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Farm Households' Willingness to Pay for Forestation Based Soil Conservation Program on Communal Land in Bagh District, Kashmir

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ABSTRACT

This study investigated farmers' willingness to pay (WTP) for a forestation based soil conservation program on communal land in district Bagh, Kashmir. Data were collected from a random sample of 180 farm households on a well-structuredquestionnaire possessed with a contingent valuation question. Majority of the sampled farm households reported moderate to high water erosion problem and their mean annual WTP for the soil conservation program was $34. The foremost beneficiary of the program were expected to be the farm households facing high erosion, and that's why their mean stated WTP was significantly high than others. Other important determinants of WTP were farm-size, household's income and head's education, farming experience, perceptions about soil erosion and contact with extension agents. The aggregate WTP for a farm household were calculated to be $214 for 10 years. This suggests that sufficient funds can be generated from local stakeholders for the implementation of the soil conservation program.

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1. Introduction

Land degradation refers to the reduction or decline in the economic and biological activity of soil on irrigated or rain-fed agricultural land, pasture and forest resulting from natural processes or anthropogenic activities (Coxhead and Oygard, 2008). Natural processes such as water and wind erosion, salinity, water logging, and loss in native plant species as a result of invasion by other species are important factors responsible for the degradation of land (Zia *et al*., 2004). In addition to these natural processes, anthropogenic activities responsible for land degradation include overgrazing, unsustainable agricultural practices, burning of forest and grasslands (Shah,2014).Land degradation is an important issue nowadays. It is happening all over the world and its consequences are devastating for human and wildlife. In South Asia, 25 percent of the total pastures and crops area is affected by water erosion, and the mountains of

Himalaya, thealluvial plains of Indus, Ganges and Deccan of Pakistan, India and Sri Lanka are the severely affected regions (Singh & Singh, 2011).

Erosion of top soil can directly or indirectlyeffect human and ecological systems. The effects of soil erosion can be bifurcated into on-site and off-site ones. On-site effects are reduced agricultural productivity and loss in value of agricultural land whereas Off-site effects arise from the transport of soil sediments to another farm, road or a freshwater body such as river, reservoir, etc (Hou, 2012). The effects of soil sediments' flow into water bodies can be categorized into biological, recreational, water storage and electricity production effects. Freshwater turbidity, due to its high sediment load results in the decrease aquatic-animal population either directly through reducing their reproductive ability or indirectly by destroying their habitat. High turbidity reduces the pleasure of swimming and boating, and decrease significantly fishing ability. Sediments deposition also reduces water storage capacities in reservoirs.

Soil resource in Northern areasand Pakistanis more exposed to erosion and land sliding. In these hilly areas, forests and agriculture constitute the major portion of food, wood and fodder and, hence, act as major source of livelihood of the locals. Anthropogenic activities, such as deforestation, overgrazing and extensive agricultural practices on slopes and in the alluvial plains have made the top soil more vulnerable to intense monsoon rains and floods (Shah, 2014). Tarbela, Warsak and Mangla Dams are Pakistan's main water reservoirs, located in the Northern areas. Heavy soil erosion has resulted in the silting up of these reservoirs and, hence, has reduced their power generating capacity. Conventional management practices of soil and water are useful tools to combat against land sliding and soil erosion, but lack its common application. The scenario gives birth to thequestions of 'how the government may respond to tackle the challenge of soil conservation?' and 'how to make the agricultural sector in Northern areas of Pakistan sustainable?'The study finds its rationale for answering questions of the like nature and investigate farm households' willing to pay (WTP) for a forestation based soil conservation program in Pakistan occupied Kashmir area.

