WILLINGNESS TO PAY FOR WATERSHED SERVICES BY DOWNSTREAM WATER USERS IN BABATI DISTRICT, TANZANIA

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ABSTRACT

The study was done to determine the willingness to pay (WTP) for improved watershed services by downstream water users in Babati District using contingent valuation method in the form of close and open-ended WTP questions. Specific objectives were (i) to assess the level of awareness of the downstream water users on the importance of watershed in the provision of sustainable water supply (ii) to estimate willingness to pay for watershed services by the downstream users (iii) to analyse factors that affect willingness to pay (iv) to examine the possible operational mode for instituting the payment of watershed services mechanism. A cross sectional research design was adapted for this study. Both primary and secondary data were collected from Babati District. Purposive and random sampling techniques were used to obtain respondents who comprised of 155 domestic water users and 50 non-domestic water users. The data was analysed using descriptive and inferential statistics. The results indicated that more than 50% of both water users have awareness on the importance of watershed in the provision of sustainable water supply. Also 71% of domestic water users and 82% of non-domestic water users are willing to pay for improved watershed services with mean WTP of TAS 1 261 per user/year and TAS 112 322 per user/year respectively. The factors that significantly influence water user's WTP include gender, occupation, education and farm size. Income is significant for non-domestic water users, however it appeared to be insignificant for the case of domestic water users. The study reveals that, the preferred basis of charging and collection mechanism of the watershed management and protection fee for both users was the same amount of payment and a separate agency/office to collect the fee. The study suggested that the amount respondents are willing to pay may serve as base for water user fee that may be collected from downstream water users in Babati district as buyers of watershed services.

DECLARATION

I, EVERLYN ESTOMIAH SWAI, hereby declare to the Senate of Sokoine University of Agriculture that this dissertation is my own original work done within the period of registration and that it has neither been submitted nor being concurrently submitted for degree award to any other institution.

_____ _____

Everlyn Estomiah Swai Date

(MSc. ENAREC)

The above declaration is confirmed by:

_____ _____

Prof. J. F. Kessy Date

(Supervisor)

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DEDICATION

This dissertation is dedicated to my parents, Eng. Estomiah Swai and Mrs. Elin Swai, my beloved young sisters Kwasmo Swai, Emmy Swai and Edna Swai for their love, encouragement and laying strong foundation of my education. I also wish to dedicate this dissertation to my best friend and love Deogratius Gervas Katwana for his comfort, love, patience and continued support throughout my academic journey.

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LIST OF ACRONMY AND ABBREVIATIONS

CBFM	Community Based Forest Management
CV	Contingent Valuation
CVM	Contingent Valuation Method
ENAREC	Environment and Natural Resource Economics
FGD	Focus Group Discussion
NFR	Nou Forest Reserve
NOAA	National Oceanic and Atmospheric Administration
PES	Payment for Ecosystem Services
PFM	Participatory Forest Management
PWS	Payment for Watersheds Services
REDD	Reduced Emission from Deforestation and Degradation
SPSS	Statistical Package of Socio-science
STATA	Statistical Software
TAS	Tanzanian Shillings
WTP	Willingness to Pay

WORKING DEFINITIONS OF SELECTED TERMS

Contingent valuation method:	Is a tool which allows people to express the value they place on non-marketed goods or services through the creation of hypothetical market
Domestic water users	These are the ones who uses water for household purposes such as cooking and washing.
Non-domestic water users	These are the ones who use water for commercial purposes such as sugar companies and small paddy rice farmers
Willingness to Pay:	Is the maximum amount an individual is willing to sacrifice to procure a good or avoid something undesirable

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Payment for watershed services (PWS) is a direct conservation approach that seeks to support the positive environmental externalities through the transfer of payments from the beneficiaries of the environment services to those providing these services that are usually the upstream communities (Maryrand and Paquin, 2004). PWS strives to give monetary value to ecosystem services by reimbursing providers (upstream communities) for their direct or indirect product manifested in their maintenance of ecological services (Branca *et al*., 2009).

The use of PWS to promote watershed management i.e. payment for watershed services (PWS) encourages the upstream land management practices to help protect or improve the quantity and quality of water downstream and thus this scheme is increasingly regarded as a viable policy alternative for resolving watershed management problems (Wunder, 2007). PWS are schemes that use funds from water users as an incentive for land holders to improve their land management practices. The watershed services are provided by land and water managers in the upstream whose decision, either individually or collectively has impact on flow regimes and quality & quantity of water available downstream (Maitre *et al.,* 2001). The downstream water users are those whose interests and livelihood depend directly or indirectly on the amount available and on the level of sediments, nutrients or other chemicals in the water (Johnson *et al*., 2000). The direct benefits of watershed services include, for example, timely availability of high quality water for irrigation or drinking water supply. Indirect benefits include the appropriate flow regimes to maintain a downstream wetland that supports a subsistence, commercial

or recreational fishery. The Babati District whose water sources are provided by the Nou Forest Reserve, is one of the areas where this mechanism can bring positive results.

The Nou Forest Reserve (NFR) covers the head waters areas of Lake Manyara and a highly productive rift valley plain which sits directly below the forest. The rivers within the forest are the major source of water used by inhabitants (household use), livestock and for agricultural irrigation farms found at the immediate as well as distant locations (Geonet work limited, 2014). Commercial coffee, sugar cane estates and irrigated rice paddy which are found at the base of the rift valley also depend on water supply from the rivers in the forest. Introduction of PWS schemes in the Nou Forest Ecosystem has been considered as important for the management and conservation of the watershed provided by the forest. Thanks to several projects conducted in the area for example PFM and improving livelihood strategies; the farmers in the upstream are engaging in improved land management practices i.e. village land use planning, and setting aside lands for forest developments (CBFM), improved grazing management, conservation agriculture and agroforestry (Kessy and Abdallah, 2013).

These activities create a healthy environment in the catchment, including the hydrological flow regimes that also benefit the downstream communities through reduced siltation and improved water flow and availability. PWS is there to bring together the upstream communities who are engaged in improved land management with downstream communities that benefit from the work of upstream communities in order to support each other in ensuring the management of NFR (Engel *et al*., 2008). Thus, this study seeks to determine the willingness to pay for watershed services by the downstream water users in Babati District for conservation and management of NFR.

1.2 Problem Statement and Justification

1.2.1 Problem statement

Willingness to pay for ecosystem services including watershed services have attracted attention of many scholars in different part of the world at large. Good examples include "Willingness to Pay for Carbon Sequestration and Co-Benefits of Forests in Turkey (Tolunay and Bassullu, 2015), Willingness to Pay for Biological Diversity Conservation in Simbu Province, Papua New Guinea (Ezebilo, 2006), Willingness to Pay towards the Conservation of Ecotourism Resources at Gunung Gede Pangrango National Park, West Java, Indonesia (Nuva and Shamsudin, 2009), The willingness to pay for the conservation of wild animals: Case of the Derby Eland (Taurotragusderbianusgigas) and the African wild dog (Lycaonpictus) in North Cameroon (Tsi*et al.,* 2008), Estimating willingness to pay for recreational services of two public parks in Peshawar, Pakistan (Khan *et al.,* 2014) and Exploring the willingness to pay for forest ecosystem services by residents of the Veneto Region (Gatto *et al.,* 2014)". This may be due to important role ecosystem services play in the lives of many people in general.

Studies have been conducted regarding willingness to pay for watershed services in particular, for example "Willingness to Pay for Irrigation Water: A Case Study in Northwest China (Tang *et al.,* 2013) and Citizens' Willingness to Pay for Improved Sustainable Water Supply in a Medium-Sized City in South Western Nigeria (Olajuyigbe, 2010)". However, despite the success on payment for watershed services projects in different parts of the world, literature shows divergence with regard to willingness to pay for watershed services among the communities in various places. For example, the study by Behailu *et al*. (2012), who investigated the willingness to pay for improved water services among water users in Shebedino District in Southern Ethiopia found that 1% of respondents showed their willingness to pay while 99% were not willingly to pay for

improved water services. On the other hand, the study by Ndetewio *et al*. (2013) in lower Moshi, Pangani Basin in Tanzania on willingness to pay for watershed services for the improved water quality and quantity among small scale farmers particularly in irrigation scheme revealed that about 79% of the farmer respondents were willing to pay an additional fee as compensation to the land owners near catchment forests in return for improved water quality and quantity. However, about 21% of the respondent were not willingly to offer any additional payment from what they are currently paying through the water user rights. This implies that willingness to pay for watershed services is a site specific aspect if the project is to be implemented sustainably (Wunder, 2007). Also capturing amount which the downstream water users are willing to pay the upstream communities is one of important aspect in the planning stage of the project to a line itself with the local situation as a means for sustainability. Since Nou Forest Reserve (NFR) is reported to provide water sources in Babati district (Sangeda and Mosha, 2011), it stands out as an opportunity for establishment of Payment for Watershed Services (PWS) to ensure conservation and management of this reserve.

Although NFR is considered an important water source for many rivers in the area, the decrease in water quality and quantity from the rivers have been marked by water users in the area. The decline is a result of human activities carried out by upstream communities which imposed impact to water quality and quantity (Sangeda and Mosha, 2011).

However, it is not known if all downstream water users in Babati disrict are capable and willing to pay additional tarriffs for their use of watershed service. Neither is it known to what level the downstream water users are aware on the importance of watershed in provision of sustainable water supply. Also the operational mode of payment and the factors that influence the willingness to pay (WTP) are not clearly known. This study therefore is an attempt to fill these gaps.

1.2.2 Justification of the study

PWS mechanisms are considered to be sustainable alternatives for financing conservation undertakings while improving community livelihoods. The study demonstrated the existing potentials for adopting PWS in Babati District as one of the pilot areas in the country and give lessons that can be used for scaling up PWS applications in other parts of the country. The study provided data which would serve as a basis for collection of water user fee under PWS scheme in NFR and gave more insights of how payments for watershed service can be established and operationalized in the country. It also added into the existing knowledge about payments for water services in Tanzania.

1.3 Objectives

1.3.1 General objective

The overall objective of this study was to determine the willingness to pay for watershed services by the downstream water users in Babati District for the conservation of NFR and improved societal welfare.

1.3.2 Specific objectives

The specific objectives of the study included;

(i) To assess the level of awareness of the downstream water users on the importance of watershed in the provision of sustainable water supply.

(ii) To estimate willingness to pay for watershed services by the downstream users.

(iii) To analyze factors that affect willingness to pay.

(iv) To examine the possible operational mode for instituting the payment of watershed services mechanism in Babati District.

1.4 Research Questions

(i) What is the extent of awareness of the downstream water users on the importance and roles of watershed services in the provision of sustainable water supply?

(ii) How much are the downstream water users willing to pay for improved watershed services?

(iii) What factors affect the willingness to pay of downstream water users?

(iv) What is the possible operational mode for instituting the payment of watershed services mechanism?

