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ROLE OF AGRICULTURAL EXTENSION SERVICES IN ADAPTATION TO CLIMATE CHANGE IN HIGHLANDS OF KAGHAN VALLEY, PAKISTAN

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The mountainous areas are generally considered among the least developed and fragile regions. Climate change has exacerbated the effect on livelihood of the mountainous areas, particularly small farmers who are striving hard to adopt the farming practices in accordance with the climate change. Agricultural advisory service in the mountainous areas has always been challenge for the extension workers especially in context of climate change. This paper examined the role of agricultural extension in adaptation to climate change in Kaghan valley of Khyber Pakhtunkhwa province of Pakistan. Both qualitative and quantitative methods were used for the purpose of data collection. The paper argues that agri. extension department can play a crucial role by creating awareness regarding adaption of best practices regarding climate change, deforestation and planting of trees. There is also need of launching campaign to educate the farmers and to build their resilience to cope with the negative effects of climate change.
Keywords: Farm services, livelihood, climate change, forestation, Kaghan valley

INTRODUCTION

Climate change is one of the most dazzling confront faced by the global world which poses its negative impact in many ways. Intergovernmental panel on climate change (IPCC) statistically defined climate change as considerable variations that persist for an extensive period. It can also be defined as the change in climate over long period of time, whether due to natural variability or as a result of human activity and it is now considered as the most significant threat to the world (Sterrett, 2011). It is now evident that earth's natural variations and human's activities which result in emission of greenhouse gases (GHG) increasing the global warming and this global warming results in the change of climate. It has been noted by the scientists that average temperature of the earth has increased by 0.74 degree Celsius over the past 100 years and if no step is taken, there will be more rise in average temperature of the earth which will be difficult to cope (Verchot *et al*., 2007).

Climate change is a major threat to agriculture as agricultural production activities are more vulnerable to climate change (Safdar, 2012). Many plants can propagate and reproduce within explicit range of rainfall and specific temperature. The climate change can affect the ecosystems and the biodiversity in numerous ways (Qureshi and Ali, 2011). It also have significant effect on the livelihood of the people as it is difficult for the people especially farmers to adopt the practices according to climate change (IFPRI, 2011). These agro-ecological changes directly affect the agriculture and food production, which threats the state of food security (Schmindhuber and Tubiello, 2007). It is estimated that average temperature will be increased by 2^0C to 4^0C by the year 2080, thereby it will results in decreasing the yield of many crops severely due to this increase in temperature (Safdar, 2012). So, in future it will be more difficult to feed the growing population and to sustain the state of food security of this world (Nelson *et al.*, 2010). Rising temperature, precipitation and extreme weather events which occur very frequently leads towards global warming and this changing climate of South Asia could decrease the production of cereals by 18.2-72.1% by the year 2080 (Von braun, 2007). Brown and Funk (2008) reported that in upcoming next four decades there will be harsh and direct impact of climate change on food systems and agriculture. Tropical and sub tropical regions would be effected noticeably by climate change as these regions are not very much capable to cope with changes in climate because they have very a small number of options in their existing agriculture system to start with except development programs and early warning systems are to be used more efficiently.

Pakistan is the 6th largest country of the world in terms of population, consists of 177 million individuals and this number is increasing at the rate of 2.07% every year (Government of Pakistan, 2013). Agriculture is the only source to feed the fast growing population and the total cultivated land is increased by 40% during past 60 years (Government of Pakistan, 2010). The associated impacts of

