

## Morphometric Agriculture Sector in Pakistan: Challenges and Prospects for The Future

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### Abstract

Pakistan is agriculture based country because it provides agriculture related economic activities to 65% people. Due attention has not been given to this sector. That is why erosion, salinity, water logging, land use change, land fragmentation, drought, desertification and climate change has adversely affected this sector. Only one fourth of the land in Pakistan is suitable for cultivation. The government should give due priority to solve the above mentioned issues related to agriculture. This article tries to give an overview of the major issues related to the agriculture sector, and suggest possible solutions to overcome these issues.

**Keywords:** Morphometric agriculture, economic, Pakistan

### Introduction

Agriculture in Pakistan provides livelihoods to around 60% of the rural population (Qasim et al., 2011). It also provides employment opportunities for the population. The issues of land degradation, salinity, soil erosion droughts and water scarcity have severely affected the arable lands in the country (Qasim et al., 2011; Qureshi et al., 2008). In Pakistan in general and in Balochistan province in particular, the farmers have problems with water scarcity for agriculture. Due to population growth, the water is withdrawn for agriculture with tube wells that has affected the water table depth. Although the farmers have adopted some indigenous methods to solve the issues but alone they are not fruitful (Qasim et al., 2014). The methods and techniques of soil and water conservation, micro-irrigation technologies, mulching, sloping agriculture technologies in Pakistan are non-existent at all. Therefore, there is a need to make the farmers aware of the modern and sustainable land management practices. Adoption of

these practices would increase the agricultural productivity in line with the population growth and will also ensure smooth supply of the resources for the future generations. This review paper therefore has attempted to discuss the issues related to agriculture sector and also to provide solutions for those problems. These problems and their solutions are discussed below

### Threat 1: Soil Erosion

Soils get degraded due to poor management (Hellin, 2006). Erosion through both wind and water causes loss of valuable soils. Improper land use, excessive grazing and collection of fuelwood have mainly affected soils of rainfed lands. Erosion seems to be the major cause of soil degradation. Table 1 show that among the provinces Punjab is severely affected by wind erosion. The water erosion is more severe in Khyber Pukhtunkhwa (KP) and Federally Administered Tribal Area (FATA) (Table 2). Balochistan province has most of its lands in the

form of rangelands. The open grazing system has affected rangelands productivity (Figure 1). The vegetation and soil structure are both affected through excessive grazing. In Semi-arid areas, deforestation is caused due to fuelwood collection. Balochistan is also faced with the fuelwood collection issues (Figure 2). Erosion has made the fertile lands as infertile. One of the main reasons for this is that the farmers are ignorant of the soil and water conservation (SWC). Soils are also less fertile due to lower manure addition. Due to large population and low productivity, the farmers

cultivate marginal lands. Deserts of Thal, Cholistan, Thar and Kharan in the country are affected by severe wind erosion. Due to its topography, the northern areas are faced with severe water erosion. There should be introduction of new technologies to reduce the erosion. Tacio (1993) has emphasized the application of SALT (sloping agriculture land technology) for solving the issues of soil erosion. Different annual and perennials in hedgerows and nitrogen-fixing plants are used to increase soil fertility. Fruitful results have been achieved with the SALT in several Asian countries.

**Table 1** Area affected by wind erosion (000 ha)

Degree of erosion	Punjab	Sindh	KPK/FATA	Balochistan	Pakistan
Slight	2251.4	295.0	13.1	36.3	2595.5
Moderate	279.1	70.2	3.8	143.6	469.7
Severe to very severe	1274.2	168.8	19.6	100.9	3081.3
Total	3804.5	2052.1	36.5	280.5	6173.5

**Source:** Anjum *et al.* (2010)

**Table 2** Area affected by water erosion (000 ha).

Degree of erosion	Punjab	Sindh	KPK/FATA	Balochistan	North Areas	Pakistan
Slight (sheet and rill)	61.2	-	156.3	-	110.5	328.0
Moderate (sheet and rill)	896.8	-	853.8	1858.6	25.8	3635.0
Severe (rill, gully and/or stream bank)	588.1	58.9	176.1	2724.4	504.2	5640.7
Very severe (gully, pipe and pinnacle erosion)	357.9	-	1,517.0	-	1,571.6	3446.5
Total	1,904.0	58.9	4,292.2	4,583.0	2,212.1	13,050.2

**Source:** Anjum *et al.* (2010)



**Figure 1** Sheep and goat flock are openly grazed in Balochistan



**Figure 2** Vegetation is removed leading to soil erosion

## Threat 2: Waterlogging and Salinity

They are called the twin menace to agriculture (Konukcu et al., 2006). The irrigated areas of arid and semi-arid parts of the country are faced with salinity issues (Khan et al., 2005). Insufficient drainage, inadequate water supplies and use of poor quality groundwater for irrigation are responsible for causing salinity (Qureshi et al., 2008). These issues have reduced productivity on irrigated lands. Almost 26% area of the country is degraded by salinity problem in the country (Murtaza et al., 2013). Salinity has mostly affected Sindh province (Bhutta and Smedema, 2007). About 40,000 ha/year soil is damaged through salinity (Khan et al., 2005). Table 3 shows that Sindh is the most affected province in terms of salinity in the country.