1.5 Conceptual Framework

According Miles and Huberman (1994) a conceptual framework is used in research to outline possible courses of action or to present a preferred approach to an idea and it represent key ideas and complex interactions of a number of important constructs on the outcome variables.

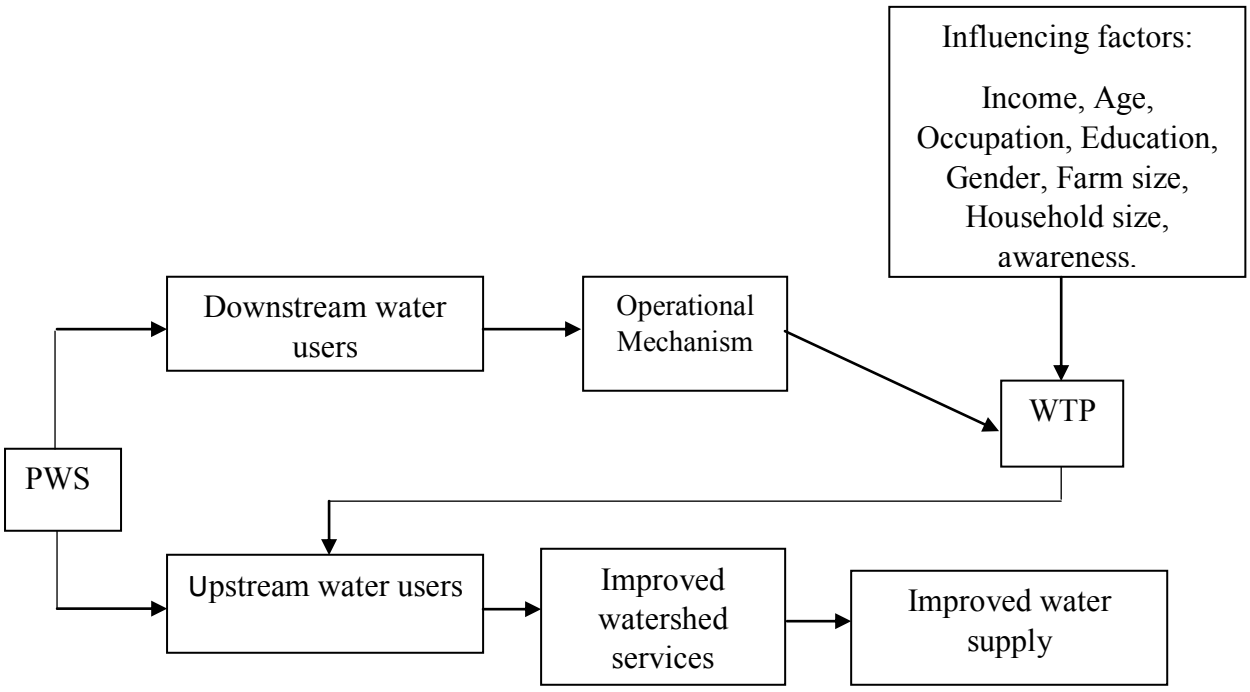

Figure 1: Conceptual framework of the study

PWS brings together the upstream communities and downstream communities to support each other in ensuring the management of watershed. Watershed services are provided by the upstream communities whose decision either collectively or individually has impact on flow regimes, quality & quantity of water available to downstream water users (Maitre *et al.,* 2001). In such a case, the paid funds from downstream water users will be used as an incentive for the upstream communities to improve their land management practices (Vargas, 2004). The collection of these funds is based on an operational mechanism of which determines the preferred options in instituting modalities for making the scheme functional by the downstream water users who were WTP for improved watershed services. Willingness to pay by downstream water users may be influenced by socio-economic factors such education, income, age, gender, farm characteristics and household size (Vargus, 2004). Awareness on the importance of watershed in the provision of sustainable water supply may also influence downstream water users willingness to pay for watershed services.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Awareness of Beneficiaries on Watershed Management

Awareness is the knowledge or perception of a situation (Gatto *et al.,* 2014). The local communities and their institutions should be aware of ecosystems services, their declining status and methods of sustaining the ecosystem (Ezebilo, 2006). This market awareness can help link the upstream and downstream communities and thus easy adoption of PWS schemes. Downstream water user's willingness to pay is driven from: the increased awareness on the economic importance of environmental services; growing awareness of threats to supply of environmental services and improved methods for monitoring status, impact and consumption of environmental services (Landell-Mills, 2002). Presence of awareness on ecosystem services and the role PWS by the community can contribute to the halting of resources degradation in both the protected areas and in its vicinity; improve functioning of PWS by adopting ecosystem services production methods and contribute to sustainable protected financing in the protected areas and outside with people having incentives to conserve.

People's awareness on environmental services varies among the sources cited. A study by Amponin *et al.,* (2007) conducted in Tuguegarao city on willingness to pay for watershed protection by domestic users revealed that most respondents are not aware of the watershed concepts presented to them. The respondents who knew about the watershed were also asked for their view regarding the importance of protecting it and majority agreed to the value of keeping it. The reasons why watershed protection is viewed as essential include providing sustainable water supply and improving water quality. Its role in controlling floods and soil erosion was also recognized by the sample respondents

respectively. The watershed role in preserving biodiversity was cited by a small number of respondents (Amponin *et al.,* 2007).

The study by Calderon *et al.* (2006) Metro Manila in Philippines shows that most respondents who were aware about watersheds thought that they are primary source of water and that good forest cover is necessary for them to function well. There were fewer respondents who knew that watershed provide tangible economic and ecosystem services. Another study in Layawan watershed in Oroguieta city in Philippines shows that more than half of respondents knew what watershed is (Calderon, 2013). In Tanzania, a study conducted in Bagamoyo District by Mshigwa (2014) has indicated that almost 98% of the respondents have high level of awareness about Wami basin as a watershed. This implies that the water users have great appreciation on its importance and are more WTP for its improvement. According to Mwanyoka (2005), a fairly big number (95%) of the respondents in Tanga know the importance of conserving Sigi River catchment and just 5% said they don't know.

Therefore awareness of watershed services and supporter of payment scheme need to share their vision for new incentives that can support economic resources and sustainable use of resources (Mshigwa, 2014). Also total economic value of ecosystem is a very useful instrument for raising awareness of the importance of watershed services to human society and for increasing the acceptability of payment scheme (Prokopy *et al.,* 2009).

2.2 Willingness to Pay for Watershed Services

Willingness to pay is estimated using Contigent valuation methods (CVM) in many studies (Tanellari *et al*, 2015). Economist argue that the criteria used by welfare economist to judge a given policy is whether that policy is Pareto-optimizing, that is if an

action has “winners” (those whose quality of life is improved by the action) and “losers” (those whose quality of live is diminished by the action), it is possible that such a situation could exist where the winners could potentially compensate the losers and still have a gain remaining (Loomis, 2002). According to this criterion, the pareto-optimal condition in the management of watershed could be achieved if gainers which are downstream water users compensate the losers which are upstream communities and still the utility of the gainers remain constant by improved watershed services.

CVM is a valuation based on a questionnaire that offers the respondents an opportunity to make an economic decision on a good, which no market exists. That is, the valuation is contingent upon the simulated market presented to the respondents. The CVM attempts to elicit the maximum willingness-to-pay (WTP) of the potential service user for an environmental good or service (Wedgwood and Sansom, 2003). Its application in environmental economics consists of estimation of nonmarket use value and non-use values or both of environmental resources (Venkatachalam, 2004). The basic assumption underlying in this method is to represent or valuing the objective quality improvement that the survey asks them to value. This is the technique which was used in this study. The guidelines prescribed by the National Oceanic and Atmospheric Administration (NOAA) panel (Francisco *et al.,* 2002) are recommended in the conduct of this study to address reliability issues on information derived from CV studies.

Different studies have estimated values non-market water related ecosystem services using CVM. Welle and Hodgson (2011) estimated the WTP of property owners for restoring lakes in two watersheds in Minnesota using CVM. Calderon (2013) used CVM to find a WTP of Php 57.48 and Php 53.89 per household per month for Improved Watershed Services of the Layawan Watershed in Oroquieta City, Philippines. Fujita *et*

*al., (*2005) used CVM to estimate the WTP for Water and Sanitation Services in in Iquitos City, The Republic of Peru. In addition, Tang (2013) found the WTP for irrigators in Northwest China are WTP 80.4 RMB/mu/year for irrigation water.

In Shebedino District in Southern Ethiopia, CVM was used to estimate the household's willingness to pay for improved water services and the study provided the amount that the household would be WTP per month (Behailu *et al.*, 2012). The study results also revealed that 1% of respondents showed their unwillingness to pay for improved water services. This might be because water is a public good and natural property and should be given freely. Other reasons given by respondents were: they were already paying taxes and any fee should be taken from these payments; they did not trust the government because of corruption; the private sector should pay and the payment should be voluntary (Calderon *et al.*, 2006).

Bautista (2003) provided explanations on willingness to pay of beneficiaries for watershed protection services. Beneficiaries would likely be willing to pay if there are threats to their present water supplies; if future supplies are uncertain and they would like to guarantee their future needs; if there is an explicit policy mandating users to pay and the government is capable of enforcing such a rule, thus, discouraging free-riding; if utility of the service to their economic activities is clearly realized; and if there is confidence on the proper use of funds. Also Amponion *et al*., (2007) showed that 78 percent of respondents specified that they would like a more reliable water supply and 21 percent valued watershed protection for the sake of future generations. Other reasons cited include wanting the PPLS or the watershed not to be destroyed (12%), wanting the watersheds to continue production of environmental services (7%), believing that

watershed protection would benefit everyone (4%), wanting to help (3%) and acknowledging that it is their duty as water users (2%).

A study by Ndetewio *et al*., (2013) in lower Moshi in Pangani Basin indicated that about 79% of the farmer respondents are willing to pay an additional fee as compensation to the land owners near catchment forests in return for improved water quality and quantity. The respondents agreed to pay additional fee but with different bids. On the other hand, about 21% of the respondent refused to offer any additional payment from what they are currently paying through the water user rights. They argued that although they are currently paying for irrigation water, they are not getting good service, so they were not ready to pay any additional amount of money until they are get assured of reliable water supply.

Contingent valuation has a number of strengths. First, it can be used to value multiple destination recreation trips, as many other non-use valuation tools cannot (Loomis, 2002). Second, contingent valuation is hypothetical in nature, so it can be used to measure the effects of an irreversible change without actually making the change (Loomis, 2002). Third, it can be used to measure option values, or the value that one places on a resource for the option of having it to use in the future (Loomis, 2002). Finally, it is the only method that can measure bequest value, which is the value one places on a resource in order to be able to pass it on to future generations, and existence value, which is the value one places on a resource just for knowing that it exists (World Bank Institute, 2002).

