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With only 5% of its land under forests, Pakistan is especially vulnerable to deforestation. This report describes the extent of Pakistan's deforestation problem as well as environmental issues related to the country's aquatic and atmospheric ecosystems, wildlife resources, human settlements and health, food and energy resources, and tourism. Background information on Pakistan's geography, biodiversity, and culture is also provided. Major problems are identified as: (1) deforestation leading to soil erosion, desertification, and flooding (more than 60% of the land is already or likely to be affected by desertification); (2) irrigation, which has created waterlogging (2 million ha) and soil salinization (4.2 million ha); and (3) increased water pollution (due to siltation, biological contamination, industrial effluents, and agricultural chemicals), which is a major threat to human health and to the fishing industry, a primary source of foreign exchange. The report also describes the country's efforts to combat these problems through institutions, legislation, and public education campaigns. Several weaknesses in the government's response are raised, including a lack of integration between conservation and development, inadequate coordination among environmental institutions, the narrow focus of environmental legislation, and the absence of agencies to enforce these laws.

Part 1 of 2 parts

PN-ABC-922

ISN 61879

GOVERNMENT OF PAKISTAN
(Environment & Urban Affairs Division)
ISLAMABAD

ENVIRONMENTAL PROFILE OF PAKISTAN

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December 1988

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PREFACE

The problems relating to environment and the need to protect and preserve it from further deterioration have lately drawn national as well as international attention. Internationally, the deliberations of the United Nationsl Conference on Human Environment held in Stockholm (Sweden) in June, 1972 clearly indicate the intensity of this problem and brought a new dimension to the environmental movement by emphasizing the corelationship between environment and economic development. Within Pakistan, it has been voiced by public leaders, experts general public and mass madia focussing attention towards deteriorating environment.

The high growth rate of population is further deteriorating the environment and fast depleting natural resources. Demands for cropland, fuel timber, and overgrazing have caused widespread deforestation leading to desertification, erosion, and flooding. Inappropriate farming practices and indiscriminate use of pesticides aggravated natural and mancaused problems. The net work of canals for irrigation in the country has created waterlogging, salinity and allied problems.

The Environment and Urban Affairs Division with a view to review the major environmental problems of Pakistan and the impact of the development process upon resources and the environment, carried out detailed study. Consequently it lead to the preparation of a comprehensive Environmental Profile of Pakistan. The Profile is intended to provide direction in future efforts to deal with the management, conservation, and rehabilitation of the environment and natural resources as the present pattern of economic growth may not be sustainable for a longer period unless due recognition is given to the linkages between population, resources environment and development. It has hoped that it will meet the desired objective.

The Environment and Urban Affairs Division is grateful to Dr. Mohammad Aslam Khan, Head of the Department of Environmental Planning and Management, University of Peshawar, to prepare this Profile for the

Environment and Urban Affairs Division. Our thanks also go to other for their invaluable support for this effort. The profile has been finalized after incorporating the government's views as received from the Ministries/Divisions/Departments/Organizations/Institutions.

AYAZ ALI SHAH,
Joint Secretary to the
Government of Pakistan
Environment and Urban Affairs Division
Ministry of Housing & Works.

INTRODUCTION/SYNOPSIS

The episodes of air pollution in Bhopal, famine in Sahel, loss of millions of acres of land through desertification *e.g.* waterlogging and salinity, and upward trends in chemical poisoning and environmental cancer, are some of the events and issues that have brought a fundamental change in the perception of environment in the developing countries. Many people who used to look at the "Environmental Movement" as the problem of the west have been increasingly convinced that the damage caused by the massive interference of man into the environment are not only jeopardising the quality of the life but form a serious threat to the survival of humanity throughout the world without any exception.

2. Though much of the initial thrust of the 'Environmental Movement' was based on concerns about natural resources preservation and pollution control, the seventies brought a new dimension to the movement by emphasizing the correlation between environment and economic development. The Founox Seminar on Development and Environment (1971) and the Stockholm Conference on Human Environment (1972) brought a major break through . . . . . "to bridge the gap in understanding the relationship between environment and development". There was general recognition that all countries needed to undergo further development, so that sound approaches to environmental planning and management should be acquired everywhere. Environmental concern instead of being a barrier to development should be a part of the process, since development that is sound environmentally is also likely to be enduring (Sustained) and avoids unforseen and un-welcome side effects (UNEP, 1982).

3. The Environment and Urban Affairs Division in the Ministry of Housing and Works is the focal point for all environmental matters in Pakistan. Since its very inception, the Division has been involved in the task of integrating environmental consideration into the economic development process. As early as 1973, it made several recommendations for improving the quality of human environment in the country. More recently it has embarked on a programme of preparing appropriate environmental policies, legislation and administrative implementation. This report, which brings out the intensity of problems facing the nation, is a very important .ep in that

direction. The report covers a wide-variety of subjects which are of vital importance to the nation in the field of environment and development.

4. The threat to natural resources, productivity, and the environment have become particularly severe at the national level during the last three decades. Short-term interests have put great strain on the environment carrying capacity. Considerable damage has been done to our terrestrial ecosystem, where forests are disappearing at the rate of one per cent every year. This is certainly disastrous for a country like ours, where the percentage of land under forests is already quite low (only 5%) and where availability of timber is only 0.013 cubic meter *per capita* as compared to 1.60 cubic meter *per capita* in USA.

5. Increasing deforestation is promoting soil erosion, desertification, and flooding. More than 60% of the land in Pakistan has either already or is likely to be affected by desertification. The suspended sediment load per KM^2 of drainage basin in this country is one of the largest in the world. This is an adequate indicator of the intensity of soil erosion which has affected as much as 1.2 Million hectares of land so far. Salt affected soils are estimated to be 4.2 million hectares, while another 2 million hectares are water logged.

6. Pakistan's aquatic ecosystem is rich in resources. It is supplying water for irrigation and other human uses. Additionally its rich fauna provides food both for local consumption and for export, but increased pollution is threatening the viability of this life support system. The existing production of fish is about 272 thousand tons from the sea and 60 thousand tons from the inland water bodies. Research shows that the fish catch potential is much higher than this, but in the absence of modelling of the sustained yield, there is a danger that any major expansion of fisheries may over-exploit one or more species to the long term detriment of the resources.

7. The rapidly conglomerating population in our urban centres and industrial areas is resulting in the increase of environmental improvement through air, water, and soil pollution on the one hand and growing slums, squatters, and congestion on the other. The countless rural communities are faced with glaring inadequacies of basic sanitary facilities, water supplies and malnutrition. All these are threatening the human health with dire consequences in a country where traditional infectious diseases are now being reinforced by new and more deadly ones like cancer.

8. These are some of the facts which show that environmental conservation and development are two sides of the same coin. Conservation aids development because it nurtures the productivity capacities of natural resources and the environment in which people live and work. Development helps conservation by ensuring that the people's needs are adequately supplied so that they are not obliged to over exploit and damage forests, soils, fisheries etc. in the efforts to survive. Recognising these needs, the government of Pakistan has taken many steps, and has promulgated laws and regulations for the rational utilization of natural resources and for the protection of the environment. The environmental problems are, however, too great for the government to tackle alone and to enforce any solutions. This endeavour requires the utmost cooperation of the people, who should be encouraged and promoted to participate in restoring and maintaining the environment. Environmental awareness in this direction has to be undertaken by means of all available media both public and private *i.e.* press, radio, television, Adult Education, school programmes, training courses, people movements, and societies etc.

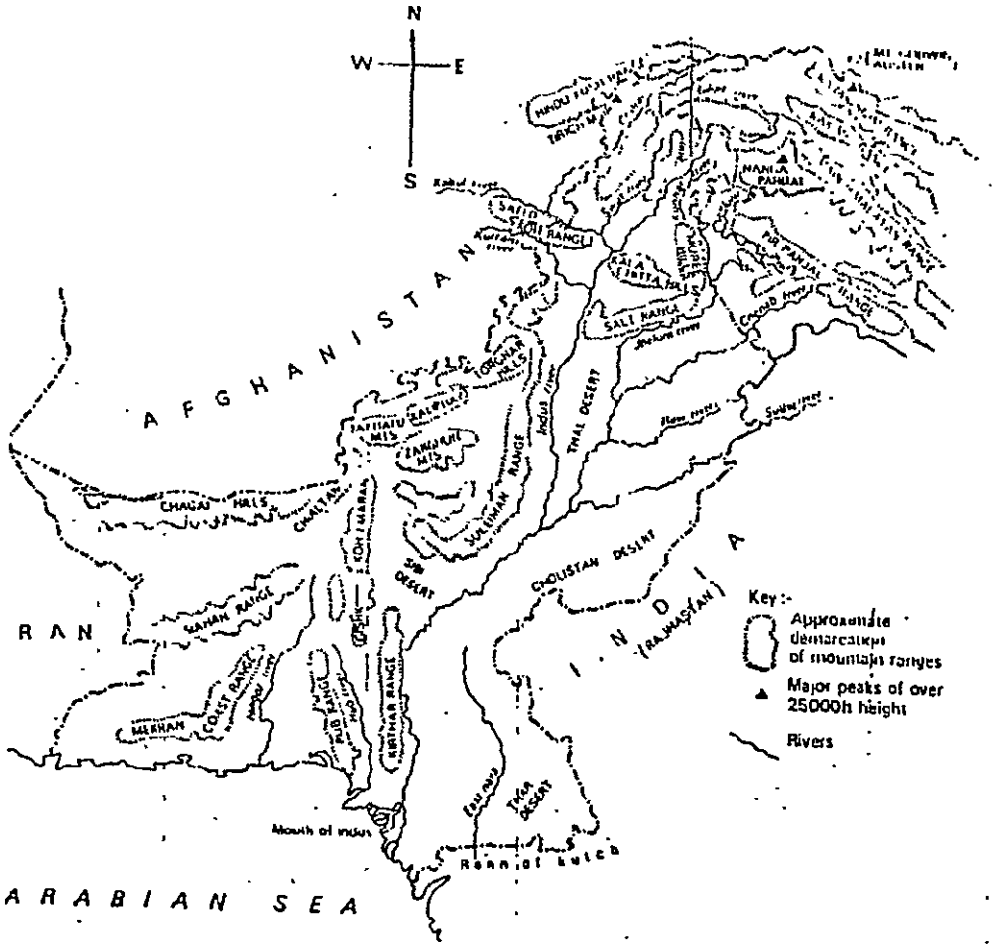

Fig: 1.3 Pakistan : Physiographic Divisions.

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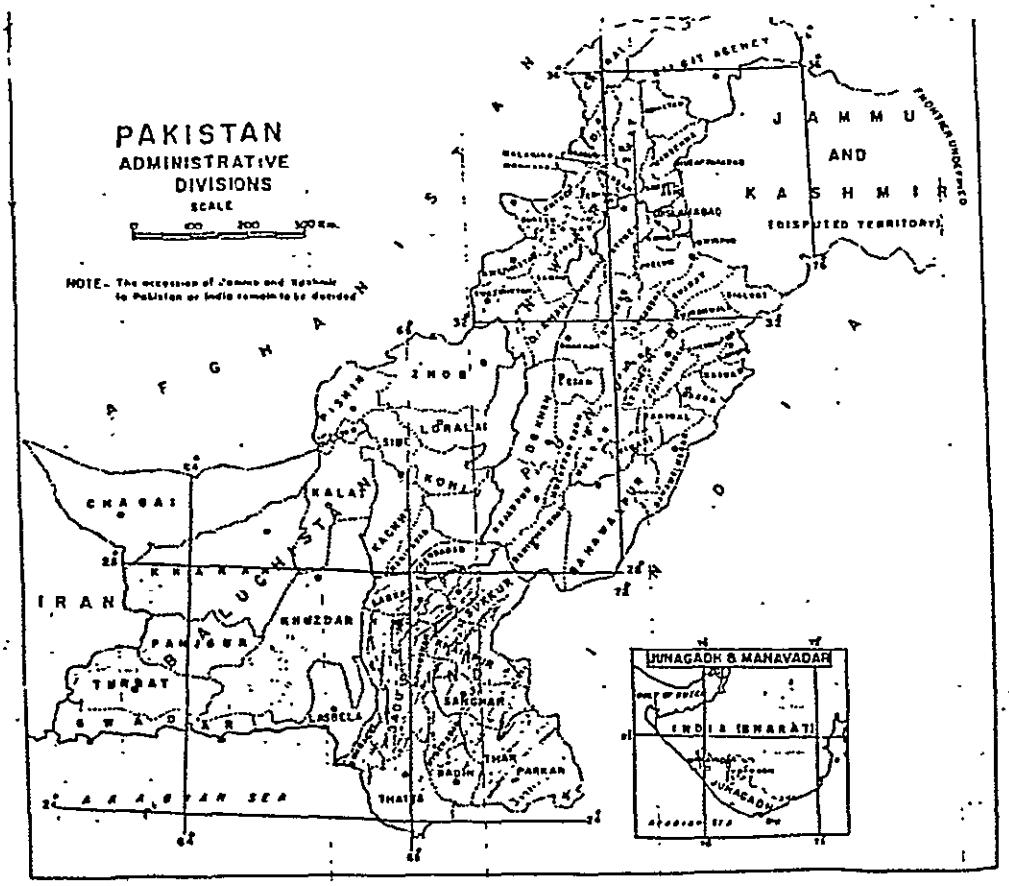
PAKISTAN
ADMINISTRATIVE
DIVISIONS
SCALE
NOTE- The accession of Jammu and Kashmir to Pakistan or India remain to be decided
J A M M U
AND
K A S H M I R
(DISPUTED TERRITORY)
FRONTIER UNDEFINED
A F G H A N I S T A N
I R A N
CHAGAI
KHARAN
KHUZDAR
PANJGUR
TURBAT
SWADAR
LASBELA
ZHOB
LORALAI
SIBI
KALAT
KOHLU
KACHHI
SUKKUR
SANGHAR
THAR PARKAR
THATTA
ARABIAN SEA
JUNAGADH & MANAVADAR
INDIA (BHARATI)
JUNAGADH

Fig: 1.2

PAKISTAN

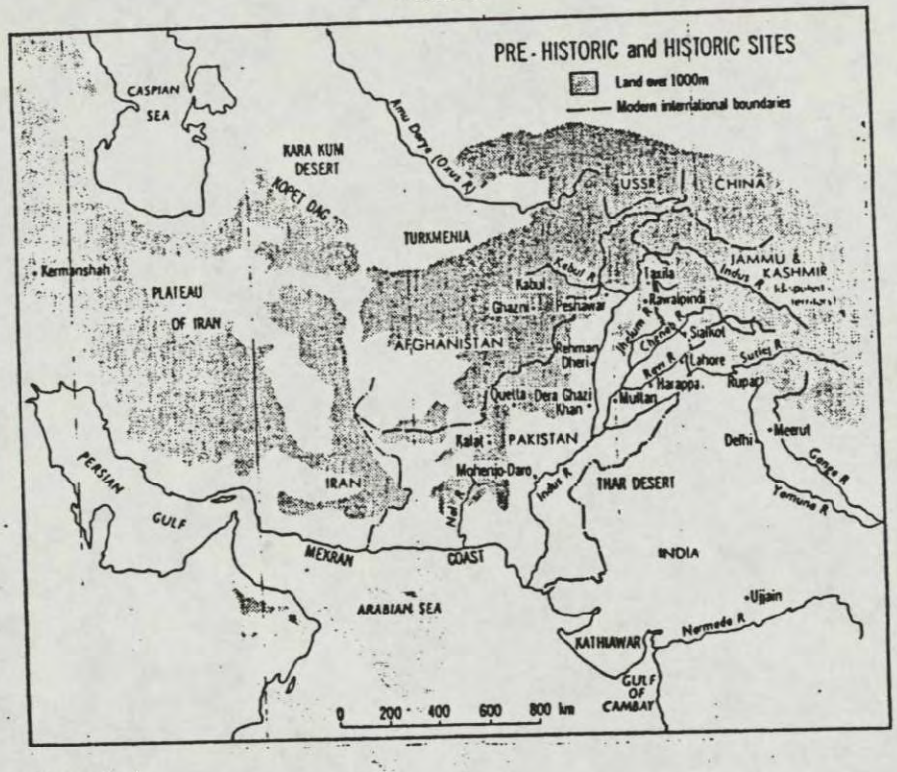

Fig: 1.1

Source: Johnson B.L.C.(1979)

CHAPTER I

ENVIRONMENTAL SETTING

A. *Location and Extent*

1.1 Pakistan occupied the easternmost basin of the three great rivers that traverse the steppe desert of the old world, the Nile, the Tigris-Euphrates and the Indus. That these basins were the cradles of early civilization gives to the Indus a distinctiveness that is lacking in other river basins in South Asia. (Johnson 1979). Emerging as an independent nation of the world in 1947, the country occupies an area of about 0.8 million square kilometers. (GOP 1985). The territory extends from 24°N to 37°N latitude and 61°E to 77° 45 E longitude. For management and administration, it has been divided into four provinces namely- Baluchistan, Punjab, Sind and North West Frontier Province and two federally administered regions. Each province is further divided into division, districts, Tehsils, cities and Mauzas (revenue villages). The two federally administered regions are tribal areas bordering North West Frontier Province, commonly known F.A.T.A., and Federally Administered Capital Territory. (F.A.C.T) of Islamabad.

B. *Physical Setting*

1.2 Physiographically Pakistan can be divided into three major units: the northern mountains, the western highlands and the Indus plain. If two imaginary lines are drawn on the accompanying map (fig. 1.2), one from Khyber Pass to Islamabad and another from Islambabad to a little west of Karachi; then roughly the northen mountains are north of the first line; and the western highland to the west of the second line, and the Indus plain to the east of the same line. In additon to these three , a relatively small physiographic division comprise Potwar plateau and salt range in the Punjab accupying the north-western section of the Indus plain.

1.3 The northern mountains are the meeting place of three great mountain ranges of the world, the Karakoram, the Himalayas and the Hindukush. Virtually all elevations here are higher than 3,500 meters above sea level, more than half are above 4,500 meters and more than fifty peaks are above 6,700 meters. The area also abounds in glaciers, some of which are the

largest in the world, outside the polar region, of course. These glaciers feed the Indus river and its tributaries which form the lifeblood of Pakistan's irrigation system. The vast drainge area of the Indus corresponds roughly to the provinces of Punjab and Sind. The Indus plain in Punjab varies from about 150 to 300 meters and consists of fine alluvium deposited by the Indus, and its five tributaries, *i.e.* Jhelum, Chenab, Ravi, Sutlej and Beas. Southward in Sind, the plain differs in that it is lower in altitude and was formed by the deposit of only one river, *i.e.* the Indus and the alluvium here is of more recent character. The Indus plain is bounded on the west by highlands which are lower than northern mountain in altitude and are also comparatively more arid. The aridity increases in these highlands as one moves from North West Frontier Province in the north to the Baluchistan province in the south. Takht-Suleman is the highest peak in these mountains with a height of 3,374 meters. Adjoining the western mountains in the northeast are the Potwar plateau and the salt range. The plateau varies in elevation from 450 to 600 meters in height. It is deeply dissected by water and wind erosion leading to the development of badland topography at places. At the base of the Potwar plateau is the east-west oriented salt range, a continuous chain of low flat topped hills having rough topography and little or no soil.

1.4 There are great variations in the soils of Pakistan. Reconnaissance surveys carried out by the Soil Survey of Pakistan covering 540,000 sq.km have established about 400 different soil series. Of these some occupy extensive areas whereas others are of limited extent. The texture of majority of the soils ranges from medium to fine. The dominant clay minerals are little type whereas chlorite and montmorillonite type have significant properties. The cation exchange capacities of the soils range from 5 to 20 meg/100gm. In most soils, crabonates range from 5 to 15 percent. The pH in the bulk of soils varies between 7.8 and 8.4; though pH values as low as 5 and as high as 10.5 have been recorded. The normal soils (not affected by salts) have satisfactory permeability rate. Sily soils with weak structure and very low organic matter (less than 0.5 percent) in the top, result in crust formation which interferes with water infiltration, and therefore, with seedling emergence. The soils are characteristically deficient in nitrogen, organic matter and available phosphorus. There are some pockets of potash deficiency as well, especially in the sandy soils and in the submountain regions. (GOP 1983).

1.5 Hydrologically, the country can be divided into three main units viz: the Indus Basin, closed basin of Kharan desert and the Makran coastal basin.

The Indus basin covering some 360,000 sq. miles (GOP 1978) is the largest amongst these. Besides its five main tributaries in the Punjab, the Indus river is also drained by Kabul and its main tributories Swat, Chitral and Panjkora as well as Kurrum and Gomal rivers of N.W.F.P. The rivers of the closed basin such as Mashkel and Zangi Nawar disappear into playes such as Hamun-i-Mashkel and Hamun-i-Lora. The Makran coast rivers, the two principal amongst which are Hingol and Dasht drain into the Arabian sea east of Indus river.

1.6 Pakistan is basically a dry country of the warm temperate zone. Great climatic differences prevail from the northern mountains down to the seacoast in the extreme sourth, but the country's general climatic character is one of aridity. Annual precipitation except in the northern highlands averages less than 250mm, decreasing from north to south. In all more than three fourth of the country has less than 250mm, annually and a small portion with more than 500mm amounts to about 7 percent of the area, and mostly that is mountain slopes. About 20 percent of the total area has less than 125mm and it should not be forgotten that lower the total rainfall, the higher its variability as a rule. (Johnson 1979). The climate of Pakistan has been classified by a number of sources including Ahmad. (1951) Kureshey (1977) and Johnson (1979). In addition UNESCO MAB (19) has also prepared a map of the World (including Pakistan) showing distribution of Arid Regions, based partly on aridity indices and partly on consideration of all available data on soil, relief and begetation (Pakistan portion has been reproduced in Fig. 4). On the basis of this map the distribution of arid, semi-arid and sub-humid regions in the country has been estimated and given in Table. 1-1.

Table 1.1 – Distribution of Arid Regions of Pakistan

Sr. No.	Province	Arid (Km^2)	Semi-Arid (Km^2)	Sub-Humid (Km^2)	Other (Km^2)	Total Area (Km^2)
1.	Punjab	119310	59678	1704	10197	206199
2.	Sind	134896	6018	–	–	140914
3.	Baluchistan	149467	197723	–	–	347190
4.	North West Frontier Procinvce	6194	16491	15160	36676	74521
5.	Federally Administered Tribal Area (FATA)	–	13580	11239	2401	27220
	Total ..	409867	293490	43413	29274	796044

C. *Biotic Setting*

1.7 Pakistan has a great diversity of bioclimates and correspondingly a great diversity of vegetation types and fauna. The major habitats in the country, are the ocean, the swamps, the rivers, the lakes, the flood plains, the arid plains, the sand and pavement deserts, the tropical thorn, tropical dry deciduous, subtropical arid, subtropical dry, subtropical plan, dry and moist temperate and subalpine forests, grassy tundras and cold deserts. (Beg 1975). The choice of habitat by an animal depends very much on its structure and biological characters. Depending upon the type of animal, a specific habitat of a definite magnitude is occupied. Many large mammals, particularly predators, and most brids range over one or more major habitats whereas most small mammals and reptiles inhabit only a portion of one, restricting to specific sites within that. For example, within the tropical thorn zone, several minor but special habitats can be recognized, which embody different animals are adjusted and are thus associated. Animals with different structural and biological characteristics are adapted to various sites. Some are tree dwellers, others rock and cliff dwellers, clay dwellers, sand dwellers, save dwellers, marsh dwellers or water dwellers. It, therefore, becomes important to include also such habitats which are expressed by edaphic vegetation types and seral and degraded vegetation stages, while dealing with the wildlife habitats. (Beg 1975).

1.8 History stands witness to the fact that many parts of Pakistan, the Indus valley in particular, have been occupied by man for several thousand years. Deforestation of vast areas, followed by agriculture and grazing, has changed the phsiognomy of this once thickly forested land. As a result, strange physiognomic patterns havedeveloped in various zones varying from savanna to scrub lands, grasslands, steppes and deserts. Thus much, of the original tropical thorn forest is now not discernible as most of it has since long been destroyed together with its fauna. Natural habitats having been destroyed wildlife suffered a great setback. Many animals could not not survive the changes brought by man and became extinct. Some managed to excape into the adjacent habitats and became adjusted. However, many did mange to survive. Even, the present fauna of Pakistan has a representation of major natural zoological regions of the world. "The trans-Indus and trans Himalayan regions are palearetic and have a good representation of European, North American and Asian Fauna. The Indus lands of Sind and Makran have a visible influence of Ethiopian fauna including African mammals. (Qadri-1974) An inventory of verbetrate fauna of Pakistan has been given in Annexur 1.1.

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1.9 The natural vegetation of Pakistan has been described and/or mapped by various authors including Schweinfurth (1957) Champion (1936) Champion, seth and Khattak (1965) Zegabgraff (1967) Selod (1969)-map only punlished), and Khan (1974). Most of them have considered the vegetation from a climatic point of view, whereas Champion, Seth and Khattak (1965) as well as Khan (1974) have also recorded edaphic types, and even seral and degraded stages and, therefore constitute the best references available. A listing of vegetative species in forests and rangeland of Pakistan has been given in Annexure 1.2. Stewart (1972) has estimated that there are roughly 6000 vascular plant species in Pakistan of these, there are 128 pteridophytes, 23 gymnosperms, 1140 monocots and 4492 dictos (Annexure. 1-3). It may be noted that some of these plants are poisnous and can be fatal for the livestock and human being. A listing of these has been done by Chaghtai etc. al. (1984).

D. *Human Habitat*

1.10 The history of human habitation and village life in Pakistan goes back to several thousand years. Some of the earliest relics of stone-age man in the subcontinent have been discovered in Soan Valley of Potowar plateau near Rawalpindi with a probable antiquity of about 500,000 years However, the process of land settlements and village formation is still uncertain. It may have developed either spontaneously or as a result of permanent settlement of the first tribes or as a delibrate act of colonization or invasion by newcomers. Recent archaeological evidence indicates that settled communities existed in the area even before the dawn of history. When the Aryans entered India they found a mature urban/agricultural civilization in Indus Valley. Parallel to Indus Valley (Wheeler, 1953) were other civilizations in NWFP at Lewan Dheri and Rehman Dheri.

1.11 The sudden end of the Indus civilization referred to above is attributed to one of the earliest known environmental degenerations. From the excavated archaeological sites of this civilization, it has been found that kiln burnt bricks were lavishly used in Harappan culture and evidently unlimited timber must have been available for use in the third Millennium B.C. Harrapan are, therefore blamed to have cruelly used the forests. With no replantation, by the community, the whole sale logging created deforestation and desertification in the Indus Valley. This degeneration of environment had far reaching affects on the existing population. In other words, the Harappans paid to respect to the nature, and had to face the consequences, that they deserved.

1.12 Removal of forests served the harmonious link between the human community and its physical environment. The first affect of whole sale logging was the destruction of forest eco system. Animals who depended on forests for food disappeared: small plant which also depended on large trees for humanous vanished. Soil was exposed to erosion: fast erosion caused silting of rivers inviting frequent and devastative floods, loss of top soil reduced the water retaining capacity of the region, depriving human community of fresh water supply. Transpiration, so important for optimum weather ceased, causing arid conditions with unbearable temperatures. Gradually the entire climate, which was once usefully moderate to sustain luxurious forests and fertile soil changed to greater exterme and turned the major area to mere dust heep. Consequently droughts, famines, floods, pestilence brought the message of apocalyptic doom for the community. Ultimately, the civilization parished leaving behind the bricked houses, roads, and city walls to tell woeful story of the extermination of a great Indus civilization.

1.13 Even before Indus Valley civilization prehistoric settlements of Baluchistan appear to have met a similar fate. "The conditions of agricultural prosperity obtaining at that time in the now barren Baluchistan, appear to be related to higher annual rainfall in those days. The numerous relics of elaborately built dams for the holding up and storage of flood water from the streams, suggest heavier rainfall. (Kureshy 1961). The dams, locally known as gabar-bands, were a common feature of settlements in sourthern Baluchistan. The gabar-bands made of stone were about 300 yards long, up to 8 feet wide and 12 feet high. Their stone facing was sometimes backed by earthern ramps. These gabar-bands reflect climatic conditions with a greater rainfall and large population to provide the necessary labour for their construction. (Stein 1931) Marshall (1951) suggests that the annual rainfall might have been between 15 to 20 inches.

1.14 It is believed that destructionof such civilizations led to reduction of the resources to support future population only at semi-nomadic level. Settlements analogous to present day villages were formed when the main races of the subcontinent passed again from nomadic to the sedentry agricultural stage. These settlements with their groups of land holdings have certain factors in common with the villages of other countries arising from similar elements in early tribal life. However, it is not particularly useful to try and extend these comparisons very far. Because of extreme diversity, it is also difficult to make generalisations about the villages within Pakistan. There are distinct varieties from the coast of Arabian Sea to the mighty Karakoram

ENVIRONMENTAL BASIS OF TRADITIONAL AGRICULTURE

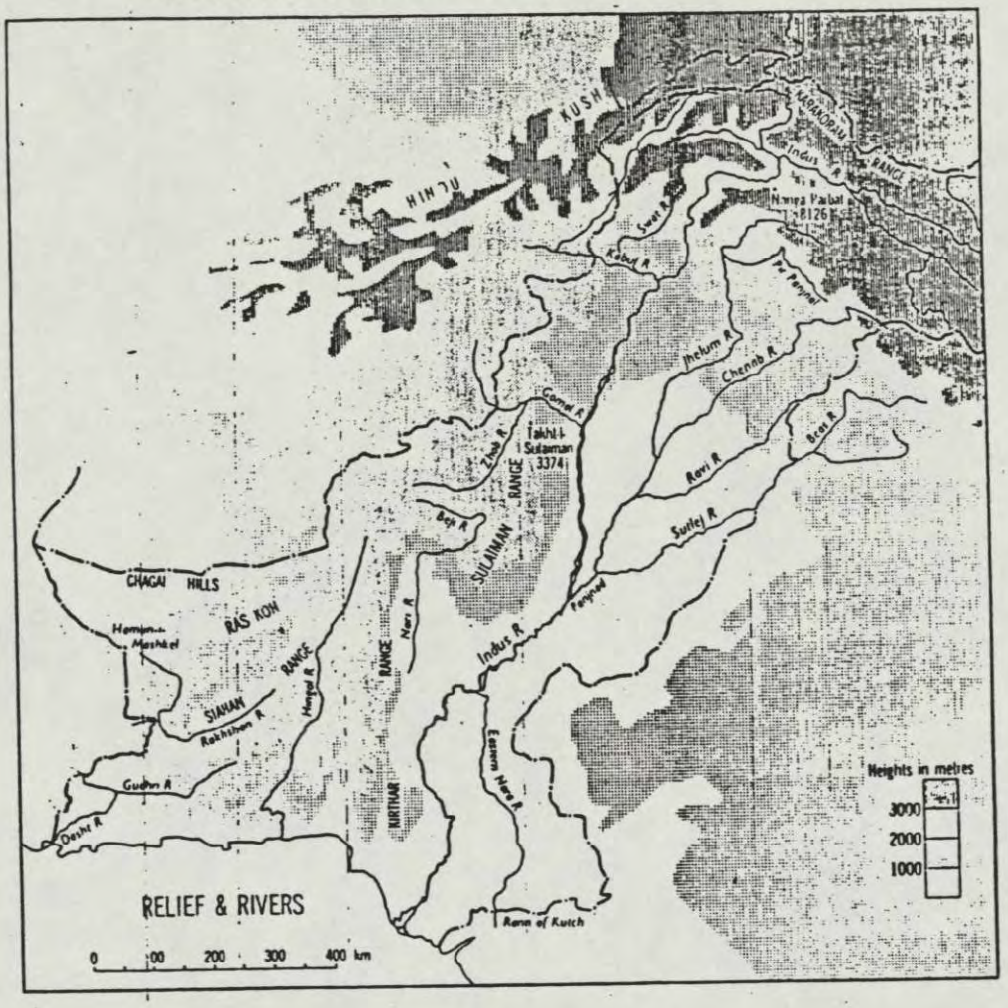


Fig : 1.4
Source: Johnson B.L.C.(1979)

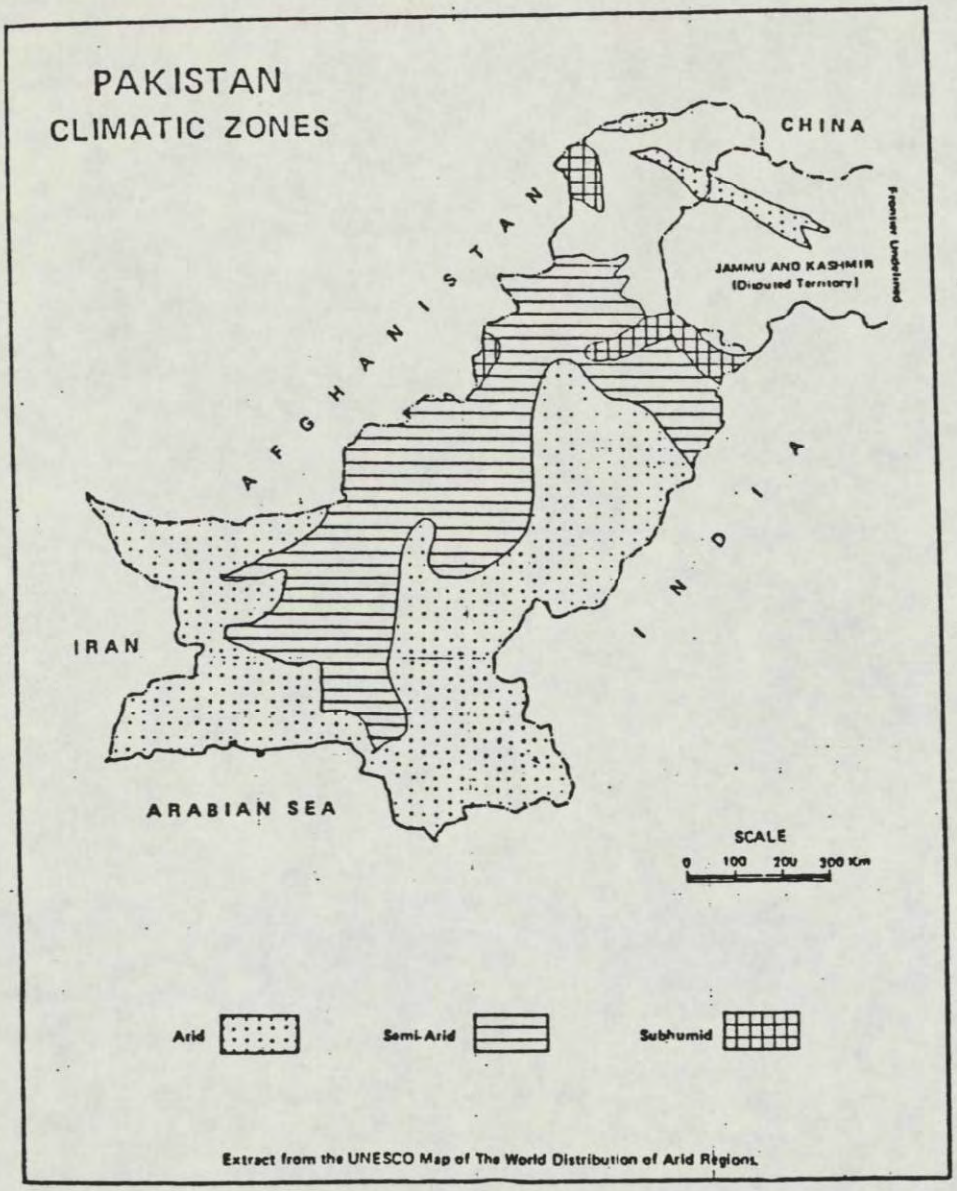

PAKISTAN
CLIMATIC ZONES
CHINA
AFGHANISTAN
JAMMU AND KASHMIR
(Disputed Territory)
Frontiers Undefined
INDIA
IRAN
ARABIAN SEA
SCALE
0 100 200 300 Km
Arid
Semi-Arid
Subhumid
Extract from the UNESCO Map of The World Distribution of Arid Regions.

Fig: 1.5

range. The difference in physical features, climate and available resources has resulted in innumerable regional and local variations.

1.15 In all there are about 43,200 rural localities in Pakistan according to 1981 census (GOP 1985). There distribution by population size is under :—

Table 1-2

PAKISTAN RURAL LOCALITIES BY POPULATION SIZE

Size of Locality	*Number*
Under 200	6360
200–499	8425
500–999	9323
1000–1999	9946
2000–4999	7682
5000-and above	1462
Total (Inhabited)	43198
(Uninhabitated)	1969*

*They are classified as Muza (revenue village) but also do not have any population within their area.
Source: Population Censes Organisation (1985) Handbook of Population Census Data".

In addition to these there are about 415 towns and cities with a great variation in size ranging from less than 5000 to over 5 million. These settlements located in varied environments have their own pattern of resource use. On the one extreme, they have traditional agricultural societies in the mountains and on the other urban-industrial system using capital intensive technologies in metropolitan cities. Environmental impacts of human activities vary amongst these and a number of transient ones. One would have thought that traditional societies would be causing little or no harm to the environment. It is however, not true. In fact, recent statistics on forest loss, erosion and sedimentation, overgrazing and desertification reveal that growing population and increased human activities in the fragile ecosystems of traditional societies is bringing irreversible changes in the environment.

1.16 Human interaction with environment is producing results of varying intensity. A comprehension of the process however requires an understanding of the ecological regions of the country. The first attempt at identifying

ecological regions in Pakistan was attempted by Selod (1969), who prepared a vegetation map of the country which was used to zone the country into ten vegetation regions. Subsequently Rafiq (1971) identified 17 crop ecological zones on the basis of physiography, climate and soil. More recently, Agricultural Research Council (1980) divided the country into ten agro-ecological zones using factors from both natural and human system. These included physiography, geology, climate, agricultural land use and water availability in perennial canals, seasional canals and ground water.

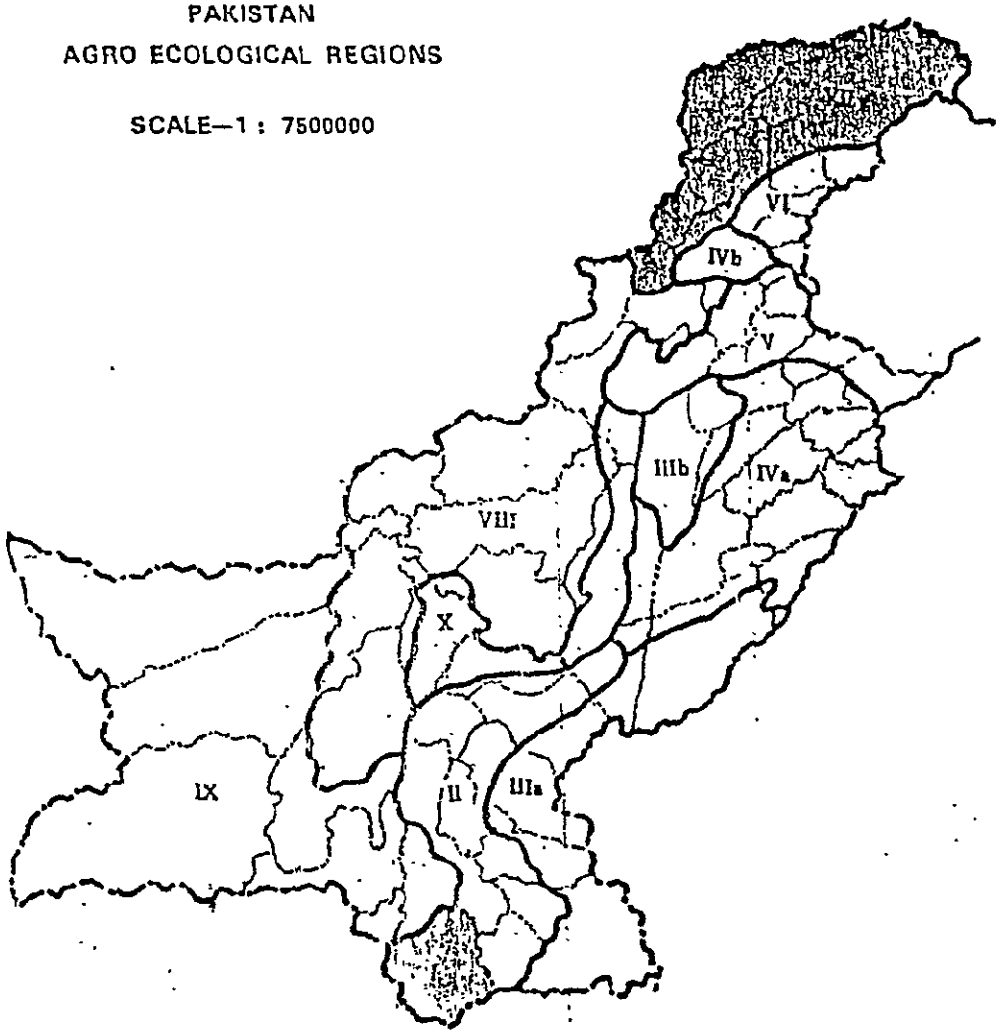
1.17 The group of ten zones thus classified (Fig. 1.6) together with an eleventh zone *i.e.* urban or city system constitutte the terrestrial ecosystem of Pakistan. The wetlands of the country including lakes, rivers, marshes and seas constitutes its aquatic ecosystem, while the blanket of air enveloping the two ecosystems (Terrestrial and Aquatic) is the third viz atmospheric ecosystem. Environmental side effects which are encounted by these ecosystems due to varied human activities and story of their endurance in the face of adversity is the theme of the following chapter of this report.

8a

PAKISTAN

AGRO ECOLOGICAL REGIONS

SCALE—1 : 7500000



I Indus Delta
II Southern Irrigated Plain
III Sandy Desert (a & b)
IV Northern Irrigated Plain (a & b)
V Barani Land
VI Wet Mountains
VII Northern Dry Mountains
VIII Western Dry Mountains
IX Dry Western Plateau
X Sulaiman Piedmont

VII VI IVb V IVa IIIb VIII X II IIIa I IX

Fig: 1.6

Source: Pakistan Agriculture Research Council.

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CHAPTER II

ENVIRONMENT AND DEVELOPMENT

2.1 Pakistan, the ninth biggest nation of the world in terms of population size has immense fragile mountainous, semi arid and desert areas whose productivity is already under serious environmental threat. Moreover, a major part of its 95 million (1985) rapidly growing population lives in near total dependance upon a delicately-balanced water management system drawn from the biggest irrigation system of the world. With this geographical background and predominant agrarian economy in which agriculture sector accounts for almost a third of country's GDP (29%), employs more than half of the population (55%), and earns over two thirds (79%) of the country's export earning (GOP, 1938) it is imperative .that Pakistan's capacity for environmental management and its treated as inseparable element in attaining future prospertiy. Inspite of political setbacks in past the country has made a noteworthy progress in both the agricultural and industrial sectors through development planning during the last thirty years. The need now is to focus upon environmental sustainability, a factor which becomes more critical when one considers the inevitable population growth of the future.

2.2 It is clear that a number of country's problems have emerged from resource misuse. Short term interests have put a great strain on environmental carrying capacity. Rapid increase in rural urban migration and uneven distribution of population has been another reason for environmental degradation and increasing miseries of human settlements. the declining population resource ratio and ensuing poverty, likewise, has affected the quality of life. What is worse is that certain types of development have themselves contributed to pollution and made the problems even greater. The situation has become so enmashed in a vacious 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 poor lead to environmental degradation or the lowered environmental carrying capacity leads to poverty. Nevertheless, it is obvious that indiscriminate use of natural resources can lead to increasing difficulty in maintaining supply and lowering the standard of living. The solution therefore lies in a broader concept of wise utilization of resources.

2.3 It appears that both lack of development and the process of development have contributed to environmental problems in the country. The people of areas with low level of development, motivated by short term exigencies of survival have been neglectful of the long tenn exploitative actions on the environment. The affluents of developed areas, on the other hand, motivated by the incentive of capital investment and higher returns have promoted increasing consumption of resources. The result in both cases have been equal *i e.* exhaustion and degradation of ecosystem. It is therefore, not the question of whether to develop or not to develop but rather how to develop in a sustainable way to meet the multiple national objectives.

2.4 The concern with human environment in Pakistan can only reinforce the commitment to development. "We may now look upon environment as the stock, seen in dynamic terms, of physical and social resources available at a given time for the satisfaction of human needs; and upon development as a process pursued by all societies with the aim of increasing human well being. Thus the ultimate aim of both environmental and development policies is to improve the quality of life. In recognitiion of this terms like 'the new development' or 'alternative styles of development', have emerged which suggest a more rounded way of looking at the purpose of development in which environmental considerations play a central role "(Tolba 1982). This type of development with imaginative policies can help mitigate the rigour of both the 'inner' (inequality, poverty, and Unemployment) and the 'outer' (natural resource scarcities) limits to growth.

2.5 Environment and development are in extricably linked with populatoin and resources. The planners in this country have to understand these relationships clearly for pursuing a policy of sustained development. In this context it may be stressed that the demand for natural resources and environmental amenities in Pakistan is bound to increase sharply for three separate reasons. Firstly the Population which was 84 million in 1981 is expected to increase to 143 million by the year 2000 (PEPAC 1983)a. Secondly the growth of economic activity (GDP) which in thepast thirty years increased at an average annual rate of 5.1%* is likely to gain momentun at a faster rate in future but even if the long term trend continues the demand for natural resources, would double in about 15 years. Thirdly the process of production which is becoming more capital and technology intensive is likely to increase further the pressure on the natural resources. However, the supply of natural resources may not increase appreciably in line with the above demands, in future and may even decrease in absolute terms. In addition, as in the past, the quality of natural resources may also continue to delcine and even assume aggravated tempo unless the remedial actions are initiated now

at an adequate scale as an integral part of development planning at the national as well as provincial and local scale. The increasing deforestation, desertification, soil, water and air pollution are some of the pointers in that direction.

A. *Resource Trends*

2.6 More than 60 percent of the land in Pakistan is either already affected or likely to be affected by desertification. The suspended sediment load per km_2 of drainage basin in this country is one of the highest in the world. It is an adequate indicator of the intensity of soil erosion which has affected as much as 1.2 million hectares of land so far (Sahib 1984) salt affected soils are estimated to be 4.2 million hectares while another 2 million hectares area is waterlogged (Khan 1986). Inspite of tremendous efforts for reclamation, large areas of irrigated land are still lying waste as a result of waterlogging and salinity mainly in the area where canal irrigation is practised.

2.7 The forests cover about 5 percent land area of Pakistan (GOP 1984). The percentage is quite low as compared to a desired level of 20 to 25 percent. The low share of the land area taken in association with the large population of Pakistan gives only .33 hectares per capita. The availability of timber per capita is only 0.013 cubic metre as compared to 1.60 cubic metre in U.S.A. (GOP 1983a). The per capita consumption of timber is estimated to be 0.0239 cubic metre. The gap between supply and demand is met by imports (GOP 1984) Rising costs and decreased supply is the most likely future scenaries of forests in the wake of increasing population and per capita income on the one hand and shrinking forests at the rate of 1 percent per year on the other. It has been estimated that the annual timber requirement of 2.0 million cubic metre would double to 4 million cubic metre by the year 2000 while the firewood consumption would also almost double from the present 16.6 million cubic metre to 30 million cubic metre in the same time span (GOP 1984).

2.8 The livestock population of Pakistan is eighty four million heads (Sahib 1984). A large portion of this is concentrated in the range lands of Pakistan, constituting about 33 million hectares or 3.8 percent of the total land area of the country. This land should normally have been capable of providing forage to support bulk of this population. However, in the past ineffective management of range resource has led to serious overgrazing. The

mobility of the herds, kept by nomadic people has devastated a very large portion of Pakistan's natural pasture. Goats in particular have eliminated entire species of edible plants. The resulting desertification has become irreversible in many parts. With this ecological degradation the range-lands have not been able to sustain the growing number of animals (from 68 million heads in 1976 to 84 million heads in 1983) with equal ease as before. The existing pressure and the expected increases in the future livestock population therefore calls for improved methods of rangeland management.

2.9 The carrying capacity of croplands also seems to be under progressively increasing stress. The per capita cropped area between 1951 and 1981 declined from 0.46 to 0.31 hectares (Khan 1984) despite extension in agricultural lands. The inevitable future increase in population of about 3 million every year necessitates to focus on additional food production and output of farm produce. In view of high manland ratio and limited prospects of increasing arable land increased production has to be achieved through increased yield per hectare (GOP 1985).

2.10 The pattern of economic growth in past entailed rising level of energy utilisation, for two reasons—the increased use of energy based household appliances and for harnessing more efficient technologies of production in agriculture, industry and other sectors. The cost of energy had been stable prior to 1973. It rose sharply since then, and as a result changed the economics of virtually all processes of production and other energy using activities. The industrial countries were quick to implement programmes of energy conservation, and were able to pass on the higher cost of energy to both domestic and foreign buyers of their manufactured products. For countries like Pakistan, therefore, the last decade has seen a major increase not only in price of petroleum and other (POL) products but also of imported intermediate and capital goods. Thus the same one metric ton of rice exports which could buy 18.5 metric tons of POL or 4.2 metric tons of chemical fertilizer in 1971-72 was good only for 1.3 metric tons of POL or 1.2 metric tons of fertilizer in 1984-85 (July—March) or alternatively where one metric ton of raw cotton export was worth 64 metric tons of crude oil or 1.2 metric tons of fertilizers in 1971-72, it was only worth 4.3 metric tons of crude oil or 0.3 metric tons of fertilizer in 1984-85 (GOP 1985). The essential task before Paksitan is therefore to delink economic growth from energy demand or at least to weaken this link. The industrial countries with high dependance on an energy intensive style of life have succeeded in breaking this close link. The adjustment was painful but rewarding. In Pakistan, where the transition to an energy-intensive alien style of life is still limited to a relatively small

minority, early measures are essential to avoid more difficult adjustments later (GOP 1983a).

2.11 The supply of mineral resources for accelarated development is not really a problem of absolute scarcity but has to do more with inaccessibility and inferior productivity. The occurence of mineral deposits in Pakistan is in remote and inaccessible areas, at least on the basis of indications of existing surveys. (GOP 1983a). At the time of independance the country produced very few minerals which confined to salt some coal and a small amount of sulpher. In the course of years, 250 mineral discoveries have been made in the form of economic deposits, mineral showings and mineral traces. Except for a few, however, the country lacks large and mineralogically rich deposits. The mineral sector hardly contributes .6% to the GDP (GOP, 1985) and the country lags behind internationally in the known mineral reserves as well as their production.

2.12 The existing production fish in Paksitan is 272 thousand tonnes from the sea and 60 thousand tonnes from the inland water bodies. The research, under the Agricultural Research Council has indicated that the fish catch potential from the coastal and deep sea belts in Pakistan's exclusive economic zone (EEZ) is much higher (IUNC 1984). However, the industry remains underdeveloped and its resources in-efficiently exploited (GOP 1983a). A number of measures have been suggested in the sixth plan of Pakistan (1983–88) to increase fish productivity but in the absence of modelling of the sustained yield potential of Pakistan's EEZ, there is the danger that a major expansion of marine fisheries could over-exploit one or more species to the long term detriment of the resources.

B. *Population Trends*

2.13 Pakistan is the ninth most populous country in the world. According to 1981 census, it population was 84.25 million (excluding roughly 3 million Afghan Refugees), which is estimated to have increased to 95 million by 1985 (GOP 1985). The regional distribution of population mirror the country's topograohical and climatological condition. The arid flatlands and barren mountains are sparsely inhabited. More than half of Pakistan's population is in the Punjab province, through it accounts for only a quarter of the country's area. By contrast, Baluchistan's meagre population of 4.3 million (GOP 1981) is scattered across nearly half of the area (Annexure-III). The density is highest in the intensely irrigated northeastern corner of Punjab and in deltaic region of the Indus surrounding Karachi.

2.14 Pakistan's population has been growing at a rate of around 3 percent per annum during 1951–81 period–a significant acceleration from the growth rate of 1.8 percent recorded during the 1941–9151 intercensal period. This high rate of growth is largely due to natural increase-low fall in birth rate and rapidly declining mortality. While the former displayed a marginal change from 50 to 42 per thousand, the latter, primarily because of extended health facilities, plummeted from 30 per thousand in 1947 to 12 per thousand at present (GOP 1985) while there is a great likelyhood of further improvement in mortality especially in the case of infant andchildren the fertility pattern hardly display's corresponding relationship with the policy measures.

2.15 The phenomena of rapidly growing population in Pakistan is also being accompanied by increasing concentration of population in the younger age group. This children (below 15 years of age) who constituted 43.84 percent of the population in 1972, an already very high proportion, increased to 44.52 percent in 1981 stretching the high dependency ratio even further. In rural areas the dependency ratio is higher because children under 15 years of age here from a still larger proportion of 45.86 percent as against 42.82 percent in urban areas (GOP 1985). The factor of such large number of people moving into reproductive age group is also significant which is compounded by one person in five being a female of reporductive age group at present.

2.16 The phenomenal increase in the population of Pakistan without corresponding expansion of basic amenities of life has exposed a majority of people to conditions which are far from satisfactory from the environmental standpoint. This can deteriorate further in the absence of a well-conceived and properly planned corrective actions in the coming years due to both inflating population and its increasing concentration in urban areas due to internal migration. Population implosion in a few metropolitan centres of the country and consequently emerging problems are increasing the doubts about the practicality of economically providing more employment and infrastructure in these urban complexes growing out of proportion. Conversely a large area in Sind and Baluchistan with highly dispersed settlements offers another serious bottleneck in the provision of infrastructure economically.

2.17 The urban population of Pakistan was 23.69 million in 1981 and its growth rate was 1.3 to 1.7 percent higher than the national overall growth of 3.0% during the past three decades. With this kind of growth rate the urban

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population has been estimated to increase to 53.0 million by the year 2000. The situation in the metropolitan areas unless checked is likely to be worse where average growth rate is estimated to be around 5.6%. This would further aggravate the present situation whereby 40% of the total urban population is already concentrated in three cities of million size–Karachi, Lahore and Faisalabad. Karachi alone houses more than one fifth of the total urban population of the country. The glaring unevenness of distribution is further apparent from an overwhelming concentration of urban dwellers in eight largest cities which account for 54 percent of the urban population, while the remaining 46% live in more than 400 small towns. (GOP 1981). The primary factor in this conglomeration of metropolitan population is the increasing rural-urban migration. In many cases this exodus from rural areas has resulted in abandoning of cultivated land due to lack of human resources (young population outmigrated) with such ecological consequences as loss of top soil through wind and water erosion. Conversely the overcrowding and congestion in metropolitan centres has its own economic and environmental costs such as uneconomical provision of services (beyond a certain limit) as well as deterioration in the quality of life through congestion and pollution of air, water etc.

C. *Development Trends*

2.18 Pakistan gained independance in 1947 and inherited an economy which was widely regarded as "economic wasteland" (GOP 1983[a]) However considerable progress has been made over the year in pure economic terms. The flow of goods and services from economic activities within the country-Gross Domestic Product has expanded almost five fold in real terms, and per capita income has almost doubled from less than Rs. 1800 at today's prices in 1950 to the level of about Rs. 4000 in 1982-83. The average growth rate for the period 1950 to 1983 has been 3.1 percent per annum. The per capita income growth was about half of this rate because of rapid growth in population. This growth performance is among the best in the developing world.

2.19 Hidden behind this long term process are periods of high growth intervened by stretches of lows. In the fifties, largely because of the economic and social problems with which Paksitan began its independant existence, the growth of economy hardly kept pace with the growth of its population. The sixties were characterised by high growth rate that exceeded 7 percent per annum. Between 1969-70 and 1976-77, the growth rate slowed down to 4.2 percent but since than the pace of average growth has again accelerated to more than 6 percent per annum. Thus with an average growth rate of 5.5

percent Pakistan which was at the bottom of the list in the fifties is now at the upper end of the lists of countries called the low income countries. In a year or two it should move into middle income countries (Aziz, 1984).