Waterlogging refers to a situation in which excess water is added to the root zone of the soil. Flooding is often caused by human interference with natural water channels. Mismanagement of irrigation system leads to waterlogging. Natural sources of salts include the atmosphere, rainfall, coastal fogs, bedrock and marine transgression. The salinity due to humans is caused through extension of irrigation, irrigation schemes with water overflows, dams and barrages and sea water intrusion in coastal areas. Salinity affects plant growth by disturbing soil structure, toxicity and osmosis. Saline soils are difficult in tillage. Low infiltration capacity and low organic matter, nitrogen, calcium and zinc make these soils unsuitable for cultivation.

**Table 3** Province-wise distribution of cultivated and salt-affected area.

	Provinces				
	Punjab	Sindh	KPK	Balo-chistan	Pakistan
Cultivated area (Mha)	12.27	5.65	2.11	1.84	21.87
Salt-affected area (Mha)	1.234	3.04	0.11	0.12	4.50

**Source:** Qureshi et al. (2008)

## Threat 3: Population growth and Increased Settlements on agricultural lands

With increase in population, arable land per capita gets decreased (Lambin and Meyfroidt, 2011). Land is degraded because population needs more housing units that are built on fertile lands. Population is the major reason for change in land use (Lambin et al., 2001). Fuel wood consumption and demand for building materials increases with growth in population (Grepperud, 1996 increased pressure on land resources has caused land and environmental degradation. The natural resources are being overexploited due to population pressure (Irshad et al., 2007). The most affected natural resources are land and water resources. Housing schemes have been introduced because of population growth. The precious fertile lands have been converted to housing units even in rural areas.

## Threat 4: Land fragmentation

Land is precious resource and in rural areas people are mainly dependent on lands for their sustenance (Qasim et al., 2011). Land tenure insecurity and poor property rights causes degradation of lands in Pakistan (Niazi, 2003; Qasim et al., 2011; Akhtar, 2011). Land fragmentation is a major hurdle in land conservation. From 1980 to 1990, the land holdings have increased from 4.07 to 5.07 million due to land consolidation (Niroula and Thapa, 2005). However, the land parcels have also increased. The consolidation of land plays a very important role in controlling land fragmentation. However, land consolidation is confronted with various issues in Pakistan, the foremost reason being sentimental attachment of farmers to their lands. Recent technological advancements don't work well in fragmental small land parcels. Therefore land productivity is badly affected.

## Threat 5: Droughts

Droughts and desertification also degrade lands. High temperatures and droughts and desertification affect agricultural yields (Farooqi et al., 2005). Rainfall has become scanty due to El-Niño (sheikh, 2009). All the provinces are affected

by droughts but Balochistan is the most affected province by droughts and desertification (Ahmad et al., 2004). The drought from 1998 to 2002 brought devastations to Balochistan province (Ashraf and Routray, 2013) that had seriously affected 3.3 million people (Sheikh, 2009). Besides Balochistan, Sindh province also faces recurrent droughts. A negative growth of 10% was recorded for wheat, cotton and rice in Sindh (Sheikh, 2009). Excess water withdrawal through tube wells have also led to desertification and droughts. The underground water sustainability has been severely affected by tube wells (Figure 3). The situation is more severe for Balochistan province, because the province has less water resources. The water scarcity issues have been locally dealt by farmers through flood irrigation (locally called “*Sailaba*”) and/or rain water (locally called “*Khushkaba*”). However, these irrigation systems are based on climate systems and their yields are very low of ten subsistence yield s are taken.



**Figure 2** A dried tube well in Punjpai area of Balochistan

#### **Threat 6: Desertification and Land degradation**

Degradation and desertification of lands occurs through both climate change and human activities. Land degradation is more concerned with human actions and desertification linked with climate related issues. But majority of the researchers believe that to some extent even desertification is caused by human misuse of land and water resources. Drylands are degraded because research shoes that up to 70% of the drylands are affected by desertification (Amin, 2004; Lin and Tang, 2002; Veron et al., 2006).