Despite these strengths, there are a number of problems with contingent valuation. Whittington (2002) enumerated three reasons why is this so: poorly executed contingent valuation (CV) survey, weakly constructed CV scenario, and poorly designed CV study

resulting to failure in testing effects of variations in the design on the results of the survey. Gunatilake (2007) identified steps to come up with a successful CV study. These steps address the criticisms on the method.

CVM implementations can differ in the elicitation technique used, i.e., in the way how the respondent is prompted to state her/his WTP (Venkatachalam, 2004). There are three common methods for this. The first is open-ended elicitation technique, where the respondents are directly asked to state their maximum WTP. Although simple to implement, the method is prone to several biases. For example, respondents may try to manipulate study outcomes by stating unrealistically high or low WTP figures i.e. strategic bias (Mitchell and Carson, 1989).

The second method is iterative bidding. The questioner asks the respondent if he would be willing to pay, for example, $10 more a year for improved water quality. If the respondent answers affirmatively, the questioner continues to increase the bid until the respondent answers no (Loomis, 1987). The third and most accepted method is dichotomous choice or referendum where the respondent is asked whether he/she is willing to pay a specific amount of money for a particular goods or service. Respondents are supposed to answer only “yes” or “no”. Such an elicitation format mimics day-to-day market decisions (to buy or not to buy a specific product) more closely than the open-ended technique, and can reduce strategic bias (Mueller, 2014). So, a dichotomous choice framework is used in this study as recommended by Carson *et al.,* (2003).

2.3 Factors Influencing Willingness to Pay

Several studies have shown a positive relationship between income and WTP for environmental services. Kulindwa (2005) noted that income emerged to be the most

important factor which influenced the Pangani Basin Domestic Water User's willingness to pay for environmental services. Vargas (2004) noted that farmers with high income were willing to pay more for watershed environmental services. Also farmers relying mainly on agricultural products for their incomes have stronger WTP (Vargas, 2004). However, Ogunniyi *et al.,* (2011) shows that household income had negative and statistically significant impact on WTP for improve water quantity.

According to Ma (2012), farmer's willingness to consider PES chiefly depends on farm and farming characteristics. Farmers with big plots are expected to indicate big amount of money to pay compared to those with small plots. Age was positive but not sufficient to influence WTP (Ma, 2012). WTP for watershed service is also likely to be influence by family size and number of people in the area (Ndetewio, 2013). Big family size demand large quantity of food and therefore need for high productivity per unity land through irrigation and thus influence farmer's WTP. The study by Junaid (2009) also finds the educational level is an important factor determining the WTP for improved watershed services. Better educated people may better understand the relationship between forest cover and water. Educated people could also perceive better the future risk of reduced water flows on crop production and hence may understand the importance of payment for watershed services as a tool to improve forest conservation (Amponin *et al.,* 2007).

Mahirah (2012) shows that education, household family size and age of respondent are variables that had a negative influence on consumer's WTP for domestic water services in Kelantan Indonesia.

2.4 Operational Mechanism

Operational mechanisms refer to institutional arrangements and structures required to operationalize PWS schemes. They range from responsible institutions in operating the

scheme, lines of accountability, contribution collection and management structures and benefit sharing mechanism. Operational mechanism depends on what stakeholders perceive to be the best options in instituting modalities for making the scheme functional. Water users can make their payments in various forms such as using tax system. Service providers on the other hand can get payments in terms of cash (e.g. subsidies, certificates, credits) or in-kind (technical assistance, equipment) (Calderon, 2013).

According to Lee and Han (2002), the selection of a realistic payment vehicle *i.e.*, how respondents pay the WTP amount in CVM is very important. Taxes and donations are often used as payment vehicles associated with preservation values (Lee and Mjelde, 2007). However, donations are more useful payment vehicles for contingent valuation because they provide a reasonable approach for estimating the economic value of small-scale public goods, while respondents may object to mandatory payment schemes *i.e.* entrance fees or taxes (Champ *et al.,* 1997). Kong *et al.,* (2014) used donation as the payment vehicle in his study while Hite *et al.,* (2002) used federal tax returns as the payment vehicle. On the contrary, the preferred collection mechanism by the respondents in Calderon *et al*., (2007) was any payment to be added to the monthly water bills. Also payment vehicle used in the study of Amponion *et al.,* (2007) was a surcharge to the water bill. This obligatory payment avoids the free-rider behaviour typical of voluntary payments (Carson, 1997).

The payment vehicle can also be changed from a monetary fee to a (non-monetary) contribution of labour hours to operate, maintain, and manage the improved water system (Vasquez, 2014). Ahlheim *et al.,* (2010) argue that labour should not be used as a payment vehicle in contingent valuation studies because labour cannot be converted into utility as easily as money. However, in areas with subsistence economies, housework may

be the primary vehicle to obtain goods that increase households' utility. Ahlheim *et al*., (2010) also indicate that empirical estimates of willingness to work depend on the kind of labour to be done and the circumstances under which it has to be provided. Thus (Vasquez, 2014) reported that respondents were willing to work approximately 19 h per month for improved services when labour hours was proposed as payment vehicle.

A study by Ndetewio *et al*., (2013) indicated that more than half (59%) of the respondents have given priority in choosing increased water user fees as a mode of payment in collecting compensation of water service. Such method of payment has been used also in Cauca Valley (Columbia), downstream water association voluntary agreed to increase the user fee paid to Cauca V alley Association in order to improve the watershed management in the upstream. On the other hand other respondents preferred direct cash payments and direct debit.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area

This study was conducted in Babati district. The District is one of five districts in the Manyara Region of Tanzania. Babati district consists of four divisions, 21 wards and 82 villages. The district covers an area of 6 069 km^2 (2343 sq mi), a large proportion (640 km^2) of which is covered by the water bodies of Lake Babati, Lake Burunge and Lake Manyara. The district is bordered to the north by Arusha region, to the south east by Simanjiro district, to the south by Dodoma region, to the south west by Hanang district, and to the north west by Mbulu district (Löfstrand, 2005). According to the 2002 national census, the district has a population of 303 013.

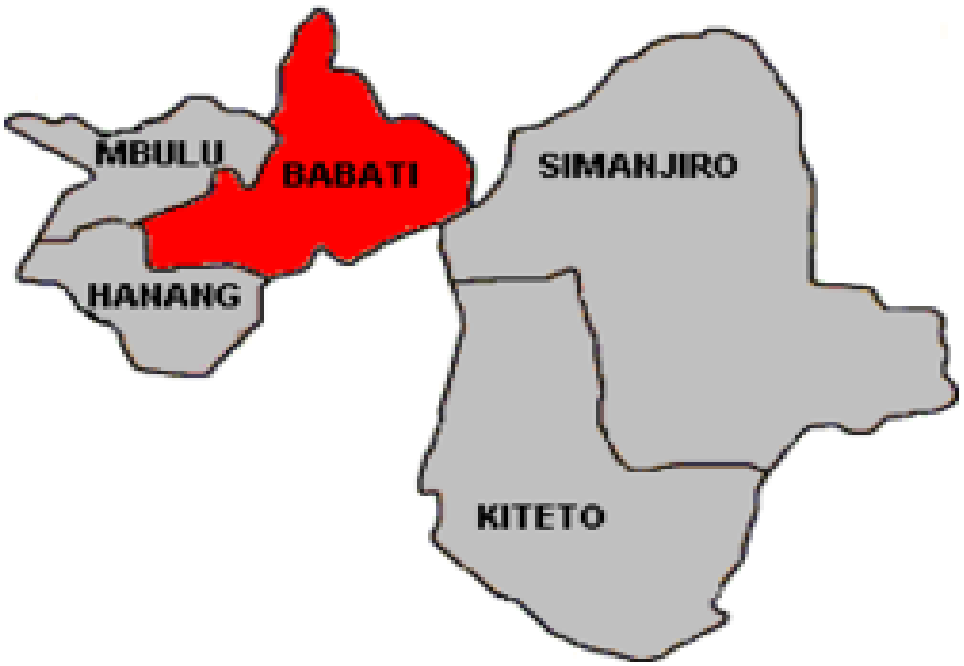

Figure 2: **Map of Manyara Region showing Babati district in red colour (Source): Löfstrand, 2005**

3.2 Economy

About 90% of the population of Babati District live in the rural areas and depend on agriculture and livestock for their livelihood (Kavishe, 2013). They are mostly small-scale farmers or agro-pastoralists practicing a semi-traditional farming system characterized by low use of farm inputs. Mixed crop-livestock, mostly maize-based systems are widely found in the district that are intercropped with varying species, such as common beans, pigeon peas and sunflowers, according to altitude and rainfall availability (Kavishe, 2013). In the lowlands, paddy rice is cultivated where irrigation is available. Livestock comprise local breeds of cattle, sheep, goats, chickens and pigs. Cattle are widely used for draught, for example pulling carts or ploughing fields (Kavishe, 2013).

3.3 Vegetation

The vegetation of Babati district is dominated by evergreen fig, mahogany trees and the jungle-like groundwater forest is the only accessible habitat of its type in East Africa. Other terrestrial habitats include the grassy lake floodplain, the rocky rift valley escarpment and the ribbon of dense acacia woodland that divides them (Jonsson, 1996).

3.4 Climatic Conditions and Hydrology

Babati district is divided by the Dabil-Dareda escarpment of the Rift Valley, providing diverse climatic and agro-ecological conditions due to a wide range of altitudes from 950 m asl. to 2450 m asl (Bishop-Sambrook *et al.,* 2004).The rains are bimodal and the short rains begin in November and end in December/January period, while the long rains begin in February and end in May (Bishop-Sambrook *et al*., 2004). This shows that the two rain season are connected.

A number of permanent rivers such as Erri, Nambis, Gilawu, Bubu, Endamanang and Dongobesh and streams such as Endayaya, Endallaha, Yaeda, Gidng'ata, Bimbili (FARMAfrica, 2014) originates from NFR. These rivers and streams are the major source of water used by inhabitants, livestock and for agricultural irrigation farms found at immediate as well as distant locations (FARMAfrica, 2014). Several rivers from the forest empty into Manyara, Eyasi and Balangida salt lakes found at the foot of the rift valleys.

3.5 Target Population

The target population of this study was Babati district downstream water users with a focus on the domestic water users, big commercial sugar cane farmers, small paddy rice and cereal crops farmers, Lake Manyara Park, small holder farmers and big ranch.

3.6 Research Design

This study employed cross-sectional research design on collecting empirical data from Babati District. The main advantage of using cross-section research design is because it requires little resource (Bailey, 1995). Also the cross-section study design provides useful data for simple statistic description and interpretations (Babbie, 1995). Data were collected at a single point in time from selected sample of respondents to represent the population of Babati District. The downstream water users were used to give information on awareness on importance of watersheds, communities WTP, the factors that influence their WTP as well as the operational mode that can work on watershed management. Both quantitative and qualitative data were collected from primary and secondary sources. Quantitative data on WTP for watershed services was collected from downstream water users based on CVM principles and objective of the study.