2.20 The structure of output and activity has undergone a dramatic change during the course of economic growth. The share of agriculture sectore in GDP has fallen to almost half, from 55 percent in 1948 to 29 percent in 1982-83. There has been a corresponding doubling in the share of manufacturing and an even more pronounced increase in the organised industrial sector, comprising large scale manufacturing, mineral, construction, electricity and gas, the share of which has risen from 4 percent to 22 percent. Large scale manufacturing alone has increased from a negligible 1 percent at the end of the forties to acquire a respectable share of 13 percent in the early eighties. Witnin the large scale manufacturing, considerable deversification has taken place. The country has moved from the first phase of industrialisation focusing on easy consumer goods industry to more sophisticated basic and heavy engineering goods. The latter include chemicals, chemical fertilisers, ship building, assembly-cum-manufacturing of cars, tractors, trucks and rolling stock for the railways, telephone and tele-communication equipment, and a host of other engineering equipment and components. The first steel mill of the country has moved into production and was completed in 1984. While the large scale increase in the share of industry in gross domestic product is a health sign of growing economy, it can have adverse effects on country's environment unless pollution control policies are implemented to reduce these negative impacts. Empirical studies show that intensity of local pollution in area of heavy industrial concentration such as Karachi, Faisalabad, Kalashah Kaku etc are already reaching alarming levels (GOP 1983[a]).

2.21 The decline in the share of agriculture represents more a diversification of the economy through rapid development of supporting sectors rather than slow growth in agriculture itself. Since the advent of the sixties, agricultural growth rate has been higher than the rate of increase in population, a feat only a few developing countries have been able to perform during the preceding two decades. The deficit in wheat has been overcome and a small surplus has emerged, being utilized at present mainly for improving the size of the reserve stocks. In food grains as a whole, including rice, Pakistan is already an exporter of some reckoning. Wheat surplus has been achieved at a domestic consumption level of 121 kg per capita (GOP 1983).

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This growth in agriculture however has been achieved through massive increase in agricultural chemicals. The rate of fertilizer consumption increased three times between 1970 and 1980 (Table II-I). During the year 1984-85 (July–march) fertilizer of take amounted to 1.05 million nutrient tonnes, 6.4 per cent higher than the previous year (GOP 1985). Alongwith expansion in fertilizer use an area of 2.9 million hectares was sprayed with chemicals for safeguarding the standing crops from pests and diseases by aerial and ground operation during 1983-84 (GOP 1985) which is almost double the area sprayed in 1971-72 (1.67 million hectares). Such spectacular increase in agro-chemicals do signify the increased hazard of pollution.

Table II-1

PAKISTAN: A ComparativeStudy with Countries in ESCAP region in term of Population, Gross Domestic Product, Investment etc. as Measures of Impact on the Environment

	Country	Size of population (in millions)		Population growth rate		Size of GDP (in millions) of US 4 1975		GDP growth rate		Percentage DGP contributed by industry	
		1980(a)	2000	1960–70	1970–80	1975	2000(d)	1960–70	1970–80	1960	1980
1.	Afghanistan	16	26	2.2	2.5	2,160	4,655	2.0	4.5	–	–
2.	Australia	15	18	2.0	1.4	76,190	178,284	5.6	3.0	37	–
3.	Bangladesh	91	141	2.4	2.6	8,820	19,009	3.7	3.9	7	13
4.	Bhutan	1	2	1.8	2.0	90	194	–	–	–	–
5.	Brunei	0.2	0.2	2.5[b]	4.8[c]	–	–	–	–	–	–
6.	Burma	36	54	2.3	2.4	3,270	7,047	2.7	4.6	12	13
7.	China	988	1,140	1.9	1.8	285,960	717,808	5.2	5.8	–	47
8.	Dem. Kampuchea	7	15	2.6	–0.2	–	–	3.1	–	–	–
9.	Fiji	0.6	0.8	2.0[b]	1.7[c]	520	1,702	–	4.5[d]	–	–
10.	Hong Kong	5	6	2.6	2.5	7,520	24,621	10.0	9.3	39	47
11.	India	698	922	2.3	2.1	91,810	197,872	3.4	3.6	20	26
12.	Indonesia	151	221	2.0	2.2	24,180	98,501	3.9	7.6	14	42
13.	Islamic Republic of Iran	39	66	2.9	3.1	48,820	198,875	11.3	2.5	33	–
14.	Japan	118	134	1.0	1.1	495,180	158,714	10.9	5.0	45	41
15.	Lao PDR	4	5	1.9	1.8	–	–	–	–	–	–
16.	Malaysia	14	20	2.8	2.4	8,690	28,451	6.5	7.8	18	37
17.	Maldives	0.2	0.2	2.4[b]	3.2[c]	–	–	–	–	–	–
18.	Mongolia	2	2	2.9	2.9	1,000	2,069	–	–	–	–
19.	Nepal	15	24	1.8	2.5	1,390	2,996	2.5	2.5	–	–
20.	New Zealand	3	4	1.7	1.5	14,460	33,836	3.9	2.3	–	32
21.	Pakistan	89	146	2.8	3.1	9,830	21,186	6.7	4.7	16	25
22.	Papua New Guinea	4	6	2.1	2.3	1,220	3,995	6.5	2.3	11	30
23.	Philippines	51	80	3.0	2.7	15,730	51,502	5.1	6.3	28	37
24.	Republic of Korea	39	51	2.5	1.7	18,650	61,061	8.6	9.5	20	41
25.	Samoa	0.2	0.2	0.7[b]	0.9[c]	50	164	–	–	–	–
26.	Singapore	22	3	2.4	1.5	5,640	18,466	8.8	8.5	18	37
27.	Sri Lanka	15	19	2.4	1.6	1,980	4,267	4.6	4.1	20	30
28.	Solomon Islands	0.2	0.4	3.3[b]	3.5[c]	–	–	–	–	–	–
29.	Thailand	47	65	3.0	2.5	14,540	47,604	8.4	7.2	19	29
30.	Viet Nam	55	79	3.1	2.8	–	–	–	–	–	–

(a) for 1981; (b) for 1978; (c) for 1981; (d) 1971–82

	Country	Gross domestic investment plus public consumption as percentage of GDP		Fertilizer consumption per hectare of arable land		Energy consumption kg. of coal equivalent per dollar of GDP		Energy consumption per capita		Chemical (value added as percent GDP	
		1960	1980	1970	1980	1960	1978	1960	1980	1976	1980
1.	Afghanistan	16[e]	14e	24	63	0.2	0.4	23	83	–	–
2.	Australia	39	41	246	277	0.8	0.7	4,060	7,214	9	8
3.	Bangladesh	13	24	142	463	–	0.3	–	49	–	16
4.	Bhutan	–	–	–	11	–	–	–	–	–	–
5.	Brunei	–	–	–	–	–	–	–	–	–	–
6.	Burma	12[e]	24[e]	34	100	0.5	0.5	6.0	87	–	–
7.	China	23	42	418	1,546	–	4.2	340	618	–	–
8.	Dem. Kampuchea	–	–	13	27	–	–	19	128	–	–
9.	Fiji	–	–	–	–	–	–	–	–	–	–
10.	Hong Kong	25	36	–	–	0.7	0.7	469	1,881	–	–
11.	India	24	33	114	309	1.0	1.2	114	210	12	13
12.	Indonesia	20	35	119	630	0.8	1.1	129	266	–	11
13.	Islamic Republic of Iran	27	–	76	359	0.4	0.9	1,185	1,210	5	–
14.	Japan	43	42	3,849	3,721	0.8	0.7	1,354	4,649	11	8
15.	Lao PDR	–	–	4	78	–	–	16	127	–	–
16.	Malaysia	25	46	436	1,051	0.6	0.8	616	881	12	6
17.	Maldives	–	–	–	–	–	–	–	–	–	–
18.	Mongolia	–	–	18	86	0.8	1.6	529	1,452	–	5
19.	Nepal	9[e]	14	30	97	–	0.1	3	13	–	–
20.	New Zealand	37	40	8,875	10,177	0.7	0.9	2,759	4,816	5	5
21.	Pakistan	23	29	168	495	1.3	1.0	143	224	9	–
22.	Papua New Guinea	41	53	76	148	0.2	0.6	36	332	–	–
23.	Philippines	24	38	214	337	0.6	0.8	159	380	13	8
24.	Republic of Korea	26	44	2,464	3,757	1.2	1.8	1,179	2,864	8	12
25.	Samoa	–	–	–	–	–	–	–	–	–	–
26.	Singapore	19	54	1,394	1,987	0.4	0.8	2,111	8,544	7	5
27.	Sri Lanka	27	44	496	770	0.7	0.5	177	201	9	–
28.	Colomon Islands	–	–	–	–	–	–	–	–	–	–
29.	Thailand	26	39	76	162	0.3	0.8	63	370	15	–
30.	Viet Nam	–	–	512	407	–	–	95	148	–	–

(e) gross domestic investment only

Source: 1. World Bank, World Development Report 1980, 1982, 1983.
2. Global 2000 Report, Entering the Twenty First Century.

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2.22 A major shortcoming in Pakistan's economic progress is the lagging social sector. That is why "in terms of social indicators like low student enrollment and literacy rates and high infant mortality and low life expectancy at birth and the rapid rate of population growth, Pakistan is still at the bottom of the list of the developing countries". (Aziz 1984). A serious effort is needed to promote sustained development and correct the imbalance between economic and social sectors. It is also evident that the problems pertaining to resource conservation and poverty will need more attention in the future. In the 1950 and 1960's, the benefits of economic progress went largely to higher income groups. In the 1970's the problems was moderated to some extent by the growing volume of remittances sent by Pakistan from other Countries. Most of these workers had gone from rural and barani areas and the remittances have had a dramatic impact on the lives of the people in these areas. However, if and when the flow of remittances begin to slow down, the problems of rural poor, with the rapid population growth we face, might surface again. (Aziz 1984).

2.23 The projections of gross national product from 1982-83 through 2003 (end of the ninth five year plan) has been made by Pakistan Environmental planning and Architectural consultants (PEPAC 1983 c). It is expected that GNP would increase in Pakistan from Rs. 413 billion in 1982-83 to 1550 billion in the year 2003, an increase of 275 percent. The corresponding growth of population is from 90 million in 1983 to 155.5 million 2003, an increase of 73 per cent. In view of the existence of under-employment and unemployment, it is not clear whether the extra population of 65.5 million (1983–2003) could be fully utilized to create the additional GNP of more than thousand million rupees.

D. *Population, Resources, Environment & Development*

2.24 Pakistan's population pressure is already putting a strain on natural resources such as water, souls, forests, fisheries, wildlife, energy and minerals, so that present assumption about potential for economic growth may not remain valid and even the present pattern of economic growth may not be sustained over the longer or medium term unless due recognition is given to the linkages between population, resources, environment and development. The country has been able to sustain more than fourfold increase in its population during this century in large part by investing nearly in the expansion of the irrigation system on the Indus and its tributaries. In little more than a hundred years, water division for cultivation has been increased

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to 100 million acre feet or two thirds of the annual flow. However, it is not possible to increase the level of withdrawals much further while maintaining reliable irrigation water supplies (GOP 1978). Moreover withdrawal of more than 120 million acre feet could also cause further sea water instrusion in the lower reaches of the river.

2.25 The capacity of other natural resources to support human population has also been severely impaired in many cases, due to intensive development, resulting in soil loss, the destruction of forests, overgrazing and fuelwood crisis etc. Most of this resource depletion is avoidable through development planning for better management. Better management means that the life support systems or the environment continue to function effectively—that water remain clean and productive, that the fertility of soils is maintained and that the air is retained fit to breath. Better management means using living resources such as fish and trees at rates such that they may continue to produces on sustained basis. It means preventing loss of valuable forest and pasture species, thus maintaining genetic variety and keeping open options for the future. In short better management is aimed at long term productivity of natural resources and at sustainable development.

Matrix of Interrelationships of Development, Population, Resources and Environment

Impact on / Influenced by	Environment	Resources	Population	Development
Environment	–	(a) Environmental Technology. (b) Area planning. (c) Environmental conservation including protection of rate monuments etc.	(a) Environmental education and training (b) Environmental awareness. (c) Improvement in human resources.	(a) Environmental institutions and legislation. (b) Environmental Management as a part of development management – environmental appraisal of development projects. (c) Integration of environmental planning into development planning.
Resources	(a) Rules, repair and recycling. (b) Major hazards such as acid rain, induced climate charges and zone depletion (c) Local resources utilization.	–	(a) Resource constraints; relative resource and population distribution. (b) Resource substitution by human capital. (c) Human settlements.	(a) Efficiency-use of resources. (b) Resource substitution by physical capital. (c) Interaction between resource patterns and production patterns.
Population	(a) Environment health. (b) Pollution: rural and urban. (c) Congestion, over-crowding and slums.	(a) Resource use for consumption. (b) Resource degradation for eking out an income, however meagra. (c) Resource exploitation.	–	(a) Supply of labour. (b) Human skills and expertise. (c) Organizational and administrative inputs.
Development	(a) Environmental amenities. (b) Eradication of poverty. (c) Community asset creation.	(a) Resources conserving technology. (b) Resource rehabilitation and replenishment. (c) Resource transformation.	(a) Family planning and welfare. (b) Human resource development: health, education and nutrition. (c) Demand for labour: income generation.	–

Source ESCAP, 1948

2.26 A matrix of interrelations of environment, resources, population, and development is outlined in Table II-2. The rows of the matrix describe the impact generally made by one of them on the other three; the columns describe the variables in terms of which each absorbs the influences wielded on it by the other three. Thus, the influence of the environment on resources comparises three factors: environmental technology helps temper the ravaging effects of production technology and introduces the element of sustainability to the development process. It also encourages area planning and a more even spatial spread of development, an impetus is provided to conservation as a principle of resource management and for sustained use of non-renewable resources and augmentation of renewable resources. The environmental inputs on population concern the improvement of human resources, environmental education and training of the population, and the promotion of environmental awareness among influential groups of the population. From the side of environment, the inputs on development relate to environmental institutions and legislation; environmental management as an integral element of development management as typified by the use of environmental impact assesment of development projects. The integration of environmental planning into development planning represents the principle component of the relationship between development and environment as its input.

2.27 Resources (*i.e.* resource use, resource enhancement or deterioration and resource transformation) can have both beneficial and harmful effects on the environment. Indiscriminate use of resources can give rise to major environmental problems such as acid rains, induced climatic changes, resource depletion and resource degradation. Compatibils and imaginative use of resources can promote environmentally sound practices such as reuse, repair, and recycling on the one hand, and can promote local resource utilization for local development on the other yielding a more equitable spread of the benefits of development. Population is strongly influenced by resource availability both in quantity and quality. The constraints in land availability impose a rather severe limit on population growth. Further population resource ratio has a threshold or a limit determined by the ability of resources to provide sustenance. A rather positive factor in resources as an input of population refers to the possibility of replacing natural resources upto a point by human resources and their skills and expertise. Human settlements and the related problems of urbanization underlie the resource-aspects of population growth and distribution. The inputs of resources to development include efforts to raise the efficiency quotient of resources use; the extent to which resources can be replaced by the accumulated physical

capital in a country; and the interative relationship between the available resource patterns and the projected prduction patters.

2.28 On environment *per se*, population produces some typically negative effects. These can be classified into environmental health problems *e.g.* the diseases, pattern of poverty; pollution (chemicals, residuals, and emissions); and congestion, overcrowding, slums and shanty towns. The impact of population on resources is also not always favourable and may be revageous in character. Natural resources are sometime directly consumed *e.g.* distress consumption of seed for the next crop; overgrazing and forest destruction undertaken for earning a meagre income; and commercial exploitation of natural resources without consideration of sustainability and long term losses in the prcess. The influences on development from population relate to population-oriented inputs of development. These are: the supply of labour as required by the development plans; the human skills and expertise as needed for implementing development programmes and projects; and the organizational and administrative inputs.

2.29 The impact of development on the environment may result in the creation of environmental amenities, the removal of absolute poverty and the enhancement of community assets by popular participation. The impact of development on resources is mostly felt on efforts to rationalize the production process and employ appropriate technology with a view to conserve resources; to rehabilitate or replenishing depleted resources, where technically feasible; and to transform resources into standardized resource units or into commodities. The impact of development on population comprises the family planning and welfare efforts, human resource planning in terms of education, health etc. and the demand for labour for the purpose of generating income.

2.30 The very key constraints in resolving the underlying population, resources, environment and development are: the inadequacy of reproducible capital; the spectre of diminishing returns; the miasma of poverty and consequent human degradation; as well as problems of technology transfer. A major development problem in Pakistan is paucity of investment resources. It has been estimated that over upto the end of ninth five year plan (2003) with maximum borrowing and wise economic policies the nation can invest at the most around 1550 to 1800 billion rupees in its urban areas and for related infrastructure byt the needs for machinery plants,

factories, dwelling, roads and dams etc. exceed Rs. 4300 billion and if concentrated in and around large cities may exceed Rs. 5200 billion (PEPAC 1983). This problem is further compounded if diminishing returns are taken into account. This even though agricultural production fisheries in eightees represent a record experience for Pakistan but when compared with the expansion in physical and technical inputs in agriculture (water, seed, fertilizer, pesticide, machinery etc.) the increase in inputs does not appear to have produced a corresponding growth in yield per hectare of crops. Diminishing return have also become operational in mining, fishing and other sectors.

2.31 The existing technical conditions and the social organisation of agricultural production are such that the prevailing level of labour absorption is inadequate to maintain even the existing farm population at a minimum standard of living. A field survey in 1978 (Hussain 1980) showed that in 5 of the principal districts of the Punjab 23 per cent of farmers in size class below 8 acres were unable to provide subsistence level of consumption. A country wide survey in 1979 (GOP 1979) based on income per month per household found that 40.3 per cent of rural households and 30.1 per cent of the rural population earned less than Rs. 600; a limit which has been defined as the threshold of absolute poverty by a World Bank study (World Bank, 1983) in Pakistan. Applying this percentage to 1981 population, the number of absolute poor in rural sector comes to 18.4 million. The cities and towns of Pakistan have only 14 per cent of their population in the monthly income group below Rs. 600, indicating that the intensity of the urban poverty is less than half the level of the rural poverty. The critical factor in increasing number of absolute poor is the pressure on cultivable land exercised by the growth of population. A consequence of such pressure in available land has been growing landlessness, increasing rural-urban migration as well as miuse of resources.

2.32 The efficiency of resource use can be raised by technology, and the drag exercised by population growth on development can partly be mitigated by a timely and liberal use of technology. Unfortunately, however, the availability of technology for a developing country like Pakistan is neither timely nor liberal. To start with, the conditions necessary for the spread of technology do not seem to be very much present in the country. There are institutional as well as internal socio-economic inadequacies and a large scale resource degradation which tend to create inhospitable conditions for the spread of technology. The non-agricultural activities in the country at least

in the past, have been mostly resource-exploitative in character and the country did not have a built-in provision for husbanding or restoring its resource base. Even in the agricultural activities, land-water soil management did not receive adequate attention; and inadequate political and administrative accountability and prevalence of land use patterns made land development practices relatively less attractive from the private enterprise point of view. A part of the reason why conditions are not conducive to an adequate and timely transfer of technonoly to the developing countries like Pakistan is the wide disparity in research and development expenditure which in the developed countries account for 97 per cent of the world total and in the developing countries only for the remaining 3 per cent. Moreover the developed countries are not always willing readily to transfer the know-how or share the benefits thereof. Skill or commodities have been often denied to countries like Pakistan when they are needed most.

2.33 The basic causes for environmental problems in Pakistan are numerous and complex. However they can be summed up to include our past tendancy to emphasize quantitative growth at the expanse of quality, the failure of our economy to provide full accounting for the social costs of environmental pollution, the failure to take environmental factors into account as a normal and integral part of our planning and decision making is dependance on expediencies, without regard to their impacts on the environment and more fundamentally the inadequacy and failure of our institutions to perceive the environment in its totality and to understand or recognise the fundamental inter-dependence of man, resources, environment and development. The present drive for economic growth in Pakistan will continue to exert a complex variety of impacts on the environment. These impacts may be seen in different lights by individuals, government functionaries and institutions depending on the value each attaches to the quantitative growth as against the broader and less measurable aspects of the quality of life. However, one has to recognise that, "Human environment is not an abstract concern or simply a matter of aesthetics or of personal taste –although it can and should involve these as well. Man is shaped to a great extent by his surroundings. Our physical nature, our mental health, our culture and institutions, our opportunities for challange and fullfillment, our very survival—all of these are directly related to and affected by the environment in which we live".

2.34. To this end, it is imperative for development planners in Pakistan to take environmental factors into account in their plans. It is important that

they not only consider the classic economic costs of producing a given product but also the diseconomies of environmental pollution and degradation, which reflects itself in future economic costs. If proper attention is paid to the environment, not only the heavy cost of adopting curative measures at a later date would be avoided but healthy living conditions could also be assured to our people in a comparatively shorter time span. There is no conflict between environmental and development goals. In fact the two sets of goals complement each other and fit into the overall objective of improving the quality of life.

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CHAPTER-III

TERRESTRIAL ECOSYSTEM

3.1 More than sixty percent of Pakistan's terrestrial ecosystem consists of rugged mountains or deserts. The land-use pattern (Table III-I) shows that an area of 26 million hectares is either under water or covered by cities, towns, villages roads and other use patterns. The land available for cultivation is 33 million hectares though only 21 million of this is actually cultivated accounting for 24 percent of the total land area and 64 percent of the cultivable land. Therew are about 4.5 million hectares of forest land lying outside cultivated area.

TABLE III-II

PAKISTAN : LAND UTILIZATION : 1984

Land-use category	Area (million hectares)	Percentage share
Cultivated.	20.7	23.6
Culturable waste.	11.8	13.4
Not available for cultivation.	25.9	29.5
Forests.	4.5	5.0
Not classified/reported.	25.0	28.5
Total . .	87.9	100.0

Source. Government of Pakistan, Ministry of Food Agriculture and Co-operatives (1984) "Forestry Range and Wildlife Management in Pakistan", unpublished report, Islamabad.

3.2 There are substantial evidences of widespread environmental degradation throughout the terrestrialeco system of the country. "In many instances such degradation is already far advanced and may be difficult if not impossible to arrest or even reverse-particularly with limited financial means; in

other areas, the process of ecological deterioration has recently begun to accelerate and threatens to present insoluble problems unless remedial action is taken very soon; in still others, the destructive forces have begun to emerge, but serious consequences could still be averted with appropriate action". (IBRD, 1985) The primary manifestation of ecological deterioration visible in the field may be broadly categorised into four group *i.e.* Deforestation, soil erosion and degradation, desertification and species extinction.

A. *Deforestation and Forest Degradation*

3.3 With recent increases in the prices of oil, wood, charcoal, and alternate fuels, people in Pakistan have been indiscriminately cutting and selling trees on a large scale, thus causing extensive deforestation. Pakistan is already in an unhappy position of being amongst the group of countries with the lowest areas under forest in the world; the forest area being less than .05 hectares per capita. Further depletion of forest resources will be simply disastrous. Extensive deforestation particularly in the watersheds is a major ecological threat to the nation as a whole. When the tree cover is lost on slopes, the top soil is washed away and fertility dwindles. The washed away soil moves with the flowing water into streams. The rising load of the silt carried by rivers is chocking up expensive reservoirs behind major dams, and filling up irrigation channels. Most threating of all to production prospects is a rise in the frequency and volume of runoff increasing severity of floods in the country. Flood data of 1973 flood (Table III-2) conveys some idea of the resulting damage.

PAKISTAN
TABLE III-2

Floodflow 1973 and design capacity ('000m3/sec)

Structure	Flood Flow	Design	Comment
Chenab			
Marala headworks.	22	31	Loss of life and of live stock up stream of barrage.
Khanki headworks.	28	23	Marginal bunds breached. Flooding of Lower Chenab canal.

Structure	Flood Flow	Design	Comment
Lower Chenab canal	453	368	Regulators damaged.
Qadirabad headworsk	24	25	
Trimmu headworks.	20	18	Right marginal bund breached and blasted to protect headworks Rangpur canal system damaged, villages, crops flood. Multan threatend.
Panjnad headworks.	23	20	Right marginal bund breached in two places when flow reached 20. Left bund reached in ten places. High winds drove waves to erode the bunds. Damage to Abbasia and Panjnad Canals, and to two towns.
Ravi			
Jassar bridge	6	8	In 1953 was hit by peak of 19.
Ravi Syphon.	6	13	In 1953 was hit by peak of 19.
Shahdara bridge.	7	7	In 1953 washit by peak of 15. In 1973 protective bunds were breached in 9 places, Shahdara town was flooded and the Ravi shifted its course.
Balloki headworsk.	5	6	Breaches to left flood embankmetn peak of 8 in 1973.
Sidhani headworks.	6	5	Banks were cut to give relief.
Sutlej			
Islam headworks.	5	8	Sutlej peak reached Panjnad 3 days after the Chenab peak.

Source : Johnson, B.L.C (1979)

3.4 The economic consequences of these developments are serious, at least in the areas immediately affected. Beside this environmental degeneration has also become an important factor contributing to, if not

directly causing, rising social conflicts; particularly notable in this context are the confrontations between forest guards and villagers over unauthorized tree felling and livestock grazing on public forest and range lands. Market prices for fuelwood and timber have risen subtantially in recent years and make it increasingly difficult for the poorer segments of the population to purchase sufficient quantities for heating and cooking. Depletion of privately and or communally owned forestry and range resources is leading to widespread illicit felling, lopping and grazing in public forests. Deforestation and range land degradation are leading causes of higher water runoff, reduced infiltration rates and aquifer recharge, flash flooding and soil erosion. The degradation and increasing desertification of overgrazed arid and semi-arid ranges, were vegetation is no longer naturally regenerating, threatens the economic survival of nomadic populations. Shifting sand, often piled into rows of moving dunes of 60 feet height and more, buries fields, irrigation systems, roads, railway lines and villages rendering substantial investments in physical infrastructure unless or requiring heavy expenditure and continuous efforts to dig free (IBRD, 1985).

3.5 Thus Pakistan is faced with the situation not less serious than what has been described by the Nairobi Conference (UNEP, 1977). Even at present Pakistan is facing a wide gap in the demand of wood and its supply. Bulk of our domestic energy requirements are being met by kerosene oil, natural gas, electricity, cowdung and agricultural wastes. All these commodities can more valuably be used for industrial and crop production rather than burning as fuel. Wood is being imported to the tune of 13100 M3 Costing 93 million rupees. With pulp and paper and other wood products the foreign exchange bill reaches Rs. 1500 million per year (GOP 1984a). We should therefore design a strategy, not only to overcome the present deficit but plan for meeting the future demands which are daily on the increase. Such a strategy can only give the required results if it covers both state and the private lands.

3.6 Of the 87.81 million hactare total land area of Pakistan 10.6 million hactares are under the control of government forest department. This figure is inclusive of rangelands (61. million hactares) which though for the purpose of management are under the control of forest department, do not contribute towards production of wood. Nevertheless these lands are an important resource for grazing cattle. The actual area under forest is 4.5 million hactares, that is 5 percent of total area. The rest 1.5 million hactare are privately owned. The privately-owned forests lie in Northern areas; Punjab and

N.W.F.P. These are called 'Guzara' or 'Community' forests. The private forests situated in the Punjab and N.W.F.P. play an important role in the country's economy as they are situated in the critical watershed arears. The areas of productive forests is about 1.5 million hactares while 3 million hactare are protective forests (GOP 1984 a). The breakdown of forest area is given in table III-3. In addition, considerable tree growth is found on the farmland scattered through-out the country.

(*) In 1984-85 (July-March) more than onebillion rupees were spent on the import of paper, board and stationary alone. (Pakistan Economic Survey, 1985).

TABLE-III-3

PAKISTAN FOREST AREA OF PAKISTAN AND AZAD KASHMIR BY VEGETATION TYPE

Vegetation type	Area (million hactares)	Percentage share
Coniferous.	1.93	42.9
Irrigated Plantations.	0.22	4.9
Riverine.	0.29	6.4
Scrub.	1.69	37.6
Coastal.	0.28	6.2
Others.	0.09	2.0
Total ..	4.5	100.0

Source : Government of Pakistan Ministry of Food, Cooperative Islamabad.

3.7 Our major state forest can be categorised as coniferous forests in the temporate zone, the irrigated forest plantations and the riverain forests. Over a long period of time, for a low priority given to forestry development, these forests have either remained stagnated or have ecologically deteriorated. The current situation in these coniferous forest is that 60% of their growing stock comprises trees over 24 inches in diametre which in the present terms of forest utilisation can be taken as over mature. Under the existing system of management hardly 1% of the volume of this over mature growing stock is being harvested annually. Because of resource constraints, forest officers

have become over conservative in increasing their harvest because they do not get matching funds for the replacement of old crop. In the irrigated plantations some of which are more than 100 years old, Water Managements system has become rather ineffective because of the silting and drainage problems. Delay of various silvicultural operations or their complete absence is the norm in these due to budgetary constraints causing their deterioration (GOP 1985).

3.8 With the construction of various dams and barrages up-stream, about one hundred thousand acres of riverain forests of Sind have badly suffered due to water shortages. The earlier average annual inundation of 9 feet in forest has been reduced to about 4 feet. These forests need rehabilitation of irrigation by either diversion of certain river creeks or through development of lift irrigation system". The diversion of river water (up-stream) into irigation system has also sharply reduced the discharge of water from the mouths of the Indus that the mangrove forests along the coast have degenerated dramatically and are threatened with total extinction with serious consequences for the port of Karachi, for the fish and crustacean breeding grounds, and for migratory birds which depend on the mangrove swamps and deltaic welands on their migration" (IBRD, 1985). The reduced flow of water in the Indus has also severely affected the reverine forests situated along the river in the Punjab, reducing the acreage under trees, the growth rates of trees and the productivity of these forests, and thus, their contribuion to meeting the national demands for wood products.

3.9 Forestry sub-sector on an average has received 0.4% of the total national development budget in the past. However, the actual funds released during the Fifth Five Year Plan period were about 46% of the total allocation of Rs. 1223 million (GOP 1984 b). In terms of its argumentation, the sixth plan's position (GOP 1983) on forestry is not encouraging in terms of resource conservation 1623 million for sustainable development. It speaks of extraction, particularly from the coniferous forests in the north, as far below the optimum-being based on a low input-output system which" neither represent the potential of the site or the species". However, though no reference is made to the importance of forestry, especially in catchment areas for downstream investments in hydro-electric systems and irrigated agriculture, the discussion of forestry does propose that the present standards of management become more sophisticated and staff trained appropriately to achieve that objective. More significant perhaps is the fact that, though inadequate recognition is given to the role of forestry and watershed management in the text, in terms of financial allocations for the sixth plan, forestry,

watershed management and wildlife are scheduled to receive more than a triple amount of the financial allocations over the fifth plan, second only to fisheries (that has been quadrupled) in increased financial priority. This tangible recognition of the importance of natural resource management in two critical areas is certainly encouraging. However the rate at which the money has been released annually so far indicates that the allocation during the sixth plan would perhaps not exceed 50% of the plan provision.

3.10 The gravity of the situation in forestry sector calls for augmentation of financial resources as well as vigorous pursuance of curative and preventive measures. The past explicit emphasis on protecting forest resources through 'policing' (*e.g.* posting of forest guards, levying of fines, impounding or destruction of livestock etc.) has been far more effective in promoting confrontation between foresters and the public than in engendering, public recognition and co-operation in resources conservation. Where this 'confrontational' approach has been abandoned in favour of effective demonstration, education and co-operation, the results have been very encouraging for example, in the dune stabilization programmes carried out by the Baluchitan Forestry and Soil Conservation departments in Mastung and Nushki and on the Makran Coast, or in the afforestation programmes implemented in both Baluchistan and N.W.F.P. under the UNHCR/IBRD Income Generating Project in Refugee Areas. This underscores the vital importance of effective 'public relations' efforts (demonstration, publicity, education) which have received far too little attention in the past (IBRD, 1985).

3.11 Afforestation and reforestation of hillsides and of land unsuitable for field crop production are essential for the effective protection of the watersheds of rivers and reservoirs, for protecting the fragile ecology and especially the water regime in many areas, for combating the increasingly critical fuel scarcity, for stabilizing hill slopes threatened with severe erosion and mass movements (landstudies) etc. Technically and economically viable methods have been developed for covering sizeable areas with trees. The quality of afforestation work has improved significantly, and many recently reforested hill sides are now under healthy and contiguous tree cover, (IBRD 1985). The benefits of these efforts have been evident, and there is increasing recognition among the population of the areas affected and among officials and political leaders of the desirability of considerably expanded efforts at establishing forests on denuded and eroding hill slopes.

3.12 In the aggregate, the reforestation and/or afforestation efforts already undertaken or currently under implementaion particularly in the

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context of watershed protection programmes in the northern Punjab, Baluchistan and N.W.F.P. (including those under the UNHCR Income Generating Project in Afghan Refugee Areas) still cover only a very small part of the total area that should be provided with tree cover. The relatively small size of this aggregate national afforestation effort may be explained by past unawarness of both the problem and the possible solution, but also by the comparatively high cost and low success rates of the initial afforestation projects. Even today, the financial resources provided for afforestation work in the provinces remain very scarce; the severe resource constraints in general (Para 3.9 above) make it difficult for planners and policy makers to provide increased funding for the Forestry Departments without reducing the allocations for other agricultural investments and activities with stronger traditional lobbies.

3.13 Awareness of the need for, and the substantial benefits of, afforestation has spread considerably in recent years, even tribal leaders in Baluchistan are now keen on afforestation works and ready to organize the necessary labour. The time seems opportune, therefore, to turn this awareness into a solid commitment which would manifest itself in increased fund allocation, institutional strengthening, proper planning (particularly for watershed protection and management) and affective implementation in collaboration with the local populations. Particular emphais should be placed on institution building, proper planning, mointoring, evaluation and follow-up, development of even more effective and economical methods, promotion of appropriate exploitation/utilization of the forest resources created, and sound integration/combination with other activities (*e.g.*, range management, rainfed agriculture, combined crop-cum-forestry farming), and so forth (IBRD, 1985).

B. *Erosion and Sedimentation*

3.14 Soil erosion is another major scourage of the terrestrial environment in Pakistan. Accelerated or man-caused erosion is severe throughout the study area. Overgrazing and clean cutting of forested lands, cultivation on marginal lands and intensive cultivation of other lands without suitable protective soil and water management practices, failure to provide suitable water disposal systems and many other related factors have demaged or destroyed large areas of productive land.

3.15 According to estimates about 76 percent of the land in Pakistan is affected to varied intensity by wind and water erosion (36% by water and

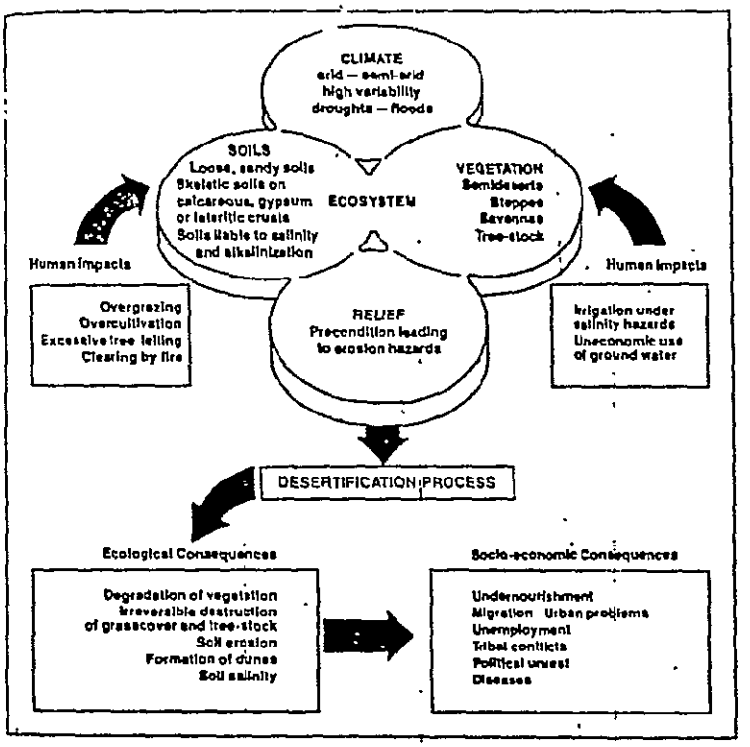

Fig. 1 – *Model of the desertification processes.*

Fig:.3.1

Source: Ibrahim,F.N.(1983) "The role of Nomadism in the process of desertification in Western Sudan,Applied Geography & development 22,Tubingen".

40% by wind) officials in N.W.F.P. operate with a working estimate of annual average soil losses on unprotected land averaging 1000 kg per acre; in several of the steeper, more critical parts of Tarbela Catchment in the Punjab, soil erosion has beenmeasured at 2-4 kg, annually per square meter: and officials in Baluchistan estimate that effective watershed protection in priority areas would reduce soil erosion by as much as 10 metric tons annually per acre treated-2.5 kg per square meter (IBRD, 1985).

3.16 Sediment studies in Pakistani rivers have been carried out from 1916. In early seventies soil at the rate of 4-7 thousand tons per square mile was carried annually in the river Chenab and Jhelum (GOP 1973). According to recent estimates the sediment load in the Indus is greater and in fact one of the highest in the world Without effective watershed protection it is estimated that Tarbela might be completely silted up in about 35 years; conversely an evaluation of the impact of watershed management activities undertaken in the Mangla catchment concluded recently that the economic life of the Mangla Reservoir, provided it were solely dependent upon the rate of siltation, has been lengthened by about 60 years through the reduction in soil erosion and siltation rates achieved during the past 25 years in the catchment area (IBRD, 1985). With a gross catchment area for Kalabagh of over 11,000 square milies, the volume of silt carried into the reservoir in the absence of effective anti-erosion activities whould be enormous and it would be highly imprudent to invest the financial resources currently envisaged in the construction of this dam without ensuring that it is sufficiently protected against rapid siltation.

3.17 An assessment and evaluation of the experience gained with watershed management activities in the Mangla catchment is also needed. This should cover the technical aspects, staffing arrangements and economics of past efforts and provide essential information for planning future watershed protection programmes for Tarbela, Kalabagh and any other catchments requiring comprehensive treatment. The assessment should also address the issue of long-term watershed management: at present, the responsibility of WAPDA's Mangla Watershed Project Unit for structures built and areas reforested lapses after only five years, when control reverts to the private owners of the land treated; this practice far too often negates the efforts made to stabilize these areas, as private interests (tree felling, range overstocking, etc.) again over ride considerations of watershed protection.

3.18 Watershed Management involves a sound multidisciplinary approach-combining engineering works, afforestation, forest management, improved

hill farming methods, range management etc. This implies even moving beyond the engineering-cum-afforestation approach. Currently applied effectively by WAPDA's Mangla watershed Project Unit, adding the promotion of appropriate rainfed farming practices, of integrated crop-cum-forestry farming and of improved range and pasture management in the catchment areas.* Secondly it is essential that each individual sub-watershed be treated as a unit and in accordance with the treatment recommended in the respective master plan for the area: the entire area requiring treatment within a sub-watershed, be it public or private land, should be covered at the same time and with appropriate means. Failure to treat public lands in the higher elevations of sub-watersheds will largely negate efforts made on private lands below. Where private landowners are reluctant to permit treatment, greater efforts need to be made to persuade them of the utility of treatment and of appropriate subsequent management and to devise treatment approaches acceptable to farmers on economic and social ground (IBRD, 1985).

C. *Desertification*

3.19 Desertification is a serious problem globally but it is more acute in case of Pakistan where almost three fourth of the land is either already affected or likely to be affected by it. Desertification is a process or a set of processes which cause diminution of the biological potential of land which ultimately lead to desert like conditions and complete loss of production and resources. The resources include land-use and land cover, crop production, forest cover, livestock, soils etc. A schematic representation of the desertification process and its ecological and socio-economic consequences have been presented in Fig: 3.1

3.20 Desertification process has been active since historical times in area constituting Pakistan. The decline of Indus valley Civilization with great cities of Moenjodaro and Harrapa has been attributed to prolonged process of desertification dessication which brought irrepairable damage to agriculture in the area. In more recent times, with all the modern technologies in hand, the process has been once again activated taking heavy tolls on the economic and social life of the area.

3.21 Amongst the factors affecting desertification in Pakistan populaton pressure is the fundamental underlying cause. Other major immediate

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(*) It would also be useful to establish and enforce standards for construction and industrial activities in the ecologically and geologically fragile hilly parts of the catchments so as to reduce the environmental damage attributable to careless excavations and earth movements.

physical causes of ecological degradation include: excessive felling of trees, and inadequate reforestation activities; uncontrolled and excessive livestock grazing and browsing in forest and rangeland thereby damanging the vegetative cover and preventing natural and/or managed regeneration of grasses, shrubs and trees; inappropriate cultivation practices in hilly and rainfed farming areas (contributing to wind and water erosion); inadequate drainage in heavily irrigated are as (cauring water logging and saleinty) as well as in adequate efforts with regard to watershed protection and management in the catchment areas of reservoirs.

3.22 Social, economic, political, legal and institutional factors and forces underlie much of this. Traditional land and resources utilization rights, particularly in tribal areas where they are very difficult to challenge, frequently conflict with the sound management and preservation of existing natural resources. Long-standing legal arrangements concerning forest and range resources exploitation are increasingly anachronistic, but extremely difficult to challenge and/or reform and combined with rapid population growth, cause excessive forest depletion and range overstocking. Skewed patterns of land ownership and access to public sector resources and services present major obstacles to effective environmental resource management with the limited financial means available. Individual and collective perceptions of short-term needs heavily outweight considerations of resource conservation for the more distant future. Institutional arrangements and financial provisions for natural resource management and conservation are inadequate. Traditional attitudes concerning wealth and prestige among livestock owners run counter to sound husbandry practices and to proper pasture and range management. In matters concerning environmental protection, official attention is foccused far more on their immediate financial costs than on their longer-term economic and social benefits. Technical solutions to the challenge to generate increased output from available natural resources are far more readily available, understood and applicable than are solution to the often complex socioeconomic, physical and biological problems and inter-relationships encountered in efforts to conserve these productive resources (IBRD 1985).

3.23 There are of course differences in Pakistan between the ecosystems in terms of desertification problems encountered, their extent and severity, their relative impact on social and economic conditions as well as their primary causes and technical and economic feasibility of intervention and safeguards (Khan 1986). These differences are apparent from the geographic

variability of habitats amongst irrigated and dry lowlands, the arid and semi arid mountain ranges and dry plateaus. Within these, there are in-numberable micro-habitats. The human activity, however, almost everywhere is patterned to cope with water shortages. The most important adjustments are irrigated agriculture based on ground water or exotic flow on the one hand and mobile herding on the other (Hewitt 1977). Dry farming is also practised in areas where sufficient rain water is available. Amongst the sedentry groups of desert herdmen or in sandy rolling plains, sporadic rains are a signal to move the animals out to graze on superior desert ranges. These are of course excellent adaptations to scarce resources, but under conditions of stress or pressure to increase output, they greatly expand the risk of desertification (Hewitt 1977).

3.24 Desertification in Rainfed Areas: The total area under rainfed cropland in Pakistan is about 5 million hactares which is about one fourth of the total cultivated area in the country. Of this 3.2 million hactare in sub-humid regions (Table III-4). Over the past few years, about 25% of this rainfed cultivated area has decreased due to erosion, and introduction of canal irrigation system.

TABLE III-4

Pakistan: Distribution of Rainfed Croplands

Year	Arid	Semi Arid	Subhumid	(Million Hectares) Total Country
1980	4.686	1.250	0.225	6.694
1983	3.166	1.111	0.225	4.980
Decrease	1.520	0.139	0.030	1.714

Source: Rehman S (1984) "Desertification problems in Pakistan" Bulletin of IDFCR Council, 14, I Islamabad.

Soil erosion particularly in the rainfed and hilly areas is big problem which limits the agricultural production. Due to water erosion in northern uplands, million of tons of fertile top soil is getting washed away, whereas in southern areas, shifting of sand dunes due to wind storms, damages crops, chokes up water ways and blows away fine particles of sand leaving behind infertile sandy wastes. It is estimated that there is a total of 1.2 million hactares or eroded land at present in the country (Rehman 1984).

3.25. Desertification in irrigated lands: The total area under irrigation in Pakistan is about 15 million hactares out of which 9.6 million hactare is arid, 3.8 million hactares is semi arid, 1.0 million hactares is subhumid and the remaining 0.6 million hactares is in transizitional climatic zones. Desertification is affecting irrigated ecosystem in the form of waterlogging and salinity. The extensive and continuous use of surface irrigation has altered the hydrological balance of the Indus Basin by substantially raising the ground water table. The watertable has risen to within 6 feet over 25% of the Basin and to within 10 feet in over one third od the entire Indus Plain. More than 40,000 hactares of irrigated land are lost each year to agricultural production due to waterlogging and salinity. To quote Spooner (1983) . . . "there is no exact method of quantifying waterlogging and salinity damages. They vary from season to season and year to year, depending in part on the strength of the monsoon and the spatial and temporal distribution of rainfall and ground water re-charge. Evaporation also varies according to temperature and ground cover. Crop damage varies according to the water and salt sensitivity of the particular plant. Surface salinity has been empared to a skin rash appearing in blotches which vary continually in intensity and extent. "Within these limitations, surveys conducted by WAPDA in 1981 revealed that about 21 million hactare of land has been severely affected by waterlogging out of which 0.4 million hactares is in Salinity Control and Reclamation Project (SCARP) area and 1.7 million hactares in the non-SCARP area. The total affected population is around three and a half million (Table: Table III-5).

TABLE III-5

Pakistan: Area and people severly affected by waterlogging in Different Climatic Zones (1980)

Climatic Zone	Area Affected (million hactares)	Population Affected (million persons)
Arid	1.88	2.842
Semi Arid.	0.17	0.468
Subhumid.	0.05	0.135
Total Country.	2.10	3.445

Source. Rehman. S. (1984), "Desertification Problems in Pakistan" Bulletin of IDTCR Council 14. 1 Islamabad.

Salinity has also taken heavy toll by affecting about 4.2 million hactares of land. According to WAPDA survey of 1981, 1.3 million hactares of this is strongly saline (Table III-6). The country can not afford this kind of deterioration of land in the wake of fast growing population, it is therefore imperative not only to check further growth of waterlogged and saline land but also to reclaim the land already damaged.

TABLE III-6

Pakistan . Extent and Intensity of Surface Salinity

(Million hactares)

Province	Area Surveyed	Surface Salinity: Slightly saline	Moderately saline	Strongly saline	Total saline
1. Punjab.	9.968	0.698	0.399	0.299	1.396
2. Sind.	5.411	1.028	0.595	0.974	2.597
3. North Western Frontier Province.	0.550	0.050	0.011	0.011	0.072
4. Baluchistan.	0.352	0.060	0.018	0.014	0.092
Pakistan.	16.281	1.836	1.023	1.298	4.157

Source : Survey and Research Organisation, Planning Division, WAPDA, 1981.

3.26 Feeforts to deal with the waterlogging problem have consisted mainly of installing tubewells in areas with fresh ground water aquifers, under a series of salinity control and reclamation projects (SCARPS) to provide drainage and irrigation through pumping of fresh groundwater. Since this technology cannot be allpied where no fresh water aquifers can be tapped for tubewell pumping, the principal need there is for adequate drainage system; the construction of the left Bank Outfall Drain in lower Sind is the first major effort to cope with this problem. Both these approaches are rooted in the traditional and hither to unchallenged presuppositon that any and all agricultural land falling within the groos command area of an irrigation system must necessarily, and almost at any cost, be utilized for crop cultivation and than, hence, crop land abandoned due to waterlogging or salinity must be reclaimed for crop cultivation. Beside WAPDA the activities of the Punjab Land Utilization Authority (PLUA) also follow the same premises. PLUA is undertaking efforts to rehabilitate, or otherwise return to economic use, appromixately 5 million acres of wasteland in the Punjab, in most cases crop land abandoned due to waterlogging and/or salinity. Although PLUA's charter does not preclude activities designed

to facilitate wasteland utilization for purposes other than crop agriculture, present directives and practices aim exclusively at returning such land to agricultural (*i.e.* cropping) purposes, mainly through tubewell irrigation (IBRD, 1985).

3.27 Differing with the above view, forestry officials in Pakistan argue that various tree species could be grown on land no longer suitable for crop cultivation because of waterlogging or salinity. However, no serious official attempt has been made so far to assess the technical potential for, and the economics of, farm forestry on such land and to weigh this against the costs and benefits of further capital intensive reclamation for crop cultivation. It is noteworthy in this context that a significant number of the owners of land reclaimed under PLUA projects have in fact, for technical as well as economic reasons, switched from wheat cultivation to various farm, forestry and orchard operations, including the production of bamboo and the establishment of tree nurseries. It might therefore be worthwhile to try to same in other areas as well.

3.28 Desertification in grazing/Rangeland: There has been an adverse affect on rangeland due to overgrazing. The ecological system throughout the rangeland has a very fragile set of relationships which can be easily disturbed. Since generations Man's livestock in the area (most notoriously his goat) through overgrazing have insidiously reduced the platable species in the plant association that would keep "climax" state in tact. As a result recovery is no longer possible in the short run and desertification is imminent. According to Johnson (1979) the areas most seriously affected by this process are those closest to watering points *i.e.* where live-stock must come regularly to drink water, especially during the hot season. Unfortunately in the arid zone, man's technological skill has sometimes outrun his ability to consider the consequences of his actions. To sink tube wells where surface water is lacking may help support life in an arid area, but by enabling larger herds to congregate around the supply, it can also spell accelerated destruction of vegetation and with it the process of desertification.

3.29 After more than 30 years of experimentation and reviews, there still is no effective leadership for managing the country ranges and natural pastures and very little effective activity in this respect (IBRD, 1985). A number of range management and improvement projects were initiated in the 1950's and early 1960's, but by the end of the 1960's, almsot all had ended in virtual failure—in large part because they were over ambitious, lacked clear objectives, and paid inadequate attention to prevailing socio-economic constraints. The single most important cause of failure was, in

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fact, sociological, rather than technical/agricultural: inability to deal effectively with the human population of the ranges, rather than the absence of, or inability to apply, technical solutions. (IBRD, 1985).

3.30 In May, 1973, a National Range Management Committee issued a comprehensive reports, containing wideranging recommendations for both the short and the long term, including: promulgation of a comprehensive National Range Policy and of provincial Range Management Acts; creation of provincial Range Management Agencies, assignment of co-ordinative lead function to the Inspector General of Forests, and creation of a Directorate of Range Management in his office: establishment of a Federal Range Management Fund for preparation and implementation of range management schemes: adequate federal and provincial financing for range management and improvement; formation of grazing associations to facilitate effective range management: effective training, education and research in range management; efforts to reduce the number of unproductive livestock; improvements in livestock and livestock products marketing: and establishment of a livestock feed industry and livestock feedlots. Although some steps were taken to implement several of these proposals, albeit often only partially, most of the major recommendations have never been implemented (IBRD, 1985). There is no effectve co-ordination among the various agencies involved; funding for range management and improvement remains extremely limited: livestock numbers have increased further and the sector's productivity and contribution to national income has declined further.

3.31 Range management remains a serious, widespread and unresolved problem, with important implications not only for the livestock sector itself, but for the water and agriculture sectors in general. Especially in the catchment areas of the major reserviors, range and natural pasture management is inseparably linked to effective watershed protection. At present, the provincial Forestry Department are charged with responsibility for public range lands, but they lack both sufficient financial resources and adequate numbers of appropriately trained staff for effective range management. Moreover, forestry departments has comparatively low inclination for, range management, as compared to traditional forestry activities. There is a dire need to change this attitude.

3.32 The level of production of private range is very low. On the average about 100 Lbs grass (Dry weight) is produced per acre. The carrying capacity therefore comes to 140 acres per animal unit. In state owned ranges where grazing is somewhat regulated the average production is 860 Lbs/acre with

the carrying capacity of 17½ acres per A.U. In areas where range improvement measures are undertaken alongwith grazing management, the production is as high as 2700 Lbs/acres with the carrying capacity of 5½ acres per animal unit (GOPn, 1976). The crucial importance of changes in current livestock sector management practices therefore can hardly be overemphasized. The probability is very high that range improvement efforts will fail unless they are combined with, if not preceded by, effective efforts to change certain important aspects of current livestock sector operations and management (IBRD, 1985). Effective range management necessarily involves changes in stocking rates and in grazing practices which depend for their effective implementation on modifications in herd management and husbandry practices, in livestock marketing, even in the feed industry. This in turn, will necessitate significant efforts to address various socio-economic aspects of current livestock operations in the major range areas, concerning both nomadic graziers and permanently settled livestock holders using public ranges. At present, the only attempts to come to grips with some of these issues are those made by a few teams of forestry staff charged with responsibility for certain specific public range lands; other institutions, (such as the provincial Livestock Departments, marketing institutions, etc) are not involved nor even interested".

3.33 Sand Dune Migration and Desertification: Moving sand dunes are a major threat to settlements, agricultural land and physical infrastructure facilities in various parts of Pakistan. In a number of locations, successful efforts have been made to stabilize shifting dunes by planting suitable species of shrubs and grasses in the interdunal spaces, on the leeward and windward dune slopes, or in line plantations ('shelter belts'). The species used have demonstrated a considerable ability to withstand drought and to regenerate naturally once they have firmly taken root. The technology developed is effective and replicable on a larger scale, provided funding and labour are available: the cost per acre is not very high, but the areas still requiring treatment are extensive. Where successful work has been undertaken, the local population is convinced of its benefits, interested in further dune stabilization, and willing to co-operate in protecting newly planted areas against grazing and firewood extraction. It would be desirable to continue further dune stabilization work. For achieving successful results however, it is necessary that firstly, a thorough evaluation should be carried out of past and ongoing projects, to search for the most effective techniques under different conditions, and find the cost effectiveness of approaches alternative: Secondly dune stabilization efforts should be combined with effective efforts to introduce sound range management techniques in the adjoining

range areas where increasing desertification causes dune creation and movement, so as to permit range vegetation to regenerate naturally and provide resistance to further wind erosion; and thirdly the local population in the areas to be treated should be effectively mobilized both for providing the labour needed for initial planting and for subsequent maintenance and protection of the stabilized areas and adjoining range lands.

D. *Species extinction*

3.34 One ever so often hears the statement that Pakistan is rich in its wildlife heritage. The zoologist list 165 species of mammals, 161 species of reptiles, 409 species of birds and 574 species of fishes (Kirmani, 1986) Ferguson (1978) lists 160 mammals and 900 birds. "Yet, travelling from north to south or West to east one hardly encounters any wild mammal. A few bird species could be seen through not so commonly seen as for example in the neighbouring country where one could see a variety of wildlife during a journey by train or road. Why is that so? Until 38 years ago the landscape was not very different. As one probes into it, one discovers that we as meat-eaters have hunted our wildlife almost out of existence. There is no longer but the stretches of sandy wastes reamin and the denuded hills. (Kirmani 1986).

3.35 Historical evidence show that faunal population was extremely rich in the past. Seals, painted pottery and figures of Moenjodaro and Harrapa around 2500 B.C. give clear evidence of existence of 2 horned rhinoceros, asian elephant and tiger (GOP, 1984[a]) With the progress of human activities in increasing intensity here, as elsewhere in the world, people started to remove forests, raise settlements and till the soil. The process intensified with the increase in population, the forest area shrunk further until it was reduced to patches and blocks. This destruction of wildlife habitat together with unscruplous hunting, commercial exploitation and competition with domestic livestock in supply of food resulted in considerable decline of wildlife fauna.

3.36 Wildlife is a vital link in the chain of renewable resources and prudence demands that wildlife is rationally conserved for the benefit of mankind. It provides us recreation, sports as well as food. Several species of wildlife help us produce better agriculture crops and therefore more food which is the basic need. Several insectivorous birds, for example, consume harmful insects which adversely affect our agricultural crops. If the birds are encouraged to multiply our dependence on pesticide can decrease, helping

our economy. The resorts to technology is not always beneficial and may indeed often prove to be counterproductive. The indiscriminate use of pesticide, for instance, destroys the harmful insects as well as those insects and birds which are not only harmless but extremely beneficial. The honey-bee, while produces honey, it also helps pollinating agricultural crops. The pesticide use kills away honeybees too and consequently the yield of oilseed crops falls spectacularly. This is what actually happened in 1968 and the sad experience was repeated subsequentl until at a late stage the realisation dawned (Kirmani, 1986).

