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The analysis of Farmers, Perceptions of Land Management Technologies to Combat Land Degradation and Desertification in Balochistan, Pakistan

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Abstract

Dry lands throughout the world are faced with the problems of land degradation and desertification. The farmers' perceptions are imperative for devising strategies to combat desertification. This study therefore tried to find out the causes, indicators, locally adopted strategies and their sustainability. Observation, questionnaire and focus group discussions were used for collection of the primary data. Results showed that population growth, increased demand for food, fodder and fuel wood were the main causes for land degradation and desertification. The farmers reported depletion of underground water, decreased rangelands productivity, gullies and rills, decreased yields of major crops and decreased soil fertility. The farmers had adopted the strategies of flood water harvesting, low water requiring crops and organic manure to combat desertification in the area. The study recommends the rotational grazing and fencing of rangelands, reforestation and leveling of badlands in the areas for combating desertification.

Keywords: Dry lands; Desertification; Land degradation; Adaptation

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INTRODUCTION

The UNCCD (1994) has defined desertification as "land degradation in the arid and semi-arid areas resulting either from climatic factors or human activities". The arid parts of the world are often faced with the environmental problems of natural resource degradation (Agyemang et al., 2007) due to their fragile natural resource base. Desertification is one of the most threatening environmental hazards, affecting 10 million hectares of the worlds land area (Amin 2004) and 250 million people (Adamo and Crews-Meyer, 2006; Irshad et al., 2007; Peng et al., 2005). Desertification is a serious environmental (Gisladottir and Stocking, 2005; Liu et al., 2003; Luo et al., 2005; Salvati et al., 2005; Yang et al., 2005; Nianfeng et al., 1999) and socio-economic issue (Liu et al., 2003; Qi and Cai, 2007). Population growth is considered to be the major cause of land degradation and the existing natural resources are under serious threats of degradation (Figure 1). Agricultural intensification, increasing number of human and livestock population and drought have brought degradation of natural resources in the dry parts of the world (Amissah-Arthur et al., 2000). In Pakistan, limited access to land and population growth lead to land degradation and desertification (Irshad et al., 2007). Bhutto and Bazmi (2007) mentioned that uneven access to land causes over cultivation problems that lead to land degradation. The anthropogenic factors that causes land degradation and desertification in Pakistan are overgrazing, overexploitation of land and water resources, marginal land cultivation and deforestation (Anjum et al., 2010) land tenure and land use (Niazi 2003). Ahmad et al. (1998), reported that out of the 21.59 million hectares of cultivated land, only 5.34 million hectare is suitable for cultivation, the rest is facing severe desertification issues. Overgrazing, over cultivation, overuse of forests and rangelands fuel wood

collection has degraded the natural resources. Due to population growth, the resources that were previously being used in a sustainable manner are now overexploited. The tube wells technology has led to excessive withdrawal of the underground water and has led to drying up of Karezes in many parts of Balochistan. The farmers' perceptions on causes, impacts, indicators and their adopted methods for combating desertification bear important policy implications (Hammad and Borresen, 2006; Lee and Zhang, 2005, 2008; Salvati et al., 2008) . Therefore perceptions of the local farmers on desertification are imperative as they are the main stakeholders in the process. Therefore, the objectives of this paper were to 1) find out the causes of land degradation and desertification in Balochistan 2, to find out the indicators of the process mentioned above and 3, to know about the locally adopted solutions for combating these processes.