3.7 Sample Size and Sampling Procedure

The study comprised of two sample units, domestic water users and non-domestic water users due to variation in consumption demand. Multistage sampling technique was used in selecting the domestic water users because it facilitates sampling from a large population. The first stage involved selection of four wards out of 21, in which (Dareda, Alaghai, Magugu and Magara) were purposively selected as they have water originating from Nou Forest Reserve. At the second stage, one village from each ward (Dareda Kati, Seloto, Mawemairo and Manyara) were also selected purposively based on the fact that this villages has community which depends on the water from the forest for their domestic uses. The final step involved the selection of village households using simple random sampling.

The sample size of 155 domestic water user (Table 1) i.e.5% from the population of villages was taken as a representative sample for this study as per formula of Boyd *et.al*.

(1981) $C = \frac{n}{N} \times 100$ ..... (1)

Where C represents a figure greater or equal to 5% of the village population, N is the total population in the villages and n is the number of sampled domestic water users. The 5% was only sufficient provided that the sample size was not less than 30.

For non-domestic water user, 50 water customers/users were purposely sampled from the wards as described by Bailey (1995) that 30 cases is the minimum recommended number enough to represent a population under study.

Table 1: Sample size summary table

Region	District	Ward	Village	H/H Population	Downstream water users to be interviewed
Manyara	Babati	Alaghai	Daredakati	1024	55
		Dareda	Seloto	672	34
		Magugu	Mawemairo	588	31
		Magara	Manyara	716	36
Total				**3000**	**155**

3.8 Data Collection Methods

3.8.1 Primary data collection

Primary data was collected directly from the field using face-to-face interview with water users based on questionnaires for WTP and focus group discussion.

3.8.1.1 Pre-testing of CV questionnaire

The preliminary survey was conducted by researcher to be familiar with the study area and preliminary data was collected to acquire general information on watershed and water consumption. The pre-testing of questionnaire (in one of the hamlet) was administered to ten respondents. According to Mitchell and Carson (1989), pre-testing of CV questionnaire is useful way to check the validity and reliability of questionnaire.

3.8.1.2The Questionnaire survey

Administration of questionnaire was the responsibility of the field researcher. The questionnaire had four parts. The first part asked the respondent for background information particularly details on their socio-economic characteristic while the second part asked respondent on awareness about watershed. The third part assessed the respondent's WTP for improved watershed services. At this point respondents were presented with information about water supply situation in Babati district, the role of forests and watershed in sustainable water supply and the proposed payment system. The

CV questions were also be presented. The fourth part assessed which operational mode the respondents would prefer for instituting the payment for watershed services.

3.8.1.3 Focus group discussion

According to Carson (2001) focus group discussion provides a way to gather information to better understand how people feel or think about a given phenomenon. Two focus group discussions (FGDs) of non-domestic and domestic water users were conducted to gain insights from the downstream water users on awareness on the role of watersheds in providing sustainable water supply, factors influencing WTP and the preferred operational mode. For domestic water users, the members included purposively were village's leaders (village chairperson, village executive officer, environmental committee leader) and three villagers whose household were not included for household survey were selected randomly. For non-domestic water users, one respondent from each unit was selected randomly for discussion to represent the unit. The FGD participants were asked whether they would be willing to pay for improved watershed services. Those who answered "yes" were asked an open-ended question about the highest amount that they would be willing to pay annually. The results of this activity were used to generate bid amounts that were used in the survey (Shah, 2002).

3.8.1.4 Method of collecting awareness information

Survey about awareness of watershed and water quality issues are increasingly being conducted, but there is no empirical evidence that one method of collecting data is superior to another (Prokopy *et al.,* 2009). In this study, briefing about watershed and its role in sustainable water supply was given. Respondents were asked a number of knowledge questions using face to face interview pertaining to protected areas, water supply issues and importance of watershed management.

3.8.1.5 CVM method in collecting WTP information

In this study a hypothetical market was set as water service is improved and watershed benefit is described. For this to be realistic and plausible, the water services and watershed benefits were properly described. Discrete choice method was applied to establish appropriate binding figure where respondents were asked to name amounts they are WTP. In this case, a dichotomous choice which does not ask an individual to state whatever amount but to "take it or leave it" with "yes or no" answer was used (Bishop and Heberlein, 1979). To increase acceptance by the respondents, a debriefing questions pertaining to the mode of payment was included in the questionnaire.

3.8.2 Secondary data

Secondary data was collected to supplement primary data. The data included the beneficiaries in the irrigation schemes who depended on the water from Nou Forest reserve for their domestic and non-domestic uses.

3.9 Data Analysis

3.9.1 Descriptive statistics

Data from CV questionnaire was statistically analyzed using Statistical Package for Social Science (SPSS). Descriptive statistics produced was used in the analysis of information on awareness of the respondent towards watersheds, socio-economic characteristics of respondents and the operational mode for instituting the payment for watershed. The respondent's descriptive statistics was used to describe data on the frequency and percentages. This is to understand and describe the variable in the data set to ensure additional quality assurance and quality control measure (Gunatilake *et al.,* 2007).

3.9.2 Inferential statistics

The WTP for a change in environmental quality was estimated with a standard probit model using Bayesian techniques. This is due to the fact that, although Maximum Likelihood estimation remains by far the most common method for estimating WTP from dichotomous-choice CV surveys, some studies have employed Bayesian estimation, including Yoo (2004), Li *et al.,* (2009) and Mueller (2013). With classical Maximum Likelihood estimations of WTP, additional simulation using methods such as the Krinsky and Robb (1986) technique is required post-estimation to obtain a distribution of WTP. In contrast, the draws of WTP post-Bayesian estimation provide a distribution of WTP without any father simulation (Mueller, 2014). I therefore choose the Bayesian estimation because of its relative convenience in obtaining a distribution of WTP post-estimation.

A STATA 11.0 package was used to run the probit regression analysis. The probit model was applied to analyse the factors that influence the willingness to pay of respondents and it was adopted due its ability to explain yes/no decision by a set of variables relating to respondents characteristics and bid price (Hanneman, 1984). Following Cameron and James (1987), the standard probit model was based on the assumption of an underlying WTP function;

$$WTP_i = Xi'\beta + \mu_i \text{…………………………………………………..………………} (2)$$

Where:

Xi'= Vector of explanatory variables

B = Vector of estimated coefficients

μ = A random error

The WTP function is not observable to the researcher, yet latent WTP is represented by the respondents' 'vote' on the WTP question. Let y_i represent the respondent's vote, i.e. 1

if ‘yes’ and 0 if ‘no’. Assume μ_i are independent and normally distributed with a mean 0 and standard deviations Ȯ, and Bid_i is the randomly assigned bid amount for each respondent $_i$. The probability of a ‘yes’ vote given the explanatory variables and random error is equal to the probability that the individual’s unobserved WTP is greater than the bid amount(Mueller, 2014). Therefore,

$\Pr(y_i = 1|X_i) = \Pr(WTP_i > Bid_i)$……... (3)

$= \Pr(X_i\beta + \mu_i > Bid_i)$……. (4)

$= \Pr(\mu_i > Bid_i - X_i\beta)$…….. (5)

$= \Pr(Z_i > \frac{Bid_i - X_i\beta}{O})$…… (6)

Where:

Z_i = the standard normal random variable

Ȯ = a variance parameter

Mean WTP was obtained using the parameter estimates from the probit. Following Hanneman (1984), mean WTP from a standard probit was as follows:

$mean\ WTP = -\alpha/\beta$Bid…… (7)

Where:

$\alpha = \beta o + (\beta_1 * \bar{X}_1) + (\beta_2 * \bar{X}_2) + \ldots (\beta k\text{-}_1 * \bar{X} k\text{-}_1)$……... (8)

For all explanatory variables except for βBid. WTP was predicted as a function of the following explanatory variables:

Table 2: Variables description and coding

Variable name	Variable description
WTP	Dependent variable (yes/no response to WTP). This takes a value 1 for yes and 0 for no
Age	Number of years of the respondent
Education	Number of years in school of the respondent
Gender	Gender, 1 if respondent is male, 0 if female
Occupation	Occupation, 1 if respondent is engaged in agriculture, 0 otherwise)
Family size	Number of individuals in the household
Income	Income of respondents (TAS)
Farm size	Hectares of the farm
Awareness	Awareness, 1 if respondent is aware with watershed, 0 otherwise

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Socio-economic Characteristics of Respondents

This part summarizes the socio-economic characteristics of the respondents which include the gender of the respondents, age of the respondents, marital status and family size, respondent education level, respondent main occupation, respondent farm size and their income level. This part is set to help provide a summary of the socio-economic characteristic that influences the respondent's WTP for improved watershed services.

Table 3: Distribution of domestic water users by their characteristics (N=155)

Variable name		Frequency	Percentage (%)
Age	18-29	31	20.0
	30-39	68	43.9
	40-49	43	27.7
	Above 50	13	8.4
Gender	Male	89	57.4
	Female	66	42.6
Education level	No formal education	18	11.6
	Elementary level	8	5.2
	Primary level	68	43.9
	Secondary level	50	32.3
	Vocational	11	7.1
	University/College level	0	0
Marital status	Single	39	25.2
	Married	116	74.8
Occupation	Agriculture	143	92.3
	Livestock keeping	5	3.2
	Formal Employment	7	4.5
Family size	1-3	46	29.7
	4-6	73	47.1
	7-8	33	21.3
	Above 10	3	1.9

4.1.1 Gender of the respondents

Both genders were involved in interviews; the idea was to gather information in a more balanced way and have opinions from both males and females. From the survey results, it was revealed that there were more males than females as shown in Table 3. Having more male respondents provides more accurate information on most issues pertaining WTP for improved watershed services because most of the heads of households are men and are the ones that own land (Ogunniyi *et al.*, 2011). Also many females in the study area relied on their husbands for decisions due to their culture and tradition. The findings are related to the one reported by Ndetewio *et al.*, (2013) where 67.6 were predominantly males.

4.1.2 Age of the respondents

The survey involved household heads/members who were at least 18 years of age at the time of interview. Respondent's age were separated into groups as presented in Table 3 whereby, group of 30 to 39 years with a mean age of 35 years was prominent. This implied that the survey comprised of respondents who were within the age defined as economically productive population (Ogunniyi *et al.,* 2011). As Mwamnyange (2008) points out, age determines individual maturity and ability to make rational decisions; in this respect, most respondents being adults and economically productive, they are capable of making difficult decisions concerning WTP for improved watershed services, regardless of any barriers that may arise.

4.1.3 Marital status of the respondents

The results in Table 3 indicates that majority of the respondents were married which implies that they (respondents) have family responsibilities. The results in this study concur with the results in a study by Mshigwa (2014), on willingness to pay for watershed management by domestic water consumers in Chalinze town. The study referred here

points out that, marriage plays an important role and therefore respondents are responsible for the availability of enough and clean water in their households. This role may influence them to engage in WTP for improved watershed services as to utilize the opportunity of obtaining more reliable water supply.

