPOE	International Panel of Experts
ITOPF	International Tankers Owner Pollution Federation
ITP	Islamabad Traffic Police
IUCN	International Union for Conservation of Nature and Natural Resources
JICA	Japan International Cooperation Agency
KESC	Karachi Electric Supply Company
KIE	Korangi Industrial Estate
KNP	Khunjerab National Park
KPT	Karachi Port Trust
LDA	Lahore Development Authority
LITE	Landhi Industrial Trading Estate
LPG	Liquid Petroleum Gas
MACP	Mountain Areas Conservancy Project
MAF	Million Acre Feet
MCM	Million Cubic Meters
MDGs	Millennium Development Goals
MEAs	Multilateral Environmental Agreements
MFF	Mangroves for Future

List of Acronyms

MoE	Ministry of Environment
MGD	Million Gallons Per Day
MOSAC	Mutual Oil Spill Auxiliary Committee
MSA	Maritime Security Agency
MTDF	Medium Term Development Framework
mtoe	million tons of oil equivalent
NAO	North Atlantic Oscillation
NAP	National Action Programme
NARC	National Agriculture Research Centre
NCB	National Coordination Body
NCS	National Conservation Strategy
NDMA	National Disaster Management Authority
NEAP	National Environmental Action Plan
NEEDS	National Economic and Environmental Development Study
NEIMS	National Environmental Information Management System
NEQS	National Environmental Quality Standards
NFRRAS	Natural Forest Resource Assessment Study
NGOs	Non Governmental Organizations
NIO	National Institute of Oceanography
NOAA	National Oceanic and Atmospheric Administration
NOC	No Objection Certificate
NO _x	Nitrogen Oxides
NSAP	National Strategy & Action Plan
NSDS	National Sustainable Development Strategy
NTFPs	Non Timber Forest Products
NWQMP	National Water Quality Monitoring Programme
ODA	Overseas Development Assistance
PARC	Pakistan Agricultural Research Council
PCAP	Pakistan Clean Air Programme
Pak EPA	Pakistan Environmental Protection Agency
PCRWR	Pakistan Council for Research in Water Resources
PCRET	Pakistan Council of Renewable Energy Technologies
PEPA	Pakistan Environmental Protection Act
PEPC	Pakistan Environmental Protection Council
PEPO	Pakistan Environmental Protection Department
PFI	Pakistan Forest Institute
PISD	Program for Industrial Sustainable Development
PM	Particulate Matter
POL	Petroleum Oil and Lubricants
POPs	Persistent Organic Pollutants
PRSP	Poverty Reduction Strategy Paper
PSDF	Pakistan Sustainable Development Fund

List of Acronyms

PTA	Pakistan Tanners Association
PWC	Physics of the Weather and Climate
RMSE	Root Mean Square Error
RON	Research Octane Number
SACEP	South Asia Co-operative Environment Programme
SCARP	Salinity Control and Reclamation Project
SITE	Sindh Industrial and Trading Estate
SLM	Sustainable Land Management
SMART	Self Monitoring and Reporting Tool
SO ₂	Sulphur Dioxide
SPM	Suspended Particulate Matter
SUPARCO	Pakistan Space and Upper Atmospheric Research Commission
T&D	Transmission and Distribution
TDS	Total Dissolved Solids
TOE	Tons of Oil Equivalent
TSP	Total Suspended Particulates
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Program
UNDP-GEF-FERTS	Global Environment Facility-Fuel Efficiency in Road Transport Sector
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational Scientific and Cultural Organization
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization
UN-REDD	The United Nations Collaborative Programme on Reducing Emission from Deforestation and Forest Degradation
USEPA	United States Environmental Protection Agency
VETS	Vehicle Emission Testing System
WAPDA	Water and Power Development Authority
WASA	Water and Sanitation Agency
WBCSD	World Business Council on Sustainable Development
WHO	World Health Organization
WWF	World Wide Fund for Nature
VOCs	Volatile Organic Compounds

Introduction

This report has two sections. The first section is the Executive Summary while the second is the main report. The main report has been divided into four related parts. The content of each of these parts is summarized as follows:

- *Part One on Environment and Development* has two chapters. The first on Environmental Setting describes the physical and biotic setting and human habitat while the second chapter unfolds the environment and development scene, highlighting resources, environment, population and development trends. It concludes by giving ecological footprint and Biocapacity as well as cost of environmental degradation in the country.
- *Part Two on Environmental Conditions and Trends* comprising three chapters discusses the environmental state and trends in terrestrial, aquatic and atmospheric ecosystems.
- *Part Three on Climate Change* presents the key emerging issues related to climate change. It has two chapters; the first of these describes the dynamics of past and future climate trends, while the second discusses the vulnerability and threats as well as the policies and programmes adapted to combat climate change.
- *Part Four* comprises two chapters *Policy Response and Challenges and Outlook*. The first highlights the response to the problems of environment by various actors including the government, industry and private sector as well as NGOs. The next chapter examines projected trends for the environment, and discusses the future challenges and outlook of environment and climate change in the country.