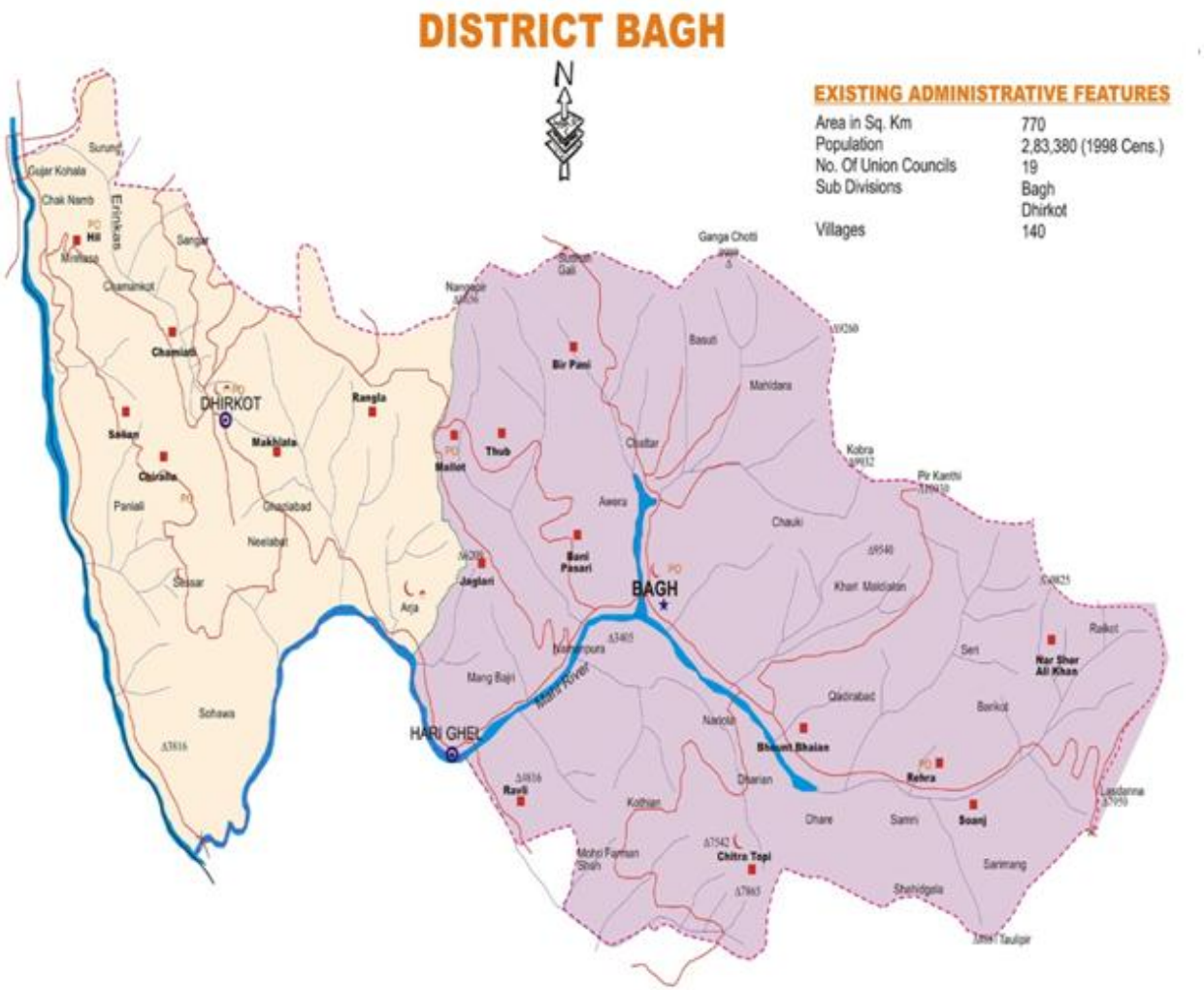
Results of the study helps in understanding whethersoil conservation program would be acceptable and viable to the households in Kashmir as well as otherNorthern areas of Pakistan, and whether participation and contribution of the locals therein can be ensured. The paper is structured into the following sections: Section 2 presents the methodology adopted for data collection and analysis; section 3 discusses theresults from data analysis; and section 4 concludes the findings of the study and extends policy recommendations for controlling soil erosion.

2. Methodology

Study Area and Sample Selection

This study was conducted in district Bagh of Kashmir. The total human population of the district is about 0.434 millions with an annual growth rate of 2 percent. Around 90 percent of the population is settled in rural areas. The total geographic area of the District is 1368km^2. Its climate varies from sub-tropical to moist temperate and average annual temperature is 21°C with a range of 2°C to40°C in the months of January to July respectively while annual precipitation is about 1500 millimeters (Shaheenet al., 2011).Baghis one of the major agricultural districts of Kashmir. In the past two decades, large scale deforestation and unsustainable agricultural practices have made the very top soil more susceptible to water erosion.

The recommended soil conservation program includes reforestation and afforestation on slopes and riparian zones, and adoption of on farm agro-forestry, terracing and fencing. Forest cover on slopes and farmland prevent loss of top fertile soil and its flow into freshwater systems (Shah et al. 2015; Nafees et al. 2008; Benavides and Veenstra 2005; Lu et al. 2003).



