

ENVIRONMENTAL REPERCUSSIONS OF DEVELOPMENT IN PAKISTAN

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Glossary

arti	middleman in agricultural credit and marketing
babul	a kind of tree: botanical name
barani	rain-fed agricultural areas
bishti	water carrier
bowzer	mechanised water tanker
doab	land between two rivers
falah-o-behbood	social welfare
ghee	clarified butter
gowcher	grazing land
hamum	depressions where rivers end in arid areas in Baluchistan
islahi	reform
jagir	land granted for services rendered to the state
jirga	a committee of the elders of various tribes
johar	pond
katcha	unbacked or temporary: in this case land subject to seasonal flooding
katchi abadi	squatter settlement
kammi	artisanal castes
karez	an underground system of tapping water resources
karez-kush	the people who build the karez
kharif	autumn crop
mandi	market
mansab	title
mohallah	neighborhood
nullah	an open drainage channel
palla	a variety of fish
panchayat	a council of 5 elders
parao	camping ground
patwari	government employed revenue collector
rabi	spring crop
sailaba	land subject to flooding
serai	a hotel
shamlaat	community land
tali	a kind of tree: botanical name
talab	open water tank
tarai	a depression in which rain water gathers
tehsil	subdivision of a district
vanaspati	industrially manufactured cooking oil
zilah	district

Abbreviations

ACHR	Asian Coalition for Housing Rights
ADB	Asian Development Bank
ADP	Annual Development Plan
ADAB	Association of Development Agencies of Bangladesh
AIT	Asian Institute of Technology
AERC	Applied Economic Research Centre
AKHS	Aga Khan Health Services
AKMU	Aga Khan Medical University
AKRSP	Aga Khan Rural Support Programme
AZRI	Arid Zone Research Institute
BCCI	Bank of Commerce and Credit International
BIAD	Baluchistan Integrated Area Development
CAA	Civil Aviation Authority
CAG	Community Action Group
CEBEMO	Dutch finance aiding agency's name
CIDA	Canadian International Development Agency
DCET	Dawood College of Engineering & Technology
EEC	European Economic Community
EIA	Environmental Improvement Agency
EIS	Environmental Impact Statement
EMS	Environmental Management Society
ENERCON	National Energy Conservation Centre
EPA	Environmental Protection Agency
EPC	Environmental Protection Council
EPO	Environmental Protection Ordinance
EPSP	Environmental Protection Society of Pakistan
EUAD	Environment and Urban Affairs Division
FAO	Food and Agricultural Organisation
FPCCI	Federal of Pakistan Chamber of Commerce and Industry
FATA	Federally Administrative Tribal Areas
FBS	Federal Bureau of Statistics
GNP	Gross National Produce
GOP	Government of Pakistan
HEC	Human Environment Cell
HIC	Habitat International Coalition
HYC	High-yielding varieties
IBRD	International Bank for Rural Development
IDRC	International Development Research Centre
IPHER	Institute of Public Health Engineering and Research
IRDP	Integrated Rural Development Programme
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
JRC	Journalist Research Centre
KCCI	Karachi Chamber of Commerce and Industry
KDA	Karachi Development Authority
KESC	Karachi Electricity Supply Corporation
KIDP	Kalam Integrated Development Project
KV	Kilo Volt
LBOD	Left Bank Outfall Drain
LCCI	Lahore Chamber of Commerce and Industry
LSCP	Low Cost Sanitation Programme
LG&RDD	Local Government and Rural Development Department
LHV	Lady Health Visitor
MEU	Mission Environmental Unit
MGD	Million Gallons Daily
MP&EC	Master Plan and Environment Control

NA	Northern Areas
NBRI	National Building Research Institute
NCS	National Conservation Strategy
NED	National Engineering Department
NEC	National Environmental Council
NIO	National Institute of Oceanography
NGO	Non-Governmental Organisation
NGOCC	Non-Governmental Organisations Coordinating Council
NORAD	Royal Norwegian Embassy Development Corporation
NWFP	North-West Frontier Province
ODA	Overseas Development Authority
OPP	Orangi Pilot Project
PARC	Pakistan Agricultural Research Centre
PARD	Pakistan Academy for Rural Development
PCRWR	Pakistan Council for Research in Water Resources
PEPF	Pakistan Environmental Protection Foundation
PILER	Pakistan Institute of Labour Education and Research
PCSIR	Pakistan Council of Scientific and Industrial Research
PEC	Pakistan Engineering Council
PEPA	Pakistan Environmental Protection Agency
PEPO	Pakistan Environmental Protection Ordinance
PFI	Pakistan Forest Institute
PHED	Public Health Engineering Department
PVHNA	Pakistan Voluntary Health and Nutrition Association
PWD	Peoples Works Department
RTI	Research and Training Institute
SAP	South Asia Partnership
SANGO	South Asian Non-Government Organisation
SCARP	Salinity Control and Reclamation Project
SDC	Swiss Development Cooperation
SAZDA	Sindh Arid Zone Development Authority
SITE	Sindh Industrial Trading Estate
SRWCO	Sindh Rural Workers Cooperative Organisation
SWMB	Sindh Wildlife Management Board
SUPARCO	Pakistan Space and Upper Atmosphere Research Commission
UNEP	United Nations Environmental Programme
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
URC	Urban Resource Centre
VO	Village Organisation
WAPDA	Water and Power Development Authority
WHO	World Health Organisation
WWF	World Wildlife Fund

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PART - I

**OVERVIEW OF NATIONAL ENVIRONMENTAL
CONCERNS AND PROBLEMS**

PART - 1

OVERVIEW OF NATIONAL ENVIRONMENTAL CONCERNS AND PROBLEMS

A. INTRODUCTION

1. Pakistan's environmental problems, like those of other Third World countries, are largely the result of the colonial and post-colonial development models promoted by the First World and of their physical, social and economic repercussions. Tackling these problems is not an easy affair because these models still persist. In addition, the task is further complicated because of increasingly unequal social, economic and political relationships between different sections of society in Pakistan and unequal trade relations between Pakistan and the developed world. Environment-related problems cannot be viewed in isolation from these larger realities.
2. Poverty is the main impediment to dealing with environment related problems that development has created. Because of it there is an increasing demand on the already meagre resource base of the country. This problem is further compounded by exceptionally high population growth rates and the exorbitant cost of installing, maintaining and operating contemporary development. Furthermore, neither the urban nor the rural populations possess the vision or the managerial and technical tools for dealing with the changes that have taken place in the last hundred years in their social and physical environment.
3. The state has similar problems in dealing with environmental matters. Per capita revenue generation and production is declining while per capita non-development expenditure is rapidly increasing. In addition, the state has traditionally used the old feudal or clan system as an intermediary between itself and the people for all development and its subsequent maintenance and operation, thus freeing itself from much of the financial and management burden involved in the process. The feudal and clan systems are now dead for all practical purposes and no new institutional set up has yet replaced them.
4. Thus, for an understanding of Pakistan's environment-related problems and for their possible solutions, a discussion on a whole range of social, economic and political issues related to development is necessary. This can best be done by describing the process of change that has taken place since the last century and its overall repercussions. It is felt that in analysing this process of change not only will the various components of the problem be understood but also some directions for the future will emerge.
5. The above considerations have defined the structure of this overview. The report describes in detail the pre-colonial social economy of the country and its various components. It also describes the nature of change as a result of colonial development and its overall social, economic, political and physical repercussions. State and community responses to these repercussions are described and their constraints and potentials, along with those of international donor agencies, are also discussed. Thus, an attempt has been made to put the environment related problems of Pakistan in their larger social, economic and political context.

1. BACKGROUND AND CONTEXT

Political and Administrative Divisions

Politically, Pakistan is divided into four provinces. These are, the NWFP, Punjab, Sindh and Baluchistan. In addition, there is the federally administrated region called the Northern Areas (NA) and the Federally Administered Tribal Areas (FATA) which border Afghanistan, Azad Jammu and Kashmir is an independent region with economic, communication and political links with Pakistan. Each province is divided into administrative units known as divisions. Each division is further divided into districts, or *zilahs* as they are called, and each *zilah* into sub-districts or *tehsils*.

The Geographical Setting

Pakistan can be divided into four broad geographical areas. These are the northern mountains, the western highlands, the Indus plains and the eastern deserts. Each of these divisions can be further sub-divided into smaller geographical entities.

Hydrologically, on the other hand, Pakistan can be divided into three main regions. The Indus basin, which consists of the river Indus and its tributaries, is the largest of the three. It drains into the Arabian Sea and is inhabited by 77 per cent of Pakistan's population. The closed basin of the Kharan desert in Baluchistan drains into larger saltpetre wastes known as *hamums*, the largest of which is the Hamum-i-Mashkhel where the Mashkhel river system terminates. The third unit is the Makran coastal basin. It consists of a large number of small seasonal rivers and two perennial ones, the Dasht and the Hingol, which drain into the Arabian Sea. In addition, there are the catchments and watersheds of the northern mountains and the western highlands which feed these river systems.

The Northern Mountains

Three of the greatest mountain ranges in the world, the Karakoram, the Himalayas and the Hindukush, meet to form the northern mountain region of Pakistan. This region has an average altitude of 3,000 metres and contains several peaks of over 6,700 metres altitude. It also contains the largest glaciers in the world outside the polar region. These glaciers feed the Indus river system on which most of Pakistan's agricultural and other human activity depend.

These three mountain ranges, especially the Karakorams, are still relatively young and not fully formed and settled. This factor, along with intense glacial activity, extremes of climate, and sparse or no vegetation, leads to massive soil erosion and landslides in this region. As a result, the Indus river and its tributaries carry huge quantities of silt with them to the plains. This process causes silting of the reservoirs, head-works and canals of the irrigation and hydro-power systems in the plains and increases the incidence of flooding.

The three mountain ranges also form the watersheds of Central Asia and Indian river systems. The Karakorams feed the Tarin basin in China and the Hindukush extends into China and Afghanistan to feed the Amu Darya river systems in Central Asia. The Himalayas extend into India and Tibet and form the watershed of the Brahmaputra and Ganges river system.

Rainfall varies considerably in the northern mountain region. Where it is substantial or where soil conditions react favourably to the melting snows, there are extensive pine and fir forests and lush pasture lands. For the most part, however, the area is barren, sparsely populated and inaccessible, except for the valleys which are fed by glacial rivers and springs. Agriculture and pastoral activity, on a small scale and at subsistence level, is carried out in these valleys by harnessing the sources of water, and fruit trees and orchards are common. In addition, a large variety of deciduous trees such as maple, poplar, birch and willow grow in these valleys.

The northern mountain region consists of the administrative units of the Northern Areas; the Kohistan, Dir, Mansehra, Chitral, Bajaur, and Malakand districts of the NWFP; and the major part of Azad Jammu and Kashmir. The area includes the valleys of Chitral, Dir, Swat, Gilgit, Hunza, Baltistan, Murree and Kaghan.

The Western Highlands

The entire region of Pakistan west of the River Indus and south of the mountain region, except for the Peshawar and Charsadda valleys in the NWFP, the Derajat plain in the NWFP and the Punjab, and the plains between the Indus and the Kirthar range in Sindh, form the western highlands of Pakistan. The Pothwar plateau, east of the Indus and encompassing the whole of the Rawalpindi division, also forms a part of this region.

The entire region is a plateau with a number of small mountain ranges whose altitude diminishes as one moves south towards the sea. The main ranges are the Safed Koh in the NWFP, the Salt range in the Punjab, the Sulaiman mountains in the NWFP and Baluchistan, the Kirthar range in Baluchistan and Sindh and the Toba Kakar range along with a number of smaller ranges in Baluchistan. The average height of the plateau varies from 600 to 1,800 metres and many of the mountain ranges have peaks of 3,000 metres and above.

The western highlands of Pakistan are, by and large, arid, rocky and sparsely populated. As one moves south from the Pothwar plateau towards Baluchistan, the aridity increases and the major part of Baluchistan is desert. Small communities carry out rainfed agriculture and nomadic pastoral activity. In the small river valleys such as Zoab, Orak, Dasht and Kech, and in areas fed by melting snows, such as Pishin and Ziarat, fairly extensive agriculture and fruit farming is carried out. However, such areas form no more than 5 per cent of the land mass of the region.

The Indus Plains

The Indus plains in Pakistan lie south of the mountain region and between the Indian frontier in the east and the western highlands, and extend down to the Indus delta country in the south. They also extend east into Indian Punjab and link up with the Gangetic plains of northern India. This entire region is flat and the soil consists of fine alluvium deposited by the Indus and its tributaries. The plains can be divided into two distinct regions, the upper plains which roughly correspond with the borders of Punjab province and the lower plains which are in Sindh.

The upper plains are watered by the Indus and its five eastern tributaries: the Jhelum, the Chenab, the Ravi, the Sutlej and the Beas. Except for Jhelum, which rises in Kashmir, all the rivers enter Pakistan from India. They combine near Multan to form the Panjnad river which joins the Indus at Rajanpur. The upper Indus plains are a vast area and intensive agriculture through canal irrigation is carried out in the *doabs*, as the areas between the rivers are called.

The lower Indus plains consist of the area below the meeting of the Panjnad with the Indus. Seldom more than 50 miles in width, they are also canal irrigated. On the east they are bounded by the Cholistan, Nara and Thar deserts and their southernmost area contains the vast Indus delta country where the Indus fans out into the sea.

Most of the area of the Indus plains has historically been an arid desert. The only natural vegetation of any substantial quantity has been along the rivers. This has consisted of tamarisk and *tali* forests sustained by the yearly flooding of the rivers. Most of these forests, especially in the upper plains, have been cleared in recent times for irrigated agriculture. In the delta region there are also substantial mangrove forests.

The Indus plains contain 77 per cent of Pakistan's population and almost all its major cities and industries. Income per capita and literacy rates are higher here than in the rest of the country, especially in the upper plains, and communications are much better developed.

The Eastern Deserts

East of the lower Indus plain are the deserts of Nara and Thar in Sindh and of Cholistan in the Punjab. These deserts extend east into Indian Rajasthan. They consist of shifting sand dunes of 20 to 100 metres in height with flat areas between them. These flat areas are fairly fertile and yield a good crop of millet and other grains after the monsoon rains. After the rains the desert also supports a variety of grasses which are excellent fodder. However, rains are meagre and erratic and these areas are subject to long periods of drought.

In addition to rainfed agriculture, the inhabitants also engage in pastoral activity. In the Thar and Nara deserts alone there are over 2.75 million head of livestock as against a human population of 760,000. Due to extremely arid conditions in the desert, this activity is nomadic in nature.

Large parts of these desert regions have now been brought under cultivation through canal irrigation. Apart from such areas, the desert region contains no major human settlements except small scattered hamlets seldom consisting of more than 40 to 60 households.

Climate

Pakistan is an arid country. Over 75 per cent of it receives less than 250 mm rainfall annually and 20 per cent of it less than 125 mm. Almost all rainfall occurs in the monsoon season between May and August as a result of the south-west monsoon which moves into Pakistan from across the Indo-Gangetic plain and strikes against the high mountain ranges. Winter rains are usually the result of local atmospheric disturbances and are very meagre. Maximum rainfall, between 500 to 1,000 mm per year, occurs in parts of the mountain region and its foothills, both of which are sparsely populated. In addition, these regions have steep slopes which pose management problems, making it difficult to utilise the rainfall adequately for cultivation. As one moves south towards the coast rainfall diminishes, with most of Baluchistan, the coastal regions and the lower Indus plains receiving less than 125 mm annually. Rainfall, apart from being meagre, is also erratic; the areas with low rainfall are also those with the most irregular rainfall patterns. The aridity of Pakistan has, to a large extent, determined the nature of productive activity in the country and made it almost entirely dependent on canal irrigation for agriculture.

Pakistan has a warm temperate climatic. In the mountain region temperatures and the length of winter are related to altitude and winters are severe with heavy snowfall in the higher regions. Summers are cool. In the western highlands, winters are comparatively short but severe in the north and in higher altitudes. Summers in most of the western highlands are severe, except at higher altitudes (as in Quetta, Kalat or Ziarat) and temperatures can be as high as 45 degrees centigrade. In the Indus plains, winters are short and mild and summers extremely hot. As one moves south the winters become milder until at the coast they are warm and of only two months duration. Summers along the coast are also milder due to the moderating effect of the sea breeze.

Population

Pakistan's population is nearly 95 million, and growing at a rate of 3.2 per cent per year. It is projected to be 143 million by the year 2000. The urban population is 31 per cent of the total population and is growing at a rate of 4.4 per cent per year. Thus, by the year 2000, it will be about 40 per cent of Pakistan's total population. In 1947, when Pakistan was created, the urban population of the country was only 18 per cent of the total population (1).

As mentioned earlier, over 77 per cent of the country's population lives in the irrigated areas of the Indus plains. Less than 6 per cent lives in Baluchistan and the rest in the western highlands of the NWFP and the northern mountain region (2). The highest population densities, over 600 persons per square kilometre, are found in the Karachi and Lahore administrative divisions, followed by the central districts of the Punjab, the Peshawar and Hazara districts of the NWFP, the Hyderabad district of Sindh and the Quetta district of Baluchistan. Densities in these districts vary from 300 to 600 persons per square kilometre. The most sparsely populated districts of the country are also its most arid and are located in the western part of Baluchistan. Densities here are lower than 10 persons per square kilometre (3).

Pakistan's high population growth is adding to the densities of the already high density areas of the country and rapidly increasing the size of urban centres. At their present level of productivity, Pakistan's natural resources cannot sustain this growth rate and there is already severe population pressure on crucial - and fragile - resources like watershed areas and semi-arid grazing grounds. Population growth is therefore likely to lead to further poverty and environmental degradation, especially in the absence of infrastructure facilities for the expanding urban population.

The Traditional Social Economy: Productive Activity

Agriculture

Traditionally, agriculture has been the main productive activity of the people of Pakistan. Before the establishment of perennial irrigation it was mainly carried out in the flood plains of the Indus rivers and their inundation channels. These flood plains are called *sailaba* lands in the upper Indus plains and *katcha* lands in the lower Indus basin. The crop was sown after the flood waters receded in late summer. In winter the *rabi*, or winter, crop was sown through either lift irrigation, mainly by the Persian wheel, or through ground water that the soil could absorb from the nearby river. Often, especially in the upper Indus plains, winter rains would help the *rabi* crop. Tamarisk forests on either side of the flood plains protected the soil of the *sailaba* and *katcha* lands from being washed away by the falling flood waters. Thus, most of the Pakistan plains were desert except for a few miles on either side of the Indus river basin. In addition to the Indus plains, similar agricultural practices were and still are adopted by farmers in the Dasht, Kech and Hingol river valleys in Baluchistan and in areas of the Kabul river valley in NWFP. In these areas, however, there is almost no water in the rivers in winter and whatever water there is, is acquired from temporary wells in the semi-dry river beds.

About five hundred years ago, the rulers of the areas that today form Pakistan started to develop a number of large inundation channels that took the flood waters of the Indus rivers long distances into the desert. In addition, they dredged the existing inundation channels and built embankments along them. This activity coincided with the development of a revenue collection system related to agriculture, and was no doubt undertaken to increase revenues. Due to this activity, large tracts of the Mianwali, Jhang, Muzaffargarh, Multan, Hyderabad and Thatta districts were brought under cultivation and constitute today the oldest agricultural areas of the Indus valley. Winter crops were grown in the region of these inundation channels through lift irrigation from large ponds. These ponds were especially developed for this purpose and evaporation of water was prevented by the plantations around the ponds and lotus plantations in them. Drinking water in these areas was acquired through wells. These irrigated areas of the Indus plains were the only areas in Pakistan, apart from the flood plains, that produced major agricultural surpluses until recent times.

In the western highlands and in the other desert regions of Pakistan, rainfed or *barani* (as distinct from irrigated) agriculture is carried out. This consists of ploughing the land, scattering seed and waiting for the rains. In the northern parts of the western highlands rains are fairly regular and adequate and fairly good summer and winter crops may be produced. However, in the southern and western parts of the highlands and in the eastern deserts only a millet crop, which is harvested in October, is possible. Drinking water in these regions is acquired by tapping a rainwater aquifer, often over 50 metres below the ground, through wells. Agriculture in the rainfed areas, however, is and always has been of a subsistence nature.

In the highlands of Baluchistan, agriculture has traditionally also been carried out through the *karez* system. This consists of tapping a regular water source in the mountains and bringing it into the valleys through subterranean channels. Some of these channels are over fifty miles long and are remarkable examples of hydrological engineering. *Karez*s are now disappearing due largely to the problems associated with the collective, community based management and maintenance which is required to sustain them. However, in the recent past the districts of Quetta, Pishin, Loralai and Kalat were extensively served by this system.