high temperature, frequently occurred extreme disasters like flood, drought and fluctuation in precipitation patterns results in low yields and increase production risks in different regions of the world, hence widening the gap between rich and poor (Malla, 2008). Khyber Pakhtunkhwa (KPK) is a province of Pakistan whose most part consists of mountains. It has large rugged dry hills and vast gravelly plains and patches of agricultural fields. The subsistence livelihood of this region is based on agriculture and livestock. Small farmers have limited access to technology and facilities and are directly affected by increased prices (WFP, 2010). Most part of the KPK is mountainous with severe cold weather and heavy snowfall make the farming impossible in rural areas of KPK which is the basic source of subsistence livelihood of people. Recent changes in temperature and heavy rainfall has severely affected the livelihoods of small farmers, because their livelihoods mainly depend on the natural resources which depend upon nature and climate (Sadaat and Saifulislam, 2011). Although, there is a full-fledged provincial Department of Agricultural Extension, well trained man-power in the province and physical infrastructure, the overall agricultural productivity in the province particularly in the mountains is very low as compared to other provinces of the country (Shahbaz *et al*., 2010). To meet the challenges of climate change and food insecurity there is need to brace up the agri. extension department to play its vital role to cope with the risks of climate change especially in the mountainous areas. With the help of promising policies of the government and guidance of extension services, farmers become capable to boost agricultural production and to attain self-sufficiency (Al-Shayaa *et al*., 2012). In this context, the main objective of this paper is to underline some of the adaptation strategies perceived by the farmers in Kaghan Valley and to suggest policy implication for an effective agricultural extension system in the area.

MATERIALS AND METHODS

Kaghan valley is in Mansehra District of the Khyber Pakhtunkhwa (KPK) Province with the altitude of 2039 m, latitude and longitude is 34° 54' 27" North, 73° 38' 56" East (Fig. 1). It was selected purposively because it is mountainous area and such areas are fragile and directly affected by climate change (Schild, 2008). Two out of four union councils Kaghan were chosen through simple random sampling. Then, from each union council (U.C) three villages were selected at random. From U.C. Kaghan, three villages (Kaghan Village, Lari and Batakundi) were randomly selected. Again from this U. C Kawai, three villages (Kawai village, Paras and Bella balseri) were selected by using simple random sample technique. From each village 20 respondents were selected randomly thereby making a sample size of 120 respondents. Structured interview schedule was prepared to collect quantitative data. Personnel observation, key informant interviews and focus group discussion were used to obtain qualitative data. Frequencies and percentages were calculated from quantitative data while direct quotes are given in the results from qualitative data.

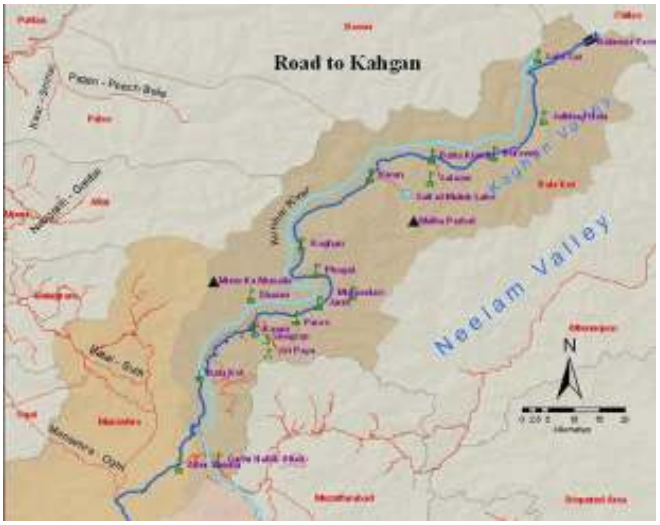

Figure 1. Map of Kaghan Valley, Pakistan.

RESULTS AND DISCUSSION

The data presented in Table 1 explained that fellow farmers were the most frequent source of agricultural information of the respondents, while 57.5% of the respondent said that they sometimes get agri. information from the radio, followed by the 27.5% of the respondent who reported that they get agri. information through agriculture department not on the regular basis. An overwhelming majority (95%) of the respondents said that they never use newspaper to get

Table 1. Perceptions of respondents according to their sources of agri. information

Source	Never		Sometimes		Frequently	
	f	%	f	%	F	%
Agriculture department	75	62.5	33	27.5	12	10.0
Radio	41	34.16	69	57.5	10	8.3
Television	95	79.16	19	15.83	6	5.0
Fellow farmers	14	11.66	16	13.3	91	75.83
Newspaper	114	95.0	6	5.0	0	0.0

agricultural information followed by the 79.16% of the respondents who never get agri. information through television. One of the respondents told that *"I get most of the agriculture and other climate update from my fellow farmers as the government officials have no concern with our condition"*.

