



Desertification in Pakistan, Challenges and Opportunities

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Abstract

Pakistan is experiencing one of the diverse kinds of weather patterns for the last three decades. Overall, the climate change in the region has affected the eco balance of Pakistan. Experiencing the drought in Thar desert (Province of Sindh in Southern Pakistan) in 2001-2004, followed by major Earthquake of 2005 (7.6 Richter scale) and then recurring flash floods of 2010 and 11 has motivated the global scientist to research the causal effects of these climatic changes and related hazards. The paper discusses in detail the effects of climate change with particular emphasis on desertification. It elaborates on desertification profile and its contours with detail. After carrying out the analysis of desertification and its causes, the paper reviewed different kinds of programs and initiatives which have been proved very effective in the past in curtailing desertification. The paper proposes these programs and initiatives can be used in future by other communities which are vulnerable to desertification with a view to tackle the issue effectively.

Key words: Desertification, Deforestation, Hazard, Drought, Wind erosion

1- Introduction

There are a number of definitions with respect to desertification but the most important and widely referred is of Princeton University Dictionary which states "the process of fertile land transforming into desert typically as a result of deforestation, drought or improper / inappropriate agriculture".

Whereas according to the United Nations Convention to Combat Desertification (UNCCD); it has been defined as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities."

Being from Corps of Engineers, I happened to serve in almost every type of terrain and topography in Pakistan. While operating in Himalayan Kashmir with a sub-zero temperature varying between -2 to -26, I was suddenly posted to Pano Aqil Cantt in interior Sind, east of THAR desert (approx 540 km South of Karachi) where the temperature varies between 45 to 55° C during Summer.

While traveling in the desert two incidents changed my life and I decided to contribute towards the social uplift and well being of desert population. The **first incident was**, on May 12, 2002, when I was traveling from Dherki to Chanesar (remote location in the middle of Thar Desert), I saw about 8-10 people carrying a woman on the cot and moving towards the town. Sheer out of humanity, I asked as to what was the problem? In their local Sindhi dialect,

they said the "patient lady is in the family way and she is required to be transported to Dherki Town hospital for the surgery (Meant Caesarian – Section). Just to mention the plight, they were still about 12 KM (3 hrs travel on foot) away from the road head where they could get the mechanical transport. The lady was screaming with severe pain and I offered them to take the patient to hospital on my 4x4 Jeep. As we were driving fast to reach the emergency centre, the screaming voice of the patient also started reducing and suddenly stopped. The husband of the lady was trying to move her, but in vain. We rushed the lady to Basic Health Unit but doctor pronounced her dead. We saw the lady dying because of non availability of basic health facility and road infrastructure.

The second incident was deep into the Thar Desert. We reached Detka Toba (Toba in native language means pond). I saw that there was a small pond in the middle of that locality and camels were drinking water and ladies were filling their mud pitchers from the same source of water. On my inquiry, their elder told that, this pond is the only source of water for them round the year. There it decided that we will provide them clean drinking water with a proper plan and financial support from Government and civil society.

With a missionary zeal by all team members, while serving in Thar Desert, we were able get constructed a network of more than 300 Km of roads and water supply scheme for over 200,000 people and their live stock of more than 400,000. In addition Rainee Canal project was given the impetus and it has now changed the life and outlook of the desert i.e. it has started to convert the desert into green belts and has created lot of opportunities of

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livelihood in the form of agriculture, fruit orchards and fishing etc.

Objective of this paper is to highlight the challenges of desert and its component of desertification, which is increasing the physical, socio-economic and environmental vulnerability of affected communities. However, in the world's developed countries, there is little acknowledgment that desertification is a serious problem outside the Third World, despite evidence the contrary (Sheridan, 1981).

2- Methodology

This paper is based on research in the Thar and Cholistan Desert. Data has been collected from various communities, including local government officials, reports on climate change and its consequences, newspapers, articles, conferences. Data collected has been analyzed in the light of field visits.