In the valleys of the northern mountain region water is brought from glaciers and snow melt originating on mountain tops, to terraced fields through water channels constructed along the contours of the hills. Some of these channels are many miles long. Agriculture in the valleys has traditionally been of a subsistence nature and in most cases the short growing season means there is no winter crop.

Pastoral Activity

Traditionally, pastoral activity has been very closely linked with agricultural activity. The nature of this link has depended on the availability of water for agriculture and pasture land for grazing.

Major pastoral activity has been concentrated in the rain-fed areas of the western highlands and in the eastern deserts, both of which support a variety of grasses after the rains in summer. In those *barani* and desert areas where rainfall is meagre and winter rains rare, such as in Tharparkar, the water in

the wells is depleted and becomes brackish by January. Often, the pastures are also depleted by February or March and the water in the *tarais* and *talabs* where animals are watered dries up. Due to these reasons, the inhabitants, along with their animals, migrate to the flood plains, which today constitute the irrigated areas. Here they were traditionally provided with water, pasture along the river and protection by the communities of the flood plains. The time of this migration coincided with the wheat harvesting season in these areas and the migrants traditionally provided labour for this activity. In addition, the desert people are excellent artisans. Much of the cloth weaving, ironmongery for agricultural implements and tanning of animal hides was done by them during their seasonal migration, for the people of the flood plains. The flood plains also depended on the desert or rain-fed areas people for a variety of dairy products such as *ghee*, or clarified butter. Thus, a relationship of interdependence developed between the people of the flood plains and those of the rain-fed areas.

There are also a number of tribes and clans, such as the Gujjars, who are exclusively dependent on pastoral activity. These tribes migrate seasonally with their animals. In winter, they would move into the area of the flood plains and under an agreement with the local communities they would water and graze their animals along the rivers. In summer, they would move into the valleys and highlands where the melting snows and glaciers would replenish the pasture lands. In addition, until recently the Kochi tribes from Afghanistan and Brohi tribes from Baluchistan also moved down in winter to the Punjab and Sindh plains respectively. Apart from pastoral activity they undertook the construction and maintenance of mud buildings, walls and embankments in exchange for protection, grazing rights in the plains and water.

Most agriculturists in the mountain region also carry on pastoral activity. In winter the animals are kept at home and inadequately staff fed. In summer they are taken to the highland pastures.

Fishing Activity

Fishing has never been a major activity in Pakistan and the communities that have been involved in fishing have been considered 'low castes' by the agricultural and pastoral peoples. These communities have been characterised by weak social organisation, and a subservience that is almost slavery to the better organised tribes and clans.

Fishing in the Indus river has been dominated by the Mohana tribe. They are considered the oldest inhabitants of the Indus valley and live on the river in wooden houseboats. They would traditionally trade their catch for dairy products with the Gujjars and for wheat, rice and vegetables with the agriculturists. Part of their catch was also collected as revenue by the officers appointed by the state. In the delta region, the fishing clans are known as Dablas and they are a far more depressed community than the Mohanas. In addition to the river valleys, Mohanas are also found on the Manchar and other large lakes in Sindh.

On the Baluchistan coast, fishing has traditionally been carried out by the Kalmate tribe. Due to limitations on the size of boats and absence of mechanisation, fishing in the coastal belt was, till the mid-seventies, a very limited and socially despised activity. However, traditionally, there was no tax on fishing activity along the coast except at Karachi and Gwadar.

A system of contracting out fishing rights in lakes, rivers and certain coastal areas to increase state revenues was instituted by the British at the turn of the century. This contracting system has further marginalised the fishing communities and constitutes the major cause of their poverty and exploitation.

Artisanal Skills, Trade and Transportation

All productive activity in Pakistan was served by artisans and so were the daily needs of the urban and rural people. The relation of the artisanal classes and the productive classes is detailed later in the Report.

Trade and transportation of goods was a major activity in Pakistan. The Central Asia trade moved across the upper Indus plain from India to Turkistan and China. In the south there was extensive sea trade between the Indus delta, the Persian Gulf and the African and Indian coasts. In addition, there was a link through Baluchistan of Arabia with Central Asia. A large number of tribal people were involved in providing animals and protection to the caravans that moved across these trade routes and

an even larger number provided maintenance and operational services to the *serais* and *paraos* on the trade routes.

One of the major modes of transportation in Pakistan was by boat on the Indus rivers. This activity was managed by the Mirbahars, superior cousins to the Mohanas. Their headquarters were at Mianwali and Kalabagh on the Indus and their boats carried all agricultural produce, timber and fuel wood from the flood plains to the major cities, most of which were on the Indus rivers or near to them.

The Urban Centres

Until the 1880s, the size of the major urban centres in Pakistan was directly related to the levels of surplus produced by the agricultural areas and the extent to which the urban areas could process this surplus for manufacture and trade. A number of smaller towns developed on the trade routes and rivers for the purpose of servicing this trade. The cities also housed the central administrative authority which controlled the revenue collection system in the rural areas.

The Traditional Social Economy: The Social and Political Organisation of Productive Activity

The environmental problems facing Pakistan need to be placed in the context of the social and political organisation of traditional productive activity, and the changes that have occurred in this area over recent decades. Traditional systems of production were sustainable for two reasons: the balance maintained between natural resource use and availability; and the interdependence between state and community institutions, which produced a relationship of relative equality. But the development activity of the last hundred years, and particularly of the last four decades, brought about major social, economic, demographic and physical changes in the area that is now Pakistan. As a result of these changes, traditional community institutions have either had to adapt, or have become redundant. Meanwhile, appropriate state institutions have not evolved to meet the requirements of the new modes of production, nor of the services sector that serves them or the expanding urban areas. In the absence of such institutions, the regulatory mechanisms necessary for environmentally balanced growth can neither be introduced nor implemented.

Actors in the Organisation of Productive Activity

Productive activity was organised in a very similar manner in most areas of Pakistan, irrespective of whether it was agricultural or pastoral, or in irrigated or *barani* areas. There were three main components in the structure of productive activity: the revenue system operated by the state and its relationship with the feudal structure; the tribal, clan or caste organisations of the agricultural and pastoral people; and the tribal or urban communities.

The Revenue System

In almost all areas that constitute Pakistan today, the state had organised a system of revenue collection through a state bureaucracy. The system was first developed in the sixteenth century and modified by the British in the nineteenth century.

In theory, in pre-British days, all land belonged to the king. It was parcelled out to court notables or politically powerful tribal or clan leaders as a *mansab* or *jagir*, on a district-wise basis, for the purposes of revenue collection and related activities, maintenance of law and order and raising of troops. These individuals held the land for a period of time, as determined by the king. The title to the land was not hereditary and they fulfilled their functions with the assistance of the *tehsil* bureaucracy and *patwaris*, or revenue collectors, who operated at the village level. The British changed the system in two ways. First, the *mansab* system was replaced by a professional bureaucracy consisting of a commissioner and deputy commissioners under him. Second, a class of hereditary landlords was created which helped and assisted the state in fulfilling its functions and was loyal to it. In the small princely states and fiefdoms which were not directly controlled by the British, the local rulers adopted a similar system of revenue collection and control over prosecution.

Tribe and Clan Organisations

All rural society in Pakistan was traditionally divided into clans and tribes. Urban society was an extension of the rural social structure and thus these divisions were also present in the towns. The major clans and tribes were agriculturists and most of them, or their sub-clans, also engaged in pastoral activity. There were also a very few tribes or clans which were by tradition exclusively pastoral and not permitted to participate in agricultural activity.

As agricultural activity required a more sophisticated level of organisation than fishing or animal grazing, the agricultural clans had a far more coherent political organisation than the other clans or tribes. As they also produced a surplus, their relationship with the state was more institutionalised.

Every clan had its *panchayat*, or council, consisting of five elders chosen with the consensus of the important members of the community. Most property and personal law and often matters related to management of *shamlaat* lands were administered by these elders. In the tribal areas these matters were dealt with by the tribal chief whose position in most cases was hereditary. More complex matters related to property, crime or violation of tribal codes were referred to a *jirga*. The *jirga* was, and still is, a regional grouping of tribal chiefs. In addition, the region's relationship with the state on existing and related matters, political groupings and development directions were discussed in the *jirga* whose decisions were binding on the tribes it represented. The whole system of clan and tribal government was helped by the fact that in almost all cases the population of an individual village belonged to the same tribal group.

With the development of European-type feudalism under British rule, the landlords became an important part of village government. They decided on the composition of the *panchayat*, they assumed the role of tribal chiefs and interfered with the functioning of these ancient institutions. In addition, they were backed by the state which, in the majority of what now constitutes Pakistan, had developed a parallel system of justice based on Anglo-Saxon law. However, traditional institutions survived with considerable vitality till the 1950s, and in the more remote areas of the country continue to function, although their role in community life has diminished considerably.

The Artisanal Castes

Agricultural villages and most pastoral communities were served by hereditary artisans. They were protected by the agricultural and pastoral communities and provided with the necessities of life. However, they were not allowed to own immovable property or animals. Each village family paid them seasonally in grain or dairy products and, in exchange, the artisans could be called upon to serve the families as and when the need arose.

The artisanal castes were called *kammis*, or low caste, by the agriculturists and pastoral people and inter-marriage between them and between the various artisanal castes themselves was prohibited. The main artisans in a village were, in order of importance and prestige, the barber, the carpenters and masons, the tailor. The weaver, the butcher, the washerman, the potter, the water carrier and the singers, dancers and entertainers, some of whom were often also blacksmiths and metal workers. The lowest castes were of the cobblers, tanners and scavengers and they were considered 'untouchables' in the more orthodox Hindu-dominated areas.

Each artisanal caste had its own *panchayat* that administered its personal law and represented it in dealings with other castes and the agricultural and pastoral clans and tribes. As the artisanal castes were dispersed over the numerous villages, the *panchayat* of each caste was on a regional rather than a village basis.

There are certain areas of Pakistan, such as the Northern Areas, where there are no artisanal classes except for blacksmiths and singers. Family members take care of the functions that the artisans perform in other parts of the country. However, this phenomenon is extremely rare and one comes across it only in very inaccessible and historically isolated parts of Pakistan.

The artisanal classes, also hereditary in nature, served the urban communities and were paid by members of the *mohallahs*, or neighbourhoods, in both cash and in food, housing, clothing and tools. They were given protection by the neighbourhood but had their own *panchayat*, often on a larger regional basis than the town they worked in.

Community Lands and Their Functions

Productive land was, broadly speaking, divided into two categories: private owned land and community land. Until the development of perennial irrigation almost all private owned land was held by big landlords and cultivated by their serfs. Community land, commonly known as *shamlaat* or *gowcher* land, was collectively owned by a village, or a group of villages and administered by the local feudal or tribal authority or by the village council. Under the 'land settlement' carried out by the British, most of these community lands were retained as such. However, large tracts of *shamlaat* and *jagirs* which contained forests and lakes were taken over by the state for commercial exploitation. Large areas of pasture lands were also taken over, to be leased out annually to pastoral tribes, thus ensuring the dependence of the tribes on the state and increasing state revenues.

Most community lands were used as common grazing and pasture grounds, and for forestry. Timber, fuel wood, reeds, grasses and other forest products like medicinal herbs or wild mushrooms were obtained from the common lands and forests. Each family in the community had access to the common lands, according to rules framed by the local authority, whether village, clan or tribal. Felling of trees for timber was done according to allocations determined by these authorities. The quantum depended on the social status of the family and its need at a particular moment. Common forests and pastures were not used for commercial purposes, and the laws governing their use were strictly enforced. The revenue system and the community leadership cooperated in this system of protection and controls over the use of natural resources. The expansion of villages into new areas as a result of growing population also took place on common lands, and was determined by the leadership, usually after discussion with the agriculturist and in some cases the pastoralist groups using the land.

Other Functions of the System

The manner in which the old social economy was organised gave the village communities a remarkable amount of self-sufficiency and fulfilled the needs of the population as defined by the more powerful classes. The artisanal system catered to every conceivable need of the village from cloth weaving, house building and shoe making to entertainment, making of agricultural implements and excreta disposal. In addition, the system also maintained the infrastructure required for agricultural and pastoral activity and undertook the necessary expansion of this infrastructure to colonise more land.

In the irrigated areas, the feudal order mobilised the community to build and seasonally maintain the water and drainage channels. In Baluchistan, the feudal order organised the construction, maintenance and expansion of the *karez* system through the *karez-kush*, the enslaved artisans retained specially for this work, and determined the relationships between the various users of the system. In the rainfed and desert areas, the people were mobilised for the building and seasonal desilting of *talabs* and *tarais* and the maintenance of embankments to control and direct water run off. In the mountain valleys, entire populations were moved to new sites to construct water channels and colonise new land. All this was possible because relationships were clearly defined on the basis of needs, social and economic mobility was seldom possible or aspired to, populations were small and their growth rates were low, the state did not interfere in local matters or try and control production processes and natural resources were not exploited commercially. In addition, most exchange was through barter and labour time did not have a cash value.

2. DEVELOPMENT POLICIES AND THEIR REPERCUSSIONS

Development Under Colonialism and After

The Capitalist Revolution in Europe and Its Repercussions

Europe's industrial revolution required two things for its expansion and consolidation: cheap and ready availability of raw materials, and markets for its manufactured goods. The tremendous growth in population in nineteenth century Europe, mainly as a result of improved water supply and sanitation, also produced new demands which Europe's limited land and other resources could not meet. Colonisation was thus an imperative, to fulfil these requirements through access to other countries' human and natural resources. The area that is today Pakistan, and was once part of British India, was also included in this process, and experienced the consequences of social and economic change that accompanied.

Objectives of Development Under Colonialism

Development brought about by the colonial regime in India had four main objectives: to exploit existing natural resources to serve the needs of industrialisation in Britain; to increase agricultural production in response to the demands of industry and domestic consumers in Britain; to prevent the development of an indigenous industrial sector in India, and limit or destroy existing industrial activity; and to increase the revenues of the empire. As a result of the achievement of these objectives, the balance of trade between India and Britain grew increasingly unequal. This inequality still exists in trade relations between Pakistan and the developed world, with severe consequences for natural resources.

The Nature and Mechanics of Colonial Development

The British enacted a number of laws in support of these development objectives. As a result, a large percentage of natural resources, such as forests, lakes and mines, were taken over from the old feudal order and local communities and became the property of the colonial state, thus making their large scale commercial exploitation possible. Laws also limited industrial activity and even artisan manufactured consumer items. In addition, laws were framed which aimed at preventing the expansion of the merchant and entrepreneurial classes.

To increase agricultural production and revenues, the British undertook the development of perennial irrigation in the Indus valley at the turn of the century. The expansion of this system has continued since then. This irrigation system brought large areas of arid land under cultivation, changed the ecology of the plains and produced large agricultural surpluses which in turn promoted trade and urbanisation. This process has brought about irreversible and widespread changes in the relationship between human and natural resources, not only in the plains but also in other areas of Pakistan.

For the development of trade and movement of produce, the British developed the railway system in India and improved the existing road network. The nature of colonial development can be best judged by the fact that the dominant settlements of the British period were all port cities, while the traditional industrial centres in India and what is now Pakistan, such as Kanpur and Thatta, diminished in size.

In order to enact their new legislation, implement development and maintain and operate the new systems, the colonial rulers carried out major administrative changes in the old system and created a number of new state institutions. The new administrative changes took effective power away from the old feudal order and local communities and their functions were increasingly taken over by the colonial administrative machinery.

Development After Independence

After independence, the government of Pakistan continued most of the policies of the colonial state. The irrigation system was expanded, new legislation enhanced the powers of the state and curtailed those of local communities and the search for additional revenues to meet the demands of a rapidly increasing population continued.

After independence, the new government embarked upon major development initiatives that had far reaching environmental implications. These include the expansion of the irrigation system, the development of large dams for storage of water and generation of power and the increased availability of electricity; the green revolution of the 1960s, and accompanying policy measures designed to promote irrigated and commercial agriculture; new roads and communication infrastructure; various attempts to foster industrialisation; and the control of epidemics through preventive measures. These developments resulted in the growth of commercial agriculture, the creation of new *mandi* towns, rapid urbanisation, and a very large increase in population. In the absence of effective government or formal sector institutions catering to the new needs resulting from these developments, Pakistan has also seen the development of a large informal sector in both the urban and rural areas. In terms of economic volume alone, this sector is now larger than the formal sector of government activity. Today, both the public and formal private sector depend on the informal sector in many ways.

Development of Perennial Canal Irrigation

Between 1872 and 1929, the British built weirs across all the eastern tributaries of the Indus so as to enable the diversion of the river waters into canals, even in periods of low flood. Weirs were also constructed on the Kabul and Swat rivers and on three sites on the Indus and its inundation channels. As a result, most of the upper Indus plains, except for the area between the Indus and the Jhelum, acquired a system of perennial irrigation and the desert was brought under the plough. The newly colonised areas came to be known as the 'canal colonies'. Agriculturists were moved onto the canal colonies under a massive government programme from the more densely populated districts of what is today Indian Punjab.

Between 1932 and 1962 four major barrages were built on the Indus. These barrages, at Sukkur, Kotri, Taunsa and Guddu, expanded the perennial irrigation system to the entire lower Indus plains and the Thal desert in the Punjab.

Ever since the first perennial canals were constructed in the 1870s, and specially since the development of the concept of the Sutlej valley project in 1919, different areas of the Indus plains have put up competing demands for water. These demands related to the availability of canal water during the critical *rabi* and early and late *kharif* seasons and became more complex as the system expanded. These disputes were settled by the government under the Northern Indian Canal and Drainage Act (VIII) of 1873 and the Sindh Irrigation Act of 1879.

Moreover, after independence, a major dispute on the use of the Indus river waters arose between India and Pakistan. The settlement of this dispute resulted in the Indus Water Treaty of 1960. Under this treaty, India was entitled to the exclusive use of the eastern Indus tributaries (Ravi, Beas and Sutlej) and Pakistan to the use of the Indus, Jhelum and Chenab. A system of inter-river link canals and storage reservoirs was to be constructed to provide an alternative source of water to the Pakistan canals taking off from the eastern rivers.

As a result of the Indus treaty, two dams with very large storage capacities were constructed at Mangla and Tarbella. An additional dam was constructed at Chashma on the Indus. Due to this enormous storage of water, allocations for the *rabi* crop have increased considerably but so has the dispute between the different regions on the use of the Indus waters.

Economic and Social Repercussions of Perennial Irrigation on the Irrigated Areas Themselves

The setting up of the canal colonies involved major engineering works, in the construction of which over five hundred thousand people participated in the last two decades of the 19th century alone. Existing artisanal skills were upgraded, technical expertise created and a new entrepreneurial class emerged to help in the construction effort as small contractors, suppliers and traders. In addition, The government revenue department expanded to become the dominant institution in the upper Indus plains. A large irrigation department was created to extend, operate and maintain the head works and the canal system and laws were enacted to regulate the functioning of the system. Local organisations and traditional institutions were by-passed in this process and became, for all practical purposes, ineffective.

Table - 1

Chronological Sequence of Canal Construction

Canal	Diversion Site	River	Year
Upper Bari Doab	Madhopur (India)	Ravi	1859
Sirhind	Rupar (India)	Sutjel	1872
Sidhnai	Sidhnai	Ravi	1886
Lower Swat	Munda	Swat	1890
Kabul	(Below Warsak)	Kabul	1890
Jhelum (Lower)	Rasul	Jhelum	1901
Paharpur	Chashma	Indus	1909
Upper Chenab	Marala	Chenab	1912
Lower Bari Doab	Balloki	Ravi	1913
Upper Jhelum	Mangla	Jhelum	1915
Upper Swat	Amandara	Swat	1915
Sutlej Valley Canal (11 canals)	Ferozepur Suleimanki Islam Panjnad	Sutlej	1926-29
Sukkur Barrage Canals (7 canals)	Sukkur	Indus	1932
Haveli (2 canals)	Trimmu	Chenab	1939
Thal Canal	Kalabagh	Indus	1955
Kotri Barrage Project (4 canals)	Kotri	Indus	1955
M.R. Link (Internal)	Marala	Chenab	1956
Taunsa Barrage Project (2 canals)	Taunsa	Indus	1958
Guddu Barrage Project (3 canals)	Guddu	Indus	1962

Source: *National Investment Plan, Federal Planning Cell, WAPDA, Lahore, 1990*

With water available for *rabi* crops and a more regular supply guaranteed for the *kharif*, large agricultural surpluses were produced. The transport, storage and marketing of this produce led to the emergence of *mandi* towns and the trader and entrepreneurial classes expanded. To curtail their growth, the government had to enact the Punjab Alienation of Land Act 1906. This act protected the agriculturist class from being economically and politically dominated by the expanding merchant classes. In spite of the Act, cash started to replace the old barter system in the village and labour started to be measured in cash-per-unit time. This encouraged the migration of the artisanal classes to the new *mandi* towns.