There are very limited sources of information for the farmers in the mountainous areas of Kaghan Valley and the agricultural extension department is also not playing its role in efficient way. This is the reason why farmers are very much relying on their traditional knowledge and the information from their fellow farmers. It was worth mentioning here that in this 21st century farmers of Kaghan Valley are not getting information from electronic and print media and there is dire need to focus on this issue so that they can get updated information in order to cope with climate change.

***Services provided by agri. extension department*:** The respondents were further asked about the services provided by the agriculture extension department and the data in this regard is presented in Table 2.

According to the respondents, agriculture extension department has failed to provide facilities to the farmers as the data in Table 2 shows that a large majority of the respondents (89.16% and 88.33%) reported that agri. extension officials never guided us how to cope against climatic extremes and never provided us climate resistant varieties so that we can somehow or the other sustain our production in the event of climate change. The results get more interesting when an overwhelming majority (84.16 and 81.66%) of the respondents reported that agri. extension officer don't update them about latest agriculture technology and don't visit them regularly. During qualitative interview one of the respondents told that *"Agriculture extension officer never visited our area since a long time and I even don't know his name and office"*.

During key informant interview with District Director Agriculture it was found that due to lack of resources it becomes difficult for an agri. extension officer to visit the farmers at their door steps. However, efforts are made to enhance the agriculture production in the area by introducing new varieties of seeds, improved agricultural practices and demonstration plots and by organizing farmer's days. One of the agricultural officers reported that *"I have to cover very large area and I have very limited resources which are not sufficient to reach and contact the farmers on regular basis"*.

Therefore, it is clear that the major problem faced by extension field staff in the Valley is the lack of resources. Kaghan valley is the mountainous area and extension worker have to travel a lot to contact with the farmers to update them about latest agricultural practices. So, in this situation there is need to address the issues of extension field staff and proper measures should be taken to address these issues so that farmers gets benefit of this.

***Services provided by forest department*:** The respondents were further asked about the services provided by forest department and the data regarding this is presented in Table 3.

The data in Table 3 depicted that a large majority (65%) of the respondents said that forest officers visit them regularly and 60% of the respondents reported that they motivate them to plant trees in order to conserve forest. However, an overwhelming majority (65.83%) of the respondents said that the forest department never provided them planting material so that they can plant trees. Typical comments of the respondents were *"We can put our efforts to conserve forest and planting trees if forest department collaborate with us and provide us planting material. We are not in the position to buy good quality planting material as we have no resources in this regard"*.

Forest plays an important role in regulating the environment and adaptation to climate change. Forests can also have a central role in protection of soil, water, conversion of

Table 2. Perceptions of respondents about agri. extension department

Service	Agree		Disagree	
	f	%	f	%
Agri. officer visits you regularly	22	18.33	98	81.66
Update you regarding latest agri. technology	19	15.83	101	84.16
Provide you climate resistant varieties	14	11.66	106	88.33
Guide you to cope against climatic extremes	13	10.83	107	89.16

Table 3. Perceptions of respondents about forest department

Services	Yes		No	
	f	%	f	%
Forest officer visits you regularly	78	65.0	42	35.0
Forest Dept. Motivate you about planting trees	72	60.0	48	40.0
Provide you planting material	41	34.16	79	65.83

biodiversity, livelihood support, poverty reduction, economic development and food security (FAO, 2010).Therefore, good forest management practices for climate change mitigation and adaptation is very necessary in future to attain food security. Wattoo *et al.* (2010) concluded that forest department with the help of local beneficiaries can play an important role in conservation of forest. Involving of local communities in decision making process and by developing consensus with local stake holders is very beneficial in forest management.

Forest department in the Kaghan Valley is very active and plying its vital role in conserving the forest of the Valley. Majority of the residents of the Kaghan Valley used the forest wood to meet their daily requirements and it results in deforestation (Safdar, 2012). Forest agents visit the farming community and guide them about the importance of forest but they are not providing planting material to the people. Due to high rate of poverty and limited livelihood activity people of Valley are not able to buy planting material from their own pocket .In this situation forest department has to provide planting material to the people to get maximum results and to decrease deforestation.