3- Findings and Discussion

Contours of Desertification in Pakistan

There has been a serious problem of desertification in many parts of our country. Pakistan is predominantly an arid and semi-arid country and mainly depends upon on the irrigated means of agriculture to support its requirements of food and fiber. Major economic output is from the production of cotton crop for the purpose of export in order to earn foreign exchange. Interestingly this cotton is grown in area around green belt bordering Thar and Cholistan Desert. Out of the total 79.61 million hectares of area of Pakistan, 68 million hectares of land lies in fragile regions receiving less than 300mm of annual rainfall. Out of the total land area which is suitable for intensive agricultural purposes, one fourth of it is threatened with wind and water erosion, water logging, salinity, flooding and loss of organic matter. Northern mountains of Pakistan are the major source of water for these Tarbela and Mangla dams, which provide 90 percent of the water for the food and cash crop production. However, these dams are silting up and thus reducing the availability of water for various purposes. Barani/arid lands are subjected to heavy soil erosion, primarily due to improper land use by crop cultivation, over-grazing by the livestock and illegal removal of vegetation cover. The irrigated areas are infested with menace of water logging and salinity. In Balochistan, underground water resources are shrinking due to very less recharge and over exploitation of it for the purposes of horticulture and crop cultivation. Livestock pressure has hampered the productivity of rangelands. The arid coastal strips and mangrove areas are under increased environmental stress from reduced fresh water flows, sewage and industrial pollution and over exploitation of other natural resources.

Major Causes of Desertification

In Pakistan, following issues are said to be the major contributors towards desertification:-

Water Erosion: Indus basin has some undeveloped soils. The surrounding mountains have some of the world's steepest and largest slopes. Soil erosion is caused due to intense summer rainfalls along with melting of snow. Land

use practices, vegetation cover, soil type and structures are other major factors related to soil and water erosion.

In the North, mountainous areas having steep slopes, water erosion is low in areas with permanently closed canopy forests, while erosion is greater in areas with arable crops on steep slopes. Around 11 million hectares of area are affected by water erosion.

Another action of water erosion is the sedimentation or silting up water channels and reservoirs respectively. Around 40 million tones of soils are brought into Indus basin each year. It shortens life span of major reservoirs and their efficiency.

Wind Erosion: Thal, Cholistan, Tharparkar and sandy areas along Makran Coast experience land degradation due to wind erosion and it is quite common. It is significant in areas close to habitation and watering points trampled by livestock. Major degrading factor is the over-exploitation of range lands for fuel wood cutting and livestock grazing. Around 35 million hectares of area are affected by wind erosion. 28 percent of the total soil loss is accounted for the soil removed by wind. High velocity windstorms cause large scale movement of sand dunes.

Deforestation: Overall area of Pakistan under the cover of forests is around 5.2 percent which is pretty low for meeting the environmental and socio-economic needs of the country. Deforestation has been a major problem in our country which is creating enormous issues. It has been a result of indiscriminate cutting, over-grazing, poor management and man-made ecological changes. Forests provide resistance to soil erosion which is caused by heavy monsoon rains. Scarcity of forests and vegetative cover causes the removal of top-most layer of soil which will further initiate erosion resulting in siltation of rivers and channels. Annually, forest cover is shrinking by 3.1 percent and woody biomass by 5 percent. Even terrorism encourages deforestation. Timber Mafia did indiscriminately in past in sync with terrorist outfits.

Livestock Grazing Pressure: Free grazing is extremely destructive to forest and vegetative cover. Natural vegetation experiences a heavy pressure with the increase in the population of livestock. Unsystematic land grazing reduces the productivity of rangelands due to soil compaction, destruction of terraces, growing trees / saplings and shrubs. As economy in deserts is pastoral, it affects both livelihoods of the desert dwellers as well as influences the fragile environment.

Loss of Biodiversity: Natural vegetation is under severe pressure due to the ever increasing human and livestock population in almost every agro-ecological region of the Pakistan. Water logging, overgrazing, aridity and prolonged drought in the area have damaged the natural flora of overall green areas of the country. These factors have contributed towards the loss of biodiversity in various regions of the country. As a result of degradation of natural habitat along with other man-made causes, over 50 species of mammals, birds and reptiles combined are listed as endangered.

Water Logging and Salinity: The major factor contributing towards the water logging in cultivated areas is the excessive percolation from the canal system, which builds up the ground water level. Total water logged area

with water depth of 5-10 feet in Pakistan is about 11 million hectares. Salinity and sodality are associated with irrigation but these also occur as a consequence of soil formation process over the centuries. Over 2.8 million hectares are affected by salinity in Pakistan. This issue has caused a decrease in the drainage capacity of soils resulting in lower fertility, decline in crop yield and loss of biodiversity.