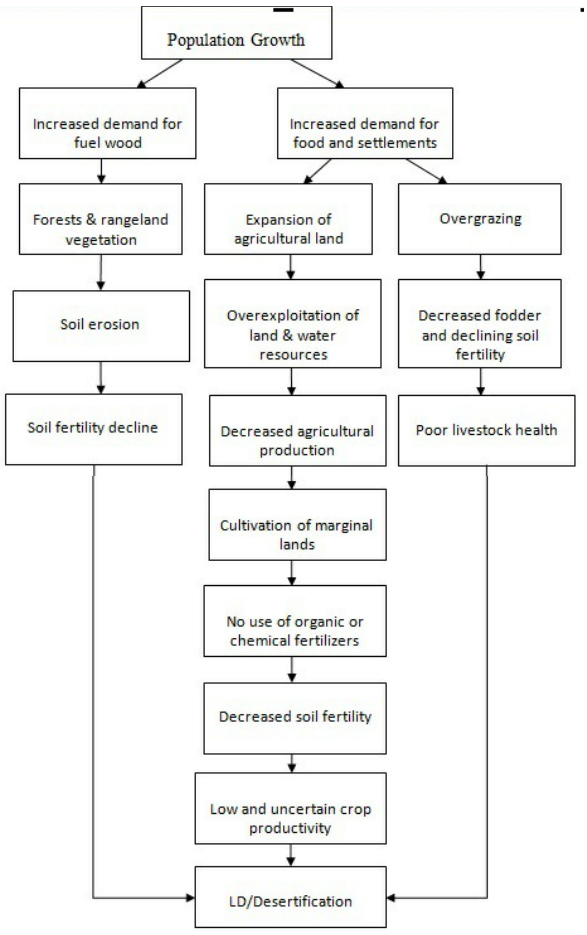

Figure 1: Causes of Land degradation in Pakistan

MATERIALS AND METHODS

The Balochistan province of Pakistan was the universe of this study. The Pishin basin (figure 2), was selected as the study area. This part of Balochistan was selected as the study area because the area is faced with severe water scarcity and unsustainable agricultural practices. For calculating sample size, the census data of 1998 is used as no updated census data were available. The study area comprised of 72,572 households (GoP, 1998). By using the Yamane (1967) equation for sample size calculation, 200 households were selected as sample size with a precision level of 7%. A reconnaissance survey was carried out to know the socio-economic characteristics of the farmers and their perceptions about the causes of desertification, indicators and their locally adopted coping strategies. A research team was made to conduct the survey which consisted of five M.Sc final students of geography department, University of Balochistan, Quetta. Questionnaire, Focus group discussions and field observations were the main methods used for data collection. Initially, a proportionate sampling was done to find out the number of households from each district, namely Pishin, Killa Abdullah and Quetta. The proportional sampling was intended for proper sampling from each locality, but not for comparison of the districts. Secondly, random sampling method was employed for selection of households from each district. The field survey was carried out from January, 2013 to April, 2014. Close ended and some open ended questions were used in the questionnaire. The research team was trained before conducting the field survey. The questionnaire was constructed in English language because the questions were easily translated by the students to *Pashto* (the local language of the study area. The average time taken for completion of one questionnaire per respondent was about one hour and 40 minutes. The male household heads were selected for the survey because of their outside activities. Females in the study area are not allowed to take part in agricultural and trade activities and therefore no information was collected from them. The primary data gathered through questionnaire survey were

analyzed statistically using, Statistical Package for Social Sciences (SPSS) version 15®. Simple descriptive statistics were used to analyze the collected data.

RESULTS AND DISCUSSION

Socio-economic profile of the farmers

The average age of the surveyed respondents was 57.2 years. The number of family members working on the farm was 3.45%. The percentage of educated members was 36.6. Fewer farmers (15%) had access to extension agents and 37.5% of the surveyed households had access to credit facilities. 57.5% of the farmers had their own lands (table 1). The socio-economic characteristics of the farmers revealed that most of the farmers were uneducated and had no access to extension services and credit facilities. These may be the reasons that most of the farmers are faced with the declining yields on their farms.

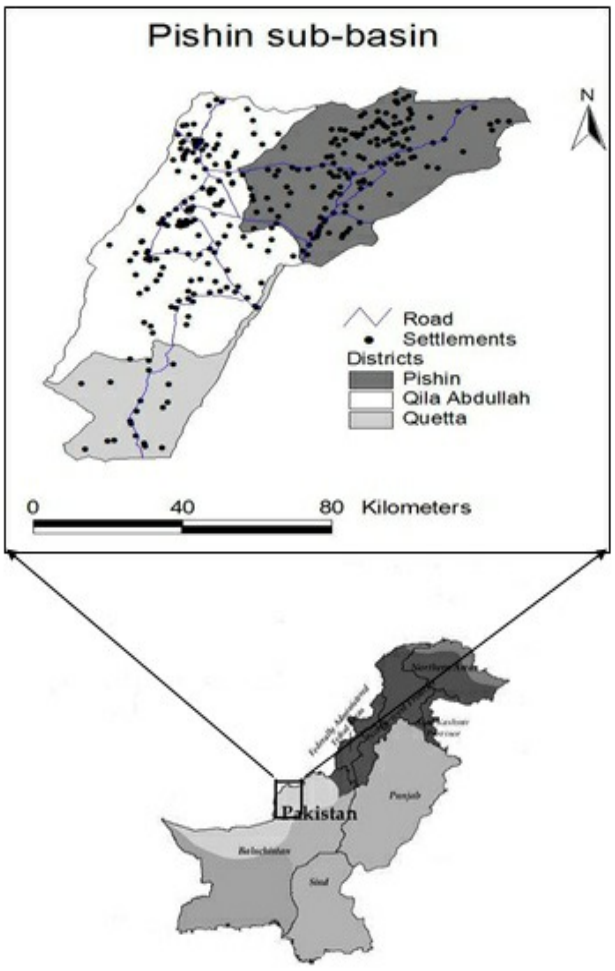

Figure 2: Location of the study area

Table 1: Socio-economic profile of the surveyed households

Variable	Percentage	Mean
Age of household head	-	57.2
No. of family members engaged in agriculture activities	-	3.45
Educated members	36.6	-
Farmers visited by extension workers	15	-=
Farmers with access to credit	37.5	-
Farmers with tenure security	57.5	-

Source: Field survey

Reasons for declining yields

The farmers advanced different reasons (table 2) for declining crop yields on their farms. The main problems were declining soil fertility, increased soil erosion, low rainfall and insufficient use of chemical and organic fertilizers. The problems of soil infertility are because of improper management practices of the farmers. They have no knowledge of the erosion control and the proper amounts of chemical and organic fertilizers needed by the crops.