4.1.4 Education level of the respondents

Data on education attainment showed that 43.9% of the respondents finished primary level while 32.3% reached secondary level. This indicates that most of the respondents have at least primary and secondary education which enables them to understand the importance of conserving the watershed so as to improve its services for their own benefits such as clean and reliable water supply. The knowledge on watershed services and its importance may influence their willingness to participate in the payment for improvement of this service. This is supported by Khan (2010) who said that awareness through education has influence on willingness to pay of the respondents.

4.1.5 Respondent's family size

WTP for watershed service is also likely to be influence by family size (Ndetewio, 2013). In this study, it was revealed that majority of the family sizes in the study area fall under the category of 4-6 people with an average of 5 people (Table 3). Thus there is a demand for large quantity of food and so need for high productivity per unity land. Therefore, secured supply of water is more important to ensure to ensure more agricultural production.

4.1.6 Respondent's occupation

The results reveal that most of the respondents engage themselves in agricultural activities as their major livelihood activity, this is due to the fertility of the soil in the

study area which encourages agricultural practice. Another reason is because most of the respondents had primary level of education which may hinder formal employment causing engagement in agriculture activity as their source of income. The fact that most respondents practice agriculture may influence their WTP for improved watershed services since they are engaged mainly on activity related to natural environment. These findings are similar to Mshigwa (2014), who found that 49.4% practice farming as their main economic activity.

4.1.7 Respondent's farm size

Farm size is an important factor which could determines farmer's WTP for watershed services. From the results in table 4, many of the surveyed domestic water users who practised agricultural activities had farms with a size of 1-3 hectares. This suggests that most of the domestic water users who practise agriculture were small scale farmers. However, many of non-domestic water users had farms whose sizes were above 6 hectares implying that they are large scale farmers. Farmers with big plots are expected to indicate high WTP compared to those with small plots (Ndetewio, 2013). This is explained by fact that production is likely to be high with big farms compared to the small farms.

Table 4: Farm size of the respondents

Farm size	Frequency (DWU)	Percentage (DWU)	Frequency (NDWU)	Percentage (NDWU)
Below 1hectare	59	38.1	0	0
1-3 hectare	81	52.3	0	0
4-5 hectare	12	7.7	12	23.5
Above 6 hectare	0	0	35	68.7
Respondent without farm	3	1.9	4	7.8
Total	155	100	50	100

DWU-*domestic water users*, NDWU-*non-domestic water users,*

4.1.8 Respondent's income level

Income is an important factor which determines the WTP for watershed services. The findings of the study revealed that most of the domestic water users have income less than 400 000 TAS. This results are consistency with those reported by Mwanyoka (2005) that 70% of respondents earns an average of 400 000 TAS per annum. The reason for having low income is due to main occupation observed in Table 3 which is small scale agriculture. Therefore, since the income level is considerably low it may result to low WTP for improved watershed services by domestic water users.

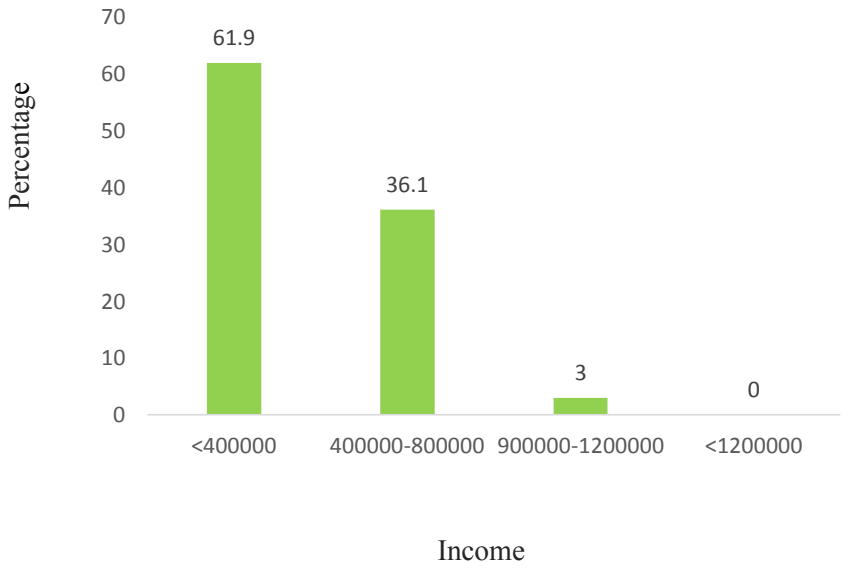

Figure 3: Income level of domestic water users

The non-domestic water users had high percentage of the respondents with income of 15 000 000-20 000 000. This is because most of non-domestic water users practise large scale agriculture thus they have high income compared to small scale farmers who practise agriculture as source of both food and income. Vargas (2004) noted that farmers with high income level indicated 33-39% increase in WTP for watershed services. As a result, income is a vital influence on WTP improved for watershed services.

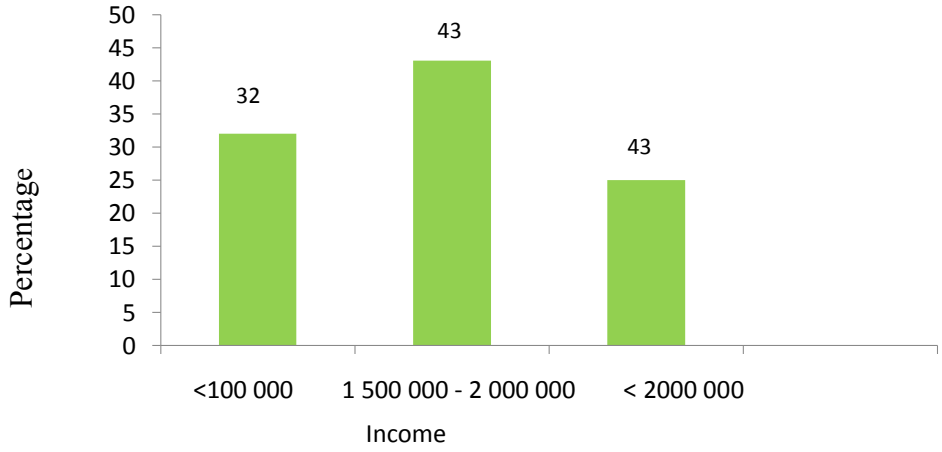

Figure 4: Income level of non-domestic water users

4.2 Level of Awareness on the Importance of Watershed

4.2.1 Knowledge on water source

Among other things, the study sought to evaluate the levels of awareness about watersheds. Large percentage of both domestic water users and non-domestic water users had high level of awareness about NFR as a watershed and also identified the NFR as their primary source of water (Table 5). This indicates that most respondents have knowledge on their source of water, have great appreciation on its importance and are more WTP for its improvement. This is due to the reason that they (respondents) depend solely on watershed services NFR for income and sustainable livelihood and hence need to know much about the environment. Also, because most of the respondents have an average age of 35 (Table 3) and are heads of households, in this view, the person shouldering such responsibility need to be familiar with what is happening in the natural environment since he/she is responsible for clean and sustainable water supply in the family.

This finding are inconsistent with a study conducted in Tuguegarao city on willingness to pay for watershed protection by domestic users, which revealed that most respondents are not aware of the watershed concepts presented to them (Amponin *et al.,* 2007). However,

these results are related to those of Mshingwa (2014) in Bagamoyo District which indicates that almost 98% of the respondents have high level of awareness about Wami basin as a watershed.

Table 5: Responses on knowledge of watershed and source water by the respondents

Knowledge on watershed	Percentage (DWU)	Percentage (NDWU)
Yes	76.8	80.0
No	23.2	20.0
Total	100	100
Source of village water supply		
Nou Forest reserve	72.9	76.7
I don't know	27.1	23.3
Total	100	100

DWU-*domestic water users*, NDWU-*non-domestic water users,*

4.2.2 Importance and roles of watershed for sustainable water supply

The respondents were asked for their views regarding the importance and roles of watersheds whereas, its role in providing other services like hydroelectric power, biodiversity conservation and recreation was recognized by majority of domestic water users while non-domestic water users were specifically concerned about watershed role as the primary source of water (Table 6). This is attributed by level of education of respondents as observed in Table 3, where by most have primary education which enables them to have knowledge on roles of watershed in their community. Similar findings were reported by Calderon (2013) in Oroqueta City where by many people were aware of the roles of the watersheds and were worried that if they do not protect Mt. Malindang, there would be decrease in water quality.

The top two reasons why watershed protection was viewed as important by the domestic water users were providing more sustainable water supply and improving water quality (Table 6). This is due to the fact that the water that respondents use is not clean because it

comes with a lot of dirty introduced by the upstream communities making the improvement of watershed important. Also since most of the respondents practise agriculture, they need enough water to increase the production of the farms. Most of non-domestic water users viewed watershed as important because it provides more sustainable water supply. These findings are supported by Mueller (2013) study which reported that most of respondents perceived watershed health important for sustainable water supply.

Table 6: Importance and roles of watershed for sustainable water supply by respondents

Indicator	Percentage (DWU)	Percentage (NDWU)
Roles of watershed		
Watershed are the primary source of water	20.6	43.3
Watersheds provide other goods like timber, and animal and plant products	27.1	10.0
Watersheds provide other services like hydroelectric power, biodiversity conservation and recreation	29.0	20.0
Good forest cover enhances the way watersheds provide various goods and services	23.2	26.7
Total	**100**	**100**
Importance of watershed		
It absorbs water and make this available for future use	**1.3**	0
It minimizes floods during the rainy season	1.3	0
Provides more sustainable water supply	30.3	30.0
It improves water quality	34.8	23.3
To avoid forest/nature destruction	21.9	26.7
Reasons to why it is not important		
It doesn't directly affect my household	5.8	0
I don't believe in its role in improving water supply	4.6	20.0
Total	**100**	**100**

DWU-*domestic water users*, NDWU-*non-domestic water users,*

4.3 Willingness to Pay for Watershed Services by the Downstream Users

For both water users, the study found that more than half of the respondents were willing to pay a specified bid amount for watershed protection. These results are similar to those of Ogunniy *et al.,* (2011) who reported that 75% of respondents were WTP for improved water quality. This reveals that respondents are willing to pay because they need

improved watershed services than they have now. Moreover, due to their high level of awareness as observed in Table 5, respondents were willing to participate in improving watershed services and WTP to ensure sustainable water supply. This observation is supported by Zheng *et al.,* (2012) study in Yibin city in China, which reported that people's initiative to participate in environmental protection will be affected positively by their awareness of environmental protection subject.