The production of surplus and the availability of cash led to the development of a new relationship with the urban centres. Urban produced consumer goods started to find their way into the rural areas and a fairly large and affluent feudal class, protected by a state that now managed and controlled infrastructure for production, consolidated itself.

The new irrigation system curtailed the flooding of the old *sailaba* and *katcha* lands and traditional pasture areas were brought under crop cultivation. The ancient communities that had lived in these areas were shifted out and, with their settlement in the canal colonies, their social system and its institutions died.

Similarly, the Mohanas and Mirbahar communities were also affected by the development of the irrigation system. The barrage areas became the major reserves of fish and the Mohanas moved to them, giving up their traditional fishing grounds. The cash economy also affected their operations; they soon found themselves dependent on middlemen for loans (extended at high rates of interest) to purchase boats and nets, and to finance their day-to-day operations. In addition, the preferred species of fish, the *palla*, which migrates many hundred miles from the sea into the Indus river system, could no longer do so because it could not cross the barrage and dams in its journey upstream.

In the same manner, the Mirbahars of the central Indus plains could no longer operate their cargo craft throughout the length of the Indus rivers as they could not pass through the barrages. As a result, river transport declined rapidly, to be replaced by road transport, and this ancient community was soon divided into smaller groups.

The changes that took place between the 1870s and the 1920s resulted in social and economic mobility for the people of the upper Indus valley, ending village self-sufficiency, destroying the traditional social system and its institutions and changing the relationship between rural communities and the state. These processes were helped by improved roads and the development of the railways.

The dynamism that the Punjab displayed in these years of development was largely due to the fact that the vast majority of the canal colony lands were developed by immigrants from eastern Punjab who had left their roots behind them. The areas where the original inhabitants remained stagnated, as they continued to be dominated by their old social system.

Environmental Repercussions of Perennial Irrigation on the Irrigated Areas Themselves

The social and economic mobility of the rural population, the emergence of cash as a means of exchange and the development of stronger government institutions, weakened the feudal structure and local community organisations. It also made the feudal-state relationship that was responsible for the protection of *shamlaat* and *gowcher* lands ineffective, as the feudals or community organisations were no longer effectively in power. In these circumstances, the more powerful members of the village community occupied the community lands and exploited their resources for their own use. Thus, the rural population was denied access to land for housing, free fuel wood and cheap materials for construction, and watering ponds and grazing areas for their animals. This process, which began as early as the 1940s, has continued ever since. More recently, the government has taken over what was left of *shamlaat* lands in Sindh and the Punjab, for rural housing schemes (4).

With the change from a barter to a cash economy and the development of *mandi* towns, village artisans migrated to the new urban settlements. Those who stayed behind increasingly worked for cash and by the 1970s, the old rural artisanal system was for all practical purposes dead. This made the hire of artisans for house construction and for garbage and excreta disposal unaffordable for the majority of the population. This, coupled with the difficulty of acquiring land and cheap materials of construction, resulted in the degradation of rural architecture, overcrowding in the settlements and increasingly unhygienic conditions.

As a result of the perennial irrigation system, 74 per cent of the water of the Indus rivers is withdrawn by the canals. 84 per cent of this is used in the *khariif* season. The present draw is 173 billion cubic metres, and if the remaining sources in the Indus system are tapped, at most an additional 25 billion cubic metres could be added to it. 77 per cent of the 21.87 billion cubic metres of water stored by the Tarbella, Mangla and Chashma reservoirs is utilised for the *rabi* crop (5). In addition, it is estimated that 60 per cent of this total volume of water is lost due to seepage while being transported by canals. This seepage has led to widespread water-logging and salinity in the irrigated areas (6).

The gravity of the situation can be judged from the fact that the water table in 25 per cent of the Indus plains has risen to two metres below ground level and in 33 per cent of the plains, it is 3.5 metres (7). Before 1932, all areas had a water table of below 5 metres and over 50 per cent of below 6 metres (8). In over 50 per cent of the Indus plains, or about 6.4 million hectares, the sub-soil water is saline and the rising of the level of this aquifer brings dissolved salts to the surface through capillary action; when the water evaporates, a salty deposit is left behind (9). In addition, there are considerable quantities of salts in the Indus system itself which, before the building of the head-works and barrages, were exported to the sea. These are now deposited on the land or seep through it to become part of the now shallow aquifers. For example, an average one ton of salt is added to every irrigated acre in the lower Indus plain every year (10). As a result of these actions, 40,000 hectares of agricultural land are lost to salinity and water-logging every year (11). Water-logging is concentrated along major canal lines and is the result not only of seepage but also of the higher availability of water in these areas and its poor management. Salinisation, on the other hand, depends on water table depth as much as on irrigation applications. Salts are moved upwards through soil capillaries or downwards by deep percolation.

The government has initiated a number of programmes and projects to tackle the salinity and water-logging issues. These are discussed later in the book along with the response of communities to them.

Riverine forests have also been effected by perennial irrigation. These forests in the Indus valley lie in the traditional flood plains of the river system. Historically, they have been, and still are the most important natural forest reserves in Sindh and the Punjab. Due to the diversion of the waters of the Indus rivers into the irrigation system, these forests are no longer inundated adequately by the flood waters of the rivers. The forests in Sindh, being downstream, are more seriously affected and less than 50 per cent of them now receive any inundation. Thus, over 100,000 acres are not completely denuded and an additional 150,000 acres have been badly damaged (12).

The damage to riverine forests has also affected large tracts of *katcha* and *sailaba* lands and added to the siltation process in the rivers. Due to deforestation, the velocity and quantum of run-off has increased when the flood waters recede and, as a result, the quantity of silt deposited on the flood plains has decreased, affecting their fertility. In the absence of protection provided by the forests, the banks of the rivers in large areas of the Indus - Jhelum *doab* and in Sindh have been destabilised and soil erosion deposited into the rivers is raising the levels of river beds, leading to greater risk of flooding.

Another region effected by the perennial irrigation system is the Indus Delta. This region covered an area of about 3,500 square kilometres. This area was criss-crossed by the Indus distributaries and contained large tracts of tamarisk forests, rich grass lands for animal grazing and over 850,000 acres of mangroves in the coastal region (13). Since this region was really one big *katcha* area, it was also the richest agricultural area in the Indus valley. Its agricultural and dairy produce, along with its timber, was exported to the Gul, Muscat and the northern areas of the west coast of India. It had at least two substantial port towns.

Since over 74 per cent of the water of the Indus rivers is now removed from the system before Kotri, the Indus delta country has shrunk to no more than 250 square kilometres. The Indus distributaries have dried up and the sea has crept in to take their place. As a result of the disappearance of fresh river water and the consequent upstream movement of sea water, the mud flats that were used as pasture lands and for agriculture have become saline and barren. The tamarisk forests have perished and the port towns are now small hamlets. In the coastal region, the drying up of the Indus has also meant the disappearance of potable water. These problems have forced the local population to migrate in large numbers to the areas colonised by the Kotri barrage scheme.

The Indus delta is no longer flushed by the fresh waters of the river. The silt, one million tons a day, that the river carried with it no longer stabilises the coast line. These factors are now endangering the mangrove eco-system of the coast, which is the nursery of fish life in the region and which can only survive in the presence of fresh river water flushing out salt sea water. In addition, the nutrients that the river carried to the coast and which sustained the fish nurseries and other marine life are no longer available. As a result of these factors, a number of marine and fresh water species are in danger of becoming extinct. More immediately, the coastal fisheries are being rapidly depleted of fresh stock.

The Indus rivers contain a heavy silt load. This silt previously found its way to the delta region or enriched the *katcha* and *sailaba* lands. However, it is now filling up the Tarbella, Mangla and Chashma reservoirs and the head-works of the major canal systems. It is estimated that there will be a fall of 8 per cent in the storage capacity of the Indus system reservoirs by the year 2000 (14). In addition, the beds of the major canal systems in the Punjab have risen and this is affecting the efficiency of the operation of the head-works. Extraordinary desilting of the head-works and canals is required if the systems are to remain operative and flooding is to be effectively controlled.

Apart from causing flooding and reducing storage capacities, both of which are bound to have disastrous effects on the environment of the Indus valley, the silting process will also affect the operation of the hydro-electric power systems at Mangla and Tarbella and it is feared that in the next forty years these dams will become silted to the extent that they become inoperative. The silting of the irrigation systems is exacerbated by deforestation in the watershed areas of the Indus rivers. In addition, overgrazing in the alpine and sub-alpine pasture lands of the watersheds also adds to soil erosion and the transfer of large quantities of silt into the irrigation systems.

The Green Revolution

In the late fifties, the government of Pakistan took two major decisions regarding development in the country. One, it decided to industrialise, and two, it searched for ways to increase agricultural productivity and incomes from agriculture. It was believed that agricultural surpluses would fuel the industrialisation process.

Thus, in the 1960s, the government launched the 'green revolution'. This consisted of introducing high-yielding varieties (HYV) of wheat, and later rice, in the farming systems of the irrigated areas. This was accompanied by the introduction of chemical fertiliser and then by pesticides to protect the new varieties as they were more prone to disease and pest attacks, than the traditional adapted varieties.

In addition to the inputs described above, the HYV also required timely and sufficient quantities of water. These were provided by the new reservoirs at Tarbella, Mangla and Chashma. In addition, the government undertook the installation of 25,000 tube wells, a cost of Rs 250 million, to tackle the water-logging and salinity problems and to provide extra and assured supplies of water. However, the water requirement for the green revolution technologies kept the revolution limited to the irrigated areas of the country. In addition, acquiring fertiliser, pesticide, HYV seeds and tube wells was a costly affair. To make these inputs affordable to farmers the government not only subsidised them but also extended loans for agricultural purposes through the specially established agricultural cooperative banks.

The green revolution technology was immediately adopted in the Punjab, which already possessed the potential for much higher levels of production of grain crops for both sociological and physical reasons. Sociological, since a large section of the settlers in the Punjab canal colonies were independent middle farmers and small landlords and it was easy for them to adapt to the new agricultural system being proposed. In addition, they were already producing surpluses, and communications and transportation and storage systems for marketing were in operation. In the more feudal areas of the Indus valley, such as Sindh, where cultivation was carried out by tenant farmers or share croppers, the tools of the green revolution made little headway in the initial years. The large land owners of this area were initially indifferent to the promise of higher productivity, and the peasants who cultivated their lands were dependent on them for external inputs like seed or fertiliser.

As a result of the green revolution technologies, the compound rate of agricultural growth which had been virtually stagnant in the twelve years after independence rose to an average of 5 per cent per year in the 1960s. Much of the surplus that were produced were translated into profits which found their way into the urban economy. It is estimated that in the fiscal year 1964-65 alone, Rs 3,600 million or 15 per cent of the value of gross agricultural output was transferred to the cities (15).

The presence of cash in the rural economy promoted the mechanisation of agriculture; beginning in the mid-60s, the number of tractors steadily increased. In the 1970s, transport of agricultural produce became mechanised and the 1980s saw the beginning of the mechanisation of harvesting. The state, through the agricultural cooperative banks, provided loans for these purposes.

The green revolution years also saw the development of hydro-electric power stations at Mangla and Tarbella and a thermal power station at Guddu. These developments helped in tapping water resources and led to the electrification of a large number of villages and small towns. In addition, the road network expanded and communications improved. These developments enabled mechanised processing of agricultural produce through rice husking and cotton ginning units and transportation and marketing of produce.

The Social and Economic Repercussions of the Green Revolution on the Irrigated Areas

With the development of increased surpluses and a service sector for the green revolution technologies, the old *mandi* towns expanded rapidly. As the transportation of agricultural produce became mechanised, the distances between these towns increased and their size also increased proportionately. In addition to markets and storage for agricultural produce, these towns increasingly also housed government, formal and informal institutions that serviced the green revolution technologies, and the engineering and artisanal skills that served the various components of these technologies.

The green revolution saw the development and expansion of a large number of government departments and institutions in the *mandi* towns and rural areas. WAPDA offices were established to take care of the newly installed tube wells and power generation systems, along with the extension service cells of the provincial agricultural departments and branches of the agricultural cooperative banks. Octroi taxes on agricultural produce were imposed by the *mandi* towns' local governments and this saw an expansion of the area of influence of the town committees, as their revenues increased. Branches of other government departments, such as the Small Industries Corporation, were established to help finance and set up agro based industries such as processing of cooking oil, cotton ginning and rice husking units and, in more recent years, sugar mills. Due to the development of industrial activity and the expansion of trade, government excise and taxation departments also established themselves in the *mandi* towns and rural areas.

To service the new technologies and the increasing numbers of cash transactions, commercial banks, insurance companies, fertiliser and pesticide agencies and their extension units, and agents for machinery spare parts established themselves in the *mandi* towns and larger villages. Similarly, mechanics and workshops for the maintenance of agricultural machinery and transport vehicles also developed, and a service sector providing board, lodging, entertainment and labour for the transporters established itself.

The spare parts and accessories for the maintenance of agricultural, transportation and related machinery were initially imported from First World countries. However, they were far too expensive for the smaller farmers to afford. The late 1960s saw the development of a light engineering industry in the *mandi* towns which undertook the manufacture of not only spare parts and accessories but also of diesel engines, electric pumps, transportation trolleys and diesel generators, all of which had become an integral part of agricultural production and rural life in the irrigated areas.

The green revolution has also led to changes in land ownership patterns. The optimum use of green revolution technologies requires land holdings of about 100 acres. This has led to the more aggressive agriculturists buying out the smaller farmers and peasants and rendering them landless. Thus, in Punjab, and more recently in Sindh, the medium size, mechanically cultivated farm is fast emerging as the most productive agricultural unit.

The green revolution technologies also require substantial financial inputs. The larger, and hence better connected, farmers can acquire them from the state agencies. The smaller farmer, on the other hand, has to depend on informal credit from *artis*, or middlemen. Almost 75 per cent of Pakistani farmers receive credit from these *artis*. This credit is in the form of short term production loans which bridge the gap in cash flow during the growing season. In return it entitles the *arti* to acquire the produce of the farmer at 40 to 60 per cent of its market value. This system of informal credit and expensive inputs into agriculture, along with the death of subsistence economies, is making small scale farming an uneconomical proposition. Thus, all over Pakistan an increasing number of small farmers supplement their incomes by remittances from members of the family who work in the industrial or services sector in large urban areas or in the *mandi* towns.

Due to the above mentioned factors, there has been a massive migration of agriculturists, both farmers and labour, from the rural to the urban areas. The green revolution, the industrialisation that has accompanied it and the high production growth rate, are the main causes of massive urban growth in Pakistan.

Mechanisation, both of cultivation and transportation, has seen the end of the role of animals in agricultural production. Almost all over Pakistan, tractors and Suzuki pick-ups are now used instead of bullocks, camels and donkeys. Small farmers cannot purchase machinery and vehicles for their own use and, even if they could, it would be uneconomical given their small holdings. Thus, they hire these from larger farmers or entrepreneurs who rent out machinery and vehicles.

The green revolution hastened the demise of the old social economy of Pakistan and its institutions, which had already been deeply affected by the development of perennial irrigation in the plains and the emergence of a cash economy. The effects of this have been felt in the mountain regions, the *barani* and desert areas and the coastal belt. This process of change produced a new entrepreneurial class in the rural areas and small towns. This class includes those who provide machinery and vehicles on hire and sell water extracted by tube wells that they have installed; fertiliser and pesticide agents; transporters and the entire services sector that serves them; *artis*; rural people now engaged as while

collar workers in banks and government departments, and small industrialists and spare part manufacturers. This class has so dominated the more developed areas of the plains that, for example, out of 10 agricultural units produced in Sindh almost 7, including the informal loan from an *arti*, are paid back to the agricultural services sector. In addition, representatives of this class are increasingly winning the local government elections by defeating the nominees of the old feudal and agriculturist classes. Most of the representative local government institutions in Pakistan are now dominated by this class.

The Environmental Repercussion of the Green Revolution

In 1958, the use of chemical fertiliser was almost unknown in Pakistan. Today, almost 50 per cent of farmers use fertiliser. About 85 per cent of fertiliser users are farmers in the Indus plains. 31 per cent of these also use manure (16). The use of fertiliser increased by 300 per cent between 1971 and 1980. The increasing use of fertiliser is associated with the high-yielding seed varieties of the green revolution, which require timely and heavy doses of fertiliser to achieve their full potential. However, dependence on chemical fertilisers, in the absence of organic matter, leads to a deterioration in soil structure. Poor soil structure means lowered capacity to absorb and retain water, rapid leaching of nutrients out of the top soil, and reduced aeration of the root zone. All these factors have an adverse effect on plant growth. As it is, most soils in Pakistan are naturally deficient in organic matter. Studies of Punjab soil, considered to be the richest in Pakistan, show that 77.5 per cent soils are deficient in organic matter and poor in structure (17). Mechanisation of agricultural operations, which has led to a decrease in the use of animal power, also reduces the availability of organic matter. Experts agree that in such soil conditions fertiliser should be used with great caution. However, though fertiliser use has increased substantially, agricultural production has grown only marginally in the 1980s. If these trends continue, they are likely to have serious consequences for agricultural production, and hence for the economy.

The use of pesticide on crops in Pakistan was also unknown before 1958. In 1980, when only 4 per cent of farms in the country used pesticides, 915 tons of active ingredients of pesticides were used in the country. By 1985, this had increased to 3,455 tons, an increase of over 350 per cent (18). The enhanced use of fertiliser is associated with greater susceptibility to pest attack, especially in cotton, and hence a greater use of pesticides. 70 per cent of all pesticide used in Pakistan is for the cotton crop alone which grows almost entirely in southern Punjab and northern Sindh. The higher profit margins on crops such as cotton, a major export commodity, also encourage the investment in pesticides (19).

Table 2

Rate of Annual Fertiliser Growth in Pakistan

Period	Fertiliser Offtake (‘000 Nutrient Tons)	Annual Growth Rate (Per cent)
1960-65	31 - 71	17.7
1965-70	71 - 283	31.2
1960-70	31 - 283	24.6
1970-75	283 - 548	14.3
1975-80	548 - 1079	14.5
1970-80	283 - 1079	14.2
1980-87	1090 - 1784	8.8

Source: *Report of the National Commission on Agriculture, 1988*

Table 3**Pesticides Sales in Pakistan**

(Tons of Active Ingredients)

	Insecticides	Fungicides	Weedicides	Other	Total	Annual Change %
1981	734	132	34	15	915	
1982	952	171	94	73	1,290	41
1983	1,471	185	119	35	1,810	40
1984	2,172	212	90	43	2,517	39
1985	3,059	224	104	68	3,455	37

Source: *Report of the National Commission on Agriculture, 1988*

Many studies have been carried out on the physical and socio-economic effects of the green revolution, but there has been little examination of its environmental impact. In general terms, however, the increase in the use of agro-chemicals, mechanical means of land preparation, heavy applications of water and the introduction of mono-cropping have inevitably had significant impacts on the environment. Considerable contamination of ground and surface waters by agro-chemicals has been indicated by studies of the pollutants in the drainage systems of Peshawar and Multan. If these pollutants are present in the quantities mentioned by these reports, it would be reasonable to assume that they must be affecting wildlife, and human health through the ingestion of agro-chemicals by the rural population. The environmental impact of the green revolution remains an area urgently in need of qualitative and quantitative analysis.

The Exploitation of Natural Resources: Forests

Pakistan's forests may be divided into four major categories. Alpine forests are situated in the high mountain region, at altitudes of between 2,000 and 3,500 metres; sub-alpine forests are those in the foothills of the mountains, in the monsoon zone; riverine forests are located in the Indus plains; and the mangrove forests are situated along the coast and the river estuaries. In addition, there are man-made irrigated forest plantations covering over 120,000 hectares in Sindh and Punjab, and scrub forests and dry tropical forest in the western highlands and the desert areas (20). The alpine of coniferous forests and sub-alpine forests are the most extensive in area, covering about 30 per cent of total forest area, and are mostly under the administration of the Forest Department.

The Forest Act of 1927 governs the ownership and use of forests. In addition to the general provisions of the 1927 Act, each class of forests has a separate set of tenure and usage rights attached to it. In the case of the tribal forests, they are owned outright by the community, which has the right to decide, on the basis of a 60 per cent majority vote, how they are to be exploited. However, the Forest Department extracts a royalty on felled timber, half of which goes to the community and half to the department for its management costs. The royalty is paid by the contractors who enter into an agreement with the community regarding the purchase of felled wood. The contractors are also required to replace felled trees with seedlings of the same variety. This rule is seldom observed.

The state owned reserved forests are administered and managed by the Forest Department, which issues permits for their exploitation and levies a royalty on felled trees. Permits may be issued to right holders for domestic requirements, in which case the rate of royalty is lower, or to contractors for commercial purposes. The Department is responsible for reforestation and all other interventions in these forests.