3.37 Early Muslim administrations of the sub-continent had recognized the inadvisability of uncontrolled hunting. Game reserves were set aside and hunting was prohibited during breeding seasons. Nevertheless, as towns, villages, and fields spread through the plains, the numbers of reptiles, amphibians, birds, and mammals declined steadily. This process has been accelerating under the pressures of modernization and industrialization. Already, among large mammals, the lion (Panthera leo persica), tiger panthera tigris), great one-horned rhinoceros (Rhinoceros unicornis), and swamp deer (Cervus duvauceli) have reportedly become extinct. The cheetah (Acinonyx jubatus), Indian wild ass (Equus hemionus), and Kashmir stag (Cervus elaphus hanglu) are also supposed to be extinct (Ferguson 1978). The continuation of practices which have threatened wildlife for centuries has led to a visible decline in total numbers as well as in surviving species. Various surveys undertaken during the past decade have attempted to identify those animals which are most serverey in danger of dis-appearance. The results of these surveys, which are not in complete agreement, appear in Table III-7. According to world wildlife Funds (W.W.F) research and the scientific sister organisation, the International Union for conservation of Nature (IUCN) 20 birds, 31 mammals and 4 reptiles are in danger of becoming extinct in Pakistan (Ali, 1986).

3.38 To some degree, the threat to selected species had resulted from their economic value. Worldwide demand for skins, furs, horns, feathers, shells, and animal-derived substances such as musk and oils has been increasing steadily in spite of attempts by several nations to limit distributions of such products. Whenever possible, Pakistani dealers have eagerly sought to profit form the international market for wildlife products. Similarly, live animals are in demand to stock zoos, serve as subjects for medical and biological experimentation, aid in hunting, or to serve as pets. Pakistan, in particular, has in the past exported many animals for such purposes. Rhesus monkeys

are a prime example of a declining species whose economic value is high on account of their suitability as clinical subjects. In recognition of this fact, the government, through the National Council for Conservation of wildlife* (NCCW), has banned the export of rhesus monkeys (Khan, 1986[b]) Falcons also have been valuable commodities, particularly among wealthy hunters in the Near East. Their export, too, has been limited to 300 per annum in 1983 which has been raised to 400 in 1985. Other species, however, have not benefited from the protective shelter of export quotas. Porcupines (Hystrix indica), Jackals (Canis aureus), field rats (Tatera spp. and Meriones spp.) various snakes (Hydrophis spp., and other fauna may be exported freely or with only moderate restrictions (Siddiqui 1974). In 1973 a single Pakistani dealer obtained and filled an order for 36,000 live turtles. Throughout the early 1970's indications were that exports of live animals were increasing. In 1970-71 total exports of faunal species amounting to Rs. 380,000. Three years later the figure had more than doubled, reaching Rs. 835,000 (U.S MAB 1981). Illegal exports have further depleted certain animal populations. Monkeys, finches, buntings and parakeets have been smuggled out of Pakistan at alarming rates. In many instances, enforcement of export quotas has remained incomplete, uneven, and arbitrary (M. Ahmed, 1980).

TABLE III-7

Pakistan: Extinct and Endangered Species Extinct = X; endangered = E

Mammals	IUCN	FWS	NCCW	Baqai	GOP
Horses					
Asian wild ass (Equus hemionus)	E	E	X		E
Bears					
Baluchistan black bear (Selenarctos thibetanus gedrosianus)	E		E		E
Brown bear (Ursus arctos)					E

*National Council for Conservation of wildlife (NCCW) is the management authority for the export of animals. It takes policy decisions and acts as a co-ordinator. Ministry of Commerce announces the policy and regulations and decides exceptions/exemptions during the year on the advice of NCCW. The permits are also issued by the same Ministry, however, the spot checking is performed through Zoological Survey Department in Karachi and provincial wildlife Departments in other areas.

Mammals	IUCN	FWS	NCCW	Baqai	GOP
Cats					
Asiatic cheetah (Acinonyx jubatus)	E	E	X		X
Caracal (Felis caracal)			E		E
Fishing cat (Felis viverrina)			E		E
Golden cat (Felis temmincki)			E		
Himalayan palm civet (Paguma larvata)					E
Leopard (Panthera pardus)	E	E			E
Leopard cat (Felis bengalensis)			E		E
Lion (Pantheral leo persica)			X		
Lynx (Felis lynx)			E		E
Marbled polecat (Vormela peregusna)					E
Pallas's cat (Felis manul)					E
Sand cat (Felis margarita)					E
Snow leopard (Panthera uncia)	E	E	E		E
Tiger (Panthera tigéris)		X	X		
Deer					
Barking deer or muntjac (Muntiacus muntjak)					E
Black buck (Antilpoe cervicapra)			X		E
Chinkara (Gazella gazella)					E
Chowsingha (Tetracerus qudricornis)					X
Goitered gazelle (Gazella subgutturosa)					E
Himalayan musk deer (Moschus moschiferus)	E				E
Hog deer (Axis porcinus)					E
Kashmir stag (Cervus elaphus hanglu)		E	X		E
Nilgai (Bosephalus tragocamelus)			E		E
Swamp deer (Cervus duvauceli)			X		
Dogs					
Asiatic wild dog (Cuon alpinus)		E			X
Wolf (Canis lups)	E				
Dolphins					
Indus dolphin (Platanista indi)	E		E		
Dugong (Dugong dugong)		E			
Goats					
Chiltan markhor (Capra falconeri chiltanensis)		E			
Straigh-horned or suleman Markhor (Capra falconeri jerdoni)		E	E		E
Tahr (Hemitragus jemlahicus)					E
Martens					
Yellow-throated marten (Martes flavigula)					E

Mammals	IUCN	FWS	NCCW	Baqai	GOP
Monkeys					
Entellus langur (Presbytis entellus)		E			E
Rhesus monkey (Macaca mulatta)					E
Oxen					
Gaur (Bos gaurus)		E			
Others					
Common otter (Lutra lutra)					E
Smooth Indian otter (Lutra perspicillata)					E
Pangolin (Manis crassicaudata)					E
Rhinoceros					
Great one-horned rhinoceros (Rhinoceros unicornis)		X	X		
Sheep					
Marco Polo sheep (Ovis ammon polii)			E		E
Punjab urial (Ovis orientalis punjabiensis)					E
Shapu (Ovis vignei)		E	E		
BIRDS					
Bustards					
Great Indian bustard (Choriotis nigriceps)		E	E		E
Houbara bustard (Chlamydotis undulata)			E		E
Lesser florican (Sypheotides indiea)					E
Cranes					
Common crane (Grus grus)					E
Demoiselle crane (Anthropoides virgo)					E
Siberian crane (Grus leucogeralus)					E
Sarus crane (Grus antigone)					E
Ducks and Swans					
Spotbill duck (Anas poecilorhyncha)					E
White-headed ducks (oxyura leucocephala)					E
Whistling swan (Cygnus columbianus)			X		
Cotton teal (Nettapus coromandelicus)					E
Marbled teal (Anas angustirostris)					E
Junglefowl					
Res junglefowl (Gallus gallus)					E
Peafowl (Pavo cristatus)			E		E

Mammals	IUCN	FWS	NCCW	Baqai	GOP
Pheasants					
Cheer pheasant (Catreus wallichii)			E		E
Humalayan monal pheasant (Lophophorus impejanus)					E
Kaleej pheasant (Lophura leucomelana)					E
Koklas pheasant (Pucrasia macrolopha)					E
Western tragopan (Tragopan melanocephalus)		E	E		E
Sandgrouse					
Large pintailed sandgrouse (Pterocles alchata)					E
Woodcock (Scolopax rusticola)					E
REPTILES					
Crocodilians					
Gavial or gharial (Gavialis gangeticus)	E	E	E	E	E
Marsh or mugger crocodile (Crocodylus palustris palustris)	E	E	E	E	E
Lizards					
Banded dwarf gecko (Tropicalotes helenae)				E	
Broad-tailed gecko (Teratolepis fasciata)				E	
Desert or Central Asian gray monitor (Varanus griseus)	E	E		E	E
Fat-tailed gecko (Eublepharus macularis)				E	
Monitor (Varanus salvator)				E	E
Yellow moniter vanauas flavescens			E	E	E
Snakes					
Afro-Asian sand snake (Psammophis schokari)				E	
Indian python (Python molurus)	E			E	E
Malabar sea snake (Lapemis curtus)				E	
Striped river snake (Enhydris pakistanica)				E	
Tortoises					
Afghan tortoise (Testudo horsefieldi)				E	
Indian flap-shell tortoise (Lissemys punctata)		E			

Mammals	IUCN	FWS	NCCW	Baqai	GOP
Turtles					
Brown river turtle (Kachuga smithi)				E	
Hawksbill sea turtle (Eretmochelys imbricata)		E		E	E
Indian soft-shell turtle (Trionys gangeticus)		E			E
leatherbach sea turtle (Dermochelys coriacera)		E			E
Narrow headed soft-shell turtle (Chitra indica)					E
Sea turtle (Caretta spp.)					
Sea turtle (Chelone spp.)					E
Spotted pond turtle (Geoclemmys hamiltonii)		E			

Source Baqai. 1979. Wildlife & natural ecological environment in the Ferguson (U.S Fish and Wildlife Service). 1978. Indus delta. Karachi.
GOP. 1971.
IUCN 1975.
IUCN. 1978.
NCCN. 1978.

3.39 Hunting, both legal and extra-legal, has also played a leading role in reducing Pakistan's wildlife population and limiting its diversity. Hunting for sport (shikar) has remained an important pastime among wealthy landed classes. Such hunting has always been subject to restrictions but centuries of activity have neverthless reduced or eliminated some game species. The value of game meat, furthermore, guaranteed a continuation of peaching within preserves and private lands. Here, too, strict regulations have remained ineffectual as hunters have depopulated entire forests and jungles of selected species (GOP 1971).

3.40 Prior to 1966 Pakistan had taken no significant steps toward establishing national parks, sancturaries, or reserves. That year the government requested the World Wildlife Fund (WWF) to undertake an extensive survey of the country (then including East Bengal). The investigation was to recommend a cohesive policy which would enable Pakistan to protect its endangered fauna and to maintain equilibrium within its ecosystem. (U.S. MAB, 1981). Accordingly, two expeditions were undertaken in 1966 and 1967 under the leadership of Guy Mountfort and including other noted naturalists such as Duncan Poore, Eric Hosking, George Shannon and Jimmy Hancock. The reports of the team provided valuable and previously unavailable information on existing species and recommended several steps for national conservation programme of wildlife. Among the suggestions, the Mountfort team advised the government to establish two large national parks

and eight wildlife reserves. In 1971, after the appointment of a Pakistan Wildlife Enquiry Committee a number of the WWF suggestions were implemented In its report, the Committee agreed to set up five national parks comprising 3415 sq km, eighteen wildlife sancturaries, and fifty-three game reserves (GOP 1971). The number of wildlife sancturaries and game reserves have now been raised to seventy and seventy four respectively (See annexure III-1 for listing).

3.41 Reserves and Protected Areas: The three categories of protected land are defined as follows

(1) National Parks. These are areas set aside for the protection and preservation of scenery, flora, and fauna in their natural states. National parks are accessible to the public for recreation, education, and research. Hunting is strictly prohibited.

(2) Wildlife Sanctuaries. These lands are reserved as undisturbed breeding grounds intended to protect wildlife. Public access is limited and exploitation of forest and animal products are pbohibited.

(3) Game Reserves. Within these territories, the government limits hunting and shooting of animals by issuing permits. These permits specify the maximum number of animals which may be killed or captured.

In 1972, within a year of the issuance of the committee's report, the nation's first national park was declared. The Lal Suhara National Park in Bahawalpur District in southern Punjab set aside 31368 ha of land for the propagation of wildlife and preservation of the natural environment. Later in the year a much larger 308,733 ha park was established at Kirthar in Sind primarily for the protection of the Sind ibex (Capra hircus blythi). In 1974 a third park namely khunjerab National Park (226913 ha) was established in Northern Areas. Its main intention has been to sustain the population of Marco Polo sheep, blue sheep or shapu, Asian wild ass, and snow leopard. Hazarganji-Chiltan (12567 ha) the fourth national park in the series was also established in the same year to protect chiltan markhor, wildsheep leopard and chukor. Margalla Hill National Park (14,786 ha) was so designated in 1980 in the Federal Capital territory to safeguard a number of mammals, birds and waterfowl. In addition to these two other areas chitral Gol in

N.W.F.P. and Durreji in Baluchistan are also slated to recieve national park status (Khan, 1986).

3.42 Like fauna a large number of plant species are also presumed to be either severely threatened or endangered (Annexure 1.2). The small efforts at ensuring the survival of various species with the designation of national Park game sanctuaries and reserves are greatly handicapped becuase funding for their protection and maintenance is extremely scarce. Continuing encroachment and unauthorized grazing and wood extraction in parts of these areas are also largely offseting current official efforts at protection and preservation. A welcome development associated with the reintroduction of vegetative cover in desert areas near Mastung has been the rivival of a number of wildlife species which had largely disappeared previously. This indicates that habitat destruction has been a major cause of the disappearance of traditional wildlife and that conversely, habitat regeneration and protection would be a major postive contribution to the preservation of endangered species (IBRD, 1985). In view of the growing recognition of the importance of preserving the genetic material and largely unexplored potential (if nothing else) represented by wild plants and animals, any measures will be beneficial which can help ease the pressure on the natural environment where animal and plant life still survive. Moreover, more direct efforts are the need of the time. These should include the establishment and proper operation of animal and plant reserves and of germ plasm depositories, the effective protection of breeding grounds for marine life, strengthening of wildlife management units in the Forestry Department and the establishment of an instituional capability for systematic data collection and scientific study of wildlife and their habitat.

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CHAPTER IV

AQUATIC ECOSYSTEM

4.1 The aquatic environment in Pakistan can be divided into inland waters, estuarine waters and marine water. The inland water bodies includes the rivers, streams (mainly those of the Indus System), lakes and other wet-lands as well as underground waters. The estuarine water occupies lower delta of the river Indus where it splits into numerous distributaries and is often inundated by tidal floods. The marine water spreads over an area of 105,400 square nautical miles in the Exclusive Economic Zone (EEZ) of Pakkistan extending for a distance of 200 natutical miles (370km) parallel to the coast from Kutch border in the east to Iranian border in the West.

A. *Aquatic Ecosystem and Development.*

4.2 The process of development has brought some major impact on the aquatic ecosystem of Pakistan. More than 95 percent of inland water in Pakistan is being used for irrigation. Another three to four percent goes into the municipal water supply for domestic consumption while about one percent being utilized by industries. Since independence there has been a great increase in man-made reservoirs for irrigation, generation of electricity, water supply and flood control. Tarbela, Mangla, Warsak, Tanda, Baran, Khanpur and Rawal are some of the examples of these reservoirs. Although irrigation plays a significant role in increasing agricultural production. Several ecological problems have been associated with improper irrigation practices. The most important adverse impacts are the result of sub-optimum use of water in a badly managed irrigation system. Out of 123 billion 3m water diverted annually, only about 67.65 billion 3m are available at the heads of water courses. It has been estimated that from 5 to as much as 65 percent per mile is lost in the water courses. Altogether less than 30 percent of water from rivers is stored in root zones for crop use. Historical data shows that water table has risen due to seepage from reservoirs and irrigation channels at an average rate of 15 to 35 cm per year since modern irrigation was introduced. Further in an area where the underground water has a salinity of 1000 part per million (ppm), which is acceptable for all crops, evaporation at the rate of about half a meter per year, which is a typical value where water table is high will raise the salt content of top one meter to

about one percent in 20 years. (Spooner, 1982). The side effects of irrigation are therefore evident in waterlogging, salinization, alkalination increased incidence of such diseases as malaria, loss of forest cover and genetic diversity as well as other consequences associated with them.

4.3. The increasing number and size of human settlements in the vicinity of waterbodies is another major cause of severe stress on the aquatic resources. This is apparent from increasing organic and biological pollution in the inland and estuarine water near the urban centres due to dumping of untreated or partially treated domestic waste. The effluent from Industries in Karachi Multan, Faisalabad, Lahore (Kala Shah Kaku) Peshawar etc. released into water bodies is no less hazarduous. Observations reveal that Korangi Creek (Karachi) receives a heavy load of organic pollution and salts of heavy metal as the Malir river enters it. Beg et al. (1975) reported that the total suspended solid release was of the order of 34.2 tons per day which created dredging problems of the Manora Channel. It has also been estimated that out of 1237 tons of BOD per day pollution load of the city, 1405 tons per day is being produced by the large industries in the city. The infrastructure development has also brought about changes and polluted the aquatic environment. The electricity generating establishments and nuclear power plants, (KANUP) often discharge coolant water causing thermal pollution. The increase in temperature cannot always be tolerated by living organism. Heavy load of suspended sediment is yet another form of pollutant that is added into Pakistanti rivers as they pass through deforested and overgrazed areas.

4.4 Amongst modern practices in agriculture; Indiscriminate use of agricultural chemicals such as pesticides, insecticides, fungicides, and herbicides and fertilizers is a significant cause of aquatic pollution. The pesticides form residues in the soil and living organisms including human beings. Some of the pesticides used as DDT, 2-4 D Aldrin, Deildrin etc, are highly poisonous to fish and other aquatic organisms. Similarly the agricultural run-off containing fertilizer create nutrient loading in the aquatic environment causing eutrophication and algal growth. Agricultural run off after rains from fields sprayed with pesticides often result in killing of fishes in large number. Dead fishes on the bank of Kabul river in certain season of the year provide ample proof of this, Mining and dredging activities also contribute to aquatic degradation. Off-shore oil exploration in Pakistan has started only recently and its deterioratory affects may be avoided by taking preventive measures. However a serious problem emerging on the beaches of Karachi is removal and transportation of sand for construction purposes.

Scars produced by the process are evident along clifton beach. If control for the same is not exercised, it may cause serious demage to the recreational area.

4.5 With the increased use of nuclear technolgy in energy, agricultural and medical fields, the aquatic pollution from radio-active wastes has become real and needs careful planning to avoid accidents and risks. A unique environmental problem that has been encountered in marine waters in recent years is the appearance of poison in certain species of fish. Access of mercury noticed in tuna fish along the north American Coast in the pacific due to dumping of that metal in sea water as industrial waste is one example, while another is the sudden poisioning of otherwise non-poisonous cignatera. The second phenomena is related to occasional appearance of red tide consisting of plankton of that colour. This highly poisonous organic material is a by-product of pollution, and once consumed by fish or shell fish can make them fatal for human consumption. The red tides have often occured on the coast of our neighbouring country India, (ESCAP, 1984). It is therefore essential to carry out research and investigation in our marine water to ward off the possible danger.

4.6 The land based industrial development as well as sea based maritime transport are the two major sources of oil pollution in-our marine environment. It has been estimated (Mian 1979) that about 20,000 tons of oil finds its way to Pakistani beaches, harbour and fishing grounds annually which is not only deteriorating the quality of our beaches, but can seriously endanger fish life. The incident of Buzzard Bay (Massachusetts) is enough to show the implication of the problem where only a small oil spill caused the immediate death of 95% of the fish, crab, lobster and clam (Gop. 1982).

B. *Aquatic Resources*

4.7 The resources of the aquatic environment in Pakistan can be devided into renewable and non-renewable types. The first of these can be divided into four broad groups (a) Fresh water resources (b) Fisheries (c) mangrove and related vegetation (d) Other aquatic flora and fauna. The non-renewable resource *i.e.* minerals such as petroleum, managanese nodules, metealliferous sediments, phosphorites and common salt.

4.8 Fresh water Resources: The water resources of Pakistan include surface water of the rivers and their tributaries local rainfall and useable groundwater. The major source of surface water is the Indus river and its major tributaries the Kabul on the right bank; and the Jhelum, Chenab, Ravi, Beas and Sutlej on the left Bank. With the implementation of the Indus Water Treaty (1960) between Pakistan and India, only rivers Indus, Jhelum

and Chenab have fallen to the share of Pakistan. These reivers flow in shallow meandering channels across the vast alluvial plain which gently slopes towards south to south-west along the river with extremely flat gradients from about 0.02 percent in the Punjab to as low as 0.01 percent in Sind. The rivers hve individual flow characteristics but they all rise in the spring and early summer with the snowmelt and monsoon rainfall and have a combined peak discharge in July or August. In winter, during the November February period, flows are much lower being less than one-tenth of those in the summer monsoon. The winter flows consist almost entirely of regeneration or bank storage returning to the river after the summer has ended with the fall inthe river stages. The annual average flow in the rivers Indus, Jhelum and Chenab and the river Kabul is about $1.72 \times 10^{11} m^3$ Because rainfall is heavily concentrated during the nonsoon months, there is a noteable fluctuation between maximum and minimum discharge rates for each river. The Indus, which is primarily supplied by glaciers, is subject to the least seasonal variation, though its maximum flow is more than fifty times its minimum (Table IV-I).

TABLE IV-I

PAKISTAN: Discharge and Characteristics of Indus System.

River	Total Drainage area (Sq Km)	[a] Length (km) Area	Location	[b] Discharge Rate (100^3m per second) Maximum	Minimum	Total (billion ^{3}m
Indus[c]	1,047,850	3,290	Attock	26	0.48	115
Chenab.	61,000	1,355	Marala.	20	0.11	32
Jhelum.	63,500	890	Mangla	22	0.11	28
Sutlej.	86,000	1,619	Near Suleimanke	14	0.08	17
Beas.	25,900	445		10	0.06	16
Ravi.	11,600	1,053	Near Baloki	7	0.03	9

(a) The Indus, chenab, Ravi, and Sutlej are partly in India, the Jhelum originates in disputed territory.

(b) Within Pakistan except for Beas.

(c) Includes the Kabul River.

Source: U.S. MAB (1981) "Environmental Profile of Pakistan".

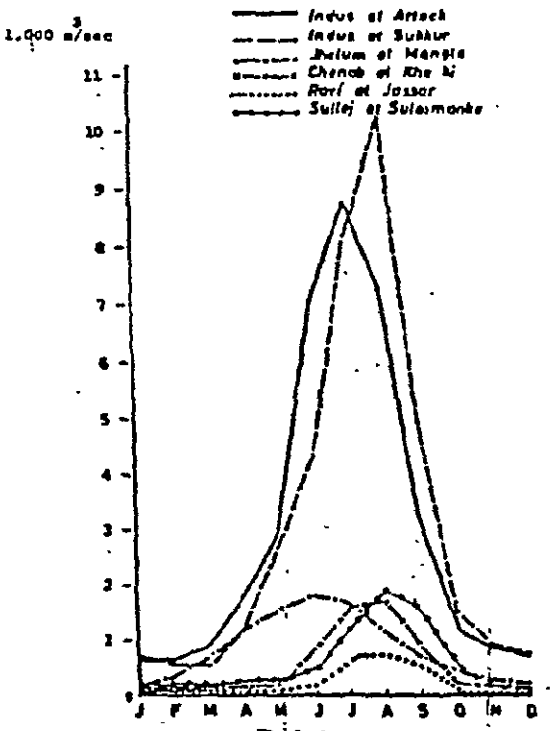
Valume increases markedly by April in the Indus, Chenab, and Jhelum but only by June for the remaining rivers. Maximum flow is achieved during the June to September period, during which more than two-thirds of the annual discharge is carried (Fig;4.1). Throughout the year the evaporation accounts for significant water losses, particularly in the plains (U'S. MAB, 1981).

4.9 The Indus basin covers about two-thirds of Pakistan's area. A second, much smaller, river basin comprises the slopes and Plateau west of the central ranges. This basin in Baluchistan drains the coastal reivers and desert streams. Of these, only the Zhob and five other minor rivers are perennial, and only at their lower ends. The remaining streams flow exclusively during the rainy season. In general, the western drainage basin is too small and irregular to sustain cultivation.

4.10 Within the Indus basin, flooding is virtually an annual occurrance. In all, nearly 15 million hctares of terrain are subjected to inundation. When rainfall is exceptionally heavy the rivers overflow their banks and cover the adjacent flood plain. In spite of modern control measures, severe floods such as those of 1955, 1973, 1976, and 1978 have caused immeasurable loss to crops, property, and human and animal life. The plains of Punjab and Sind are particularly susceptible to such disasters. Poor drainage in the lower Indus basin prolongs flood conditions and increases damage.

4.11 A major use of river water is in irrigation. One of the oldest method employed for irrigation in the area constituting Pakistan appears to have been the use of natural floodwater. There is evidence that as early as the third century B.C. floodwaters were diverted by means of man-made channels. Throughout the medieval period, muslim rulers promoted a public works policy which included canal construction. Inudation canals, intended for seasonal use during the monsoon, were dug along the active and meander flood plains of the Indus basin. This mode of irrigation continued during the nineteenth century. By 1861 the government felt the need to extend the limits of irrigation beyond the brief flood season. This led to the development of perennial irrigation. Through the construction of barrages which enabled canals to flow year-round. The upper Bari Doab canal, the region's first perennial network, was followed by others. At present the entire Indus basin is covered by a web of canals which bring river water to interfluvial areas and link the rivers themselves.

4.12 The present irrigation network from surface flow comprises some 61,000 km of conveyance channels (canals, branches, distributaries and



Pakistan

Figure 4.1 Mean Monthly Discharge of the Indus System

Source: Dureshy. 1977.

minors) in 42 principal canal systems which have more than 78,000 water courses (farm channels). In addition, some 600 km of link canals of very large size have also been constructed. There are now sixteen barrages and canal diversion works in the Indus River System with two major storages at mangal and Tarbela with 152.92 x 10^3 m^3 and 266.2 x $10^3 m^3$ respectively. The combined diversion capacity of the main canals system is nearly 7000 m^3 per sec. (250,000 cusecs) With individual capacities upto 439 m^3 per sec (15,500 cusecs). The diversions are generally limited in the high flow season (Summer) by the capacity of the canal system and in the low flow season (winter) by the available water supply. The gross area commanded by the irrigation system (within the Indus Plan) totals about 16 million ha (GOP 1983a).

4.13 The other extreme to flooding in Pakistan are droughts which have been repeatedly experienced in the country in past. Low annual rainfall together with low riverine discharge and high levels of evaporation have made most of Pakistan water deficient. Without irrigation, agriculture in most of the Indus basin would be impossible because of deficient and seasonal rain fall. The present contribution of rain to crops in the irrigated areas is estimated at about 7.40 x 10^9 m^3 which is anticipated to rise to $10 m^3$ as the cropped area increases in the course of development (GOP 1983a). The tract totally dependent on rainfall commonly termed as "Barani" or rainfed area is around five million hactares. In such a large area, the rapid and widespread adoption of appropriate rainfed farming techniques needs to be recognized as a crucial component of effective watershed protection. This aspect has, however, to date received very little attention in Pakistan among policy makers and agricultural administrators, as well as in the agricultural research establishment. Inappropriate land preparation and cultivation techniques not only reduce water retention and infiltration and, thus farm productivity but also contribute substantially to soil erosion and siltation.

4.14 Beside utilizing surface sources Pakitan has a long tradition of use of groundwater for agricultural purposes. Baluchistan in fact was one of the first regions in the world to tap subsuraface aquifers (U.S. MAB, 1981), Farmers here have been using underground channels known as 'Karez' for thousand of years to irrigate their land. The utilization of groundwater potential in the Indus Basin on a large scale, however, was started only after 1920. The deep alluvial deposits of the Indus Plain form an extensive groundwater aquifer. The physical characteristics of the alluvium are generally

favourable to groundwater development. Keeping in view the irrigation water quality constraints and gradual deterioration of groundwater it has been estimated tht about 4.1 x 10 103m3 of groundwater can be developed annually most of which needing dilution with canal water for agricultural use. According to estimates there were 1,88,857 public and private tubewells operating in the country pumping 4.1 x $10^{10}m^3$ m in 1981. The number had crossed 0.2 million by 1985 (GOP 1985).

4.15 Quality of Freshwater Resources: The proliferation of unlined canals and the construction of massive dams have combined to deteriorate the chemical quality of much of Pakistan's water. Seepage, sometimes as high as 50 per cent, has induced steady rises in the water table of the Indus basin. The river water which saturates the soil is high in mineral content. As a result, the growing reeservoir of groundwater is becoming increasingly saline and therefore unusable (Fig. 4.2). Such alkaline water threatens underground roots and thus prevents the extension of agriculture. In addition, saline groundwater cannot be pumped and utilized for irrigation. Further much of the nation's drinking water is drawn from subsurface sources such as boreholes, wells and springs and the excessive salinity is making this water importable. Other factors causing deterioration in water quality have been discussed in the next section (c) dealing with aquatic pollution.

4.16. Fisheries: Pakistan has rich fisheries resources in its network of fresh water bodies and marine environment. According to FAO's estimate, the North-West Part of Indian Ocean/Arabian sea in which Pakistan is situated is believed to contain one of the largest potential resources of marine fish. About 400 species of fishes belonging to 21 orders, 9 sub-orders and about 188 families have been recorded in this region. Out of these about 40 species of fish are axploited on economical scale and are of economic importance. As regards shrimps about 21 species of family Penaeidae are found in our coast; out of which 12 species are commercially exploited, Lobsters of the family palinuridae also inhabit our water and are commercial exploited. Crabs, Molluscs and other marine animals are also caught during trawling operations. The water along the entire coast have a large variety of species, the most important being groupers, snapper, mackerel, horring cat-fish, sharks, rays, jewfish, pomfret, shrimp and lobsters (Majid 1985).

4.17 In 1947, at the time of the creation of Pakistan, total production of marine fish was 32,893 metric tons and the catch from inland water was 7,050 metric tons. Thus the total fish production was almost 40,000 metric

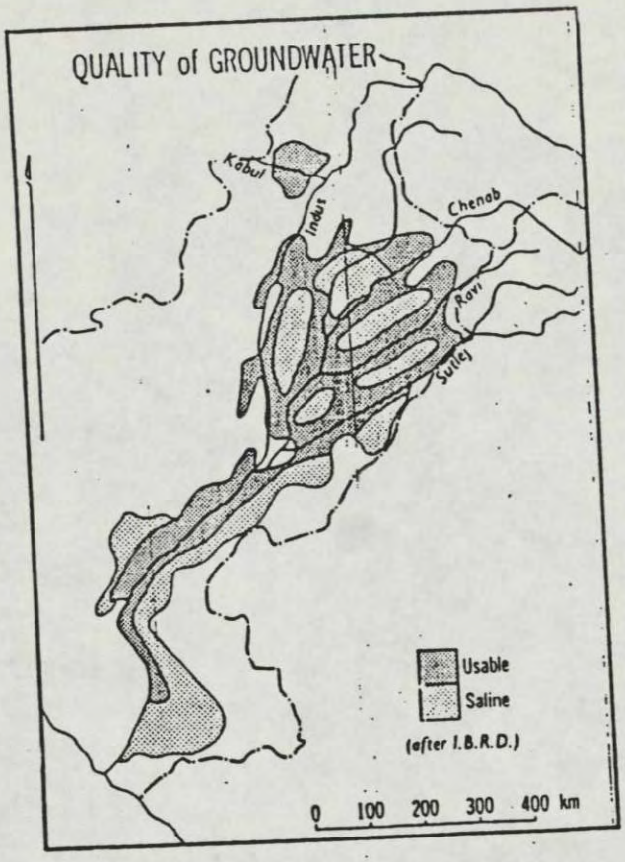


Fig: 4.2

Source: Johson B.L.C. (1979)

tons. In 1960 total fish production was doubled to 80,657 metric tons (Marine fisheries contributing 62,157 metric tons and inland fish 18,500 metric tons). By 1984 the total production had gone up to 378,656 tons. Marine fish was 308,050 metric tons and inland water 70,606 metric tons) FAO estimated that the maximum sustainable yield (MSY) of marine fish (except mesopelagic species) in Pakistan waters was between 450,000 metric tons (low estimate) and 725,000 metric tons (high estimate). On the basis of these estimates FAO concluded that the additional catch possible without depleting the country's marine resources would be 235,000 metric tons (excluding mesopelagic species). Mesopelagic species identified in Pakistan are not directly suitable for livestock feed.

4.18 Catches of fish species along the coast tend to increase from West to East. The main species are Indian salmon, eel, jewfish catfish. pomfret, red snapper, grouper, sharks and rays, which are found along the entire coast including the western and northern part of the Arabian sea. The pelagic fish comprise the major part of the commercial catches in Pakistan with Indian mackerel and oil sardines being the most important species. Pelagic species such as sardines, mackerel and anchovies are mainly found off the coast of Pakistan during the northeast monsson season which extends from October to June, Sardines and anchovies are mainly caught along the beach. Tuna fishing is not yet developed in Pakistan, but shrimps are widely caught and its yield has already reached 18,000 metric tons. Shrimp catches have the biggest value because of the high price command in international market. Three main variety of shrimps locally known as "Jaira" (large size), "Kalri" (medium size) and Kiddi (small size) are caught, processed and exported.

4.19 The fishermen form the backbone of the fisheries industries. In 1984, the total number of fishermen earning their livelohood from marine and inland fisheries industry *i.e.* active fishermen on board the fishing vessels, the labourers and technicians engaged in shore installations was 2,18,582 as against 100,223 recorded in 1960 showing an increase of more than 100 per cent. Out of the total number of 2,18,582 fishermen, it is estimated that 86,822 fishermen were engaged in marine fisheries. In addition to active fishermen, a large number of persons are engaged in net making, transport, processing and other ancillary industries using fish as raw material. The average monthly income of a fishermen was around Rs. 175 per month in 1960 and it has increased eight times to Rs. 1,400 per month in 1983.

4.20 Till 1955 not a single fishing vessel was mechanized and the whole of the fishing fleet was sail driven. By 1984 the total strength of marine and

inland fishing fleet of Pakistan reached 21,345 comprising 2,722 mechanizec 4,166 mechanized-cum-sail driven and 14,457 non-mechanized boats wheree in 1960 the total strength of the fishing fleet was 5,007 comprising of 24(mechanized and 4,761 non-mechanized fishing boats. Operation of th present fleet of mechanized gillnetters mainly occurs in the Indus Delta area along the coast line from Karachi to Sonmiani Bay, 70 km West ot Karachi It also occurs along the coast-line near the fishing stations of Baluchistan Other fishing methods such as mid-water trawling, long-lining and pursesein ing have not yet been introduced in Pakistan.

4.21 Fish is an important source of foreign exchange earning for Pakistan The country exported 31,615 metric tons of fish and fish products in 1981 which was worth over a billion rupees. Besides export earning fisheries are ar important source of protein for Pakistan and increases in fish production are designed in the sixth Plan (GOP 1983 b), to meet both domestic demands and increased exports. The Sixth Plan states that research (carried out under the Agricultural Research Council) has indicated the tremendous fish catch potential from the coastal and deep sea belt in Pakistan's exclusive economic zone (EEZ). The Plan points out, however, that the industry remain under-developed and its resources inefficiently exploited. A number of measures are proposed under the Sixth Plan to increase fishing productivity. These include: the introduction of mechanised boats and fishing gear, adoption of efficient fishing technology, establishment of new fish harbours and landing facilities, extension of credit and improvement of modern marketing facilities. A substantial public sector investment (Rs. 856 million) is proposed to raise fisheries output. Despite research on fisheries potential, however, there has been an absence of modelling of the sustained yield potential of Pakistan's EZZ. Thus there is the danger that a major expansion of marine fisheries could over-exploit one or more species to the long-term detriment of the fishery (IUCN, 1984). The Sixth Plan calls for immediate examination and revision of all laws concerning fisheries, the removal of obstruction to private enterprise and 'dismantling of unnecessary governmental controls. It also calls for 'induction of selected foreign fisheries specialist firms for joint collaboration with local enterepreneurs, particularly for deep sea fishing and in order to develop expertise in modrrn technology.

4.22 Inland Fisheries: Fishing from inland waters is also widespread in Pakistan, occuring in all provinces/regions. The lakes, ponds, and barrages along the Indus and its tributaries within the Punjab and Sind, as well as dams and reserviors in the two provinces are the chief breeding areas and principal procucers. Over the past four decades total inland production has

increased substantially (from 7,000 metric tons in 1947 to 70,606 metric ton in 1984). This rise, however, has not kept pace with the growth of the marine fishing industry in recent years. Consequently during the same period the inland fisheries share of total production increased from 21 per cent in 1947 to 30 per cent in 1960 but then fell to 23 per cent in 1984. Nevertheless, inland fisheries employ more persons than their marine counterparts. Of 218,582 persons engaged in fishing, more than half, or 131,760, worked at non-marine hatcheries and fisheries. The main sites for these activities are: Manchar, Kalri, and Haleji Lakes in Sind, the barrages at Gudu, Kotri, Sukkur, and Thatta on the Indus River; the Barani tract in the Punjab; the artificial lakes created by dams at Warsak, Mangla, and Tarbela in NWFP; and the Chitral, Kaghan, and Swat valleys in NWFP. Endemic species of carp such as mahasheer (Barbus Mosal), rohu (Laboe rohita), mori, and thaila has been supplemented with imported breeds such the common carp (Cyprinus carpio) and rainbow trout (Salmo gairdnerii). In addition to providing a source of protein and a means of livelihood for thousands, fish hatcheriesare expected to stock several picturesque northern mountain streams and thereby boost tourism and sporting in these areas. The government is extending the area allotted to inland fisheries which is more than 3 million ha at present. It has been estimated (U.S. MAB 1984) that by better utilizing this area, the inland fish production can be raised to more than 200,000 metric tons per year. However the efforts in this regard need to be carried out in conjunction with programmes intended to introduce new species and designed to make better use of available scientific hatchery techniques.

4.23 No doubt, there is a great potential for increased fish protein production from inland as well as marine fisheries for both domestic demand and export. However, inadequate work has been done on ensuring the sustained yield over the longer term. Similar concerns over sustained yield apply to the coastal mangrove areas whose fish and crustacean production as well as the forest viability is in many places under threat from coastal development. The latter seems a particularly under-studied area of potential for sustainable development (IUCN, 1984).

4.24 Mangroves are a collection of woody plants plus associated fauna and flora, that utilize a coastal, saline depositional environment involving a variety of coastal landforms. Although mangroves can survive in sea water, it is not a physiological requirement. In contrast, fresh water is required for mangroves to attain their maximum structural development Cintron, 1981). Their dominance intertidal saline environments is due to their ability to

tolerate salinity better than their potential glyco-phyte competitors. However, they cannot survive saline concentrations greater than approximately 90 ppt (scholander et al. 1962) In Pakistan the largest area of mangrove development), is the Indus delta region south of Karachi and north of the international boarder with India. The Indus River, sixth largest in the world (Wells, 1985) has a delta which is the second largest in area in the Indo-Pak sub-continent (the delta of the combined Ganges-Brahmaputra river is the largest). The region has sufficient fresh water to support potentially a large mangrove forest.

4.25 The area of mangrove forests in Pakistan has been estimated at about 249,486 hactare (Khan, 1966) in the Indus delta and less than 20 hactare along the Makran coast in Baluchistan (Snedaker, 1985). The indus delta thus ranks as the fifth or sixth largest single mangrove area in the world; second on the Indian sub-continent after sunderban which cover more than 850,000 ha (Snedaker 1985). Historical records indicate that the distribution of mangroves in the Indus delta has significantly changed during the past several hundred years. Earlier, the major spill rivers of the Indus emptied through distributaries close to Karachi. Around that time the mangroves were tall and healthy and their growth was dense and extensive (Khan, 1966). It is believed that at the time of the last major shift in the Indus towards the Rann of Kutch, these mangroves experienced a process of deterioration but simultaneously rapid development of extensive forests occurred in the delta areas of the new, more southerly, spill rivers. This broad pattern of change is consistent with the observations of geomorphologists (e.g. Thom, 1967; Thom et; al. 1975) who have documented the sequential appearance of mangroves associated with temporal and spatial changes in coastal fluvial deltaic processes.

4.26 The Indus delta mangrove play very important role from economic point of view. They supports local fishery enterprises (promfrets anchovies, Hilsa ilisha, etc.), a commercial shrimp fishery that contributes to the export market, and provide a source of firewood and other forest products for local use (Saifullah, 1982). In addition, the leaves of the dominant genera, Avicennia, serve as a dry season fodder for domestic camels. It is also reported that when Avicennia leaves are stall-fed to dairy cows, the dietary supplement increases the butterfat content of the milk (Saifullah, in Prep.). At present, the mangrove forests are protected by law, and some revenues, albeit insignificant, are collected from the sale of their forest products.

4.27 There is an absence of reliable quantitative data on the status of Indus delta mangroves, particularly with respect to changes that may have taken place over the past several decades in association with the upstream withdrawal of Indus Rvier Water for irrigation. This is mainly due to the great logistic difficulty involved in travelling to, and within, the extensive Indus delta region. However Snedaker, who visited the Indus twice-one in 1977 (as a representative of Unesco's Division of Marine Sciences) and again in 1982 (during the U.S.--Pakistan Workshop on Marine Science) made some important observations. Comparing the existing conditions with historical record, he wrote, "it was apparent that the tall and extensive forests of the Indus delta (cited in colonial records) were no longer present. Instead the existing forests generally reflected the imposition of an environmental stress associated with reduced fresh water availability that led to hypersalinity and nutrient impoverishment. Apparently the best developed trees only occured along well-flushed tidal channels. Whereas the interiors of the deltaic islands (*i.e.* poorly flushed areas) were sparsely inhabited by the dwarf form of Avicennia spp. The village of Keti Bunder showed dramatic evidence (*e.g.* surface salt accumulation and corrosive deterioration of domestic structures) of the effects of hypersalinity that presumably led to the associated partial collapse of fishing industry" (Snedaker, 1984). These observations are consistent with other reports on mangrove degradation due to reduction in freshwater discharge from the Indus because of upstream diversion and use in agricultural irrigation (IBRD, 1985). At present, the Indus has a significant discharge only during the southwest monsoon while during the low water season, the fresh water is diverted by upstream dams and barrages. The future water-resource development plan appear to be oriented toward the total capture and diversion of Indus water for agricultural irrigation, suggesting, that at some point in the relatively near future (measured in decades) the Indus will no longer have a freshwater discharge into the delta area and the Arabian sea leading to a total destruction of mangrove ecosystem. Even today the deterioration of the Indus delta mangrove ecosystem is much more extensive and severe as compared to its counterpart in the Gangetic delta (India) which is experiencing accelerated hyper salinity (Snedaker, 1984).

4.28 Offshore mineral extraction is still in an exploratory stage in Pakistan. Efforts have been increased to search for crude petroleum and gas. Manganese nodules are not economically feasible for mining at present but at some point in future may prove an important potential source of such precious minerals as nickel, cobalt, copper, and manganese etc. Sand and

common salt is being obtained presently from the coastal areas. Likewise alluvial gold washing in Indus sand has continued for hundreds of years. Placer deposits in the Indus Rvier also have radio-active minerals. Some other aquatic resources of great economic importance are flora and fauna other than fishes. These include large animals such as sea turtles, crocodiles, whales as well as micro-organisms. The wetland habitats have been classified into twenty two types Table IV-2 back with its own flora and fauna. Although some wildlife sanctuaries and games reserves have been established in the country in these habitats (Annexare-I) not much systematic work has as yet been done on the wetland resources.

C. *Aquatic Pollution*

4.29 Whether used as habitat or to meet drinking and irrigational demands, the maintenance of quality of water is crucial for survival of life. However, due to increasing siltation (emnating from physical disruption), biological contamination.

TABLE IV-2

Variety of Wetland Habitats

1. Sea bays and staits (under 6 metres at low tide)
2. Estuaries, deltas
3. Small offshore islands, islet
4. Rocky sea coasts, sea cliffs
5. Sea beaches (snad, pebbles)
6. Intertidal mudflats, sand flats
7. Mangrove swamps, mangrove forest
8. Coastal brackish and saline lagoons and marshes.
9. Salt pans (artificial)
10. Shrimp ponds, fish ponds
11. Rivers, streams-slowflowing (lower perennial)
12. River, streams—fast-flowing (upper perennial)
13. Oxbow lakes and riverine marshes
14. Freshwater lakes and associated marshes (lacustrine)
15. Freshwater ponds (under 8 hectares), marshes, swamps (Palustrine).
16. Salt lakes, saline marshes (inland drainage systems)
17. Water storage reservoirs, dams

18. Seasonally flooded grassland, savanna, palm savanna
19. Rice paddies
20. Flooded arable land, irrigated land
21. Swamp forest, temporarily flooded forest
22. Peat bogs

(by agents of human diseases and animal and plant pests) and chemical pollution (arising out of Industrial effluents and agricultural chemicals, etc) in Pakistan the quality of water is under constant deterioration. Researches of the National Institute of health, Islamabad and Pakistan Medical Research Council have revealed that a large proportion of diseases in Pakistan are caused by the consumption of polluted water.

Even the large rivers like the Ravi and Chenab are heavily polluted today, let alone the rivers like Lyari and the Leh which pass through the dense urban areas of Karachi and Rawalpindi respectively. Community wastes from human settlements in these cases is much higher as compared to waste added by industrial effluents. Most of these wastes are discharged directly into the water courses. While domestic sewage and garbage are full of microbes, the industrial wastes often release toxic substances in their immediate environment. Hence if the purification of water is not done and sufficient time is not allowed to nature to do its job, the river water courses and reservoirs become progressively more polluted. The implication of such massive pollution, for the health of the nation, is extremely serious. According to estimates of the Planning Commission 40% of deaths in Pakistan are related to water-borne diseases such as typhoid, diarrhoea, infective hepatitis, etc. The extensive change in Pakistan's hydrological environment through irrigation has also caused an increase in anthropoed activity and some of the diseases in troduced by them have increased and others hitherto unrecognised virus diseases have appeared.

4.30 Water pollution also has severe effects on aquatic life. Occurence of massive fish kill and the destruction of lower aquatic forms due to indiscriminate use of pesticides in the agricultural fields along river banks and release of industrial pollutants into water bodies has become a common feature in various parts of the country. The sea waters of Pakistan are no exception. Their rich marine life is being seriously endangered by the land-base pollution and the oil spills in the coastal waters. Wastes from tankers and ships in the coastal waters are discharged in large quantities due to lack of port facilities and an institutionalised system to deal with the pollutants.

Cumulatively, over the years the quantity has been estimated to have run in thousands of tons which has threatened the very life of marine fauna and flora. The toxicity of industrial waste discharges can not be over emphasized. Both inorganic and organic chemicals even in extremely low concerntrations may be poisonous to fresh water fish and other smaller aquatic micro-organisms. Highly complex organic compounds produced by chemical industry for textile and other industries have also proved toxic to fish life. Invariably, all salts some even in low concentrations are toxic to certain forms of aquatic life (GOP 1983[c]).

4.31 There are about 50 metals that are of special interest with respect to their toxiological importance to human health. Lead and mercury continue to be the most important but many others such as arsenic, beryllium, cadmium, manganese, chromium, nickle and vanadium have been of increasing toxiological importance. Certain ions such as nitrates, flourides, sulphates have also their health effects. A few industries such as tanneries and slaughter houses also discharge some wastes containing bacteria. An example is the anthrax bacillus orginating in tanneries where hides from anthrax-infected animals are processed. Vegetable and fruit canneries may also add bacterial contamination to streams which may be extremely harmful. Considering the wide variety of the industry established in Pakistan any of the above mentioned pollutants can be suspected to be presented in the natural bodies of water. However to what extent its presence is harmful can only be determined through sustained programmes of monitoring and analysis.

4.32 The metropolitan city of Karachi has major industries at four places. Sind Industrial Tading Estate (SITE) Landhi Industrial Trading Estate (LITE), Korangi and West Wharf. (SITE area alone at present has 1605 industrial units which discharge their industrial wastewater into Lyari River. Similarly all the industries in LITE area drop their effluents into Malir River. The pollutants include salts of heavy metal, organic load as well as significent quantities of oil and grease. These industrial effluents are the major cause of absence of plant and other aquatic life in the Malir and the Lyari rivers heavily polluted. The water of these rivers as they enter the coastal water also causes marine pollution. Thus Korangi Creek receives a heavy load of organic effluents and salts of heavy metals as the Malir River enters it.

4.33 The industrial waste pollution survey (GOP 1983[c]) carried out for Environment and Urban Affairs Divison Government of Pakistan in industrial

areas of six cities viz. Karachi, Multan Faisalabad, Kalashah Kaku (Lahore) Nowshera and Peshawar reveals that a number of industries are discharging effluents with high concentration of pollutants varying from toxic metal and metals salt to bacteria, acids and oil. Some important parameters which give a fair idea about the pollutional characteristics of the industrial wastewaters of sample industries of these areas and the load they are going to impose on the receiving bodies of water has been given in the series of seven tables (IV-3 to IV-9). The pollutional load in these tables assesses the magnitude of pollution created by an industry and has been determined by the discharge and quality of the industrial effluent in terms of BOD. The following relationship was used to assess the parameter:

Pollutional load (Lbs BOD/day) = Effluent discharge (m.g.d.) x8.34x Effluent BOD(mg/1)

The parameter is extensively used in sizing the various wastewater treatment plant units. In addition many countries of the world tax the industries on the basis of their pollutional load and as such the parameter is of great significance with respect to water pollution control (GOP, 1983[c]). The effluent figures for many of the industries surveyed indicate BOD figures for above the values being permitted in other countreis (GOP, 1983[c]).

TABLE IV-3

Karachi: Toxic Substances in Effluents of sample Industries

Sr. No.	Name of the Industry	Copper mg/1	Cadmium mg/1	Zinc mg/1	Nickle mg/1	Manganese mg/1	Lead mg/1
1.	Ahmad Food Industries	0.43	0.028	0.238	0.270	0.073	0.230
2.	Burma Oil Mills	0.027	0.028	2.187	0. 648	0.217	0.480
3.	Karachi Beverage Co. Ltd.	0.090	0.035	2.06	0.407	0.129	0.0347
4.	Adamjee Textile Mills	0.02	0.045	5.32	0.514	0.085	–
5.	Karachi Tannery	0.30	0.153	7.00	1.142	0.44	1.800
6.	Indus Alkalies	0.138	0.028	0.220	1.180	0.258	0.660
7.	Buxley Paints	0.065	0.940	0.480	0.203	0.073	3.880
8.	Karachi Shipyard	0.28	0.10	1342.5	0.74	5.30	11.75
9.	Javedan Cement Industries	0.33	0.33	2.66	1.0	5.13	0.79

Source: GOP (1983c)

TABLE IV-4

Karachi: Pollutional Load in Effluents of sample Industries

Sr. No.	Name of the Industry	Dis-charge m.g.d	Temp. OC	Colour Units	pH Value	S.S. mg/l	COD mg/l	lbs. BOD per day
1.	Ahmad Food Industries	0.004	30	65	6.0	218	1778	17
2.	A.G. Fisheries	0.3	20	20	7.3	4420	11075	–
3.	Burma Oil Mills	0.53	42	20	7.6	1160	4296	9273
4.	Adamjee Textile Mills	0.45	45	100	10.3	1390	5530	750
5.	Dadabhoy Paper Mills	0.29	30	60	7.0	6	126	1934
6.	Karachi Tannery	0.015	32	320	4.1	1140	6784	58
7.	Indus Alkalies	0.38	38	20	9.2	3560	2235	–
8.	Buxley Paints Ltd.	0.003	31	60	2.1	8	8080	–
9.	Karachi Shipyard	0.1	34	70	2.1	286	30	–
10.	Javedan Cement	0.005	40	65	6.3	7740	54	–

TABLE IV-5

Multan: Pollutional Load in Effluents of sample Industries

Sr. No.	Name of the Industry	Dis-charge m.g.d	Temp. °C	Colour Units	S.S. mg/l	BOD mg/l	PH Value	lbs. BOD per day
1.	Pak Arab Fertilizer Ltd.	2.58	38.0	20	2200	245	8.3	5282
2.	Shaikh Fazal Rehman and Sons	1.45	44.0	60	470	595	6.8	7215
3.	Khawaja Tanneries	0.02	27.5	60	3800	469	7.9	86
4.	Alpha Industries	0.007	28.0	65	3376	532	10.5	32
5.	Colony Textile Mills	3.45	51.0	80	608	231	8.0	6650

Source: GOP (1983c).

TABLE IV-6

Faisalabad: Pollutional Load in Effluents of sample Industries

Sr. No.	Name of the Industry	Discharge m.g.d	Temp. °C	Colour Units	pH Value	S.S. mg/l	BOD mg/l	lbs. BOD per day
1.	The Lyallpur Dairy Farm	0.024	26	20	5.1	3144	1787	356
2.	Army Welfare Food Industries	0.47	45	25	7.6	686	260	898
3.	Crescent Sugar Mills Distillery	0.29	32	350	3.8	2984	1295	3100
4.	The Lyallpur Chemical & Fertilizers Ltd.	0.15	32	20	3.9	558	26	82
5.	Crescent Textile Mills	0.47	42	70	7.4	276	514	2000

TABLE IV-7

Kala Shah Kaku: Pollutional Load in Effluents of sample Industries

Sr. No.	Name of the Industry	Discharge m.g.d	Temp. °C	Colour Units	pH Value	S.S. mg/l	BOD mg/l	lbs. BOD per day	Toxic Matter
1.	Kohinoor Oil Mills	2.58	31	30	8.0	676	530	11400	–
2.	Ravi Rayon Mills Ltd.	0.64	30	20	5.8	900	833	4867	–
3.	National/W.Pakistan Tanneries	0.29	28	200	6.7	1971	591	1410	–
4.	Ittehad Chemicals	1.615	30	60	9.0	.154	293	3946	Hg. 5.6 ppm
5.	Lasani Steel Mills	0.015	30	20	7.8	54	193	24	–
6.	Govt. Weaving and Finishing Centre, Shahdara	0.08	31	25	7.8	1724	453	305	–
7.	P. Leiner and Sons Chemical and Food (Pak) Ltd.	1.29	31	25	6.5	1596	390	4204	–

Source: GOP 1983c).

TABLE IV-8

Peshawar: Pollutional Load in Effluents of sample Industries

Sr. No.	Name of the Industry	Dis-charge m.g.d	Temp. °C	Colour Units	pH Value	S.S. mg/l	BOD mg/l	lbs. BOD per day	Toxic Matter
1.	Sarhad Fruit and Vegetable Products	Nomi-nal	23	25	6.9	428	509	–	Not detected
2.	Kharana Sugar Mills	2.5	25	25	6.7	960	31	642	"
3.	Makk Beverage & Mineral Waters	0.67	21	20	8.7	392	46	260	No3=25mg/l F =90mg/l
4.	New Frontiere Punjab Tanneries	0.38	23	65	6.1	4060	767	8794	Not detected

TABLE IV-9

Nowshera: Pollutional Load in Effluents of sample Industries

Sr. No.	Name of the Industry	Dis-charge m.g.d	Temp. °C	Colour Units	pH Value	S.S. mg/l	BOD mg/l	lbs. BOD per day	Toxic Matter
1.	Associated Industries Ltd.	4.06	35	35	7.5	844	143	2404	Not detected
2.	Colony Sarhad Textile Mills	0.12	42	20	11.7	5828	485	485	"
3.	Adamjee Paper and Board Millls	4.50	27	65	6.7	21113	930	34900	"
4.	Sarhad Development Authority Leather Factory	0.001	30	30	7.6	1692	839	11	Chromium 0.53mg/l
5.	Adamjee Chemical Industries	0.90	26	25	2.0	4040	1021	7664	Not detected

Source: GOP (1983c).

4.34 In Karachi industrial wastewaters are posing a great threat to the purification capacity of the receiving waters. It is also evident that Indus Alkalies, A.G. Fisheries, and Javedan Cement Company are producing effluents which are heavily polluted in terms of suspended solids content and causing great damage to the receiving waters. At the same time the microbiological activity in the streams is also being hindered by the extremely low pH values of certain wasterwaters. The colour of the effluent is harmful for agriculture use and rearing of fish. Presently all the waste is being discharged untreated to the sea. The industrial wastes when examined for various metals such as copper, cadmium, zinc, nickle, maganese and lead revealed that 11 out of 15 industries surveyed were discharging effluents with toxic matter concentration above the maximum permissible limit (GOP 1983c)

4.35 In Multan the major source of pollution is the Pak Arab Fertilizer Factory which releases highly polluted waste in the Multan Canal through a Katcha Channel without any check or hinderance. This untreated waste poses great problem to over one lac acres of agricultural land. The problem is aggravated during closure and low discharges of the canal. Further due to spillage from the banks of katcha channel, crops in the vicinity are being affected. Deaths of animals have also been reported on account of drinking the heavily polluted water or by grazing on the affected crops. The villagers have filed many damage suits amounting to millions of rupees against the fertilizer factory. The effluent also appears to have affected the subsoil water because the use of the water from hand pumps has caused intestinal diseases resulting in dysentary and diarrhoea (GOP 1983c).

