

STATUS OF DESERTIFICATION IN PAKISTAN — A REVIEW

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Abstract

Status of desertification in Pakistan has been reviewed in the light of increasing population and various land-uses, with particular reference to agriculture, range management with livestock population, watershed management and forestry, compiling the statistical information available on various aspects in relation to desertification.

Introduction

Deserts are the areas which receive little precipitation, maintain scarce vegetation and, therefore, present fewer options for better land management unless modified through the treatments of irrigation and soil improvement. Pakistan, by and large, is an arid/semi-arid country with 68 million hectares of the land area, receiving less than 300 mm annual rainfall. Already so, the country is faced with a serious problem of desertification, whereby almost three-fourths of the land is either affected or likely to be affected by this process. Most of the population has to derive its livelihood from the ecological delicately balanced land mass of the country.

Indiscriminate cutting of trees for fuelwood and removal of vegetative cover for various end-uses has led to the disturbance of the fragile ecosystem, degradation of watersheds and salinity problem in the country. About 422 million tonnes of soil is lost to Mangla and Tarbela reservoirs, every year which, not only causes siltation of these structures, reducing their life span, but also as the top fertile soil takes alongwith it the valuable minerals and soil nutrients (PARC, 1987)

Out of total area of the country, 51.5% is arid, 36.9% is semi-arid, 5.4% is sub-humid and 6.2% is humid (table 1). The desert area of the country has problems different from those of irrigated areas such as scarcity of potable water, degradation of vegetal cover and wind erosion. Thousands of hectares of fertile land are going out of cultivation annually due to water-logging and salinity in irrigated areas, water erosion in northern uplands and wind erosion in arid and semi-arid areas.

Population

Pakistan is the ninth most populous country in the world. Its population has grown from about 16 million in 1901 to 83.3 million, vide 1981 census and is further estimated to have increased to 95 million by 1985. Of this 71% of the people live in rural areas (Sabadell, 1987).

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Geographic Regions

The country can be divided into following three main geographical regions on the basis of physiography (Anonymous, 1981).

The mountains occupy the northern and western parts of the country. The northern mountains are the termination of Himalayan range with a number of peaks above 6000 meters which remain permanently covered with snow. The sub-mountainous areas are not very high and are generally unproductive. Most of the hilly area is denuded, with little soil left.

The Indus plain is the western part of the Indogangetic plain which forms one of the most prominent and extensive physiographic divisions of the sub-continent. The plain is believed to be more than one thousand meters deep and is formed by large quantities of alluvial material, deposited since times immemorial by the Indus and several of its tributaries. Much of the land in this basin, hitherto desertic, has been developed by irrigation.

The coastal belt is a narrow fringe bordering the Arabian sea. It includes also the Indus delta and the saline marshes of the Runn of Kutch. The distribution of the arid regions in the country is given in table 1. (Akram, 1987).

Land-Use

Agriculture, as the mainstay of the country's economy contributes about 30% of the GNP (FAO, 1987), employing 55% of labour force and directly or indirectly provides 67% of the country's exports (Chaudhri, 1987). The pattern of land utilization is given in table 2. (Anonymous, 1987).

Table 1

Distribution of arid regions in Pakistan (km²)

Sl. No.	Province	Arid	Semi-arid	Sub-humid	Other	Total Area
1.	Punjab	119,311	59,678	17,014	10,250	206,253
2.	Sind	134,897	6,018	—	—	104,915
3.	Baluchistan	149,465	197,723	—	—	347,188
4.	North Western Frontier Province	6,194	16,491	15,160	36,677	74,522
5.	Federally Administered Tribal Area (FATA)	—	13,580	11,239	2,398	27,217
Total		409,867	293,490	43,413	49,325	760,095

Table 2
Land Utilization

S.No.	Land Use	Area (Million ha)	% of total land area
1.	Cultivation	20.54	23.3
2.	Culturable waste	11.19	12.8
3.	Not available for cultivation	23.25	26.4
4.	Area under forest	4.58	5.2
5.	Unclassified Area	28.42	32.3
Total		87.98	100.00

Causes and Consequences of Desertification

There are two major causes, responsible for the process of desertification, viz. natural and man-induced.

Among the natural causes climate has great influence in acceleration of desertification processes which may be due to low and sporadic rainfall and a high rate of evaporation, and consequently overall dryness of the atmosphere in the arid regions.

Among man-induced causes, the economic activity of man is one of the main reasons, causing desertification in this country. Major factors contributing towards enhancement of desertification processes in this regard are as under:

- Unscientific land-use practices and mismanagement of land and water resources
- Indiscriminate removal of trees, shrubs and other vegetation to meet the fuelwood needs
- Extension of cultivation into the erodible sites, due to rapid growth in population
- Uncontrolled and excessive livestock grazing and browsing in forests and rangelands.