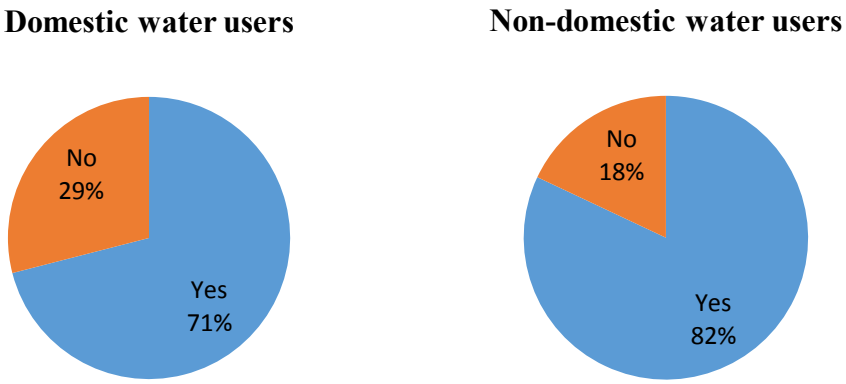

Figure 5: Response on willingness to pay question by the respondents

The water users that were willing to pay, the study inquired about the amount of money they declared to be willing to pay for improved watershed services. Table 7 below provides the amounts the water users would be willing to pay in TAS/user/year. It was noted that the non-domestic water users were willing to pay a higher amount of money for improved water services than the domestic water users. This is because of high income of the non-domestic water users compared to the lower income of domestic water users. Moreover, it was observed that the bid amount of TAS 1 000 had high frequency than TAS 500 for domestic water users while TAS 100 000 had high frequency than TAS 50 000 for non-domestic water users, this shows that the likelihood of accepting an offered bid amount increased with bid amount offered. These results imply that the downstream

water users of Babati District were willing to pay the maximum amount of money they could afford regardless of their low income for improved watershed services. This findings are inconsistency with many literatures such those of Akter (2013), who showed that bid amount is negatively related to respondent's WTP, thus as the bid amount increases the willingness to pay of respondent's decreases.

Table 7: Reported WTP from the bid by domestic water users

Bid (TAS)	Frequency	Percentage
500	20	13
1 000	45	29
1 500	21	13.5
2 000	24	15.5
Total	110	71

Table 8: Reported WTP from the bid by non-domestic water users

Bid (TAS)	Frequency	Percentage
50 000	15	30
100 000	17	34
200 000	7	14
300 000	2	4
Total	41	82

To determine what motivates the respondents to be willing to pay, respondents who were willing to pay the bid price were asked to identify the reasons for their willingness to pay for improved watershed services. For this study, the main reason for the decision by both water users was the desire for clean and more reliable water supply (Table 9). This is due to the fact that majority of the water users depend on agriculture as their source of income and thus need more reliable water supply so as to increase the level of production of the farms while the need of clean water is a result the requirement of clean water for their health. The respondents also felt that it was their duty as the water users to pay for improvement in the watershed services since they would be the ones to benefit anyway. This is consistency with Amponion *et al*., (2007) who in his study provided possible

explanations on willingness to pay by the water users, where by 78% of respondents specified that they would like a more reliable water supply and 21% valued watershed protection for the sake of future generations.

Table 9: Reasons on WTP question for improved watershed services by the respondents

Indicator	Percentage (DWU)	Percentage (NDWU)
Reasons for willingness to pay		
I want clean and more reliable water supply	30.3	33.3
It is my duty as a water user	16.8	26.7
I want the watersheds to continue producing other environmental services , biodiversity conservation and recreation	14.2	13.3
I would like the future generations to have reliable water supply	9.7	10.0
Reasons for not willing to pay		
I cannot afford to pay any additional amount to what I am currently paying	12.9	0
I think the current waters price could recover the water supply cost	9.0	6.7
I think it should be the government that finances the watershed management activities	6.5	6.7
I do not believe that any additional payment will result in improved watershed services	0.6	3.3
Total	**100**	**100**

DWU-*domestic water users*, NDWU-*non-domestic water users,*

The respondents who were not willing to pay said they cannot afford to pay any additional amount to what they are currently paying (Table 9).This reason is due to income constrains that this users face as a result of practising small scale agriculture. This group argued that it is the responsibility of the government to finance the conservation activities through the money they are already paying through water user rights. The results for this concur with Bautista (2003) who told that non-WTP may be associated with communities recognizing their rights to good water quality and that access to it has

no constrains, users are used to obtain services for free due to inability or lack of income to pay.

4.4 Factors that Affect Willingness to Pay

This objective was analysed by using probit regression. The robust standard error was used instead of a normal standard error to correct the problem associated with heteroscedasticity. The result model summary show that the number of observation in the model was 152 (domestic water users) and 50 (non-domestic water users). The Wald chi²or likelihood ratio (LR) chi-square test was 1334.79 (domestic water users) and 35.94 (non-domestic water users) implies the goodness of fit of the overall model as in an F test. The p-value is compared with critical value, that is, 0.05 or 0.01 to determine whether or not the overall model is statistically significant. In this case, the model is statistically significant because the p-value is less than 0.01.

Table 10: Probit regression for non-domestic water users

WTP	Coefficient	Robust Std. error.	Z	p>|z|	[95% Conf.	Interval]
Income	0.001	0.001	2.880	0.004**	0.001	0.001
Farm size	-0.768	0.306	-2.510	0.012**	-1.367	-0.169
Awareness	-0.543	0.741	-0.730	0.464	-1.995	0.909
Constant	-2.310	0.876	-2.640	0.008	-4.026	-0.592

Obscs = 50, Wald chi² (4) =35.94, Prob>chi² = 0.0000, Pseudo R^2 = 0.6824, Log likelihood = -7.4858043

The variables which were significant in the model included gender, occupation, education, farm size at different levels of significance. Income was significant for non-domestic water users, however it appeared to be insignificant for the case of domestic water users. The results also indicate that respondent's age, family size and awareness were not significantly influencing WTP for improved watershed services.

Table 11: Probit regression for domestic water users

WTP	Coefficient	Robust Std. error.	Z	p>|z|	[95% Conf. Interval]	
Age	-0.019	0.048	-0.39	0.693	-0.113	0.076
Gender	-4.821	1.093	-4.41	0.000*	-6.964	-2.678
Occupation	3.881	1.066	3.64	0.000*	1.792	5.971
Income	-0.001	0.001	-1.02	0.309	-0.000	0.001
Family size	0.326	0.270	1.21	0.226	-0.203	0.858
Education	-0.226	0.086	-2.61	0.009**	-0.396	-0.056
Farm size	1.107	0.375	2.95	0.003**	0.372	1.841
Awareness	0.562	0.582	0.96	0.335	-0.597	1.703
constant	-4.667	3.016	-1.55	0.122	-10.578	-1.244

Obscs =152, Wald chi² (9)=1334.79, Prob>chi²=0.0000, Pseudo R^2 = 0.9118, Log likelihood = -8.0635252

4.4.1 Gender

Gender had a negative and significant impact on the WTP for improved watershed services indicating that female household heads have high WTP than male household heads. These results are explained by the fact that, according to the study area tradition, women are more involved in household chores such as collecting water and family hygiene. Also they are the ones most likely to perceive the strain of walking distances when collecting water. The findings are in agreement with Ogunniyi (2011) study which reported that males have lower WTP than female. However, this findings are inconsistency to those of Ma (2012) which showed that gender had a positive influence on WTP but not sufficient to influence WTP.

4.4.2 Occupation

Occupation is also statistically significant with WTP and shows a positive coefficient. Thus, respondents who are engaged in agricultural activities as their source of income have more WTP than those who do not depend on agriculture activities for income. This is because the improved watershed services will result into more reliable water supply,

which in turn is closely related to increased agricultural production. The higher the production, the higher the portion of income from agricultural activities. The observation is supported by Kong (2014) study in China which reported that when a farmer's household income is sourced mainly from planting, breeding, and other traditional industries, environmental quality improvements are likely to be more beneficial to him, and therefore, such farmers are more willing to compensate the environment. Similar results have been discovered by Vargas (2004) that farmers relying mainly on agricultural products for their incomes have stronger WTP.

4.4.3 Education level

Respondent's education level has a significant negative influence on the WTP for improved watershed services, meaning that as education level increases, the WTP for improved watershed services decreases. These findings may be explained by the fact that most of the respondents in the study area had primary level of education which may have acted as an obstacle to formal employment. In that case, majority of respondents had to engage themselves on agricultural activities for their income, and so attach high value to the natural environment irrespective of their education level. Therefore, they are more willing to pay for improved watershed services to obtain sustainable water supply for their agricultural activities. This findings are similar to Moffat *et al.,* (2013) study which reported that educated people are lesser willing to pay for improved water quality and reliability in Chobe ward at Maun because they regarded water services as an entitlement that should be provided by the government. However, the results are different from Amponin *et al.*, (2007) who reported that educated people perceive better the future risk of reduced water flows on crop production and hence may understand the importance of payment for watershed services.

4.4.4 Farm size

Farm size has significantly positive influence on WTP by domestic water users meaning that as the farm size increases, the WTP for improved watershed services increases. These results is consistent with Ma (2012) who argued that farmers with big plots are expected to indicate big amount of money to pay compared to those with small plots. Since domestic water users depend on agriculture as their source of income and food, it may be that domestic water users with big plots earn well from farming. Thus, if their environmental quality deteriorates, their incomes from farming would reduce. As a result, they are more willing to pay for improved watershed services. However, in the case of non-domestic water users, farm size shows negative significant influence on WTP implying that as farm size increases, the WTP for improved watershed services decreases. The difference in the results of these water users is explained by the reason that non-domestic water users have small farms compared to non-domestic water users, therefore any disturbance such as water scarcity in the farms will results to a big loss for them, while non-domestic water users with big farms may see the disturbance as a small loss in their productions. This makes the domestic water users to have a significant positive influence and non-domestic water users to have a significant negative influence on WTP for improved watershed services.

4.4.5 Income

Unlike many of the existing literature, this study did not find significant relationship of income to WTP for improved watershed services by the domestic water users. This is because of the correlation of household income with other explanatory variables in the model such as education and occupation (Akter, 2013). It also implies that most domestic water users attach high value to natural environment regardless of their income level. This observation is supported by Ezebilo (2006) study in Simbu province in Papua New

Guinea, which reported that income seemed not to have statistical significant effect in Kegsugl.

However, there was a positive significant influence on WTP for improved watershed services by the non-domestic water users which implies that as the income increases, the WTP also increases. This is because there has been a wide edge among the income levels of non-domestic water users, thus giving more opportunity of WTP to respondents with higher income level than respondents with lower income level. Moreover, the watershed services is one of the main source of water supply for their activities, therefore non-domestic water users are very much willing to pay for improved watershed services to guarantee sustainable water supply. This is in agreement with Tang (2013) who reported that respondents with high income were willing to pay more for environmental services. It also seems to be in line with Field (1994) who reported that the wealthier a person is, the better that person can afford to pay for various goods and services. Hence, non-domestic water users at higher income level will be willing to pay more for improvement of watershed services than lower income earners.