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Executive Summary

Pakistan is the sixth largest nation of the world in terms of population size, having tremendous amount of natural resources and a variety of ecological regions from the Karakoram Himalayas in the north to the coastal zone in the south. The Himalayan and Hindu Kush ranges lie in the west, while the flood plains of Indus and its tributaries are in the east. Each of these ecosystems has been bestowed with resources that have contributed to the economic development of the country. The rangelands, which cover the bulk of the mountainous landmass, have contributed to maintain its flourishing livestock industry. The highly productive coastal zones of Sindh, with 800 species of fish and a variety of shrimps, have enabled to sustain a thriving fishing industry. The mountainous, riverine and mangrove forests, besides a valuable source of forest products, have provided vital ecological services, protected watersheds, and maintained soil productivity. Last, but not the least, the floodplains of River Indus and the irrigated deserts have provided the breadbasket to the country as productive farmlands.

1.0 Fragility of Environment

The natural resources in the ecosystems of Pakistan are delicately balanced and face numerous challenges. The most critical is the aridity combined with the dependence on a single river system - the Indus, which supports the biggest irrigation system of the world. The country has a predominantly agrarian economy, and agriculture is the second largest sector of economy, which contributes to over 21 percent of GDP, employs 45 percent of the total labour force and provides commodities that are the major source of export earning (GOP, 2010). Its dependence on natural resources, make it imperative that Pakistan's capacity for environmental management is treated as an inseparable element in attaining prosperity through development.

2.0 Driving Forces Affecting the Environment

There are numerous basic causes or driving forces for environmental problems in Pakistan. These include emphasis on quantitative growth at the expense of quality in the past; lack of integration of environmental factors in planning and decision making; dependence on expediencies without regard to their impact on environment; failure of institutions to consider the environment in its totality; and lack of realization of the fundamental interdependence of man, resources, environment and development.

One of the major driving forces putting pressure on the environment has been increasing population. Since its independence in 1947, in roughly three generations, Pakistan's population increased from 32.5 million to 180.7 million in 2012 (GOP, 2012) at an average rate of 2.7 percent per annum. Although the pressure on resources has increased, as more food, more houses and more employment are needed, the growth of population also means increased human power, which can be utilized for sustainable production and for reaping the benefit from demographic dividend.

The phenomenon of the rapidly growing population in Pakistan is also being accompanied by increasing concentration of population in the urban areas. The country's urban population multiplied more than ten-fold during 1950-2012 period, compared to this, the total population increased over five-fold. The trend of growing urbanization has also witnessed concentration of urban population in a few major cities. Karachi, the largest city of the country has 20 per cent of the total urban population, followed by Lahore and Faisalabad with another 20 per cent. Rawalpindi, Multan, Hyderabad, Gujranwala and Peshawar together hold another 14 per cent, while the remaining 46 per cent of the urban population lives in about 400 relatively small town and cities. The eight largest cities mentioned above have been growing at the rate of over three percent per year, and according to projected trends this growth rate will continue in the next decade (City Mayors Statistics, 2012).

From the environmental stand point, the phenomenal increase in the population of Pakistan, whether total or urban, without corresponding expansion in basic amenities of life and infrastructure has exposed a majority of people to conditions, which are far from satisfactory. This can deteriorate further in the absence of well-conceived and properly planned corrective actions in the years to come.