4.36 The major source of industrial pollution in Multan is the city tannery wastewater which is either disposed on land or dumped into the Multan Development Authority's sewer system. These discharges although low in magnitude contain excessive amounts of settleable solids, chromium, sulphides, and colour with potential hazard of sewer choking and sewer corrosion. As a result the Multan Development Authority banned the discharge of these wastes into MDA sewers without treatment. The disposal of the wastewater on open land has also given rise to odour problems and contaminated the subsoil water in the area so much that the drinking water obtained through hand pumps contains colour and taste. Effluent from Textile industries in Multan is highly coloured wastewater which gives extremely unaesthetic appearance and exerts heavy oxygen demand on purification capacity of the River Chenab.

4.37 The effluent producing industries in Faisalabad are about 235 in number. The industrial waste is mixed here with domestic wastewater with the result that the municipal sewage can no more be used for irrigating the fertile land around the city. Large areas have been spoiled due to the discharge of industrial effluents on the fertile land. At many sites the wastewater forms large pools and stagnates as the areas are badly drained. Most of the present industrial liquid discharge is pumped to paharang Mian Drain which is heavily polluted with highly coloured effluent. Large quantities of hot discharges (of cooling water) from some big industrial units are also being sent into the municipal sewers. This practice would necessitates larger sewers, extensive pumping machinery and civil works which will reflect heavily in capital, operational and maintenance costs for the local authority.

4.38 Pollution problem at Kala Shah Kaku is more acute in severity. Industrial wastewaters generated here from the huge industries are dumped untreated into Deg Nallah which eventually joins the River Ravi. The total discharge of Deg Nallah (as monitored by Punjab Public Health Engineering department) in 1979 varied from 12 to 4275 cusecs while the combined discharge of industrial waste effluents varied from 2.1 cusecs to 5.9 cusecs. This meants a dilution ratio of about 1:3 at the time of minimum runoffs which is extremely low clearly depicting the severity of the water pollution. The discharges of strong hydrochloric acid and highly injurious wastes have completely destroyed the acquatic life in the Nallah and rendered it unfit for irrigation and livestock consumption. The annual catch of fish from Deg Nallah used to be to the tune of two lac kilograms which would mean fetching about 4 millions rupees at the present prices. Besides Lahore, Multan and Faisalabad other industrial centres in Punjab such as Muridke, Sheikhupura, Rawalpindi etc are no different from their counterpart in contributing to the acquatic pollution in the province. The condition of Leh Nullah which passes right through the centre of Rawalpindi is extremely precarious in this respect.

4.39 The state of aquatic pollution in the North West Frontier Province is also on the increase. Three industrial estates have been set up in Peshawar which discharge their un-treated wastewaters into Bara river which has an average daily discharge of 304 cusecs only and ultimately joins Rvier Kabul. The absence of any treatment of the industrial wastes has resulted in the discharge of highly polluted wastes to the river Kabul, which is a very important source for fresh water fisheries, agriculture/irrigation, water supply for domestic and livestock consumption. Down stream, the River

Kabul gets an additional load of pollutants from the industries situated at Nowshera which further deteriorates its quality. Kalapani river passing though Mardan city and collecting effluents there joins Kabul River down stream of Nowshera. Due to ample dilution and seration available in the river, the pollution conditions at present are not alarming, but may deteriorate in near future, particularly in certain pockets near Peshawar and Nowshera.

4.40 In addition to their hazardous effects on human health and aquatic life the industiral waste discharges exert significant impact on waterbodies in terms of aesthetic aspects, economy and ecology. For example inorganic salts present in the industrial wastes cause water to become hard and make a stream undesirable for industrial, municipal and agriculture usage. Acids and alkalis discharged by chemical and other industrial plants make a stream unsuitable for recreational use. Moreover wide variety of organic matters present in these wastes exhaust the oxygen resources of receiving water bodies and create unpleasant tastes and odours and general septic condition. Fish and most aquatic life are stifled by lack of oxygen. Certain organic chemicals such as phenols affect the taste of water. On the other hand suspended solids settle at the bottom or wash up on the banks causing odours and depleting oxygen in the river water. Similarly floating solids and liquids in the the industrial discharges including oils, grease etc; make streams unsightly and also obstruct passage of light through the water retarding the growth of vital plant food. Likewise heated water discharges may lower the dissolved oxygen content of receiving bodies of water and affect fish life. Colour as contributed by textile, paper mills, tanneries, slaughter houses and other industries is another form of pollution which interferes with the transmission of sunlight into streams thereby decreasing photosynthetic action. Foam producing matter usually discharged by textile mills, pulp and paper mills and chemical plants also gives an undersirable appearance to the receing waters. The same is true of detergents which also reduce the oxygen transfer across air-water interface adversely affecting the aquatic life. A more hazarduous effect is that of petroleum products and refinery wastes which are generally listed among possibly mutagenic and carcinogenic substances.

4.41 Aquatic resources are also subject to pollution by agricultural chemical. To increase agricultural production, Pakistan has been relying increasingly upon chemical pesticides, many of them are dangerously chlorinated biphenyls such as PCB (Yates et al 1974). Between 1972 and 1978 the amount of cropland sprayed nearly tripled to 5 million ha. approximately a

third of the total sown agriculturalarea (Akhtar 1978). Many of the chemicals employed as pesticides are ultimately find their way into river water or seep into the soil and contaminate the groundwater. Chemical fertilizer use has also dramatically increased, doubling between 1968 and 1977. The component of these fertilizers filter through the groundwater to become unhealthy ingredients of the water supply (Jackson 1973).

4.42 Finally, living organisms pose perhaps the greatest impediment to a safe water supply. Drinking water is often drawn from open, untreated sources. Rural supplies are particularly exposed to infestation by rodents, insects, flatworms, roundworms, and micro-organism. Gastrointestinal disorders as well as other serious infectious diseases such as polio, salmonella, hepatitis cholera, typhoid, and tuberculosis are contracted from stagnant, unclean water and spread rapidly through population centers. There is also evidence that contamination of water has begun to threaten fresh water organisms. This not only endangers wildlife and fish, but affects the food supply (MAB, 1979). In the cities, a greater proportion of residents are said to have access to safe drinking water—75 percent. Nevertheless inadequate pumping facilities here cannot maintain sufficient water pressure to prevent seepage. Old decaying pipes permit additional seepage into the system and reintroduction of both chemical and infectious pollutants (U.S.MAB 1981).

4.43 Domestic sewerage from human settlements particularly major cities is another important source of biological aquatic pollution. These discharges of huge organic load in the nearby receiving bodies of water exert heavy oxygen demands on their purification capacity. Municipal wastewater from city of Lahore, the second largest city of Pakistan is being discharged into the Ravi River without any proper treatment. The estimated sewage flow from the city in 1979 was 348 cusecs with hardly 1:1 dilution available in low flows (Tariq & Aziz 1979). Sewage from Faisalabad and Multan cities also find their way in a similar way into Chenab River heavily taxing its assimilative capacity. Likewise the Kabul river receives dozes of waste water all along its course. The biggest of these is from the city of Peshawar where the sewage gravitates into natural storm water channel and streams eventually falling into the Kabul river. Unfortunately very little attention has been paid to the necessity of municipal waste treatment. With the exception of Karachi and Islamabad, none of the major cities in the country employ any biological treatment process to the municipal wastewaters. If treatment is provided it is limited to screening and sedimentation, otherwise in most of the cases the effluents are discharged untreated into the receiving bodies. Even in Karachi

only a fraction (40 mgd) of the total sewage is treated in the two trickling filter plants and the rest is thrown into the sea without treatment. Similarly in Islamabad an activated sludge plant provides treatment to 15 mgd, wastewater before its disposal into the nullahs and small natural stream.

4.44 Little work has been done in Pakistan to assess the assimilative capacity of the natural water courses. This is partly due to financial and technical constraints and to a large extent because of the fact that most of the receiving bodies of water used for dumping wastes until recently offered adequate dilutions and did not overtax their natural regeneration capacity. However due to increased industrial discharges and municipal wastewaters the self purification capacities of the rivers can no longer be relied upon and there is an immediate need to deal with this vital issue. So far in Pakistan only two major studies have been made on the subject. One in Lahore as a result of collaboration between water and sanitation Agency (WASA) and Institute of Public health Engineering and Research Lahore was carried out on the pollution of Ravi River for two years, (Tariq and Aziz 1979). In the first part of the study (Tariq and Ziai, 1978) it was concluded that the river in the vicinity of Lahore was highly polluted, unfit for recreational purposes and might affect the warm water fish population. The treatment of Lahore sewage was particularly stressed to improve the river water quality. In the second party of the (4.5) investigation the two years data was put to analysis and it was revealed that to maintain a minimum dissolved oxygen levels of 4mg/l for fish rearing in the river, the Lahore sewage must be treated to achieve BOD removals of 76% and 86% respectively in the year 1986 and 2000, before its discharge into the river. A second important study was carried out in N.W.F.P. to assess the purification capacity of the River Kabul by Karns (1978) under a UNDP project. In this study the nature of industrial wastewaters and their impact on the beneficial uses of the Kabul river was indentified and remedial measures recommended. The Report concluded that there did not appear any substantial adverse impact on the river quality due to the discharge of biodegradable organics. However sulphide concentrations found in the Kabul River were toxic for fish.

4.45 The status of marine pollution varies in different coastal zones of Pakistan. The one most affected with pollution is the coastal area adjacent to Greater Karachi (KDA 1983). The effluents received here include both land-based domestic wastes and industrial effluents as well as sea based waste discharges from ships. An idea on the same can be obtained from a passage in a reported of Karachi Development Authority (KDA) which describes the nature of pollutants getting into Karachi sea in the following words. "The

Monora channel receives effluents from several sources; domestic wastes are received from four island populations namely Manora, Baba, Bhit and Shamspeer as well as other drainage outfalls in the vicinity; oil wastes from oil tankers, cargo ships, mechanized boats and trawlers and oil jettics, metal scrap and rust from a ship building yard and oil, liquid wastes and effluents from fish process in processing plants at the fish harbour. Throughout the year the channel also receives an unending supply of industrial waste from the Karachi industrial area known as SITE as well as sewage and garbages from the northwestern areas of Karachi.

4.46 Haq (1976) has given an account of the pollutants coming from the industry pointing out the scarcely of treatment plants and the inadequacy of the sewerage system. Amongst other researchers Beg et al (1975) have estimated that Karachi Harbour receives total dessolved solids of the order of 376.2 metric tons (mt) Calcium ebicarbonate 162.0MT. Chloride (152.46MT) Sulphate (151.74MT), Calcium Carbonate (115.74MT) Magnesium oxide (60.0 MT). Organic matter in TDS (47.34MT) Suspended solid (34.2MT) Iron oxide (5.14MT), Phosphates (2.62MT). Total Nitrogen 2.354MT) Ammoniacal Nitrogen (2.3MT) Arsenic oxide (1.40MT) Alumunium oxide (1.36MT) and Albuminoid Nitrogen (0.054MT) from the discharges of Lyari river alone. The same workers mentioned that the suspended matter reaches the coast at an average rate of 30 tons per day creating dredging problems for the Manora Channel. The Karachi Master Plan Department (1972) estimated the total pollution from the city of Karachi as 1,237 tons BOD, 1040 tons per day of BOD being the industrial contribution. The sea based pollution is increasing with time in the absence of supervision and prosecution of offender ships. Karachi port remain extremely congested most of the time and merchant ships and oil tankers have to wait a long time in to the open sea for entering the harbour. Oil and empty can on the sea surface has been observed in this area (Qureshi 1975). This waste is released mainly by ships in waiting.

4.47 It is now a well established fact that increased organic loading of coastal water may result in an increased productivity accompanied with oxygen depletion of water near the bottom (will be harmful to benthic shrimps such as penacids and ground fishes) and may give rise to blooms of noxious phytoplankton or of algal species. Mortality through red tide or phytoplankton blooms has not been known to occur on the coast of Karachi, though Hornell (1917) reported mortality of fish in the Monara Channel due to sulphuretted water. Blooms of microorganisms have, neverthless, been seen in these waters. A bloom of the diaton skeletonema coatatum was

observed during OctoberNovember, 1976, long patches of Noctiluca blooms were observed during a May 1977 cruise of R.V. Dr. Fridtjff Nansen" near the salt water creeks and during February 1977 blooms of exclusively Noctiluca were observed in Manora Channel (Ahmad, 1977). There is a great dearth of baseline data in Pakistan which could be used for the monitoring of marine pollution in its coastal environment. The institute of marine biology at Karachi has initiated some studies (KDA). However many more studies are needed on marine pollutions particularly with respect to their impact on fisheries and other aquatic life. It may be mentioned here that about ten year back Qureshi (1975) had warned that various industrial effluents of the Lyari river were slowly poisoning offshore with the result that shrimps and other form of fishes which were once abundant near Manora and Hawkesbay were receding into deep waters. Shrimp fishermen of Karachi area have made similar complaints.

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CHAPTER V

ATMOSPHERIC ECOSYSTEM

5.1 Atmospheric ecosystem has a close linkage with both terrestrial and aquatic ecosystems. Therefore any degradation of air quality such as transport of sediments and pollutants and acid rain or release of fumes and toxic gases have significant impact on the health of both terrestrial and aquatic ecosystems. It is only recently that mankind has become aware of the extent to which human activities can interfere with the atmospheric ecosystem. The alteration these of activities are causing and the exact impact of those alterations on human well being are, however difficult to identify and measure (UNEP, 1982). Neverthless, dramatic episodes in this century in the Meuse Valley (1930), Donor, Pennsylvania (1948), London (1952) and more recently Bhopal (India) have demonstrated that in extreme cases community air pollution can result in considerable loss of life and serious illness. Further.... "studies strongly suggest that long term exposure to air pollution of even moderate intensity impairs health" (WHO, 1972).

A. *Development and Atmospheric Ecosystem*

5.2 The continuous growth in Pakistan's economy since independence has been accompanied by mass consumption and processing of resources. The multiplication in number and type of industries, growing use of chemicals and fast increasing mechanical traffic have all affected the quality of atmospheres ecosystem in varying degrees. The atmosphere has a certain capacity to absorb pollutants without adversely affecting human health or terrestrial and aquatic ecosystems. However, once the atmosphere's carrying capacity has been exceeded, increased air emissions from vehicles, power plants, and industrial facilities can impose health and resource costs both close to and at a distance from the sources of pollution. These kinds of environmental costs have to be considered when the nation makes decisions about economic growth, if it expects to use the full range of its natural resources most efficietnly.

5.3 The adverse environmental effects of air pollution are difficult to quantify in economic terms for a number of reasons. First of all, it is difficult to estimate at what levels of concentration different air pollutants begin to

affect human health. Different people are affected to different degrees by the same pollutant concentrations because of factors like age, diet, and smoking habits. Therefore, the protection of human health is a goal more easily articulated than quantified. Second, the pollutants emitted into the atmosphere may not be harmful by themselves, but only after mixing with other pollutants or after being transformed by atmospheric processes. Consequently, it is often difficult to determine what air pollutants have to be controlled and to what degree to protect human health. Third, the atmosphère is a major pathway by which toxic air pollutants reach and contaminate terrestrial and aquatic ecosystems. Sometimes the same ecosystem can be affected by air emissions from a number of different sources at varying distances from the point where the pollutants are deposited. In this case the source of economic damage to terrestrial or aquatic resources (at the given point) can be difficult to identify, and because the damage itself may be longterm, the economic cost is difficult to quantify/ (ESCAP, 1984).

5.4 Amongst industries, thermal power plants are major contributers to atmospheric pollution. Burning of coal here produces and emits large quantities of sulphur dioxide into the air. This is exidised in the atmosphere to form sulphuric acid which increases the acidity of rain water. Sulphur dioxide and chlorine released from paper industry also has the same effect. Ultimately the plants, building and waterbodies are adversely effectd. Hundreds of softwater lakes in Central and Eastern Canada, in the Northeastern and North central U.S.A. and in Scandinavia have become so acidic over the period that they now contain no fish. Likewise limestone and marble buildings of great historic and cultural values have sustained more damage from this process in the last 20 years than in their past long life. Instances such as the Acropolis in Athens, Taj Mahal in Agra and Quide-Azam's Mausoleum in Karachi elucidate the point. Other specific pollutants arise from particular sources, for instance Urea dust from Urea factories, lead from automobile emission, flurides from aluminium production, sulphur dioxide from oil refineries, cement and lime dust from cement plants and radiation from nuclear power stations. The common sources and environmental effects of these major pollutants have been listed in annexure-3.

5.5 Lack of control to ward off the hazards caused by the injurious emission is a major setback to environmental health in the country. Sanctions issued by the Government of Pakistan for the establishment of industries so far do not generally lay down standards for industrial waste disposals. As a result contamination of air, water and land in major industrial

towns is glaring. A large number of factory workers are at the same time facing serious occupational health hazards. Fortunately the deterioration, as a whole, has not been so far to an alarming level (GOP, 1983). Nevertheless if left unchecked, it is likely to adversely affect the quality of life in areas around major industrial concentrations besides upsetting other development activities due to pollutional hazards.

5.6 The importance of an pollution problem through industrialization can be judged from its consequences on human health and well being of animals and plants. Epidemiological studies indicate that industrial air pollution has cumulative effects on susceptibe people. Many types of industrial emissions produce unpleasant ordours, irritation of eyes, nose and throat. Some may even cause dryness of mucous membrane, headache, dizzines and coma. There is also an undeniable association between the well being of patients with respiratory diseases and air pollution measured in terms of certain specific pollutants. There are reasons to believe that industrial air pollution may be causative factor in chronic bronchitis. There is also ample circumstantial evidence of general deterioration in health in large industrial areas where air pollution is increasing (GOP, 1983). Pollutants such as lead are stored in the human body and may produce toxic or other effects. Pollution of industrial atmosphere by synthetic chemicals and their intermediates is also quite common and has hazardous effects on the health of industrial workers.

5.7 Besides affecting human health industrial air pollution sometimes had tangible economic consequences that can be precisely estimated in certain cases for example when crops of economic values are at stake. Sulphur dioxide, hydrogen flouride ozone and organic peroxides are the most common air pollutants that affect plants. In fact hydrogen flouride and sulphur dioxide are well known for being photo toxic. Several other compounds like mercury, ammonia, chlorine, hydrogen sulphide may also cause injury to both plants and animals when present in the atmosphere in excess quantities. Fluorosis may develop in cattles when air is contaminated with flourides, particularly when hydro-fluoric acid gas is there. Fluorides are released in air during the reduction of phosphate fertilizers as well as clay products. Ozone, another gas is known to be lethal to animals at higher concentrations. It also causes extensive damage to rubber goods and textiles and is a dominent constituent of photochemical smog.

B. *Air Pollution*

5.8 "Air pollution is the result of foreign gases, vapours droplets and particles or of excess amount of normal constituents, such as carbon dioxide and suspended particulate matter produced by bruning fossil fuel" (WHO 1972). The general concept of pollution as a consequence of human activity suggests a classification based on the type of activity resulting in pollution In Pakistan atmospheric pollution is caused by combustion of fuel for domestic and power generation purposes, specific industrial activities, certain community activities and even personal habits such as smoking.

5.9 Air pollution from household heating and lighting is a major health hazard posed by burning of both fossil as well as non-commercial fuels. According to 1980 housing census (GOP 1980) only thirteen percent of the housing units in Pakistan use fossil fuel for domestic cooking, but as many as sixty seven percent use it (Kerosene Oil) for lighting. The non-commercial fuel such as wood and cow-dung are the principal fuels for domestic cooking accounting for eighty seven percent of the housing units. The combustion of domestic fuel contributes a lot of smoke gaseous material and particulate matter. No quantitative estimates are available on its magnitude but..... This probably represents the earliest recogniseable form of pollution although its effects on indoor air have often been under estimated but. (WHO, 1972).

5.10 Thermal power plants produce sulphur dioxide, nitrogen oxides and particulate matter. Their intensity and effects are subject to locational condition of the plant; type of fossil fuel used and its quality and chemical composition as well as technology used. Thus a thermal plant located in a densely populated place would do more harm as compared to its location in an area which is inhabited at low density. Similarly coal fixed thermal plants cause maximum pollution and gas fired the least. Likewise planty with turbine using gas pressure are more efficient as compared to those which combust gas to generate steam for power development. The total present installed capacity of thermal power generation in Pakistan is around 1442 Mw (GOP 1985 a). This is generated in numerous units which vary in size from 18Mw at Abdullahpur in Faisalabad district (Johnson 1979) to around 400 Mw at Guddu (GOP 1985 b). A generalised idea on the environmental impacts (including air emissions) of a thermal power plant of 1000 Mw capacity (Using different fossil of nuclear fuels) can be obtained from table V-1. This table can serve as a guide (rule of thumb) to estimate the

TABLE V-1

Comparative Environmental Impacts of 1000-MW Electirc Energy Systems Operating at a 0.75 Load Factor with Low Levels of Environmental Controls or with Generally Prevailing Controls

	Air Emissions			Water Discharges				Solid Waste			Land Use	
System	Tons ($X 10^3$)	Curies ($X 10^3$)	Severity	Tons ($X 10^3$)	Curies ($X 10^3$)	Btu's ($X 10^{13}$)	Severity	Tons ($X 10^3$)	Curies ($X 10^8$)	Severity	Acres ($X 10^3$)	Severity
Coal												
Deep-mined	383		5	7.33		3.05	5	602		3	29.4	3
Surface-mined	383		5	40.5		3.05	5	3267		5	4.3	5
Oil												
Onshore	158.4		3	5.99		3.05	3	NA		1	20.7	2
Offshore	158.4		3	6.07		3.05	4	NA		1	17.8	1
Imports	70.6		2	2.52		3.05	4	NA		1	17.4	1
Natural Gas	24.1		1	0.81		3.05	2			0	20.8	2
Nuclear		489	1	21.3	2.68	5.29	3	2620	1.4	4	19.1	2

NA = not available. Severity rating key: 5 = serious, 4 = significant, 3 = moderate, 2 = small, 1 = negligible, 0 = none.
Source: Ref. (7).
Source: Philip G: Hill, "Power Generation: Resources, Hazards, Technology and Costs". The MIT Press, Cambridge.

quantity of pollutants which are being released by our thermal power plants of different types and sizes. Leaving aside the exact magnitude of emissions, the most unofrtunate aspect of thermal power generation in Pakistan is the siting of plants in densely populated, major cities such as Karachi, Lahore, Faisalabad, Multan, Hyderabad, Quetta, Sukkur etc. These cities also happen to be major industrial centres, the plants are therefore putting additional stress on the atmospheric carrying capacities which is already absorbing large quantities of industrial effluents in these urban compleaces of unprecedented size.

5.11 Like other forms of air pollution, the magnitude of industrial pollution has not been fully assessed in Pakistan but sporadic surveys have been carried out in the country by some governmental institutions and scientists in a few major cities. In Karachi, the master plan department of KDA had initiated a study in collaboration with the Pakistan Council for Scientific and Industrial Research (PCSIR). Preliminary surveys in this study have indicated that alarming proportions of pollutants are released by a number of industries (KDA. The pollution survey committee selected about 60 industrial units in the city——"all of which are a source of air pollution— cement plants, chemical units, colour, paint and plastic industries, cotton waste cleaning, rubber, Tanneries, oil refineries etc. (KDA).

5.12 The results of industrial emissions sample survey carried out by consultants of Environment and Urban Affair Division (GOP, 1983) give some more specific idea on the nature of atmospheric pollution and their impact in cities of Multan, Lahore, Peshawar and Nowshera. Discussing the situation in Multan the survey report states," the greatest gaseous pollution in Multan is caused by thick yellowish brown fumes of Nitrogen Oxides emitted by Pak Arab Fertilizer limited. The gaseous emissions also contain ammonia and hydrofluoric acid" (GOP 1983). The effluents analysed outside the factory indicated the intensity of 66 ppm for oxides of nitrogen, 8 ppm for flourine and 1.02 ppm for ammonia. The report adds," these emissions are causing respiratory diseases in the people residing near the factory. Obnoxious smells can be felt at even long distances from the source in the direction of the wind."People complain about the nuisance but no control measures have been adopted by the management. The pollutants released have also caused damage to the buildings. An extensive damage to concrete structures was observed inside Pak Arab Fertilizer Ltd., due to the emissions of ammonium nitrate dust. The dust has also very corrosive effects

on the motor vehicles parked inside the factory premises. During winter nights the suspended matter around the factory area causes mists and the visibility is very much reduced (GOP, 1983). The risk of respiratory diseases are aggravated in this situation particularly if the inversion of temperature takes place During 1973 inversion was reported for a week in districts of Lahore, Gujranwala, Gujrat and Jhelum causing traffic accidents. Since fossil fuels are burnet in small quantities, and industrial pollution is also relatively low therefore the history of London or Meuse was saved from repeating itself here. However, dust and soot remained trapped.

5.13 The situation at Kala Shah Kaku is another typical example to show how the highly polluted industrial effluents are being discharged in the atmosphere to damage the environment. The result is that the human health is being exposed to considerable risks. The survey conducted by the Punjab Public Health Engineering Department (Iqbal, 1981-82) showed that 64.7% people of all age group were suffering from vomiting, 50% from pain in the chest (respiratory ailment) 64.7% from sore throat, 61.76% from chronic cough, 64.7% from sore eyes and 6.25% from unconsiousness. The gaseous emission had also caused serious damage to plant life: the growth of plants had been retarded and their leaves bleached. Intensive damage also occured to the rice paddy which is the main cash crop of the area. Two other industrial complexes situated in the vicinity of Kala Shah Kaku at Muridke and Lahore-Sheikhupura Road are also the cause of obnoxious ordour prevailing in the area which is a great nuisance for the residents.

5.13A The survey of the air pollutants in Lahore (GOP 1983) indicates that the gaseous emissions from Ittehad Chemicals are hazards to human health and damage the crops specially rice peddy which is the main cash crop of the area. The sampling carried out at site indicated the presence of the following pollutants:

1.	Sulphur Dioxide.	9 ppm
2.	Chlorine.	35 ppm
3.	Sulphur Trioxide.	14 ppm
4.	Particulates.	182 ppm

5.13B These figures indicate a severe nature of pollution in the area. The intensity of the situation can be appreciated by the fact that obnoxious and toxic ordours are always there even in the areas for removed from the factory. There is also medical evidence of the ill effects of these emissions on

the health of the factory workers. Aesthetically the environment has been completely damaged.

5.14 The survey (GOP 1983) of gaseous emission from various industries in Peshawar and Nowshera indicates that there is no significant gaseous pollutant problem within the cities of Peshawar and Nowshera. However, the working atmosphere within the premises of Sarhad Textile Mills, Nowshera remains polluted with the air borne fine cotton waste. It was found to be most congenial atmosphere for tuberculosis and aesthema (GOP, 1983). A high concentration of particulate matter was also noticed inside Adamjee Paper and Board Mills Nowshera near lime grinding and baggass cutting unit.

Sulphur dioxide concentration in the gaseous emissions at the sulphur burning chamber was also noticed to be quite high which poses strong health hazard for the workers. Similarly at Nowshera Engineering Works and Pakistan Tobacco Co., Akora Khattak a high concentration of particulate matter was noticed. The able below summarizes the results of important gaseous pollutants and particulate matter as experienced in these industries during the survey (GOP 1983).

TABLE V-2

Peshawar-Nowshera: Particulate and Gaseous Emission by selected industries

S. No.	Name of Industry	Particulate Matter mg/l	SO^2 mg/l	CO mg/l	C^2 mg/2
1.	New Frontier (Peshawar Tanneries).	65	30	–	–
2.	Colony Sarhad Textile Mills Ltd.	280	–	–	–
3.	Adamjee capital and Board Mills.	362	55	–	8
4.	Adamjee Chemical Industries.	345	–	–	–
5.	Nowshera Engineering Works.	180	4	–	–
6.	Pakistan Tobacco Company Ltd.	285	–	–	–

Source: GOP, 1983.

5.15 The industrial emission survey conducted at Faisalabad by PCSIR Laboratories Lahore indicated that the hazardous pollutants are being emitted by two industries: these are follows:

TABLE V-3

Faisalabad: Gaseous Emission by sample industries

S.No.	Name of Industry	SO_2 ppm	CO ppm	SO_3 ppm	Fl_2 ppm	CH_4 ppm
1.	Army Welfare Food Industries.	–	50	–	–	12,000
2.	The Lyallpur Chemical and fertilizers Ltd.	35	–	72	398	–

Source: GOP, 1983.

The above figures clearly indicate that heavy air pollution is being caused by these emissions which exceed the limits permitted in other countries. In fact these emissions are resulting in an uncomfortable environment and the health of the factory workers is also being affected (GOP 1983).

5.16 The situation regarding industrial pollution as of today vividly presented here, gives a picture of an atmospheric ecosystem that has been deteriorated in pockets (cities immediate surroundings of industries) but can still be saved, if proper actions are initiated with out delay. Environmental conditions inside the factory premises are particularly bad. It is therefor, imperative that due recognition should be given to industrieal hygiene and occupational health in conjunction with environmental pollution control.

Further it is important to note that the degree and type of industrial air pollution is not only dependent on the source but also on the climate, weather and topography. Thus wind direction and speed can transfer the pollution hazard from one area to another. Likewise inversion of temperature can produce deadly results in heavily polluted areas. It is therefore all the more important that these and other related factors should be given due consideration while planning the location and siting of new industries in the country.

5.17 The pollution problem being generated by ever increasing mass transport, public and private vehicles is also assuming alarming proportion. The exhaust containing large quantities of sulphur, carbon mono-oxide, lead and nitrogen oxide in the urban almosphera is not only a perpetual source of nuisance but a prime factor for increasing incidence of austhama, chronic bronchitis and other diseases of heart, lung and skin. The cities of Pakistan

TABLE V-4

KARACHI

Average Concentration of Pollutants*

July to November, 1982

(Morning)

Parameters	Sabil Masjid	Numaish	Seventh day	Tibbet Centre	Jamia Cloth Market	Lakshmi Bldg.	Tower	Chamber of Commerce	Burns Rd.	Regal Bus Stop	Empress Market
Time.	10.15	10.40	11.50	11.15	11.35	12.00	12.30	1.00	1.25	1.45	2.15
Temperature °C.	33.5	34.0	34.0	34.5	34.5	35.0	35.2	35.5	35.5	35.8	36.0
Air Velocity (m/min).	20.0	60.0	30.0	70.0	45.0	45.0	60.0	50.0	40.0	35.0	35.0
Noise (dB).	90–94	90–95	86–96	85–96	83–92	85–92	86–96	80–86	92–96	86–92	90–96
Carbon dioxide (ppm)	400	400	300	450	400	500	400	350	400	300	320
Carbon monoxide (ppm)	25	25	20	40	20	20	10	15	15	10	10
Smoke concerntration (ug/m^3)	530	560	630	662	640	692	630	512	570	482	425

*Data under publication.

Source: KDA (1981).

TABLE V-5

KARACHI

*Average Concentration of Pollutants**

July to November, 1982

(Evening)

Parameters	Sabil Masjid	Numaish	Seventh day Hospital	Tibbet Centre	Jamia Cloth Market	Lakshmi Bldg.	Tower	Chamber of Commerce	Burns Rd.	Regal Bus Stop	Empress Market
Time.	6.15	6.30	6.45	5.15	3.30	3.45	4.15	4.30	4.50	5.25	5.50
Temperature °C.	29.0	29.0	28.5	30.5	35.0	34.5	31.0	31.0	30.8	29.5	29.5
Air Velocity (m/min).	58.0	90.0	50.0	60.0	45.0	70.0	80.0	50.0	60.0	70.0	65.0
Noise (dB).	90–98	88–98	86–96	86–96	85–95	85–95	80–90	80–90	82–92	86–96	80–86
Carbon dioxide (ppm)	450	500	350	400	300	400	350	380	380	400	400
Carbon monoxide (ppm)	25	20	20	30	10	20	18	7	10	22	6
Smoke concerntration (ug/m^3)	612	512	580	660	530	590	570	510	615	602	580

TABLE V-L

KARACHI

*Average Smoke and Lead concentration in the air around Qaid's Mazar

Time	Site	No. & Type of Vehicle	Air Velocity	Air Direction	Temp.	Humidity	Smoke	Lead
Afternoon (1.30pm)	A	Light vehicles 3,075	230m/min	W→E	35°C	56%	680μ/m^3	.013μg/m^3
		Heavy vehicles 617						
Morning (10.15am)	B	Light vehicles 4,533	255m/min	W→E	31°C	62%	1245μg/m^3	.024μg/m^3
		Heavy vehicles 480						

A=M.A. Jinnah Road near Old Numaish
B=M.A. Jinnah Road near Grumandir
*Data under publication
Source: KDA (1981)

are faced with peculiar traffic pollution problems due to (a) faulty vehicles on the road (b) deliberate use of inappropriate fuel mixture (c) tremendous increase in the number of vehicles. The results of survey in the cities of Karachi and Lahore show that the air is being depleted of oxygen in large cities and is simultaneously getting contaminated by toxic and unwanted gases from the automobile exhaust. The survey in Karachi examined two hundred and twney five (225) samples at eleven points for five month (July—November, 1982) to assess the quality of air on the main roads, traffic intersections, streets, lanes and by lanes at various timings (KDA 1981). Estimated data on Noise carbon Monoxide, carbon dioxide, and smoke concentration are given in table V-4 and V-5 for all these points, while table V-6 presents the concentration of smoke and lead around Quaid-i-Azam Mausoleum. The data collected so far shows that the air is grossly polluted in the city centre during peak traffic hours. The same areas also face high noise level (KDA, 1981).

5.18 IPHER (Sheikh et al, 1974) undertook a similar survey in Lahore. It was revealed that carbon monoxide concentrations on Shahrah-e-Quaid-e-Azam in the city were higher than normal whereas maximum concentrations of ozone observed reached adverse levels by Californian standard. It was concluded that smoke from diesel engines was the biggest nuisance on the streets and responsible for lot of inconvenience and discomfort to the citizens. Another survey conducted by the Institute (Hayat & Tariq, 1983) has again indicated similar effects. It has revealed that the particulate pollution in the city has exceeded permissible limits several times. It has been estimated that of the total emission in and around Lahore the automobile exhaust contributes 14.7% particulate matter, 92.8% carbon monoxide, 88.95% hydrocarbons, 63.2% nitrogen oxides, 50% sulphur oxides and 100% aldehydes. These studies amply demonstrate that in Karachi and Lahore emissions from automobile exhaust are approaching a limit where some control measures are very much desired. Studies and extensive surveys of other urban area are also needed to find the ambient air quality and to identify the potential pollutants.

5.19 Natural dust fall is another serious problem that deteriorates atmospheric ecosystem. Dust storms in summers are a big nuisance in this regard. No data on natural dust fall is available for cities of Pakistan except for Karachi and Lahore sludied/KDA group studied it for Karachi in 1982, while Aziz et al (1974) of IHPER assessed it for lahore. Dustfall figures for

Karachi around Quide Azams Mausoleum is given in table V-7 for three months.

TABLE V-7

Karachi: Dust Fall (Monthly Average), Tons/SQ. Mile/Month Around Quide Azam's Mausoleum

Direction	July	Aug.	Sept.	Oct.	Nov.
East	186.1	23.5	18.2		
West	192.7	15.2	30.4		
North	1.1	12.1	13.8		
South	46.3	16.4	38.9		

(Four petri dishes (sampling dishes) where placed in four direction NEWS) on the dome of Quaid's Mazar)

Source: KDA (1981)

The figures for July are high compared to the usual range of 40–70 tons/sq.mile/month in U.S.A. The natural dust fall in Lahore was found to be much higher at a rate of about 1390 tons/sq.mile/month in June. This figure is enormously high when compared to the usual range in U.S.A. (Aziz et al, 1974). Similar or worse may be the conditins in Multan and other desert areas of Pakistan. Regular measurements of the natural dust fall are necessary to know the extent of pollution. On the preventive side measures such as tree plantations and protective vegetative covering should be used and deforestation and overgrazing need to be checked.

5.20 The increase in the levels of radiation has also started proving harmful. Some of the dangers of exposure to increasing radiation would be genetic deformities and cancers. One of the commonest sources of exposure to radiation come from X-rays. In most of our large cities such as Karachi, Lahore etc there are hundred of X-ray clinics and laboratories. A sample survey in Karachi has shown that practically no safety measures are used either for patients or for the operators and technicians (KDA, 1981). There is also the question of the disposal of radioactive waste, for these can remain active and continue to cause damage for as long as 30 years. In fact this is

the major worry of all countries where nuclear technology is being experimented with and utilized. Vast containers carrying radioactive wastes have been dumped into the sea but there is a constant fear of leakage and destruction of marine life. Similarly some wastes have been disposed off by burying it in the ground. But it does not rule out the possibility to their being scattered as a result of a natural calamity such as an earthquake. Moreover in Colorado (USA) it was observed that underground disposal of such material had by itself triggered off a series of minor tremors. Perhaps more dangerous than bulk radicative wastes are the number of isotopes continually being released into the air and water by the nuclear plants. In some areas of the world these isotopes have turned up in potentially serious concentrations. The planners and scientists in Pakistan will have to make serious attempts to word off these hazard which may be further aggravated by the increase in nuclear power generation in the future. The projected release of one isotope alone, krypton-85 an estimate shows, coluld, within this century raise the level of radiation exposure of the general population to 60% of the maximum permissible level. It must be remembered that krypton-85 is just one of 200radiocative substances released by nuclear reactor and nuclear plants (KDA 1981).

5.21 Increasing noise level in the atmosphere is another form of pollution. Noise is generally defined as unwanted sound. It is one of the worst pollutants of the urban environment. Apart from being nuisance, it has now been established from research that noise has harmful effects on the human systems. In repeated exposure to mild levels of noise, the result may be reduction in work output lack of efficiency or impairment of hearing. Noise interferes with sound sleep leading to fatigue. It can also contribute to stress-related diseases such as ulcers. The main sources of noise and vibrations are loudspeakers, vehicles, industry, aeroplanes and overcrowding. Pakistani towns are noisier than their western counter-part. Karachi with the noise level above 90 decibels (Table V-4 & V-5) is one of the noisiest cities in the world. Lahore, Peshawar and other cities are no different. Noise pollution in the West is checked by legislation but in Pakistan such kind of legislation alone will not help until the people are convinced that noise is a menace and take step to curbit (Khan, 1984).

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CHAPTER VI

ENVIRONMENT AND HUMAN SETTLEMENT

A. *Huamn Settlements as Ecological Systems*

6.1 Human settlements are recognised as having some of the features of an organism in that they consume resources, transform materials and energy and create new products and wastes. This is the perspective of the "metabolism of human settlements", which has led to their ecological planning. With in Pakistan the metabolism of small settlements in a rural setting and their impact on the hineterland is small-scale and localised. The range of the impact is limited usually by how far a person can walk in a day and return by nightfall. Because people and animals are the primary means of transporting fuel, food and water, the quantities involved are small—just sufficient, to satisfy the very modest demands of peasant folk. Moreover, the impact of whatever residue remains after the food, water and fuel have been used in the settlement are minimal, because where the level of subsistence is low nearly all wastes are regarded as resources and use can be made of even the most unlikely material. Thus wastes from food are fed to animals whose dung is used for fuel and brick-making or returned to the land as fertilizer. What little is not-re-used is relatively easily assimilated by the local resources of air, water and land.

6.2 The situtation is completely different for large urban centres. Here the transporation network brings in people and supplies from a vast area and concentrates them into a relatively small one. This give rise to mobility of people (mirgation) and movement of food, energy and water resources from peripheral areas to the centre and its immediate environs. As affluence in the city grows, the perception that sees all wastes as resources dies, and more and more of the waste products of urban metabolism are cast back into the

environment in quantities so large that the local water, air and land can no langer assimilate them and pollution results. This pollution poisons not only the immediate environment of the city itself but extends into the countryside affecting the productivity of the land upon which the city's survival depends.

6.3 Urbanization involving the relocation of large number of people from rural, sparsely populated areas into more densely populated cities and their suburb is not necessarily a process which leads to environmental degradation. For example, urbanization can provide the labour force needed for large-scale economic development project. Economies of scale allow many amenities—e.g. sewage disposal, electricity, transporation, health care, education—to be provided at a lower per capita cost and in the rural areas (ESCAP, 1984). However, the possible advantages of urbanization will not be realized if nations undergoing strong demographic shift (towards cities) fail to invest enough resources in urban areas to develop the urban infrastructure needed and to allow increasing populations to load economically and physically healthy/lives. Urbanization not only concentrates people; it also concentrates economic opportunities and environmental pressures. A nation that is unable to exploit the opportunities and alleviate the pressures through innovative economic and environmental planning find that unchecked urbanization can pose enormous economic and environmental problems that become more and more difficult to solve as the poulation becomes denser.

6.4 Like other developing countries, Pakistan is suffering from the negative effects of urban agglomeration and concentration. It has not been able to take advantage of the potential economic benefits of population density. Per capita income in the country allows only subsistence living with low public consumption and investment levels. Therefore, the resources available for the development of urban infrastructure are meagre. Despite these heavy dozes of investments have made through they have failed to keep pace with the unprecedented needs arising out of massive rural-urban migration. It may be added here that resources have been drawn even from the rural areas for urban investments. (PEPAC, 1983). This has aggravated rural poverty, triggering of further migration thus adding to the miseries of both rural and urban areas. Spatial shifts in the location of population therefore constitute an extremely important dimension of the problem of human settlements in Pakistan.

TABLE VI-1

Pakistan: *Population Size, Rural-Urban Ratio and Growth Rate, 1901–1981

Year	Population in Thousand			Proportion		Annual Growth Rate		
	Total	Rural	Urban	Rural	Urban	Total	Rural	Urban
1901	16,577	14,958	1,619	90.2	9.8	–	–	–
1911	18,805	17,116	1,689	91.0	9.0	1.27	1.36	0.42
1921	20,243	18,184	2,058	89.8	10.2	0.74	0.61	2.00
1931	22,640	19,871	2,769	87.8	12.2	1.13	0.89	3.01
1941	28,244	24,229	4,015	85.8	14.2	2.24	2.00	3.79
1951	33,740	27,721	6,019	82.2	17.8	1.79	1.36	4.13
1961	42,880	33,240	9,640	77.5	22.5	2.43	1.80	4.84
1972	65,309	48,715	16,594	74.6	25.4	3.67	3.33	4.76
1981	84,253	61,270	23,583	71.7	28.3	3.1	2.58	4.38

Source: Population Census Organisation
*including tribal areas

6.5 Within this century (Table VI-1) the rural ratio in total population constantly declined in Pakistan except for the decade 1901-11 Evidenfc indicate that it was not due to any significant differential in rates of urban and rural natural increase. According to the pupulation growth survey (1976) as well as recent findings on fertility and mortality in Pakistan, the rate of natural increase in rural areas is almost the same as that in urban areas (Alam and Shah, 1982), hence the rural decline and urban gain is mainly due to the rural-urban shift. About 2.5 million net migrants were estimated in the urban areas of Pakistan in 1981 which constituted about 15% of the total urban population, (Khan and Karim, 1983), percentage of gross mig-

rants was much larger as shown by duration of migration and rural urban residence in table VI-2.

TABLE VI-2

Pakistan: Percentage of Gross Migrants (Age 10+) by Residence and duration of Migration

Current Residence	Duration of Migration 1973			Duration of Migration 1981		
	<10 yrs.	10+yrs.	All	<10yrs.	10+yrs.	All
Rural	3.0	12.2	15.2	3.0	7.6	10.6
Urban	10.3	30.7	41.0	10.0	19.7	29.7
Total ..	5.3	17.6	22.9	5.1	11.0	16.1

Source. a Post-Census ho

Source: a Post-Census housing, Economic and Demorgraphic survey Vol. II, Population Census Organisation 1973, Islamabad.
b. Population Census Organisation 1981, Special tabulations.

In addition to internal migrants, some 1.7 million Pakistanis migrated abroad during 1971–81 period; 82.8% of these originating in rural areas. This again indicates the large scale exodus that is taking place from our rural areas.

6.6 The question of exodus of out-migration from rural areas and in-migration to urban areas, has been a matter of great concern to both urban and rural planners. The urban planners are worried as how to manage the cities growing out of proportion as ecological system, in the wake of pressures generated by the ever increasing demand on already overburdened facilities and services there. The task for rural planners is equally tough. The environmental problems here can be discerned in the disturbed demographic balance loss of man power, damaging family and social relationships and other serious ecological implications due to impairment of economic activities by such processes as soil erosion, operating intensively in fields abandoned due to lack of manpower for tilling them.

6.7 Pakistan's rural population living in some 43,000 (GOP, 1985) villages is almost totally dependent on the productivity of land. Out of 9

million rural households in 1980 (GOP 1980a), 6.3 million or 70% were agricultural households (GOP, 1980b). Production conditions, and therefore, the social organisation of agricultural production, is the key to the proper maintenance of rural population in Pakistan. An important feature of the country's agriculture is the predominance of small farmers. A study of such farmers owning land below 8 acres in Punjab, revealed that about a fourth of them were unable to meet the basic needs of their families from their income from land, and had to obtain loans for achieving a subsistence level of consumption (Hussain, 1980). The income and expenditure survey of 1979 found that about a third (30%) of the rural population earned less than Rs. 600 per month, an amount that has been used as a threshold of absolute poverty (Ahmad, 1984). Rural poverty has been a major push factor for outmigration from rural areas but a variable that has out-weighted this is the decline in rural carrying capacity, which in turn may be attributed to such other factors as:

(a) Slow progress in agricultural sector (expect during the third and fifth plan periods).

(b) The decline in per capita cropped area for rural population from 0.46 hectares to 0.31 hectares between 1951 and 1981 (GOP, 1982).

(c) Low crop yields which are about 1/3 of the particular seed varieties being used (GOP, 1979).

(d) Inefficient land and water management practices (GOP 1983).

(e) Failure to adop appropriate technology and to introduce such mechanization in agriculture, which, while increasing demand for skilled workers, resulted in decline in the absorption of unskilled workers.

(f) Inability of non-agricultural occupations in rural areas to open up employment opportunities (PEPAC, 1983).

(g) Environmental degradation by deforestation and desertification (including soil pollution).

6.8 The increase in the carrying capacity of rural areas for labour absorption in future would require many changes, which include reclamation and expansion of agricultural land, improved irrigation efficiency, increased crop yields, adoption of appropriate technology as well as institutional changes in the rural society to reduce the inequality in the distribution of land ownership and income. Most of these factors are not mutually exclusive, for example improved irrigation efficiency would help in checking the deterioration of soil through water logging as well as in expanding irrigated agriculture. In addition to these a more fundamental change is required in the

planning, perspective at national as well as regional levels to realise that (a) The distribution of population is as significant for resource use as is its size and growth. (b) Human settlements do not exist in isolation and their development requires a holistic treatment whereby both rural and urban sectors have to be treated as components of the same interacting system. (c) Population/settlement distribution, technological alternatives and institutional aspects of resource development are all interlinked and critical determinant of ecosystem capacities, (d) All these critical factors are affected by national policies (micro-economic and sectoral) and are amenable to manipulation by policy instruments. And finally (e) Dominated by man's decision more than any other ecosystem human settlements both individually and collectively are faced more severaly with the conflict between the needs for environmental stability and short term economic gains experienced in other ecosystems.

B. *Development and Human Settlements*

6.9 The process of economic development brings a number of changes in the human settlement system. A critical dimension of this is the inevitable urbanisation of a rural society. The process usually progresses with the rapid growth in industrial, service and infrastructural sectors, with a reduction in the overall dependence on agriculture. A resume of planned development in Pakistan shows that the growth in industries has consistently exceeded the parallel growth in agriculture (Table V-3).

TABLE VI-3
Pakistan: Economic Growth by Sectors

Sector	First Plan 1951–60	Second Plan 1960–65	Third Plan 1965–70	Non-plan 1970–78	Fifth Plan 1978–83
Agriculture.	2.4	3.4	6.3	1.7	4.4
Manufacturing.	5.2	11.7	8.1	3.5	9.0
Large Scale.	7.6	16.8	9.9	2.2	9.7
Other Sectors.	3.6	8.3	6.6	6.2	6.0
GDP.	3.1	6.8	6.7	4.2	6.0
GNP.	3.0	6.8	6.8	4.9	6.5

Source: Government of Pakistan, Planning Division (1983), Sixth Five Year Plan of Pakistan, Islamabad.

The table reflects a rapid expansion of industrial economy. This was accompanied by increasing urbanisation with higher level of wages, and incomes in the cities on the one hand and growing number of slums and squatters on the other.

6.10 On the whole, three phases have been identified in the process of urbanization in developing societies. The first of these relates to primitive societies. It is characterised by a general even distribution of the urban population in a number of small urban centres. The second phase, coincides with the initial stage of development. The growth of one big city the primate city is much more rapid as compared to other urban centres during this phase. The primate city tends to dominate the settlement scenario due to a number of social, political and economic reasons. The last phase dawns when the development process reaches an advanced stage. This stage is marked by redistribution of urban population over a number of cities and the urban society returns to the original multi-polar state with the primate city losing its dominance (Hoselitz, 1962). In case of Pakistan, it is too early to describe the growth of large cities in terms of this model on the basis of the experience of only 38 years. Partition of the sub-continent in 1947 changed the entire demographic situation as the region now comprising Pakistan was part of a much larger country. However, since 1947, trends the emergence of a bi-polar urban society can be discerned, with two large cities of Pakistan, Karachi and Lahore dominating two economically and socially distinct parts of the country (Ahmad, 1984).

6.11 At the time of independence Pakistan was predominantly rural with only about 18 per cent of the total population living in urban areas. Since then the rate of urbanisation has been fairly rapid and the urban population has quadrupled between 1951 and 1981. The intercensal urban population growth rate has been consistently higher than the growth rate of the rural population, although there has been a slow deceleration of the urban growth rate in the last three intercensal periods (Table VI-1). The present urban population lives in about 415 cities in Pakistan which can be devided into three categories according to their size i.e. large cities with population of 100,000 and above, intermediate cities with population of 25,000 to 100,000 and small cities having population of less than 25,000. As table VI-4 indicates, intermediate cities have shown an accelerated growth rate in the last intercensal period (1972–81) whereas there has been a rapid deceleration in population of small cities. Large cities have shown a slow decline in their growth rate in the three intercensal periods, although their growth

rate still remain considerably higher than the rest of urban areas. Urbanisation in Pakistan thus still retains a bias in favour of large cities (Ahmad, 1984). At the turn of century Pakistan had no million city and the cities of 100,000 or more were only two in number viz Lahore and Karachi. Even at the time of independence there were only 8 cities of 100,000 and none of these had achieved a million size (Karachiachieved a million size after the influx of refugees in 1947). By 1981 however, three cities, Karachi, Lahore an Faisalabad exceeded a million mark where as 29 cities (including million cities) crossed 100,000 size and accounted for 57 per cent share of the total urban population of the country.

TABLE VI-4

Pakistan: Urban Growth by city-size

(Population in millions)

		1951		1961		1972		1981
1.	Population of large cities (100,000 and above).	3.06	(6.3)	5.49	(5.71)	10.49	(5.17)	16.06
2.	Population of intermediate cities (25,000 to 100,000).	1.46	(3.42)	2.04	(3.09)	2.91	(5.11)	4.44
3.	Population of small cities (less than 25,000)	1.50	(3.52)	2.11	(3.60)	3.19	(0.54)	3.34

(Figures in brackets show intercensal average growth rates).

Source: Population Census Organisation.

6.12 Amongst the million cities, Karachi was Pakistan's first capital (1947–59), the only seaport and major destination of muslim refugees from India in 1947. The post-independence development strategy reinforced this by making it attractive for industrial location. The subsequent polarisation of economic activities (inspite of the transfer of the seat of Federal government to Islamabad), generated strong 'pull' forces resulting in the tremendous inflow of man and material from the rest of the country. The second million city has been Lahore the capital of the Punjab Province, since very very long (even before independence. It was also an important commercial and industrial centre of the province and headquarters of the railways. It has remained the primate city of this part of the sub-continent throughout this century. Even in 1901, it accounted for over 50 per cent of the urban

population of the undivided province of Punjab (Burki, 1973). Faisalabad the third million city started as a canal colony mandi (Market) town which rapidly industrialised attracting textile units in large number winning the nick-name "Manchester of Pakistan". Thousands of migrants have moved into this city from surrounding rural areas to man the multiplying industrial units and for seeking employment in increasing service opportunities.

6.13 While both Karachi and Lahore can be described as primate cities for their own hinterland Faisalabad is heading fast towards their path. Karachi plays a far more significant role in national development. According to a recent report the city housing only 6 per cent of the total population of Pakistan, accounts for 15 per cent of the country's GDP, 42 per cent of the value added in large scale manufacturing, 35 per cent of employment in large scale industry, 50 per cent of bank deposits, 72 per cent of capital issue and 25 per cent of federal revenues. Inspite of this, poverty level in the city is fairly high. According to one calculation (IBRD, 1983), 26 per cent of the house-holds have less than Rs. 600 per month income, as compared with 14 per cent for the entire urban population of the country. Thus the primate city has more than its due share of the absolute poor.

C. *Urbanisation and Environment*

6.14 Urbanisation or the concentration of more and more people into fewer and fewer cities is regarded as one of the major environmental threats of today (UNESCO, 1981). The process is expected to escalate in Pakistan but even if the present trend continues, it has been estimated that by the year 2003 (end of tenth Five Year Plan) the number of million cities in Pakistan would increase to nine. Overall large cities (100,000–1,000,000) would be 88 in number accounting for 78 per cent of the projected urban population (PEPAC, 1983). The million cities alone are expected to accomodate as many as 36 million people.

The implication of this kind of fast urbanisation in relation to human well being and environmental quality can be summed up as:

(a) Declining environmental quality in urban areas through air, water and soil pollution, noise, modifications to microclimates and loss of natural areas;

(b) Severe degradation of the surrounding environment and ecological systems of urban hinterlands, exerting heavy demand on their resources:

(c) Demographic transformations through migration in rural and urban areas, which have severe social, economic,and environmental consequences:

(d) Inadequate housing, transportation, public services (water, sanitation, schools, health etc.) which threaten human health and quality of life:

(e) High rates of unemployment and related social pathologies, such as crimes:

(f) Urban poors who are vulnerable to deficiences in food, ground water, fuel and other basic needs:

(g) Massive increases in public expenditure in cities at the cost of other parts of national economies:

(h) The threat of political instability;

(i) The threat of environmental non-sustainability.

6.15 Although urbanisation process has affected all part of the country and all sizes of human settlements in one way or another but the intensity of impacts are most critical in the large cities. There are indications that several large cities in Pakistan for instance Karachi, Lahore, Faisalabad, Rawalpindi, Multan, Hyderabad, Gujranwala, and Peshawar, amongst others, not only face the traditional environmental problems such as lack of sanitation, chronic shortage of services, polluted air and water, disappearing open spaces and recreational areas, traffic congestion but newly emerging problems are adversely taxing the capacity of the surrounding ecosystem to sustain the growing population. Some of the more critical environmental issue (both new and traditional) have been described in the following account by citing specific examples.

6.16 One major problem of urbanization in Pakistan is the eating up of cultivated area by concrete structure of ever expanding cities. In most cases this encroachment has been on prime agricultural land. Thus Lahore and Faisalabad which had several patches of agricultural land about 25 years back, have almost no arable land left within the city limits. A case study of Peshawar has revealed that the city has lost over 2700 hactares of agricultural land to urban user over the past 20 years. This is in addition to over 400 ha of waste/vacant land that has also been eaten up by exapnding urban

functions. Indeed a matter of great concern is shrinking land under parks and green spaces. Their area has gone down from 163 hactares to only 75 hactares. (Table VI-5). The situation is not much different in other cities of the Punjab and N.W.F.P. In fact, urbanization has occured in these two provinces mostly on the prime agricultural land, especially because nucleus human settlements which exploded into highly urbanized ones, were built on this kind of productive land.

TABLE VI-5

City of Peshawar: Ecological changes in land-use 1965-85)

Land-use	Area (Hactares)		Percentage	
	1965	1985	1965	1985
Residential	1992	4283	9.0	19.4
Agriculture	14897	12149	67.7	55.2
Education	249	256	1.1	1.2
Parks and Green Spaces	163	75	0.7	0.3
Civic and Public Administration	588	826	2.7	3.8
Graveyard	236	458	1.1	2.1
Commercial	83	179	0.4	0.8
Industrial	31	373	0.1	1.7
Culturable Waste/Vacant	3779	3349	17.2	15.2
Woodland	–	70	–	0.3
	22018	22018	100.00	100

Source: Khan, M.A. (Under prepration) report of the Project Impact of metropolitan expansion on the ecology of rural urban fringe, a case study of Peshawar.