A multistage random sampling technique was used in selecting farm households for data collection. In the firststage, 6 villages were randomly selected from district Bagh. In the second stage, 180 farm households were selected randomly from those villages. The sample size was decided on the basis of Yamane (1967)'s formula, and proportional allocation sampling technique was used in selecting number of farm households from each village (Cochran; 1977).

Utilitarian Approach for WTP Measurement

Climate change,in South Asia, has increasedthe intensity and frequency of occurrence of monsoon floods. In addition, large scale deforestation and unsustainable agricultural practices in the past twenty years have made the top soil more vulnerable to water erosion.In this scenario, reforestation and afforestation on slopes and riparian zones could be used as useful and effective tools for combating stopping floods and controlling soil erosion.

Agricultureis the main source of food and income for most of the households in the study area and any sort of improvement in the on-farm soil erosion controlwould improve agricultural productivity andprofitability.The farm household's welfare function of can be written in the form of indirect utility function as;

$$U(Y, P, j) \ldots\ldots\ldots (1)$$

Where Y is farm household's income, P is vector of prices and j = (0,1) represent soil erosion situation; Let j = 0 indicates the current situation of on-farm soil erosion and j = 1 indicates the controlled soil erosion situation. If B is the benefit received by the farm household from on–farm soil erosion control, then the two situations can be compared as,

$$U(Y - B, P, 1) = U(Y, P, 0) \ldots\ldots\ldots (2)$$

As household's preferences are unobservable to researcher and their WTP for the proposed program depends on benefits they receive (B≥WTP); therefore, the utility in each situation can be written as follows:

$$V(Y - WTP, P, 1) + e1 \geq V(Y, P, 0) + e0 \quad \ldots\ldots\ldots (3)$$

Where e_0 and e_1 are random variables, independently and identically distributed with mean zero and they represent the part of utility unobserved to the researcher. Equation 3 presents the condition that determines if the farm household accepts to pay for the reforestation program. The economic valuation of on-farm erosion control benefit by the program is based on the question whether or not a given household is better off. This WTP could be zero if the benefit they receive is zero.

Contingent Valuation Method (CVM)

Farm households' gain in welfare from on-farm erosion control benefit of reforestation and a forestation on communal and state owned land in Bagh district of Kashmir was estimated using Contingent Valuation Method (CVM) which is a survey based Stated Preference approach.

CVM results are sensitive to the WTP question format designed for an environmental quality improvement (Carson and Haneman 2005). Based on literature review the WTP question formats used in CVM can categorized into: (1) Open ended question; (2) Single dichotomous choice question (3) Double or multiple bounded dichotomous choice questions; and (4) Payment card question (for more details see Shah et al., 2015; Zhongmin et al. 2006; Carson and Haneman 2005). The National Oceanic and Atmospheric Administration (NOAA) Blue Ribbon Panel suggested the use of single dichotomous choice question with a mandatory payment for designing WTP scenario (Arrow et al. 1993). Later research studies experienced that the single dichotomous choice questions provides limited information about household's WTP, and produces higher WTP compared to payment card and open-ended questions (Zhongmin et al. 2006). Also, both the single and double bounded dichotomous choice questions require large number of respondents to obtain accurate estimate of WTP (Carson and Haneman 2005, Shah et al., 2015). Furthermore, a mandatory payment, such as the income tax, is often associated with high protest rates (Loomis et al., 1993). This protest rate could be higher in developing countries where households have low income and liquidity problems. Consequently, open ended elicitation format with donation as payment vehicle was used to design WTP question for the proposed program. The wordings of the WTP question are:

> *As the loss of top fertile soil due to intense rainfall and flood waters in summer season is a serious problem in this area. Reforestation and afforestation on slopes and riparian zones could prevent floods and thus control soil erosion on slopes and farmlands. On-farm soil erosion control can improve crops production and returns.*
>
> *Suppose the local government set up a Natural Resources Conservation Fund (NSCF), and asks local households to makedonations to this fund. The fund would only be utilized for forestation on communal and state owned land in Azad Kashmir. This will help in controlling on-farm soil erosion and conserving farmland fertility.*
> *Would you be willing to contribute to that Fund?*
> *Yes* *No*
> *If Yes, then*
> *How much your household would be willing to donate every year to this NRCF?*
> *Rs._____ per year.*

CVM survey was administered in summer 2016, and selected farm households were interviewed face to face. Before conducting the survey, all questions were pretested in a pilot study and final changes were

made in the light of results from pretesting.