Since independence, the economic growth rate in Pakistan has been higher than the average growth rate of the world economy. The average annual real GDP growth rates were 6.8% in the 1960s, 4.8% in the 1970s, and 6.5% in the 1980s. The average annual growth fell to 4.6% in the 1990s when the real GDP growth declined to an average of 4.9% in the first half, and 4.0% in the second half of the decade (GOP, 2003). The economic growth varied considerably after the turn of the century. It was just about 2 % in 2000 but it took a turnaround at over 5 per cent in 2002-2003 (GOP, 2003). Growth performance for the next four years (2004-08) was striking (GOP, 2008) - recording an average rate of 7.0 per cent per annum. Since the beginning of 2008, however, Pakistan's economic outlook has taken a turn to stagnation due to domestic and external shocks including the sharp rise in international oil and food prices, the internal security hazards brought on by the war on terror and the repeated natural disasters in the form of successive floods. The year 2008-09 saw a dismal growth of 1.7 per cent, which improved in 2009-10, when the economy grew by an estimated 3.1 per cent with slight improvement to 3.7 per cent in 2011-12. Although the macroeconomic context remains difficult in the near term, the economic resilience shown by the country in past could lay the basis for higher growth in future.

Economic growth provides an avenue for promoting development and reducing poverty, but it does not mean that economic successes should inevitably lead to environmental degradation. Sometimes it is justified in terms of the Environmental Kuznets Curve (World Bank, 2006), which shows that with the increasing economic growth and development, pollution intensity increases in the initial phase but declines later. It is, however, misleading to imply that environmental neglect is an economically prudent development strategy. The prevention or mitigative strategy to environmental damage has been found to be more cost effective remedy (World Bank, 2006). A case in point is the trend of infant mortality in Pakistan, which was initially lower in the country compared to other nations in the same income group. Later, Pakistan's growth rate enhanced much faster, but unfortunately the same could not be achieved in terms of reduction in infant mortality.

Similarly, the rate of deforestation in Pakistan during the last decade of the previous century was greater than other countries in the same income group, despite better economic growth. This clearly implies that with economic growth alone, the country cannot simply "grow-out" of environmental or social problems and policies are needed to address the negative externalities that erode natural resources, damage the environment, and have adverse social consequences. The planners in this country, therefore, have to

understand and incorporate these relationships clearly for pursuing short- and long-term policies for sustainable development.

3.0 Environmental Pressures and Trends

A number of Pakistan's environmental problems have emerged from resource misuse. Short-term interests have put a great strain on the environmental carrying capacity. In addition, the declining population resource ratio and ensuing poverty have also affected the quality of life. Certain types of developments have themselves contributed to resource degradation and pollution, and made the problems even greater. The situation has become so enmeshed in a vicious circle that it is not possible to separate cause and affect clearly, or to establish dividing lines. For example, it is difficult to establish whether the actions of the poor lead to environmental degradation or the lowered environmental carrying capacity leads to poverty.

The pressures on all kinds of ecosystems in Pakistan are increasing with time. In terrestrial ecosystem, for example, the pressure on cropped area is quite high and the per capita availability of cropped land is only about a quarter hectare per person. Despite expansion in agricultural lands, it declined from 0.46 hectares per capita in 1981 to 0.21 per capita in 2010 (Khan, 1986 and GOP, 2012). The inevitable future increase in population of about 3 million every year necessitates to focus on additional food production and farm output. However, in view of high man-land ratio and limited prospects for increasing arable land, the pressure is on enhancing production through farm inputs and other innovative means.

The process of land degradation has affected a large portion of the country's agricultural land (GOP, 2002). The suspended sediment load per km sq of drainage basin in the country is one of the highest in the world. It is an adequate indicator of the intensity of soil erosion, which has affected about 18million hectares of land so far; salt affected soils are estimated to over 5 million hectares; while another 2 million hectares is waterlogged. In spite of tremendous efforts for reclamation, large tracts of irrigated lands are still lying waste as a result of waterlogging and salinity, mainly in the area where canal irrigation is practiced. Annual costs of agricultural losses from soil salinity, erosion and rangeland degradation have been estimated at 48-100 billion rupees (World Bank, 2006).

Forests cover about 5.2 percent land area in Pakistan (GOP, 2010). This percentage is quite low as compared to a desired level of 20 to 30 percent. According to the Natural Forest Resource Assessment Study (NFRAS 2005), forest resources in the country are declining, and it has been estimated that the deforestation rate over the 1990-2005 period was 2.1 percent or 47,000 hectares annually. Among various types, the most valuable coniferous forests are declining at the rate of 40,000 hectares annually. Gilgit Baltistan and Khyber Pakhtunkhwa have the highest annual rates of deforestation (about 34,000 hectares per year in Gilgit Baltistan, and 8000 hectares per year in Khyber Pakhtunkhwa). The rate of decline in riverine and mangrove forests was estimated at 2,300 and 4,900 hectares per year respectively. These are alarming rates considering the low level of forest coverage in the country together with high ecological value of forests in maintaining the life support system. Annual costs of deforestation losses have been estimated at 206-334 million rupees (World Bank, 2006).