The respondents were further asked to rate the role of agri. Extension in adaptation to climate change in a likert scale (1= strongly disagree, 2= disagree, 3= undecided, 4=agree, 5= strongly agree).

The data in Table 4 show that farmers perceived that agri. extension staff can play a main role as effective mitigation to climate change. They include promoting awareness and adoption of best practices in event of climate change (M=4.53), creating awareness to stop cutting trees and planting new trees to conserve forests (M=4.43), dissemination of latest agricultural technology to the farmers (M=3.96), retraining and capacity building of extension field staff in climate risk management (M=3.65) and building resilience capacities of vulnerable peoples to cope with climate change (M=3.18).Climate change poses enormous threat to the food security in many countries especially in developing countries, so there is need to create awareness among people and to adapt recommended practices to cope with the negative effects of climate change and in this case agri. extension should have to play its vital role to promote awareness among people. Deforestation occurs where forests cut down rapidly than they are replaced is the major contributor to climate change. The main cause of the deforestation in the study area is the demand of wood for fuel. As one of the respondents said that *"We have to cut wood for our cooking purpose and also for fire purpose because we have no cheaper alternative"*.

There is dire need to provide alternate source of fuel so that people conserve forest and decrease the risks of deforestation which made them more vulnerable to climate change. The primary role of agri. extension is to disseminate latest agricultural technology to the farmers and to awareness among the other rural residents who depends on agriculture in one way or the other. Therefore, it is the prime responsibility of the extension department to publicize the updated agricultural technology developed through the research efforts around the world and also to boost up the adaptive capacity and resilience of the marginalized people against the climate change. Khatam *et al.* (2013) reported that first step towards the adoption process is the awareness and agricultural extension is the best medium which is available to the farming community for their capacity building. Agricultural extension is only one of its kind services in the way that it provides access to latest information to the rural poor and small farmers who are living away from the urban areas. Muhammad and Garforth (1995) concluded that has shown that access to information by the farmers is the most important factor which persuades their adoption behavior. The respondents highlighted the need to activate the agri. extension services by re training the staff to acquire the capability (knowledge and skills) in the event of climate change and climatic extremes. The focus of the training should be the field staff of agri. extension department who is directly contact with the farmers. As one

Table 4. Perception of respondents regarding role of agri. extension in adaption to climate change

Role of Agri. extension	Mean	SD	Rank
Promote awareness and adoption of best practices in event of climate change	4.53	1.020	1
Create awareness to stop cutting trees and planting new trees to conserve forests	4.43	1.074	2
Dissemination of latest agricultural technology to the farmers	3.96	0.991	3
Retraining and capacity building of extension field staff in climate risk management	3.65	1.207	4
Building resilience capacities of vulnerable peoples to cope with climate change	3.18	1.207	5
Use of ICTs like FM radio, television, leaflets, posters to create awareness on climate change among farmers	2.88	1.278	6
Use of farmer field schools to promote learning of farmers on the measures used to mitigate and adapt the impact of climate change	2.79	1.270	7
Providing feedback to government about various causes of climate change	2.46	1.003	8
Use of demonstration technique to educate farmers	2.37	1.028	9
Formulate local societies to encourage and educate young farmers about climate change	2.11	0.754	10

of the agricultural officers reported that *"There is lack of training courses or us which are very necessary to get exposure to latest development in field of agriculture and to combat with impacts of climate change"*.

Ozor and Cynthia (2011) reported that there is need to reshaping the role and capacity in the extension system so as to accommodate the new dimensions carried out by climate change. Resilience of farmers must be developed through education and training so that they can cope with the negative impact of climate change and sustain their livelihoods and food security.

***Conclusion*:** The aim of the study was to clarify the role of agricultural extension in adaptation to climate change in the Kaghan Valley. Results revealed that fellow farmers are the main source of information of majority of the farmers, while agri. extension department is unable to lend a hand to farmers regarding climate change. On the other hand, forest department visits the farmers regularly but they are unable to provide planting material to the farmers and farmers are also not interested in planting trees. There is dire need to create awareness and adaption of suitable practices regarding climate change, deforestation and planting of trees. It is recommended that there is need to start a campaign in order to build resilience and adaptation capacity of the small farmers to cope with the negative effects of climate change and agri. extension department can play an active role in this regard.