6.17 One of the corellaries of rapid urbanization is exponential growth in the demand for water, coupled with a dramatic decrease in the quality of surface water and a critical lowering of ground water due to high pumping rates. In cases, drinking water is provided from catchments, even when the water quality is unsatisfactory. Further to make water drinkable, certain halogen-organic compunds are added to it. They are suspected to be carcinogenic if they exceed certain limits. Therefore, environmentally sound methods for restoring the quality of drinking water for human settlements have to be found.

6.18 Access to clean water supply is available only to 77 percent of the urban population. Only 30 percent have house to house connections and the rest are being served by stand-posts or public taps (GOP, 1983). Per capita water consumption in urban area is 30 gallons per capita per day (Nizami, 1983) which is about the bare minimum to sustain a human life. Even so situation is not uniform. It varies among cities and even within the same city. Water supply position is particularly bad in big cities. In Karachi, for example, total demand for water is estimated at 327 million gallos per day (MGD). Actual supply in 1983 was only 217 MGD. Only 38 percent of the people in Karachi have house-to-house connections, 46 percent get their supply from community stand-posts and 16 percent from tanker trucks. Per capita daily consumption of water ranges from 50 gallons capita/day in Lahore to 37 gallons/capita/day in Karachi and 25 gallons/capita/day in Hyderabad (IBRD, 1983), but distribution of water between the more affluent and less affluent section of cities is extremely unequal. Though the water is treated adequately in bulk, when it reaches to consumer after mcuh of it being wasted through leakages, it is badly polluted. Moreover water mains are underutilized because of lack of connections in residential areas.

6.19 Sewerage/sanitary systems are limited to parts of a few major cities and the remaining urban population depends for waste disposal on septic tanks, soak-pits or overflows into storm drains. Only 48 percent of the total urban population has access to sewerage system (GOP, 1983). In Karachi, the biggest city of Pakistan installed sewage treatment capcity is only 40 million gallons per day (Table VI-6) relative to the water intake of 100-120 Million gallons per day. Only half to three fourth of that capacity is operative, for want of proper management, and the entire sewerage system is capable of handling only 4 percent of the biological oxygen demand generated daily (KDA, The high overall rate of urbanisation and lack of proper sanitation have caused wide-spread pollution of drinking water and aggravated the existing un-satisfactory environment in human settlements of Pakistan. As a result of improper disposal of human excreta (in many areas there is no disposal) from the housing environs, a very large number of children suffer from hookworm at a period when they undergo intense physiological development. This leads not only to a considerable loss of food value but also makes the children easily vulnerable to the attack of other diseases.

6.20 Solid waste management is another serious urban problem in Pakistan, where manual storage is practised often with the help of open motor vehicles, but also using carts drawn by animals. Most of the waste in

the country is disposed of by crude dumping. Solid waste not only effects public health to a great extent but also contributes towards air pollution and water pollution as well. The putrefying organic waste is a fertile medium for spreading diseases especially when the outburst of house flies occurs. Foods sold by hawkers are greatly contaminated especially in front of school gates where children purchase these things to eat at break time. Karachi alone generates.

TABLE VI-6

Karachi: Sewerage generation and Management

Sewage Generated	192 MGD
Pollution Generated	1236 ton BOD
Per Capita Generated	357gm BOD
Population served	28%
Connections	3,10,000
Collection network	2,140 miles
Treatment plants	2 of 20 MGD
Sewage treated	30 MGD
Sewagte rate	100% subsidized
Staff employed	1980
Capital cost	Rs. 2855 million
Annaul expenditure	Rs. 139 million
Annual Revenue	Nil
Agencies Responsible	Karachi Water & Swerage Board.

Source: KDA "Environmental Pollution: Status report on the city of Karachi.

5880 tons of solid waste (Table VI-7) every day only 33% of the generated waste is transported to the dumping sites and the rest is left on site to deteriorate creating a highly undersirable dirty environment. Because of the inefficient system of disposal the practice of burning part of the refuse at site has also become very common and this adds greatly to air pollution.

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Thus those houses that may not be directly affected by dumps of solid wa are affected by the emmission of smoke.

TABLE VI-7

Karachi: Solid waste generation and Management

Daily generation	5880 tons
Rufuse collection points	3873
Refuse bins	2513
Trucks & tractors	155
Area served	55%
Refuse transported	33% of total
Dumping sites	North Karachi & Korangi
Annual expenditure	Rs. 136 million
Annual Revenue	Rs. 27 million
Agencies responsible	KMC, KDA, KPT, Cantt. Boards, SITE,PWD, Defen Authority.

Source. KDA Environmental Pollution: A status report on the city of Karachi.

6.21 The government has recently agreed to establish two compost pla in Karachi that will turn garbage into organic fertilizers. One such plant being built at SITE and another is scheduled for the Korangi area. Th refuse composting plants aim at producing 24 tons/hour of compost. T principal input for these will be the city garbage. The raw material will converted into manure (compost) which can be used directly or combination with other artificial fertilizers for agricultural purposes. T composting process will be the cheapest method of converting garbage in manure. It compares very favourably cost- wise with artificial fertilizer, production cost of which is highly cpaital intensive. Apart from cost savi the establishment of these projects, will help in keeping the city clean recycling process. Other thickly populated cities like Lahore, Multan, Fais abad and Hyderabad generating huge amount of rubbish-domestic refuse a human secretions daily should also explore the possibility of compostin There are many other ways for disposal of wastes beside composting such landfills, recycling plants etc. It is particularly easy to dispose of waste wi greater vegetable and putriscible material through composting. But the no biodegradeable material like plastic, create a serious problem of dispos Unfortunately use of such material is constantly on the increase in Pakista

Analysis of garbage samples from different areas in Karachi by Beg et al (1985) shows that percentage of biodegradable material in this waste is low as compared to western cities but high as compared to non-western cities of Calcutta, Madras and Jakarta (Table VI-8).

TABLE VI-8

Karachi. Physical characteristics of city refuse (% by weight)

Place	Bangkok (Thailand)	Jakarta (Indonesia)	Calcutta (India)	Madras (India)	Paris (France)	London U.K.)	New York (U.S.A.)	Karachi Pakistan)
Paper	24.6	2.0	3.18	7.85	34	38	50	3.6
Plastics	7.0	2.0	0.65	0.88	4	2.5	3	2.1
Rags	0.6	–	3.6	4.8	4	3	2	7.1
Metals	1.0	2.0	0.66	0.95	8	9	8	0.2
Glass pieces	1.0	2.0	3.8	0.95	8	9	8	2.5
Fines*	8.3	25.0	34.0	28.0	20	11	7	18.2
Compostable matter	44.0	60.0	47.0	48.0	15.0	24.0	18.0	52.0
Moisture	–	–	41.11	36.63	35	25	30	43.5

*Includes fine sized material, i.e. dust, ash etc.
Source: Beg et. al. (1985).

6.22 Human settlements in Pakistan also face serious problems in housing both in terms of quantity and quality. Quantitywise the estimated shortage of houses work out to be over 3 million units which amounts to roughly 25 percent of the households in the country (GOP, 1985). Another manifestation of the rapid worsening of housing situation is the increase in the number of slum and Katchi abadi (squatter) dwellers in the urban areas. It is estimated that presently about 25 percent of the urban population in the country lives in slums and squatters. A comparative study of 1972 HED Survey (GOP, 1973) and 1980 Housing census (GOP, 1980) shows increase in condition of overcrowding. The occupancy rate per housing unit during this period (1973–1981) went up from 6 to 7 persons whereas the room density (persons per room) increased from 3 to 3.5.

6.23 Statistics on quality of housing are not very encouraging either. Only 5 percent of the rural houses are reported as pucca (GOP, 1980) while this

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proporition is 43 percent for urban areas. About 6 million people are livin in slums and squatters in urban Pakistan. The situation is particulary grave i Karachi where 2 million slum dwellers (35% of the city's population) have a average of 4.7 persons per room (Faruqi, 1982). There numbers is said t grow by about 200,000 each year (IBRD, 1983). There are 0.82 millio dwelling units in Karachi out of which 30 percent are 'Semi pucca. A number of these have been constructed on encroached land formin squatters settlement (Katchi Abadies). There has been an increase i squatters in most large urban centres of Pakistan. According to a stud carried out by the E&U A Division, upto 23-3-85 the province of Sind i reported to have 1226 Katchi Abadies. The squatters in Sind are spread ove an area of more than 22614 acres covering polulation of 3.24 million. Th Punjab province has 824 squatters settlements spread over an area of 529 acres covering a population of 1.30 million. No Katchi Abadies exist in th Privnce of NWFP while the Baluchistan Province have identified 18 majo slums inhabitated by 100,000 persons. In a study of slums in Lahore, Gulza (1981) reveals that the size of slum varies with the area available for fre development. She identified small clusters of 65 households in 'Najaf Colony as well as a settlement of 7000 people in 'Daras Barey Mian'.

6.24 A common feature of resource allocation in Pakistan is the bias i favour of the urban sector. Thus in provision of development funds, socia services and determination of sectoral priorities, greater benefits are receive by urban areas through investment, pricing, and control and regulator policies of the government, and also through development of infrastructure and location of industries and financial system (PEPAC, 1983). Urban pe capita income are, therefore, understandably higher than rural per capit incomes but the problem of urban poverty has become more serious ove time (Ahmad, 1984). The operational definition of poverty can be taken as level of per capita expenditure that fails to satisfy the minimum basic need of an average individual (Nasim, 1973). The household income and expen diture survey (1979) reported that 21.4 percent of households and 1 percent of the urban population in Pakistan earned less than Rs. 600 whic has previously been defined as the threshold of absolute poverty in thi profile. Total urban population in 1979 was estimated to be 21 millio (IBRD, 1982). Thus the number of absolute poor in urban sector in 197 comes upto 2.94 million. If, however, the poverty line is raised to thos earning below Rs. 800 the number of urban poor would more than double 28.7 percent or 6 million persons. It is interesting to note that income distribution turns out to be more skewed in urban areas than in the rura sector (Ahmad, 1984) "While in the rural sector 30.1 percent of populatio

earned less than Rs. 600 and their share in total income was 21.2 percent (with income co-efficient of 0.704), in the urban sector, 14 percent of population received 7.4 percent of income (income-efficient: 0.528)".

6.25 The urban poor mostly consist of fresh migrants from villages and small towns who are either unemployed or only causally employed in the informal sector. They also include part of the urban population which has no access to either ownership of assets, or general or vocational education. They are generally unskilled with very low educational levels. Primarily they are engaged as workers in production, sales and service sectors which are the traditional refuge of unskilled labour. The average size of their household is smaller (2.3 to 4.9) than the average for urban population (6.4), indicating that many of them have left their dependents back home. A very large number of households have only one earner (Ahmad, 1984). A case study of urban poverty in Rawalpindi (Wasay, 1979) found that the number of absolute poor and the number of unemployed almost coincided. Amongst those employed 60 percent had education, below primary level and 78 percent were unskilled workers in production (42 percent) or service sector (36 percent). It was also found that 59 percent of these were married males in prime working age (25–35 years), the age at which people are more likely to migrate to big cites in search of new opportunities.

D. *Natural disasters and human settlements*

6.26 UNEP defines a Natural Disaster as an extreme natural event (natural hazard) which effects man and the environment causing physical, ecological and/or socio-economic damage. (UNEP, 1977). Inspite of a growing scientific understanding of natural hazards, disaster risk to human settlements has increased in recent years. This is due largely to increasing density of population in areas exposed to natural hazards as a result of the increasing pressure to occupy and develop such areas. Flood prone Banks of Lyari and Malir rivers in Karachi and Leh in Rawalpindi ridden with squatter settlement are the glaring example of the type. Another consequence of population growth has been the increasingly destructive impact of man on environment. Practicies such as cultivation of steep slopes triggers off landslides. Similarly deforestation aggravates the process of natural disasters, increasing the potential for destructive flooding and soil loss.

6.27 The global data shows that four main natural hazards are responsible for more than 90 percent of all loss of life and damage to human settlements and their environment. These are droughts, floods, tropical cyclones and earth quakes (UNEP, 1977). Other hazards such as volcanic activities, landslides, tornadoes, avalanches, fires, hail and extremes of temperature which are of less global significance can cause disaster of a high magnitude on a local level. Floods and droughts have been two adverse natural hazards in Pakistan. Earthquakes have periodically caused serious damage to human settlements while other hazards such as tidal waves, tornadoes, landslides, avalanches hails etc have also caused damages albeit on a small scale.

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6.28 While droughts and floods have recurred periodically throughout the recorded history in Pakistan, it is noteworthy that severe flooding of the Indus plains has been more frequent during the past twenty five years than over the previous sixty five years (Akhtar, 1978 and US. Aid 1979). Some scienitists attribute this change to long-term meteorological conditions. Most observers, agree that the probable factors have been the gradual denuding of hilly catchments and the introduction of artificial barriers. Deforestation and overgrazing cause rainwater to run off into the rivers instead of soaking into the ground. The destruction of vegetation also erodes the soil, thereby depositing silt into the river beds, raising their levels, and permitting them to flow over low-lying flood plains during times of maximal discharge. Construction of barriers such as dams, barrages, and embankments has added to the problem by raising riverine water levels in adjoining areas. These structures cause additional silting, raising the levels further. When accumulated pressure occasionally washes away these obstruction, water flows with increased force and causes more damage (Akhtar, 1978).

6.29 In 1955 the flood inundated 2420 villages levelling 3121 of them. Built of mud bricks, village house do not stand up long to flooding, 40 people and 70,000 cattle lost their lives. The standing crop was ruined over an area 101,911 hactares. The total damage caused by the flood amounted to Rs. 83 million (Johnson, 1979).

TABLE VI-9

PAKISTAN : ECONOMIC LOSS BY FLOOD DAMAGE FACTORS FOR PUNJAB, SIND NWFP AND BALUCHISTAN

Location	Flood Damage Factors	
	Rural Areas, Rupees/Acre inundated	Urban Areas, thousand Rupees/Acre inundated
Punjab		
Sutlej River	650	121
Ravi River	650	121
Chenab River	575	121
Jhelum River	550	121
Upper Indus River	425	121
Sind		
Lower Indus/Right Bank	550	105
Lower Indus/Left Bank	650	105
NWFP		
Swat River	825	60
Kabul River	900	60
Upper Indus River	725	60
Baluchistan		
All Rivers	375	50

Source GOP (1978) Federal Flood Commission, National Flood Protection Plan.

6.30 Apart from this ,other past flood have wrecked enormous destruction to life and property. Between 1973 and 1978 five serious floods have victimized 12.7 million persons (1,516 person killed) and cost perhaps $ 15 million (U.S. Aid 1979). Floods in 1973 inundated approximately two million ha of crops and ten thousand villages.

Heavy down our in Karachi in 1977 caused flash flooding in Lyari and Malir rivers killing 280 people, rendering 18,000 homeless and destroying 5,000 dwellings, many of them washed away in the bed of the Malir into which squatters had overflowed from the adjacent Drigh Road Colony. Low lying areas of Karachi city were flooded to a depth of 1.5 meter. Railway tracks near Maripur were washed out, telephone, power supplies and drinking water mains were cut and the whole city was separated for several days from its sources of supply of vegetables and meat. The floods also struck industry. Pakistan National Oil Refinery lost 60,000 drums of petro-chemicals scattered over 16 km of estuary (Johnson 1979). Based on various flood damage factors (population density, cropping pattern and intensity etc.) the Federal Flood Commission (GOP, 1978) has estimated economic loss that is incurred per unit area by flooding in various rivers. It has been presented in Table VI-9.

6.31 An earthquake is a geotectonic event caused by the sudden release of accumulated strain energy that takes the form of shockwaves and elastic vibrations that are transmitted through the earth in all directions. The resulting oscillatory and sometimes violent movement of earth surface is often davastating. Several earthquakes have been recorded in Pakistan. One of the most damaging of which occured in Quetta in 1935. Major tremors hit the city in 1931 but the worst came four year later killing between 20 and 60 thousand inhabitants (Stamp 1970: Myrop et. al. 1975). More recent quakes killed nearly 5,000 persons in Kohistan in 1974, and struck NWFP in 1975, and again in 1981. The Kohistan quake also destroyed thousand of dwellings. It may be mentioned here that Baluchistan, N.W.F.P. and Northern Punjab are all located within seismologically active zones and are susceptable to this hazard.

6.32 Major tidal waves and cyclones are less frequent in Pakistan, but nevertheless cause extensive damage periodically along the coast. In addition to these catastrophes are other disasters which are triggered off by human interference or mismanagement of the environment. Landslides are a prime example of such phenomena. In the mountainous regions of the north, land clearing, roadbuilding, irrigation channel construction and livestock grazing have made the soil less cohesive. Slides of these unstable soils have diminished the availability of top soil, reduced the amount of cropland, threatened settlements below, and increasd the destuctive capacity of rivers which carry the resulting debris and soil (Sheikh and Aleem 1975).

Glacial surges have also been common in northern areas resulting in daming of rivers.Glacial dam bursts have caused some of the worst floods in the Indus. In one such floods a whole sikh regiment was washed away at Attock.

6.33 The direct effect of natural disasters on human settlements are obvious; destruction of buildings and their infrastructure, disruption of communications, water and energy supplies. The short term affects on human health due to outbreak of diseases in the aftermath of the event sometime reaches epidemic stage and can be devastating. Long term impact of these losses lead to the disruption of individual as well as societies or social systems. The degree of disruption to a society caused by a disaster will be largely determined by the degree to which the society has developed realistic expectations about and preparation for future disasters. It is therefore imperative to map disaster prone areas in Pakistan such as active flood plains and zone them as areas unsuitable for human habitation. Likewise in seismically active belts, proper planning for human settlements is an important way of reducing potential damages. Siesmic maps should be consulted before the construction of either human settlements or industrial plants. Consturction should be made far from major faults and points of weakness and buildings should be constructed so as to tolerate horizontal vibrations. Such special technology has been widely used in active seismic zones in Japan and U.S.A. Similarly ecologically damaging practices such as deforestation and cultivation of steep slopes should be controlled to prevent other hazards like landslides and similar mass movements. Moreover, the present measures of forecasting hazards and notifying them. should be expanded and public advised well in advance as to what they should do. Further government departments should be well equipped to cope with emergencies at the time of floods, earthquake and droughts.

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Part 2 of 2 parts

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GOVERNMENT OF PAKISTAN
(Environment & Urban Affairs Division)
ISLAMABAD

ENVIRONMENTAL PROFILE OF PAKISTAN

1260

CHAPTER VII

HUMAN HEALTH

7.1 One out of every ten (10) born Pakistani dies within one year of age. The loading causes of death amongst infant and pre-school children are diarrhoea and pneumonia, Tuberculosis takes a heavy toll of mortality in elders. The diseases pattern is characterised by high morbidity due to infectious and communicable diseases. Thousands of children in the country die of measles, pertussis, poliomyelitis, diptheria and tetnus. Many more are crippled, blinded and spend rest of their lives with one or more complications of these diseases (GOP, 1984). About 1.6 million persons have radiologically active tuberculosis including more than 250,000 open cases. Protein energy malnutrition (PEM) is still a problem; with seven per cent of children (less than 5 years of age) exhibiting third degree of malnutrition (GOP, 1983). The statistics of Planning Committee show that 30 per cent of all reported cases of illness and 40 per cent of deaths in the country are attributeable to water=borne diseases. These figures are glaring evidence of environmantal implications.

7.2 The public health problem in Pakistan arise not so much from industrialisation as in the case of industrialized countries but mainly from such factors as absence of safe drinking water supply, inadequate sanitation, severe malnutrition and crowded housing conditions. Lack of pure water supply causes high infant mortality, a factor that has been aggravated due to the increasing use of imported powdered milk. Absence or inadequacy of sanitation is causing helminthic infections which have been estimated to affect over 80 per cent of children by the time they are two years of age (KDA, 1981). Mulnutrition beside causing anaemia and other diseases also enhanced the intensity of environmentally acquired and congenital diseases. Climate has its own toll on human health. Diseases like influenza and pneumonia are more prevalent in colder regions as compared to warmer ones Seasonal temperature, humidity and rainfall often contributes to increases of contagious disease vactors. Inversion of temperature in and urban industrial areas causes heavy smog enhancing to risks of morbidity and mortality due to respiratory diseases. There is often an interplay among the environmental (infections) nutritional and congenital factors. For instance an intra-uterine infection of the foetus by rubella virus often predisposes it

to mental retardation and is furhter aggravated by poverty and malnutrition. Similarly, a congenital and tetanus or bacterial meningitis (ESCAP, 1984). Lack of housing and slum development is causing conditions of poor health to mothers and children and is also creating mental stress and neurosis. Tuberculosis is encountered in crowded urban condition and where malnutrition prevails.

7.3 Until very recently there was little awareness in Pakistan of the health hazard of human environment and much of the past efforts in health field remained limited to curative methods. The adoption of preventive measures however, are on the increase now. The new health policy has laid great emphasis on the need of adopting preventive measures to control diseases and environmental pollution. This policy aims at providing maximum facilities at grass root level, namely Rural Health Centre (RHC) to which will be attached medical and paramedical personnel to look after th curative measures and the sanitary engineers and inspectors to take care of the preventive aspects of human health. It is imperative to see that the policy is implemented truely in its letters and spirit.

TABLE VII-1

Pakistan: Health Related Statistics

		Pakistan			Middle income economies
		1965	1978	1983	1977
Life expectancy at birth (years.	M	47	54	55	61
	F	45	53	54	
Infant mortality rate (aged 0–1)	(per 1,000 live births)	140	105	100	60
Child death rate (aged 1–4).	(per 1,000)	12		10	5
Crude death rate.	(per 1,000)	16	14	12	9

Source: GOP (1983).

A. *Level of Development and Human Health.*

7.4 The problems of environmental health is colosely related to the state of development of a country, for instance less than a hundred years age, in New York city the infant mortality rate was 140 per thousand. The rate deopped to 30 by the middle of the present century. The most relevant conditions for this decrease were improvements in living conditions i.e. an

adequate (and improved) availability of food, nutrition, better supply of utilities and services—water, housing, sanitation, education, and increased income (ESCAP, 1984). In Pakistan infant mortality, life expectancy and child death rate indicate that the country has still aquired (Table VII-I) only a low level of development. However, the crude death rate which was around 40 per thousand in Pakistan during the early part of the century declined gradually to 30 per thousand in 1950.

By mid 1960, it had declined to 16 per thousand further coming down to 12 per thousand in 1982 (GOP, 1983). The infant mortality rates have also been reduced substantially from 162 in 1960-61 to 100 per thousand in 1982-83 according to Planning Commission (GOP, 1983). The world bank development report however still puts it to 121 per thousand in 1982. Both figures however show substantial reduction in death which is a reflection of improvement in living condition particularly those of the poor.

7.5 It is a well recognised fact that when poverty is reduced and the level of development improves, the nature and geographic extent of environmental health problems tend to change. "In the earliest stages of development, the epidemiological picture is determined largely by an endemic infectious disease situation with a high prevalence of parasitosis, gastroenterisis, respiratory diseases, malnutrition and vector-borne diseases—as living standards rise and environmental conditions improve, the endemic infectious diseases are brought under control, and measles, whooping cough, poliomyelitis and other bacterial and virus diseases dominate the epideiological picture. In the final stage of economic development, the degenerative diseases of a cerebrosclerotic nature, hypertansion, heart failure, diabetes, psychosomatic diseases, and cancer comprise the major portions of ill health. Under nutrition gives way to over-nutrition, and the severity of the disease pattern shifts from the child to the aged." (U.S. Govt. 1980). An overview of the dynamics of environmental health problems in the course of societal development has been presented in Table VII-2.

BEST AVAILABLE

TABLE VII-2

Evolution of Environmental Health Problems

State of Society	Environmental Health Problems	Predominant Patterns of Disease, Mortality and fertility	Goals, Types and scope of Health Services	State of Nutrition
Traditional.	Largely rural environment with contamination of water and food; proliferation of insects and rodents; periodic food scarcities.	Endemic infections parasitism, infestation nutritional deficiencies high death rate and high birth rate.	Indigenious system medicine based on trational practices and beliefs.	Undern nutrition a result of food scarcities in a subsistance economy, and practices and preferences of food production and consumption of a tradation society.
Early Transitional.	Largely rural environment with contamination of water and food: proliferation of insects and rodents; adulteration of foods and drugs; food scarities.	Endemic infections, parasitism, infestation and nutritional, deficiencies; intermediate death rate and high birth rate.	Medical relief and family planning in key centres; control of endemic diseases and environmental sanitation in selected areas; nationwide extension of categorical health services (malaria and smallpox eradication) requiring only minimal judgement from auxiliary staff with typical duties (residual spraying and vaccination).	Protential improvement in nutrition in areas of monetary economy through possible modification of social, ecnonomic, and agricultural policies favouring the consumption of a variety of nutrition foods, facilititation of the extension of modern practices of agriculture food technology and marketing, nutrition education, child feeding and school lunch programmes to the majority of the population within the scope of the nutrition programme of the health education and Agriculture services.

State of Society	Environmental Health Problems	Predominant Patterns of Disease, Mortality and fertility	Goals, Types and scope of Health Services	State of Nutrition
Late Transitional.	Rural environment still resembles traditional society, whereas the urban environment resembles modern society.	Endemic diseases prevail at reduced levels in rural area whereas the disease pattern of urban areas resemble those of modern society; low death rate and intermediate birth rate.	Comprehensive and integrated system of preventive and curative health and medical services in key centres, with nationwide extension of medical relief, family planning, nutrition, basic sanitation health education, and communicable disease.	Continuing improvement of nutrition as a byproduct of economic growth and as the result of progressive extension of nutrition programmes nationwide, including the production of protein-rich foods and the fortification of staples.
Modern.	Largely urban environment with pollution of air water and food, plus hazards from use of cigarettes, alcohol, food additives, new drugs and narcotics.	Bronchopulmonary and cardiovascular disease, malignant neoplasias, mental illness, accidents obesity, low death rate and low birth rate.	Nationwide extension of complex system of comprehensive and integrated preventive and curative health and medical services requiring a prosperous society and an enlightened public, as well as ample health manpower, qualified to exercise independent judgement.	Over nutrition as a result of an abundance of food in an industrial economy of an affluent, sedentary and aging society.

Source: Arthur S. Boughy, Readings in Man, The Environment, and Human Ecology, p. 251, quoted in UNAPDI, Readings in Environmental Management (Bangkok, June, 1980) P. 245-246.

7.6 By the prevailing health situation, one can place Pakistan somewhere between early and late transitional state of society (Table VII-2). The nation has been able to eliminate smallpox and reduce the incidence of malaria and paedriatic (child) diseases. However the efforts to integrate preventive and curative measures have yet to go a long way. Mortality due to communicable diseases has been reduced (though the country is still infested with high occurence of communicable diseases (Table VII-3) but incidence of deaths by degenerative and stress diseases such as those of heart and vascular systems as well as the ones caused by environmental pollution such as malignant neoplasms have increased particularly in urban areas.

7.7 The disease patterns which prevail in the "modern" society skin to our urban areas call for specific disease-oriented health programmes which go beyond the resources and sophistications of the primary health care system. Cancer treatment is an obvious example. Though the initial diagnosis may be made in a primary health care institution, the later treatment will have to be handed over to specialists in chemotherapy, radiation theraphy etc. But in the country's rural society, health programmes have to be handled largely by the primary health care system. The latter is defined by the Alama at a Conference (1878) as "essential, care based on practical, scientifically sound and socially acceptable methods and technology and universally accessible to individuals and families in the community through their full participation and at a cost that the community and country can afford to maintain at every stage of their development in the spirit of self-reliance and self-determination. It forms an integral part both of the country's health system of which it is the central function and main focus, and of the overall social and economic development of the community. It is the first level of contact of individuals, the family and the community with the national health system, bringing health care as close as possible to where people live and work, and constitute the first element of a continuing health care process" (WHO/NUCEF, 1978).

TABLE VII-3

PAKISTAN: ESTIMATED FIGURES FOR COMMUNICABLE DISEASES, 1982 (PROVISIONAL FIGURE)

Name of Diseases	Cases	Deaths
1. Cerebro-Spinal	1,066	44
2. Influenza	19,135	1
3. Poliomyelitis	581	10

Name of Diseases	Cases	Deaths
4. Whoping Cough (Pertusses)	50,932	2
5. Measles	18,374	11
6. Diphtheria	671	30
7. Chicken pox	2,166	2
8. Leprosy	1,187	0
9 Puerperal Fever	789	0
10. Scarlet Fever	72	0
11. Sprue	703	0
12 Enteric Fever	51,364	92
13. Dysentry	2,39,807	147
14. Mumps	20.715	0
15. Erysipelas	3	0
16. Tuberculosis	1,09,662	619
17. Tetanus	1,618	202
18. Neo-Natal Tetanus	907	220

Source: Planning Commission, Government of Pakistan.

7.8 The Alma Ata Conference on Primary Health Care recommended that primary health care should include at least education concerning prevalent health problems and the methods of identifying, preventing and controlling them; promotion of food supply and proper nutrition an adequate supply of safe water and basic sanitation: maternal and child health care, including family planning; immunization against the major infectious diseases; appropriate treatment of common diseases and provision of essential drugs: (WHO/UNICEF, 1978). In view of the comprehensive scope of the primary health care, most, if not all, of the health programmes related to environmental quality fall within its purriew. This close relationship is further strengthened between primary health care and environmental health programmes in view of some common characteristics they share. In both environmental health care and primary health care programmes health and disease become the focal points around which community action can be mounted on a multi-sectoral basis. Both of them also involve actions which promote the nutrition of the low income groups. This trust tends to make better health a direct outcome of development. Together, they also help determine a large part of the quality of life in a community, especially that part of the quality of life which affects of expectancy and the rate of infant mortality (ESCAP, 1984).

7.9 According to Government estimates twenty one per cent of Pakistan's rural population misses out even the most elementary form of health case (GOP, 1983). This is most serious because in more ways than one, primary health care lays the foundation for environmental health programmes. An

effective primary health care programme can help eliminate many diseases to which people, especially children, are exposed and thus help them cope competently with the problems of the environmental disease. The institutions and equipment of primary health care, where it exists, can be used to promote environmental health, especially in rural areas. In the same way, the infrastructure of environmental health programme, especially in the urban areas, can contribute to the effectiveness of primary health care.

TABLE VII-4

PAKISTAN: PER CAPITA DIETARY SUPPLIES COMPARED TO NUTRITIONAL REQUIREMENTS (PERCENTAGE OF REQUIREMENTS)

	1967—69	1970—72	1975—77	1978—80	Requirements Kilocal per capita per day
Afghanistan.	89	80	81	75	2440
Australia.	122	126	124	120	2660
Bangladesh.	89	88	81	85	2210
Bhutan.	40	40	41	41	2310
Brunei.	102	108	117	119	2240
Burma.	100	100	102	106	2160
China.	89	91	99	105	2360
Dem. Kampuchea.	100	100	84	81	2220
Fiji.	92	92	98	108	2660
Hong Kong.	113	119	117	126	2290
India.	86	92	86	90	2210
Indonesia.	89	90	96	106	2160
Islamic Republic of Iran.	89	94	122	121	2410
Japan.	115	119	120	123	2340
Loas	95	95	87	84	2220
Malaysia.	109	112	115	118	2240
Maldives.	81	79	78	81	2210
Mongolia.	98	99	108	112	2430
Nepal.	92	91	92	87	2200
New Zealand.	134	135	132	133	2640
Pakistan.	90	95	96	100	2310
Papua New Gunea.	80	83	83	86	2660
Philippines.	85	87	94	102	2260
Republic of Korea.	104	112	116	124	2350
Samoa.	79	81	85	86	2660
Singapore.	111	123	126	136	2300
Sri Lanka.	104	103	95	101	2220
Solomon Islands.	81	78	77	80	2660
Thailand.	101	101	101	104	2220
Viet Nam.	96	102	97	94	2160

Source: FAO, The State of Food and Agriculture, 1982, p. 198.

7.10 FAO (1982) puts Pakistan into a happy picture as compared to some other countries of Asia and the Pacific concerning dietry supplies compared to nutritional requirement (Table VII-4). However, it may be stressed that these statistics based on average fail to take into account the large percentage of low income group suffering from malnutrition. A study by Hussain (1980) shows that during the period 1965–1978 the diet of small farmers (owing land below 8/acres) suffered a deterioration in both quantity and quality. The Sixth Plan (GOP, 1983) also shows concern over dissatifactory progress in the nutritional sector.

7.11 Two National Surveys, The West Pakistan Nutrition Survey 1965-66 and the Micro-nutrient Survey 1977-78 and a number of limited and specialized studies have been made in Pakistan. Important among the later are the studies of the National Institute of Health, Islamabad, including the Nutrition Survey of Azad Kashmir and Northern Areas. The main nutrition problems of Pakistan that emerged from these studies (Khan, 1986) have been listed below:

1. Protein-Calorie malnutrition (P.C.M.) manifested by
   a. Growth retardation.
   b. Low birth weight in 30% live born children.
   c. High incidence of marasmus among the peri-urban slum dwellers.
   d. High infant mortality.
   e. Infection and Diarrhoea.

2. Anaemia: Basically of iron deficiency type 45% in male and 70% in female population.

3. Biochemical evidence of Vit A deficiency in 30% cases.

4. Goitre in localized areas of:
   a. NWFP most marked in Chitral District.
   b. Azad Kashmir and Northern areas.
   c. Multan Region.

According to the micro-nutrient survey 1977-78 the incidence of P.C.M. in children is as under:–

Severe	7.2%
Moderate.	9.5%
Mild.	43.0%
Satisfactory.	40.31%

Only 40% of the children have been found to have normal weight, while 7% children demand immediate attention. There is very little overt deficiency of Vitamin a leading to Keratomalicia and blindness in plains like South India and Bangladesh where unvitaminized rape seed oil is used. However, there are about 34% cases of biochemical deficiency of Vitamin A. The practical solution is to increase the present level of vitaminization of Banaspati.

7.12 WHO report gives poverty and lack of education as the prime causes of malnutrition. However, the more direct dietary causes that are more emenable to correction must also be identified. The individual nutrition is a function of two factors, the food intake and infection. This can be written in the form of an equation. Individual Nutrition=F (Food in take, infections. From the micronutrient survey and other small studies carried ot in Pakistan (Khan, 1986). It is evident that the P.C.M. is more common. From the dietary studies also it is noted that the intake of food rich in energy is less than what is required. The most probable reasons pointed out in case of pre-school children were:

a. Late introduction of solid food.
b. Prolongation of breast feed more than two years.
c. Ignorance and food taboos etc.
d. Mal-distribution of food within the family itself.
e. Non-availability of (in very small number of cases) high energy food.
f. Dependency on imported milk.

Concerning infections, the study of National Institute of Health (Khan, 1986) revealed that 62.16% of the infant showed some type of infection in the month preceeding the study, while 51.25% had diarrhoea lasting 1–4 days during the previous 3 months period. The average incidence per annum came out to be 80% and most of the children had 3-4 attacks of diarrhoea in a year. Among the adults, worm infestation was found to be wide spread and formed an important factor in causation of anaemia and general malnutrition.

Pakistan among ESCAP Countries · General Indicators of the Quality of Life

Country	Total Population (millions) 1981	Crude Birth Rate/Crude Death Rate 1981	Life Expectancy at Birth (Year) 1981	GNP Per Capita (US $) 1981	Infant Mortality Rate (aged 0-1 year) 1981	Infant Mortality Rate (aged 0-1 year) 1960	Adult Literacy Rate 1970 M/F	Adult Literacy Rate 1980 M/F
Afghanistan	16.4	47/26	37	170	200	230	13/2	26/6
Australia	14.9	16/7	74	11,080	10	20	–	100
Bangladesh	90.6	47/18	48	140	130	160	36/12	43/20
Bhutan	1.3	40/19	45	80	150	200	–	–
Brunei	–	–	–	–	–	–	–	–
Burma	36.2	37/13	54	190	100	160	–	66
China	1,007.8	21/8	67	300	70	170	–	69
Dem. Kampuchea	6.8	41/23	39	70	190	150	71/23	78/39
Fiji	–	–	–	–	–	–	–	–
Hong Kong	5.2	19/5	75	5,100	10	37	90/64	94/77
India	676.2	35/13	52	260	120	170	47/20	55/29
Indonesia	150.5	35/13	54	530	100	150	66/42	77/58
Islamia Republic of Iran	39.0	43/11	58	2.160	100	160	40/17	55/30
Japan	117.6	13/6	77	10,080	7	30	99/99	99/99
Lao PDR	3.8	43/21	43	80	130	160	37/28	51/36
Malaysia	14.4	31/7	65	1.840	30	70	71/48	79/61
Maldives	–	–	–	–	–	–	–	–
Mongolia	1.7	34/7	64	780	50	110	87/74	93/86
Nepal	15.0	44/20	45	150	150	200	23/3	34/6
New Zealand	3.1	16/8	74	7,700	12	23	–	99
Pakistan	84.6	46/16	50	350	120	160	31/11	39/18
Papua New Guinea	3.1	36/15	51	840	100	170	32/19	48/30
Philippines	49.5	34/7	63	790	50	110	83/80	90/88
Republic of Korea	38.7	24/7	66	1,700	33	80	92/78	96/88
Samoa	–	–	–	–	–	–	–	–
Singapore	2.4	18/5	72	5,240	11	36	82/55	88/70
Sri Lanka	15.0	27/6	69	300	43	70	85/69	87/76
Solomon Islands	–	–	–	–	–	–	–	–
Thailand	47.5	30/8	63	770	50	100	86/72	93/83
Viet Nam	55.0	35/8	63	100	100	160	–	87

Source: UNICEF, The State of the World's Children (1984), pp. 40-41.

7.13 Two principal indicators of environmental health are life expectancy at birth and infant mortality rates. UNICEF has ranked countries by the per capita income and magnitude of these two variables (Table VII-5). The data reveals that countries with a per capita income of U.S. 2,000 correspond with typical life expectancy of 65 years and infant mortality rates of 30 per thousand. There are however significant exceptions pointing out that "the cutting edge of development is not per capita GNP alone but alone imaginative development policy towards social indicators. The case of Sri Lanka with a per capita GNP US. $ 300 (less than Pakistan) is a case in point. Here the policy oriented to public services and their effective delivery to the low income groups has raised the life expectancy and lowered infant mortality rates substantially.

B. *Pollution and Human Health*

7.14 Of all the threats man faces today none is more serious than the threat posed by the steadily increasing pollution of human environment. The extent of pollution in our world can be gauged from the fact that right from ionosphere down to the deepest part of hydrosphere, pollution exists every where and in reality has become the major determinatent of human health. A major cause of concern in Pakistan in this regard is biological pollution or the contamination of water with faecal waste. The magnitude of water and and sanitation inadequacies is staggering with sixty two per cent of the nations population lacking clean water and 84 per cent having no access to sewerage facility (GOP, 1983). Even where clean water is available, it is subject to contamination before use. A research study in rural area (Akhtar et al 1981) shows that contamination is present in water samples collected from various sources. The hand pumped, wells and tube-well samples are comparatively less polluted and their mean values reaches the acceptable standard of 50 faecal coliform/100 ml but the water undergoes further contamination in the storage containers where its quality deteriorates appreciably. This demonstrates amply that the supply of piped water alone to rural communities is not the answer to the control of water borne infectious diseases because in the absence of environmental sanitation and use of contaminated storage such containers water supplies are as prone to contamination by faecal organisms as those of open wells.

7.15 Urban areas also face similar problem. Several studies and surveys have been carried out in and around the city of Karachi (Hussain & Sultana, 1954, Ahmad et al. 1964 KDA, 1981) to evaluate the quality of water. It

has been found that in almost 40 per cent cases the water received by end users does not confirm to WHO specifications although it does so at source (KDA, 198?) It has been found that in older areas of the city water is contaminated because of the leaking of sewers and faulty water mains which leads to seepages and renders the drinking water unsafe. The water samples from these areas show the presence of bacterial organism that cause recurring diseases and gastro-enterities. In new areas of Karachi, one of the main reasons for contamination is the peculiar storage condition. It has been found that the end-users in such areas store their water in underground tanks whose quality of construction is either unsatisfactory right at the start or soil movement causes cracks so that they are susceptible to seepage from outside. Further, laying of the sewerage line takes no account of the vicinity of the storage tanks and thus any leakage of sewer can induce pollution. To prove their point the study team tested the sewerage pipes and found that in at least 60% cases, the pipes burst from small pin holes which widen during the application of pressure. Such pipes loaded to carry the sewage, start deteriorating and then they leak after a few months time. This builds up a water level which is highly contaminated with faecal organisms. Another reason for the pollution of such tanks is, the underground or over head tank which are seldom cleaned (KDA 1981) A PCSIR study also collected samples from a number of localities faced with scarcity of water. The residents here had resorted to using underground water either from dug wells or from hand pumps. The underground water in almost 70% cases was found to be contaminated with sewageorganisms.

TABLE VII-6

A Comparative Study of Pakistan and Selected Asian Countries in the Incidence of Infectious Disease (1981)

	Chloera	Intestinal Infection	Tuber-culosis	Malaria	Typhoid
1	2	3	4	5	6
Afghanistan	–	7,377	2,658	200	1,087
Burma	64	6,213	1,713	10,703	1,029
Bangladesh	–	328,752	61,339	45,902	–
China	–	3,454,244	–	3,059,635	75,455
Hong Kong	3	–	–	62	500
India	5,237	8,515,576[a]	520,948	2,800,000[f]	186,604
Islamic Republic of Iran	6,034	–	42,717[b]	29,654	36,341
Japan	19	52	68,318	41	477
Malaysia	479	–	7,050	52,833	1,715
Nepal[b]	–	2,069[a]	1,050	82	823
Pakistan	–	177,255[c]	78,139	–	44,784
Philippines	1,385[d]	210,608[d]	118,587[d]	35,353[d]	4,333[e]

1	2	3	4	5	6
Republic of Korea	145[b]	57[c]	154,377	–	174
Thailand	39	2,328[c]	1,423	473,210	11,326
Viet Nam	374	107,564	–	59,307	3,222

Source : World Health Statistics Annual 1983.

a Amoebiasis only (1980).
b 1980.
c Amoebiasis only.
d 1978.
e 1977.
f 1980, WHO–SEARO Bulletin of Regional Health Statistics 1981.

7.16 The diseases caused by contaminated water can be classified into five categories. These are: (a) water-borne diseases such as typhoid, cholera, dysentery, gastro-enteritis, and infectious haptitis; (b) water washed infections of the skin and eyes such as trachoma, scabies, yaws, leprosy, conjunctivitis, and (c) water-based diseases such as schistosomiasis and the guinea-worm (d) diseases with water-related insect vectors (mosquitoes); (e) infections that are primarily caused because of defective sanitation such as hookwork, etc. (ESCAP, 1984). The estimated number of people suffering from water related diseases is immense. At any one time in Pakistan there are thousands of people, suffering from dysentary, diarrhoea trachoma, worms and malaria. A comparative study of Pakistan to some other Asian countries regarding the number of cases afflicted by infectious disease of cholera, intestinal infection, T. B. malaria, typhoid and paratyphoid is given in table VII-6. The importance and inadequacy of safe water availability and sanitation in curbing infectious diseases can be hardly be over emphasized.

7.17 The domestic sewage generated in human settlements is led sometime directly into the agricultural fields in Pakistan. These fields act as reservoirs of biological disease agents such as flies mosquitos, lice, ticks and many other kinds of parasites which cause a variety of environmental diseases. Rice field with stagnant water are also fertile grounds for malarial mosquitos. This disease is still endemic in Pakistan. There were 37,923 reported cases of Malaria in 1980. Its incidence increased in the country from 6,416 in 1962 to 108,773 in 1970 but has decline to 37,932 since then (Table VII-7). However resurgence of malaria is a common phenomenon and needs a careful monitoring and control.

TABLE VII-7

A Comparative Study of Incidence of Malaria in Pakistan and Selected Asian Countries in time

Country	Recorded Cases of Malaria For selected years		
	1962	1970	1980
Afghanistan.	640	33,996	47,285
Bangladesh.	740	8,173	67,727
India.	59,575	694,647	2,844,815
Indonesia.	5,901[a]	20,311	149,576
Japan.	18	17	41
Pakistan.	6,416[b]	108,773	37,923
Philippines.	40,342	35,482	97,567
Sri Lanka.	31	468,199	47,383
Thailand.	18,746	148,926	427,792

Source: WHO, "World Health Statistics", 1983.

7.18 Several small studies have been carried out in different parts of Pakistan to assess the food contamination problem. One of these was carried out at National Institute of Health, Islamabad to assess the Bacterial Contamination in sample collected from Rawalpindi/Islamabad. The results have been summarised in table VII-8.

7.19 Contaminated food are dangerous to health and sometimes may even cause death. A long spectrum of diseases can be transmitted through contaminated food, and thus may be responsible for the various health hazards. The common food born disease in Pakistan are

1. Gastro-enteritis (Summer Diarrhoea).
2. Food Poisoning.
3. Bacillary and amoebic dysentry.
4. Typhoid and paratyphoid.
5. Hepatitis.
6. Ascariasis.
7. Non-Pulmonary Tuberculosis.
8. Diphtheria.
9. Brucellosia.
10. Cholera.
11. Taeniasis.

TABLE VII-8

Rawalpindi-Islamabad: Bacteriological Examination of selected food

Types of Foods.	Conta-minated	Satis-factory	Organisms isolated
Chicken, Mutton, Beef Eggs, Somasa Kabab (cooked).	52%	48%	E. Coli, Bacillus subtili Mirabilis, Pseudomonas Sp Staphylococcus, Epider midis.
Beef.	50%	50%	Clostridium perferinges Salmonella, E. Coli Coli-forms.
Milk and Milk product.	48%	52%	Salmonella, E. Coli, Bacillus Cerus, Pseudomonas aero-genosa Fungus.
Fruit & Vegetable.	48%	52%	Salmonella, E. Coli Coli-forms.
Meats and Poultry (Raw).	44%	56%	Pseudomonas aeroginos dastridium perferinges E Coli, Coliforms, Fungus.
Dried Foods.	40%	60%	Staph Coagulase+Ve Coli forms, Fungus.
Fish & Fish Product (Cooked).	39%	62%	Salmonella, E. Coli Coli forms.
Cakes, Sweets, Pastry & Biscuits.	26%	74%	Coliforms, Fungus.
Pickles.	20%	80%	Coliforms, Fungus.
Soft drinks.	5.88%	94.12%	Streptococus Faecalis.

Source: National Institute of Health, Islamabad.

TABLE VII-9

Rawalpindi-Islamabad : Percentage of contaminated foods from different sources

	Food type	Class of Hotel/Restaurant		
		High	Middle	Low
1.	Milk & Milk product.	Nil	10%	–
2.	Meats and Poultry (Raw).	7%	10%	–
3.	Fruits & Vegetable.	1%	No sample	10%
4.	Dried Food.	1%	10%	30%
5.	Cakes, Sweets, Pastry and Biscuits.	Nil	10%	30%
6.	Beef (Raw).	30%	35%	50%
7.	Chicken, Mutton, Beef, Eggs, Samosa, Kabab.	Nil	Nil	50%

Source: National Institute of Health, Islamabad.

It appears from the table that in cooked food the percentage of contamination is higher in items like Sâmosas, Chicken samples collected from low grade Cafe/Vender Shops were also found to be more contaminated than the packed food (Khan, 1986). The samples taken from vendors are more contaminated perhaps due to poor and unhygienic sanitary conditions.

7.20 Apart from biological contamination, chemical pollution of air, water and food is also on the increase and becoming an extremely serious health hazard. The use of chemicals on a wide scale began with the dawn of the twentieth century. Reliance on natural sources for the supply of chemicals could not cope with the explosive increase in the demand for them. The growth of experimental chemistry helped in the development of new chemicals. Crude oil was used as a new source of supply for chemicals. Organic chemistry emerged as a new scientific discipline, helping to synthesize all kind of organic compounds orginating from crude oil feeds tock. For example, DDT, which was widely used as a pesticide and disinfectant is a compound made by organic chemists. Now the use of chemicals has become ubiquitous. At the session of the Governing council of the United Nation Environment Programme, convened in 1978, it was estimated that four million identifiable chemicals were in use then, and some 1,000 new chemicals were being introduced to the market every year. Although

chemicals have benefited human society in many ways, their widespread use for economic activity began to cause concern for the environment and human health only in recent years. Studies indicated that radium, originally used on watch faces for luminous figuring, caused cancer. Similarly, dibromochloropropana (DBCP), originally developed as a herbicide, caused male sterility if exposure was direct. Vinyl chloride monomer caused angiosarcoma of the liver. Accidents during the transportation of chemicals in bulk could require evacuation of whole communities. Disposal of chemicals also posed serious problems. Water bodies could be contaminated because of an indiscriminate dumping of chemical waste. In general, toxic substances can be classified into carcinogens (causing cancer) mutagens (producing mutations), and teratogens (causing birth defects). The gravest perils to human life are these relatively persistant toxic chemicals and metal which can build up to dangerous levels before even being detected.

7.21 A report submitted by the Pakistan Medical Research Council in 1976 has highlighted the incidence of Cancer in Pakistan with special reference to the incidence in the city of Karachi. The incidence in Pakistan ranks 2% which is considered to be the second highest in the world as compared to inhambane District in Mozambique where it is 3.6%. In Karachi the incidence recorded (according to the registration of cancer in JPMC) is 3.5%. This a cause of great concern to the epidemiologists and the encologists. Research conducted in this field (Nizami et al 1974, 1975, 1976, 1978) has elucidated the occurance of chemical carcinogens in the environment and naturally occurring carcinogens like the Aflatoxins (Nizami and Zuberi 1976). "With the preponderance of liver cancer and oesophageal cancer as well as cancer of the breast and uterus, concerted efforts are required to assess the kinds of carcinogens responsible for this type of cancer and the magnitude of the problem as well as to find the source of the carcinogens that are consumed by the general population. The age group most effected is from 35–40 years which is the age of productivity. This should and does have a great impact on the industrial production because the higher percentage is of the industrial workers. Chemical carcinogens like the Nitrosaminess have been found in foods and naturally occuring carcinogens from fungal metabolites like Aflatoxins, sterigmatocystins, Ochratoxins and patulins have been detected" (KDA, 1981). A survey of the SITE industrial area in Karachi was conducted to examine carcinogens in the food sold and consumed by the working class people of the area. Results obtained showed that the occurence of Dimethylnitrosamine in the cooked food was common. It may have been due to the material used in cooking or perhaps because of the absoroption of NO^2 from the air into the cooking mixture and the

CO present in the air from burning coal over which the food was cooked. The other Nitrosamines det detected were Nitrosopyrrolidine and Nitrosopiperridine as well Nitrosodiethylamine in some cases.

7.22 The long term effects of minimal doses of toxic polutants have not been evaluated in Pakistan. Limited studies have been carried out in this area so far. However few autopsy and biopsy specimens of human depot fat disclosed that the concentration of total DDT equivalent in body fat of human population in Pakistan is among the highest so far reported in the world. The chemicals industry products and uses a variety of inorganic chemicals, petro-chemicals, agricultural chemicals, drugs and pharmaceuticals, for example the production of the paints, varnishes dyes, plastics, synthetic fibres and chemical fertilizers is undertaken on a large scale in Pakistan without assessing their impact on human health. How hazardous some chemical can be to human being can be judge by Bhopal tragedy of 1984, during which a leakage of methylisocyanate from a pesticide factory killed over 2,000 people and affected over 60,000 people.

7.23 Chemical industries per se are only one source of toxic chemicals. Equally important producers of chemical pollution are other small-scale and medium-scale industrial activities like dyeing, textile printing, leather processing, bangle-making, carpet weaving and household utensil manufacture. All these involve the handling of toxic chemicals. In welding operations, whether in large engineering workshops, wayside smithies or at repair shops, the welders are exposed to the fumes of toxic metals. Inorganic dust containing considerable amounts of silica and particles of heavy metals is a major pollutant in all kinds of mining, quarrying stone-cutting and dressing operations. Similarly, organic dust raised in cotton textile mills, ginning plants, coirrnetting and processing, sawmills and plywood industries is also potentially toxic.

7.24 Many chemicals which are being used indiscriminately for saving agricultural crops from pest are also toxic. Likewise Spraying and application of pesticides in the control of malaria, and other diseases are, hazardous operations involving exposure to highly toxic chemicals. Similarly some construction material used in past have been found to be carcinogenic. Asbesto is a well-recognized environmental pollutant capable of producing serious respiratory diseases, including lung cancer. The extensive and growing use of synthetic chemical fertilizers has also been known to be a serious

source of environmental pollution. A major problem with this is the contamination of subsoil and running water. The chemical components of fertilizers can have adverse effects on human health through a variety of environmental mechanisms. For example, most of the components present in the waste waters of a fertilizer factory can affect the water quality of the stream which receives them. Acids and alkalis can destroy the normal aquatic organisms. Nitrate fertilizers used in agriculture if eaten or drunk by human in high concentrations can enter the bloodstream where they interfere with the bloods ability to carry oxygen. Nitrates can also combine in compounds that may cause cancer humans. Nitrate pollution of drinking-water is a growing concern in many countries, because nitrogen applied on land as a fertilizer often reaches the ground water table as mitrite-toxin. This demands a note of caution in Pakistan where fertilizer production and we has registered a steep rise in view of the need for increasing food production. Table VII-10 gives the changes in fertilizer nutrient consumption and fertilizer use per hectare in Pakistan and selected Asian countries during 1969–71 and 1979–81 periods respectively.

TABLE VII-10

A comparative study of Pakistan and othr ESCAP countries with respect to change in total fertilizer nutrient consumption 1969–1982

	Average level 1969–71 thousand metrictons)	Average level 1979–81	Average Annual percent growth 1970s	1969–71	Average fertilizer (nutrien use per hectare 1981-82
	1	2	3	4	5
Afghanisatn	19	50	10.2	2	6
Bangladesh	129	415	12.4	14	45
Burma	36	106	11.4	3	10
China	4,217	14,208	12.8	42	12
Faji	6	16	10.3	28	58
India	1,868	5,386	11.2	11	30
Indonesia	215	1,043	17.1	12	54
Iran	120	518	15.7	8	30
Malaysai	172	444	9.9	44	104
Nepal	6	22	13.9	3	9
Pakistan	324	1,062	12.6	17	51
Papus New Guinea	3	5	5.2	8	1.8
Philippines	204	338	5.2	21	34
Republic of Korea	365	838	4.0	247	30

	1	2	3	4	5
Sri Lanka	98	153	4.6	50	74
Thailand	105	265	9.7	8	17
Vietnam	292	217	(−)3.0	51	35
Total World	68,526	114,246	5.2	49	79

Source: ESCAP, Agro-Chemicals News in Brief, Special Issue December, 1982 pp. 25.29, Vol, VII, No. 4, Oct. 1983, p.9

7.25 Increasing air pollution by industrial and is already a serious threat to automobile emission/human health. There is a relationship between the increase in air pollution ratio and the rise in the incidence of respiratory diseases. Air pollution also boosts the frequency with which people especially children, contract short-term respiratory ailments. Cardio-vascular deaths, infant mortality, and death of those over 65 years of age can also be linked with air pollution. Hundreds of tonne of pollutants are emitted by factories and cars and other vehicles. Thickly populated cities like Karachi, Lahore, Faisalabad, Multan, Hyderabad, Rawalpindi, Gujranwala & Peshawar. Karachi alone happens to be the largest industrial centre in Pakistan with thousands of industrial units and about half a million auto-vehicles are plying on its roads using leaded gesoline. Studies conducted by university of Karachi, Faculty of Pharmacy have shown that a high concentration of lead is excreted in urine of people residing in Denso Hall Area. Excessive lead concentration of this kind can pose serious kidney problems.

7.26 Threat to human health due to radio activity in this country is due neither so much to the radio active fall out or due to experiments carried out with radio-active materials so far. Scientists working with radioactive materials know the dangers of radiation and use proper safety measures. The most important radiation hazard in Pakistan is due to X-rays. It is essential that proper regulations for the safety of X-ray technicians and patients should be enforced. There should be periodic checks to see if there is any leakage of X-rays from the machines and the technicians should be required to wear dosimeters of film badges. Arrangements should be made to ensure that the patients are not exposed to X-ray radiations at places where the human body is most sensitive to radiation.