The low share of the forest area taken in association with the large population of Pakistan gives only 0.033 hectares per capita compared with world average of one hectare (GOP, 2010b). Rising costs and decreased supply is the most likely future scenario of forests in Pakistan, in the wake of increasing population and growing income and demands on forest products. It has been estimated that the annual timber requirement of 2.0 million cubic meters in the early eighties has already doubled to about 4.0 million cubic meters at

present, while the contemporary firewood consumption has also almost doubled from 16.6 million cubic meters to 30 million cubic meters (GOP, 2010b) during the same period.

No systematic attempt has been made in Pakistan so far to list the diversity, endemism or threats to species of fauna and flora. However, according to the IUCN Red List of Threatened Animals (IUCN, 1996), 37 species and 14 sub-species of mammals in Pakistan are internationally threatened or near threatened. Among birds and reptiles 25 and 10 species are internationally threatened respectively. Some 500-plant species are also believed to be nationally rare or threatened (Davis et al 1986). Regarding genetic diversity, Pakistan is rich in indigenous crops with an estimated 3,000 taxa of cultivated plants. There are about 500 wild relatives of cultivated crops, most of which are found in the Northern Areas of Pakistan (GOP, IUCN and WWF, 2000).

Historically, northern and western Pakistan constitutes one of the world centres on the origin and diversity of cultivated plants. However, this genetic diversity is under serious threat after the introduction of high-yielding varieties and mono cropping. Expansion of land for cultivation, deforestation, overgrazing and dam construction are posing additional threats to wild land races of cultivated crops.

Pakistan's aquatic resources are also under pressure. According to estimates, the Indus River irrigates 80 percent of the agricultural land extending over an area of 21.5 million hectares (GOP, 2010c). With the diversion for irrigation, the amount of water in the Indus River downstream has declined dramatically from 185,000 million m³ per annum in 1892 to 12,300 million m³ per annum in 1990s (IUCN, 2009). As a consequence of reduced water flows, the natural ecosystem of the Indus Delta has been seriously affected by saltwater intrusion due to backwash from the sea. The resultant adverse impacts on the ecology and economy of the Indus Delta have contributed to the loss of millions of dollars (IUCN 2003, 2009). Besides problems arising due to water withdrawal, irrigation itself has created several ecological problems. The most serious - water logging and salinity - has resulted from sub-optimum use of water in a badly managed irrigation system. While average water delivery efficiency due to age, overuse, and poor maintenance of canals and consequent seepage has reduced to 35 to 40 per cent from the canal head to the root zone (Faruquee, 1999), it has also caused land degradation through water logging and salinity.

Pakistan's per capita availability of water is about 1000 m³, which puts it in the category of 'high stress' countries. Vision 2030 has estimated that in the wake of high population growth, increasing demands of agriculture and related economic activities, growing urbanization and industrialization, as well as extended periods of droughts, an additional 48 billion m³ water would be required in the near future. This will require water conservation as well as judicious use and management of the available water resources. River flows fluctuate in Pakistan and during flood season, high flows cause serious damage to life and property. Due to low storage capacity, the excessive water cannot be utilized effectively and gets wasted by flowing into the sea. According to current estimates, on average, 43 billion cubic meter of water flow into the sea during the flood season. The country's current water storage capacity is only 9 per cent of the average annual flows compared to the world average of 40 percent. Therefore increasing storage capacity to conserve flood water must form an important part of the water policy/strategy.

Deteriorating water quality is another serious environmental problem in the country. The important sources of water pollution are silt, salt and municipal and industrial waste. The increasing number and size of human settlements in the vicinity of water bodies is a major cause of severe stress on the aquatic resources. The total waste water discharges in Pakistan are estimated to be 7,590 million cubic meters (MCM) per annum (21 MCM per day). Thirty percent of these discharges are from industries, which amount to about 6.25 MCM per day (Khan, 2010). The municipal/domestic discharges are more than half of these discharges. It is projected

that both municipal and industrial discharges will double by 2025. Presently only one percent of urban wastewater is treated in Pakistan, and the remaining flows into streams and rivers without any treatment (GOP, 2007). The treatment of industrial waste water is particularly essential in view of the fact that currently a considerable amount of their discharge contains toxic chemicals and heavy metals, which find their way into river water and the sea.