The forests which formerly belonged to the feudal rulers, such as those in Swat, Dir and the feudal princedoms of the Northern Areas are now owned by the state, but the traditional right holders are allowed to continue using them as before. Instead of applying to the feudal authority for permission to fell timber, they must now apply to the Forest Department. The Department also has the responsibility of managing the forests and of reforestation.

In all classes of forests, there has been heavy deforestation in the past decade, facilitated by the construction of roads. Uncontrolled exploitation, combined with heavy grazing pressure and the clearing of land for cultivation, has resulted in the almost total depletion of forest resources. The

increased demand for timber has meant an added pressure on natural forests, and heavy felling has taken place where tracts of natural forest lie close enough to a road to make it profitable.

The coniferous forests are the most important in relation to the conservation of both soil and water resources; the maximum amount of soil erosion, which silts up the components of the irrigation and hydro-electricity systems and causes flooding of the plains, takes place in the geologically unsettled high mountain region where they are situated. These forests are also the major source of commercial timber in the country. Riverine forests play a comparable role in protecting the silt of agricultural lands in the flood plains of the Indus rivers from being washed away and protect the river banks from erosion. Similarly, the mangroves protect the coastline and are the nursery of marine life in the delta region. The scrub forests are used locally as fodder for animals, and for firewood.

Deforestation in Pakistan

Deforestation in the regions that constitute Pakistan is not a recent phenomenon. However, it has accelerated in the past century, and in the last 75 years forest cover has decreased from 14 per cent of the land area to 5.2 per cent. Between 1974 and 1985, timber supplies from state forests declined by 45 per cent (21). The greatest damage has been done since the First World War. Efforts at afforestation and attempts at watershed management have not kept pace with increased demand and excessive cutting and overgrazing.

Reasons for Deforestation

Traditionally, in Pakistan, forests have been community property and considered a part of *shamlaat* or *gowcher* lands. However, through various legislative measures the colonial state took over the majority of forest areas in the country. When administered by the feudal authority or community organisations, timber from these forests was primarily for the use of community members or their dependent artisan class. Since traditional rural culture was limited by poverty, and therefore conservationist by nature, wastage was discouraged and needs were modest.

The taking over of large tracts of forest by the colonial state coincided with a considerable increase in the population of the country. After independence this growth increased even further, especially in the urban areas. To meet the housing and fuel needs of the increasing population, especially in the urban areas, state forests were auctioned to contractors for commercial exploitation. In addition, a capitalist consumer culture was replacing the old subsistence system, and thus timber needs per capital increased substantially.

The break-up of the old social economy and how it led to encroachment and forced occupation of community lands has already been explained earlier. Forests, too, were taken over in a similar manner by powerful individuals or groups and their commercial exploitation became possible. This process is continuing and private forests supply 78 per cent of the locally met timber demand (22).

The development of the canal colonies for cultivation in Sindh and Punjab was accompanied by the clearing of hundreds of thousands of hectares of riverine, scrub and thorn forests in the Indus plains. Not even a fraction of this loss has been made up by tree plantations along the canals and through irrigated forest plantations that have taken place.

In addition to clearing of forests for agriculture, large areas of traditional community owned grazing grounds have been brought under cultivation as a result of encroachments in the *barani* areas, and colonisation through the expansion of the irrigation system. In addition, the livestock population has increased substantially: between 1976 and 1986 alone, heads of livestock increased from 66.1 million to 87.23 million (23). As a result of these two factors, the pressure on pasture land is increasing. This over-grazing is leading to the loss of vegetative soil cover, followed by erosion and the loss of topsoil. In addition, excessive grazing of certain species palatable to animals means the selective loss of valuable plant types, and their replacement by non-edible competitors. Over-grazing also means that new tree growth is damaged and restricted, as goats tear off young bark and leaves in search of fodder.

It is estimated that 90 per cent of all wood consumed in Pakistan is for fuel (24). According to the housing census of Pakistan (1980), 79 per cent of rural and 48 per cent of urban households use wood for cooking and heating purposes. Fuel wood alone provides 50 per cent of the domestic

sector's total energy requirements. The seriousness of the shortage can be gauged from the fact that fuel wood prices have increased 4.5 times between 1970 and 1980 (25). In addition, by the year 2000, Pakistan's fuel wood needs are expected to increase by 100 per cent. On the other hand, since 1975 private forest production has increased by only 1.3 per cent per year and state forest production by 1.8 per cent. Meanwhile, timber imports have increased by 5.2 per cent annually (26) during this period. However, this imported timber is not used for fuel purposes but for construction.

Repercussions of Deforestation

The increase in the price of building timber is already adversely affecting the quality of housing in the country and the scarcity and cost of fuel wood is becoming a major economic burden on low income communities. As a result, gas cylinders are in great demand, even in rural areas, as their monthly cost is less than half that of the fuel wood.

One of the most visible, and perhaps the most significant, impacts of deforestation is soil erosion. The mountain regions where the majority of natural forests are located are characterised by steep slopes, fragile and thin topsoil, and unstable geological conditions. When tree cover is removed, there is nothing to stop the soil from being washed away by even mild rainfall. In addition, landslides and rock-falls, which occur frequently in spring as a result of melting snow and ice, are exacerbated by the absence of tree cover. Vast areas of the Karakorams and Hindu Kush are naturally arid and barren, and little can be done to prevent or control soil erosion in these areas. But the historically heavy silt load of the Indus, which flows through these mountains, is being augmented now by large quantities of valuable topsoil swept off the slopes of the foothills and lower mountains in the monsoon zone. This erosion has a dual impact on the environment: it leads to desertification of once-productive upland areas, and silting up of waterways in the plains, making them more prone to flooding. In addition, there is increased silting up of irrigation and hydro-electric systems, lowering their efficiency and shortening their life spans. The building of roads is probably the single biggest factor contributing to rapid deforestation. Previously inaccessible mountain areas, like the Kohistan district of NWFP, have in the last twenty years been connected to the plains by major roads. Transportation facilities have made the logging of these rich and ancient natural forests a viable commercial proposition. The extreme poverty and hardship of life in these remote areas has meant that the local communities have seized this opportunity to earn a substantial income in a short space of time, by selling their trees to down country contractors.

Table - 4

Productive and Protective Forest Areas by Forest Types

(Area '000 ha)

Forest Type	Productive Forests	Protective Forests	Total	Percentage
Coniferous forests	867	1,092	1,959	42.75
Scrub forests	158	1,568	1,726	37.65
Riverine forests	158	138	296	6.50
Mangrove forests	-	347	347	7.60
Irrigated plantations	83	151	234	5.10
Linear plantations	-	17	17	0.40
Total area	1,266	3,313	4,579	100.00
Area (%)	27.6	72.4		

Table - 5

**Estimated Timber Supplies from private Farmlands,
Government Managed Forests and Imports**

(Million M3)

Year	Private Farmland	State Forests	Imports	Total
1975-76	0.99	0.29	0.57	1.85
1976-77	0.98	0.32	0.64	1.89
1977-78	0.88	0.20	0.84	2.00
1978-79	0.92	0.37	0.72	2.01
1979-80	0.68	0.38	0.97	2.03
1980-81	1.08	0.23	0.78	2.09
1981-82	1.38	0.23	0.53	2.14
1982-83	1.33	0.23	0.66	2.22
1983-84	1.14	0.32	0.82	2.28
1984-85	1.11	0.34	0.90	2.35
Total	10.44	2.91	7.43	20.86
Average	1.04	0.29	0.74	2.08

Source: *Report of the National Commission on Agriculture, 1988*

The Exploitation of Natural Resources: Fisheries

Fishing was not an economically important activity in Pakistan in the past and the communities engaged in it were traditionally considered outcasts by the agricultural and pastoral people. Fishing was concentrated in the lakes of Sindh, the delta of the Indus and the Baluchistan coast. Another area where it was a substantial activity was on the Indus in the Mianwali and Kalabagh districts of the Punjab. After the development of the irrigation system, it developed as a major commercial activity at the head-works, barrages and dams of the system.

Fishing production expanded in Pakistan from 63,000 tonnes in 1958 to 408,000 tonnes in 1985. This expansion was the result of the availability of credit facilities for mechanising boats, building new ones and acquiring nylon nets. In addition, the Fisheries Department through the FAO was able to provide related technical assistance to entrepreneurs engaged in the fishing industry. The major part of this increase took place in the coastal areas, where production increased from 46,000 tonnes to 333,000 tonnes to become 81 per cent of the total fish production (27).

The fishing industry is now the sixth largest foreign exchange earner in Pakistan. 20 per cent of the production is exported, 25 per cent if consumed locally and the rest is turned into poultry feed (28).

Development of the Fishing Industry in Pakistan

Traditionally, fishing rights in lakes and barrage areas were extended to the local fishing communities through a licensing system. However, in the early 1960s, the Department of Fisheries introduced a contracting system through which fishing rights in these areas were auctioned to the highest bidders. These contractors were almost always big businessmen or powerful local landlords. The fishing communities lost their rights to fish in these areas, except as employees of the contractors. The contractors introduced new types of nets, cold storage facilities for the catch and new methods of fish farming which resulted in increased production and catch. The fishing communities dependence on the entrepreneurs increased until they became their serfs and are now forced to depend on loans from them for building boats and acquiring nets. In addition, indiscriminate fishing in these areas, without consideration of seasons and depth of waters, is depleting the fish population to levels which may become unsustainable.

In the late 1950s, the Department of Fisheries was established by the government of Pakistan. The department provided technical assistance and financial assistance through loans to entrepreneurs and members of the fishing community to build new boats, mechanise the existing ones, acquire new types of nets and introduce new fishing techniques. The formation of the department coincided with

the establishment and rapid expansion of the poultry industry, which relied heavily on fish feed, and also with an increased demand for Pakistani seafood, especially shrimps, prawns and lobsters, from First World countries.

These factors led to the development of the fishing industry in the coastal areas. The loans, however, were taken by entrepreneurs from Karachi and Mianwali districts and not by the traditional coastal fishing communities, as they did not have the necessary access to government officials and agencies. These entrepreneurs, through middlemen, mechanised the boats of local fishermen, extended loans to them for new boats and supplied them with the necessary nets and advice on new fishing techniques. The fishermen, in turn, were required to sell their produce to the middlemen at half and at times at even one-third its market value, a system comparable to that of the *artis* in agriculture. The result of this process is that the coastal fishing communities are heavily in debt to the middlemen, to the extent that over time they are now bonded labour.

The entrepreneurs have also established a complex transport and cold storage system and ice factories along the coast to service their activities. Due to the scale of these activities, even people of the more important tribes in the coastal areas of the districts of Gwadar, Lasbela and Thatta have abandoned agriculture and pastoral activity and are employed as labourers on the mechanised crafts. In addition, between 1958 and 1985 the number of trawlers operating on the coast increased from 3 to 1,631, gill netters from 72 to 1,249 and mechanised boats from about 20 to 4,500 (29).

The Social and Economic Repercussions of the Development of Fisheries

The development of fisheries along the coast has broken the hold of the old feudal and tribal institutions. The subsistence pastoral and agricultural economy has been replaced by a dynamic cash economy dominated by capitalist relations. The services sector linked to the fishing industry has brought with it transporters, ice factory labour and mechanics, and increased the activities of the local boat-builders. In addition, it has led to the creation of workshops for the maintenance of transport vehicles, boats and factory machinery and of banking and insurance systems.

People have abandoned their traditional agricultural and pastoral activity in favour of fishing, with the result that the coastal areas have become totally dependent on the Karachi market for food grains and on neighbouring agricultural districts for vegetables. Fresh milk has become scarce and this scarcity is made up by powdered milk imported from abroad through Karachi.

The development of fisheries has also created a number of fish harbours, of which Karachi is the largest. These harbours are a source of seasonal employment for the labour employed in the industry. This has made a previously static population mobile, raised its awareness and hastened of the break-up of the old social order.

The Environmental Repercussions of the Development of Fisheries

The commercialisation and mechanisation of fishing along the coast of Pakistan is having severe impacts on marine life and on the coastal environment. There are three types of fishing vessel operating off the coast: local, traditional, small craft which cannot venture very far from the shore, and are thus limited in the nature of their catch; medium size vessels operated on a commercial basis, which can remain away from land for several days at a time; and large trawlers, operated either by foreign companies (mostly Korean), or under "joint venture" arrangements between foreign and local businessmen. The small craft have to operate within the 12 mile limit of the coast designated for local fishermen. The large trawlers are legally confined to deep sea areas over 12 miles from the coast. However, there have been many instances of conflict over the encroachment by various types of craft in zones prohibited to them. This is one indicator of the rapid depletion of fish which is taking place as a result of over-fishing by commercial vessels. The larger trawlers, with their fine nets, draw out all deep sea fish, including the immature. The commercially viable ones are selected from the catch, and the rest thrown back into the sea (30). These dead fish decay, polluting the water and rendering it unhealthy for other fish. As a result of this wastage and pollution, many varieties of valuable fish are being depleted beyond sustainable levels. Though regulations governing fishing activities according to breeding season and geographical limits do exist, they are not enforced.

Fishing operations also create considerable pollution. The catching, loading and unloading, packing of fish and the storage and use of ice, diesel and salt all produce solid waste, most of which is inorganic.

In the absence of any solid waste management system, this material litters the beaches and is washed into the sea. In addition to this type of pollution, 20,000 tonnes of oil from marine related activity is also deposited on beaches, in harbours and fishing grounds (31).

The coastal areas of Baluchistan are arid. The only water available is drawn from wells dug in the bed of seasonal rivers. It is near these wells that all human settlements in the region are situated. The development of fisheries has increased the population of these settlements considerably and the meagre quantity of water in the desert aquifers can no longer meet the requirements of the population.

The growing of *babul* trees for fuel wood was common in the coastal regions of Baluchistan. However, people have now abandoned forestry and agriculture for fishing. In addition, these catered clumps of trees are now also being used in ship-building and saw mills have been established in Gwadar to process them. This has raised the price of fuel wood and timber for building and there is a general consensus among the population that the forests are vanishing. This process will lead to soil erosion and the death of whatever pastoral and agricultural activity that still survives.

Industrialisation

In 1947, when it came into existence, Pakistan was entirely an agricultural country. Though the rate of industrialisation has not been as rapid as in some other Asian countries, 43 years later, industrial production and its related sectors account for over 30 per cent of the GNP, and this proportion is increasing. In addition, the proportion of population involved in the industrial and related services sector had increased from 42.21 per cent of the labour force in 1968 to 48 per cent in 1983 (32).

Industrial activity in Pakistan is primarily of two types. One is through large scale industrial units operated by the state, large industrial houses and the multi-nationals. These units include the steel mill sited at Port Qasim, near Karachi, and its downstream industries; energy production plants; agro-chemical units and other chemical industries; oil refineries; cement plants; light and heavy engineering industries and the textile industry. The other type of industry is small scale, serving the larger industrial units. Many of these are operated by the informal sector. These industries include power looms in both urban and rural areas for the manufacture of textiles and carpets; tanneries; cotton ginning and rice husking units; brick manufacturing units; small scale manufacturing of dyes, soap and chemicals; foundries and light engineering workshops and lathe machines.

Most of the industries are located in large urban areas such as Karachi, Kotri, Multan, Faisalabad, Peshawar, Gujranwala and in the industrial suburbs of Lahore. The larger formal sector industries are located in industrial estates which were originally outside the city limits. However, most of the early estates, such as SITE in Karachi, are now part of the city and are surrounded by low income residential areas. On the other hand, many of the major agro-chemical plants, such as the Pak-Saudi in Mirpur Mathelo and the Exxon plant in Dharki, are in the rural areas. The smaller units, however, especially of the informal sector, are located in low income residential areas of the cities, near transport activity or on the periphery of formal industrial estates. In the smaller towns they are located in or near the wholesale markets. Most of the areas where small units are situated are either badly serviced or unserved. Small units and informal industrial activity have developed mainly in the rural and urban areas of the districts of central Punjab, where there is a tradition of artisanal skills and feudal control has traditionally been weak.

The Social and Economic Repercussions of Industrialisation

Industrialisation and the services and trade sector that has developed to support it, has created a large number of jobs in the urban areas of Pakistan. Due to this, the rural poor who have been affected by the green revolution and the break-up of traditional institutions, have been absorbed into the urban economy.

Working in the industrial or its support and spin-off sectors is far more lucrative for the lower and lower middle income groups than working as agriculturists or pastoralists, especially in the subsistence *barani* areas. As a result, an increasing number of people from these areas have moved to the cities and send money back to their families in the villages. This remittance economy has adversely affected agriculture in these areas and they are becoming increasingly dependent for their grain requirements on the irrigated agricultural belt.

Migration of members of rural families to the cities has had a profound effect on the lifestyle and cultural values of the rural areas. Coupled with the local changes in production modes, this has led to the breaking of clan ties, and although the extended family still survives, the nuclear family in urban areas is rapidly becoming independent of it.

Links with the urban areas have also meant the awareness of, and demand for, urban-type facilities such as piped water, sanitation, education, health services and consumer goods. Over the last twenty-five years this has also seen the emergence of a number of university educated young men in the rural areas who are playing the role of activists, promoting development in their villages and assuming leadership of the rural communities. They, along with the commercial entrepreneurs and middlemen, are linking rural communities with the twentieth century.

The migration of young men to the urban areas has created a situation in a large number of *barani* areas where only the older males and women and children are left in the villages. In addition, it has added a large number of single males to the population of the cities. Both these situations have given rise to a number of social and psychological problems.

Environmental Effects of Industrialisation

The environmental effects of industrialisation may be divided into two major categories. There is, firstly, air and water pollution resulting from industrial processes. Coupled with urban growth and the increase in mechanised vehicles, pollution loads have reached critical levels in some areas. The other major type of effect is the encroachment by industrial units on farmland and on the habitats of various plant and animal life.

An industrial waste pollution survey carried out by the EUAD of industrial areas of six Pakistani cities - Karachi, Multan, Faisalabad, Nowshera and Peshawar - reveals that a number of industries are discharging effluents with high concentrations of pollutants varying from toxic metals and metal salts to bacteria, acids and oils (33). However, very little work has been done in Pakistan to assess the quality and quantity of industrial effluents and their impact on the environment. Whatever work has been done is mainly on Karachi and on the Punjab by the Punjab Environmental Protection Agency.

Studies on Karachi have established that effluent from tanneries contains a higher pollution load of oil than the oil industry itself. In addition, it contains chromium and other toxic metal salts that are used in the tanning process, such as chlorides and sulphates of sodium and potassium. There is no on-site treatment of this effluent, not even the removal of suspended solids. The effluent from the cotton industry, though high in organic contents, is less noxious but does contain traces of chromium and copper (34). The cotton industries and tanneries are the most widespread industrial activity in Pakistan and are carried on through small, often informal units, in both the urban and rural areas.

In Karachi, 1,354 million cubic metres of sea water is processed for cooling purposes for the major industrial units, and heated water is sent back to the creek system on the Karachi coast. The intake naturally kills all the planktonic organisms in the water, and such a large volume of heated water entering the sea is bound to put many organisms under stress. Large industrial units discharging into the Korangi creek system are the steel mill, oil refinery and Sindh Alkalis. The main discharge from the steel mill is particulate iron. This is not considered particularly harmful to the environment as it is an inert material. Refineries, on the other hand, produce a very small portion of the total water load (35).

Again in Karachi, tests revealed that sea water was contaminated by petroleum hydro-carbon residues, chlorinated hydro-carbons which include chlorinated pesticides, biphenyls and trace metals. However, with the exception of a high level of mercury pollution, values are not high enough to pose a threat to the marine environment in the foreseeable future. Studies to determine organo-mercury levels have not been carried out and as such the threat posed by high levels of mercury can neither be evaluated nor eliminated. No strong evidence of contamination was discovered in marine life, and pollution levels in the Korangi creek area were of a lower range than other polluted areas in the world. However, dry fish meal samples had a very high level of contamination. This contamination was also found, but at a very low level, in chicken who feed on this fish meal and in the eggs they produce (36).

Apart from small industrial units which pollute water bodies, most cities also have larger formal sector units that do the same. In Multan, the Pak-Arab Fertiliser factory releases highly polluted waste into the Multan canal, a major irrigation and drinking water source for animals. The effluent of 235

industries in Faisalabad is carried untreated to the river by the main drain of the city. At Kala Shah Kaku industrial estate in Lahore, the industrial effluent is also carried untreated to the river Ravi through the Deg *nullah*.