BEST AVAILABLE

TABLE VII-11

Pakistan among ESCAP Countries: Status of Health Service Delivery system 1960–80

	Thousand people/nurting personnel						Thousand people/medical doctor						Thousand people/hospital bed						Health centres						Percentage of health expenditure/government expenditure					
	1960	1965	1970	1973	1975	1980	1960	1965	1970	1973	1975	1980	1960	1965	1970	1973	1975	1980	1960	1965	1970	1973	1975	1980	1960	1965	1970	1973	1975	1980
1. Ghana	223	31	–	–	03	–	7	5.1	–	1.1	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
2. India	112	87	–	4.3	5.7	6 4	6.1	5.6	4.7	4.2	3.9	3.6	2.30	2.0	2 0	2.1	1.4	1.3	–	22.152	28.542	37413	46.725	–	3.9	7.5	5 9	4 6	4 9	–
3 Bangladesh.	–	–	–	66.7	–	42.1	–	–	8.1	8.8	9.3	15.1	8.0	10.9	5.9	4.5	5.6	4 4	–	152	256	–	–	–	–	3.5	2 8	2.3	–	4.3
4. Indonesia	5.4	9 6	–	4.6	2.8	–	48	31.9	27.7	23.9	20.0	12.6	1.35	1.45	1.71	1.60	1.7	1.4	–	–	12.336	16.334	–	–	1.6	0.1	2 0	3.97	1 4	5.5
5. Pakistan	21.1	16 2	–	5.9	10 0	–	11	6 0	9.0	3.6	3.8	3.6	5.60	2.82	4 0	2.17	1.9	1.9	–	–	–	–	–	–	–	2.54	5.0	5.0	2 2	1.2
6. Japan	0.5	0.4	–	0.2	0.29	–	0.9	0.9	0.88	0.86	0 85	–	0.11	0.09	0 08	0.08	–	–	–	–	–	–	–	–	–	2.2	1.9	–	2.3	–
7. Afghanistan	406	33.1	–	21.7	25.1	–	40	21.4	20.4	27 9	28.3	28.3	8.0	5.8	6.9	–	6.6	6.6	–	–	–	–	–	–	–	–	–	–	2 3	–
8 Burma	92	11.6	–	3.0	4.4	–	11.4	11.9	9 0	7.1	7.1	4.6	1.2	1.2	1.2	1.17	0.7	1.4	7.69	–	1182	1403	5706	–	–	5.7	5 8	1.5	6 7	6 9
9 Iran	8.1	4.2	–	1 8	1.9	–	3.8	3.7	3.3	3 25	2 6	–	0.95	0.9	0.78	0.73	–	–	–	–	–	–	–	–	–	4 2	2.5	5.85	–	–
10 Philippines	4.6	1.3	–	2.0	3.1	–	1.6	1 4	1.1	3.0	2.8	0.7	1.18	0.73	0.79	0.78	0 6	0.7	–	–	–	–	–	–	–	–	5.4	–	9.2	4.7
11. Vietnam	4.1	6.0	–	1.97	–	2.4	29 0	37.4	8.3	8.2	5.2	4.2	0.68	0.59	0.48	0.9	0 4	0.4	–	–	–	4149	–	2412	–	–	2.3	–	–	–
12 Thailand	5.6	1.4	–	2.1	1.2	–	7 8	7.1	6.25	5.4	8.5	7.2	1.25	1.20	0.9	0.92	0 8	0.8	1573	2042	3800	4718	3688	4033	2 8	3.5	2.5	4.8	3.3	4.0
13. Republic of Korea.	6 5	2.9	1.7	1.3	0.62	0 42	3.5	2.5	1.9	3 0	1.8	1.6	2.60	1.25	1.8	2.0	1.5	1.1	–	–	–	–	–	–	–	0.9	0.9	1.4	0 5	–
14. Sri Lanka	4.8	3.2	–	1.3	2 0	7 1	4.5	4.2	1.9	4.0	6.3	7.2	0.12	0.30	0.33	0.33	0.3	0.3	–	1168	1321	–	–	1.371	8.2	8.0	1.4	6.7	6.3	1.5
15. Demoh hampuchea	3.4	3.2	1.4	–	–	–	4 0	22.5	15.3	–	–	–	–	1.23	1.34	0 89	–	–	–	–	–	–	–	–	–	–	–	10.1	–	–
16. Malaysia	2.8	1.5	–	0.7	0 8	–	6.5	5 3	3.9	4.4	7 6	3.4	0.29	0.27	0.30	0.34	0.36	–	–	–	–	–	–	–	–	3 4	5.8	6.2	4.5	2 0
17. Nepal	15.2	45.8	15.6	16.8	1.35	–	72.2	45.1	50 8	42 8	36.0	26 1	8.10	6.80	7.00	5.90	5.7	5.2	9 6	105	150	418	353	560	4.9	4 6	4 9	5.4	0 6	0.4
18. Austtralia	–	–	–	–	0.12	0.9	0 85	–	0.72	0.65	–	0.09	0.08	–	0 08	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
19. Papua New Guinea	4.5	2.0	–	–	1.9	–	17.0	15.2	11.9	11.7	11.7	11.2	0.17	0.12	0.27	0.22	–	0.2	–	–	–	1 37	1.47	–	–	–	–	–	–	–
20 Manadus	0.3	0.3	–	0.26	0.25	–	1.1	0.72	0.6	0.51	0.51	0.47	0 12	0.11	0.11	0.10	0.10	0.09	58.1	6.85	9.10	1 252	–	–	10.0	–	9.3	10 0	–	–
21. Newzealand	–	–	–	0.15	0.17	–	0.85	–	0.87	0 85	0.77	0.74	–	0.1	0.16	–	–	–	–	–	–	–	–	–	–	20 0	–	–	–	–

Source: United nations, Health and Development, (Bangkok, 1985, ST/ESCAP/

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To sum up human health issues in Pakistan, it is very encouraging that despite the increase in population, the humer of people covered per nursing personnel and doctors has shown improvements in the country. The number of health centres has also increased. However efforts and measures for improving the status of human health in Pakistan yet overshadowed when compared with some other Asian Contries like Nepal and Thailand (Table VII-11). Nevertheless even the existing measures, both preventive and curative, can yield much better results if they are associated with: (a) a time-bound programme for the eradication of absolute poverty; (b) a specific target group oriented programme for eliminating malnutrition; (c) a programme of water and sanitation for all; (d) measures to prevent agro-chemical and industrial pollution; and (e) special measures to control water and air pollution. Just as the symptomatic treatment of diseases does not cure the diseases, treating diseases as they occur or even undertaking prophylactic measure does not have a long-term ameliorative effect on the health conditions of the society unless the nutrition and environmental conditions are improved. An integrated approach covering these fundamental elements can go a long way in improving the quality of life and lessening the environmentally induced morbidity of the people in Pakistan.

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CHAPTER VIII

FOOD RESOURCES AND ENERGY

A. Food Resources

A.1 *Food & Population*

8.1 Pakistan population was 84.25 million in 1981 (GOP, 1985). It is expected to increase to 143 million by the year 2000 (PEPAC, 1983), which means adding up of three Baluchistan to the nation every four years in terms of population. No immediate decline in the ratio of population growth is expected. Billions of rupees have been spent on programmes to limit birth rate since 1965 yet the registered decline in birth rate has not been able to match the decline in death rate during the 1965-85 period. Should we continue to invest so heavily in our family planning programmes? Leaving aside the issue, one thing is sure and that is we will have to produce food at rates faster than the growth of population to continue feeding the new borns adequately.

8.2 From 1950 to 1975, the balance between the production of food crops and the growth of population was slightly in favour of food production. The population in these twenty five years grew at an average rate of 2.8 percent per year and the food (crop) output increased at 3.1 percent per year (GOP, 1978). However the period also witnessed an increase in the per capita consumption of food. Data is not available on this for the whole period but during its last five years *i.e.* 1970–75 the rate of increase of cereal food consumption was 2.75 kgs per capita per year. The food output during the fifth plan (1978–83) improved substantially. One important result of which was conversion of huge food deficits into modest food (grain) surplus (GOP, 1983). The food crop output in terms of quantity went up from 15.9 million tonnes to about 18 million tonnes during the Fifth Plan period. The situation however has deteriorated during the sixth Plan. The production of food cereal has gone down by 1.3 millions since 1983 to 16.7 million tones in 1984-85. As a result of this more than 800 metric tons of wheat had to be imported during 1984-85 period (GOP, 1985). Beside grains, the country has paid enormously in foreign exchange for the import of edible oil, sugar, tea and powdered milk in past. The import of edible oil alone accounted for more than five billion rupees in one year (1984-85). The import of grain, pulses and flour costed more than

2 billion rupees for the same period. Twenty years ago the import of milk was almost unknown in the country but enormous quantities have to be imported now to meet the nation's demand. A crucial aspect therefore is to increase the supplies from the food production system of the country without harming the ecosystem. This can be achieved in two ways, one of which is to increase the production and the other is to save crop and other losses.

A.2 *Enhancing Food Supplies*

8.3 The technical production for increased food production in Pakistan is based on two premises. The first of these is to raise the yields of existing crops and the second is to bring in more land under cultivation. It has been estimated that Pakistan's crop yield for the major food crops are about one third of the potential of the particular seed varieties being used (Table VIII-1)

TABLE VIII-1

Pakistan: Pakistan potential for increasing yields of major food crops

Crop.	Weighted mean (Mounds/Acre)	Median of upper range (Mound/Acre)	Potential (C/B)x100
A	B	C	
Wheat	15	50	333
Rice	20	55	275
Maize	15	45	300
Sugarcane	320	850	266

Source: WAPDA (1979) Revised Action Programme for Agriculture, Main Report Vol. II.

The yield potential defined here is in terms of upper range of observed yields, threfore, it represents effective use of current technology rather than employing some future technology. The three principal determinants for the difference have been pointed out to be fertilizer, water and improved cultural practices. The vertical growth in agriculture (increased yield per unit area) that has been due to use of agricultural inputs like fertilizer, improved seeds and other chemicals including pesticides and harmones etc., however, need a careful study. Any of these inputs if not properly applied, may have an adverse effect on the final yield and its end

uses. For instance, the fertilizers if excessively, inappropriately or untimely applied and insecticides used indiscriminately can lower soil fortility, reduce the long term yields, pose a positive threat to human health, kill the beneficial insects and ultimately lead to the pollution of waters receiving the drainage effluent from the fields. Similarly the new crops/varieties being more fertilizer responsive are also more susceptable to insects and diseases and require increased use of pesticides including insecticides, herbicides. fungicide and other chemicals. Much of the agricultural chemical drain into the soil or shallow wells which supply the water for village and cities. Consequently, pollute environment and become potential source of hazards to human being particularly the farmers. The introduction of improved technology for raising yield of food corps should therefore be preceded by proper examination, studies, research and investigation.

8.4 The water and power development Authority (WAPDA) has also estimated that 21.8 million acres of land in the existing canal command area can be reclaimed for irrigated cultivation (Table VIII-2). The existing form gate availability of water is 73 MAF, but this can be raised to 111 MAF (increase of 38 MAF) by means of investment in canal remodelling, surface storage and ground water development. The conversion of terrain to farm land however also requires careful ecological considerations, oterwise it can be accompanied by erosion, flooding and pest out break. For example bringing of sloping land under cultivation can promote gullying and soil erosion. This is a common feature in Patwar plateau. Likewise, converting land to agriculture may also cause pests to increase, sometimes, as their natural predators and competitors are eliminated either directly or indirectly by habitat destruction. Similarly floods can be triggered off, if a land covered with vegetation is cleared off for as agricultural purposes. Ironically, these losses may nullify the attempts to raise production by increasing cropland. Finally irrigation by itself, if wrongly designed and poorly managed is very often followed by degradation of soil.

TABLE VIII-2

Paksitan: Status Reclamability

(Million Acre Feet)

	Usable Ground-Water	Unusable Ground-Water	Total
Land requiring drainage			
– Early Sub-surface Drainage	7.3	4.2	11.5
– Later Sub-Surface Drainage	0.5	2.0	2.5
– Surface Drainage including rice area	–	–	7.8
Total . .	7.8	6.2	21.8

Source: Revised Action Programme for Irrigated Agriculture, 1979.

8.5 Increased food production is also possible from Barani, Rodkohi and wetlands. The country can also increase livestock resources through proper range management and improved animal husbandry practices. However a very important prerequisite is the development of a proper land-use plan on the basis of existing land potential so that future ecological degradation could be avoided and development could be promoted on sustained basis.

8.6 Losses in food production occur due to many natural hazards including floods, droughts, inclement wheather (including torrential rain fall, hail storms and wind storms). They cause great devastation affecting crops, animals, men and their belongings. The pre-harvest and post-harvest crop losses due to pests including insects, diseases and weeds are estimated to be 25% of the total harvest. In accordance with the estimates for 1982-83 the contribution of agriculture sector to GDP was Rs. 18.2 billion. The crop sub-sectors accounted for Rs. 12.4 billion. Thus the losses due to pests amount to Rs. 3.1 billion per annum. Pakistan being a food deficit country cannot afford this loss with such a high rate of population growth. Pest invasion (out breaks) still cause greater losses and results in food scarcities. The pest control methods, including cultural, mechanical, physical, legal, biological and chemical to combat crop pest complexities, are in use but still

the total pest control coverage operations do not account for more than a quarter of the irrigated crop areas, and they too are not effectively applied. The use of inappropriate methods and technologies have resulted in new crop pest problem. The use of Chemicals for pest control has been very indiscriminate which has resulted in new pest problems, insect resistance to chemicals and environmental pollution. A substantial body of scientific evidence has accumlated to demonstrate that no part of the world is now free of environmental stress agents such as pesticides, radionuclides fallout, polychlorinated biphenyle and other industraially produced synthetic chemicals, (GOP, 1982). Monitoring system have revealed their presence in air, soil, water plants, animals and in various food chains causing mutations. The correlation of mutagens with carcinogens is greater than 95% for all classes of chemical and physical agents, so far studied in U.S.A. The problems of environmental hazards resulting from indiscriminate use of chemicals is therefore self evident. The crises may have developed in Pakistan because of the vast influx of chemicals needed to implement to green revolution.

8.7 Livestock and poultry industry in Pakistan has not adequately progressed on scientific and commercial line. The scattered efforts by farming community to raise live stock and poultry have been very primitive and under unhygienic conditons. Nearly 16 million heads of live stock and poultry, valued at Rs. 2.5 billion die from diseases every year in the country. A large number of cow, buffaloes, sheep and goats recover from diseases but maintain low yield of milk for varying periods, inflicting further losses to the tune of Rs. 150 million per annum. These losses are clossal and cause shortages which lead to malnutrition and deterioration in the quality of life of the average citizen. (GOP, 1982) Considerable improvement has taken place in the life expectancy and performance of live stock because of better vaterinary cover provided to them. Some diseases like rinderpest have nearly been eradicated, and sera and vaccines against major contagious vectors have also been produced and used successfully by the volterinary Research Institute, Lahore. However, as a large numbe rof animals stills die a premature death, there appears to be ample room for improvement through strengthening of the veterinary cover as well as intensive reserach and better extension services on live stock diseases.

A.3 *Saving Food Losses*

8.8 A substntial proportion of agricultural produce gets wasted in one or the other form while moving from production to consumption stage. This ineffeciency of resource use and under-utilization of production potential brings low return to the producer and inadequate supply to the consumer.

The marketing system in our country particularly for agricultural produce is extremely inefficient and involves an element of dis-honesty. It has been estimated that the post-harvest losses for wheat, rice and maize alone count to the tune of Rs. 360 million annually. It is reported that Pakistan sustains losses of over one billion rupees per annum owing to the defective methods of marketing crops animals and their products (GOP, 1982). Losses also occur due to incorrect methods of harvesting, defective storage, lack of grading, unregulated distribution, insufficient utilization of the by-products and poor financing systems. If annual losses of wheat, rice and maize alone can be prevented, 3.6 million more people can be fed for one year at the present rate of consumption. Likewise, if animal products going waste can be protected, eight million more people can be fed with proteins for a year at the present rate of intake. Role of viabole agricultural marketing organization, trained men-powered and research in this regard therefore can hardly be over-emphasized.

8.9 Besides supplies in quantitative terms, two other important aspect of food that have environmental implications are the nutrional value and purity or degree of contamination. Malnutrition results in high morbidity and morality rates in Pakistan. Nearly two thirds of the population eat insufficient or unbalanced diet, particularly with regard to proteins (GOP, 1982). Protein deficiency in advanced cases can result in mental retardation and low I.Q; and in less severe cases there is slow psychomotor development, stunted physical growth, low birth weight, height, high morbidity and mortality in infants. The importance of nutrition arises from the fact that the nutritional status of an individual defines his well-being. Indeed, the nutritional status of the mother sets the foundation for the growth of the child. A study in Indonesia in 1973-74 showed that labour productivity also has to do a lot with nutrition deficiency resulting in anaemia which affects productivity. Treatment of anaemia for a period of 60 days led to an increase in productivity of around 20 per cent for rubber tappers and 25 per cent for weeders (ESCAP, 1984). The same study showed that infections were much more common in workers suffering from anaemia. Both absenteeism and actual physical capacity for output were related to anaemia. A small follow-up study in northern India where anaemia was not so severe tended to confirm these results, though caloria intake was found to affect output more than anaemian (IBRD, 1977).

8.10 Food contamination in Pakistan is taking place by both pathogens and toxic substances. Example regarding bacteriological contaminations have already been discussed in the chapter on Human Health in this profile.

Estimation of residual pesticides and fertilizers in the food consumed is not being done on regular basis. However food contamination study carried out in National Institute of health Islamabad revealed that excessive use of urea fertilizer has resulted in greater contents of Nitrite and nitrate in sample of Beet and Spinach (Table VIII-3). Case of addition of earcinogen to cooked food in SITE industrial area discussed previously is another example of chemical contamination. Biological are added contiminants are added primarily due to lack of cleanliness & hygiene Extensive practice of adulteration of food stuffs either by dilution or by mixing with other substances is another reason for food contamination. An example is the use of common water from ponds or canals in milk.

TABLE VIII-3

Nitrate and Nitrate Nitrogen contents of fresh Beets Andspinach at different rates of Nitrogen Fertilizer

	Beet		Spinach	
Fertilizer lb M/acre.	Nitrate (ppm)	Nitrate (ppm)	Nitrate (ppm)	Nitrate (ppm)
100	58	0.9	193	0.5
200	150	1.5		
400	415	1.2		
	455	2.0	552	0.6

Source · GOP, 1982.

8.11 The problems of nutrition and contamination can be tackled best by creating awareness and importing proper education to masses. In Pakistan, health education has not been given the importance it needs. The common man has not been made to understand the benefits accuring from (i) eating correct and well balanced diet, (ii) planning for and having a healthy family (iii) drinking potable water from a safe and clean source (iv) providing good sanitation facilities and having clean environment.

B. Energy

B.1 *Energy, Environment & Development*

8.12 The provision of of energy (particularly fuel for domestic use) to 95 million people of Pakistan is a problem which in its magnitude and urgency.

is in the same class as food. Barring a small number of urban dwellers, the majority of people in the country use little commercial fuel for domestic use and are generally dependent on firewood, dried twigs and leaves, agricultural wastes and dried animal dung for their fuel needs. The exponential growth of population has caused a sharp rise in the demand for wood and animal dung thereby triggering of a process of rampage by man through forest cutting, uprooting of scrub and bushes, and burning of animal dung. The last of these has denied to the land valuable manure which was so badly needed by its due to depletion of nutrients as a result of cultivation of exhausting crops such as wheat, Millet and cotton year after year. The position of forest area per capita viz-a-viz consumption (Fig 8.1) is also precarious compared to other countries of the world. All in all the fuel demand is the dominent issue in the ecological balance and presents one of the most serious problem faced by the country.

8.13 The per capita consumption of energy is a reflection of living standards, prosperity and economic development of a country. In Pakistan estimated per capita consumption of energy for the year 1985-86 is 0.673 (GOP, 1985[b]). A comparative picture of the production and use of primary energy on a per capita basis in different countries of the world puts Pakistan in a noticeably lower scale (Fig:8.2). Historically per capita consumption of energy in Pakistan recorded a compound growth rate of 4.8 percent per annum between 1960-74 and 7.20 per cent per annum between tons of oil equivalent 1973-74 to 1980-81 (GOP, 1983) it has been constantly on the increase since then. Overall there has been more than tenfold increase in the per capita consumption of energy since independence but it still accounts for only one ninth of the world. 1/42 and of the U.S. and 1/46th of the Norwegian average.

8.14 Inspite of low consumption of energy, the sharp rise in oil prices and the resulting energy crises has added a new dimension to the existing problems of the country's economy. The national bill for import of petroleum rose from 257 million rupees in 1971-72 to 1961 (according to 13.09 Rupees per dollar exchange rate) million rupees by 1983-84 (GOP, 1985[b]). The industrial countries were quick to implement programmes of energy conservation and were also able to pass on the higher cost of energy to both domestic and foreign buyers of their manufactured products. For countries like Pakistan therefore the last decade has seen a major increase not only in thep price of petroleum and other (POL) products but also of imported intermediate and capital goods. Thus the same one metric ton of rice export which could buy 18.5 metric tons of POL or 4.2 metric tons of

158a

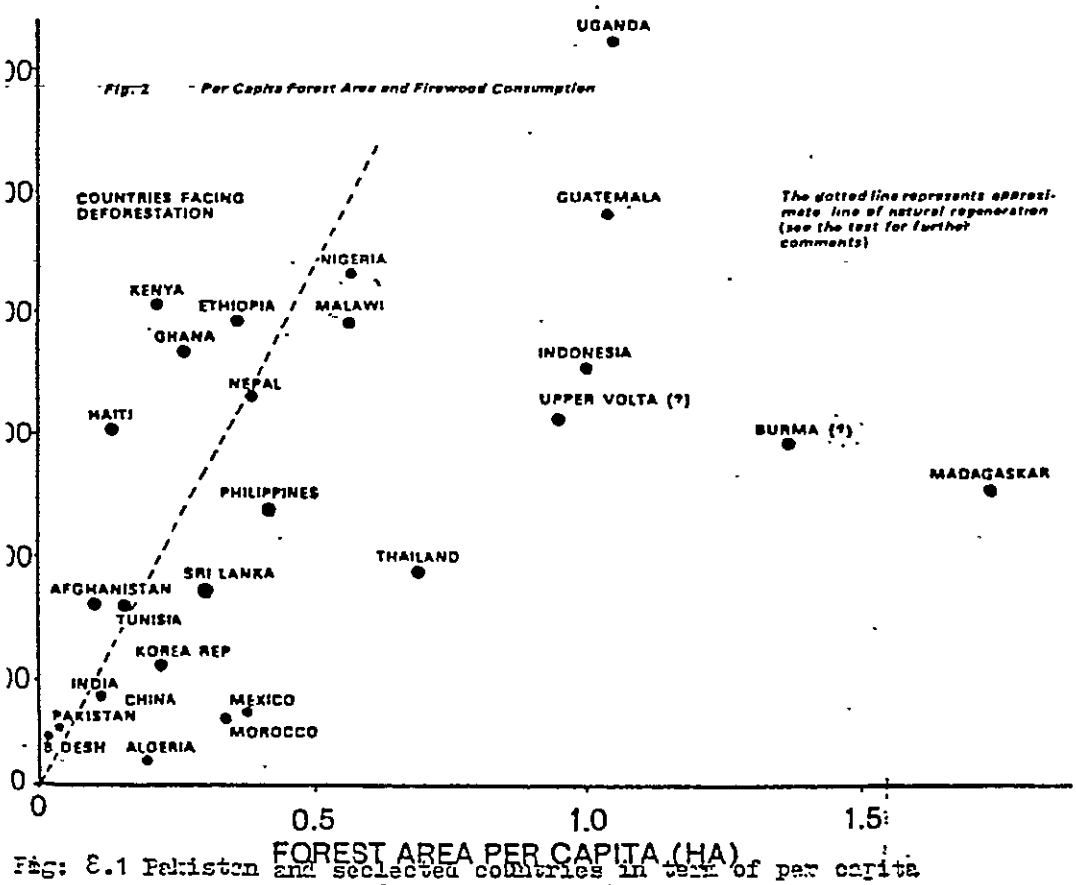

Fig: 8.1 Pakistan and selected countries in term of per capita Forest area and firewood consumption.

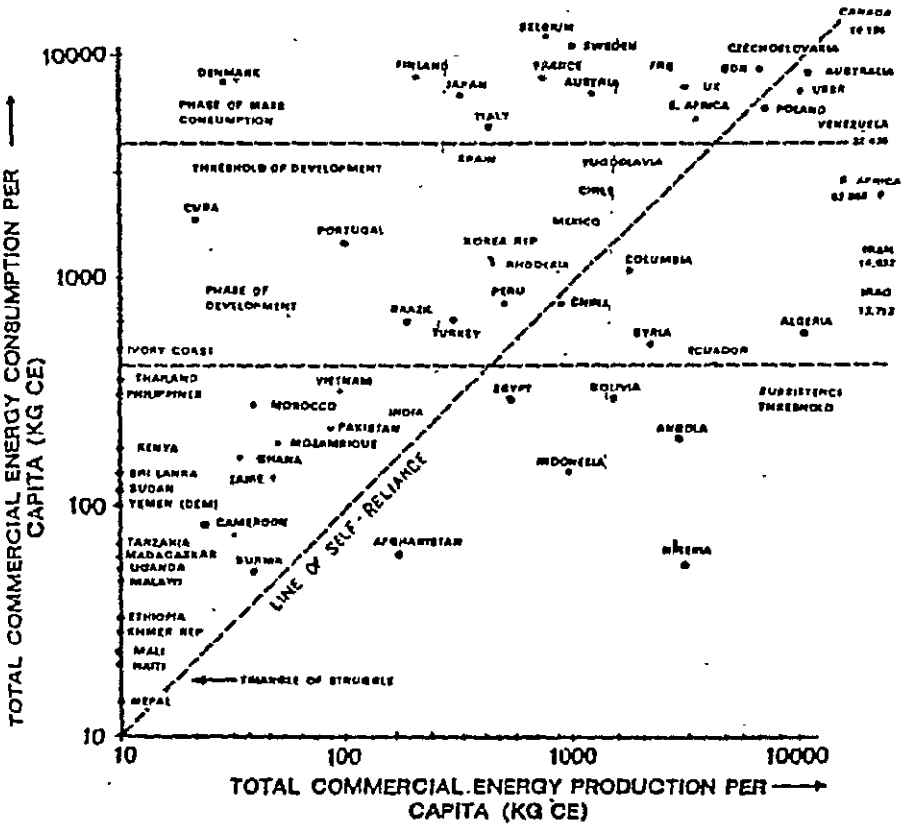

Fig: 8.2

Pakistan Compared to other Countries in Term of per Capita production and consumption of Commercial energy.

chemical fertilizer in 1971-72 was good only for 1.3 metric tons of POL or 1.2 metric tons of fertilizer in 1984-85 (July–March). Likewise where one metric tons of raw cotton export was worth 64 metric ton of POL on 1.2 metric tons of fertilizers in 1971-72, by 1984-85 (July–March), it was only worth 43 metric tons of crude oil or 0.3 metric tons of fertilizers. The current gap in import and export as a result has reached the order of 34.9 billion rupees (GOP, 1985[b]) which would have been far less in 1971-72 prices of petroleum.

8.15 While the affluent nations faced one energy crises due to rise in petroleum prices, Pakistan in common with a number of other developing countries is faced with two serious crises, viz the oil crises and its related complications and the other infinitely more pernicious and demaging crises in availability of the fuel to fast growing population for domestic use. The real crises for the mass of people in Pakistan is the daily scramble to find the fuel they need to cook their food.

TABLE VIII-4

Pakistan: Historical trends in commercial energy consumption

Source	Percentage Consumption by type of commercial energy		
	1947	1971-72	1983-84
Gas	–	35.6	34.2
Oil	37.8	42.9	39.1
Coal	59.1	8.3	7.4
Hydroelectricity	3.1	12.8	18.5
Others	–	0.4	0.9
Total . .	100.00	100.0	100.0

Source: Govt. of Pakistan, Planning Division, (1983) Sixth Five Year Plan (1983–88) Islamabad.
2. Govt. of Pakistan, Finance Division (1985) "Pakistan Economic Survey".

8.16 The total primary energy consumption for the year 1985-86 in the country is estimated at 25.40 million tons of oil equivalent (MTOE). Of this two third are met by commercial energy and one third by non-commercial energy resources, (GOP, 1985[b]). The commercial energy resources are

characterised by sizeable natural gas reserves and substantial waterpower potential but limited known deposits of crude oil, coal or radioactive minerals. A scrutiny of historical trends regarding the use of these energy sources in this country reveal some interesting patterns (Table VIII-4). The most dramatic change has occured in the use of coal, the dependance on which has been drastically reduced, (Mainly because good coal producing areas have gone to India after independence). As opposed to this, the use of gas, which was discovered after independence, has seen a sustained increase. Hydroelectricity is another form of energy, the use of which is experiencing a constant increase over time.

8.17 The end-use consumption of commercial energy (1983-84) shows that about a third is consumed by industries, (Table VIII-5). If power and fertilizer is included within this sector, the total reaches 50%. The transport sector consumes 19 percent while household commercial energy consumption is of the order of 16 percent. The share of agricultural sector is only 5%.

TABLE VIII-5

Pakistan : Total commercial Energy Consumption by Sector

(Unit 000 TOE)

Sector	1971-72	1976-77	1983-84	July–March 1983-84	July–March 1984-85
Residential	615	1,117	2,598	1,956	2,114
Commercial	137	267	538	397	436
Industrial	2,502	2,968	4,836	3,574	3,923
Agriculture	533	583	821	592	698
Transport	1,161	1,679	3,164	2,280	2,362
Power	1,078	1,595	2,592	1,768	2,026
Fertilizer	185	268	758	567	583
Other Government	760	710	1,052	776	772
Total..	6,971	9,188	16,359	11,910	12,914

Source: Directorate General of Energy Resources.

TABLE VIII-6

Pakistan: Average Annual Growth in Energy Consumption 1978-79 to 1983-84, By Source & Sectors

(%p.a)

Sector	Oil	Gas	Coal	Electricity	Total
Residential	0.65	21.64	−6.01	16.74	11.25
Commercial	14.23	8.52	.	13.77	11.52
Industrial	26.38	2.47	6.58	10.49	7.45
Agriculture	−5.17	.	.	8.18	4.13
Transport	6.48	.	.	.	6.48
Power	116.42	5.34	−3.69	.	12.57
Fertilizer[b]	.	17.36	.	.	17.36
Other Government	5.71	.	1.19	10.15	6.92
Total..	9.02	7.14	6.15c	11.87	9.46d

Source: DGER, Energy Yearbook, 1984.
. Not applicable.
a. Excluding Pakistan Steel Mills.
b. Including gas as feedstock.
c. Including imports (mainly for Pakistan Steels), the growth rate was 14.42%.
d. Net of thermal generation.

The current energy production in Pakistan is deficient to meet country's need. The prblem gets especially acute in winter when there are less releases of water from Mangla and Tarbela, the two main sources of electricity generation, due to reduced requirement of irrigation water and closure of canals for maintenance etc. In contrast to limited supply commercial energy demand has grown at a much faster rate (see Table VIII-6) and is expected to continue growing faster than supply. Amongst fossil fuels, the consumption of gas during the Six Plan period is expected to increase from 979 million, cubic feet per day (MMCFD) in 1982-83 to 1,121 MMCFD in 1987-88, a growth rate of 2.7 percent per annum. The supply of gas, on the othr hand, is expected to increase from 692 to 916 MMCFD during the same period (GOP, 1985[b]). Similar demand-supply gaps exist for the other energy sources. If demand-supply integration has to be attained, then there is a need to concentrate on three major issues:

1. The assurance of continued oil and gas supplies from existing and new resources.
2. The speedy implementation of workable measures to conserve energy and to use it more efficiently and economically.

3. Sustained development of all energy sources with emphasis on renewables.

B.2 *Saving the non-renewables*

8.18 The basic aim of any sustained development or conservation policy is to save non-renewable resources and increase the exploitation of renewables. The long term policy of the country should therefore aim at minimal exploitation of exhaustable sources of energy and maximum utilization of renewable and non-conventional sources such as solar, wind, bio-gas and geothermal energy. Efforts should be made to overcome the technical/economic and social problems involved in introducing these technologies to the masses and make them aware of the urgent need to change the age-old energy consumption pattern with the newly available technologies.

8.19 Energy conservation is one of the important priorities of the current energy policy in Pakistan, comprising both price and non-price measures. On the price front, the policy of the government has been to keep kerosene oil prices low as kerosene is consumed heavily by the lower income groups. Retail prices of petroleum products have generally kept pace with international prices, as the government has been pursuing a policy of passing on all cost increases to the final consumer. The latest price increase in June 1984 by 6.9% has resulted in bringing petroleum prices in Pakistn roughly at parity with international prices. Similarly consumer prices of natural gas have been based on a sliding scale, under which different rates are charged from different classes of users. For special customers such as power, fertilizer and cement companies, a two part tariff comprising a fixed charge and commodity charge per MMCFT is prescribed. Unitl 1973 low gas prices were used as an instrument to induce substitution of gas for imported oil. After 1973, however, the government decided to increase consumer gas prices gradually, as part of its policy of rationalizing overall prices to promote conservation. Since 1982, gas prices were raised four times with relatively larger increases for fertilizer, power, industry and larger residential consumers. The objective is to adjust gas prices in such a way that the price factor becomes neutral in the choice of the fuel use by the consumer.

8.20 A number of non-price measures were also taken to regulate energy demand, some of which are reported below:-

(i) During 1983-84 all public sector cement plant were required to convert from the cheaper gas fired kilns to fuel oil fired kilns.

(ii) Fertilizer plants have been asked to schedule annual closures for general plants maintenance during December to March, which are the critical energy supply months.

(iii) An Energy Conservation Cell has been set up in the Ministry of Petroleum to formulate a comprehensive conservation programme.

(iv) Under a World Bank financed project, the public sector consultancy organization NEAR Petrotech Services has strengthened its capacity for conducting energy audits and conservation studies in the industrial sector.

(v) The government has resorted to load-shedding and staggering the working hours of different industries.

(vi) No new industrial plant will be given gas connection until more gas is developed and realistically priced.

(vii) Mari gas would be allocated to the power sector and would not be made available for other uses.

The present efforts are commendable but a lot more needs to be done perticularly to achieve the essential task of delinking economic growth from energy demand and to minimise import dependence through interfuel adjustments or energy mix.

8.21 Oil is the largest source of energy. It is primarily an imported commodity. Of the total oil consumed locally, 90 percent is imported. The current demand for oil and its products are increasing by 10-12 percent every year putting heavy strain on import bills. It is therefore a matter of great importance to formulate and implement strategy for oil conservation. Bulk of the country's oil is used in the transport and household sector. Therefore the first prong of strategy should focus on reductio in oil consumption through adoption of appropriate transport policy e.g. emphasis on most economical freight haul (railroad may be more economical in one area and trucks in another) or preference to public transport compared to private car traffic (Orientation to public transport e.g. Bus can help in transporting more people at lower energy cost compared to private cars). In household sector increasing electrification may reduce consumption of kerosene. The second set of strategy should focus on alternative fuels particularly those

that can be derived from biomass. Ethanol, the Brazition sustitute to the oil problem is a case in point.

8.22 Natural gas ranks second amongst the sources of commercial energy utilized in Pakistan. It is being used mainly as a fuel for the industrial sector and for power generation. The pattern of gas utilizations (1983-84) is as follows :

1. Fertilizer 33 percent. (This also includes the Gas which is being used as feed-stock in the fertilizer sector).
2. Power 24.5 percent.
3. General industry 24.4 percent.
4. Cement manufacture 3.5 percent.
5. Commercial 3.1 percent.
6. Domestic use 11.5 percent.

As gas is a valuable raw material for petrochemical industries, burning it away as fuel is wasteful. The use of natural gas should be encouraged only as feed stock in industry and its indiscriminate use for such purposes as power generation and cement plants should be discouraged.

8.23 Pakistan has large deposits of coal which canbe classified as highly volatile to sub-bituminous with relatively high ash and sulphur content. The coal found in the sharigh field however possesses medium coking characteristics. The estimated coal reserves in the country (including the proven, indicated and inferred reserves) are about 763.10 million metric tons (GOP, 1985[b]). At present most of the coal is being used for brickkiln industry. These requirements could perhaps be partly replaced by using lime-sand or soil-cement building blocks which do not require much heat to prepare. The coal then could be more profitably utilised for fertilizer production and power generation (of course with due cognizance to Environmental impact assessment) instead of the wasteful use of natural gas for producing thermal power. Better quality coal found in small quantities should be reserved for metallurgical and other industrial uses. Extensive research shold be carried out for producing coal gas of high BTU from low grade coal for efficient use of the resource. Besides exploration, exploitation of the coal reserves should be expanded and production from the existing collieries should be maximised. A review of the coal industry needs to be undertaken with a view to critically examining various cost components particularly aimed at increasing productivity and reducing transport costs. In the context of increased oil

prices, the technoeconomic prospects of utilizing the indigenous coal reserves should be reappraised. Also considering the relative cost economics in money as well as pollution terms, the consumption of coal should be increased by switching back to coal from natural gas to meet the fuel requirements of the industry where possible.

8.24 Supply of the electricity in Pakistan is from thermal as well as Hydro-electric plants. At present Hydle power is supplied from the northern grid centre. The major sources are the power plants at Warsak, Mangla and Tarbela. The entire hydro-potential of Pakistan is dependent upon river Indus and its tributaries, namely Kabul. Ravi, Jhelum and Chenab. The theoretical hydro-potential of Pakistan is about 18,000 mega watt (M.W) out of which 2803.54 M.W. is presently being utilized. The use of electricity is dominated by the industrial sector which uses the lion share of the production. All other sectos such as residential agricultural and commercial etc. account for comparatively low percentage, of the total use of electricity. In the agriculture sector, running of tube-wells with electricity has been given a priority in recent years but the growth rate in usage does not exceed the overall growth rate. The thermal power plants cause-pollution and also utilize non-renewable resources. In the short run we may have to increase its generation in view of energy shortages but long terms policy must be oriented towards reduced dependence on this form of energy.

B.3 *Enhancing the renewables*

8.25 Hydel power is the most important single renewable soure of energy which still has potential for expansion except in those cases, where they have serious environemntal consequences for example, flooding of a vast area of habitation. Another source of the renewable energy is the nuclear energy which accounts for about 5 percent of the energy use. The projected economic benefits of the nunclear power plant are relatively high compared to the high prices and scarcity of the fossil fuel. The favourable aspect of the nuclear energy is its lesser dependence on continuous supply of fuel but it requires large initial investments for installation of the plants. However, there are problems of resources, both financial due to the high cost of the plants and of man-power and technological competence to run efficiently and safely a large number of nuclear plants. Another serious problem is the disposal of the nuclear wastes. Besides, there are several limits to the proliferation of the nuclear energy plants. We are still dependent on world sources for such plants and pressures are very great against the potential suppliers. At the global level by the end of the current century, it is expected

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that only about 10 percent of the world's commercial energy would come from nuclear sources. Only a break-through in nuclear fusion could result in a significant difference. Since Pakistan would for that we remain dependent on outside soirces for nuclear power plants, it is therefore relentlessly pursue all avenues open to us to increase our energy supplies from other local sources.

8.26 Non-commercial renewable is also an extemely important component of the overall energy system in Pakistan, more particularly in the domestic and farm sectors. As a sub-system in the overall energy consumption pattern, it is exceedingly important. Dung, firewood, agricultural wastes etc., are gathered by indivicual and processed or stored as part of the overall activity of farming and rural life. The low income group of the urban areas also do the same. The task of fuel gathering is largely manual and with the dwindling of the resources and the increase in population it is becoming increasingly more and more time-consuming and difficult.

8.27 In rural areas, dung is available to the farmers who maintain animals for farm power and for milk. Some urban dwellers also keep animal for commercial purposes. Village population uses part of the animal dung as manure and the rest for domestic cooking and heating purposes, while urban inhabitants utilise it mostly as fuel, except in a few organised dairy farms where it is sold to be used as manure. However, the use of dung as a fuel is robbing the fields of much needed organic manure which has to be substituted by chemical fertilizers. With the exponential growth in population, the use of animal dung as fuel is increasing faster because the commercial sources of energy are getting beyond the financial means of the mass of the people. The drop in the application of farmyard manure to corpland is resulting in the sharp fall of soil fertility which is already very low due to little application of high priced chemical fertilizers, water erosion and leaching of the soil and washing away of the top soil. (GOPN 1976). The replacement of dried cattle dung fuel with bio-gas prepared by fermenting cattle dung and organic farm waste, which provides both energy and manure is therefore an exceedingly high priority area for both extension and research.

8.28 Wood meets half of the total domestic energy requirements in Pakistan (GOP, 1984). Current annual consumption of fuelwood in the country is estimated to be 16.6 millionm^3, of which 90% comes from farmlands and 10% is contributed by state forests (GOP, 1984). The housing census carried out in 1980, reports that 70% of the total households in Pakistan use wood for cooking and heating while in rural areas the

dependence goes upto 80%. Firewood consumed in the country is of two types One of these is the wood gathered from branches of trees and bushes etc, and the other is the wood collected in bulk from the forests. The second type is sold mostly in market and is used mainly in towns and cities. However, in rural areas and hilly tracts, where other sources of energy are scanty or not available people not only cut their own trees but also those which do not belong to them, through illegal means. With the increase in the price of wood, charcoal and alternate fuels, people are indiscriminately cutting and selling trees on a large scale, thus causing extensive deforestation. In the absence of suitable alternate energy sources further demands would continue to be made on firewood. It has been estimated that with the present rate of growth of population and the pattern of domestic energy consumption our wood fuel requirement would increase by 66% to about 30 million cubic meter annually by the year 2000 (GOP, 1984). The community must be educated to understand that this quantity of wood is no longer available and that new resources will have to be created by establishing energy plantations in every locality. Since the people have traditionally un-restricted and free access to grazing, and wood-gathering, they are apt to view the programme of energy plantation with suspicion or even hostility. The state should mount a vigorous educational programme through all available mass communication media and use all public forums for the purpose. Carefully worked out research programmes should also be developed to find out what quick growing species could be planted. The state can provide stimulus, technical adivce and financial assistance but the programme of afforestation would only succeed if the people themselves are involved.

8.29 To meet the target for the year 2000 indicated in para 8.28 above, tree plantation for energy over about 814,000 hectares will have to be raised by 1994 to be available for harvesting by the end of the century. Half of this requirement will have to be met by planting on style lands with expected financial outlay of Rs. 6,125 millions over a period of ten years or an annual expenditure of Rs. 651.2 millions in addition to the allocation made in the 6th plan for afforestation work (GOP, 1984[c]).Since the provincial forestry sector could not afford funding of this kind therefore energy plantations has recently been classified as an activity falling within the energy rather than forestry sector and funding for this purpose is provided out of the Federal Government annual development Programme (ADP). However in order to achieve success it is necessary that:

(a) All waste lands having scope for fire wood production be diverted to and committed to raising energy plantations

through a system of incentives to the land owners. A suitable machinery should be evolved to achieve this objective.

(b) Farmers be encouraged to increase tree planting in irrigated plains (as a part of Agro-forestry scheme) in a more organised and planned manner for which Government may provide extensive technical support.

8.30 Non-conventional renewable sources of energy which are receiving world-wide attention are solar radiation, atomic fusion, synthetic fuel from solids and shales, bio-conversion processes, geothermal energy, wind energy, tidal energy, and energy stored in under-sea currents etc. Most of these sources of energy require considerable research and development efforts to make them economically viable while others involve complex technical operations. Considering the prevailing conditions in Pakistan the use of bio-gas and solar energy appear to offer considerable scope for exploitation in the near future. Development potential of these sources has been outlined below.

8.31 Bio-gas energy: About 50 percent of the animal dung which is equivalent to several million tons of superior quality manure is being burnt as fuel, which can otherwise be saved for use to increase soil fertility. Bio-conversion of organic materials, such as animal dung, farm yard waste, tree leaves, algae and municipal refuse, in a bio-gas plant yields methane gas for burning and the sludge for manure, thus providing a renewable source of energy and fertilizer. Rough estimates show that one ton of dry organic matter can be converted into almost two barrels of oil or about 280 cubic meter of gas and 0.73 tons of fertilizer, through anaerobic fermentation in bio-gas plant (GOP, 1976). A beginning has already been made in Pakistan on the bio-gas plants using animal dung. The nunber of large animals (cattle) in Pakistan is around 29 million*. Theoretically the dung from these animals could supply energy equivalent of approximately nine nuclear power stations of 400 Megawatts. There is certainly the potential to harness energy from about 25 percent of the livestock dropping. If processed through bio-gas plants it will not only yield twenty seven million cubic meters of gas per day but also about 40 million metric tons of wet manure annually.

(*) Beside these live stock population also has 51 million sheep and goat.

8.32 According to estimates (GOP, 1976) about 20 kg of dung is produced by one animal unit. One kg. of fresh dung produces o.05m^3 of gas. The gas required for cooking and lighting needs per person per day is 0.6m^3 and 0.45m^3 of gas is required for an engine per H.P. per hour. Accordingly a farmer with 6 family members having 8 heads of cattle** who installs a bio-gas plant, can meet his energy requirements for cooking and lighting. Besides he can use the gas for running a water pump of 4 H.P. for about an hour a day. Initial cost for the installation of plant, according to estimates can be paid back in a period of 2-3 years in terms of fuel, fertilizer and higher grain production and all through simple, non technical local labour. Therefore wide use of bio-gas plants in the rural areas should be encouraged and government should give subsidies for the purpose on the same Principle on which subsidies were given to the farmers for fertilizers initially. Banks should also be induced to give loans to the farmer for the installatin of bio-gas plants. Another important advantage of installing bio-gas plants is the safe disposal of all sorts of organic wastes. There are more than 100 diseases naturally transmitted between animals and man and dung and manure carry multitude of dangerous micro-organisms. The anaeorobic fermentation destroys all disease organisms and parasites and makes the environment safe for man and animals. The surroundings of the bio-gas plants are free from foul smell, mosquitoes and flies which generally hover on the dung cakes left in the streets for drying. The plants, therefore, could be installed near the residential areas and provide cleaner and healtheir atmosphere. This is an added adavantage to other multi-purpose uses of the bio-gas plants.

8.33 Solar Energy: In a world fast running out of fossil fuels and also highly dependent on them, development of solar energy has great potentialities for the future in the long run. The fuel in this case is free and is not going to run out for a country like Pakistan which is situated in such latitudes that falls within the sunny belt of the subcontinent. Solar energy when converted to heat below 95C° has the efficiency between 40 to 50 percent and can be used for water heating, air heating for crops, fruit and fish drying, desalination of brackish water, industrial process heating, house heating and cooking. Coversion of solar energy for power generation has an efficiency lying between 3 to 15 percent. On the whole, the solar energy can provide between 40 to 60 percent of the total energy requirements but the

(**) In Pakistan most of the individual farmers hardly own 8 heads of livestock, therefore they will have to pool their resources for installation of the bio-gas plant and sharing the benefits.

system has to be boosted up with alternate sources of energy in cloudy weathers. The technical feasibility of harnessing power from the sun is no longer in doubt and the technological possibilities of solar energy are immense. However, the cost involved is still high and the technologies have still to be developed so that the energy can be made available at a cheap price. At present applications of solar energy for domestic cooking and water heating appear quite feasible and should be encouraged. However, significant technical break-through is required before solar energy could be used cheaply for electricty generation to overcome the energy deficit. Exploration of silicon technology may be worthwhile in this regard.

CHAPTER IX

TOURISM

A. A Great Evil or A Great Good

9.1 "Leisure, Mobility and wealth, the growth of all three has contributed to make one of their byproducts–'Tourism'–an importatnt part of world economic, social and physical development. Depending on your prejudice, tourism can be seen as a force for great evil or great good. There are statistics in plenty to back either point of view..... As a destroyer of Fragile mountain ecosystems in the Alps or the Himalayas, as a contributor to inflation, as a disrupter of local life styles, as a cause of marine pollution, tourism can be portrayed as an entirely negative force. But as a provider of employment and scarce foreign exchange for poor countries as a source of income to maintain parks and reserves, monuments and museums collections, and as a preserver of rapidly disappearing skills in arts and crafts, toruism can be seen as a positive force." (Table 1983).

9.2 Tourism is now considered as second most important item in international trade after oil (GOP 1984). The industry is of particular significance to Pakistan from the point of view of its contribution to national income, foreign exchange earning and general economic development. The magnitude of domestic tourism is not available due to lack of precise data in the sector. However, a rough idea can be obtained from the number of trips taken by each mode of transport per annum during 1973 which include 1400 million journeys by road, 140 million journeys by rail and 0.7 million journeys by air, (SEMA-METRA 1974). However, very few of road and rail travellers stay overnight and most of these journeys are made by commuters travelling to and from work. Perhaps a better idea can be obtained from the hotel bednights which were estimated at 2.8 million in 1973 and forecasted to increase to 3.7 million in 1980 (SEMA-METRA 1974). Foreign tourist arrivals during 1984 were recorded at 0.407 million. The share of Pakistan in world arrivals during 1984 went upto 0.136 percent as against 0.124 percent in 1983.

This was possible due to substantial increase of 11.6 percent in arrivals to Pakistan as compared to world increase of only 2.1 percent. Over the period 1972–84, the growth of tourist arrivals to Pakistan stood at 12.3 percent as against 4.3 percent of the World (GOP 1984).

9.3 Mountain lands, fresh water systems and coastal zones are three major ecosystems types in Pakistan that are utilized most extensively for recreational purposes. If managed properly toruism can serve the dual purpose of conservation and recreation of these ecosystems. Wildlife tourism is a case in point. However, studies (UNESCO 1973) show that tourist development has occured to such an extent in some ecosystems (e.g. Mountains) that it has resulted in numerous environmental problems and in certain cases the demage has reached a critical stage. Thus very careful attention need to be given to utilization of varied ecosystems as foci of tourism and recreation. The factors that require special consideration in this regard are the assesment of the tourist carrying capacity of varied ecosystems, interaction between tourist and native population, social and medical aspects as well as impacts of tourist industry on environment e.g. upon wildlife, vegetation, water quality etc.

B. Toruism and Development

9.4 Tourism was first thought of and used as a vehicle of economic development after the second world war (GOP 1977). Today it is a major international activity, one of the largest and fastest growing elements in world trade when measured in terms of gross receipts from visitors spending. There are several positive aspects of the tourism development particularly for traditionally agricultural economics like Pakistan needing to generate foreign exchange to finance their economic development. According to Soviet statisticians average profit from one tourist is equal to the export of nine tons of coal, fifteen tons of oil or two tons of grain. This reveals the significance of tourism as a source of foreign exchange earnings (GOP 1977). Receipts from foreign tourists in Pakistan amounted to 201.6 million U.S. dollars in 1983 accounting for 0.7 percent of the GNP. The tourism receipts in the country have increased more than twenty times since, (Table IX-1) while the ratio of tourism receipts to GNP has more than doubled during the same period indicating a better performance of this sector compared to others.

TABLE IX-I

Pakistan and World Tourism

Year	Pakistan				(c) World			
	(b)Arrivals (000)	Percentage Change	(a)Receipts (Million US $)	Percentage Change	Arrivals (Million)	Percentage Change	Receipts (Billion US $)	Percentage Change
1972	101.0	–	10.6	–	181.9	–	24.6	–
1973	141.9	40.5	18.9	78.3	190.6	4.8	31.1	26.4
1974	154.5	8.9	20.8	10.1	197.1	3.4	33.8	9.0
1975	172.0	11.3	32.3	55.3	214.4	8.8	40.7	20.4
1976	197.3	14.7	40.6	25.7	220.7	2.9	44.4	9.3
1977	220.4	11.7	60.4	48.8	238.2	7.9	55.1	24.1
1978	291.5	32.2	82.9	(c) 37.2	257.4	8.1	69.7	26.5
1979	318.6	9.3	100.0	(c) 20.6	272.0	6.1	83.2	19.5
1980	299.0	(–)6.1	153.9	(c) 54.0	284.3	4.1	97.0	16.6
1981	290.2	(–)3.0	128.2	(c)(–)16.7	287.4	1.2	97.7	0.7
1982	313.7	8.1	187.0	(c) 45.9	285.1	(–)1.0	94.2	(–)3.6
1983	365.1	16.4	201.6	(c) 7.8	(c) 293.8	3.0	(c) 96.2	2.1

Source: (a) State Bank of Pakistan, Karachi.
(b) Interior Division, Government of Pakistan, Islamabad.
(c) Regional Breakdown of W.T.O. (Ed. 1984).

9.5 Role of tourism as an instrument of regional policy is no less impc tant. It can help in achieving an equitable balance between developed ai lagging regions through income transfer. Paradoxically in Pakistan tl areas regarded as most attractive from the point of view of scenic beau e.g. mountainous areas. also lag behind in the pace of economic growt Tourism can play a vital role in the development of these areas. It cr particularly be used as an effective mechanism for generation of emloyme for semi-skilled and un-skilled people of such areas in abundance. As labour intensive industry, a major advantage of tourism is that it requires le capital for job operation. Besides it is easier to attract foreign capital tourist industry as compared to other economic activities. Hence apart fro adding to national prosperity, the industry can promote much need interntional liquidity for investment in backward regious.

9.6 A major advantage of tourist industry is that it depends on le exhaustible resources. Thus historic monuments, pleasant scenary, goo beaches, sun or snow and nountains which are valuable assets to tour. economy, are less exhausttible as compared to more tangible resources su as oil wells and gold mines. Pakistan is rich in these less exhaustible resourc The country is dotted with historical wonders, archeaological remains ai great scenic beauty. More than half a dozen civilization have flourished the areas now constituting Pakistan, each leaving behind its footprints on t sand of time (GOP 1984). Some of these civilizations are as ancient as tho of old Egyptian and Inca civilizations and offer attractions no less in vali to visitors both local and foreigners who throng to these places in thousan and marvel at their antiquity and beauty.

9.7 Amongst other benefits of tourism are the facts that it can be us as a mean of conservation through such efforts as establishment of natior parks and preservation of historical monuments etc. Moreover, the indust can be of great help in promotion of better understanding between peop of different parts of the county, on the one hand and between native popul tion and and foreign tourists on the other.

9.8 Much of the original attraction of tourist areas are natural scer grandeur and low population density. However, in some parts of Pakista e.g. Murree and Abbottabad the tourist industry has developed to such extent that these two original qualities are being compromised and degrade Furthermore. this degradation is accompanied by serious detrimental affec on the ecosystem themselves including damage to vegetation, wildlife ar

water balance. The high intensity of tourism in these areas is further resulting in pollution and depression of the original local communities and also increasing natural hazard potential due to inadequate planning of new buildings and communication systems in the fragile mountain ecosystems. Scenically, prime areas in other ecosystems, especially those proximate to major population centres are increasingly presenting similar problems. Future tourism development without careful regulation can undoubtedly lead to many environmental disruption which may become irreversible, at least in the short term. Haphazard development may imperil the very purpose and objectives of the tourist industry and produce a lowering of aesthetic and financial values, at the same time, inducing the spread of long-scale tourist development to new areas, this resulting in further degradation.

C. Tourism and Environment

9.9 Tourism activities include winter sports, camping hiking and mountaineering, summer touring, hunting and swimming, water sports and fishing. These various recreational activities have different impact on the environmment. They may compete with each other in their demands upon ecosystems. More crucially perhaps, they may often prove to be incompatible with such activities as water and power production, mining and agriculture, and also with conservation. Specific damage in mountain ecosystem is concentrated in the especially vulnerable treeline zone, in the lower valley floor area and in the river systems where attendant downstream effects are produced. In acquatic ecosystem it may seriously impair the water quality. In addition, an important feedback mechanism may be involved in the saturation of so-called 'safe' aras. The Possibility of disastrous losses in human life and property is increased as more and more buildings and communication systems are constructed in areas that were carefully avoided by the original farming and fishing communities; these include areas subject to floods avalanches, mudalides, landslides, land creep and rockfall. As essential prerequisite for any detailed analysis of this problem in Pakistan is the preparation of a series of case studies that will provide documentation for areas where optimum tourist development and over-development have already occured. These should be selected to include different types of natural areas with contrasting types of primary recreational activity. This should also be accompanied by an inventory of areas relatively little used or even unused that might, in the near future, become foci for large scale development. In addition, it would seem advisable to identify areas of remnant original cultures of unusual, aesthetic value as objects worthy of preservation through zoning, special land-use planning and possible financial subsidy.