In marine environment, besides pollution, the shrinking of mangroves has been a serious setback, partly due to excessive water withdrawal upstream of Indus, and as a result of deforestation. Lately the management and afforestation efforts have improved mangrove situation though (See Chapter 4). In terms of pollution, the worst hit is the Karachi coastline, which is being affected by a number of economic activities taking place in urban and industrial, port and shipping, municipal and domestic and transportation sectors. A major portion of untreated wastewater from these activities is discharged into the sea mainly through Lyari and Malir rivers. Many creeks and coastal waters in the Karachi area exhibit increased organic loads resulting in an increased productivity accompanied with oxygen depletion of water near the bottom (harmful to benthic shrimps such as penaeid and ground fishes). They have also given rise to noxious phytoplankton and algal blooms in recent years.

The production of fish in Pakistan went up from 272 thousand tons from the sea and 60 thousand tons from inland water bodies in the early nineteen eighties (IUCN, 1984) to 668,000 metric tons from the sea and 284,000 tons from the inland water bodies at present (GOP, 2010). The fish catch potential from the coastal and deep-sea belts in Pakistan's Exclusive Economic Zone (EEZ) needs to be estimated urgently, in the absence of modeling of which there is danger that a major expansion of marine fisheries could over-exploit one or more species to the long term detriment of these resources.

The deteriorating quality of urban air and global climate change are the major issues affecting the atmospheric ecosystem in Pakistan. Urban air quality has deteriorated in the wake of growing industrialization, multiplication in number and type of industries, enhanced use of chemicals, fast increasing mechanical traffic and increased energy consumption. Based on existing air quality monitoring data, particulate matters (PM_{10} and $PM_{2.5}$) are the main sources of air pollution. PM concentrations were found to considerably exceed the limits set by WHO guidelines in all surveyed cities. Heavy concentrations of PM cause a high burden of respiratory diseases in the population. This is confirmed by a World Bank (2006) study that the estimated high health costs of air pollution related diseases ranged from Rs.62 to Rs.65 billion per year, about 1% of GDP (World Bank, 2006). It is important to consider these kinds of environmental costs in the national planning and decision-making process for attaining economic growth, if the country expects to use the full range of its natural resources most efficiently. It also underscores the urgent need to effectively implement measures to reduce particulate pollution.

In terms of climate change, in agreement with the global trend, average annual temperature over Pakistan increased by $0.6^{\circ}C$ during the last century. The rate and nature of change, however, has not only varied over time but also across the country. For example the temperature increase over northern Pakistan was higher than over its southern part ($0.8^{\circ}C$ versus $0.6^{\circ}C$). Further, it was higher in second half compared to the first half of the last century. Projections at the Global Change Impact Studies Centre (GCISC) in Pakistan, based on historical weather data and modeling have shown a strong correlation among the IPCC's predictions and projections for Pakistan. Studies based on the ensemble outputs of several Global Circulation Models (GCMs) project that the average temperature over Pakistan will increase progressively corresponding to an increase in average global surface temperature by $2.8-3.4^{\circ}C$ by the turn of the present century. The projected temperature increases, for Pakistan as a whole in 2020s, 2050s and 2080s are $1.31^{\circ}C$, $2.54^{\circ}C$ and $4.38^{\circ}C$

respectively in A2 scenario and corresponding 1.45°C, 2.75°C and 3.87°C in A1B scenario (See Chapter 6).

Climate change will have serious impacts on all aspects of sustainable development in the country - economic, social as well as environmental. This is despite the fact that the country contributes very little to the global green house gas (GHG) emissions. Its per capita emissions of GHG falls much below the global average with 1.9 tons of per capita GHG emissions, Pakistan stands at a level which corresponds to about one-third of the world average, one-fifth of the average for Western Europe and one tenth of the per capita emissions in the US, putting it at 135th place in the world ranking of countries on the basis of their per capita GHG emissions (GOP, 2010c).

4.0 Economic and Social Impacts

One of the major impacts of environmental degradation has been on the carrying capacity of resources and ecosystems. For example, the livestock population of Pakistan is over 167 million heads (GOP, 2012), a large portion of which is concentrated in the rangelands of Pakistan, constituting over half the land area of the country (GOP, 2010a). This land should normally have been capable of providing forage to support bulk of this population. However, in the past, ineffective management of range resources has led to serious overgrazing. The mobility of the herds kept by nomadic people has also devastated a very large portion of Pakistan's natural pasture.