Atmospheric pollution resulting from industrial activity is creating major health hazards in some areas. Thermal power plants using diesel are one significant source of pollution, and they are increasing in number. Most of these plants are sited in the densely populated areas of Karachi, Faisalabad, Lahore, Multan, Hyderabad, Quetta and Sukkur. These plants produce sulphur dioxide, nitrogen oxide, and particulate matter which affect plant and animal life. Proposals to use coal as a source of energy for new plants have met with environmental objectives. Work on a coal fired power plant at Lakhra in Sindh has been stalled because of a negative environmental impact assessment.

Studies by the Punjab PHED of the situation at Kala Shah Kaku in Lahore have indicated the effects of atmospheric pollution in the area. 64.7 per cent of the population suffered from vomiting, 50 per cent from respiratory problems, 61.76 per cent from chronic cough, 64.7 per cent from sore eyes and 6.25 per cent from occasional unconsciousness. In addition, the growth of plants in the area was restarted, leaves were bleached and extensive damage was caused to paddy, the main crop in the sub-district. Similar effects have been caused by the emission of Bela Chemicals in the Lasbela district of Baluchistan (37).

Another study in Lahore established severe sulphur dioxide and chlorine pollution in the industrial belt of Ittehad Chemicals. Studies for Karachi have yielded far more serious results. Cement factories, in particular, are causing respiratory problems. Skin diseases and various types of allergies to the population living near them (38).

In addition to industrial emissions, a major source of pollution is from automobiles. Their number in Pakistan had increased from 575,558 in 1975 to 1,654,354 in 1984 (39). Since then, it is estimated that they have increased overall by 30 per cent and are concentrated in about 8 major cities of the country. Studies carried out on traffic policemen working in the more polluted areas of Karachi (40) and other studies on Lahore show that traffic emissions in these cities have become critical and are creating very serious health problems for the residents.

Other sources of atmospheric pollution in Pakistan are from burning of solid wastes in the open and from household heating and lighting. According to the 1980 Housing Census, only 13 per cent of housing units in Pakistan use fossil fuel for cooking but 67 per cent use kerosene for lighting. 87 per cent of all households in the country use non-commercial wood and cow-dung as cooking fuel which contribute gaseous materials and particulate matter. However, there are no estimates on the pollution this causes.

Another study in Karachi has shown that in the Korangi and Phitti creek area of the city, pollutants from casual soap manufacture from tannery wastes has a more adverse effect on the environment than do the major industries in the area, which produce much larger quantities of toxic emissions. This is because, in the case of large industries, the pollution is emitted from high stacks and is dispersed by wind (41).

There are no studies to show the impact of industrial pollution on the labour force of the industrial sector. Under law, certain safety measures are required in the factories. Larger industrial units often comply with them. However, no safety measures are adopted by the smaller units and the informal sector.

Both atmospheric and aquatic pollution caused by industrialisation and mechanised transport are becoming serious environmental problems in Pakistan. Some laws to deal with these issues exist but the standards that determine pollution control have not been incorporated into legislation as yet. In addition, as most of the industrial units are small and informal, state control over their functioning is impossible. Pollution control devices on the larger units mean an increase in the price of the manufactured products which the poorer sections of the Pakistan public cannot possibly afford. Again, to control transport emitted pollution low lead fuel is required, which would raise transport and related costs. The imposition of standards and accompanying legislation also requires the creation of effective institutions and their decentralisation, which does not seem to be happening in Pakistan's anarchic political climate. Other avenues for dealing with these issues need to be investigated but the most important tool for tackling them is awareness building and environmental education.

Human Settlements

At the time of independence, 18 per cent of Pakistanis lived in urban settlements. By 1981, this figure had increased to 30 per cent and at the current growth rate of 4.4 per cent in the urban sector it will increase to about 40 per cent by the year 2000 (42).

The present urban population lives in 415 cities (43) which can be divided into three categories according to their size. Large cities have a population of 100,000 and above, intermediate cities of 25,000 to 100,000; and small cities of less than 25,000. Intermediate cities have shown an accelerated growth rate since 1971 (44) Gujranwala, for instance, has grown at the rate of 7.5 per cent per year, attracting more immigrants than Lahore. Large cities have shown a slow decline in their growth rate while the populations of the small cities have declined rapidly. However, between 1980 and 1990 the urban population of Pakistan increased by 10.5 million (45).

Fertility rates of the urban and rural population in Pakistan are almost the same. The higher urban growth rate is because of rural-urban migration. In 1981, over 2.5 million net migrants were estimated in the urban areas of Pakistan, which accounts for 15 per cent of the total urban population (46). 60 per cent of all rural migration takes place within the Punjab (47). The main cause of rural-urban migration is the reduction in per capita cropped area for the rural population from 0.46 hectares in 1951 to 0.31 hectares in 1981 (48), as a result of population growth and subdivision of land. This process is continuing.

The Social and Economic Repercussions of Urbanisation

The urbanisation process has resulted in the continued migration of a large number of people from the rural to the urban areas. This process has broken traditional values and social systems. The new aspirations and demands of the second generation of migrants are now increasing and the state finds it impossible to fulfil them. This is resulting in class, ethnic and political conflict; increase in crime and violence and in social alienation of the lower income groups who account for over 70 per cent of the urban population.

The urban literacy rate in Pakistan is much higher than the rural, 47.12 per cent as against 17.33 per cent. This rate is increasing in the urban areas while the national rate remains static. Male literacy in the urban areas is 55.32 while female literacy is 37.27 per cent. In the rural areas male literacy is 26.24 per cent and female 7.33 per cent (49). These figures speak for themselves, in terms of general awareness, access to information and the quality of life.

The management of large cities is a complex and expensive exercise and requires considerable managerial and organisational skills. In addition, it required the development of appropriate institutional arrangements. Unfortunately in Pakistan the economic resources of the urban areas have not been efficiently tapped nor have skills been mobilised or institutions of local government developed.

The development of the urban economy and its increasing control over the requirements of agricultural production is creating a situation where the dominant economic power rests with the cities and political power with the rural areas because of their larger number of votes. The situation has in it the seeds of a major conflict.

The Environmental Repercussions of Urbanisation

The major problems confronting the urban areas is the provision of land for housing the low income groups. To house the increase in the urban population alone, over 275,000 units are required every year. The state and the formal sector combined provide land for no more than an average of 25,000 people a year and this too at a price that is unaffordable by the poor (50). The rest of the population is taken care of by the informal sector or by increased densities in the environmentally degraded city centres.

Where state land is available, as in Sindh's cities, the informal sector is operated by middlemen who encroach upon it with the help of corrupt officials and the police and subdivide and sell to the poor at a price that they can afford. These squatter settlements, or *katchi abadis*, as they are called, contain 22 per cent of Pakistan's urban households and over 40 per cent of Karachi's (51). Where state land is

not available, agricultural land is informally subdivided and sold. As agricultural land is very expensive, the plots are kept small and the access roads narrow so that the price of a plot can be kept low. These informal settlements are common in the NWFP, Punjab and Baluchistan and along with the *katchi abadis* house over 50 per cent of the urban population in Pakistan. Both these types of settlements are unserved and in the absence of credit and technical advice for construction, the houses are of extremely poor quality. Another reason for the poor quality of construction is the absence of good artisans in low income areas and the end of the hereditary artisanal system.

Table - 6

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

Year	Population (in '000)			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: *Environmental Profile of Pakistan, Government of Pakistan*

Table - 7

Pakistan: Urban Growth by City-Size

(Population in million)

	1951	1961	1972	1981
Population of large cities (100,000 and above)	3.06 (6.3)	5.49 (5.71)	10.49 (5.17)	16.06
Population of intermediate cities (25,000 to 100,000)	1.46 (3.43)	2.04 (3.09)	2.91 (5.11)	4.44
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: *Environmental Profile of Pakistan, Government of Pakistan*

Table - 8

Karachi: Sewerage Generation and Management

Sewerage generated	192 MGD
Pollution generated	1,236 ton BOD
Per capita generated	357 gm BOD
Population served	28 %
Connections	310,000
Collection network	2,140 miles
Treatment plants	2 of 20 MGD
Sewage treated	30 MGD
Sewage rate	100 % subsidised
Staff employed	1980
Capital cost	Rs 2,855 million
Annual expenditure	Rs 139 million
Annual revenue	Nil
Agencies responsible	Karachi Water & Sewerage Board

Source: *Environmental Profile of Pakistan, Government of Pakistan*

Table - 9

City of Peshawar: Ecological Changes in Land-Use 1965-85

Landuse	Area (Hectares)		Percentage	
	1965	1985	1965	1985
Residential	1992	4,283	9.5	19.4
Agriculture	14,897	12,149	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	3,779	3,349	17.2	15.2
Wood land	-	70	-	0.3
	22,018	22,018	100	100

Source: *Environmental Profile of Pakistan, Government of Pakistan*

Table - 10

Literacy Ratio by Sex and Rural/Urban Areas: 1972 and 1981

Area	1981			1972		
	Both Sexes	Male	Female	Both Sexes	Male	Female
All areas	26.17	35.05	15.99	21.71	30.17	11.62
Rural	17.33	26.24	7.33	14.34	22.57	4.69
Urban	47.12	55.32	37.27	41.50	49.95	30.91

Source: *1981 Census Report of Pakistan*

Since the vast majority of the settlements which house the poor are without services, they are faced with severe environmental problems. Water is acquired by *bowzers* in Karachi or by the installation of hand pumps where possible, as in the sweet water districts of the Punjab. In recent years, piped water has been extended to many of these settlements, with the result that 68 per cent of the urban population and 38 per cent of these settlements are served by stand posts or house connections. However, the water is poor in quality and insufficient in quantity. In addition, over 40 per cent is lost in leakages in the system and in many cases, because of similar leakages from the neighbouring sewerage pipes, is highly polluted.

Many cities in Pakistan are facing water problems. In Karachi, for example, it is not possible to tap the Indus any further, and the ground water is saline. In Quetta, due to over-extraction by tube wells, the level of the aquifer is falling fast. A similar fall in aquifers is also taking place in other towns of Pakistan and in some they have been totally depleted, as in Mithi, in Tharparkar, where only saline water is now available in the aquifer in the dry season.

Only 47 per cent of the urban population in Pakistan has sewerage and drainage facilities (52). In the informal settlements this figure is no more than 24 per cent. Here the sewerage flows through the lanes into natural *nullahs* and then to the river or sea. Alternatively, it is collected in a cesspool or *johar*. When the *johar* fills up, residents drill a well and connect the effluent to the subsoil water, in most cases, this subsoil water is used for drinking purposes through hand or mechanical pumps.

Karachi is one of Pakistan's best serviced cities. But even here, 192 MGD of sewerage is generated and only 40 MGD is treated (53). The rest flows untreated into the sea causing severe marine pollution and health hazards. Similarly, only 33 per cent of Karachi's solid waste is transported to the dumping sites and the rest is left to deteriorate (54). In most intermediate cities of Pakistan, the situation is much worse and in the smaller towns sewerage systems, treatment plants and solid waste management systems are unknown.

Environmental degradation of old city centres has also taken place due to the nature of Pakistan's urbanisation. The centres of old towns in Pakistan contain beautiful historic architecture. These centres were also the residential areas of the traditional elite. The streets in most of these areas are narrow and not accessible to vehicular traffic. In the heart of these towns and adjacent to railway terminals were the markets and commercial areas that served the needs of the original cities. These markets and commercial areas expanded when the population of the towns increased. In the absence of proper planning and an alternative, this expansion took place in the old residential and civic areas. Old historic neighbourhoods were converted into storage facilities for wholesale markets and later into areas of manufacturing activity. The elite moved into the suburbs and migrant daily wage labour moved into the city centre. These areas, in a period of 25 years, have been converted into congested slums and much of their historic architecture has been demolished and replaced by markets and warehouses or is in a poor state. Atmospherically, they are also the most polluted areas of the city due to the high volume and congestion of traffic. Their services, originally meant for much smaller populations, are over-taxed and the lower castes that maintained them have disappeared with the death of the old social order. The inner and/or walled cities of Peshawar, Lahore, Rohri, Karachi and Multan, to name but a few, have suffered this destruction and in the process the cities have also lost a central civic and cultural zone.

The urbanisation process, especially in the Punjab and NWFP, has been on valuable and productive agricultural lands. In addition, land-use changes in the Pakistani cities have adversely affected environmental conditions, with green areas, playgrounds and entertainment spaces shrinking. A case study of the city of Peshawar (see table 9) shows how disastrous this development has been in environmental terms. The development pattern of most other Punjab and NWFP cities are similar and those of Faisalabad, Multan, Gujranwala, Sheikhpura and Mian Chunnu much worse.

Atmospheric pollution as a result of industrial activity and transport emissions has already been discussed in the previous section. To this one may add the atmospheric pollution that is caused by the flow of untreated sewerage in the lanes and open *nullahs* and the piles of garbage which cannot be taken care of by the municipal authorities in Pakistan. Sample surveys in low income settlements in Lahore have shown that malaria, diarrhoea and typhoid, in that order, account for 60 per cent of all diseases in the settlements and that there is a marked fall in the incidence of all three diseases in settlements which have paved streets, sanitation and some form of garbage disposal system (55).

Small rural settlements are becoming less populated but large villages are expanding. Environmental conditions here are also fast deteriorating. Rural architecture has suffered due to the disappearance of traditional sources of cheap building material, skilled labour and the availability of affordable land. The traditional water sources have become inadequate and the *bishti* is no longer available. Similarly, due to the emergence of the cash economy, 'scavengers' who lift excreta and clean the lanes are difficult to find and expensive and the nomadic tribes that undertook the maintenance of mud building no longer visit the rural areas. In these circumstances, the environmental situation, with only 17 per cent of the rural population having access to potable water and 4 per cent to sewerage and drainage facilities, is very critical (56).

The Effect of Development on *Barani* and Desert Areas

Most of the land area of Pakistan is *barani*, yet only about 10 to 12 per cent of the population lives in the *barani* areas. Since agriculture in most of these areas depends on erratic rainfall or the tapping of meagre subsoil and surface water sources, it is supplemented by pastoral activity, which has traditionally involved seasonal migration to the flood plains of the Indus rivers and, in recent history, to the irrigated areas.

The development of the irrigation system in the plains and the technologies of the green revolution did not directly affect the *barani* areas. However, as a result of these developments, the relationship between the *barani* areas and the irrigated areas underwent a major change. This change was further reinforced by urbanisation and industrialisation, and by the emergence of a cash economy in these areas.

The Social and Economic Repercussions of Development on the *Barani* Areas

The people of the *barani* areas migrated to the flood plains of the Indus in the dry season. Here they worked as farm labour for the harvesting of wheat; provided artisanal skills, especially for the repair

and manufacture of agricultural implements and leather goods; and supplied dairy products. In exchange, they were given the right to graze and water their animals and a small share of the agricultural produce. Any other transactions between the two groups were strictly on the basis of barter.

The development of the irrigation system in the Indus plains colonised large tracts of pasture land that the *barani* area people used when they migrated to the irrigated areas. In addition, cash replaced the old barter system in the newly colonised lands, especially after the green revolution. Industrially produced agricultural implements, the introduction of *banaspati ghee*, and the development of stall-fed dairy farming in the canal colonies made the artisanal skills and dairy products of the desert and other *barani* people useless to the irrigated areas.

Increasingly after the early 1960s, cash dominated the relationship of the *barani* areas with the rest of Pakistan. As the traditional economy of the *barani* areas could not generate cash, two things happened. One, people from the *barani* areas started to migrate to the urban areas so as to supplement their incomes. Two, in order to generate cash the *barani* area communities increased the number of heads of cattle so as to cater to the needs of the urban areas and tried to increase the area under cultivation. In the process, they reduced effective pasture land considerably. In Thar, it is estimated that over 50 per cent of what was traditionally *gowcher* land is now under cultivation. In addition, the animal population increased by 185 per cent, from 445,240 to 1,268,960, between 1976 and 1986 (57). To support agriculture, subsoil aquifers were tapped mechanically and attempts were made to produce cash crops instead of food.

The effect of these changes has been the decay and eventual demise of the old feudal order. With its death, and in the absence of a new order, *tarais*, *talabs* and *karezes* can no longer be maintained, the *gowcher* pasture lands and *shamlaat* forests cannot be protected and food grains and pasture land grasses of 'good' years cannot be stored for use in 'bad' rainless years.

The people of the *barani* areas cannot market their goods in the plains themselves as they do not have the skills or the capital to do so. As a result, aggressive middlemen from the plains invade the *barani* areas, give credit for production of cash crops, animals and animal products and acquire them at half or even less their market value from the producers. The local communities also purchase, again often on credit, industrially produced consumer items such as cloth, shoes and soap. This unequal relationship between the middlemen and the *barani* communities is made further unequal by a bad road network and a general lack of education in the *barani* areas. In most of the valleys of the high mountain region, a similar situation is fast developing. Due to the factors detailed above, in those *barani* areas where change began earlier, such as the Mansehra and Hazara districts, agriculture or pastoral activity is no longer a primary activity and the communities sustain themselves through remittances from the urban areas. In other areas, such as Tharparkar, the same process that took place in Hazara and Mansehra, NWFP, some twenty years ago, is taking place now.

In those *barani* areas where there is substantial subsoil water, such as the Pishin district in Baluchistan, it has been tapped mechanically for agricultural purposes and the technologies of the green revolution have been adopted. However, such areas do not constitute more than 5 per cent of the *barani* areas of the country.

Environmental Repercussions of Development in the Barani Areas

The colonisation of major parts of the traditional seasonal pasture lands of the *barani* people, an increase in the animal population, and the encroachments on traditional pasture lands, have resulted in over-grazing of the range lands. In Thar, for instance, where range is degraded, the stocking rate is 68 heads to 100 hectares, whereas for excellent range land it should be 30 (58). This over-grazing, in the absence of controls, has also resulted in the destruction of those trees and shrubs that are palatable to animals. Unfortunately, all such trees and shrubs are also good soil stabilisers. This process has led to pasture lands, accompanied by massive soil erosion. In areas adjacent to the earlier canal colonies, such as the Cholistan and Thal deserts, this process has been irreversible and the desert is dead.

The cultivation of pasture land in the more arid of the *barani* areas has led to soil erosion. Ploughing the land for cultivation loosens the soil. If rains do not materialise the topsoil is carried away making the land unproductive.

With the breaking up of feudal and community institutions the maintenance of infrastructure to tap and store water has suffered and in many cases ceased to exist. In the more affluent parts of the *barani* areas, or where electricity is available, this has led to the mechanical extraction of subsoil water for drinking and agricultural purposes. In the Pishin and Quetta valleys this resulted in an expansion of orchards and agriculture in the 1960s. However, over the last few years the level of the subsoil aquifer is falling at the rate of 27.5 cm per year and many tube wells are becoming inoperative (59). If this extraction continues without proper water management the Pishin-Quetta area will become a desert.

Large areas in the oasis of Malir, Gadap and Kathore, which had traditionally supplied vegetables to the city of Karachi, are now unproductive because the subsoil aquifer has been depleted by mechanical extraction. The recharging of the aquifer has been hindered because of increased water run off caused by the large scale lifting of gravel and sand for construction purposes from the beds of seasonal rivers in the area. This process is also taking place in geological areas similar to the Karachi region and near expanding urban centres such as Turbat, Panjgur, Quetta, the coastal towns of Baluchistan and Tharparkar and around Islamabad.

The *barani* areas are therefore fast becoming unproductive deserts due to over-grazing leading to desertification, soil erosion and depletion of water sources and the decay of old systems of water management. This process is being accelerated by the need for cash which in turn leads to the extreme exploitation of the areas meagre resources.

Women and Environment: The Effects of Development

Women's role in society and their relationship to production processes in the old social economy were dominated by of segregation from men, except for the immediate family or in some cases the extended family, clan or *mohallah*. This segregation seldom existed in the case of the lower castes such as scavengers, tanners and entertainers. In addition, folk wisdom generally considered women as a major source of conflict in society.

However, women have always participated in agricultural and pastoral activity. Harvesting, care of livestock, processing of agricultural produce and even, in some cases, sowing of seeds have been performed by women. In the case of the potter and blacksmith castes, women have always worked alongside their men and in fishing communities the making of nets and drying and packing of catch have been entirely the domain of women.

In addition to participating in these production related activities women ran the home. In this capacity, they collected fuel wood and gathered water, often from long distances, and washed clothes at the village well or *tarai*. These were collective activities in which the women of the entire neighbourhood participated. These activities, therefore, also had a social function and gave the women a chance to interact among themselves.

Among the upper classes and merchants, women's role was restricted to the home and even if they ventured out they did so veiled.

Even though women played, and still play, a major role in agricultural production and pastoral activity they rarely own property or the factors of production such as seeds, animals and agricultural or artisanal implements. Thus they have had little say in decision making about cropping patterns or management of agricultural or pastoral production.