Skiers Walkers.	Extreme Transit (Passing through, day trippers, overnight stoppers, etc.)
Hunters Fishermen.	Campers
EEI Tourists (Extreme Energy Input, e.g. use of helicopters in high mountain areas)	Caged Tourists (Confined to hospitals, hotels, etc.)

Fig: 9.1 Type of tourist.

9.10 Efforts should be directed towards quantification of the concepts of 'aesthetic value' and carrying capacity and research to identify ecosystems or parts of ecosystems of a particularly fragile nature. Moreover, impact of various types of tourist should be identified by the dominant role of characteristic which most influences their ecological behaviour and attitudes (Figure 9.1). The most important factor is purpose (ski health, hunting, etc.) but other factors may be significant, *e.g.* residence (hotel, motel, camp, etc.) duration of stay, or socio-economic status (related to high energy input, even such things as deviance). The basic object is to investigate the values (including aesthetic and recreational values), needs and behaviour of different types of tourist. In particular, it is necessary to find out what are the social correlates of different types of tourist activity in so far as they relate to the ecosystems.

9.11 In mountin ecosystems two different types of tourism can be distinguished: Sightseers, and treakkers and mountaineers. The number of tourist of both types is increasing each year, but it is the former which is increasing more rapidly. Throughout the region the trekking parties and mountaineering expeditions alter the environment in various ways. The major threat comes from deforestation to meet the need for firewood. The amount of additional wood needed is significant. The data for Pakistan is not available, but a case study in Nepal revealed that 1,000 per year of firewood is collected along the trekking routes. The study further observed, 'hard pressed by the food requirements of the unorganised trekkers, the local people have been going for extensive hill agriculture. These people are thus unscientifically cultivating the lands which had been carefully avoided by their forefathers who had learnt with time to keep harmony with nature and did nothing to disturb the balance with the local ecology (Shresta 1976). The case in Pakistan is not much different. Empty tins, cans, broken bottles and glassware, plastic waste, trash and garbage left behind by trekking

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ties is further deteriorating the environment. The traditions and culture mountain people are also being effected adversely by the tourists. Irre-sible changes in their outlook, social behaviour and religious sentiments e become inevitable. The simple hearted people in the past had on rare asions a traveller stopping in their village and hence treated him as an ›ortant guest and provided him with free food and shelter. But now in al-Himalayas they are often compelled to provide charity to many 'poor' :kers who so frequently cross their locality. It may be mentioned here t many tourists have settled permanantly in Swat valley. Drug addicts quite common amongst these settlers.

2 As food, firewood and daily necessities are becoming scarcer to the .l people themselves, due to the larger demands of these items by ever easing number of tourists in mountains the prices of commodities have e up considerably. The majority of the trekkers and all the mountaineer-expeditions can buy firewood at inflated prices (or even carry all their if asked to do so) but not the local inhabitatnts. They therefore, go nst "forest protection laws" and the traditional understanding and :rol of "Collecting only dead wood from the forests'. Thus the easily ssible forests within the vicinity of these people are being gradually royed. Even the wood for construction of buildings and huts is getting :e and expensive.

A very important effect of tourist industry is the initiation of relati-large proejects involving construction of buildings, roads, infrastructure These projects have their own environmental impacts. No effort, as yet, been made to evaluate these adverse effects of these projects not even in ; which are relatively fragile and subject to irreversible changes.

TABLE IX-2

›me Recreational Activities and their Impact on Mountain Ecosystem

›ities	*Impact*
rt Building	Destruction of valuable.
Construction	Agricultural land or natural communities.
g, walking, camping hunting	Intensification of loal pressures of human use system. (food energy). Distribution of Wildlife Increase in natural hazards.

Increasing flow of good and traffic.	Landslides, rockfalls, etc. Unnecessary predator destruction. Alteration of River and water ecology.

9.14 The coastal ecosystem is another major area of tourist attraction in Pakistan. However, the open coast beaches are also being degraded both by tourist and other sources. Empty cans and solid waste are increasingly seen along Clifton and Manora beach dumped in those areas by picnic parties. Liquid and solid wastes discharged by ships in the coastal waters are also being transported by waves and tidal currents to the exposed coastal beaches such as Manora, Sandspit, Hawkesbay, Paradise Point, Buleji and Cape Monze. During the Southwest monsoon when the seas are rough and winds are blowing at high speeds, an occasional cargo ship may drift ashore and become grounded on the sandy open coast beaches. Explosion and fires have broken out on such ships leading to the spreading of chemical substances medicines, glass jars, plastic cans as well as oil on the open coast beaches and the sea wall marring the aesthetic beauty of the beaches temporarily (KDA 1981). Serious pollution control measures are necessary to safeguard the scenic and aesthetic beauty of these areas of reat value for tourist industry.

9:15 An overall analysis of past trend of tourism development in Pakistan shown a lack of ecological planning. Development has already been radom and many feasibility studies have been undertaken without ecological guidelines with the result that the projects have failed to produced desired result. The present tourist potential of the country has only partially been utilized and future pressures on other sources may compel the planners to use this resource more intensively. This enhances the need of ecological planning, a great deal. Experience from developed countries like Switzerland shows that large scale development of tourism can bring with it a number of environmental problems. It is therefore, imperative to determine the scope of these problems and to explore methods whereby the benefits of tourism may be realised without excessive environmental and social costs.

A key factor in striking a balance between tourism and the environment is to ensure that tourist development should be related to the carrying capacity of resources. The assesment of carrying capacity and the balancing of levels of tourist development and activity with that capacity are the vital means of preventing environmental damage, protecting resources and securing the continuance of the long term profitability of tourism itself. 'Reconciling tourism with enviornmental protection starts with the responsible behaviour of the individual tourists, extends to the tourist industry, and rests ultimately with the Government' (Tolba, 1983).

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GOP : Government of Pakistan.
KDA : Karachi Development Authority.

CHAPTER X

INSTITUTION AND LEGISLATION

10.1 The development of environmental institution and legislation is a reflectio of conciousness of a nation towards its environment. It is a well documented fact that economic development must incorporate environmental considerations if the quality of life in its broadest sense is to be improved (ESCAP, 1984). An administrative and political recognition of this reality has been expressed in two different ways (a) The development of government and non-government institutions (b) the enactment of legislation. Whereas the development of environmental organisations indicates a general concern about environmental quality, environmental legislation is a concrete methodology through which environmental policies can be implemented. Legislation is also a measure of political power that environmental institutions can wield in their efforts to protect the environment. Indeed environmental institutions and legislation reinforce each other and in the process each becomes more effective.

A. Institutional Development

10.2 The important national institution s in Pakistan which play or can play significane role in safegarding the environment can be broadly classified into three categories. (a) the government organisations (b) The political institutions such as local bodies. (c) The non-government organisations (NGOs) Internationally Pakistan is a member of a number of inter-governmental organisations that have been established to safeguard regional and global environment such as UNEP (United Nations Environment Programme) SACEP (South Asia Cooperative Engironmental Programme) ESCAP etc.

10.3 At governmental level there are two types of organisations in Pakistan. First of these are the ones that have been established solely with responsibility of environmental protection. The Environment and Urban Affairs Division in the Ministry of Housing and Works is the principal organisation of this type. It is responsible for planning activities in relation to the environment, pollution and Ecology. It was through the initiative of this division that Environmental Protection Ordinance of Pakistan was promulgated in December 1983. Among other things the legislation has provided

for the creation of a National Environmental Council and an Environmental protection Agency in the country. The council would be headed by the President and provide leadership and general policy guidance for the direction and co-ordination of environmental programmes whereas the agency would enforce the regulation and standards for controlling pollution and protecting the environment. The second type of governmental organisations are concerned primarily with resource augmentation and conservation. The examples of these organisations are line departments and other agencies such as Water and Power Development Authority (WAPDA) of Pakistan, Geological survey of Pakistan (GSP) Pakistan Forest Institute (PFI) Atomic Energy Commission Pakistan Agricultural Research Council (PARC), Provincial Forestry and Livestock departments etc. Many of these institutions carry out survey's monitoring and research work of great relevance to environmental protection. However, there is a lack of co-ordination between these departments. Amongst line (sectoral) departments, bye and large, each agency has gone about pursuing isolated task. If one department is engaged in establishing energy plantations in an area, another is pursuing programmes of sheep and goat rearing and a third in introducing new horticultural crops (GOP, 1976). The policies and programmes have been sometimes conflicting and contradictory. Attempts have been made, from time to time, under a variety of programmes from rural reconstruction to Integrated Rural Development, to co-ordinate functioning of different governmental agencies. Such programmes are always viewed by existing vertically oriented technical departments and services as a threat to their power structure (GOP n, 1976). Beside other thing, this has has been a major factor responsible for lack of co-ordination between research, policy making and implementation of co-ordinated programmes, resulting in waste of resources and little achievement in environmental protection efforts. It is very likely that the same would continue unless the need to safeguard our scarce resources and environmental protection are established as the prime national goal, above all departmental/technical objectives.

10.4 It would be difficult to envisage widespread horizontal integration without strengthening local and regional institutions even for the executions of projects or programmes of national scope. It must also be realized that there are serious difficulties involved in assigning responsibility for integrating all relevant dimensions about environment within a single organization (for example an agency or public enterprise) which has traditionally held a rather narrow brief-say, entrusting all questions pertaining to the rural environment to an agency hitherto responsible only for food and agriculture: the consequence would inevitably be that one point of view would dominate

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: others. A better solution would be to establish joint responsibilities ong various sector-oriented organizations representing several points of erest, and to foster co-operation among them in order to prevent serious ılries.

.5 Inspite of highly centralised political and administrative system der which Pakistan's economy has functioned since independence, the portance and need of spatial decentralisation and the creation of institu-ıns for planning and implementation of policies and programmes at gional level, at times, have been well appreciated by the national planners han, 1983). Efforts have been made to create the planning and implemen-tion institutions at the regional and sub-regional levels and to delegate em powers to decentralise the planning and development process in the ıntry. Some measures were also taken to delegate decision making and ıancial powers to subordinate units of government and to transfer certain evelopment functions to autonomous/semi-atonomous public organisations. easure have also been taken to promote devolution through local govern-ent institutions. However these measures need considerable strengthening. ost of the past efforts have failed to give desired results because of varied ason. In some instances they have resulted in the creation of too many gencies promoting dilution of finances and inter-departmental rivalries, in ther cases lack of statutary powers (the present local government system is ot recognised as an indepent tier in Pakistan's constitution and derives its ower from the goodwill of provincial legislature) and financial resources ave been the major bottlenecks. It is extremely necessary to give serious ttention to these problems and evolve desirable solutions for effective unctioning of planning and development at local and regional level.

0.6 Whatever solutions are adopted the comprehensive integration of nvironmental considerations requires a contextual approach. This approach ecognizes the interdependence that exist between activities in separate ectors. In practice the realization of the objectives of one sector depends as ıuch on the performance of other sectors as on its own performance. The ontextual approach to environmental problems thus consists in elucidating he environmental policies that are implicit in the various sectoral options, ocating the key factors, analysing the possible contradictions between mplicit policies and explicit environmental objectives, and specifying the ılternative contextual course of action required to head off or soften these contradictions (Godard, 1982).

10.7 The specificity and diversity of environmental problems confer great importance on regional and local dimensions of development. Decisions

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made at the national level should not be permitted to inhibit the freedom of action that is necessary at regional and local levels to take the environment into account effectively. This is why consideration of the environment itself leads to the establishment of new relationships between levels and ipso-facto to a reconsideration of which decision making levels are the most appropriate. The problem of the relationship between decision making levels is often tackled through an adjustment in the degree of decentralization. The centre has the responsibility for the decisions that are of regional or national consequences in terms of their impact or resources involved, while at the local level decisios with local consequences are made. Many people imply from this that the environment is principally or exclusively a metter of local interest. This is not true as many decisions at the local level have long term impacts on regional and national levels. For such decisions the problem is not one of knowing at which level to assign responsibility, but rather by what means the different planning levels may be co-ordinated in order to ensure that the decisions take account simultaneously of the interests of the local, regional and national levels. A good example of this is water resource management that involves issues such as sharing of water and preserving the water quality upstream to assure clean and pollution free supplies downstream. Conversely some management problems can only be tackled at the local level. Example of these are such municipal functions as waste disposal facilities, drinking water supplies etc. Nevertheless, even these sometimes, become matter of dispute between local authorities in cases where waste generated in one area is disposed off in another. It is therefore necessary to have vertical and horizontal cooperation and consultation between various agencies and parties concerned at different levels.

10.8 Government functionaries play important role in environmental management, but for any permanent gains emphasis must shift from the government functionaries to people's institutions and local communities motivating and organising, them to promote self sustained growth without causing undue harm to the environment. The valuation of suitable strategy for community participation and sustained development at grass root level has been the subject matter of serious consideration both at the Federal and Provincial level for a long time in Pakistan. It was in the early fifties that the nation lunched its first major programme of community development, known as Village Agriculture and Industrail development (village Aid) for motivation, self help and self reliance. No effective evaluation of this programme has been made. In the sixties, it was replaced by the Basic Democracy institution. Some experts have have credited this programme as "Successful innovation in grass root development". Its achievements are

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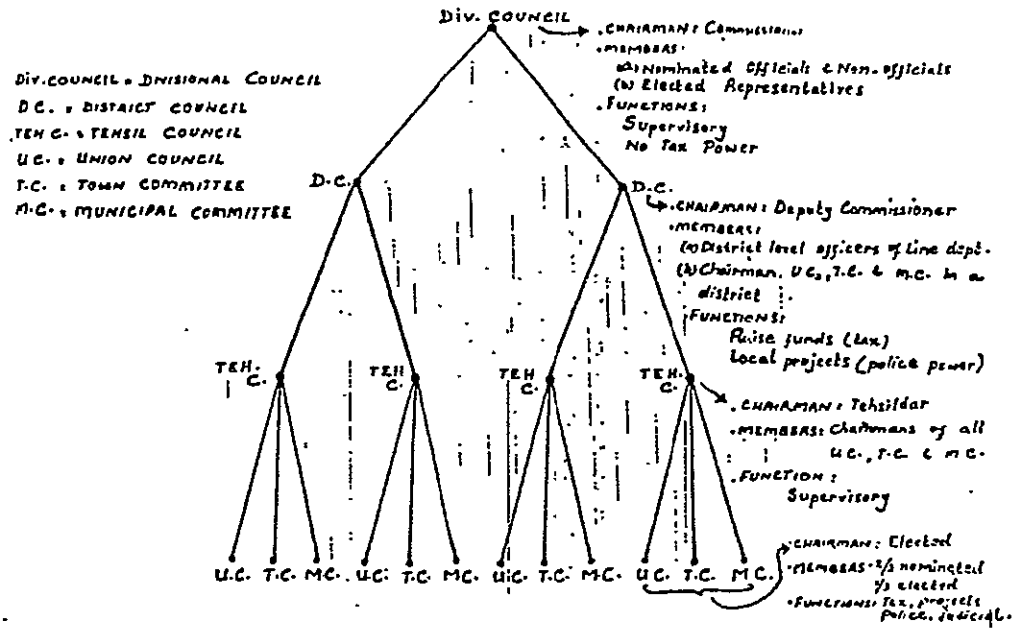

Fig: 10.1 Structure of Basic Democracy.

listed in the completion of 60,000 projects, mobilisation of local contribution to the extent of 25 percent of the cost of the projects, creation of an awareness about development needs and administrative flexibility. This was a begining towards local self administration to a small degree because above the tier of union council (grouping of 5-10 villages) all chairman were appointees of the government (fig:10-1). However, country-wide mass mobilisation was started during this scheme (Imam, 1983). The main cause of the demise of this institution was its use as an electoral college which negated the main emphasis from development orientation to being used towards political structure (Imam, 1983). In seventies, the concept of growth with social justice led to the promotion of integated Rural development Programme in Pakistan which was primarily based on "growth centre" and "target group" approach. (fig:10-2). The programme was supplemented by a seperate works programme known as people works programme. The overall impact of both I.R.D.P. and P.W.P. on the quality of life was insignificanet (Imam, 1983).

10.9 An exhaustive analysis was carried out at the begining of the Fifth Five year Plan to evaluate the concept of rural development and grass root planning. It was found that poverty was the result of low income which was the outcome of low productivity. Families that were least productive were mostly found in agriculture. The conclusion arrived at was that there was no ready made pre-fabricated formula for achieving a break-through in our rural production. It was noted that the I.R.D.P. with its package deal and area development appraoch had the necessary ingredients of a viable strategy to revamp the rural economy provided it was implemented through representative local institutions and that the works programme was made an integral part of the system rather than allowing it to run parallel and become counter-productive. An important factor emerging out of this analysis was that, "not withstanding the best intentions, economic well being cannot be attained unless the programme is supported by democratic institutions where the people's representatives can articulate their views, involve themselves in planning and implementation of development activities at the commonly known grass root level ("Imam, 1983).

10 10 The fifth Plan (1978 -83) introduced a new grass root development programme—"with its package deal and area development approach with the necessary ingredients of viable strategy to mobilise the local resources, improve the local economy and promote sustained development through duly elected local councils" (Ahmad, S. 1983). In rural areas, there is a union council with about 10 villages. At the middle level there is a provision

for Markaz/Tehsil/Taluka council covering an area of 50–100 village (although some provinces e.g. NWFP and Sind have decided not to have them). The district level is the top tier which is not only coordinatory but also policy making andmonitoring tier. Separate urban councils have been inducted in towns and cities to manage the local affairs within their limits. Altogether 54,811 elected councillors were inducted into office in 1979– in 83 district councils, 3,656 union councils, 12 Municipal Corporations, 108 Muncipal Committees, 273 Town Committees and 35 Cantonment Boards (Imam, 1983). No doubt creation of this kind of local government institution was the great necessity of the time but it is only the first step on a long path. It is imperative to help this infant institution function properly and ge deeply entrenched in our planning and development process. If provided with the right orientation, the institution can become a major vehicle of sel sustained development and environmental conservation. It can be used effectively to disseminate environmental education and create public aware ness to prevent misuse of resources and uplift the quality of life throug improvement in public hygiene and health as well as recycling and prope disposal of wastes.

10.11 Beside local government other community institutions including non government organisations (NGO's) should also be allowed to play effectiv role in promoting environmental cause. The programme of environmenta safeguard is so vast in scope that it needs utilization of every available effor whether it is from a government functionary. local body, NGO or a ordinary citizen. Experience in Pakistan reveals that non-governmen organisation can be quite effective in slum upgradation schemes within urba areas. Orangi project (Khan A.K. 1984) is a case in point. It is also im perative to learn from the experiences of the development authorities i winning community participation in uplifting areas/neighbourhoods i different cities. Lessons from Lahore Faisalabad (Khan S, 1984) and Karachi can be very useful in this regard.

B. Legislative Development

10.12 Pakistan, has had a long tradition of environmental legislation, whic it partly inherited from British India. Land tenure and use, forestry, can irrigation, wildlife protection, energy development, pesticide use, and noi pollution have all been regulated to some degree in past.

(*) Lahore Development Authority and Karachi Development Authority have published su stantial literature for their own cities respectively.

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10.13 During the 19th century British administration engaged in numerous projects relating to arboriculture and forest management. By 1894 the Government of India had formulated an explicit policy concerning the use and control of the subcontinent's then shrinking forests. In 1927, India was provided with its first comprehensive legislation, "the Forest Act". The statute sought to "consolidate the law relating to forest, the transit of forest produce and the duty leviable on timber and other forest produce". With two subsequent amendments, the West Pakistan Goats (Restriction) Ordinance of 1959, and the West Pakistan Goats Restrictions Rules of 1961, the Forest Act remains Pakistan's principal legislative instrument controlling forestry. The Act of 1927 empowers the government to set aside forest reserves, appoint officers charged with the management of those territories, enforce rules governing the use of forests, determine the degree to which timber and other products may be exploited, and regulate the movement of cattle upon these lands. Moreover, the Act authorizes the government to punish violators of the stipulation contained therein. The 1959 and 1961 goat restriction ordinances recognize the damange incurred to rangelands by limitless grazing of goats. Accordingly the government has been empowered to limit the number of goats in the country and to regulate their movement (Ahmad C.H. 1975). More recently, passage of Firewood and Charcoal (Restriction) Act of 1964 limits the burning of firewood and charcoal. Similar legislation regulating forest use exists at the provincial level. (Annexure X-1).

10.14 The legislation pertaining to hunting goes back to Mughal period. The Mughals (A in-i-Akbari) has codified regulations pertaining to hunting. The Sikh and British rulers who succeeded the Mughals, also found of hunting, continued these policies. In 1860 the Criminal Code out-lawed the killing or maiming of any animal whose value exceeded ten rupees. The statute, moreover, extended protection to demosticated animals such as elephants, camels, horses, mules, buffaloes, bulls, cows, or oxen (Pakistan Penal Code 1860). These laws were incorporated into the criminal procedure Code in 1898 and have been maintained ever since. By the twentieth century with faunal populations coming under increasing threat of elimination, the British government enacated the Wild Birds and Animals Protection Act of 1912. This law has remained in force and has served as a model for provincial local legislation adopted after independence. List of legislation concerning wildlife is quite long. It has been given in (Annexure X-1). It limits hunting to certain areas, to non-breeding seasons, to licensed individuals, and of non-endangered species.

10.15 Legislation affecting water use closely followed the construction of canals during the 1860's. The Canal and Dramage Act of 1873, and the Punjab Minor Canals Act of 1905 are the earliest statutes governing the implementation of irrigation in the Indus basin (Annexure X-I) lists other pertinent legislation). These act govern canal use throughout the remainder of the British period, and with amendments have continued in force since independence. A factory Act however unsatisfactory it may be had also existed. Legislation for soil reclamation 1952, land reforms (Annexure X-I) Noise (1965) and pesticide use were promulgated after independance. The last of these regulates the use of pesticides in the country through an Agricultural pesticide Ordinance of 1971 and Agricultural Pesticide Rules of 1973 which require that all products must first be registered with the government before being marketted in the country. The law requires that in order to qualify for registration, candidate pesticides must first be cleared by a Federal Pesticide Laboratory by confirming the claims made by the applicants in respect of chemical and physical characteristics of their products. Subsequently, field trials for two crop seasons are conducted by provincial agricultural research personnel in collaboration with promotors of the products against the claims preferred. These data are scrutinized by two committees before a product is finally approved for registration. The whole process consumes nearly 2-3 years. Starting in October, 1973 todate, 182 products have been registered for use in Pakistan.

For selecting pesticidie for manufacture, the government of Pakistan set before it, in 1964, the following Criteria :—

Effectiveness 40%:

The pesticide should have wide range of activity and should be capable of providing minimum 80% control of pest against which it was used.

Hazards-Toxicity 27%:

The insecticide s should be safe to handle for the workers and its fish and bird toxicity should be nil at the recommended doses

Tolerance 8%:

The pesticide should be safe from the consumer's point of view on the basis of residues left on food and food products after spraying

Phototoxicity 3%:

They should be non-phototoxic when used.

Accumulative toxicity 7%:

The pesticide should not possess any accumulative hazards to mammals and should break down to non-toxic substances after serving its purpose.

Economic 15%:

The cost of the pesticide should be within the reach of the farmers.

10.16 These acts/ordinances act did not cover all eventualitie and many aspects of environmental degradation remained uncontrolled and under-regulated. Mineral developers for example, were not required to restore ruined land by any of these legislation. Similarly toxic substances apart from pesticides were neither categorised nor any provision existed for their control. Likewise offshore pollution and solid waste disposal was left without control. Above all there was an urgent need for enacting a comprehensive legislation to safeguard the national environment. This major task was achieved through the enactment of Pakistan Environmental protection ordinance 1983 (GOP, 1983). The ordinance has provided for the creation of an institutional base in the form of the Pakistan National Environmental Council and an Environmental Protection Agency with the following functions.

10.17 *Functions of the National Environmental Council.*

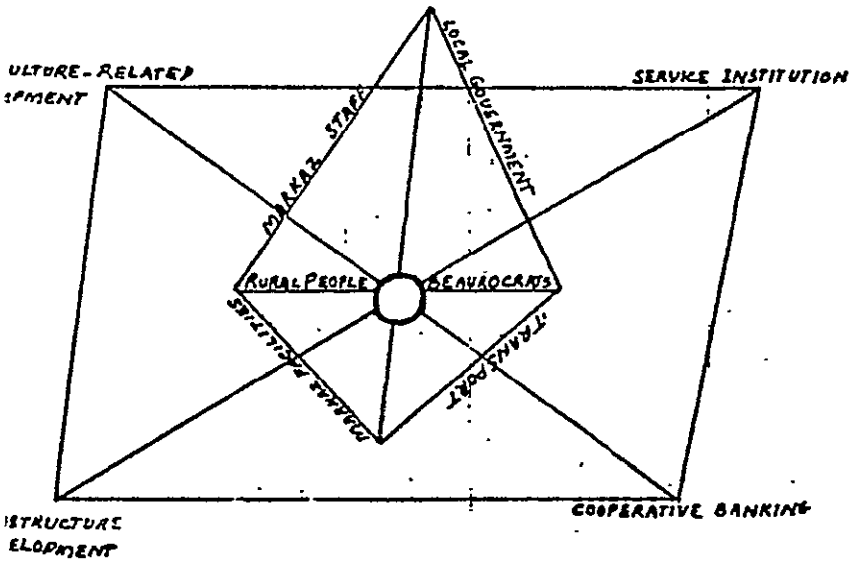
(a) Ensure enforcement of the Environmental Protection Ordinance of Pakistan.
(b) Establish comprehensive national environmental policy.
(c) Give appropriate direction to conserve the renewable and expendable resources:
(d) Ensure that environmental considerations are inter-weaved into National Development Plans and Policies.
(e) Ensure enforcement of the National Environmental Quality Standards: and
(f) Give direction to any Government agency, a body or a person requiring it or him to take measures to control pollution being caused by such agency, body or person or to

refrain from carrying out any particular activity prejudicial to public interest or the purposes of this Ordinance.

10.18 *Function of the Environmental Protection Agency.*

(a) Administer this Ordinance and the rules and regulations:
(b) Prepare national environmental policy for approval of the Council:
(c) Publish an annual report on the state of environment.
(d) Establish National Environmental Quality Standards with the approval of the Council.
(e) Revise the National Environmental Quality Standards as and when deemed necessary:
(f) Coordinate environmental policies and programmes nationaly and internationally:
(g) Establish systems for survey, surveillance, monitoring measurement, examination and inspection to combat environmental pollution:
(h) Take measures to promote the development of science and technology which will contribute to the prevention of environmental pollution, such as the consolidation of survey and research system, the promotion of research and development, the dissemination of the results of such research work and development work, and the education and training of research experts and other governmental functionaries :
(i) Provide information and education to the public on environmental matters and to recommend to the council the introduction of environmental information in the syllabi of educational institutions; and
(j) coordinate and consolidate implementation of measures to control pollution with provincial Government and other Government agencies.

10.19 The ordinance also has provision for Environmental Impact assesment. The legislation quotes "Every proponent of a project the construction of which is likely to adversely affect the environment shall file with the Agency (Pakistan Environmental Projection Agency) at the time of planning the project, a detailed environmental impact statement including information on (a) the impact on the environment of the proposed industrial activity (b) the treatment work of the proposed project (c) the unavoidable adverse environmental effects of the proposed project (d) the steps proposed to be



FUNCTIONS:
1. DISTRIBUTION
2. DECENTRALIZATION
3. DEMONSTRATION
4. ORGANIZATION
5. COORDINATION
6. MOTIVATION

Fig 10.2 I.R.D.P. Structure and Functioning of a Markaz.

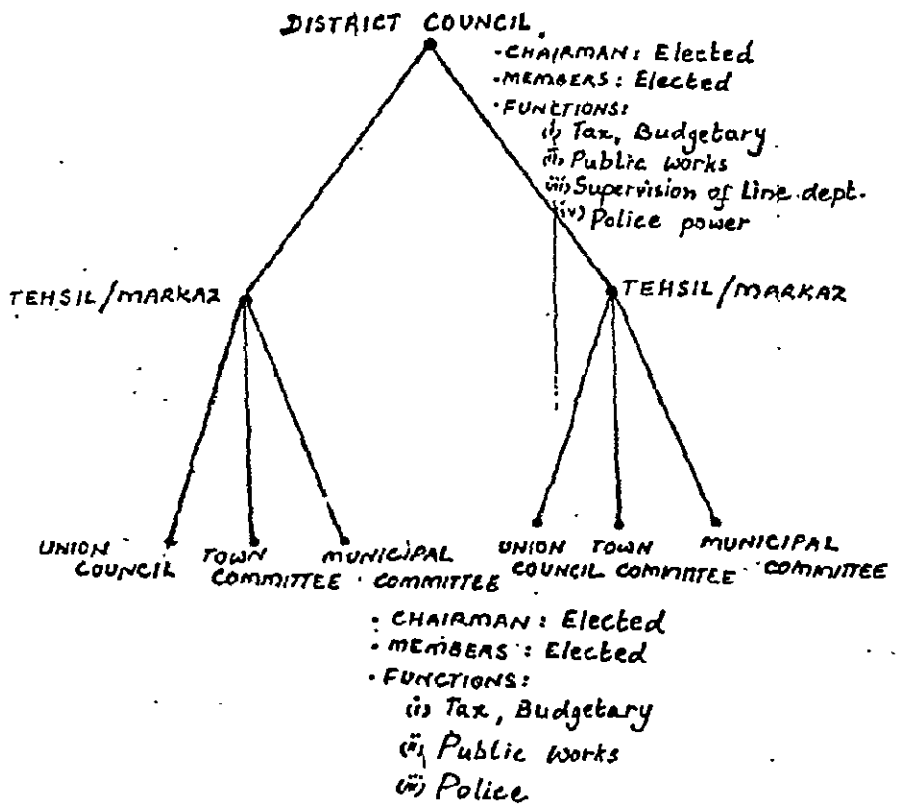


Fig: 10.3 Contemperary Local Government Structure.

taken by the project proponent to minimise adverse environmental effects" (GOP, 1983).

10.20 The exercise of the ordinance however (Hassan, 1981) should be carried out with caution in respect of environmental quality standards. Other countries, may have, over the years, built a strong professional cadre of scientists and engineers and otherwise developed the technical acpability of monitoring effluent discharge into the air, public water and the territorial seas. Pakistan today does not have the trained personnel or the equipment for a sophisticated monitoring of such pollution. Its proposed legislation should, at the same time, provide the resilience to escalate to effective controls as and when the technical capability is gradually accomplished. There is nothing that could provide a greater disservice to a nation than to have a legislation that is not enforced or is incapable of being implemented. Such a situation would breed an undesirable disrespect for the law".

10.21 A second note of caution concerns an indiscriminate application of the proposed legislation. The caution is against overkill. Our local preculiarities demand a statutory flexibility in a matter of, say, areas to which certain provisions of the ordinance shall apply or regarding the sources of pollution. Thus, an ordinance that regulates all industrial effluents all over Pakistan may not be capable of implementation given the paucity of our resources. Moreover, such a blanket regulation may not even be necessary for environmental considerations. Instead, if the ordinance enabled an indentification of certain areas that have assumed or are likely to assume a critical environmental hazard level, or of certain major industrial pollutants, its application could be initially restricted to these areas or sources. The Kala Shah Kaku industrial estate, for example, would deserve the earliest attention or the most serious pollutants such as leather tanneries could be the first industry to be regulated. Gradually, as the national capability to monitor improves or other areas are potentially developing the Kala Shah Kaku syndrome, regulation could be spread to these new situations, under the ordinance, on an on-going basis. With this in-built flexibility, the ordinance would respond to both the needs of today as well as tomorrow (Hassan 1981).

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GOP : Government of Pakistan.
GOPn : Government of the Punjab.

CHAPTER XI

ENVIRONMENTAL EDUCATION

. Implications and Approach

1.1 The growing recognition of the consequences and implications of ıvironmental problems must be coupled with an increasing awareness. The ›le of education in the face of environmental problems and opportunities . therefore crucial one. Environmental education should be integrated into ne whole system of formal education in Pakistan at all levels, to provide the ecessary knowledge, understanding, values and skills needed by the general ·ublic and many occupational groups, for their participation in devising solu-ions to environmental questions. Non-formal education also has an xtremely important role to play. The full utilization of mass media for truly :ducational purposes would also help create wide-spread awareness and ınderstanding. The ultimate aim of environmental education is to enable ›eople and planners to understand the complexities of the environment and :he need to adapt their activities and pursue development in ways which are ıarmonious with the environment. In this way, it adds a new dimension to the efforts being made in the country to improve living conditions. Environmental education must also help create an awareness of the economic, social and ecological interdependence so as to enhance a spirit of responsibility and solidarity among communities. This is a prerequisite for resolving serious environmental problems at the national level, as for example those relating to sedimantation and river pollution.

11.2 Environmental education must adopt a holistic perspective which examines the ecological, social, cultural and other aspects of particular problems. It is therefore inherently interdisciplinary. However, the problems it addresses should be those familiar to the learners in their own home, community, and area and it should help the learners acquire the knowledge, values and skills necessary to help solve these problems. This means that environmental education involves learning from the environment as well as about the environment, and in many situations this would require changes to be made in some well-established approaches to teaching, especially in formal education. With the adoption of this problem-oriented and action-oriented approach, environmental education thereby becomes both lifelong

and forward-looking. By its interdisciplinary nature, as well as by bringing education nearer to the environment and to life, environmental education can play a considerable role in the revonation of education systems (UNESCO, 1977).

11.3 The particular content, methods and materials for environmental education must be adapted to the needs of the learniners. Distinctions have to be made in the role of education, either formal or non-formal, for developing an increased awareness and understanding of environmental problems among the general public (children, youth and adults); for preparing certain occupational groups whose responsibilities bear directly on environmental problems and opportunities (for example, engineers, planners, architects, medical personnel, teachers, administrators, industrial managers) and for training specialists for research or other work relating to the environmental sciences. There is a considerable need for innovation in approaches and methods for all of these levels and types of environmental education. By the same token, there is a necessity for the exchange of information and experience with other developing countries, which have made significant advances towards implementing environmental education programmes.

11.4 In keeping with the nature of environmental education, many extra curricular or informal activities emphasizing participation and stimulating initiatives have been undertaken in a number of countries. These include excursions, study tours, and field studies, along with many other activities carried out by youth associations, clubs, political movements, and trade unions. Youth has been enlisted in sanitary and other self-help campaigns. Youth camps have been organized. Travelling exhibitions, competitions, lectures on environmental topics have been used in order to increase environmental consciousness. Prizes for children's literature and medals for environmental activities have been awarded. Mass media, radio, television, films and the press have played a very important role in many countries for the dissemination of environmental information. Publications have popularized recent scientific findings, and ecofilm festivals have been held. In certain cases, a council for environmental education has been set up (UNESCO, 77) Environmental education programmes have not always been conducted exclusively by ministries of education but also by ministries which are concerned with environmental problems such as ministries of health, agriculture, land and mines, community development, and by those ministries that have special responsibility for the environment.

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. Review of Past Activities

.5 A review of past activities in Pakistan shows that programmes related environmental education have been undertaken by various ministeries and ·partments. These included para-medical training under Ministry of Health, ɔmmunity development programmes under Ministry of Rural Development ıd Co-operatives, adult literacy programmes under the Literacy and Mass ducation Commission, and community forestry programmes under the ɔrest Department. However a major initiative in this connection has come om the environment and Urban Affairs Division, which initiated a three ɜar project for promotion of environmental education in the country. The ·oject has both formal and informal inputs and includes the development of ;hool curriculum and course material within its scope. The project is at resent being implemented with the help of the Ministry of Education.

1.6 The subject of environmental studies is not being taught as a separate iscipline in school or colleges of Pakistan, but an institute of environmental tudies has been established at the University of Karachi for higher educa-on. The existing school education has "infusion approach" based on incor-oration of some principles of environmental education within the appro-riate traditional subject such as civics, hygiene etc. The situation in out of ;hool forum or non-formal education is the least satisfactory in the country /here only a little more than a quarter of the population is literate. The cological or environmental education in non-formal education sector had narrow range of strategies in past. These included agricultural extension ·rogrammes and wider outreach techniques through occasional use of mass nedia. The biggest drawback has been the lack of proper infusion of environ-nental education in both school curriculum and the adult literacy pro-;rammes. Likewise no effort has been made to create environmental awareness hrough national compaigns, which is a great need of the time.

11.7 Regarding the institutions and mechanism for the implementation of 'ormal environmental education at undergraduate level the responsibility lies ɔrimarily with the Directorates of Education, Text Book Boards, and Boards ɔf Intermediate and Secondary Education. The Ministry of Education, and Provincial Education Department provide Guide lines, and technical expertise and carry out planning and development work. They also coordi-nate activities at Federal and Provincial levels respectively. Planning and development of curriculum for graduate education falls under the purview of the Universities. University Grants Commission acts as national coordi-nators at this level. In each case of formal education, courses are designed

by the committee of experts and approved by the relevant board of studies and other appropriate bodies. Non-formal education is handled primarily by the Literacy and Mass Education Commission (LAMEC), while Allama Iqbal Open University at Islamabad conducts the distant learning courses. Pre-service training courses for teachers are organised, by the colleges of education while in service training is given through workshops and short term training courses. In service training for government functionaries is imparted in institutes of public Administrations (Karachi, Lahore, Peshawar) and administrative staff college Lahore.

11.8 Concept of environmental education has undergone great change in Pakistan during the last few years. Starting from hygiene and health education to biological ecology, it has made a beginning in the right direction by accepting the totality of environment. Today the accepted definition of environmental education in Pakistan encompasses natural, man-made, ecological political, economic, technological, social, legislative, cultural as well as aesthetic aspects of environment. Despite this, opportunity for active learning is provided only by the more narrowly defined environment such as public health. The shift of emphasis is not yet reflected fully in the curricula. Further, the courses in formal environmental education have neither been integrated at various level, nor micro associations have been developed to show properly the linkages that exist between the local, national and global environment.

C. Future Strategies for the Development of Environmental Education

11.9 The efforts to develop environmental education in Pakistan will have to cover a vast range of activities at various levels and in various types of education. A major task is to incorporate properly environmental education into primary and secondary school curricula. This exercise has to include pre and in-service training of educators in subjects linked to the environmental education and the development of syllabi and teaching materials combining the oretical knowledge and practical experiments in local environments. In respect of non-formal education of the general public, special attention could be needed for the education of young people and adults, particularly the illiterate, in the form of programmes suited to the characteristics and requirements of the various population groups concerned. Simultaneously encouragement for in-service training activities in the environmental education of various social and occupational categories of the population, such as factory workers, farmers, civil servants etc. would be

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uired. The preparation of audio-visual and printed teaching materials ıcerning the environment and the use of mass media should be an integral t of this criticise for sensitize and informing board sectors of the public ɔut the environment. Development of environmental education at the versity and post-graduate levels is also imperative for specialists and ›fessionals, such as engineers, educators, planners and natural scientists social scientists. In this connection the University Grants Commission developed a course module which can be taught as a subject coordinated ctive course, a distant learning course or even as a separate diploma pro-mme in the Universities.

.10 In order to make it meaningful the environmental education should made an integral part of the education process. It should centre on .ctical problems with an interdisciplinary character. It should aim at ilding up a sense of values, contribute to public well-being and concern ɜlf with the survival of the human species. Its force should reside mainly the initiative of the learners and their involvement in action and it should guided by both immediate and future subjects of concern, secondly the nning, environmental education should be more broad based and not nain confined within the formal system. The integration of environmental ucation with other forms of education, in particular with education ncerning the working environment for the pupil at school, the worker in ɜ factory or in the fields, and for the consumer in his surroundings, and th education related to economic development, represents an urgent ed. Its subject-matter should permeate every part of formal and non-:mal programmes and constitute one and the same continuous, organic ɔcess in which none of the phases essential to integration must ever be erlooked.

.11 In formal education, at all levels, account should be taken of all the ;redients of the eudcation process (programmes and curricula, books d textbooks, teaching aids and resources methods etc.) and interdiscip-arity gradually achieved. The requirement is without repudiating the istence and individual character of each traditional discipline, to avoid the er-analytical nature of subject disciplines and the differences stemming ›m their respective methodologies, which make it difficult for the learner apprehend the environment; he often lacks a proper framework and, ɔreover, the usual approach by successive abstractions sets him at distance r removed from the subject under study. The solutions are thus :—

To introduce into each subject the essential environmental dimension have curricula prepared by interdisciplinary terms : and to study practical oblems that is, the reality sorrounding pupils and teachers.

11.12 Environmental education should not be just one more subject to add to existing programmes but should be incorporated into programmes intended for all learners whatever their age. A new joint pattern of work must be drawn up, involving home, community and school to introduce young people to environmental issues. Environmental education should serve as a catalyst or common denominator in the renewal of contemporary education. Clear and functional relations must be established and maintained between needs, goals, objectives, the curriculum proper and evaluation methods. Moreover it should not give rise to "competition" with the various subjects at present on the curriculum; it should represent a means of introducing a certain unity into the education process in the minds of pupils and enable them to manage the environment in which they lived through the judicious use of resources.

11.13 Special priority should be given to the various most disadvantaged social groups such as, the illiterate, who are nevertheless producers. Educational resources should therefore be mobilized for them in the form of functional literacy teaching incorporating an environmental dimension (the dimension first of their social background and then of their occupation). Potential role in this respect of political organizations, associations of students, citizens and associations for the protection of nature should not be ignored in this respect.

11.14 The training of qualified personnel also needs consideration as a priority activity. This holds good for both initial and in-service training, for the purpose of familiarizing teachers in formal education, organizers of non-formal activities for young people and adults, administrative personnel and educational planners and researchers with environment-linked subject-matter and educational and methodological guidelines. The basic training of all environmental specialists will need to include study of the principles of environemntal education, sociology and ecology which are necessary to enable the learners to foresee the consequences of their environmental work and not simply make do with temporary expedients.

11.15 Although environmental education should constitute one single organic and continuous process, each stage of this process has its own particular educative value. In primary school, for instance, a few useful directions for the promotion of environmental education would be; programmes of visits, the use of free time for activities in close contact with the environment, the development of a critical faculty and ability to see things in the right perspective and the transcending of cultural and scientific levels so as to

gain an awareness of relations with the community and move towards solutions. Secondary schooling should take the pupil on to a more ecologically, socially, politically and economically based application of idea about the environment. Although a separate course known as environmental education has been developed for school level (KDA, 1981) but a better option appears to be a continuation of "infusion approach" in view of already congested school curriculum. University-level education should see the introduction as a basis for all specialized courses (for engineers, architects planners, economists, etc.), of thorough knowledge of the functioning of ecosystems and an insight into the socio-economic factors governing the relations between people and the environment, together with knowledge of the characteristics, limits and possibilities of the scientific and technical revolution.

11.16 In non-formal, out-of-school education, strategies for the introduction, promotion and development of environmental education depend on particular situations (e.g. rural setting or urban setting, occupations, socio-cultural back ground etc). They should be based on channels of social communication, on the mass media and on the various movements of community organisations. In addition to their special educational role, these activities are of vital importance since they make it possible to overcome many of the administrative or bureaucratic difficulties associated with formal education. It is probably in the field of adult education that the most important development are required. Here the mass media can play an important role in the promotion of environmental education; press, radio, films and television (and, similarly, competitions, festivals or even "environment days"), which constitute ideal media for reaching the widest possible audience. The media can and should prepare, launch and conduct a whole series of campaigns in support of environmental education. Cleaning-up campaigns, the systematic removal of domestic refuse, demonstration campaigns, etc. are calculated to attract people attention and thus stimulate their environmental awareness.

11.17 The importance of environmental education, including in-service training, for the professional group whose activities and decisions have an impact on the environment can hardly be over emphasized. There is a vital need to develop awareness of the environment and the necessary proficiency among decision-makers and those responsible for development planning, designers, engineers, administrators, industrial managers, architects and town-planners as well as those trained for the health, legal and economic professions. (UNESCO, 1977).

D. Public awareness and Participation

11.18 The safeguard preservation and improvement of the environment is a task of such a magnitude that no one group, howsoever influential or knowledgeable, can undertake it successfully without the cooperation and participation of all the people. Since vide public participation is essential for success in tackling this extremely complex problem systematic efforts will have to be made to arouse awareness of and a deep and abiding concern for the defence of environment, in every man, woman and child. No citizen should be left in ignorance of the essential inter-dependence of man and his environment and of the way in which the well being of the present as well as the future generation is dependent on the wise management of man's own activities and the environment. This task is extremely difficult specially when the rate of literacy is very low and a very large segment of our population has either not been through a formal process of education or is even now not sufficiently motivated to take advantage of the opportunities that may be made available in this field. In addition, therefore, to arranging for the education and training of the youth in the social institutions of education, effective programmes using all other possible media will have to be launched for creating awareness of the problem among the general public (GOP, 1973).

11.19 The mass media-television, radio films and newspapers have a crucial role to play in this regard. All modern communication techniques for imparting information should be continuously used in making known events and phenomena which affect the environment. A very effective means for gaining the attention of the nation, particularly the decision makers and opinion makers in the community, is to maintain a steady flow of information through surveys and national reports on the issue. Government machinery alone cannot reach every nook and corner of the country. People should be organized every where through the formation of non-governmental voluntary organizations—environment clubs, associations and societies which should be aided and supported in organizing camps, symposia, seminars, debates etc. on the issue. These groups by remaining vigilant and obtaining publicity for every local and national happening affecting environment can keep the environmental issue alive and engage the public attention continously. Public awareness and participation programmes can also help to form widespread attitudes which support conservation and an economical use of resources and which recognize the personal health and economic damage that can result froma a degraded environment. They can alert masses of people to the realization that socially responsible behaviour includes protection of the

environment, because benefits accurue both to individuals and to the society as a whole. Environmental awareness and public participation programmes generally have the following characteristics:

> They emphasize resource conservation (e.g. the economical and efficient use of the natural resources through recycling).
>
> They promote community-wide consensus for corrective measures in specific cases where industrial or agricultural activities have polluted local ecosystems.
>
> They promote a simpler and less resource—intensive style of living.

Environmental awareness programme complement education and training programmes in the sense that they represent the ultimate goal of educationa and training: an informed population. Furthermore,the incorporation of environmental considerations into economic development planning is almost always predicated on the public pressure that arises from public awareness of the issues. Thus the development of national environmental policy and the degree of its success are often dependent on the extent and quality of public environmental awareness (ESCAP, 1984).

Developing countries have adopted a variety of environmental awareness and public participation programme which can provide good lessons to us. The methods used in promoting environmental awareness range from a direct mass communication of environmental messages to environmental planning through community frameworks. (ESCAP, 1984). Generally, these methods can be broken down into six types:

(i) Direct communication to the people of the need for action to protect the environment, and soliciting their participation in programmes designed for the purpose such as in the philippines.

(ii) Public surveys which ask people to indicate their performances on environmental issues and to evaluate action already taken to protect and improve the environment.

(iii) A multi-faceted approach which encourages maximum participation by the people together with the articulation of

environmental rights in the country's constitution such as in India and the Republic of Korea.

(iv) The organization of people to oppose specific development project which threatens the environment such as in India and Malaysia.

(v) The public expression of an official policy on environmental protection such as in Indonesia, the philippines, Republic of Korea and Thailand.

(vi) The preparation of a fully developed, community-based framework of environmental planning of which the promotion of environmental issues is an integral part such as in Indonesia, and the Republic of Korea.

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(Organised by UNESCO-UNEP)

Paris

ESCAP : Economic and Social Commission for Asia and the Pacific.

GOP : Government of Pakistan.

KDA : Karachi Development Authority.

UNESCO : United Nation's Economic Social and Cultural organisation.

CHAPTER XII

POLICY RESPONSE TO ENVIRONMENTAL CHALLENGES

12.1 The policy response to enviornmental challenges within the areas constituting Pakistan today has varied during the course of years. We may divide this into three phases a pre-colonial phase, a colonial phase and a post-independence phase. The first two phases have been discussed here to provide a background for thepresent phase which has been discussed here to provide a background for the present phase which has been discussed in some lingth by further subdividing it into three periods.

A. The pre-colonial Phase

12.2 In pre-British Pakistan, people lived with nature in such a way that the natural ecosystem was not disturbed. The rural areas then were the centre of power and wealth and equity developed along common concern and community lives. Each village had a large proporation of land, which was known as common land that was utilized not only for community uses such as graveyards, forests, etc. but also was a source of help to needy people in case of financial difficulty. In the latter case a piece of land was allotted to such persons for a temporary period till he got out of the difficult financial situation. The traditional society also had system of community self-help as well as mechanisms for conservation of resources whereeby exploitation of resources such as forest beyond specified limit was punishable. An example of such case was cofiscation of one sheep or goat of the defaulter which was killed to provide a feast for all the village people. The urvan areas were also relatively small in size where again community organisations were strong and green areas such as parks and gardens were extremely important. In fact, Mughal gardens are some of the finest ones in Pakistan even today. The overall environmental conditions were therefore healthy and balanced.

B. Colonial period

12.3 Against the traditional way of life, the British erected a system of legal basis of landownership involving more or less absolute proprietorship together with a system of revenue collection. The extension of governmental

control over common land and its distribution among people faithful to colonial government together with an exploitative system of resource use disturbed the balance maintained by the traditional society. Evide.ıces seem to support that the British created socio-economic order was decidedly unfavourable not only to long-term progress in agriculture but also to the management of ecosystem. With the passage of time as liberal socio-economic and political developments made their impact round the world, the British introduced a few schemes of land reclamation through irrigation. Unfortunately the unlined canals constructed in these schemes sowed the seed of further environmental degradation through waterlogging and salinity

12.4 In human settlements, the centres of the British attraction were the cantonments. These new settlemehts were constructed adjacent to old cities to house the coloinal rulers. The policies of development of infrastructure were also geared to cater for the British administrative and strategic designs oriented towards cantonments and port cities. A dendritic system of marketing was generated whereeby raw material ccould be exported to the ruling country and the finished goods supplied to the colonial market. The resulting process destroyed the existig self sustained and economically viable system of human settlements and introduced a dualism not only between the rural and urban areas but also between cantonments and contiguous indigenous cities, a pattern which persists even today.

C. Post-independence Phase

12.5 'With the departure of the British, Pakistan emerged as an independent state in 1947. The governmental policy towards environment during this phase can broadly be divided into three periods. The first period lasted from 1947 to 1957 during which environmental problems by and large remained neglected. The second period lasted from 1958 to 1972. Environmental problems during this period were tackled in isolated and *ad-hoc* fashion and no attempt was made to see these problems in an ecosystem perspective. The final period started from 1972 and continues today. This period initiated after the United Nations Conference on the Human Environment in Stockholm (June 1972) effectively marks the beginning of a concern in Pakistan for environmental management with broad perspective on a national scale.

12.6 Environmental concern 1947-57: During the first decade after independence (1947-57), the Government of Pakistanwas pre-occupied totally with the formidable problems of restoring normal economc, commercial and

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communication systems and channels of the new nation, as well as extablishing new central and provincial government organisations. The government prepared its first six years development programme (July 1951 to June 1957) in great haste and it was incorporated into Colombo Plan. The programme, to be quite pricise did not suggest any major administrative change, economic reform or environmental concern. It was actually a hasty grouping of schemes. In later years, the First Five Year Plan (1955-60) tried to initiate the concept of physical planning but it was still limited to housing in genral and settlement of displaced families (which had migrated to Pakistan after independence) in particular. Colonisation of thal desert with the provision of 640 villages and 6 towns under the thal development authority was, however, a majro achivement of this period. The main thrust of planning was towards linear economic growth and development of some social services and the programmes for inducing modernisation in rural life lagged behind improvements in physical output.

12.7 Environmental concern 1958-1972: This period is marked by a considerable expansion in the country's industrial sector, introduction of green revolution in agricultural sector and completion and launching of mammoth irrigation projects such as Warsak, Mangla and Tarbela dams and initiation of Karakarom Highway Project (from Pakistan to China). Unfortunately no environmental impact studies were made of these projects and the general attitude like the previous period was that of laissez faire. It was believed that the best form of development takes place under the minimum regulation. Nevertheless the emergence and expansion of enviornmental problems in the wake of exploitative use of resources and growing population did receive some acknowledgment. Remedial actions, though not in a concerted and systematic manner, were undertaken to combat the growing poblem of soil pollution by waterlogging and salinity. Through SCARP (Salanity Control and Reclamation Project), a large part of deteriorated land was recoverd. Considerable importance was also given to soil erosion. A soil survey department was added in the Ministry of Food and Agriculture by the Federal Government while soil conservation departments were establshed in the provinces. A Forest Research Institute was also created to carry out studies on forest, range and wildlife management. A large scale family planning programme wa also started to curb the rapid population growth. Some studies and action also started in physical planning particularly in large cities like Karachi Lahore and Peshawar, etc. Likewise rural development also received some attention through introduction of a local government programme. Each of these actions related to improvement of the human environment or resource conservaton in one form or another.

However, these still remained isolated actions and the fundamental premise that the national development should not be wasteful and that resources should be utilized as a trust for future generation was still not recognized. Despite the induction of a sytem of local government the development process was still controlled by bureaucracy on the colonial pattern and quality of life theme did not receive recognition.

12.8 Environmental Concern 1972-1984. The period 1972-84 marks a major breakthrough in the attitude of both people and government of Pakistan towards environmental preservation. Before 1972, the communication media remained virtually silent and perhaps, was blissfully ignorant of the subject of pollution and environmental hazards. Today the newspapers are replete with the stories drawing national attention to continual environmental degration. Even a casual reading of the newspapers particularly the sections dealing with letters from the readers reveal a growing public awaremess about the need to safeguard environment and control pollution. A random sample would include complaints against the alarming effects of wastes discharged from certain industrial projects, against industrial odors and unbearable noises in residential areas as well as unsatisfactory sanitation. The scientific societies and learned bodies are also holding open forums, seminars and symposia to highlight the environmental problems and issues. The Scientific Society of Pakistan in one of its session focused on the plight of the Quide Azam Mausoleum (our most important national momunent) resulting from the onslaught of air pollution in Karachi. (Hasan, 1981). The number of research papers dealing with different aspects of environmental problems and issues have also increased proportionally in the scientific journals of the country.

12.9 The increasing awareness on environmental degradation has shown visible impacts on the governmental policies and programmes. As stated earlier there were certainly a number of steps taken *prior to 1972 in individual problem creas of Pakistan's environment such as waterlogging and salinity, deforestation, siltation, fisheries and wildlife etc. but, the idea that such isolated concern should be evaluated and coordinated under broader perspective was one truly significant outcome of the Stockholm Conference.* The federal government took up the issues raised in Stockholm and directed that an immediate examination be made of the steps which should be taken to meet the threat to the human environment in Pakistan. Subsequently the Ministry of Presidential Affaris convened a meeting of experts concerned with various aspects of environment in November 1972. A major outcome of this meeting was the formation of a committee on Human Environment to

make necessary recommendatins. The committee submitted a reportin April 1973 making a number of recommendations (GOP 1973). The report stressed that the magnitude and complexity of the problem of environmental degradation required an urgent attention and needed dealing in a comprehensive manner. It called for a two pronged approach-embracing both the long-rang preventive and short term curative measures, so that economic development would not produce. . ."Chaotic human environment, poor living conditions and serious degeneration of the environment".

12.10 Another major positive development of 1973 was constitutional mandate for the preservation of environment. The federal focal point for general environmental matter was also gradually strengthened. The function of looking after general environmental matters was entrusted to the Ministry of Production Industries, Town Planning and Agrovilles in 1972. However, Ministry of Science and Technology also looked after many issues dealing with general environment. A new Environment and Urban Affairs Division was created within the Ministry of Housing, Works and Urban Development in 1975, and the responsibilities for all general environmental matters were shifted to this Division.

12.11 Despite the above developments the environmental input within the national planning throughout 70's was very small. The response to the growing need for legislation was also negligible. The existing laws such as Pakistan Penal Code and the Factories Act, Forest Act, Hunting and water use legislation etc had some provisions, however unsatisfactory they may have been, environmental protection could be premised on these but no attempt was made to enforce them. These observations show that although a beginning had been made during the last decade, the country still had a long way to go.