The situation in crop land is no different. The agricultural production in the eighties represented a record experience for Pakistan. However, when compared with the, expansion in physical and technical inputs in agriculture (water, seed, fertilizer, pesticide, machinery etc.) the increase in output or yield per hectare of crops does not appear to have produced a corresponding growth. Moreover, it has also led to the emergence of such problems as water logging and salinity and chemical contamination. Diminishing return and damage to life support system have also become operational in mining, fishing and other sectors. It is vital to improve environmental performance, reverse these trends and protect the life support system for maintaining growth and productivity of natural assets in Pakistan and to enhance human welfare.

A major impact of environmental contamination has been on human health including morbidity and mortality. This is evident from the two leading causes of death in children - diarrhea and acute respiratory infection. The former is caused by polluted water, while the later by polluted air. The World Bank has estimated that the health cost of ambient air pollution alone is 62-65 billion rupees per annum, whereas the same cost has been estimated to result from indoor air pollution. The World Bank (2006), monetizing overall losses from environmental degradation states, "The mean estimated cost of environmental and natural resources damage is about 365 billion rupees per year in Pakistan or 6 percent of GDP". This amounts to a loss of one billion rupees per day.

Pakistan is also a victim of environmental impacts that have resulted from actions beyond its border and resulted in such phenomenon as climate change. The impacts of climate change will be quite serious on the country. These affects are likely to be multidimensional i.e. across sectors and ecosystems and will have adverse impacts on both natural resources and the livelihoods that they support. Particularly at stake are food, water and energy security. The vulnerabilities of Pakistan to climate change have enhanced due to its warm climate; preponderance of arid and semi-arid land; and dependence of its rivers on glaciers that are reported to be receding as a result of global warming. The economic dependence of the country on agriculture makes it highly climate sensitive. Agriculture in the country is increasingly at risk due to variability in monsoon rains and, increasing floods and droughts.

The frequency and severity of extreme natural events has considerably increased lately (See Chapter 7). A severe flood in 2010 submerged one fifth of the country and affected over 20 million people (Oxfam, 2010). Likewise another flood in 1991-92 had heavy impact on agricultural sector, made its growth rate for 1992-93 negative and reduced the overall GDP growth rate from 7% in 1991-92 to only 2% in 1992-93. Droughts have also become common. The worst drought in Pakistan was experienced during 1998-2001, which affected over 3.3 million people across all provinces of the country. It made thousands of people refugees and hundreds died of thirst and starvation. The drought also affected about 30 million livestock, amongst which over 2 million got killed (GOP, 2003).

Climate change will also have social impacts by affecting health, causing displacement of people and resulting in reduction or loss of people's income due to enhanced natural calamities such as floods and droughts etc. It can also affect hundreds of jobs there by putting increased number of people at risk of hunger and malnutrition and triggering migration and civil unrest. The capacities of individuals, communities and societies in the country to effectively respond to such threats will depend on a combination of natural and socio-economic factors. Coastal communities and small farmers will be at greater risk. Rural houses constructed from mud and makeshift materials will be more vulnerable compared to better quality houses in urban areas. The poor will also have problems due to increased cost of living as a result of reduced food security, enhanced health related expenditure and increase in energy prices. It is therefore extremely important for policy makers in Pakistan to take these factors into account while framing adaptation measures.

5.0 Institutional and Policy Response

The gravity of environmental challenges has varied in Pakistan in historical perspective, so has the policy response during the course of years. The history of policy response to environmental problems in the post-independence period can be divided into four phases. The first phase from 1947 to 1957 was a period of environmental neglect. The second phase, which lasted from 1958 to the holding of the United Nations Conference on Human Environment in 1972 in Stockholm, was a period of adhocism, when environmental problems were tackled in a piecemeal fashion. The third phase from 1972 to 2000 marked the beginning of a new era during which institutions, policies, and legislation were evolved. The fourth or current phase, from 2000 onwards, marks the beginning of an era during which the environmental institutions matured, a number of policies were developed, environmental monitoring system was established, and an environmental management system was developed.