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REFERENCES

Al-Shayaa, M.S., M.B. Baig and G.S. Straquadine. 2012. Agricultural extension in the Kingdom of Saudi Arabia: Difficult present and demanding future. J. Anim. Plant Sci. 22: 239-246.

Brown, E.M. and C. C. Funk. 2008. Food security under climate change. Science 319: 580-581.

FAO. 2010. Managing forests for climate change. Brochure of forestry FAO, Rome Italy.

Government of Pakistan. 2010. Pakistan statistical year book. Federal Bureau of Statistics, Statistics Division, Islamabad, Pakistan.

Government of Pakistan. 2013. Economic survey of Pakistan. Ministry of Finance. Government of Pakistan, Islamabad, Pakistan.

IFPRI. 2011. International Food Policy Research Institute (IFPRI) Annual Report 2010. Washington DC, USA.

Khatam, A., S. Muhammad and I. Ashraf. 2013. Role of individual contact methods in dissemination of agricultural technologies. Pak. J. Agric. Res. 26: 40-45.

Malla, G. 2008.Climate change and its impact on Nepalese agriculture. J. Agric. Environ. 9: 62-71.

Muhammad, S. and C. Garforth. 1995. Farmers' information exposure and its impact on their adoption behavior. Pak. J. Agri. Sci. 32: 262–265.

Nelson, G.C., M.W. Rosegrant, J. Koo, R. Roberston, T. Sulser, T. Zhu, C. Ringler, S. Msangi, A. Palazzo, M. Batka, M. Magalhaes, R.V. Santos, M. Ewing and D. Lee. 2010. Climate change: Impact on agriculture and cost of adaptation. International Food Policy Research Institute, Washington DC, USA.

Ozor, N. and N. Cynthia. 2011. The role of extension in agricultural adaptation to climate change in Enugu state, Nigeria. J. Agri. Ext. Rural Develop. 3: 42-50.

Qureshi, N.A. and Z. Ali. 2011. Climate change, biodiversity Pakistan scenario. J. Anim. Plant Sci. 21: 358-363.

Schmindhuber, J. and F.N. Tubiello. 2007. Global food security under climate change. Proc. Nat. Acad. Sci. (PNAS) 104: 19703-19708.

Sadaat, A. A. and A.K.M. Saifulislam. 2011. Impact of climate change on rural livelihood: A case study. 3rd International Conference on Water and Flood Management (ICWFM-2011).

Shahbaz, B., T. Ali, I.A. Khan and M. Ahmad. 2010. Analysis of problems faced by farmers in the mountains of northwest Pakistan: Challenges for Agri. Extension. Pak. J. Agri. Sci. 47: 417-420.

Safdar, U. 2012. Securing livelihoods in the realm of climate change and food insecurity: A case study of Kaghan valley. M.Sc. (Hons.) Thesis, Institute of Agri. Extension and Rural Development, University of Agriculture, Faisalabad, Pakistan.

Sterrett, C. 2011. Review of climate change adaptation practices in South Asia. Oxfam Research Report. Climate centre, Melbourne, Australia, November, 2011.

Schild, A. 2008. International centre for integrated mountain development (ICIMOD,S) position on climate change and mountains systems. International Mountain Society 28: 328-331.

Von Braun, J. 2007. The world food situation: New driving forces and required actions. IFPRI biannual overview of the world food situation presented to the CGIM annual meeting held in Beijing, China in December, 2007.

Verchot, L.V., M.V. Noodwijik, S. Kandji, T. Tomich, C. Ong, A. Albrecht, J. Muckensen, C. Bantilan, K.V. Anupama and C. Palm. 2007. Climate change linking adaptation and mitigation through agro forestry. Mitigation and Adaptation Strategies for Global Change 12: 901-918.

WFP. 2010. Food security and market assessment in crises areas of NWFP and FATA, Pakistan. World Food Program, Islamabad, Pakistan.

Wattoo, M.A., T. Ali, M.A.J. Khan and B. Shahbaz. 2010. Stakeholders role and interactions in context of forestry extension interventions in North West Pakistan. Pak. J. Agri. Sci. 47: 173-177.