12.12 With the dawn of the present decade the government of Pakistan has shown a higher level of awarness compared to the last one. The clearest manifestation of this new concern is the enactment of Pakistan Environmental Protection Ordinance 1983. The new legislation has created a powerful Naional Environmental Council with the personal involvement of the head of the state who is the chairman of this Council. It is hoped that this association at the highest level of the Government would facilitate enforcement of important environmental legislation and decisions without the customary delay. A high powered Environmental Protecton Agency has also been created by the same ordinance. The major initial duties of the agency are the preparation of National Environmental Policy and framing of the

national environmental quality standards (both have to be approved by the National Environmental Council). The agency shall be able to revise the standards as and when required (with the approval of the council of course). The tasks of the agency include administration of Environmntal Protection Ordinance of Pakistan and coordination of Environemtnal policies and programmes nationally and Intenationally. The agency shall also carry out surveys, surveillance and monitoring; publish an annual report on the state of the Environment in the country; and disseminate infomation to the public on environment related matters. The process of Environmental impact assessment mentioned in the ordinance can also be used as a power ful tool to save the environemntal degradation in the country.

12.13 Another significant aspect is the development of a positive attitude within the Ministry of Finance, Planning and Coordination which controls overall direction of economic and social policy. The Ministry has willingly incorporated aspects of environmental conservation in economic planning. If this initiative is seen in the context of the strategy for the Sixth Five Year Plan (1983-88) of Pakistan, then already a considerable covergence of objectives become clear. Of particular relevance to the conservation aspect of development is *emphasis on more efficient use of fertilizer, water and farm technology to produce a major increase in agricultural yields. Also* emphasis on the establishment of agro-based industries for processing agricultural surpluses as a part of continuing emphasis on repaid industrialisation has its implications on industrial pollution. A more important perhaps than either of these *is the increase in the share of public sector social development programmes from 9.6% in the fifth plan to 17% in the sixth plan* a quantum leap in absolute terms, of about four times (GOP 1983). The objective of these programmes is to imporve the Pakistan's quality of life indices. *Eight of these listed in the plan include literacy, primary education, infant mortality, access to clear water and sewerage, as well as availability of electricity and telephones. Each of these indices relates closely to the improvement of the human environment and resource conservaton; for example,* improved literacy is vital to a better understanding of resource use, conservation and sustainable future growth. The sixth plan also focuses heavily upon decentralised development activities and massive acceleration of the 'rural transformation' with special emphasis on rural social services, electric supply, road networks and drinking water etc. With this deicsion of achieving a major breakthrough in the provision of physical infrastructure and social services for the rural areas, the plan may perhaps achieve more than what could be achieved by any other means in the past for sustainable pattern of future development.

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2.14 A more critical examination of the plan however, suggests *only a passing familigarity with the often serious or critical state of the ocological infrastructure on which any sustained development must depend.* The plan locument appears to pass over several aspects of development practices in he past which, if continued, can jeopardise the precious natural resources of the country. "Many current porjects are exploitative of natural resources and have gone ahead without an updated natural resource inventory to show what the sustainable yield should be . . . Thus for example the strategy in agricultural sector lays great stress upon increased use of chemical fertilizers and pesticides and on farm mechanisation without significant reference to the problems of pollution from agricultural chemicals or salinated soil. Similalry the plan includes substantial programmes for exploiting forestry and fishery potential, within the bounds of sensible economic, technical and ecological constraints but without any reference to what such constraints are or how they may be calculated and coped with" (IUCN 1984).

In nutshell an analysis of recent policies shows that despite a number of positive steps taken in the last few years including constitutional provision, creation of institutional setup, promotion of development at local/grassroot level and environmental protecton legislation, a lot more remains yet to be done and a number of shortcomings are glaring. Thus a review of the Sixth Five year Plan (1983-88) of Pakistan shows that the planning currently is based too exclusively on economic criteria and does not give enough recognition to ecological infrastructure. Secondly the integration between conservation and development is lacking at both the policy level (wich stresses only rehabilitation and productvity) as well as at the project level (where environmental impacts are often ignored). Thirdly there is a lack of coordination between various environmental institutions concerned with research, policy and information dissemination. The functioning of the institutions is also poor due to lack of properly trained staff. Finally the environmental legislation enacted recently is still inoperative because of lack of implementing agencies which are yet to be formulated. Moreover the legislation itself is far from complete and focuses mainly on urban and industrial pollution control.

12.15 In view of above it is imperative that a realistic policy/strategy for action need to be developed without delay to safeguard country's environment. This policy should define the priority problems to be attended to, determining both those conservation measures which are essential for human welfare and survival and those which encourage development. It should take into account the supply of natural resources and the demand for them enabling development planers to allocate these resources without waste so that

they meet the increasing and changing needs of the country's people. This policy should not be a set of unconnected recommendations but an ordered approach for action which can work alongside development planning. The main objectives (Figure 12.1) of the policy should stand as long term background for development plans so as to :

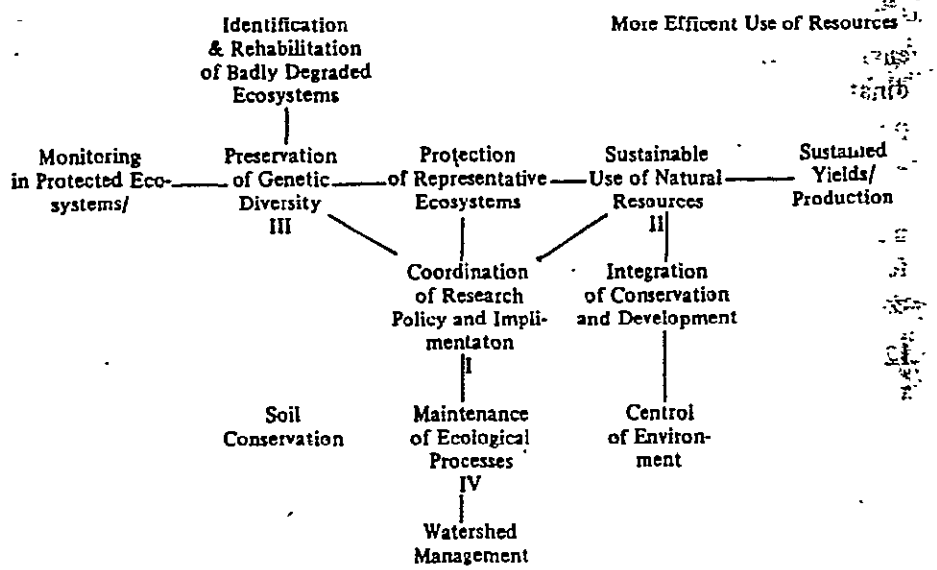
(a) Ensure the sustainable use of Pakistan's natural resources including minerals, oil and gas, irrigated land, forests, fisheries, wildlife, agricultural and gazing land and natural scenary.

(b) Preserve the genetic diversity governing the scope of yields and quality of crops and livestock as well as the rich diversity of wildlife.

(c) Maintain essential ecological processes such as soil protection, nutrient recycling, protecton of water and air.

(d) Promote the institutional coordination in researcy, policy and implementation on the one hand and between people as well as government at federal, provincial and local on the other.

Figure 12.1 Broad Objectives of an Environmental Policy for Pakistan.



12.16 It may be stated here that no country in the world can undertake all the necessary efforts for environmental conservation all at once. The inital actions have to be most cost-effective. The criteria for defining PRIORITIES, SIGNIFICANCE, URGENCY and IRREVERSIBILITY have to be based on indegious situation, standards and capability. Some of the principle guidelines for that have been outlined below:

(a) Mix cure and prevention: While extensive environmental damage needs to be repaired, it may be more cost-effective to prevent future problems.

(b) Mass Involvement: It is important to involve masses in the environmental rehabilitation and protecton. The local councils can provide effective platform for this kind of involvement. The role of mass media in increasing the civic awareness also needs to be taken into account.

(c) Dynamism/Flexibility: There is no single, unique and unchanging way in which environmental conservation can aid development. It is an interdisciplinry art which evolves through the interaction between experts of various disciplines and agencies who understand the different uses of resources. The plolicy should therefore evolve through their coordination and its emphasis should be periodically reviewed.

(d) Education and Training: Formal education should reflect environmental dimension and concern. Moreovr, ways and means have to be devised for training to create awareness amongst decision makers, administrators and economic planners so that effective environmental input can be introduced in planning and development.

12.17 In the end it may be emphasized here that the scope, content and implementation of the Enviornmental Policy of a country is a complex matter and neither any single person is capable of that nor it is posible to discuss all these aspects in this profile. The main theme that has been presented here is that indiscriminate use of resources in Pakistan in past has resulted in serious enviornmental degradation and is taking a heavy toll on the quality of life. In future this can be avoided by accepting the fundamental primise that the national development should not be wasteful, instead natural resources should be utilized as a trust for future generation.

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GOP : Government of Pakistan.

IUCN : International Union for Conservation of Nature and Natural Resources.

Annexure I.1

VERTEBRATE FAUNA OF PAKISTAN

(1) *Fisheries:* Total species 574

Major Food Fishes

Mackerel, Tuna, Jacks, Threadfins Shads, Grey mullets, Snappers, Seabreams, Tonguesoles, Croakers Rockcods, Pomfrets, Perches, Grunts, Sharks, etc.		150 Species
Minor Food Fishes		350 Species
Discarded/Poisonous		74 Species
	Total	574 Species

(2) *Reptiles:* Total species 161

Snakes		*67 Species*
Poisonous = 26	(Marine = 14) (Land = 12)	
Non-poisonous = 41		
Lizards		*80 Species*
Turtles/Tortoises	(Marine = 2) (Fresh water = 8) (Tortoises = 2)	12 Species
Crocodiles		1 Species
Gavial		1 Species
	Total	161 Species

(3) *Birds:* Total species 742

Migratory Birds

Winter visitors		233 Species
Passage Migrants		69 Species
Stragglers		18 Species
Summer visitors		68 Species
Vagrants		21 Species
	Total	409 Species

Resident Birds

Local migrants		25 Species
Resident		308 Species
	Total	303 Species
	Grand Total	742 Species

(4) *Mammals:* Total species 165 Total 165 Species

Annexure I.2

Table 1 : Vegetable Species in Forests of Pakistan.

Table 2 : Vegetation Species in rangeland of Pakistan

Table 3 : Endangered Flora.

TABLE 1

Vegetative Species in Forests

		Name of Species		
		Local	English	Botanical
1. *Natural Conifer Forests*				
(a) *Fir Type, 11,000 to 7,500 feet, moist, temperate*				
Dominant	1.	Paludar	Fir	Abies webbiana
	2.	Kachal	Spruce	Picca smithiana
Associated	1.	Dayar	Deodar	Cedrus deodara
	2.	Kail	Blue Pine	Pinus wallichiana
	3.	Bhuj Patra	Birch	Betula utilis
	4.	Banjar	Oak	Quercus semecarpitalia
	5.	Tarkan	Maple	Acer caesium
	6.	Kain	Elm	Ulmus wallichiana
(b) *Pine Type, 7,500 to 4,000 feet, moist, temperate*				
Dominant	1.	Kail	Blue Pine	Pinus wallichiana
	2.	Chil	Chir Pine	Pinus roxburghii
Associated	1.	Akhrot	Walnut	Juglans regia
	2.	Sufaida	Poplar	Populus cilieta
	3.	Rin	Oak	Quercus incana
	4.	Barungi	Oak	Quercus delitata
	5.	Tarkan	Maple	Acer caesium
	6.	Kalakot	Cherry	Prunus padus
	7.	Bankhor	Chestnut	Aesculus indica
	8.	Batangi	Wild pear	Pyrus pashia
(c) *Juniper Type, 10,000 to 6,000 feet; dry, temperate*				
Dominant	1.	Juniper	Juniper	Juniperus macropoda
Associated	1.	Necza	Nut Pine	Pinus gerardiana
	2.	Pista	Pistacia	Pistacia khinjak
	3.	Hanus	Ash	Fraxinus xanthoxyloides
	4.	Ephedra	Ephedra	Ephedra gerardiana

		Name of Species		
		Local	English	Botanical
2. *Natural Hardwood Forests*				
(a) *Riverain Forests*				
Dominant	1.	Babul	Acacia	Acacia arabica
	2.	Jand	Prosopis	Prosopis spicigera
	3.	Bhan	Poplar	Populus euphratica
Associated	1.	Pilchi	Tamarix	Tamarix dioica
	2.	Farash	tTamarix	Tamarix articulata
	3.	Kana	Cane	Saccharum spp.
(b) *Coastal Mangrove Type*				
Dominant	1.	Tiwar	Avicennia	Avicennia officinalis
Associated	1.	Chauri	Ceriops	Ceriops candolleana
3. *Artificial Hardwood Forests*				
(a) *Irrigated Plantation, Plains areas*				
Dominant	1.	Tali	Shisham	Dalbergia sissoo
	2.	Tut	Mulberry	Morus alba
Associated	1.	Bakain	Melia	Melia azedarach
	2.	Semal	Kapok	Samalia malabarica
	3.	Babul	Acacia	Acacia arabica
	4.	Sufeda	Eucalpytus	Eucalyptus spp.
	5.	Kala Shirin	Black siris	Albizzia lebbeck
	6.	Chitta Shirin	White siris	Albizzia procera
(b) *Canalside and Roadside Plantations*				
Dominant	1.	Tali	Shisham	Dalbergia sissoo
	2.	Babul	Acacia	Acacia arabica
	3.	Semal	Kapok	Salmalia malabarica
	4.	Kala Shirin	Albizzia	Albizzia lebbeck

		Name of Species		
		Local	English	Botanical
4. *Shrub Forest*				
(a) *Hill Schrub Forest*				
Dominant	1.	Zaitum	Olive	Olea cuspidata
	2.	Phulai	Acacia	Acacia modesta
Associated	1.	Ber	Jujyhe	Zizyphus jujuba
	2.	Meskeet	Mesquite	Prosopis juliflora
	3.	Sanatha	Dodonia	Dodonia viscosa
	4.	Garn	Garanda	Carissa spinarum
(b) *Inland Shrub Forest*				
Dominant	1.	Pilu	Salvadora	Salvadora oleoides
	2.	Frash	Tamarix	Tamarix articulata
	3.	Jand	Prosopis	Prosopis spicigera
Associated	1.	Meskeet	Mesquite	Prosopis juliflora
	2.	Karir	Capparis	Capparis aphylla

Source : Zehngraff, 1967.

TABLE 2

Vegetable Species in Rangelands (exlusive of species listed in Table 1)

(a) *Tropical maritime*

Cenchrus setigerus
Cenchrus ciliaris
Commiphora mukul
Cymbopogon jwarancusa
Eleusine flagellifera
Elyonurus hirsutus
Euphorbia caudicifolia
Dactiloctenium scindicum
Panicum turgidum

(b) *Tropical plains (non-sandy)*

Dicanthium annulatum
Dismostachya bipinnata
Most of the species of a. above except c. *mukul*, and e. *caudicifolia*.

(c) *Tropical plains (sandy)*

Aerva persica
Aerva tomentosa
Aristida depressa
Calligonum polygonoides
Elyonurus hirsutus
Haloxylon salicornicum
Heliotropium tuberculosum
Ipomea pes-caprae
Panicum turgidum
Pennisetum dichotomum
Salsola foetida
Sericostoma pauciflorum
Suaeda fruticosa

(d) *Tropical submontane*

Acacia modesta
Adhatoda vasica
Aristida spp.
Bothriochloa pertusa
Bothriochloa spp.
Capparis aphylla
Cenchrus ciliaris
Chrysopogon aucheri
Chrysopogan montanus
Cymbopogon jwarancusa
Cymbopogon shoenanthus
Cynodon dactylon
Desmostachya bipinnat
Dicanthium annualatum
Digitaria spp.
Dodonea viscosa

Eleusine flagellifera
Elyonurus hirsutus
Eulaliopsis binata
Gymnosporia royaleana
Haloxylon ammodendron
Haloxylon salicornicum
Heteropogon contortus
Olea cuspidata
Otostegia limbata
Panicum antidotale
Pennisetum orientale
Rhyza stricta
Sageretia theezan
Tetrapogon villosus
Themeda anathera
Zizphys spp.

(e) *Mediterranean*

Acantholimon spp.
Artemisia maritima
Artemisia sacrorum
Caragana spp.
Causina spp.
Chrysopogon aucheri
Cybopogon shoenanthus
Ebenus stellatus
Ephedra spp.
Fraxinus xanthoxylo ides
Haloxylon griffithii
Juniperus macropoda
Lactuca spp.
Pinus gerardiana
Pinus wallichiana
Agrophyron spp.
Bromus spp.
Erymopyron spp.
Koeleria crisata
Lolium spp.
Oryzopis aequiglumis

Pennisetum orientale
Poa bulbosa
Poa sinaica
Rotobellia spp.
Stipa pinnata

Source: C.M.A. Khan, 1974.

TABLE 3

Endangered Flora of Pakistan

SOME THREATENED PLANTS OF PAKISTAN

The flowering plants of Pakistan are represented by 204, Families. Prof. Dr. Khalid Hamid Sheikh and his student (Nasreen Akhtar Bhatti) at the Department of Botany, University of the Punjab, Lahore have scanned the published accounts of 159 Angiospermic Families of Flora of Pakistan (Nasir, E. and Ali, S.I. 1970–1984. *Flora of Pakistan.)* for the plants which have been described as 'rare', 'not common', and 'restricted' in their distribution. This list of 474 'rare', 'not common', and 'restricted species of flora of Pakistan constitutes a preliminary list of threatened species of flowering plants belonging to these 159 families only field surveys for the present distribution in nature of these 474 species will help in the determination of IUCN categories (Endangered, Vulnerable, Rare) of these threatened species of flora of Pakistan. Many more species may be added to this list after the study of 45 Families of Angiosperms yet to be blulished.

Source: World Wildlife Fund news letter 4-4-1985.

Annexure II.1

PAKISTAN

Table 1—Area, Population size and Growth, Density, Urban Population and Household size by Province since 1951)

Province/year	Area (sq. km.)	Population		Population density (persons) sq. km.)	Urban Population (percentage)	Average annual growth rate (percentage	Household size
		Number	Per cent				
1	2	3	4	5	6	7	8
Pakistan							
1951	796,095 (100)	33,816,555	100	42.5	17.8	–	–
						2.4	
1961		42,978,261	100	54.0	22.5	–	5.5
						3.7	
1972		65,320,939	100	82.0	25.4	–	6.6
						3.1	
1981		84,253,644	100	105.8	28.3	–	6.7
NWFP							
1951	74,521 (9.4)	4,587,120	13.6	61.6	11.0	–	–
						2.3	
1961		5,752,432	13.4	77.2	13.2	–	5.7
						3.3	
1972		8,392,323	12.8	112.6	14.2	–	6.1
						3.3	
1981		11,061,328	13.1	148.4	15.1	–	6.8
FATA							
1951	27,220 (3.4)	1,336,785	3.9	49.1	–	–	–
						3.3	
1961		1,847,195	4.3	67.9	1.3	–	–
						2.6	
1972		2,491,230	3.8	91.5	0.5	–	8.3
						1.5	
1981		2,198,547	2.6	80.8	–	–	8.3
Punjab							
1951	205,344 (25.8)	20,556,800	60.8	100.1	17.5	–	–
						2.2	
1961		25,499,876	59.3	124.2	21.5	–	5.4
						3.4	
1972		37,611,668	57.6	183.2	24.4	–	6.4
						2.7	
1981		47,292,441	56.1	230.3	27.6	–	6.4
Sind							
1951	140,914 (17.7)	6,054,474	17.9	43.0	29.2	–	–
						3.3	
1961		8,374,032	19.5	59.4	37.8	–	5.8
						4.6	
1972		14,158,279	21.7	100.5	40.4	–	6.2
						3.6	
1981		19,028,666	22.6	135.0	43.3	–	7.0

1	2	3	4	5	6	7	8
Baluchistan							
1951	347,190 (43.6)	1,187,036	3.5	3.4	12.2	– 1.6	–
1961		1,385,165	3.2	4.0	16.9	– 5.0	5.0
1972		2,432,516	3.7	7.0	16.4	– 7.1	6.2
1981		4,332,376	5.1	12.5	15.6	–	7.3
slamabad							
1951	906 (0.1)	94,340	0.3	104.1	–	– 2.4	–
1961		119,561	0.3	132.0	–	– 6.0	
1972		234,923	0.4	259.3	32.6	– 4.5	5.5
1981		340,286	0.4	375.6	60.0	–	5.7

Note: 1. Area and population of the province has been adjusted according to the boundaries at the time of 1981 Census.
2. Population includes foreign nationals except diplomats and their families.
3. NWFP stands for North-West Frontier Privince.
4. FATA stands for Federally Administered Tribal Areas.
5. Islamabad is the Fedral Capital Area of Pakistan.

ource: Population Census Organisation.

Annexure III.I

LIST OF NATIONAL PARKS, WILDLIFE SANCTUARIES AND GAME RESERVES

I. National Parks

"National Parks" means comparatively large areas of outstanding scenic merit and natural interest with the primary object of protection and preservation of scenory, flora and fauna in the natural state with limited forestry activities to when access for public recreation, education and research may be allowed. Uptil now the following national parks have been noticed :–

S. No.	Name of National Park	Privince	Area in hectares	Wildlife of the area
1.	Lalsohanra	Punjab	31,368	Black buck, Chinkara, Blue Bull and Waterfowl.
2.	Kirther	Sind	81,926	Sind Ibex, Urial, Deer, Leopard, Grey Partridges and Houbara Bustard.
3.	Hazarganji Chiltan	Baluchistan	12,567	Chiltan Markhor, Wild Sheep, Leopard, Chukor and Scesec.
4.	Khunjerab	Northern Area.	226.913	Marcopolo Sheep, Blue Sheep, Himalayan Ibex, Snow Leopard, Wolf, Brown Bear, Tibetan Wild Ass, Ram Chukor and Chikor.
5.	Margalla Hills	Federal Capital	14,786	Leopard, Goral. Rhesus Monkey, Grey & Black Partridge, Kilij Pheasant, Cheer Phcasant and Waterfowl.
		Total ..	367,560	

II. Wildlife Sanctuary

"Wildlife Sanctuary" means an area closed to hunting, shooting or trapping of wild animals, declared as such by a Government as undisturbed breeding ground primarily for the protection of wildlife inclusive of all natural resources such as vegetation, soil and water. The following areas have been declared as game sanctuaries :–

S. No.	Name of Wildlife Sanctuary	Province	Area in Hectares	Wildlife of the area
1	2	3	4	5
1.	Rasool Barrage	Punjab	1,138	Waterfowl.
2.	Tehra (Jallo) Plantation	"	339	Partridges.
3.	Khabbe-ke-Lake	"	283	Waterfowl.

1	2	3	4	5
4.	Taunsa Barrage	"	6,569	Hog-Deer, Otter, Hare, Black and Grey Partridges.
5.	Kharar Lake	"	235	Waterfowl.
6.	Chumbi Surla	"	55,968	Green pigeon and Partridges.
7.	Nemal Lake	"	486	Waterfowl.
8.	Chashma Lake	"	33,007	Waterfowl.
9.	Takkar	Sind	43,513	Deer, Grey Partridges and Houbara Bustard.
10.	Kinjhar (Kalri) Lake	"	13,465	
11.	Hudero Lake	"	1,321	
12.	Haleji Lake	"	1,704	Waterfowl.
13.	Lung Lake	"	19	
14.	Drigh Lake	"	764	
15.	Mahal Kohistan	"	70,577	Deer, Grey Partridge, Sand Grouse and Houbara Bustard.
16.	Hab Dam	"	27,219	Deer, Grey Partridge, Sand Grouse and Houbara Bustard and waterfowl.
17.	Ghandak Dhoro	Sind	31	
18.	Miani Dhand	"	57	
19.	Samno Dhand	"	23	
20.	Gulsher Dhand	"	24	
21.	Dhoung Block	"	2,098	
22.	Lakhat	"	101	
23.	Kot Dinghano	"	30	
24.	Mohabat Dero	"	16	
25.	Bijoro Chach	"	121	
26.	Norung	"	243	
27.	Cut Munarki Chach	"	405	Waterfowl.
28.	Sadnani	"	84	

1	2	3	4	5
29.	Shah Lanko	"	61	
30.	Hilaya	"	324	
31.	Majiran	"	24	
32.	Gullel Kobri	"	140	
33.	Matho Kotri	"	162	
34.	Munarki	"	12	
35.	Khadi	"	81	
36.	Keti Bunder North	"	8,948	
37.	Keti Bunder South	"	23,046	
38.	Khat Dhoro	"	11	
39.	Runn of Kutch	"	2,150	Houbara Bustard, Deer, Wild Ass.
40.	Nara Desert	"	3,650	Houbara Bustard, Deer.
41.	Chitral Gol	NWFP	7,780	Markhor, Urial, Leopard, Black Bear, Monal Pheasant, Snow cock.
42.	Sheikh Buddin	"	15,540	Suleman Markhor, Urial, Chukor.
43.	Bilyamin	"	4,050	Black and Grey Partridges, Hare.
44.	Giddar Baik	"	4,450	Ibex, Leopard, Black Bear, Monal Pheasant, Snow cock.
45.	Manglot	"	715	Grey Partridge, Chukor.
46.	Borraka	"	2,025	Urial, Leopard, Chukor, Black Partridge.
47.	Manshi	"	2,321	Leopard, Black Bear, Monkeys, Monal Pheasant, Koklas, Snow cock, Musk Deer.
48.	Band Khush Dil Khan	Baluchistan	1,296	Waterfowl and Seesee.
49.	Masalakh	"	46,559	Chinkara, Seesee, Houbara Bustard, Sand Grouse, Urial and Chukor.
50.	Surkhab	"	3,757	Urial, Chukor, and Seesee.
51.	Sasnamana	"	6,607	Chukor, Seesee and Hare.
52.	Ziarat Juniper	"	37,247	Urial, Markhor, Seesee, Chukor.

1	2	3	4	5
53.	Koh-e-Geish	"	24,356	Ibex, Urial, Leopard, Chukor and Seesee.
54.	Kachau	"	21,660	Chinkara, Urial, Houbara Bustard.
55.	Dhrun	"	30,567	Chinkara and Urial.
56.	Shashan	"	29,555	Ibex, Urial, Chukor and Seesee.
57.	Chorani	"	19,433	Ibex, Urial, Leopard and Bear.
58.	Dureji	"	178,259	Chinkara, Ibex, Urial, Seesee, Sand Grouse and Houbara Bustard.
59.	Khurkhera	"	18,345	Grey Partridge, Sand Grouse and Houbara Bustard.
60.	Raghai Rakshan	"	125,425	Chinkara, Ibex and Urial.
61.	Kolwah Kap	"	33,198	Chinkara, Urial, Sand Grouse, Houbara Bustard and Grey Partridge.
62.	Buzi Makola	"	145,101	Chinkara, Ibex.
63.	Lasbela	"	1,687,579	Chinkara, Ibex, Sand Grouse and Houbara Bustard.
64.	Kachhi sibi and Nasirabad	Azad Kashmir.	2,336,448 810	Chinkara Houbara, Busterd, Phensants.
65.	Naltar	Northern Area.	27,206	Markhor, Ibex, Snow Leopard, Musk Deer, Fox, Ram Chukor and Chukor.
66.	Kurgah	"	44,308	Ibex, Markhor, Musk Deer and Snow Leopard.
67.	Astore	"	41,457	Astore Markhor, Himalayan Ibex, Musk Deer, Snow Leopard, Brown Bear, Black Bear, Wolf, Lynx, Fox, Flying Squirrels, Monal Pheasants, Ram Chukor, Chukor, Hawks, Eagles, Vultures, Kites and Falcons.
68.	Baltistan	"	41,457	Ibex, Markhor, Urial, Musk Deer, Snow Leopard, Brown Bear, Fox, Chukor, Ram Chukor and Birds of Prey.
69.	Banni Gala Hill etc.	Federal Capital Territory	3,521	Partridges, Fancy Birds etc.
		Total ..	5,239,074	

III. Game Reserves

"Games Reserve" means an area declared by a Government as such for the protection of wildlife and increase in the population of important species of the area wherein capturing and hunting of the wild animals shall be unlawful except with permits. Uptil now the following areas have been notified as game reserves :–

S No.	Name of Game Reserves	Province	Area in Hectares	Wildlife in the Area
1	2	3	4	5
1.	Sodhi	Punjab	5,820	Chukor, Seesee, Partridge, Urial and Chunkara.
2.	Khari Murat	"	5,620	Urial, Deer, Grey Partridge, seeseae and Chinkara.
3.	Attari	"	1,736	
4.	Kamalia	"	4,500	Grey and Black Partidges, Hare.
5.	Gat Wala	"	5,885	
6.	Kathar	"	1,141	Cheer and Kalij Pheasant, Barking Deer and Leopard.
7.	Chaupalia	"	9,861	Chinkara and Partridge.
8.	Rahri Bunglow	"	5,466	Chinkara, Houbara Bustard and Sand Grouse.
9.	Bheni	"	2,069	Chinkara and Grey Partridge.
10.	Bhon Fazil	"	1,063	Waterfowl and Black Partridge.
11.	Head Qadirabad	"	2,850	Blue Bull, Hog Deer, Black Partridge and Waterfowl.
12.	Bajwat	"	5,466	Blue Bull, Chukor and Partridge.
13.	Bhawalpur Forest	"	514	Grey Partridge.
14.	Daphar	"	31,093	Black and Grey Partridge.
15.	Perowal Kikarwala	"	506	Black and Grey Partridge.
16.	Chichawatini	"	891	Black and Grey Partridges.
17.	Kot Sabzal	"	10,121	Houbara Bustard, Sand Grouse and Grey Partridge.
18.	Head Islam	"	3,132	Waterfowl.
19.	Chaubara-Mankeera	"	321,166	Chinkara and Grey Partridge.
20.	Kala Chitta		132,664	Urial, Chinkara, Leopard, Grey Partridge, Chukor and Seesee.

1	2	3	4	5
21.	Diljabba Domeli		118,154	Urial, Chukor, Black and Grey Partridges
22.	Cholistan	"	2,694,478	Chinkara, Black Buck, Blue Bull, Caracal cat, Desert Cat, Houbara Bustard, Imperial Sand Grouse and Grey Partridges.
23.	Abbasia	"	10,070	Hare, Black and Grey Partridges, Houbara Bustard and Sand Grouse.
24.	Dauluana	"	2,429	Hare, Black and Grey, Partridge and Quails.
25.	Border Belt (Indo Pak)	"	–	Hog-Deer, Blue Bull, Sand Grouse Waterfowl, Grey and Black Partridges.
26.	Hala	Sind	953	
27.	Sahib Samo	"	349	
28.	Deh Khalifa	"	429	Partridges (Grey and Black).
29.	Deh Jangisar	"	314	
30.	Mirpur Sakro	"	777	
31.	Nara	"	109,966	Partridges (Black and Grey), Hog-Deer.
32.	Sumbak, Surjan, Eri and Hothiano.	"	40,632	Sind Ibex, Grey Partridge, Deer.
33.	Mando Dero	"	1,234	
34.	Dosu Forest	"	2,312	
35.	Khipro Forest	"	3,885	Partridges (Black and Grey) and Hog Deer.
36.	Tando Mitha Khan	"	5,343	
37.	Pai Forest	"	1,969	
38.	Indus River (From Guddu Barrage to Sukkur Barrage).	"	–	Indus Dolphin.
39.	Yakh Darra	NWFP	1,040	Monal Pheasant, Koklas.
40.	Agram Basti	"	2,560	Ibex, Snow Leopard, Snow cock.
41.	Darosh Gol	"	1,680	Markhor, Leopard.

1	2	3	4	5
42.	Gahriat Gol	"	3,000	Markhor.
43.	Parit Gol Ghinar Gol	"	5,460	Markhor, Snow cock.
44.	Daggar	"	100	Black and Grey Partridges and Chikor.
45.	Totali	"	16,190	Partridge (Black and Grey). Chukor.
46.	Swagali	"	1,620	Grey Partridge, Chukor.
47.	Shinawari	"	. 400	Grey and Balck Partridges.
48.	Resi	"	5,050	Grey, Partridge, seesee.
49.	Thanadarwala	"	4,050	Grey and Black Partridges.
50.	Nizampur	"	780	Hare, Grey Partridge, Seesee.
51.	Makhnial	"	4,248	Kalij Pheasant and Chukor.
52.	Zawarkan	Baluchistan	3,887	Markhor, Urial, Chukor and Seesee.
53.	Ras Koh	"	11,660	Ibex, Urial, Chukor and Seesee.
54.	Gogi	"	7,773	Chukor.
55.	Wam	"	10,364	Leopard and Chukor.
56.	Machayara	Azad Kashmir	13,537	Musk Deer, Ibex, Black Bear, Goral, Snow Leopard, Langoor, Rhesus Monkey, Pheasants, Chikor and Ram Chukor.
57.	Maji	"	3,861	Goral Balck Bear and Pheastrants.
58.	Kazinag	"	4,832	Markhor, Snow Leopard, Ibex. Black Bear, Rhesus, Monkey Langoor, Pheasants and Chukor.
59.	Hillan	"	423	Markhor, Goral, Snow Leopard, Pheasant.
60.	Mori Said Ali	"	243	Markhor, Goral, Black Bear, Snow Leopard and Pheasants.
61.	Phala/Kuthnar	"	324	Markhor, Musk Deer, Ibex, Black Bear, Goral, Rhesus Monkey, Langoor, Pheasants, Chukor and Ram Chukor.
62.	Vatala	"	450	Markhor, Blue Bull, Grey and Black Partridges.

1	2	3	4	5
63.	Ghamot	"	27,283	Ibex, Goral, Musk Deer, Monal and Western Horned Tragopan.
64.	Danyor Nallah	Northern Area	44,308	Ibex, Markhor, Urial, Snow Leopard, Chukor and Ram Chukor.
65.	Sherqillah	"	16,842	Ibex, Markhor, Brown Bear, Lynx, Chukor and Ram Chukor.
66.	Kilika Minteka	"	65,036	Marcopolo Sheep, Ibex, Snow Leopard, Wolf, Fox, Brown Bear, Chukor and Ram Chukor.
68.	Pakura Nallah	"	7,515	Ibex, Snow Leopard, Fox, Wolf Chukor and Ram Chukor.
68.	Nazber Nallah	"	33,425	Ibex, Snow Leopard, Lynx, Chukor and Ram Chukor.
69.	Chassi/Bowshdar	"	37,053	Ibex, Snow Leopard and Brown Bear.
70.	Tangir	"	14,251	Markhor Black Bear, Lynx, Wolf, Snow Leopard, Fox, Monal Pheasant, Chukor Ram Chukor and birds of Prey.
71.	Askor Nallah	"	12,955	Markhor, Ibex, Snow Leopard, Chukor, Ram Chukor and Birds of Prey.
72.	Satpara	"	31,093	Urial, Ibex, Musk Deer, Chukor and Ram Chukor.
73.	Nar Nallah	"	7,255	Ibex and Musk Deer.
74.	Islamabad	Federal Capital Territory.	53,878	Grey and Black Partridges and Waterfowl.
		Total ..	3,999,284	

*Except the Punjab borde belt with India.

Annexure IV-1

I. Pakistan Environmental Protection Ordinance (1983)

II. Table 1. Land Use Legislation
Table 2. Legislation regarding Energy and Soils
Table 3. Water Legislation
Table 4. Legislation regarding Vegetation
Table 5. Legislation regarding Wildlife
Table 6. Noise Legislation

PART I

Acts, Ordinances, President's Orders and Regulations including Martial Law Orders and Regulations

GOVERNMENT OF PAKISTAN

MINISTRY OF LAW AND PARLIAMENTARY AFFAIRS
(Law Division)

Islamabad, the 31st December, 1983

No. F. 17 (1)/83-Pub.—The following Ordinance made by the President is hereby published for general information:—

ORDINANCE No. XXXVII OF 1983

AN

ORDINANCE

to provide for the control of pollution and preservation of living environment

WHEREAS it is expedient to provide for the control of pollution and preservation of living environment and for matters connected therewith or ancillary thereto;

AND WHEREAS the President is satisfied that circumstances exist which render it necessary to take immediate action;

NOW, THEREFORE, in pursuance of the Proclamation of the fifth day of July, 1977, and in exercise of all powers enabling him in that behalf, the President is pleased to make and promulgate the following Ordinance:—

1. Short title, extent and commencement.—(1) This Ordinance may be called the Pakistan Environmental Protection Ordinance, 1983.

(2) It extends to the whole of Pakistan and its territorial waters, Exclusive Economic Zone and historic waters.

(3) It shall come into force on such day as the Federal Government may, by notification in the official Gazette, specify in this behalf.

2. Definitions.—In this Ordinance, unless there is anything repugnant in the subject or context,—

(a) "Agency" means the Pakistan Environmental Protection Agency ('PEPA) established under section 5;

(b) "Air pollutant" means any substance that causes alteration in chemical, physical, biological or radiological integrity of air and includes soot, smoke particulates, combustion exhaust gases, obnoxious gases and radioactive substances;

(c) "Council" means the Pakistan Environmental Protection Council established under section 3;

(d) "discharge" means spilling, leaking, pumping, pouring emitting, emptying or dumping;

(e) "effluent" includes any material in solid, slurry, suspension, liquid, vapour, fumes or gaseous form coming out as or from any industrial activity or any other source;

(f) "effluent standards" means the permissible limits prescribed by the Agency regarding the quality and quantity of effluents and wastes;

(g) "emission standards" means the permissible standards for emission of air pollutants prescribed by the Agency;

(h) "Exclusive Economic Zone" shall have the same meaning as in the Teritorial Waters and Maritime Zones Act, 1976 (LXXII of 1976);

(i) "Government agency" includes a division, department, bureau, section, commission, board, office or unit of the Federal Government or a Provincial Government;

(j) "historic waters" means such limits of the water adjacent to the land territory of Pakistan as are for the time being specified by notification under section 7 of the Territorial Waters and Maritime Zones Act, 1976 (LXXXII of 1976);

(k) "industrial activity" means any process for manufacturing, making, altering, repairing, ornamenting, finishing, packing or otherwise treating any article or substance with a view to its use, sale, transport, delivery or disposal or for pumping oil, water or sewage or for generating, transforming or transmitting power;

(l) "industrial waste" means waste resulting from an industrial activity;

(m) "local authority" includes any agency set up or designated by the Federal Government or a Provincial Government to be a local authority for the porposes of this Ordinance;

(n) "local council" means a local council constituted or established under a law relating to local government;

(o) "municipal waste" includes sewage, refuse sludge and human excreta and the like;

(p) "pollution" means any matter which, on being discharged into the air, soil or public waters, alters unfavourably the chemical, physical, biological or radiological integrity of the air, soil or public waters or, by itself or in combination with other discharges, is likely to make the air, soil or public waters unclean, noxious or impure or injurious or disagreeable or detrimental to the health, safety, welfare or property of persons or harmful to aquatic life, animals, birds, fish, plants or other forms of life;

(q) "prescribed" means prescribed by rules or regulations;

(p) "public waters" means water areas in public use and includes streams, nullahs, canals, seepage drains, natural or artificial water courses, rivers, wells, ponds, ditches, lakes reservoirs, underground or artesian water, territorial waters, the Exclusive Economic Zone and historic waters;

(s) "regulations" means regulations made under this Ordinance;

(t) "rules" means rules made under this Ordinance;

(u) "sewage" means liquid wastes from sanitary conveniences, kitchens, laundries, washing and the like;

(v) "standards" means effluent standards and emission standards;

(w) "territorial waters" shall have the same meaning as in the Territorial Waters and Maritime Zones Act, 1976 (LXXXI of 1976);

(x) "treatment works" means the various processes and devices used in the treatment of wastes; and

(y) "wastes" includes liquid wastes, solids wastes, industrial wastes, municipal wastes, wastes from mining processes and wastes from farm and agricultural activities such as poultry, cattle, animal husbandry, abattoirs and the use of fertilizers and pesticides.

3. **Establishment of the Council.**—(1) The Federal Government shall, by notification in the official Gazette, establish a Council to be known as the Pakistan Environment Protection Council and consisting of:

(i)	the President of Pakistan	Chairman.
(ii)	the Minister incharge of the subject of Environment	Vice-Chairman.

(iii)	Ministers incharge of the subject of Environment in the Provinces ..	Members.
(iv)	such other persons as the Federal Government may appoint..	Members.
(v)	the Secretary to the Government of Pakistan dealing with the subject ..	Secretary.

(2) The members of the Council, other than ex-officio members, shall hold office for a term of three years.

(3) The Council shall frame its own rules of procedure.

(4) The Council shall hold meetings as and when necessary:

Provided that not less than two meetings shall be held in a year.

(5) The Council may, by general or special order and subject to such conditions as it may consider fit, delegate any of its functions under this Ordinance to a Committee or any member of the Council.

4. Functions of the Council.—(1) The functions of the Council shall be to—

(a) ensure enforcement of this Ordinance;
(b) establish comprehensive national environmental policy;
(c) give appropriate direction to conserve the renewable and expendable resources;
(d) ensure that environmental considerations are interweaved into National Development Plans and Policies;
(e) ensure enforcement of the National Environment Quality Standards; and
(f) give directions to any Government agency, a body or a person requiring it or him to take measures to control pollution being caused by such agency, body or person or to refrain from carrying out any particular activity prejudicial to public interest or the purposes of this Ordinance.

(2) The Council may, or if so required by the Government or any Government agency shall, direct the Agency to prepare, submit and promote projects for the prevention of environmental pollution or to undertake research in any specified aspect of environment.

5. **Establishment of the Agency.**—(1) The Federal Government shall, by notification in the official Gazette, establish an Agency to be called the Pakistan Environmental Protection Agency to exercise the powers and perform the functions assigned to it under the provisions of this Ordinance or the rules and regulations.

(2) The Agency shall be headed by a Director General who shall be appointed by the Federal Government on such terms and conditions as it may determine.

(3) The powers and functions of the Agency shall be exercised and performed by the Director-General.

(4) The Agency shall have such administrative, technical and legal staff as the Federal Government may appoint.

(5) To assist him in the discharge of his functions, the Director-General may establish such Advisory Committees as he may deem fit and appoint as members thereof emient representatives of universities, research institutes, the business community and other professions and fields of knowledge.

6. **Functions of the Agency.**—(1) The Agency shall—

(a) administer this Ordinance and the rules and regulations;
(b) prepare national environmental policy for approval of the Council;
(c) publish an annual report on the state of environment;
(d) establish National Environmental Quality Standards with the approval of the Council;
(e) revise the National Environment Quality Standards as and when deemed necessary;
(f) coordinate environmental policies and programmes nationaly and internationally;
(g) establish systems for surveys, surveillance, monitoring, measurement, examination and inspection to combat environmental pollution;
(h) take measures to promote the development of science and technology which will contribute to the prevention of environmental pollution, such as the consolidation of survey and research system, the promotion of research and development, the dissemination of the results of such research work

and development work, and the education and training of research experts and other governmental functionaries;

(i) provide information and education to the public on environmental matters and to recommend to the Council the introduction of environmental information in the syllabi of educational institutions; and

(j) coordinate and consolidate implementation of measures to control pollution with Provincial Governments and other Government agencies.

(2) The Agency may—

(a) request any Government agency to furnish any information or data relevant to the functions of the Agency;

(b) with the approval of the Federal Government, initiate requests for foreign assistance in support of the objectives of this Ordinance and enter into arrangements with foreign agencies or organisations for the exchange of material or information and participate in international seminars or meetings;

(c) establish and maintain laboratories to conduct research in various aspects of environment and provide grants to institutions for specific projects;

(d) delegate any of its powers under this Ordinance and the regulations to any Government agency;

(e) identify the needs for legislation in the environmental field;

(f) at the request of the Federal Government or a Provincial Government or any Government agency, provide advice and assistance in environmental matters; and

(g) perform any other function which the Council may assign to it.

7. **Powers of the Agency.**—Subject to the provisions of this Ordinance, the Agency may—

(a) lease, purchase, acquire, own, hold, improve, use or otherwise deal in and with any property, both movable and immovable;

(b) sell, convey, mortgage, pledge, exchange or otherwise dispose of its property and assets;

(c) execute instruments, incur liabilities and do all acts or things necessary for proper management and conduct of its business; and

(d) appoint such advisers and consultants as it considers necessary for efficient performance of its functions on such terms and conditions as may be prescribed by regulations.

8. **Environmental impact statement, etc., to be submitted to the Agency.**—(1) The provisions of this section shall apply to such—

(a) persons or class of persons, or
(b) industrial activity or class of industrial activity, or
(c) category, type or volume of discharges of air pollutants or wastes, or
(d) area or class of areas, or
(e) classes of public waters.

as may be prescribed by regulations.

(2) Every proponent of a project the construction or completion of which is likely to adversely affect the environment shall file with the Agency, at the time of planning the project, a detailed environmental impact statement including information on:

(a) the impact on the environment of the proposed industrial activity;
(b) the treatment works of the proposed project;
(c) the unavoidable adverse environmental effects of the proposed project; and
(d) the steps proposed to be taken by the project proponent to minimise adverse environmental effects.

(3) The Agency may prescribe guidelines for the preparation of environmental impact statements and, where such guidelines have been prescribed, the proponents of projects shall prepare environmental impact statements according to the said guidelines.

(4) The Agency may itself or through the appropriate Government agency review the environmental impact statement and, where it deems appropriate, it may also involve public participation in the assessment of the environmental impact statement.

(5) After the review under sub-section (4), the Agency may either approve the environmental impact assessment or recommend to the Federal Government that the project be modified or rejected in the interest of environmental objectives.

9. **Agency to assist local councils, etc., in disposal of wastes.**—The Agency shall assist the local councils, local authorities or other Government agencies and persons to implement schemes for the proper disposal of wastes in line with the standards and procedures prescribed by the Agency.

10. **Funds of the Agency.**—The funds of the Agency shall be derived from the following sources, namely :—

(a) grants made and loans advanced by the Federal Government or the Provincial Government;

(b) grants, loans, advances and other moneys received from local or international agencies;

(c) fees, rates and charges received by the Agency under the provisions of this Ordinance; and

(d) all other sums received by the Agency.

11. **Audit and accounts.**—(1) The Agency shall submit its annual budget estimates for approval of the Federal Government through the Council.

(2) The Agency shall maintain proper accounts and other relevant records and prepare annual statement of accounts in such form as may be prescribed by rules.

(3) The accounts of the Agency shall be audited in such manner as may be directed by the Federal Government.

12. **Penalty.**—(1) Whoever contravenes or fails to comply with any provision of this Ordinance or of any rule or regulation or any direction issued by the Agency thereunder, shall be punishable with imprisonment for a term which may extend to two years, or with fine which may extend to one hundred thousand rupees, or with both, and in the case of a continuing contravention or failure, with an additional fine which may extend to ten thousand rupees for every day after the first during which such contravent or failure continues.

(2) The Director General or an officer generally or specially authorised by him in this behalf may compound any offence under this Ordinance.

13. **Indemnity.**—No suit, prosecution or other legal proceeding shall lie against the Council, the Agency, the Director General, or the members,

officers, employees, experts or consultants of the Agency for anything in good faith done or intended to be done under this Ordinance or any rule or regulation.

14. Bar of jurisdiction.—No Court shall take cognizance of any offence punishable under this Ordinance except on a complaint in writing made by the Agency.

15. Dues of Agency recoverable as an arrear of land revenue.—Any dues recoverable by the Agency under the provisions of this Ordinance or any rules or regulations shall be recoverable as an arrear of land revenue.

16. Power to make rules.—(1) The Federal Government may, by notification in the official Gazette, make rules for carrying out the purposes of this Ordinance.

17. Power to make regulations.—(1) The Agency may, by notification in the official Gazette, with the approval of the Federal Government, make regulations, not inconsistent with the provisions of this Ordinance or the rules, for carrying out the purposes of this Ordinance.

(2) In particular and without prejudice to the generality of the foregoing power, such regulations may provide for the levy of fees, rates and charges in respect of services rendered, actions taken and schemes implemented by the Agency.

GENERAL,
M. ZIA-UL-HAQ,
President.

C. A. RAHMAN,
Secretary

Annexure V.1

SELECTED ATMOSPHERIC POLLUTANTS

POLLUTANT	PRINCIPAL HUMAN SOURCES	EFFECTS	REMARKS
CARBON DIOXIDE	Fuel combustion for heating, transport, energy production.	No direct effect on people. Over time, may lead to increase in earth's temperature.	Normal constituent of atmosphere. Essential to plant life.
CARBON MONOXIDE	Incomplete fuel combustion (as in motor vehicles).	Deprives tissues of oxygen. People with cardio-respiratory diseases more sensitive.	Contribution of natural sources small. Smoking more significant for humans than exposure to traffic.
SULPHUR DIOXIDE	Burning of sulphur-containing fuels like coal and oil.	Combined with smoke, increases risk and effects of respiratory diseases. Causes suffocation, irritation of throat and eyes. Combines with atmospheric water vapour to produce acid rain. Reduces crop yields. Leads to acidification of lakes and soils. Corrodes buildings.	
SUSPENDED PARTICULATE MATTER	Smoke from domestic, industrial and vehicular sources.	Possible toxic effects depend on specific composition. Aggravates effects of sulphur dioxide. Reduces sunlight and visibility. Increases corrosion.	Chemically, a most diverse group of substances. Natural sources include dust-storms, volcanic eruptions and sea spray.
OXIDES OF NITROGEN	Fuel combustion in motor vehicles and furnaces. Forest fires.	Possible increase in acute respiratory infections and bronchitis morbidity in children. Produces brown haze in city air. Causes corrosion.	Nitrogen oxide and nitrogen dioxide are the two components.
VOLATILE HYDROCARBONS	Partial combustion of carbonaceous fuels, industrial processes, disposal of solid wastes.	React with other pollutants to produce eye irritants (acrolein, aldehydes). Ethylene is harmful to plants. Aerosol particles reduce visibility. May produce unpleasant odours.	
OXIDANTS AND OZONE	Emission from motor vehicles. Photo-chemical reactions of nitrogen oxide and reactive hydrocarbons.	Cause eye irritation and impaired pulmonary function in diseased persons. Corrode materials and reduce visibility. Ozone is one of the most damaging pollutants for plants.	Mainly derivative, products of atmospheric reactions between other pollutants. Ozone is a natural and essential constituent of the upper atmosphere.

Source: Preparatory document 48/8, Conference on the Human Environment, Stockholm 1972.

TABLE 1
LAND USE LEGISLATION

1. The Easements Act (No. V), 1882. Law of Easements and Licenses.
2. Transfer of Property Act, 1882.
3. The Land Acquisition Act, 1894.
4. Government Grants Act (No. XV), 1895.
5. Punjab Tenancy Act (XVII), 1887.
6. Government Tenants (Punjab) Act, 1893.
7. The Punjab Land Preservation Act (No. II), 1900.
8. The Colonization of Government Lands (Punjab) Act, (No. V), 1912.
9. The N.W.F. Tenancy Act, (No. XXV), 1950.
10. The Punjab Betterment Charges and Acreage Rates Act, 1952.
11. West Pakistan Land Reform Rules, 1959.
12. West Pakistan Land Reforms Regulation, 1959, M.L.R. No. 64.
13. Consolidation of Holdings Ordinance (No. VI), 1960.
14. West Pakistan Land Reforms (Ejectment of Tenants to Provide for Buildings) Rules, 1961.
15. Grant of Land (Gudu Barrage Area) Rules, 1964.
16. Land Revenue Act, 1967, Rules, 1968, Assessment Rules, 1968.
17. Pat Feeder Canal (Control and prevention of alienation of land) Ordinance (No. IX), 1967.
18. West Pakistan Land Revenue (Conferment of Rights of Ownership) Rules, 1969.
19. Land Reforms Regulation, 1972 (Repeals 1959 Regulation).
20. Sind Land Reforms Rules, 1972.
21. Land Reforms Regulation Sind (Amendment) Act, 1972.
22. Land Reforms Regulation Sind (Second Amendment) Act, 1972.
23. The Punjab Land Reforms Rules, 1972.
24. Punjab Land Reforms Rules, 1972 (Amendments).
25. Land Reforms (Amendment) Act, 1973.
26. Land Reforms (Punjab Amendment) Act, 1973.
27. Land Reforms (Amendment) Act, 1974.
28. Procedure for Ejectment Suits Rules, 1974.
29. Land Reforms (Amendment) Act, 1975.
30. The Punajab Land Reforms Appointment of Managers of Impartible Joint Holdings Rules, 1975.
31. Board of Revenue Instructions about Colonization Operation. (Standing Order No. 67 date uncertain).

Source: Johnson and Johnson. 1977.
M.Z. Khan. 1977.
Mian. 1976.

TABLE 2

LEGISLATION REGARDING ENERGY AND SOILS

The Electricity Act (IX). 1910 Soil Reclamation Act, (No. XXI), 1952. (Amended by Ordinance. 1964, 1965. and amended and extended by Ordinance (No. V), 1964.

Source: C.H. Ahmad. 1975.
Johnson and Johnson. 1977.

TABLE 3

WATER LEGISLATION

1. The Canal and Drainage Act (No. VIII) 1873. There are several similar and related acts, ordinances, amendment (1952, 1965, 1968, 1970).
2. The Sind Irrigation Act, 1879 (Amendment Ordinances, 1961, 1969).
3. Criminal Procedures Code (Act V), 1898). Sections 324 and 430.
4. The Punjab Minor Canals Act (No. VII) 1905.
5. The Inter-State Water Dispute Act. (No. 33) 1956.
6. The West Pakistan Water and Power Development Authority Act, 1958. (Similar Ordinance and Amendment Ordinances, 1958, 1964, 1967).
7. Determination of Land Revenue and Water Rate Ordinance. (No. IV), 1959. (Amended 1961).
8. The Indus Water Treaty, 1960.
9. The West Pakistan Land and Water Development Board (Authorit for payment from Board Fund) Rules, 1966; Reclamation (Fee Rules, 1965.
10. The Greater Lahore Water Supply Sewerage and Drainage, Ordi nances, 1967.
11. Notification (No. 5174-68/155-CRI) National Calamities (Preventio and Relief) Rules. 1969. Extensive provisions especially in respect o flood control.
12. Ordinance (No. IV). 1969. The Kabul River Project (Control an Prevention of Speculation in Land) (Amendment) Ordinance. 196 Further amends the Kabul River Project (Control and Prevention c Speculation in Land) Act. 1948.

Sources: Johnson and Johnson. 1977.
Major Acts. 1976.

TABLE 4

LEGISLATION REGARDING VEGETATION

1. Forest Act, (No. XVI) 1927. The Forest Act (Several Notifications fall under this heading). Protection, regulation of exploitation. includes protected forests.
2. The West Pakistan Goats (Restriction) Ordinance (XLII), 1959.
3. West Pakistan Goats Restriction Rules, 1961.

Sources: C.H. Ahmad. 1975.
Johnson and Johnson. 1977.

TABLE 5

LEGISLATION REGARDING WILDLIFE

1. Wild Birds and Animals Protection Act, 1912.
2. Rules for the Prohibition and Regulation of Fishing Burboster, Labeo Rohita, Catlcatla, Cirrhina and Mirgala less than 10 inches in length. (No. 2989/54-6541-D (f), 1954.
3. The Punjab Wild Birds and Wild Animals Protection Act (No. XIII), 1955. Punjab Wildlife (Protection, Preservation, Conservation and Management) Ordinance, (No. XXI), 1972: sepcifically related Rules, 1973.
4. Food and Agricultural Department (No. IV/(5)/17-SOA-VII-F and A/58). Rules for the Protection of Fish in the waters of the Shikarpur District. (Preceded by a Provisional Constitution Order, 1957).
5. The Goats (Restriction) Ordinance, (No. XLIII), 1959. Restricts the number of goats.
6. West Pakistan Wildlife Protection Ordinance, 1959.
7. Wild Life Protection Rules, 1960. Regulates hunting. (Various licence forms attached.) Wild Life Protection Ordinance (No. LVI) 1959.
8. Fisheries Rules, (No. 4(107)S.O. (F and C). 1964. Licences, etc.
9. The Sind Wildlife Protection Ordinance.
10. Baluchistan Wildlife Protection Act (No. XIX), 1974.
11. NWFP Wildlife (Protection, Preservation, Conservation and Management) Act (No. V), 1975.

Sources: Baluchistan Gazette. 1974.
Johnson and Johnson. 1977.
NWFP Gazette. 1975.

TABLE 6

NOISE LEGISLATION

The West Pakistan Regulation and Control of Loudspeakers and Sound Amplifiers Ordinance (II), 1965.

Source: C.H. Ahmad, 1975.

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