5.1 Institutional and Legislative Developments

A major positive development after the United Nations Conference on Human Environment was the provision of constitutional mandate for the preservation of environment in 1973. Another manifestation of new concerns was the issuance of the Pakistan Environmental Protection Ordinance in 1983 (GOP, 1983). The new Ordinance created a powerful Pakistan Environmental Protection Council (PEPC) and a Pakistan Environmental Protection Agency (Pak EPA) in 1984. An initial task assigned to the Agency was the preparation of National Environmental Quality Standards (NEQS). The Agency had the mandate to revise the standards as and when required with the approval of the Council. The most important task of the Agency was the administration of the Environmental Protection Ordinance. The Pakistan Environmental Protection Act (PEPA) of 1997 (GOP, 1997), superseded the Pakistan Environmental Protection Ordinance of 1983. It was a framework legislation that provided an umbrella for setting the general condition, while providing legal mechanisms for the control of pollution and the promotion of sustainable development. The Act defined and demarcated the powers and functions of PEPC, Pak EPA, provincial EPAs and Environmental Tribunals. The

establishment of PEPC with legislative power, Pak EPA and Provincial EPAs with administrative powers and Environmental Tribunals with judicial powers completed an integrated system of environmental institutions in Pakistan.

A significant aspect of the eighties and nineties was the realization of the link between development and environment, which resulted in the creation of an Environment Section in the National Planning Commission. The provincial planning departments also established corresponding environment sections. These sections were made responsible for the environmental screening of public sector projects. As a responsible member of the community of nations, Pakistan also ratified important multilateral environmental agreements/conventions including United Nations Convention on Biodiversity (UNCBD), United Nations Framework Convention on Climate Change (UNFCCC), United Nations Convention on Desertification (UNCCD) and Convention on Persistent Organic Pollutants (POPs) etc.

5.2 Policies and Strategies

In terms of policies, a landmark feature was the adoption of the National Conservation Strategy (NCS) in 1992 as the guiding environmental policy for Pakistan. The turn of the century saw considerable progress in environmental policy making and planning and development of a number of sectoral and sub-sectoral policies/plans as follows:

- Biodiversity Action Plan of Pakistan 2000
- National Action Programme to Combat Desertification in Pakistan 2002
- Poverty Reduction Strategy Paper 2003
- National Energy Conservation Policy 2006
- National Sanitation Policy 2006
- Pakistan Wetland Programme 2007
- Energy Security Action Plan 2005
- National Drinking Water Policy 2009
- National Water Policy 2005
- National Rangeland Policy
- National Wetland Policy
- National Forest Policy
- National Climate Change Policy

As per the recommendation of Agenda 21 (United Nations, 1992) and Johannesburg Plan of Implementation (United Nations, 2002) Pakistan also finalized its National Sustainable Development Strategy (NSDS) with funding assistance from the United Nations Environment Programme (UNEP). NSDS has taken into account the existing sectoral policies (such as the Biodiversity Action Plan, Forestry Sector Master Plan, Health Policy, National Sanitation Policy and Social Action Plan) as well as intersectoral policies (such as Poverty Reduction Strategy, Energy Security Action Plan). Priorities in three dimensions of sustainable development - environmental, economic and social - have been highlighted in the Strategy. The NSDS document has identified more than a dozen strategies and policies that are important building blocks for NSDS implementation. The main challenge for NSDS in Pakistan is to put the country on a sustainable development path, the progress in which should be measured through improvements in the quality of life of its people as well as economic growth. Another challenge is to seek active participation of all major groups/actors in the implementation of this people-centred approach advocated by the Strategy. The past tradition of involving

major groups/actors in the development and implementation of NCS and other policies and plans could be quite useful in this regard.

Among major groups, national and international NGOs and academia including IUCN, Leads Pakistan, WWF and universities have played important role in promoting sustainable development through advocacy, education, training and capacity building, demonstration projects, monitoring and research, undertaking environmental campaigns and raising environmental awareness and/or acting as pressure groups. Besides working on their own, they assisted the Government in the development and implementation of projects and programmes. The media has also remained proactive and played a major role in drawing attention to pressing environmental problems and in raising awareness and communicating important messages.

Despite the above efforts, however, the environment continues to deteriorate and the implementation of the initiatives remains a challenge in Pakistan in terms of institutional, legislative as well as regulatory or incentive based performance. A number of previous studies have discussed shortcomings of institutional and legislative framework particularly with reference to meeting the objectives of environmental governance for which they were created. Many Governmental Policies and reports have themselves raised pointers in this direction (see chapter 8). There is a need in the country to reform the institutional and regulatory framework on the basis of lessons learnt. This would better ensure the improvement of environmental performance and sustainability of Pakistan's economic growth.