Econometric Model

The following regression model was estimated to determine the i^{th}farm household WTP as function of their socio-economic and agricultural characteristics.

$$WTPi = XiB + \varepsilon i \ldots\ldots\ldots (4)$$

Where WTP is the ith farm household\s willingness to pay, *X* is a vector of socio-economic and agricultural characteristics of the ithfarm household, *B* is a parameter vector and ε is error term along with '0' mean and constant σ^2. For open ended WTP question, a linear functional form was used and was estimated using ordinary least square (OLS) method.

3. Results and Discussion

Household Characteristics

Table 1 show that all of the households were headed traditionally by male individuals with an average age, education and farming experience of 55.7, 10.0 and 20.7 years respectively. Household size was on average 7 individuals and their average aggregated monthly income was Rs. 55777. The average farm size was 1.10 acre and agricultural practices included crops production and animal husbandry. Major crops grown in the area were maize, wheat and rice; and valuable livestock products were milk, butter and yoghurt. Small operational holdings, Irregular topography with terraced farming pattern were the apparent reasons for subsistence agricultural practices and low income.

Table 1. Characteristics of Farm Households

Characteristics	Mean/Percentage	Std. Dev.
Head's gender [male(percent)]	100	0.00
Head's age (years)	55.70	12.40
Head's education (years)	10.00	4.00
Head's farming experience (years)	20.70	13.50
Household size (individuals)	7.00	2.90
Monthly income (Pakistani Rupees)	55777 ($533.8)	31155 ($298.1)
Farmland area (acre)	1.10	0.50

1 Pakistani Rupee = 0.0096 U.S. Dollars

On Farm Soil Erosion and Agricultural Productivity

Sampled farm households were asked questions on their on-farm soil erosion. Around 74 percent of the farm households reported frequent soil erosion caused by intense rainfall and floods in summer season. Most of them were practicing terraced farming on high, but irregular slopes. The intensity of on-farm soil erosion was investigated on a scale of low, moderate and high erosion. Moderate and high erosion were reported by 52 and 22 percent of the respondents respectively.

Majority of the respondents believed soil erosion as a prime cause for the reduced on-farm productivity. Yield gaps of 30 percent and 44 percent for wheat and maize respectively were found on high eroded soils in comparison to that of conserved soil in the study area. As land rent reflect agricultural productivity of a farmland, the rent per acre for a conserved agricultural land was on average 45 percent higher as compared to a highly eroded agricultural land in the study area. All these indicate the adverse effect of soil erosion on farm productivity and land value.

Farm Households' Response to WTP Question

In reply to CV question for reforestation and afforestation on communal and state owned land, 95 percent

of the selected farm households were willing to pay for the program. This high response rate among farming community was because of widespread soil erosion in the study area and its adverse effects on farm productivity and returns. The mean annual stated WTP was Rs.3533per household. This amount was 6.3 percent of their total annual income which confirms the validity of their stated WTP response. Table 2 further distributeshouseholds' WTP response with reference to on-farm soil erosion intensity. The annual WTP for households facing zero-low, moderate and high on-farm soil erosion were Rs.1391, Rs.3511and Rs.6050, respectively. The positive WTP forfarm households facing zero-low erosion isgood example of Warm-glow phenomenon1 described by James Andreoni in 1989.

Table 2. Household Stated WTP for Soil Erosion Control Program

Categories	Observations	Mean Annual WTP (Pakistani Rupees)	Std. Dev.	Min	Max
Household facing zero-low erosion	46 (26%)	1391 ($14)	1316	0	4000
Household facing moderate erosion	94 (52%)	3511 ($34)	1702	500	6000
Household facing high erosion	40 (22%)	6050 ($59)	1709	3000	8000
Average WTP per household	180 (100%)	3533 ($34)	2274	0	8000

1 Pakistani Rupee = 0.0096 U.S. Dollars

Determinants of Farm Households' WTP

The estimatedfarm household's WTP model for soil conservation on communal land is given in Table 3. Most important determinants of farm household's WTP are intensity of on-farm soil erosion, farmland size, contact with extension agent, head's education and farming experience and total monthly income.

Intensity of on-farm soil erosion: The estimated coefficients for moderate and high on-farm erosion are positive and statistically significant which indicate that farm households facing moderate or high erosion are likely to pay more for the soil conservation program on communal land.