Drought: The phenomenon of drought can occur in all climatic conditions but has a higher frequency and probability in the arid and semi-arid regions. Periodic droughts are the primary cause of desertification in Pakistan. Baluchistan, Sind and Southern Punjab have been experiencing this problem due to the dry spell in the past three years. An estimate shows that 2.2 million people and 7.2 million heads of livestock have been affected. Affects of drought last for many years.

Flooding and inundation: Floods are a common hazard that affect our region in general and country in particular. In Pakistan, floods are usually caused by excessive precipitation particularly during monsoon season due to weather and climatic disturbance. The floods of 1973, 1992 and 2010 and 2011 caused severe damages, resulting in land degradation and loss of biodiversity. Floods render a patch of fertile land infertile by depositing a layer of infertile sediments.

Socio-Economic Constraints: Pakistan is ranked as 7th largest country in terms of population. A number of issues arise as a result of such an enormous population size. If land is rendered useless, people will be forced to abandon and migrate from rural to urban areas in search of a livelihood. It is the poor community which suffers as a result of desertification and drought. Unless properly managed, the already degraded resources will be under heavy pressure. Around 66 percent of total rural work force is committed in agriculture, forestry and fishing.

Effective Programs to Control Desertification (Sharing experiences of Pakistan)

Desertification being a global issue; concerned organizations in Pakistan are also playing their vital role in combating this matter. Various programs have been launched and executed to address this issue and are discussed below.

Salinity Control and Reclamation of Affected Areas

Indus basin region is the country's major salt-affected soil area. Secondary salinity, which is related to modern irrigation system in Pakistan, is a result of either (a) accelerated redistribution of salts in the soil profile due to high water table or (b) use of insufficient water to leach salts out of the soil.

The first salinity control project was undertaken by WAPDA in the sixties. It came to be known as Salinity Control and Reclamation Project (SCARP). This project has been very effective in increasing crop production and improving overall vegetation in the affected areas.

Rehabilitation of Desert Ranges through Reseeding

Artificial reseeded is prescribed where natural vegetation cannot recover within a short period of time and there are few considerable species which are yielding growth of vegetation. In desert rangelands, grass is often seeded in strips. In Thal area, planting tufts of *Cenchrus ciliaris* and *Lasiurus sindicus* on shifting sand dunes dramatically increased forage yield. These species have successfully reseeded thousands of hectares of land in Thal area. These grasses perform considerably well where there is annual rainfall between 150 and 750 mm.

Desertification Control in Cholistan Desert

The Pakistan Council of Research in Water Resources (PCRWR) conducted a research in Cholistan desert with the objective to conduct specific research on sites related to water, land and plant resources for making them sustainable and productive to combat desertification. These activities included development of catchment areas for rain water harvesting, establishment of ponds from harvested rain water for consumption by humans and livestock, grassland development, arid land horticulture under conjunctive irrigations, rangeland development, desertification assessment and mapping of Cholistan desert.

Conversion of Desert into Green Belt

Water And Power Development Authority (WAPDA) of Pakistan is taking on numbers of projects to convert the deserts of Thal and Thar into green belts:

Rainee Canal. It is a 155 Km long Canal originating from Guddu Barage and going up to Khinju. After running idle, then number of distributing are developed and shall convert desert into Green land. This project will accrue multi-sectoral benefits of controlling desertification and mitigating flood in the province. Project has been in the execution phase and will be completed in the next fiscal year. The objectives of this project are listed below:

- Better utilization of flood water ensuring greater supply of water to Sindh
- Better flood mitigation and aversion of losses to property
- Irrigation of 412,400 acres of barren land
- Cropping intensity during Kharif would increase from 0% to 80% in initial five years
- Improved forestry and fruit production
- Development of cattle breeding, dairy farming
- Drinking water for Arid Zone
- Social uplift and poverty alleviation
- Environmental improvement due to changing of lakes
- Development of fish farming to the extent of 258 tons annually
- Development of transportation routes in project area
- Creation of job opportunity