6.0 Future Outlook

The findings of the Environment and Climate Change Outlook Report of Pakistan consistently show that challenges related to sustainability have been intensifying with the continuous deterioration of the environmental trends in the country. Lack of financial resources and technology, inadequate capacity, unsustainable consumption and production, population increase, poverty and inequity are the key problems and constraints. In addition, knowledge gap, inadequate research and development efforts, particularly on the part of the private sector and lack of consumer associations and traditions for environmentally friendly goods also pose critical shortcomings. Other policy gaps include:

- Lack of conducive policy environment for business and industry to promote resource efficiency, generate low waste and toxic materials and strive for carbon neutrality;
- Lack of policy framework for internalization of social and environmental costs in the production process;
- Lack of policy measures to promote demand and supply of sustainable products and services in the market;
- Lack of mainstreaming sustainable use and management of natural resources in the decision-making process;
- Lack of policies and measures for sustainable public procurement;
- Limited development of institutional capacity through knowledge management, technology transfer, education, training and awareness raising.

If the future outlook for environment is explored in terms of driving forces, one clearly sees enhanced pressure on the environment due to growth in population and economic activities as well as changing lifestyle, which is getting more resource profligate with time. In terms of population, Pakistan will become the fifth largest nation on earth by 2050 with a population of about 265 million (GOP, 2010). In economic terms,

the current Pakistan Framework for Economic Growth (GOP, 2011a) as well as Vision 2030 (GOP, 2007) advocate and project high rates of output growth. Such growth is critical in creating employment, alleviating poverty and making resources available for infrastructure and human resource development and for increasing access to basic amenities. However, this will also increase the pressure on resources. For example, according to Energy Security Action Plan (GOP, 2005a), the primary commercial energy demand in Pakistan is projected to increase six and a half times from about 55 million ton of oil equivalent (mtoe) in 2005 to 360 mtoe by 2030 (GOP, 2005b, 2007).

The pollution load in terms of discharges is also expected to increase inevitably as material inputs expand. Thus, with unchanged policies and technologies, emissions from power plants, industries, and traffic will grow exponentially, and is likely to have a corresponding high cost on human health. Hence, there is a need to implement appropriate policies, programmes and to create mechanisms for the same. A major task is to develop clear signals and incentives that the Government can provide to organizations and actors responsible for promoting development. Enforcement of environmental legislation, rules and standards for enforcing policy instruments poses one of the biggest challenges that would need to be resolved effectively.

As mentioned above, the global environmental problems such as climate change also had their toll in Pakistan. The Government has formulated its National Policy on Climate Change. While implementing this policy, it is important to make it multi-faceted that should not only cut across a number of priority sectors but also incorporate an interlinked array of economic and political decisions. Priority mitigation and adaptation measures also need to be adopted to ensure a climate sensitive development in the country. Moreover, it should be implemented within the overall context of the international policy framework comprising the Climate Change Convention and the Kyoto Protocol while safeguarding the national environmental imperatives.

A key cross-sectoral challenge for Pakistan will be to build a resilient interrelated socio-economic and ecological system, which is able to respond to the types of shocks such as financial, fuel and food crises that recently affected the world economy. The roots of such a system will lie in the adoption of resilient and adaptive governance with focus on three elements: (i) respecting the limits; (ii) developing resilience; and (iii) caring for system linkages.

Sectoral planning would also need revamping. It should closely analyze the links between the sector in question and the rest of the economy. For example, energy planning should take into account the needs of transport, industry and agriculture, as well as the input requirements of the energy sector, economic equity impacts of energy prices, availability and security of supply. Within the sector, it should consider interrelationships among the sources of energy, for example, coal, oil, natural gas, biomass and renewables, together with their costs, environmental impacts and other trade-offs.

The command-and-control model has not yielded the desired results in improving the environmental performance so far. A pressing challenge therefore is to substitute the present command-and-control model with a more appropriate one. The diminishing resources are making it imperative to seek a policy model based on a mix of command-and-control and market-based mechanisms. The role of the Government in such a model should be that of a facilitator rather than provider. Moreover, a more prominent and rigorous role would need to be played by the private sector through improved management and a pricing reform for providing environmental goods and services. This model used in some South East Asian countries appears to have great potential for Pakistan, both in terms of resolving the financial resource deficits and rapidly increasing costs of providing infrastructure and services (including water supply, sanitation, transportation and power expenditures) required for a large and fast growing population.