In view of the above contributory causes, the country is facing the following problems of national importance which are affecting its economy directly or indirectly to a great degree:

- Abandoned croplands, affected by waterlogging and salinity (Punjab),

- Abandoned villages, traditional irrigation systems and croplands desertified by deteriorated ground-water aquifers or lowering of the ground-water table (Baluchistan)
- Siltation of rivers, irrigation systems and reservoirs,
- Land-slides in hilly areas,
- Disappearance of physical infrastructure of rangelands under shifting sand dunes.

Socio-economic conditions of the people inhabiting the arid lands have also contributed significantly towards the problem of desertification. People living in or around the arid areas are generally less educated, poor and isolated from the modern technologies and amenities of urban agricultural environments. These characteristic features of the socio-economic conditions of the people make them suffer from cultural discriminations which further widens the gap of isolation and poverty in these areas.

Agriculture in relation to Desertification

The area under irrigated agriculture in the country is about 15 million hectares while the other most important categories of areas from agricultural point of view are those exclusively dependent on the rainfall. These are generally called the barani or rainfed tracts, constituting about 5 million hectares of the total area (Anonymous. 1983).

The problem of waterlogging and salinity in Pakistan is really alarming. Billions of dollars of government exchequer are being spent on projects, aimed at the reclamation of these areas. The economic costs of waterlogging and salinity are estimated at US \$ $140 \times 10^6 \text{ yr}^{-1}$ (\$ 25 ha⁻¹ yr⁻¹) (Sandhu and Qureshi 1987). Like many developing countries the irrigated land in Pakistan is inadequately drained and canals are unlined. Thus, water seeps into the ground and causes a rise in the water-table. Throughout the irrigated areas of Pakistan, the water has either risen to the surface or is just below it. This situation not only inhibits the growth of deep-rooted crops due to lack of aeration in the root zone but also causes an accumulation of alkaline salts and other minerals near the surface. This salinity build-up further impairs the agricultural fields by reducing their soil fertility.

The barani areas are prone to severe soil erosion, thus limiting the agricultural production to a great extent. The Pothwar plateau has been particularly subjected to the processes of soil erosion (Brown, 1987) There are about 1.3 million hectares of gullied land in Pothwar plateau (Khan, 1987). Due to water erosion in the northern uplands, millions of tonnes of fertile top soil has been washed away. Shifting sand dunes due to wind storms damage the crops, choke-up water ways and blow away fine particles of sand, leaving behind infertile coarse sandy waste in the southern parts.

Rangelands and Livestock in relation to Desertification

Extending from the alpine pastures in the north to the arid and semi-arid areas in the south, the rangelands constitute about 60 percent of the total area of the country. As the major source of feed for the livestock in the country, they are being over-grazed by all categories of animals. Distribution of rangelands in various parts of the country is given in table 3.

Table 3
Distribution of rangelands in Pakistan

Province	Total Area (million ha)	Range Area (million ha)	Percentage of total area
Punjab	20.63	9.70	47
Sind	14.09	9.28	65
NWFP	10.17	5.68	55
Baluchistan	34.72	32.43	93
Northern Areas	7.04	3.50	50
Azad Jammu & Kashmir	1.33	0.60	45
Total	87.98	61.19	65

Most of the rangelands in Pakistan not being properly managed and further subjected to overgrazing are in a depleted condition. The overuse is caused by certain practices, customs and problems peculiar to the Hindukush-Himalayan region (Akram, 1987).

The cattle and other livestock play a vital role in Pakistan's rural economy. The livestock census of 1972 reported a population of 53.8 million, whereas in 1976 it was 68.0 million and in 1981, 91.8 million, registering a spectacular increase in livestock population since 1972. The year-wise livestock composition is given in table 4.

The contribution of livestock of GNP is about 8.4 percent. Based on the constant cost factor livestock contributed Rs. 5,033 million during 1982-83 to GNP of the country. Livestock grazing on the rangelands alone contributed 4.5 percent to the GNP as compared to 0.1 percent that of forestry (Anonymous, 1983).