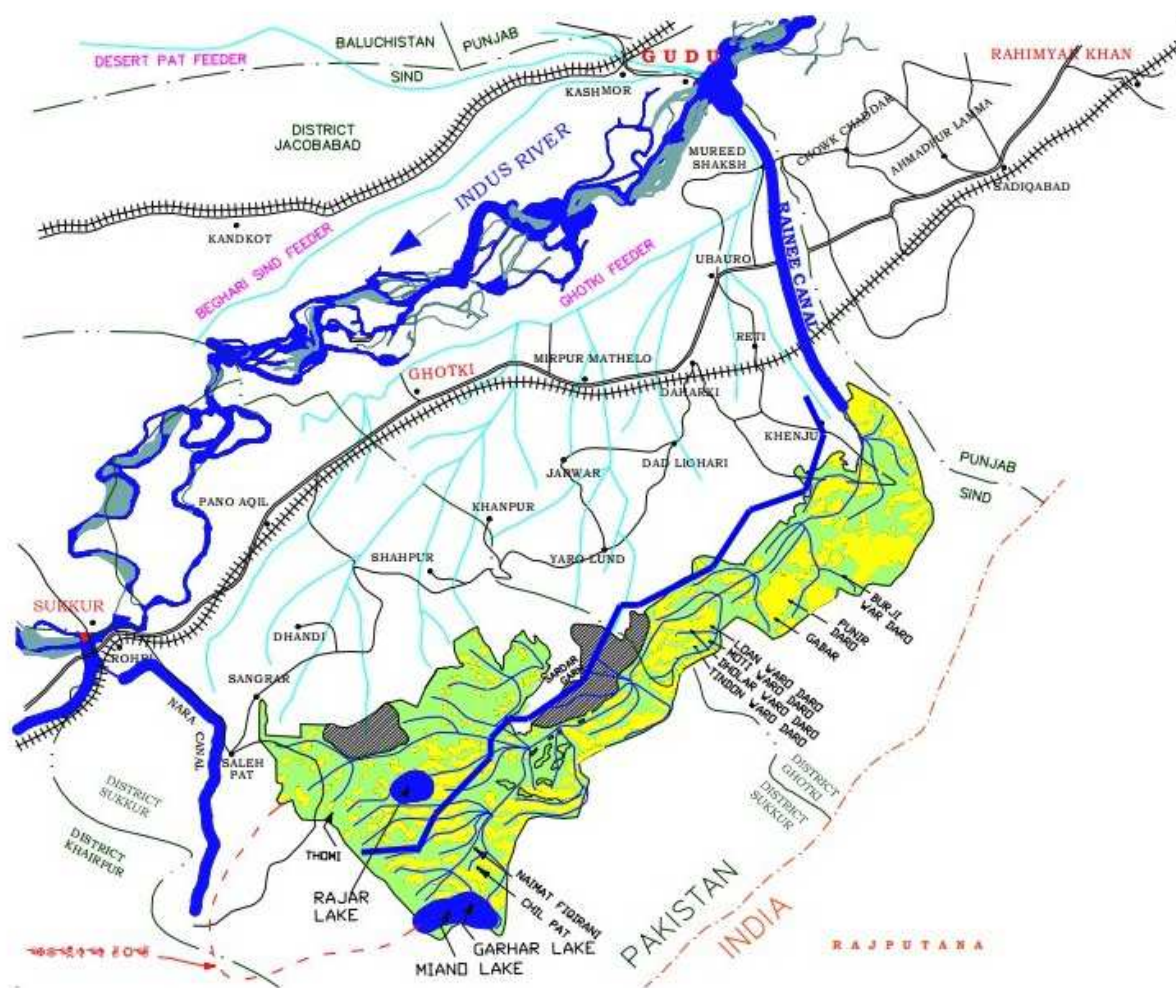


Figure 1: Plan view of raine canal (Ref:ww.wapda.gov.pk)

Greater Thal Canal Project

Thal canal is a WAPDA sponsored project. It is a 35 Km long canal with 344 KMs of branch canals. With this canal approx 1.796 Million Acres of land would be irrigated mainly of desert / arid belts of District Layyah, Bhakkar Khushab and Jhang. Characteristics and detail about this project can be seen in the table provided.

Forage Reserve Establishment in Arid Highland Balochistan

Balochistan is having a high density of arid areas. Specific treatment can be carried out in order to reduce these dry zones. One of the treatments that can be carried out is the plantation of forewing saltbush, which is an

evergreen shrub with dense foliage and adapts to a wide range of soils and climates. The most important characteristic of this plant is extreme drought and cold tolerance. This plant has the potential for utilization as fuel wood in addition to its use for livestock forage. This experience has worked well in Dist Khuzdar (South west of Quetta)

Fuel wood comes high in demand during cold season in Balochistan. Local shrubs are uprooted and used for these purposes which add to the degradation of land. Growth of such a shrub like forewing saltbush on a massive scale can help overcome this issue and develop the lands into much better state than in what they are right now.