Changes in the Old Social Economy and Its Effect on Women

Changes in the old social economy have had little or no effect on the lives of women involved in agriculture. They still do not own the factors of production or have a say in decision making. Indeed in areas where the green revolution technologies have been adopted their role has diminished as machines operated by men have taken over the work they used to do.

Increasingly, men from rural areas are seeking employment or sources of income outside their areas. However, women have few, if any, alternatives outside their villages.

In urban areas there has been a large increase in the number of working women, especially from the lower and lower middle income groups. This is due to economic necessity. In these groups women are playing an important role in shaping their physical environment by developing their homes and neighbourhoods. However, this role is possible because of the pressure of urban life which keeps the men away from their homes for the major part of the day. In addition, these new urban settlements are in the process of developing and women living in them have been distanced from their traditional social environment.

Due to economic pressure there is a great demand in most societies in Pakistan for the development of income generation activities for women, especially in urban areas and rural settlements where the green revolution technologies have been adopted.

Women and Environment

As gatherers of fuel, fodder and water women have an impact on the environment and are affected by environmental changes. There is a growing scarcity of these resources in most arid or subsistence economy areas of Pakistan and this is an added burden on the women in terms of time and labour. In addition, women are responsible for feeding the household in rural areas, but as agriculture becomes increasingly market oriented they find it difficult to find subsistence food stuffs which were available in traditional systems.

Development of piped water schemes and the use of kerosine and LPG cylinders for fuel are releasing rural women in the more developed areas from the labour of collecting water and fuel. However, this is also depriving them of the opportunity of getting together.

Women's access to resources (credit, appropriate technologies, education and skills improvement) and to decision making is even more limited than men's, and hence the quality of their interaction with natural resources is less open to improvement e.g. planting of appropriate varieties of trees or grasses to increase fodder and fuel availability, building of appropriate infrastructure to reduce their labour burden, or training in appropriate skills to improve their management and use of resources like trees, water and land.

3. GOVERNMENT RESPONSE TO ENVIRONMENT ISSUES

The Nature of Government Response

As explained in the preceding sections, most development since the nineteenth century has resulted in the creation of environment related problems. Until recently these problems were not viewed in their larger ecological context nor was the philosophy and politics of development that produced them questioned. They were tackled individually either through rectification and relief programmes or through the enactment of isolated laws and regulations. Thus, water-logging and salinity led to the develop of the Salinity Control and Rectification Programme (SCARP); deforestation and soil erosion to watershed management projects and the West Pakistan Goats (Restriction) Ordinance 1959; industrial pollution to the Factories Act 1934 and so on.

Government programmes are designed and implemented by a number of agencies. These include semi-autonomous organisations such as WAPDA, provincial line departments of the PWD, PHED, education, health and irrigation; local bodies with support from the LG&RD department; and specially created organisations that operate prestigious internationally supported projects, such as BIAD in Baluchistan.

The first attempts at government level to relate development to larger ecological issues are to be found in the fifth 5 year plan (1978-83) documents and are further expanded upon in the sixth and seventh 5 year plans. In 1983, the Environmental Ordinance was enacted and in 1984 the Environmental Protection Council (EPC) and the Pakistan Environment Protection Agency (PEPA) were created to promote the objectives of the Ordinance. Government response can thus be divided into two clearly defined and parallel zones; one, response to the effects of development and two, plans for a larger environmental policy. In the paragraphs below both these responses are dealt with in detail.

Response to the Effects of Development

Salinity and Water-logging

To tackle the salinity and water-logging problem, the government has been operating two major programmes, SCARP and Surface Drainage projects. In addition, there is also a programme for lining water channels with concrete by involving the small farmers.

The SCARP programme commenced in 1959. Its main component was the installation of tube wells in water-logged areas. These tube wells pump out subsoil water and discharge it back into the irrigation system. Thus, most of the SCARP tube wells were installed along canals and other irrigation channels and where they were not, the pumped effluent was used for irrigation purposes.

The programme now comprises more than 14,000 tube wells and covers an aggregate area of 6.7 million acres or one-fifth of the total irrigation areas of the Indus plains (60). The programme operation has lowered water tables in most areas and developed additional ground water for agriculture. As such the salt affected area in the country is decreasing (61). In addition to these achievements, the SCARP programme has led to the installation of over 180,000 private shallow tube wells. The annual pumpage from these wells is estimated at 25.14 MAF, as against 12.57 MAF by the SCARP tube wells, and contributes upto 77 per cent of total ground water use (62).

In spite of these achievements the SCARP programme has faced a large number of difficulties. In areas where subsoil water is saline the tube well effluent could not be pumped back into the irrigation system for fear of contaminating it and nor could it be used for irrigation. The disposal of this effluent is one of the major problems faced by SCARP. In addition, private tube wells are not installed in saline water zones either as the effluent cannot be used for agricultural purposes.

Operation and maintenance (O&M) costs of SCARP tube wells have been a major drain on the national exchequer and due to political and social considerations taxes for O&M have not been levied on the beneficiaries of the programme. In addition, power shortages have made the operation of tube

wells irregular, especially in Sindh, and diesel operated pumps are uneconomical. To overcome these problems, the government has initiated the SCARP Transition and Improvement Project whereby publicly owned tube wells are being transferred to private ownership. However, in the saline water zones the state will continue to operate SCARP tube wells.

The SCARP programme has been limited to tube well installation and operation. Its name notwithstanding, it has not undertaken any programme of work for reclamation of salt affected soils or other related agricultural and water management issues.

Since vertical drainage through tube wells is not possible in the saline water zones of the Indus plains, the government has been developing horizontal drainage systems. In areas not accessible to the sea these drains empty their effluent in large natural depressions and these are not always easily available. In addition, the slope of the land in most cases in the Indus plains is insufficient for effective gravity flows over long distances. These problems have been most acute in the lower Indus plains. To overcome them the government has initiated the Left Bank Outfall Drain (LBOD) project with the assistance of the ODA, World Bank and the UNDP. The project consists of tube wells and scavenger wells which pump out saline effluent into an enormous drainage system. The main spinal drain is 160 miles from Nawabshah to the Rann of Kutch and the Arabian sea. Other project components are 360 miles of interceptor drains which will provide additional irrigation water, 2,760 miles of 11 KV electricity distribution, on-farm management and maintenance facilities. The additional advantage of the drain is that it will carry away storm water from the agricultural belt. This storm water causes considerable damage to the cotton crop in the Nawabshah area. The total area which will benefit from Stage - 1 of the project is 1.3 million acres. The cost of the project is estimated at 8,372 million rupees spent over an 8 year period (63).

The LBOD project has attracted much criticism. It is felt that the operation and maintenance of this enormous system will pose major financial, technical and managerial problems. In addition, the on-farm management component, which is an integral part of the programme, has not yet been initiated and nor are there appropriate institutions to promote it. It is pointed out that at this cost concrete lining of major canals in Sindh could have been undertaken, thus reducing water seepage and costs of maintenance of the irrigation system as a whole. It is also pointed out that the repayment of loans, taken for the implementation of the project, will not be possible through imposing taxes on the beneficiaries.

Concrete lining for water channels has been promoted by the government in many districts of the Punjab. Under this system, the small farmer provides labour and aggregate for the lining and the state provides cement and burnt brick. This programme has not been carried out on a large enough scale to have any significant impact.

Prevention of water-logging and reclamation of salt affected land is essentially an on-farm activity consisting of proper water management practices and maintenance of on-farm and common infrastructure. It is only the farmer himself, or an association of neighbouring farmers, who can undertake this activity effectively. For this they need to be owners of the land and not tenants on it and have to be provided with means, incentives and technical assistance. In addition, they have to work together to maintain and operate common infrastructure, something the old feudal order managed before. Without incorporating these components in their programmes, the purely technical inputs of SCARP, LBOD and concrete lining of water channels cannot effectively overcome problems related to water-logging and salinity.

Research has shown that special varieties of vegetables, fodder, trees and fruits can be grown in water-logged and saline land. However, very few attempts have been made in Pakistan to introduce these in the affected areas, and only at an experimental level.

Green Revolution Technologies

A considerable amount of desk and laboratory research on the general effects of the use of green revolution technologies is carried out by government organisations such as PARC and at academic institutions. In addition, details regarding the amount of fertiliser and pesticides used and yields achieved are also published periodically by them and by the Federal Bureau of Statistics, government of Pakistan. However, the results of this research are not extended to the farmers or even the

agricultural departments of the provincial governments and nor are there any institutional arrangements that can make this possible.

The extent of aquatic and atmospheric pollution, soil damage and the resulting environmental problems due to the use of green revolution technologies have neither been quantified or fully studied. Nor has there been any programme for raising the awareness of farmers or peasants regarding these issues.

The only legislation regarding the use of green revolution technologies is the Agricultural Pesticide Ordinance, 1971. The ordinance seeks to regulate the quantum and manner of pesticide use. However, there are no arrangements for overseeing the implementation of the ordinance and nor are the farmers in Pakistan aware of its existence.

Watershed Management and Afforestation

Watershed management through afforestation and soil conservation is one of the major environment protection programmes of the government of Pakistan. In addition, considerable desk research on the afforestation part of the programme has also been carried out by the Pakistan Forest Institute, which has also initiated a number of small pilot projects. These programmes have considerable financial, technical and managerial support from international organisations such as the World Food Programme and the EEC.

Watershed management programmes in Pakistan so far, in spite of considerable inputs, have not been very successful. This is because of a reluctance on the part of farmers to permit their land to be terraced or planted with trees, especially in areas used by them for grazing and cropping purposes, since such afforestation would have to be coupled with strict controls on grazing. The result is that the programme implementation is patchy and therefore comparatively ineffective. In addition, it has only been carried out in a small part of the total catchment area.

Table - 11

Summary of Watershed Activities in Pakistan

Past, Present and Future

(Area treated in thousand hectares)

	Punjab	Sindh	Baluchistan	NWFP	A.K.	N. A.
A. Area where work has already been completed:						
i) Afforestation	37.0	-	366.1	93.8	52.0	4.1
ii) Soil Conservation	436.0	-		73.0	20.9	0.1
B. Area where work is in progress:						
i) Afforestation	3.4	-	428.5	307.6	2.5	0.3
ii) Soil Conservation	11.6	-		307.6	0.2	-
C. Area where work is contemplated/required:						
i) Afforestation	3.2	-	10,606.1	72.0	8.3	90.5
ii) Soil Conservation	42.6	-		13.2	6.5	90.5
D. Area with severe hazards of soil erosion	NA	13.5	7,400.0	400.0	100.0	181.0

Source: *Report of the National Commission on Agriculture, 1988*
 Ministry of Food and Agriculture, Government of Pakistan

Table - 12

Province-Wise Afforestation Efforts

Province	(Hectares per year)			
	1960-61 to 1969-70	1970-71 to 1979-80	1980-81 to 1984-85	1960-61 to 1984-85 (Average)
Punjab	15,980	8,497	5,400	10,900
Sindh	630	575	786	637
NWFP	3,457	2,634	13,320	5,100
Baluchistan	60	231	160	148
Northern Areas	345	1,822	1,093	1,304
Azad Kashmir	2,833	4,968	5,617	4,244
Total	23,305	18,727	26,376	22,333

Source: *Report of the National Commission on Agriculture, 1988*
Ministry of Food and Agriculture, Government of Pakistan

People living in the catchment areas where these programmes have been implemented are poor and survive on subsistence agriculture and cattle grazing and depend on timber for their fuel needs which, due to extremes of climate, are considerable. Unless the programme also provides for alternative means of livelihood or finances, and technical support for improved agricultural production and stall feeding of animals, there is little chance of it achieving its objectives.

Considerable effort has been made at afforestation by the government of Pakistan through the provincial forest departments. However, with the current afforestation rate of 23,000 hectares per year, it would take 50 years to add the present minimum requirement of one million hectares (64).

Potentially, the most effective part of the afforestation programme is seen by experts as the promotion of planting and management of trees on privately owned land. This requires not only the involvement of individual land owners but also, in many cases, of entire village communities. However, institutions and personnel for undertaking this extension work and the social research that goes with it, have yet to be created. Institutions for technical research, on the other hand, are well established.

There is also a need to re-examine current timber harvesting practices, involve rural communities in this activity and abolish the previous system of harvesting through private contractors. This may call for major changes in the Forest Act, 1927.

Fisheries

There are no government plans for dealing with the environment problems being created due to the expansion of mechanised fishing in the coastal regions or inland fisheries. Although the people are aware of these problems and their long term repercussions, they are unable to take any action in these matters. This is because the fishing communities are the serfs of big business whose financial interests are best served by the use of trawlers and indiscriminate harvesting of fish life. The development of independent fishermen and/or associations of fishermen would go a long way to overcome these problems. However, this again requires an extension programme and supporting social and technical research, along with financial assistance. The present system of contracting out lakes, barrages and canals through public auction to entrepreneurs for farming purposes also needs to be reviewed.

The rehabilitation of the mangrove ecosystem in the Indus delta through the introduction of new varieties of mangrove that can survive in a more saline environment, has been mentioned in some international agency reports (65) and discussed in the national press. However, there is no definite programme to undertake this rehabilitation.

Atmospheric Pollution

Atmospheric pollution at various locations in the industrial cities of Pakistan has been studied by the PCSIR, EPA, PHED of the Punjab and IPIHER, in addition to small surveys undertaken by academic institutions, urban development authorities and the IUCN (66). However, an overall national picture regarding atmospheric pollution in the country does not emerge from these studies.

The two main sources of atmospheric pollution in the urban centres are industrial and automobile emissions. Appropriate legislation for regulating these emissions exists, although the standards defined are questioned by experts in the subject. However, there is no arrangement or institution for monitoring these emissions or for overseeing the implementation of these laws. The public at large and even the informal sector industrialists are unaware of these laws or of the damage that industrial and fuel combustion emissions cause.

Through experience, communities living in areas of heavy atmospheric pollution have learned of the adverse effects of this pollution. In many cases, they have petitioned the district administration regarding this issue and have also agitated for its rectification. However, it is not clear as to who has the jurisdiction in dealing with this issue or what is the right course for seeking relief.

Aquatic Pollution

The three main sources of aquatic pollution are: sewerage from human settlements, industrial wastes and pesticide infested water run-off from agricultural areas. The effluent from human settlements is a growing menace. Except for a few large and intermediate cities where there are plans for putting up sewerage treatment facilities through international aid, there are no government plans to tackle this problem.

There are laws and standards that seek to regulate the quality of industrial wastes and of potable water. However, there is no arrangement for monitoring these or for taking action against defaulters. In addition, the vast majority of the informal sector entrepreneurs and the public at large are unaware of the existence of these laws or of the damage that their wastes are causing to the environment in general and to health in particular.

Urbanisation

The urban areas are receiving a lot of government and international attention. Master plans for all of the major and intermediate cities have been prepared recently or are in the process of being prepared through UNDP and World Bank assistance. In addition, a massive programme for shelter for low income communities is under preparation. It is being funded by the SDC and the government of Japan and is being administered by the World Bank. In addition, plans are also being prepared for a limited number of small towns and for the rehabilitation of city slums.

In the previous decade a large number of similar international agency aided projects and master plans were undertaken for the urban areas of Pakistan. Their successful implementation would have had a major impact on the urban environment. However, almost all these plans failed to meet their targets, like the *Katchi Abadi* Regulation and Improvement Programme of the Karachi Municipal Corporation, and in a number of cases had to be abandoned, like the Karachi Metroville project.

There are two reasons for the failure of the urban projects of the previous decade. One, community participation in project design, development and implementation, which formed an important part of a number of project concepts, failed to materialise and secondly, the planning, monitoring and implementing agencies of the projects lacked the technical and managerial skills for detailing and operating the projects, and the political will to carry them through. In addition, the administrative structure of the urban development authorities and the local government was not compatible with the nature of developments proposed, especially with their social sector components. Surprisingly, a restructuring of these organisations did not form a part of the programme proposals. It is feared that given the nature of urban development authorities, local government and the increasing scale of environmental degradation, the developments proposed for the 1990s will meet the same fate as for the previous decade.

The Problem of the Barani Areas

Government plans for the *barani* areas mainly consist of exploration of ground water resources and range land management. In addition, there are programmes for storm water conservation through check dams, water galleries and small dams on seasonal rivers.

Exploration and development of water resources has been undertaken by WAPDA in Baluchistan (67), NWFP and Sindh arid zones with assistance from the Netherlands and German government. In addition, SDC has been assisting the Sindh PHED and UNICEF in drilling for fresh water in the Sindh arid zones. However, apart from the SDC assistance to Sindh PHED, none of these projects have progressed beyond the stage of investigation and project proposals and nor have the institutions required to implement, maintain and build on these programmes, especially socially, been developed. The project documents do not discuss the ecological problems that these developments, especially the exploitation of subsoil water, will create for the area and its inhabitants.

Range land management is one of SAZDA's main programmes. However, the programme has not yet taken off. The success of the programme depends on an effective extension component which has to be backed by social and technical research and the active participation of local communities. The social research aspect is missing from SAZDA's overall programme. SAZDA was created in 1985.

SAZDA also has proposals for development of forests and agriculture through the use of saline subsoil water. Again, this has not progressed beyond the initial project proposal stage.

An Arid Zone Research Institute has been set up at Quetta. The work of the institute has so far mainly been of a technical nature. Again, social research, so essential for the development of a successful extension programme and for appropriate technical inputs, does not figure in the institute's research papers and publications.

Women and Environment

Although there is no specific government response to the issue of women and environment. The government of Pakistan has set up a Women's Division in the Cabinet Secretariat. The division is lavishly funded and has a research wing attached to it. This wing is responsible for carrying out research on social, economic, cultural and political issues related to women and in developing policies for women's emancipation and development.

The Women's Division is funding a large number of NGOs dealing with women's issues. Many of these NGOs have programmes related to women in development and are often, directly or indirectly, related to environmental issues.

Plans for a Larger Environmental Policy

The Pakistan Environmental Protection Ordinance

In 1983, the government of Pakistan enacted the Pakistan Environmental Protection Ordinance (PEPO). The objective of the ordinance was "to provide for the control of pollution and the preservation of the living environment". The ordinance, through the institutions that it has created and seeks to develop, is in a position to question and reframe existing environment related legislation and standards and to propose new ones. Thus, the piecemeal approach to environmental legislation has, in theory, been replaced by an integrative one.

The idea of a comprehensive set of laws relating to the environment was first conceived during the 1970s by the then PPP government. The first draft was due to be submitted to UNESCAP for comments in 1977, but political events in Pakistan precluded action in this regard. Subsequently, a comprehensive ordinance was drafted, which encompassed pollution control and solid waste management, the development of national parks, remedial measures for existing environmental problems, and the mandatory application of Environmental Impact Assessments. However, the government of General Ziaul Haq rejected the comprehensive draft of the ordinance, and retained only the institutional provisions and the introduction of Environmental Impact Statements for new projects. The ordinance was finally promulgated in 1983, and led to setting up of the Environmental Protection Council (EPC), headed by the president.

In the seven years since the EPO was promulgated, the EPC has not met even once. As a result, the remaining provisions of the ordinance have also largely remained in cold storage. However, a temporary Director General has been appointed for the proposed Pakistan Environmental Protection Agency (PEPA), and Environmental Protection Agencies (EPAs) have been set up in Sindh and Punjab and, on a "part-time" basis, in Baluchistan and NWFP. The federal government formally requested the provincial governments to set up their own EPAs, but the response has been largely a function of the interest shown in environmental matters by the two largest provinces.

The functions of the PEPA are to administer the ordinance and prepare the national environmental policy for approval by the government. In addition, the PEPA is charged with the responsibility for developing national environmental standards and for establishing systems of monitoring environmental pollution with the aim of combating it. For this purpose, it is to promote necessary scientific and social research and its extension, and to coordinate its work with relevant government departments, international agencies and NGOs.

The first provincial EPA was set up in Punjab in July 1987, under instructions from the federal EUAD, and in the provincial department of Housing, Physical Planning and Environment. The Punjab EPA has its headquarters in Lahore, and field offices in Faisalabad and Lahore. It is funded by the department of housing, through the provincial ADP.

The Punjab EPA has initiated some moves to control pollution and has proposed measures to assist local industries in this regard. However, it is obliged to act through existing laws and regulations, as it is not empowered to draft its own laws. Its powers are limited to administering orders, rules and regulations; to establishing systems for surveys, surveillance and monitoring; and to carrying out analyses on physical indicators of pollution. EPA in other provinces have yet to develop proper administrative systems and employ necessary technical staff.

The Institutional Framework

The Ordinance has provided for the creation of a National Environmental Council (NEC) and the PEPA. In addition, it requires that all proposals for development should be accompanied by a detailed Environment Impact Statement (EIS) along with details of economic and technical factors related to the design and implementation of the project.