4.5 Estimation of Mean WTP

The aim of this study was to estimate downstream water users WTP for improved watershed services. This was done using the parameter estimates from the probit model, following Hanneman (1984).

Table 12: Mean WTP of domestic water users

Variable	Coefficient	Mean	Coefficient*Mean
Bid	0.017		
Age	-0.019	37.631	-0.717
Gender	-4.821	0.579	-2.791
Occupation	3.881	0.934	3.626
Income	$-5.40e^{-06}$	478026.3	-19.279
Family size	0.326	4.908	1.608
Education	-0.226	8.263	-1.867
Farm size	1.107	1.691	1.871
Awareness	0.561	0.776	0.436
Constant	-4.667		-4.667
Total			-21.780
Mean WTP =		-(-21.780) / 0.017	1 281.18

Table 13: Mean WTP of non-domestic water users

Variable	Coefficient	Mean	Coefficient*Mean
Bid	0.0000674		
Income	4.40^{-07}	1.64^{07}	0.000
Farm size	-0.766	7.280	-5.588
Awareness	-0.543	0.600	0.326
Constant	-2.309		-2.310
Total			-7.572
Mean WTP =	-(-7.572)/0.0000674		112 344.21

The study reveals a mean willingness to pay of TAS 1 281 by the domestic water users and TAS 112 344 by non-domestic water users per year per person on top of their normal fee paid for fixed volume of water. Although it is difficult to compare different contingent valuation studies since it is well known that the results of any contingent valuation study are sensitive to the assumed econometric specification (Bengochea-Morancho *et al.,* 2005), we can say that WTP for an improvement in the watershed service in Babati district is low in comparison to the results of similar research. In this sense, this amount is lower than the WTP for watershed management by domestic water consumers in Chalinze town of TAS 5237 per person per year above the existing tariff (Mshingwa, 2014). The high WTP for watershed services by the water users in Chalinze town was contributed by

higher income category of many respondents which is 400 000 to 800 000 (Mshingwa, 2014).In addition, a study by Kaliba (2002) in Dodoma Region and Singida Region reported WTP of TAS 32 per 20L of water above the existing tarriff and TAS 91 per household per year respectively. The higher amount was contributed by high demand of water prior to shortage of water and climatic condition in those regions.

Therefore, since the environmental economic theory assumes the demand for an improved environmental quality increases with income (Moffet *et al.,* 2013) the lower amount of WTP by downstream water users in Babati district is contributed by their low income level, thus they are willing to pay maximum amount they can afford. This implies that the WTP differs significantly with various locations depending on various factors such as income of the respondents (Wunder, 2007). Moreover, the explanation for this relatively low WTP is contributed the current climate of conflict in the study villages of Babati district as it was observed in Table 12 that most respondents preferred a separate agency/office to collect the fee. If users are dissatisfied with the service provided by the current management, they can be expected to provide low amount to an increase in the water bill (Vasquez, 2014); (Kong, 2014). In any case, it must be said that the research provides no conclusive evidence of this relationship since the questionnaire did not include any question aimed at capturing the 'degree of conflict' between the community and the water management in the study area.

4.7 Possible Operational Mode for Instituting the Payment of Watershed Services

The operational modes are the institutional arrangements and structures required to operationalize PWS schemes. This operational mechanism depend on what respondents perceive to be the best options in instituting modalities for making the scheme functional. These include the basis of charging the fee and the preferred collection mechanism.

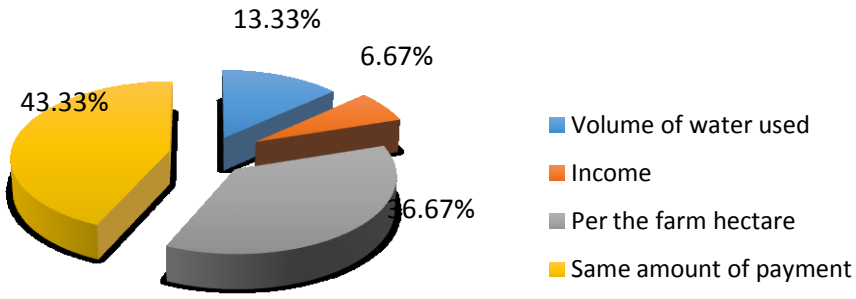

Figure 6: Reported basis of charging the watershed protection fee by non-domestic water users

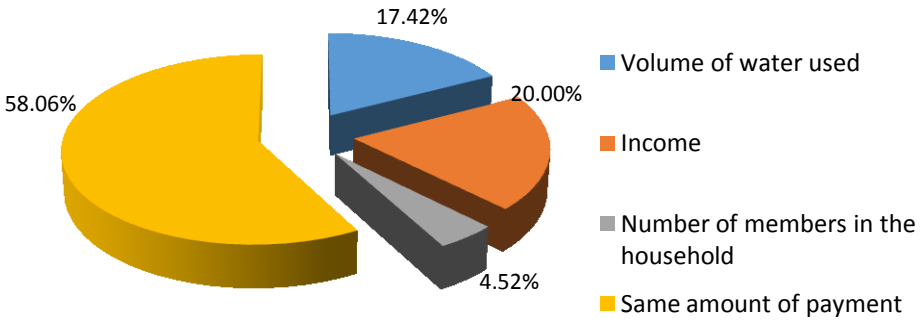

Figure 7: Reported basis of charging the watershed protection fee by domestic water users

Regarding the basis of charging the watershed management and protection fee, both non-domestic water users and domestic water users as seen in Figure 6 and Figure 7 preferred it to be the same amount of payment. The respondents explained that this is convenient as it would require them to make only one payment regardless of the volume of water consumed, income, per hectare size and number of members in the household.

Table 14: Reported mechanism to collect watershed management and protection fee

Indicator	Percentage (DWU)	Percentage (NDWU)
Amount to be added to water bill as a fee, which is to be managed by the council	3.2	0
A separate agency/office will collect the fee	42.6	63.3
Direct cash payments to water district	9.7	6.7
Village water committee	26.5	16.7
Catchment office	18.1	13.3
Total	**100**	**100**

DWU-*domestic water users*, NDWU-*non-domestic water users*

For both domestic water users and the non-domestic water users, the preferred collection mechanism was for a separate agency/office to collect the fee as observed in Table 14. This is because they did not trust other mechanisms that were mentioned to them for example village water committee. Small number of respondents for both users preferred amount to be added to monthly water bill as a fee, which is to be managed by the council. This is in contrary to Ramajo and Saz-Salazar (2012) study which reported an increase in the current water bill was the preferred collection mechanism since it was considered the most appropriate with regard to the credibility of the hypothetical market, while being plausible and familiar to the population surveyed. The results are also inconsistence with those of Calderon *et al*., (2006) and Amponian *et al.,* (2007), where by the preferred collection mechanism by majority of the respondents was any payment to be added to the monthly water bills. Similarly, Gatto (2014) reported best payment is through annual regional tax paid by each household.

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Based on the results of this study, it is possible to draw logical conclusions in relation to specific study objectives**:**

The findings showed that respondents are aware about watersheds, including their roles and importance in providing improved watershed services. Majority of the respondents agreed that it is important to manage and protect the watershed in order to have a sustainable supply of water as well as improve the water quality. This could have been the reason why majority of respondents showed a positive WTP.

More than half of downstream water users were WTP for improved watershed services, with the estimated mean WTP being TAS 1261 by domestic water users and TAS 112 322 by non-domestic water users. This mean WTP is low due to the respondent's relatively low income.

The factors that influence respondent's WTP are gender, occupation, education, farm size at different levels of significance. Consequently, income was significant for non-domestic water users, however it appeared to be insignificant for the case of domestic water users. The results also indicate that respondent's age, family size and awareness were not significantly influencing WTP for improved watershed services.

Additionally, the findings show that both domestic and non-domestic water users preferred the basis of charging the fee should be same amount of payment because it is convenient as it would require them to make only one payment that regardless of factors such as income. Respondents also preferred a separate agency/office to collect the fee.

5.2 Recommendations

Despite the level of awareness showed by the respondents on watershed's roles and importance, education is very much needed to expand the willingness of water users to use market based instruments. The Tanzania government should further provide environmental awareness to the public for example through training and media on the importance of PES policies and how this could benefit both the environment and people's livelihoods.

The findings have further indicated that majority of the respondents have shown positive WTP for improvement in watershed services. On this ground, it is recommended that the policy and decision makers should start implementing the PES policies in the area. Furthermore, it is recommended that downstream water users should be represented in watershed decision making and management.

Based on the findings from this study, it is recommended that research is needed to shed light on reasons underlying the factors which influence WTP for improved watershed services in the study area.

For the operational mechanism, it is recommended that the government should create a legal and regulatory system in place to enforce the payments for watershed services based on the preferred collection mechanism and basis of charging the fee selected by the respondents. This will help remove any wary in case it arises that the funds will not be used for the intended purposes.

Moreover, this study only focused on willingness to pay for improved watershed services by the downstream water users in Babati district. It did not consider the willingness to

accept by the upstream community. Therefore, it is recommended to conduct a research on upstream community so as to provide convergence planning for future payment of environmental services

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APPENDICES

Appendix 1: Contingent valuation survey (Questionnaire)

Introduction

Good morning/afternoon/evening! I am……. from Sokoine University of Agriculture, Morogoro, and I am part of a research team conducting a study on estimation of the willingness to pay for watershed services by downstream water users in Manyara region. I would like to assure you that the information that you will reveal in this interview will be used solely for purposes of research, and that your identity as well as your answers will be treated with confidentiality. In answering my questions, please remember that there are no correct or wrong answers. We are just after your honest opinion.

Basic Information:

Name of Respondent: _____

District: _____

Ward: _____

Village: _____

Questionnaire for Domestic Water Users

Questionnaire for assessment of socio-economic profile of domestic water users

1. Age: _____ years old
2. Gender:
   - Male _____
   - Female_____
3. Marital Status:
   - Single_____
   - Married _____

4. What is your educational attainment?

- No formal schooling_____
- Elementary level (indicate grade) _____
- Elementary graduate_____
- High school level _____
- Vocational_____
- College level _____

5. What is your occupation?

- Agriculture _____
- Livestock keeping _____
- Employed _____
- Others, please specify _____

6. Number of members in the household?

- 1-3 (……)
- 1-5 (……)
- 1-7 (……)

7. What is the household total monthly income (Please put a tick)

- Less than 400 000 TAS_____
- 400 000-800 000 TAS_____
- 900 000-120 000 TAS_____
- More than 120 000 TAS_____

8. If you are practicing agriculture, what is the size of your farm?

- Below 1hectare _____
- 1-3 hectare _____
- 4-5 hectare _____
- Above 6 hectare _____

Questionnaire for assessment of watershed awareness and concern. The interviewer should let the respondent answer question 1 & 2 before briefing about watersheds and its role to sustainable water supply

A watershed is like a kitchen sink. You've seen how the kitchen sink catches water from the faucet and drains this into an outlet. The watershed works in a similar manner. It also catches water, though from the rain and not from the faucet, and drains the water through a network of rivers and streams in the area, until it reaches a common outlet.