Table 4
Livestock and Livestock in relation to desertification

Livestock		Population (Million heads)		
		1972	1976	1981
1.	Cattle	14.2	14.6	15.0
2.	Buffaloes	9.7	10.5	11.7
3.	Sheep	9.5	18.6	28.4
4.	Goats	14.7	21.1	32.8
5.	Camels	0.5	0.7	0.8
6.	Others	5.2	2.5	3.1
Total		53.8	68.0	91.8

Watershed in Relation to Desertification

During the recent years, as a result of exploitation of limited forest resources, over-grazing and trampling of soil and vegetation in the watershed areas distinct changes in hydrology have increased the frequency of floods and the loss of top soil both through run-off and wind erosion. All these processes have adversely affected the infiltration of rainfall and percolation of water, which has caused lowering of water level in the wells. The Indus and its four main tributaries discharge more than 200 billion cubic meters of water annually into the Arabian Sea. The rainfall is usually heavy during the monsoon season, therefore, a wide fluctuation exists between maximum and minimum discharge for each river in the basin.

The watersheds of the Indus basin rivers have unfortunately suffered from excessive wide-spread felling of woody vegetation and heavy overgrazing in the past many centuries. The land is being cultivated upto 3000 meters altitude and on steep slopes, not at all suited for this activity. Several million tons of soil is removed annually from our watersheds by water erosion. This sediment is subsequently deposited in streams, channels, lakes, reservoirs and harbours, requiring costly remedial measures to keep up their useful lives.

Forests in Relation to Desertification

Per capita forest area in Pakistan is 0.05 ha which produces 3,84,000 m³ timber and 16,00,000 m³ of firewood. Fuelwood requirement for the population is met 90 percent from farmlands and 10 percent from state forests (Mohammad, 1988). Through the extension of urbanization and agriculture, there has been considerable encroachments of forest lands. Reportedly there has been an annual loss of about 1.1 percent in the

designated forest area during the last decade (1970-71 to 1979-80) (Anonymous, 1981). The forests of the country thus have to bear a heavy population pressure. Being honey-combed with dwellings, the forests are subjected to severe degradation, including overgrazing by livestock. The soils are degraded, and the natural regeneration hampered.

Quite often forests are deliberately set on fire by the local residents to obtain green tender grass for their cattle. These fires destroy the young regeneration, the delicate parts of the vegetation as well as the soil micro-fauna and flora. The combined effect of all these factors gradually results in elimination of the vegetative cover only to help the processes of desertification in the area.

Institutions combating Desertification in Pakistan

In the past, no concrete efforts were made to tackle the problem of desertification in the country. Sporadic efforts were made by the provincial forest departments to stabilize shifting sand dunes in Thal, Cholistan and Baluchistan through planting. Similarly, watershed management activities were carried out in high catchment areas to check soil erosion. However, with the passage of time, the government took cognizance of the gravity of this problem, and several agencies emerged during the past two decades which are at present involved in desertification research and development activities on diversified parameters of the arid / semi-arid lands of the country. These organization / institutes are:

- (i) Arid Zone Research Institute, Quetta.
- (ii) Barani Research Institute, Chakwal.
- (iii) Barani Agriculture College, Rawalpindi.
- (iv) Cholistan Development Authority, Bahawalpur.
- (v) International Waterlogging and Salinity Research Institute, Lahore.
- (vi) Pakistan Forest Institute, Peshawar.
- (vii) Pakistan Agricultural Research Council, Islamabad.
- (viii) Pakistan Council of Research in Water Resources, Islamabad.
- (ix) Punjab Soil Salinity Research Institute, AARI, Faisalabad.
- (x) Sind Arid Zone Development Authority, Karachi.

These agencies are fighting against desertification by devising appropriate measures for its control in one way or the other. However, there appears to be a strong need for a close collaboration among these agencies, so as to achieve some concrete tangible break-through to check desertification in the country.

Conclusions

Extensive areas of productive land of the country are subjected to severe ecological degradation. Increasing deforestation is promoting soil erosion, desertification and flooding. More than 60% of the land in Pakistan has either already been or is likely to be

affected by desertification which operates through land-use systems and results from a combination of (a) the natural fragility of the resource ecosystems in arid and semi-arid areas and (b) excessive pressure of land-use exceeding the carrying capacity. Manifestations of desertification include;

- Deterioration of rangelands
- Degradation of rainfed croplands
- Waterlogging and salinization of irrigated lands
- Deforestation and destruction of woody vegetation
- Declining availability of quality water supplies.

A lot of knowledge and technology packages have been evolved on diversified parameters of desertification and dozens of institutions are working in the world to fight this menace on all fronts. There is, however, a strong need to apply the methodologies to this country and according to her own social and cultural norms. Special attention is needed for a biological approach for identification and establishment of dry zone tree species with reasonably moderate rate of growth. Development of suitable water harvesting techniques and reclamation technology to avoid salinization and alkalization of soils are other areas to be considered. UNEP is doing a marvelous job in developing data-base on desertification control. Contacts may be developed with such international bodies so as to get maximum benefit from their experiences.

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