The functions of the NEC are to ensure the enforcement of the ordinance and establish a comprehensive national environmental policy. This means that the NEC has to ensure that environmental considerations are interwoven into national development plans and policies.

The Role of EUAD

In the absence of the PEPA and the lack of interest shown by the EPC, EUAD remains the major government agency directly concerned with environmental administration. However, its role is largely confined to that of a clearing house for various environment related policies, and its location in the Ministry of Housing and Works places considerable constraints on its scope of work. Though, in theory, EUAD is considered to have a coordinating function between various ministries, in fact it is unlikely to have much influence outside its own ministry. This factor must be borne in mind when considering the role EUAD is expected to play in relation to the National Conservation Strategy (NCS).

The National Conservation Strategy

The NCS process was initiated in 1986, as a result of collaboration between the government of Pakistan, IUCN and donor governments. It is linked to EUAD, though it has a separate Steering Committee and coordinator. The function of the coordinator is to arrange, with the help of consultants, for a situation analysis. The purpose of this situation analysis was to carry out, firstly, a wide ranging investigation of the current state of the environment and, secondly, to recommend measures to address the situation, in particular, reforms and adjustments in policies which are likely to affect the environment. The final set of conclusions and recommendations was submitted to the federal cabinet for consideration and approved in 1992. These recommendations now form the National Conservation Strategy. Action on the strategy is to be taken by the various ministries and agencies, where relevant.

The NCS process has involved a review of government policy as it relates to environment; technical and scientific reviews of major environmental issues; discussions with local government, provincial government and NGOs; consultancy reports on topics such as women and environment, and the role of NGOs; and “grassroots” meetings to test the assumptions and hypotheses of the NCS.

The NCS recommendations are envisaged as being implemented through three major channels. Firstly, environmental concerns, as defined by the NCS, would be incorporated in the planning and development process at both the federal and provincial levels. Secondly, the monitoring role of EUAD would be strengthened and EUAD would become responsible for acting as a watchdog over the implementation of the NCS. Thirdly, specialised institutions would be created (subject to the availability of funding) to develop policy recommendations, carry out studies and deliver training to government and NGO staff. One such institute, the Sustainable Development Planning Institute (SDPI) has already been created in the non-government sector.

In addition to these broader levels of implementation, the NCS will recommend specific programmes and projects. These include demonstration projects dealing with significant environmental problems; key institutional innovations, and technical innovations. The NCS has not proposed the drafting of new legislation relating to its recommendations. Thus, at present no enforcement measures (other than those already incorporated in the PEPO) are envisaged. Since many of the recommendations will require inter-ministry coordination and cooperation for effective implementation, the specific actions envisaged by the NCS depend on acceptance by all concerned ministries.

The NCS emanated from the administrative arm of government and seems likely to remain within this domain. This gives it certain advantages - it is not dependent on any particular government for support or implementation, and is therefore likely to be a relatively stable component of government policy. However, this also means that it largely remains divorced from political or participatory public processes. Attempts have certainly been made during the formulation of the NCS, to incorporate NGO and community concerns and these attempts have been successful. The Steering Committee of the NCS also includes representatives from a wide range of occupations. Nevertheless, public debate and discussion of the NCS has been conspicuous by its absence except, perhaps, in the English language media, and to a limited extent. How this will effect the implementation of the NCS remains to be seen.

Evaluation of Government Response to Environmental Issues

Government commitment to the protection of the environment is clearly stated in the sixth and seventh 5 year plans. The link between development, environment and community involvement for sustainable development is also clearly spelt out. In addition, decentralisation of the planning and implementation of development is advocated and the importance of women in the process is emphasised. The enactment of PEPO, the development of the NCS, the setting up of the Non-Governmental Organisations Coordinating Council (NGOCC), financial support for the expansion of the activities of the Women’s Division and increased allocations for watershed and range land management and afforestation, all point to this commitment.

To translate government commitment into action, the development of appropriate institutions and the orientation of planners and supporting staff members is necessary. Again, for decentralisation of planning and implementation of development, structural changes are needed in the bureaucratic and local government set up. However, none of these actions have so far been taken by the government and nor are there any plans to do so in the near future.

Constraints in Appropriate Government Planning and Implementation Processes

In the survey of government response to environment related problems in the preceding paragraphs, a number of constraints that government programmes face have emerged. These are summarised below.

Most government planners and technocrats are trained conventionally and have a poor understanding of the sociology and economics of poor urban and rural communities and of the process of change that has destroyed the old social economy. Many of them belong to the civil services and give greater importance to “good” administration than to innovation and experimentation. Thus, translating environment related guidelines of 5 year plans into operational plans poses many problems.

Government and academic institutions in Pakistan are, by and large, engaged only in desk research, their aims and objectives notwithstanding. Because of an absence of institutional arrangements and procedures even this research does not reach planning and implementation agencies, NGOs or community groups.

Almost all research at government and academic institutions is technical and scientific in nature. Social research is seldom undertaken, and even where it is, it is purely academic in nature. As a result, effective extension programmes cannot be developed even where they form an important component of the programme.

The programme planning and implementing agencies such as WAPDA, PHED, the provincial line departments or the urban development agencies are geared and structured for the physical implementation of programme. The social sector components such as community participation, awareness raising, training and education are seldom undertaken, and if they are, they are abandoned due to lack of success.

Most government institutions do not have the technical and managerial capacity to operate the programmes they are saddled with. As such, not only are programmes badly implemented, but long delays, over-expenditure and lapsing of funds is a common feature of most development projects.

The provincial line departments are responsible for the implementation of most development that affects the environment at a local level in Pakistan. However, the line departments are not organised at a local level, but at a highly centralised provincial level, and have no involvement of community leaders or district or union council representatives. Similarly, in the larger towns, development priorities are set and planning is done by the city development authorities that are bureaucratic, non-representative organisations, and not by the municipal authorities.

Local government in Pakistan is organised at village, district, town and city level, is representative in character and in touch with local communities. However, its technical and managerial capacity is weak and at most union council levels and in many district councils and town committees, non-existent. In addition, under the 1979 provincial local body ordinance, the local councils are subservient to the provincial bureaucratic set up. This seriously affects their independence and effectiveness.

In addition to the constraints mentioned above, no clear cut division of functions or coordination exists between many agencies involved in development. Thus, district councils and provincial PHEDs both install, operate and maintain water supply system in rural areas; municipal councils and provincial education departments both run primary schools in the urban centres; infrastructure is provided to the same urban localities through local councillor organised programmes, development authority area development schemes and special programmes such as the People's Works Programme or internationally aided projects. Thus, a lot of parallel and uncoordinated development takes place with resulting environment related problems.

Organisations for monitoring aquatic and atmospheric pollution, such as the PEPA and PCSIR, are in the process of being developed. In addition, there are organisations that can be upgraded to develop local standards related to aquatic and atmospheric pollution, such as the Pakistan Standards Institute. However, there is no institutional set up that can possibly enforce such standards. Similarly, there are no organisations that develop and operate extension and effective awareness raising programmes on the subject, or carry out the necessary research for their formulation. The problem is further compounded by the diversity of environmental problems in different parts of Pakistan and the different levels of social and economic development in the different regions of the country.

The other major constraints to the effective development of environment related programmes is the poverty of the communities that are affected by them. Many programmes, like watershed and range land management, can be of long term economic benefit to them but in the short run they adversely affect their already meagre agricultural produce and cash generation. Similarly, the installation and operation of a treatment unit for effluent from a small informal sector tannery will make the setting up and the operation of the tannery beyond the means of the entrepreneur. In many larger formal sector industries, environmental controls according to western standards will raise the cost of production and many make the manufactured items unaffordable to the lower income communities. The need, therefore, is for manageable standards and for cheaper treatment and control units.

4. COMMUNITY ACTION GROUPS (CAG) AND NGOS IN PAKISTAN AND THEIR INVOLVEMENT IN ENVIRONMENTAL ISSUES

The Beginnings of Environmental CAGs and NGOs

The last decade has seen the emergence of the environment as an issue of public and donor concern. As a result, a number of environmental NGOs and CAGs have emerged, encouraged by media coverage and the comparatively easy access to funding from external sources. However, there are a large number of CAGs and NGOs that have been, and still are, involved in local level development work and economic uplift programme. Some of their work has led to improved environmental conditions at the local level although they have never consciously related it to larger environmental issues. In addition, their impact on improved environmental conditions is far more marked than that of the professed environmental NGOs, and is likely to remain so. In the paragraphs below the nature of CAGs and NGOs is described, along with their shortcomings and potential.

Community Action Groups (CAGs)

Informal Groups

Informal CAGs are more an urban phenomenon rather than a rural one. In most low income urban settlements, and now sometimes in large villages as well, neighbourhood residents get together to tackle some of the problems they face. In the vast majority of cases these problems are related to sanitation and solid waste disposal.

To overcome these problems the CAG usually undertakes the construction of open drains and, in some cases, of underground sewers and road paving as well. These carry the effluent away from the lane to the nearest natural drain or depression. In many cases, residents get together and employ a scavenger to collect their garbage and dump it outside their neighbourhood, and to sweep their streets. In most cases, the group also tries to lobby with the local government or area councillor to intervene for the improvement of their areas. In almost all cases, the group falls apart after its basic objective is achieved (69).

In the rural areas similar action groups for water management, agriculture related issues and infrastructure maintenance do not exist. However, there are examples of rural communities fighting deforestation, such as Chaprote in the Northern Areas, or undertaking afforestation, the such as at village Gunyar in the NWFP (see case studies).

In recent years, residents of Gulshan-i-Iqbal and Qasba Metroville in Karachi have also agitated collectively against emissions from the National and Javedan Cement factories. Residents of Gulshan-i-Iqbal, being from the middle class, have secured the promise of the divisional administration that the factory will be shifted. However, the Metroville residents, being from the low income groups, have been ignored.

Assessment of Development Work and Lobbying Done by CAG

Almost all development work undertaken by CAGs is defective in quality. Roads are unevenly paved; drains do not have proper gradients; and sewerage systems do not work. People are aware of these defects and because of them they often stop maintaining these infrastructure projects. However, in lanes where building skills are present excellent work is done and is well maintained. All work done by such CAGs is self-financed and self-managed. Hence, if its quality can be improved, it is potentially sustainable. Lobbying done by informal CAGs for improvement of their areas seldom yields any results. This is because the groups are far too small to be considered of any importance by the authorities and also because they are not legal entities.

Formal Groups

Groups usually formalise their existence by registering with the Social Welfare Department. They normally call themselves *falah-o-behbood* or *islahi* committees. Registration with the department gives them not only an identity, but also entitles them to some funding from government sources and the possibility of approaching other funding agencies for assistance.

In the case of almost all neighbourhood social welfare associations, the organisers are young men with well-above-average education for the area they live in. Many of them have been active in student politics. In rural areas, especially where feudal control is weak or non-existent, this leadership role is performed by ex-army men.

Few of these groups undertake development work that has a direct environmental impact. Most of them organise mother and child clinics, vocational schools for girls, primary schools or lobby with state agencies for facilities such as water supply, gas, electricity, post offices and banks. They do this fairly successfully.

In recent years, such organisations have received financial assistance from international agencies and mission funds. It has been noticed that when such funding is curtailed or stopped the organisation stops functioning.

There is considerable potential in these community groups for undertaking development work and raising finances from within the community. However, this potential can only be tapped if the necessary orientation is developed and a change of attitude in the office bearers takes place. This requires exposure to new ideas and forms of functioning. Where such exposure has taken place, the differences are apparent (70).

Such social welfare organisations exist all over Pakistan in large numbers both in rural and urban areas. In Lyari, a slum of 600,000 population in Karachi, there are over 700 such groups.

A few of these neighbourhood based CAGs have expanded to become affluent institutions. They run large middle and secondary schools and organise vocational training for over 100 girls at a time. Health education is, in some cases, part of their extension programmes. In addition, their teachers are well trained and their clinics well equipped and well staffed. Their administration is in the hands of paid administrators and their office bearers are well-to-do persons. Many of these organisations own considerable property, the rent from which also finances part of their activities. Such CAGs are usually connected to religious organisations and have access to a large number of funding sources. However, they have no outreach activities, do not involve themselves with larger urban or rural development issues, and as a result cater mostly to the immediate needs of the lower income classes.

Different Types of NOGs in Pakistan

Larger Welfare Oriented NGOs

There are an increasingly large number of NGOs that are not area or settlement specific. They do very much the same things as the neighbourhood social welfare associations, but on a larger scale. Instead of ill-equipped clinics, they run medium or large hospitals; instead of small vocational classes they run secretarial and computer training schools for girls, in addition to elaborate courses for garment stitching, knitting and home management.

The professionals who run these NGOs are often highly qualified and well-paid. The office bearers are normally married women belonging to the elite classes. Often the reason for their involvement with NGO activity is to "do good" for the poor.

Raising funds for these NGOs does not pose problems. Their office bearers are well-connected and have easy access to both the corridors of power and the foreign missions. Budgets of these organisations can be as high as Rs 10 million a year. However, these organisations have never tried to become self-sufficient and one wonders what will become of them when the foreign funds, with which they finance part of their operations, are no longer available.

The NGOs described above do provide health care facilities and education to a large number of people. However, they do not effect a change in the living environment, attitudes, awareness or organisational levels of the urban or rural poor. Nor are their programmes replicable by other NGOs or the state because of their high cost.

Discipline Specific NGOs

A small number of subject specific NGOs have emerged in Pakistan. The broad categories are given below.

NGOs dealing with women's issues are run, for the most part, by professional women. They deal with awareness raising among women, adult education and legal aid. To promote awareness and dialogue, they arrange workshops, seminars, publish literature and carry out research. In addition, they touch upon important developmental issues, including the environment, related to society as a whole and women in particular. Since these NGOs deal with women's problems, which are important issues today, they have no shortage of funds. The work of these NGOs is too new to be evaluated.

In Karachi, the Pakistan Institute of Labour Education and Research (PILER) has been involved in labour education and research since 1981. It arranges short and long courses for industrial labour for general awareness raising. The courses deal with safety, industrial production, environment, health, housing, energy and legal matters. Prominent experts participate as resource persons in these courses. Feedback suggests that a follow-up on the courses can result in effectively involving the course members in development and environment related issues in their settlements. Funding is from grants by foreign agencies in Pakistan and abroad. Such NGOs are not large in number but given current trends in Pakistan society are bound to increase in number.

A number of NGOs are involved in promoting population planning. Judging from reports available, and from the failure of the population growth rate to register a fall, they are not very successful. However, some of them are impressive organisations spread all over Pakistan (71).

Development Oriented NGOs

In recent years, the concept that development in poor societies can only take place if people are empowered to run their own affairs, has caught on. But to empower people, one has to raise their awareness levels, their technical skills, their economic conditions, and above all motivate them to organise, generate savings, and operate and maintain the development they carry out. In this process, not only do the physical conditions in their areas undergo a change, but their relationship with local governments and with political power becomes less unequal. This in turn makes further development more appropriate to their needs. To make such development possible, a research and extension organisation, based in the area of its operation, is necessary. This organisation needs to be in constant touch with the community and its problems on the one hand, and should be able to call in expert technical advice for the solution of those problems, on the other. But to do this in a big way, not only is trained manpower necessary, but also exposure to this form of development. In Pakistan, a small number of NGOs are involved in developing such replicable models of development (72), while others are trying to train manpower which can help promote this form of development (73).

To make such development affordable to the people, technical research has to lower the cost of such development while social research has to relate it to local conditions and help generate local finances.

Successful projects run by such NGOs have demonstrated that both rural and urban communities can generate savings over a period of time (74) and given technical and managerial advice and training bring about development that positively affects the local environment.

The work of these NGOs has attracted international attention and they have no problems of funding. In addition, the government, at least at federal level, has shown a great interest in their work and in the last 5 year plan expressed the need for incorporating its principles into official planning.

Although there are a large number of NGOs that undertake development work, only a few have been able to develop successful and replicable models. The others face problems in involving the local communities, giving sound technical advice, modifying traditional practices or developing managerial expertise.

Environmental NGOs

Most environmental NGOs have been created in the last 5 years. The objectives of almost all of them are awareness raising regarding the environment and lobbying with government agencies for improved environmental conditions. Both these objectives are approached through the holding of seminars and workshops and through the publication of newsletters. Funding for the secretariat and awareness raising activities comes from foreign mission funds and foundations, government grants, international agencies or through membership fees.

Although most of the environmental NGOs are involved in local level awareness raising and lobbying, there are some like the ICUN, which are assisting the government in developing environment related national policies and supporting NGO programmes.

Most environmental NGOs are urban based, run by the elite and deal primarily with the problems of upper middle income areas. In addition, it is too early to assess their effectiveness. However, they have certainly been able to draw the attention of society to environmental issues rather than localised environment related problems.

NGOs Constraints and Potentials

Constraints

Government planning concepts at the federal level recognise and promote the need for involving CAGs and NGOs in the planning and implementation of development. However, this never materialises, even in the case of large development NGOs like the OPP. As a result, a lot of NGO action, that can be in support, or as a part of a larger official plan, dissipates itself in uncoordinated and ineffective work.

Moreover, most CAGs and NGOs do not have the technical and managerial capacity to absorb funds. In addition, most have to depend on external funding sources for their daily functioning. This development breeds as insecurity that is justified, for as soon as the funds stop, the CAG or NGO stops functioning. Attempts at generating funds locally are seldom made, even where the possibility exists. Another major problem is that donors are usually only willing to give funds for capital costs, training and programme inputs, and not for administrative purposes. Without funds for administration NGOs and CAGs find it hard to function efficiently.

In addition to the above constraints, NGO leadership is patriarchal in nature and feels that it can only keep itself in power if it can provide people with facilities rather than help empower them to change their social and physical environment. This is specially true of rural areas where most NGOs are operated by the landed classes and even internationally funded NGO projects are 'hijacked' by them. Similarly, as mentioned earlier, urban based environmental NGOs usually discuss the environmental conditions of slums and rural areas but have no links with the communities that live there. However, in CAGs and NGOs where the people themselves finance development, popular involvement and participation is guaranteed.

Research shows that many attempts by CAGs and NGOs at development fail because of a lack of access to technical and managerial know-how. This failure discredits community activists, who are the most valuable asset in any local development projects, and results in despondency among the community. In addition, there is dearth of trained manpower in Pakistan that understands grass-root issues and can relate them to larger environmental and development issues.

Due to an absence of effective government and formal sector involvement in the provision of services and credit, there is a powerful informal sector that serves the needs of both rural and urban communities. This sector provides agricultural credit and manages its marketing and provides land, credit and technical support for housing in the urban areas. In addition, it provides a whole range of other services, including health and education.

The informal sector, although exploitative in nature, is well established. It has the skills and finances necessary for its operation, countrywide linkages and good relations with relevant government

agencies. Often NGOs take on projects that compete with this sector and, as a result, fail. Almost no NGOs try to support and improve the activities of this sector.

There are other problems as well. Most national and international aid goes towards financing the physical implementation of projects. Comparatively little money is spent on arranging exposure to ideas, training and research. Targets are set for physical development that are unrealistic given the capacity and capability of most NGOs. Failure to make use of funds in time and to submit progress reports often 'black lists' the NGO. All this results in mismanaged and inappropriate development.

In the last decade, international agencies have promoted the participation of community leaders and activists in national and international seminars and workshops in a big way. Most of these are held in five star hotels and involve international travel. Many rural and urban communities are resentful of the nature of their leaders' involvement in these affairs. This resentment distances the leadership from the community and there are instances where organisations have broken up as a result. In addition, it promotes rivalry and discord among activists as they compete for participation in seminars and for trips abroad.

There is a need to bring donors and NGO support organisations together in a dialogue to determine their respective roles. Many parallel programmes in the same area and spheres are initiated due to a lack of such co-ordination and the result is detrimental to the development process.

CAG and NGO Potentials

The increasing inability of the government to tackle environment related problems and to provide services to the people is forcing communities to organise and take action at the local level. It is also forcing them to seek help and assistance from NGOs and other support agencies.

The government realises the importance of NGO involvement in development, awareness raising and relief measures. This realisation has grown over time and is expressed clearly in the last three 5 year development plans.

Pakistan is lucky inasmuch as it has a number of successful replicable NGO projects complete with demonstration areas and well documented strategies and history. Thus, the development of orientation and training for other NGOs can take place at these institutions. The government, with the assistance of foreign governments, have undertaken a number of projects that effectively involve local communities. These projects can also serve as training centres for other NGOs.