Table 2: Reasons advanced by farmers to explicate declining crop yields on farmlands

Reasons	Percent respondents
Declining fertility of soils	27.5 (55)
Increased soil erosion	21.5 (43)
Low & erratic rainfall	18.5 (37)
Insufficient use of chemical fertilizers	11.0 (22)
Insufficient use of manure	7.5 (15)
Over cultivation of land	7.0 (14)
Pest attacks	7.0 (14)
Total	100.0 (200)

Source: Field survey

Degradation of the available natural resources

Results revealed that due to the degradation of the natural resources, the time required for their harvesting has increased the passage of time (table 3). Fuel wood was collected by the young members of the family and they reported that they travel longer distances to collect fuel woods at present than that of two or four decades ago. They also reported that previously they spent less time to graze their animals. Due to shortage of feed grasses, the times for grazing animals have also increased. Similar situation was found for irrigation of crops. This is because of the continuous mining of ground water; the depth of the water table has almost reached to 455 meters. If proper land management technologies are not taken, the people may

suffer severe consequences in terms of food and water availability in the study area.

Adoption of conservation technologies

The farmers mentioned the use of very few conservation technologies on their farms. They were using agronomic (79.6%), structural (17.7%) and vegetative technologies (2.7%). Out of the agronomic technologies 43.6% used farmyard manure and 36% used compost on their farms. The structural techniques applied were terraces (7.0%), water harvesting structures (7.0%) and check dams (3.7%). 2.7% of the farmers used wind breaks as vegetative techniques on their farms (table 4). The respondents did not use the agronomic technologies like crop rotation, mixed cropping and mulching. The vegetative technologies like grass strips, agroforestry and hedge barriers were also non-existent. The management technologies like area closure and rotational grazing were totally lacking in the area. The results show that the farmers used only few conservation technologies and were ignorant of the other recent conservation technologies that were imperative for conservation of lands.

Table 3: Time spent in harvesting of natural resources

Variable	Measurement	Four decades ago	Two decades ago	Presently
Fuel wood collection	Time required to collect sufficient fuel wood for the full day (hours/day)	2	4	6
Grazing animals	Time required to graze animals (hours/day)	3	5	9
Ground water	Time required to fully irrigate the field (hours/acre)	2	4	5

Source: Field survey

Table 4: Adoption of different types of conservation technologies

Main type	Sub-type	Adopted by HHs (%)
Agronomic	Farmyard manure	43.6
	Compost	36
Structural	Terraces	07
	Water harvesting	07
	Check dams	3.7
Vegetative	Wind breaks	2.7

Source: Field survey

Indicators of desertification, their causes and sustainability of adopted strategies

The surveyed respondents reported six indicators of desertification and their associated causes in the study area (table 5). The adopted strategies for different indicators were also assessed if they had any negative impacts on the availability of the natural resources in future. Results revealed that the adopted strategies of flood water harvesting, land use change and use of organic manure to augment water for agriculture, increase agricultural production and increase soil fertility that were used by the farmers were sustainable. The results revealed that the farmers had not adopted strategies for low forage productivity on rangelands, decreased vegetation cover and increased gullies and rills in the area. These issues were mainly associated with the whole community (Common pool resources) and may be therefore, they were not given attention by the farmers.

Table 5: Desertification indicators, their causes and locally adopted strategies perceived by the respondents

Indicators	Causes	Adoption strategy	Impacts of adopted strategy		Sustainability status of adopted strategy
			Positive	Negative	
Depletion of underground water resources	Increased mining of water through tubewells	Flood water harvesting	Increased cultivated area	Sometimes no crops due to uncertain climatic conditions	Sustainable
Low forage productivity of rangeland resources	Climate change, Common pool resource & Overgrazing	N.A	N.A	N.A	N.A
Decreased vegetation cover	Deforestation, Overgrazing & Fuel wood extraction	N.A	N.A	N.A	N.A
Increased gullies and rills	Soil erosion	N.A	N.A	N.A	N.A
Decreased production from apple and other fruit orchards	Drying of Orchard trees	Land use change	Crops requiring less water are planted	No negative impacts	Sustainable
Decreased fertility of the soil	Improper use of fertilizers, Intensive agriculture	Use of organic manure, Fallow	Increased crop yield	No negative impacts	Sustainable

Source: Field survey

CONCLUSION

The socio-economic characteristics of the farmers revealed that majority of the farmers were illiterate and had no access to extension and credit facilities. They had adopted some agronomic, vegetative and structural

conservation technologies. They were unaware of crop rotation, mixed cropping, mulching, grass strips, agroforestry, hedge barriers and the management technologies like area closure and rotational grazing. The farmers reported about the indicators, causes of degradation in the area. They had not adopted strategies for low forage productivity on rangelands, decreased vegetation cover and increased gullies and rills. The study recommends the provision of credit and extension facilities to the farmers. The farmers should be given proper training on rangelands management, agroforestry techniques and gullies and rills control to protect their lands. The NGOs should contribute in creating awareness and providing technical education and support on micro irrigation technologies in the area.

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