You can also think of the soil in the watershed as a sponge that absorbs water. If you cover the sink with a sponge and turn on the faucet, it will take some time before water will be drained because the sponge will absorb most of it first. Thus, the more water is absorbed, the less will go down the drain. In the case of watersheds, the more water it absorbs, the less water will go to the lowlands. In effect, the more water is absorbed, the fewer floods there will be. Also, the more water is stored in the watershed, the better will be the water supply during times when there are no rains. We are not saying, however, that a well-managed watershed will prevent the occurrence of floods and droughts. With prolonged rains, floods can result even from the best-managed watersheds. Likewise, droughts can happen during extremely long dry seasons.

The interviewer will demonstrate this using a plastic bottle cut into half with the smaller hole as the outlet, a container of water, and a piece of towel enough to cover the hole of the plastic bottle. Initially, only a small amount will be poured, which the towel will absorb. As more water is added, some of it will be drained or retained on the surface, representing a "flood." However, the amount of water that can be stored in the watershed is largely affected by its land uses. It is widely accepted that maintaining a good forest cover increases the capacity of the watershed to store water and regulate its flow. But as

you may already know, our country is fast losing its forest cover. Deforestation and poor land use practices are common and these have damaged the hydrologic condition of many of our watersheds. As a consequence, floods during the rainy season and droughts during the dry season are common.

Good management will provide a whole package of benefits to you and to society as a whole.

1. Have you ever heard anything about water sources?
    - Yes (Proceed to #2) _____
    - No (Proceed to #4) _____
2. Where do you think is the Village water supply getting the water they are distributing to residents? _____
3. Which of the following statements do you think is/are true about water sources?
    - Watersheds are the primary source of raw water _____
    - Watersheds provide other goods like timber, and animal and plant products_____
    - Watersheds provide other services like hydroelectric power, biodiversity conservation, recreation, and carbon sequestration_____
    - Good forest cover enhances the way watersheds provide various goods and services_____
4. In your opinion, are the management and protecting these watersheds to ensure a stable water supply important?
    - Yes (Please proceed to # 7) _____
    - No (Please proceed to # 8) _____
    - I don't know_____
5. If you answered **IMPORTAN**T, why is it important?
    - It absorbs water and make this available for future use_____

- It minimizes floods during the rainy season_____
- It improves water quality_____
- Provides more sustainable water supply_____
- To avoid forest/nature destruction_____
- Others, please specify: _____

6. If you answered **NOT IMPORTANT**, why is it not important?
   - It doesn't directly affect my household_____
   - I don't believe in its role in improving water supply_____
   - Others, please specify: _____

Questionnaire for assessment of the willingness to pay for watershed services

1. Would you vote YES or NO to the *Watershed Management Program*?
   - Yes (Please proceed to # 2) _____
   - No (Please proceed to # 4) _____
2. If you vote YES are you willing to pay TAS.500/1 000/1 500/2 000 per annum as additional to the current annual fee for improved watershed services.
   - Yes (Please proceed to # 3) _____
   - No (Please skip to 4) _____
3. Please indicate your reason/s why you are willing to contribute to the fund.
   - I want clean and more reliable water supply _____
   - It is my duty as a water use _____
   - I want the watersheds to continue producing other environmental services , biodiversity conservation and recreation _____
   - I would like the future generations to have reliable water supply_____
   - Others, please specify:…….

4. If you are not willing to contribute any amount to the fund, please identify your reason/s.
    - I cannot afford to pay any additional amount to what I am currently paying _____
    - I think the water tariff I am paying at present is already too high _____
    - I think it should be the government that should finance the watershed management activities_____
    - I think the current waters price could recover the water supply cost (RECO) _____
    - I do not care about the reliability of water supply.
    - I do not believe that paying will result in improved watershed management.
    - I do not believe that improved watershed management will result in more reliable water supply.
    - I do not trust the institution who will manage the funds for this conservation work _____
    - Other reasons, please identify _____

Questionnaire for assessment of operational mode

1. Which do you think is the most appropriate mechanism to collect the watershed management and protection fee? (Please check only one)
    - Amount to be added to water bill, which is to be managed by the council _____
    - A separate agency/office will collect the fee _____
    - Direct cash payments to water district _____
    - Village water committee _____
    - Catchment office _____
    - Other means, please specify _____

2. What do you think should be the basis of charging the fee?
    - Volume of water used _____
    - Income _____
    - Number of members in the household_____
    - The amount paid to be similar _____
    - Others, please specify _____

Questionnaire for Non-Domestic Water Users

1. What is your total annual income (Please put a tick)
    - Less than 10 000 000 TAS_____
    - 10 000 000 -20 000 000 TAS_____
    - More than 20 000 000 TAS_____
2. Do you engage yourself in agricultural activities?
    - Yes (proceed to #12) _____
    - No _____
3. If YES, does agricultural activities act as the source of either of the below?
    - Income _____
    - Others, please specify

Questionnaire for assessment of watershed awareness and concern. The interviewer should let the respondent answer question 1 & 2 before briefing about watersheds and its role to sustainable water supply.

A watershed is like a kitchen sink. You've seen how the kitchen sink catches water from the faucet and drains this into an outlet. The watershed works in a similar manner. It also catches water, though from the rain and not from the faucet, and drains the water through a network of rivers and streams in the area, until it reaches a common outlet.

You can also think of the soil in the watershed as a sponge that absorbs water. If you cover the sink with a sponge and turn on the faucet, it will take some time before water will be drained because the sponge will absorb most of it first. Thus, the more water is absorbed, the less will go down the drain. In the case of watersheds, the more water it absorbs, the less water will go to the lowlands. In effect, the more water is absorbed, the fewer floods there will be. Also, the more water is stored in the watershed, the better will be the water supply during times when there are no rains. We are not saying, however, that a well-managed watershed will prevent the occurrence of floods and droughts. With prolonged rains, floods can result even from the best-managed watersheds. Likewise, droughts can happen during extremely long dry seasons.

The interviewer will demonstrate this using a plastic bottle cut into half with the smaller hole as the outlet, a container of water, and a piece of towel enough to cover the hole of the plastic bottle. Initially, only a small amount will be poured, which the towel will absorb. As more water is added, some of it will be drained or retained on the surface, representing a “flood.” However, the amount of water that can be stored in the watershed is largely affected by its land uses. It is widely accepted that maintaining a good forest cover increases the capacity of the watershed to store water and regulate its flow. But as you may already know, our country is fast losing its forest cover. Deforestation and poor land use practices are common and these have damaged the hydrologic condition of many of our watersheds. As a consequence, floods during the rainy season and droughts during the dry season are common.

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7. Have you ever heard anything about water sources?
   - Yes (Proceed to #2) _____
   - No (Proceed to #4) _____
8. Where do you think is the Village water supply getting the water they are distributing to residents? _____
9. Which of the following statements do you think is/are true about water sources?
   - Watersheds are the primary source of raw water _____
   - Watersheds provide other goods like timber, and animal and plant products_____
   - Watersheds provide other services like hydroelectric power, biodiversity conservation, recreation, and carbon sequestration_____
   - Good forest cover enhances the way watersheds provide various goods and services_____
10. In your opinion, are the management and protecting these watersheds to ensure a stable water supply important?
    - Yes (Please proceed to # 7) _____
    - No (Please proceed to # 8) _____
    - I don't know_____

11. If you answered **IMPORTAN**T, why is it important?
    - It absorbs water and make this available for future use_____
    - It minimizes floods during the rainy season_____
    - It improves water quality_____
    - Provides more sustainable water supply_____
    - To avoid forest/nature destruction_____
    - Others, please specify: _____

12. If you answered **NOT IMPORTANT**, why is it not important?

- It doesn't directly affect my household_____
- I don't believe in its role in improving water supply_____
- Others, please specify: _____

Questionnaire for assessment of the willingness to pay for watershed services

5. Would you vote YES or NO to the *Watershed Management Program*?

- Yes (Please proceed to # 2) _____
- No (Please proceed to # 4) _____

6. If you vote YES are you willing to pay TAS.50 000/100 000/200 000/300 000 per annum as additional to the current annual fee for improved watershed services.

- Yes (Please proceed to # 3) _____
- No (Please skip to 4) _____

7. Please indicate your reason/s why you are willing to contribute to the fund.

- I want clean and more reliable water supply _____
- It is my duty as a water use _____
- I want the watersheds to continue producing other environmental services , biodiversity conservation and recreation _____
- I would like the future generations to have reliable water supply_____
- Others, please specify:…….

8. If you are not willing to contribute any amount to the fund, please identify your reason/s.

- I cannot afford to pay any additional amount to what I am currently paying _____
- I think the water tariff I am paying at present is already too high _____

- I think it should be the government that should finance the watershed management activities_____
- I think the current waters price could recover the water supply cost (RECO) _____
- I do not care about the reliability of water supply.
- I do not believe that paying will result in improved watershed management.
- I do not believe that improved watershed management will result in more reliable water supply.
- I do not trust the institution who will manage the funds for this conservation work
- Other reasons, please identify _____

Questionnaire for assessment of operational mode

3. Which do you think is the most appropriate mechanism to collect the watershed management and protection fee? (Please check only one)
   - Amount to be added to water bill, which is to be managed by the council _____
   - A separate agency/office will collect the fee _____
   - Direct cash payments to water district _____
   - Village water committee _____
   - Catchment office _____
   - Other means, please specify _____
4. What do you think should be the basis of charging the fee?
   - Volume of water used _____
   - Income _____
   - Number of members in the household_____
   - The amount paid to be similar _____
   - Others, please specify _____

Appendix 2: Questionnaire for Focus Group Discussion

1. Do you know the primary source of your water?
2. Are the present supplies adequate?
3. If no, how do you fulfill your demand? How many liters you buy and how much it cost?
4. Why do you think the water scarcity problem is increasing?
5. Do you think people of upstream are responsible for decrease in water supply in district? If yes, what do you think they could do to increase the water supply? If no, who are responsible?
6. What could be the possible ways to increase the water supply and can you help for it? How?
7. If the people of upstream are ready to work in watershed for increase in water supply. Would you like to help? How?
8. How could you minimize leakage and the scarcity in water supply?
9. Is there any group in district/ward/village who looks for the water supply and demand? Any program conducted?
10. Have you heard about payment for watershed services? If yes, do you believe it will help to improve watershed supply in your place?
11. What is the maximum amount that you are willing to pay for improved water services?