5. SUCCESSFUL NGO PROJECTS: CASE STUDIES

Aga Khan Rural Support Programme (AKRSP)

History

The Aga Khan Rural Support Programme (AKSRP) was initiated in 1983 by the Aga Khan Foundation as an experiment in cooperative rural development at the village level. Its area of operations is three districts in the mountains far north of Pakistan: the Gilgit and Baltistan districts of the federally administered Northern Areas, and the Chitral district of NWFP. The population of the programme area is around 800,000 and consists largely of small subsistence farmers. Until the building of the Karakoram Highway in the 1970s, the districts of the North were cut off from the rest of Pakistan, except by air. Chitral district is still landlocked for six months of the year by the snowbound Lowari pass. The area experiences extremes of climate, is very arid and is characterised by fragile ecosystems and low agricultural productivity.

Objectives

AKRSP's objectives are to increase the productivity of the area's smallholder subsistence agriculture, with the aim of producing marketable surpluses leading to an increase in income. More importantly, however, AKRSP aims to achieve this effect through the establishment of permanent village level development institutions, known as Village Organisations, which are capable of taking and implementing development related initiatives. Thus, the programme has three fundamental operating principles which guide its activities; the broad based village level cooperative organisation; the generation of village level capital through collective savings; and the improvement of skills and human capital through training and extension.

Methodology

AKRSP's entry point into the village is through the offer of a grant to meet the expenses involved in construction of small scale productive infrastructure. The specific project is chosen by the villagers on the basis of consensus. In return, the villagers must undertake to adopt the principles outlined above; they must form an organisation, undertake collective savings and nominate and undertake to support members of the organisation for training in specific skills. The infrastructure projects have mostly been small, local irrigation channels (using traditional technologies), link roads, and bridges.

The infrastructure project serves as a focal point for collective effort and is intended not only to expand village resources, but also to act as a means of cementing the Village Organisation (VO), through regular meetings and collective decision making. The construction and maintenance of the project is a collective enterprise in which all VO members are expected to participate, and from which all should benefit. Further projects may be undertaken by the VO, with the help of loans extended by AKRSP. Long and short term collective loans are also available for a number of activities, including land development, purchase of agricultural inputs and machinery, and marketing of produce.

AKRSP's training programme covers a wide range of agriculture related skills, and is regularly expanded to keep pace with the growing needs of the VO members. The aim of the training programme is to create village level cadres of skilled specialists who can offer services like livestock vaccination, plant protection, advice on marketing or maintain VO accounts, on a part time basis in return for nominal fees. In this way, the VOs have access to a range of important services which help to enhance the productivity of traditional technologies, and ensure the realisation of the full potential of new inputs.

In 1987, AKRSP initiated a village based forestry programme with the collaboration of IUCN. The programme aims to increase the supply of fuel, fodder and building timber through irrigated plantations of multi-purpose trees. The same elements (improved skills, new inputs and credit support) which characterise other AKRSP activities are also present in this programme. In addition to the direct environmental impact of the forestry programme, there is also the effect of new land and water

management practices introduced by AKRSP, and the effect of new crop varieties, inputs like fertiliser and new methods of cultivation.

Achievements

At present, AKRSP has formed 1,315 VOs, representing 62 per cent of households in the programme area. Over 3,000 villagers have been trained, and collective savings of the VOs total Rs 81.17 million. Future plans include the development of permanent support institutions which will continue offering necessary services to the VOs. These include a training institution, a financial institution (based on VO savings), and a marketing institution.

AKRSP has been cited in numerous reports as one of the most successful examples of rural development in the world. As such, it also acts as a model to be replicated in other parts of Pakistan. Similar programmes have been initiated in NWFP and Baluchistan provinces in the past year, and AKRSP is now carrying out training of rural development practitioners from these and other projects.

Reasons for Success

The success of AKRSP is a result of a combination of factors, which include the initial receptivity to the programme ensured by the link with His Highness the Aga Khan (whose followers form part of the target population), and the fact that the people of the area are almost entirely owners of their own family farms. The opening of the area to new opportunities by the Karakoram Highway, and the abolition, in the 1970s, of the old feudal system both created a situation conducive to the introduction of new methods of community organisation and resource management.

However, these favourable circumstances should not detract attention from the harsh working conditions or, more fundamentally, from the inherent strength of the conceptual model. The basic ingredients of the model - collective organisation, collective capital and training and extension by highly qualified project staff - have been derived from experiences in rural development in other parts of South Asia as well as Pakistan, and have proved to be a sound basis for small farmer development at the village level.

AKRSP and Environmental Issues

In terms of environmental management, AKRSP has demonstrated that without a channel of communication with village communities (such as that provided by the VOs), attempts to introduce new ideas or methods are unlikely to take root. In addition, villagers need to be supported with appropriate skills and technologies, whether it is for improved agricultural practices or better environmental management. The VO, again, is a powerful means of extending such support to the majority of villagers.

The Gunyar Youth Association (GYA)

History and Original Objectives

The Gunyar Youth Association (GYA) was set up in 1985 in Gunyar village in the Malakand district of NWFP, by a group of young educated men from the village. Its basic aims are to promote general community development and work towards the improvement of village social and economic conditions. Initially, the association attempted to carry out community development of sanitation infrastructure, and to introduce income generation projects for women. Members of the association meet once a month and are required to save Rs 2 in a general welfare fund.

Environmental Management Programme

In 1987, with the help of a member of the village, Dr. Quazi, who was working as a professor of biology at Peshawar University, the GYA introduced an environmental management aspect to its activities. An area of communal village land, a deforested slope above the village, was protected from grazing animals and planted with pine and eucalyptus saplings made available with the help of Dr. Quazi.

The protection of the area from grazing demonstrated the potential for natural regeneration of grasses and shrubs. Over-grazing by goats and other livestock is one of the most serious causes of

deforestation of mountain slopes in Pakistan, and no attempt at reforestation can hope to succeed unless young saplings are protected from grazing animals. However, enforcing protective measures has been one of the most difficult and least successful aspects of forestry programmes carried out by both government agencies and NGOs. The Gunyar project thus managed to accomplish something that has seldom met with success; the voluntary control by a community of its livestock.

Achievements

Three years after the initiation of the project, the GYA continues to receive the support of the community in its efforts at reforestation. In 1989, the protected area produced grass hay which earned the association Rs 18,000. This money was used for other community development projects, including the building of a concrete pathway through the village and the laying of a pipeline for domestic water supplies, as well as paying for the salary of a guard for the protected area.

The GYA has also managed to attract some external funding: a small grant from the government's Social Welfare Department and, this year, a Rs 240,000 grant from the New Zealand embassy, which is being used to purchase some high-yielding varieties of cattle. These will be managed collectively by the association, in a departure from the tradition of individual management of livestock. The experience of the AKRSP in collective management of resources indicates that while common resources like infrastructure and community land (forests and pastures) can be successfully managed by the collective organisations, traditionally individual property, like livestock or crop land, are less amenable to collective management. Thus, the experience of the GYA in this new endeavour should provide interesting lessons for other similar projects. Other plans include the planting of fruit trees and experiment with new fodder varieties.

Reasons for Success and Future Directions

The success of the GYA can be attributed to three main factors: the building of a consensus through community organisations; new inputs in the shape of scientific advice and planting material; and the presence of educated members of the village who promoted new methods of management. The association has shown a degree of vision and commitment that has carried it through the first stage of a difficult programme. However, in order for these successes to be consolidated, external support is required. Firstly, members of the village need to be trained in skills related to management of the projects initiated by the association. These could include livestock management, forest and range management, and technical skills related to infrastructure building. Secondly, the association needs to expand its capacity to raise community funds, and to receive training in management and accounting skills. Thirdly, members need exposure to other similar programmes, to exchange experiences and learn from their successes and failures.

In addition, village resources need to be expanded to meet the needs of the growing population. As Gunyar is in a rainfed area, it can only grow one crop a year, and even that is dependent on erratic rainfall. The association is interested in providing the village with irrigation, either through a tube well or through some form of irrigation channel tapping mountain springs. But in order to do this both technical advice and material inputs are required.

The example of Gunyar has not yet been successfully emulated in neighbouring villages, though some attempts have been made in three or four villages to start similar projects. It was not possible to investigate the reasons for their failure, but it may be that some external organisation is required to promote and support community development in the area. The GYA is a member of a body called the Malakand Coordination Council, which includes 18 such organisations, representing many more villages in Dir, Swat, Chital and Bajaur districts.

The Orangi Pilot Project (OPP)

History and Objectives

The Orangi Pilot Project (OPP) was established in 1980 as a result of an understanding between Akhtar Hameed Khan, the director of the project, and the BCCI Foundation, its major source of funds.

Orangi Township, where the project operates, is the largest squatter settlement in Pakistan and has a population of about one million. Before the OPP began operating in Orangi the township had no water

and sewerage facilities or health and education services worth mentioning. For disposal of excreta the residents had to pay scavengers and spend considerable sums of money on their health needs.

The main objective of the project was to develop community based organisations that could involve themselves in the development process in Orangi. It was felt by the director that when people organise themselves effectively services invariably improve and the unequal relationship between the people and the state becomes more equal.

The Low Cost Sanitation Programme (LCSP) of the OPP

In their dialogues with the OPP the people of Orangi identified sanitation as their most pressing need. OPP's research showed that squatter colonies could not acquire sanitation facilities from the local government because they could not afford to pay for them and the government could not afford to provide these facilities free of charge. Where international loans had been used for providing these facilities payment from the users could not be recovered to repay the loan.

Further OPP research showed that the high cost of development for sanitation facilities was because of excessive overheads of government institutions and international agencies, contractors profiteering, corruption and inappropriately high technical standards. The OPP then asked itself that if overheads, contractor's profiteering and corruption could be eliminated and standards and construction technique modified could the cost of the system be made affordable to the people? If yes, then could the people be motivated to fund, manage and construct such a system themselves? The OPP decided to give it a try.

The OPP's LCSP consisted of the following stages. One, motivation: the OPP social organisers, who were residents of the township, motivated the residents of Orangi to form a lane organisation and ask the OPP for assistance to build their sanitation system. Two: the OPP prepared plans and estimates of the system for the lane organisation that applied. Three: the lane organisation then collected money from its members and undertook construction work. Four: the OPP gave technical advice and supervision for the work being carried out and undertook the training of the lane organisation members and activists through a massive extension programme. In addition, OPP consultants and staff carried out technical research to lower costs and to modify standard engineering practice to make it compatible with the concept of community participation in development.

The creation of lane organisations led to neighbourhood action and the people pressurised their municipal councillors to divert their funds in order to build larger, ward-level facilities. The OPP advised the neighbourhood activists in identifying these facilities and gave the councillors technical and organisational assistance. Thus the programme expanded.

Other Programmes

Making the LCSP its base, the OPP introduced other programmes into Orangi. The Women's Welfare Programme consists of advising women's groups in the lanes which have adopted the LCSP, in health, hygiene, nutrition and family planning. This advice is given by a lady doctor and her team of LHV's by holding meetings in the lanes in the home of a women activist.

The Housing Programme consists of upgrading the products at the building component manufacturing yards in Orangi which are responsible for supplying all building material to house builders. In addition, new and cheaper products, especially related to roofing elements, have been developed at the yards by the OPP and are now being marketed by them. The programme also includes masons training and awareness raising of residents through a training and extension programme.

The OPP also runs a social forestry programme, a programme for the promotion of kitchen gardens, women's work centres and a small loans programme for family enterprises.

Achievements

So far 66,000 houses in Orangi out of a total of about 86,000 in over 4,300 lanes have acquired a sanitation system. The people have invested US\$ 3 million in this effort and maintain and operate the system they have created. The OPP's investment in the LCSP has been US\$ 165,500 and has been spent on research, extension, administration and capital expenditure, such as vehicles.

The programmes of the OPP have changed the relationship of the residents of Orangi with the local bodies, which are now taking an increasing interest in more appropriate development for Orangi.

Many squatter settlements in Karachi have applied to the OPP for assistance and extension of its programmes. This is being done by the OPP through its newly established Research and Training Institute (RTI) for the Development of *Katchi Abadis*. Upgrading projects involving the RTI and using the OPP model have also been taken up by UNICEF and the government of Sindh for the towns of Sukkur and Shikarpur, and more recently by the World Bank sponsored Shelter Project for selected Hyderabad katchi abadis.

The OPP model has been cited as a viable alternative to the government's *Katchi Abadi* Improvement and Regularisation Programme, which has failed to take off successfully, by international aid agencies. The OPP programme has also involved the Department of Architecture and Planning at the Dawood College of Engineering and Technology (DCET), and the Aga Khan Medical University (AKMU), Karachi, in its work, affected their curriculum, and led to the creation of the Karachi based Urban Resource Centre (URC).

The research of the OPP and the development work undertaken has been minutely monitored and documented. This documentation has a wealth of social, technical and economic material in it regarding informal sector operations and their clientele in the urban areas of Pakistan.

Causes for Success

The main reason for the OPP's success is its social research, which has led to an understanding of the dynamics of development in urban low income settlements and a clear identification of the actors in this drama and the problems in the process. Technical research has lowered the cost of development and training has improved performance.

In addition, the OPP's programmes have trained a number of social organisers and technicians and transferred the vision of development through community finance and management to the entire township. This expertise in its turn is being used for new projects in new locations. The psychological, technical and economic barriers that prevent communities from participating in development have all been broken down by the OPP research-and-extension methodology.

The active involvement of the community is the direct result of its funding the development activity and without their involvement the OPP could not have succeeded.

The project has had no shortage of finances. The BCCI gave the OPP sufficient funds in its initial stages. The subsequent success of the programme has attracted a number of donor agencies, both national and international

Conclusions from the Three Case Studies

All the three case studies have a number of similarities. These are:

- The local community was involved in decision making regarding their priorities and in generating savings or financing the project.
- Motivation, awareness building, training and extension were an integral part of the programme and this was provided by specialists in the field.
- The social organisation was undertaken by people who were from the community.
- The programme office was located and operated from the project area.
- After the first intervention the programme direction has developed as a result of interaction between the community and the project.

6. RECOMMENDATIONS FOR NGO ACTIVITY

Conclusions drawn from the Previous Chapters

Major Environmental Concerns

The major physical environmental concerns in Pakistan are:

- Water logging and salinity.
- Effect of green revolution technologies.
- Watershed management and deforestation.
- Aquatic and atmospheric pollution.
- The repercussions of urbanisation.
- Desertification.
- Institutional arrangements.

These physical problems should not be viewed in isolation, but should be placed in the context of institutional arrangements which govern the ownership and use of these resources. In addition, to the specific problems outlined above, attention needs to be directed to the development of a larger environmental understanding and awareness on the part of the public at large.

NGO Needs

For the development of NGO activity, especially for environment related issues, a number of needs have been identified. These are:

- Involvement of NGOs in support of government programmes at the local level in planning and implementation.
- The development of an understanding as to how development related problems are related to larger environmental issues.
- Identification of and easy availability of literature and extension aids relevant for individual NGO programmes.
- Exposure of NGOs and relevant government agencies to successful NGO projects.
- Easy availability of technical and managerial support and training of community leaders, activists and technicians.
- More appropriate international assistance that lays greater stress on capacity and capability building than on making money available for physical development.
- Extension of NGO activity to cover programmes, such as water management, in which no such activity exists.
- The development of an appreciation that in the long run environmental education at school level is the best guarantee for environmental protection.

Recommendations for SAP/NGO Activity

Identification and Categorisation of NGOs

The SAP office should survey the NGO scene and identify NGOs that are, or have the potential of undertaking environment related work. These NGOs should be placed in the following categories.

- NGOs having developed programmes which can be used by other NGOs for orientation and training purposes.
- NGOs that have a sound approach but need technical and management support.
- NGOs that have a potential for developing environment related projects.

The profiles of these NGOs should give special attention to;

- the socio-political and physical environment in which the NGO operates and its effect on NGO functioning;
- the background of the leadership and the nature of the activists;
- given the above information, the type of programmes that the NGO can develop in the future;
- the type of assistance the NGO requires for its current programmes.

It is possible that the SAP office may not be able to undertake this study and will require external assistance for it. Such assistance should be provided. In addition, this information will have to be updated periodically.

Identification of Research and Extension Materials

In addition to identifying NGOs, the SAP office should also identify research and extension materials for different programme types and the institutions that produce them. A profile of the institutions should be prepared along with a statement of their capacity and capability.

Similarly, a list of research material and resource persons in different fields of development, their availability and charges should also be compiled and periodically updated. There are organisations (75) which are in the process of doing this work and they should be assisted.

Development of Training Facilities

The SAP objective of effective NGO participation in development and in combating environmental degradation can only succeed if the capacity and capability of the NGOs to do this work is built up. To facilitate this, the SAP office should encourage projects which:

- Build up training facilities for NGOs in successful projects, training institutions and government departments;
- help NGOs identify their training needs and put them in touch with organisations and/or resource persons that can help them to fulfill these needs;
- promote the concept of monitoring and evaluation with NGOs and help develop training materials and institutions for this purpose;
- assist in the development of mobile or other technical and managerial support units for different types of activity. These would be of special importance to small local level CAGs.

The interaction and networking that this activity requires should be properly structured and monitored and on the basis of feedback the programme should be modified periodically.

The Development of Environmental Awareness

The relationship between local level problems and larger environmental and development issues, should be built up in community leaders, activists, NGO staff and local communities. For this purpose, a number of small workshops involving these actors in the NGO drama should be held. The location of the workshops should be in the project areas of other NGO activity.

Such activity already takes place. However, except for a few cases, it is not properly structured. In addition, follow-up activities defined in these workshops seldom, if ever, materialise.

Environmental Education in Schools

There are schools in Pakistan (76) that have developed courses in environmental education. There is a need to review these courses and update them. For this, the schools need technical assistance.

The need to spread the concept of a school environmental course is also necessary. The development of an extension service for this purpose should be promoted and financed. Most educational facilities in urban low and middle income settlements in Pakistan are privately owned and need no government sanctions or approvals to incorporate this subject in their curriculum.

The funding of low cost publications and films on environment related subjects should also be supported. However, such literature and films should be judged for their impact and should cater to a

wide cross-section of the rural and/or urban population. In Karachi, a small group (77) is trying to bring out books for children that deal with environmental issues and promote the involvement of children with them.

Advice to Environment Related Action Groups

In recent years, a number of local communities have agitated against emissions from factories, burning of garbage in their localities and the presence of informal industrial activity and poultry farms in their neighbourhood. Most of these groups are poor and as such have no access to the corridors of power. They require legal and procedural advice if their attempts are to succeed in addition to community action.

The creation of a cell that gives such advice to NGOs and communities is essential. The existence of the cell should be well publicised for if the awareness raising programme, outlined above, takes root, many communities will come forward to lobby for the resolution of their local environment related problems.

Expansion into Neglected Areas of NGO Activity

Although sanitation forms a major area of NGO activity, the larger issue of aquatic pollution and its various components remains beyond the scope of NGO involvement. Similarly, although salinity and water-logging are major environmental issues, there are almost no community based NGO projects related to water management, land reclamation or for the promotion of agriculture through the use of brackish or saline water. It is essential that NGO involvement is promoted in these fields.

In this regard the development of a modern and low cost maintenance system for the *karez* in Baluchistan is of utmost necessity. There are communities (78) that have been agitating against the linking of tube wells in their region and have maintained, through community involvement, their old *karezes*.

NGOs and Government Plans for Development

A number of NGOs and CAGs are unaware of government plans for their areas or their sector of operation when they undertake a programme. This is specially true of development plans for *katchi abadis* in urban areas and development of road infrastructure in rural areas.

Organisations, whether NGOs or government agencies, that promote or publish research on the subject should be assisted. The development of institutions that can disseminate this information to NGOs and CAGs should be promoted.

Research

All social and technical research that can be of assistance to the development of effective environment related NGO activity should be supported. However, this research is valueless unless it can reach the relevant NGOs and community leaders and is in the national language.

The dissemination of this research to training institutions, intermediate NGOs and resource persons must be arranged and an appropriate institutional system developed for it.

The Requirements of the SAP Office

The actions for SAP-NGO activity outlined above, mean that the SAP office will have to play an important and expanded role. If the office cannot develop the capability to play this role, it can always hire consultants or part-time contract assistance for this purpose.

The development of training, extension and promotional activity should not be viewed as office expenditure but as projects in themselves. Furthermore, it must be clearly understood that without the development of this activity, CAGs and NGOs will not be able to effectively utilise the funds that are being so generously made available to them.

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Arif Hasan was born in Delhi (India) in 1943, and migrated with his parents to Karachi (Pakistan) in 1947, where he has lived since then. He studied architecture at the Oxford Polytechnic, UK and established an independent architectural practice in Karachi in 1958. He is the author of a large number of important residential, commercial and educational facilities in Pakistan. In addition, he has been consultant to various community action groups, NGOs, government institutions and international agencies for housing policy, development and environmental issues. He has taught at the Department of Architecture and Planning, DCET, Karachi from 1979 to 1989 and has received a number of national and international awards for his work. Since 1982 he has been consultant to the Orangi Pilot Project, Karachi.

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