GREATER THAL CANAL PROJECT	
Location	Eastern part of Thal Doab within the boundaries of Bhakkar, Layyah, Khushab and Jhang Districts of Punjab.
Main Canal Length	35 KM (Whole in Phase-I)
Off take Point	RD 180 of Chashma Jehlum Link Canal near AdhiKot.
Canal Capacity	8500 Cusecs
Branch Canals	344 KM (Phase-I Mankera Branch 65 KM)
Area to benefit	1.976 Million Acres (Phase-I, 0.405 Million Acres)
Approved PC-I Cost	Rs.30,467 Million
Commencement	16.08.2001
Completion	31.12.2008 (Phase-I) 30.06.2013 (Whole Project)
Project benefits	Rs.5 Billion per year on completion of whole project.
Present Status	<ul style="list-style-type: none"> • Phase-1 is almost completed. • Phase-1 of GTCP has been completed and handed over to I&P Department Government of Punjab for further Operation and Maintenance. .
Updated 13.09.2012	

Figure 2: (Ref:WWW.WAPDA.GOV.PK)

Restoration of Land Productivity in Barani/arid Lands

Agency for Barani/arid Areas Development (ABAD) has been playing a vital role in execution of various programs in rain fed areas in order to counter land degradation. Places where they have carried out these projects, the local communities have experienced an increase in agricultural productivity, vegetative cover and biodiversity. ABAD has carried out the development of small dams, mini-dams, dug wells and also carried out terracing, land reclamation, fruit tree plantation, gully plugging and public forestry. All these activities have resulted in generation of tremendous amount of water resources and also helped in reduction of soil erosion and increase in vegetative cover in these areas.

Rangelands Utilization Model in Pothwar Plateau

Pakistan Agricultural Research Council (PARC) has been active in carrying out its efforts to address the issue of desertification. It has initiated a research project at Lohi Bher Range to evolve and test a package of technology for the Pothwar Plateau Rangelands. This range covers around 435 hectares of area. Various programs related to range improvement, vegetation dynamics, forage yield and water harvesting techniques were carried out and data recorded. The range utilization model developed at Lohi Bher Range provides useful application for introducing commercial ranching and development of private livestock farms in the Pothwar Plateau.

Gully Land Management through Soil Conservation and Water Harvesting

There is a serious problem of land and water resources management that are available in Pothwar plateau. A project by the name of "Management of Land and water resources in Gully-eroded Area in Pothwar Plateau" was launched by the PARC in order to protect valuable lands from erosion and other problems while making it useful for crops, pastures and trees.

Contoured trenches were constructed with small bunds across the slope of the land so that long slope is cut into a series of small ones and each contour bund acts as a barrier to the flow of water thus controlling run off. To drain excess water to high intensity and rain-storms during monsoon season, grassed waterways and outlets were provided. The tree plantation was made in the eye-brow terraces along the contours, whereas the pasture species were planted in the contour bundled fields without much land shaping. Surface run off decreased to 19 percent with the adoption of eyebrow land shaping technique and planting *Leucaenaplant* with elephant grass. Vegetation cover and frequency of desirable grass/forests increased due to protection. The increase in ground cover also helped to overcome the problem of soil erosion.

Range Improvement through Community Participation

Operational Range Research Program (ORP) was initiated by the PARC to benefit the end user which in this case was the livestock farmer. This program included

supervision by technical experts on the rangelands maintained by some of the farmers. Reseeding, planting of trees and shrubs was done as a remedial measure with help from the farmers.

Fivefold improvement was experienced as a result of these remedies within a span of two years. The production potential, reduction in soil erosion and provision of a better habitat for flora and fauna, these all parameters experienced a remarkable improvement in them. Locals in the areas were very much impressed with the outcomes and were asking for assistance from these research experts for helping with their farms as well.

Conclusion

This paper has highlighted various efforts which could be helpful in reducing desertification but these are short term and limited in scope. The need of the hour is that all these efforts need to be combined with a timeline and it should be given a strategic direction where the planning should be for at least 50 years. Good governance and checks and balances need to be ensured that projects will actually be executed and their results will have to be monitored to ensure that efforts that are being carried out are paying the needed dividends or otherwise. Desertification is a global menace which has to be countered with dedicated efforts in order to ensure economic prosperity of the country and the livelihood of the major population of Pakistan.

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