Farm size: As indicated by the positive and statistically significantcoefficient for farm size households having larger farms are likely to pay more as compared to others. The coefficient value shows that an increase in farm size by 1 acre would increase farmer's WTP for the program by Rs. 18.46 PKR.

Contact with extension agent: Extension education may enable farmers to better understand the impact of soil erosion on their productivity and how large scale forestation program can help in conserving soil and water resources. Thus farmers receiving extension education were expected to have high WTP for the program. The estimated coefficient for contact with extension agent is positive and significant, which is in accordance with prior expectations. This result is in line with findings of Tafa et al., 2008; Teklewold and Gunner., 2010; Gebremariam et al.; 2013 and Meseret D., 2014.

Head's education and farming experience: In Pakistani society a household head controls their common material resources and takes major decisions. The estimated coefficients for head's education and farming experience are positive and statistically significant, showing that a farm household's WTP for soil conservation increases significantly with their head's educated level and farming experience.

Household's monthly income: As income increase people start care for natural and environmental resources. Household's income has a positive significant coefficient, which is consistent with Shah et al., 2016 and Janku et al., 2014 findings.

1It explains that some people give donation to charitable trust and community development works simply because of getting satisfaction from helping others.

Table 3. Estimated Farm Household's WTP Model for Soil Conservation

WTP determinants	Coefficient	T-value	P value
Moderate erosion (1 if yes, otherwise 0)	1274.30	5.26	0.000
High erosion (1 if yes, otherwise 0)	4192.69	14.56	0.000
Farm size (Acre)	18.46	1.82	0.072
Contact with extension agent (1 if yeas)	1613.46	3.02	0.000
Head's education (years)	38.34	2.65	0.009
Head's farming experience (Years)	11.78	1.90	0.061
Household monthly income (PKR)	0.03	8.17	0.000
Household size (Individuals)	-40.53	-0.89	0.370
Constant	-491.84	-1.10	0.270

F(8,171) = 54.3, Prob>F = 0.000, R-squared = 0.7175, Adj. R-squared = 0.7043
1 Acre = 0.405 Hectares
1 Pakistani Rupee (PKR)= 0.0096 U.S. Dollars

Estimated Aggregate Willingness to Pay

The accumulatedbenefitsto a farm household from such on-farm soil erosion program through forestation were calculated to be Rs.22358 ($214), using a suitable discount rate of 12%2and keeping the annual WTP of thefarm household as constant over the lifespan of 10 years of the program as shown in Table 4. This aggregate WTP measures the value of on-farm erosion control benefit of a farm household andsignifies to the existence of sufficient potential for raising funds from the local stakeholders through donations for financing the implementation of proposed soil conservation program in Northern areas.

Table 4. Present Value Aggregate WTP for Soil Conservation Program

Assumed project life	Assumed discount rate	Present value aggregate WTP per household (Pakistani Rupees)
10 years	12 percent	22358 ($214)
10 years	11 percent	23096 ($221)
10 years	10 percent	23880 ($229)

1 Pakistani Rupee = 0.0096 U.S. Dollars

3. Conclusion and Policy Recommendations

Small operational holdings, Irregular topography with terraced farming pattern of agriculture were the apparent reasons for subsistence agricultural practices and material yield gaps were observed in wheat and maize farming leading to a decreased rent of 45 percent eroded soils in comparison to the conserved ones. The discrepancy in rent provides a sound rationale for the initiation and launchingof a community based soil conservation program in the study area.Thewillingness to pay as well as aggregate benefits to a farm household over a span of ten yearssuggests that sufficient potential exists for raising fundsin the forms of donations and other mandatory paymentsfrom the local stakeholders for the implementation of community based soil conservation program through proper mobilization

On-farm soil erosion intensity, head's education, farming experience and perception of soil erosion, monthly income, farmland size and contact with extension agents are the important determinants of farm household's stated WTP for soil conservation program.

Reforestation, afforestation and adoption of techniques like terracing, ditching, fencing and trees plantation on farmlands are suggested for controlling soil erosion and land sliding in the study area.

2In Pakistan, the Ministry of Planning and Development use 10–12 % discount rate. CVM studies in developing countries have used discount rate in the range of 3–12%. The high discount rate for environmental goods means the publicunderestimate the importance of future benefits from environmental goods, and also demonstrates that they prefer to take short term actions on environmental restoration and protection.

The Agricultural Department, Pakistan Forest Department and other non-government organizations, such as USAID and National Rural Support Program (NRSP) can play key role in educating and mobilizing farmers.

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