Excluding Antarctica, people in all other continents are affected by land degradation and desertification (MEA, 2005). Of the affected countries, 80 are underdeveloped countries (Amin, 2004). Human well-being is affected through land degradation. The rural poor are mostly affected than the people in urban areas, because the rural people are relying on primary economic activities. They are involved in farming, fishing, hunting and gathering of wild fruits and nuts. Land degradation affects 250 million people and one third of land area (Adamo and Crews-Meyer, 2006; Irshahd et al., 2007; Peng et al; 2005). It has reduced crop yields and increased sedimentations in dams and rivers. Climate, international water and biodiversity are also affected by land degradation (Pagiola, 2009). The degradation of lands causes social, economic and bio-physical conditions of the humans (Fernandez, 2002). According to the opinion of some researchers, drylands degradation should be referred to as desertification.

#### **Threat 7: Climate change**

Green House Gases (GHGs) are released by the industries and vehicles to the atmosphere that causes climate change and global warming problems (Farooqi et al., 2005). Climate change has severe impacts on agriculture. The monsoonal pattern has been changed because of climate change that has its impacts on crop yields. The climate change has caused floods in some areas and droughts in the other. El-Nino is considered to cause aridity through rainfall deficiencies and La-Nina is responsible for severe floods (Sheikh, 2009).

#### **Solutions and future perspectives**

To reduce the impacts of water erosion, besides SALT technologies certain structural measures are needed. These include bunds and check dams that will reduce speed of the water. Terraces and contours cultivation should also be promoted in hilly areas to increase production and reduce erosion. Wind breaks should be used in regions where permanent winds flow that may also reduce erosion. Fencing should be introduced to control open grazing in pastoral regions. Afforestation and

reforestation programs need to be introduced. They protect lands from erosion and increases soil fertility (Asafu-Adjaye, 2005). Deforestation should be discouraged, and huge penalties should be introduced for illegal logging. These activities will reduce erosion and improve soil fertility in the country.

To control the twin menace of waterlogging and salinity, the Salinity Control and Reclamation Projects (SCARPs) needs to be initiated in affected areas (Shah et al., 2011). Salt tolerant plants should be promoted on such soils for cultivation (Yamaguchi and Blumwald, 2005). If these projects are properly implemented, this would enhance crop yields. Exploitation of natural resources can be better controlled through controlling population growth (Lambin et al., 2001). Land suitability maps needed to be prepared and fertile lands need to be saved from encroaching settlements. Poor and infertile lands should be allocated to settlements. Multi story buildings should be constructed with proper care to avoid settlement construction in high seismic risk zones. Land reforms were initiated in Pakistan in 1959 (Niroula and Thapa, 2005). Land reforms were introduced to give ownership of the lands to the tenants, but in fact the landlordism is even still present in all the four provinces of the country. Farmers should be properly advised on the advantages of land consolidation. The land fragmentation could thus be checked or minimized. Different land values and sentimental attachments to land cause hurdles in adoption of land consolidation (Thapa and Niroula, 2008). Disputes arising from consolidation needs to be settled by the concerned government authorities (Niroula and Thapa, 2005). Through proper implementation of these programs, land fragmentation can be controlled.

Irrigation channels should be improved to avoid loss of water (Sheikh, 2009). Delay action dams should be constructed to save water for future use. Even the underground water table would be recharged with the construction of dams. Workshops and seminars should be arranged to make the farmers aware on efficient use of water resources. Water supply schemes should be built in drought affected areas of the country (Kahlown and Majeed, 2003).

Water should be conserved even through water harvesting methods. Small dams should be constructed instead of large dams for effective utilization of water resources (Sheikh, 2009). Sustainable land management (SLM) is the best way to overcome degradation and desertification of lands. Conservation methods of both land and water should be disseminated to the farmers to save land and water resources from degradation. Poor farmers should be given subsidy on agricultural inputs. Afforestation and reforestation and agroforestry should be promoted. Efforts should be made to make rehabilitate the degraded lands. Forests and plantations should be promoted to enhance carbon sequestration. The excess of carbon released from the industries may be captured by the plants that may reduce climate change and global warming. The International Panel on Climate Change (IPCC) has made policies for lowering of Chloro Floro Carbons (CFCs) which should be strictly followed. As for as the agriculture sector in Pakistan is concerned, the farmers should use early maturing varieties of crops, adopt soil and water conservation technologies and diversification of crops to cope with the climate change.

## Conclusion

Agriculture is the main source of livelihood for the rural population in the country. Although, the agriculture sector is faced with different problems discussed in detail in the paper, there were provided better solutions for overcoming those problems too. To eradicate the issues related with the land and water, the farmers should be prioritized to be made aware on the issues and their solutions. However, Political will is also needed to support the farmers to adopt the soil and water conservation technologies. If serious steps are not taken by the government now, the country may face severe difficulties in feeding the growing population.

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