Journal of Environment and Earth Science
ISSN 2224-3216 (Paper) ISSN 2225-0948 (Online)
Vol.10, No.4, 2020

Use of Weather and Climate Information in Decisions on Conservation of Water Resources in Kilombero River Catchment, Tanzania

Emanuel L. Moirana[1*] J.J. Kashaigili[2]
1.Department of Wildlife Management, P.O. Box 3017, Sokoine University of Agriculture, Chuo Kikuu, Morogoro, Tanzania.
2.Department of Forest Resources Assessment and Management, P.O. Box 3013, Sokoine University of Agriculture, Chuo Kikuu, Morogoro, Tanzania.

The authors thankfully acknowledge the financial support from Uncertainty Reduction in Models for Understanding Development Applications (UMFULA) Project under the Future Climate for Africa (FCFA). Special thanks go to Declan Conway (London School of Economics and Political Science) who contributed invaluable inputs to the publication.

Abstract
This study assessed the use of climate information in decisions on the conservation of water resources and determined influencing factors in Kilombero River Catchment in Tanzania. A cross-sectional research design was employed. Purposive sampling was used to select Kilombero, Ulanga and Malinyi districts and Lumemo, Nakafulu and Biro villages while simple random sampling was used to select respondents. A total of 120 household respondents were interviewed in the three villages. In addition, 7 Key Informants' Interviews (KIIs) involving officers from Kilombero Game Controlled Area (KGCA) and Rufiji Basin Water Board (RBWB) and 3 Focus Group Discussions (FGDs) with the villagers were conducted. Quantitative data were analyzed using Statistical Package for Social Science (SPSS) and STATA computer programs while qualitative information was analyzed using content analysis. Results show nearly half of respondents of weather and climate information in decisions to conserve water resources. Although ten decisions were identified in the area, weather and climate information was highly used in deciding conservation measures (X^2=5.992, p<0.05), construction of small pans or bore holes for water storage (X^2=6.580, <0.05) and reducing the number of livestock (X^2=5.889, p<0.05). Four variables which had significant and positive correlation with conservation of water resources were identified. Foremost among them is extension visits (ß=0.079; p<0.01) which implied access and frequency of extension visits influence use of weather and climate information in making decisions. It is concluded that communities in the area use weather and climate information in decisions which conserve water resources. Policy makers are advised to emphasize factors which had positive significant correlation with conservation of water resources.
Keywords: Climate Information Use, Water Conservation Decisions.
DOI: 10.7176/JEES/10-4-06
Publication date: April 30th 2020

1. Introduction
Information on weather (hours to months) and climate (months to decades) are useful tools for building adaptive capacities of communities and governments to climate change (Ambani & Abalabe 2017). It does this by reducing the vulnerability of societies and people to the effects of increased variability and changes through; reducing shifts in hydro-meteorological trends, protect and restore ecosystems that provide critical land and water resources and closing the gap between water supply and demand (Bergkamp *et al.* 2003). Yet, little is known regarding the uses of weather and climate information in decisions on the conservation of water resources in Tanzania, especially in the Kilombero River catchment.

The Kilombero River catchment is one of the largest seasonal freshwater lowland floodplains in East Africa and it joins the Great Ruaha, Rufiji and Luwegu Rivers in the Rufiji River basin (Wilson *et al.* 2017). The area is of global, national and local significance ranging from the provision of water for a number of functions such as domestic use, agriculture and industrial activities to supporting the ecology of seasonally migrating animals in Selous-Mikumi ecosystem (Lyon *et al.* 2015; Wilson *et al.* 2017). The aim of this study was to investigate climate information use for water resources conservation. The specific objectives are as follows; 1, to assess the use of climate information on decisions to conserve water resources, and 2, to determine factors that influence the use of weather and climate information in decisions on conservation of water resources.

2. Materials and Methods
2.1 Study Area Description
This study was conducted in Lumemo, Nakafulu and Biro villages of Kilombero, Ulanga and Malinyi districts in Kilombero River catchment within the Rufiji River Basin. The river catchment is located between Longitudes

34°33'E and 37°20'E and Latitudes 7°39'S and 10°01'S (Figure 1). The area shares borders with the Udzungwa Mountains to the north and west and with Mahenge highlands to the east and is surrounded by steep slopes rising up to 2,576 meters above sea level (m.a.s.l.) in the north-western side while the land rises more gradually along the southeastern side reaching a maximum height of 1,516 m.a.s.l. (Minas 2014).

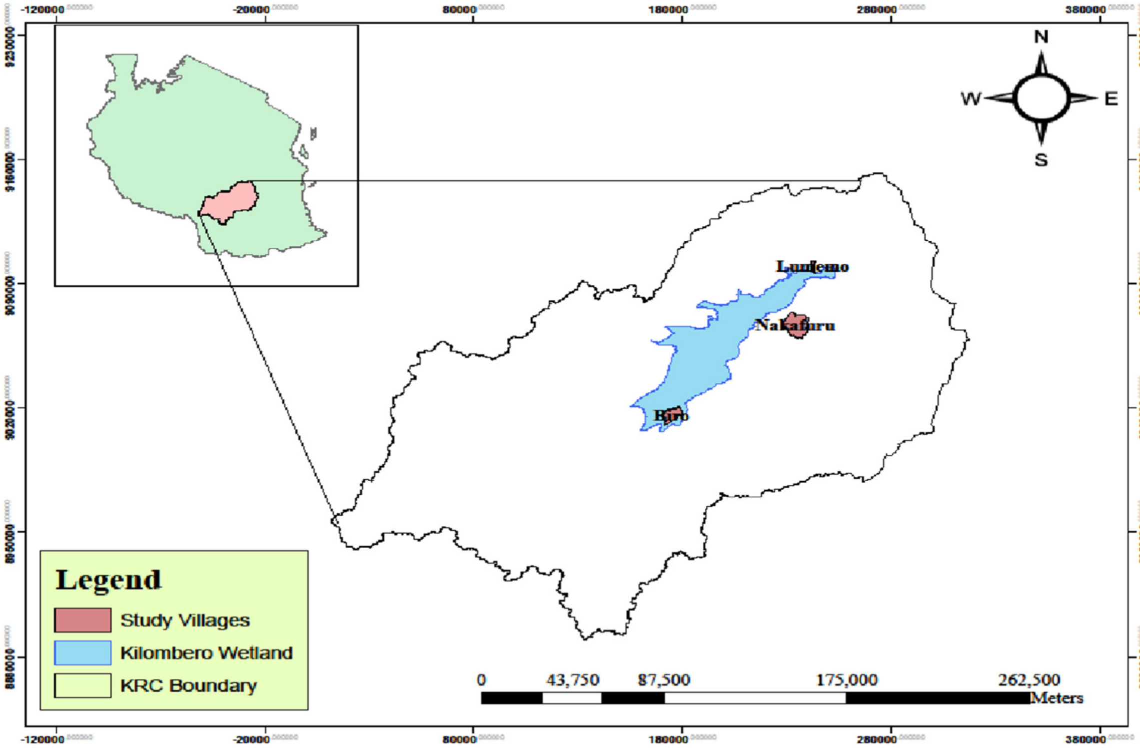

Figure 1: Location of Kilombero River catchment in Tanzania and study villages

2.2 Research Design, Sampling Procedure and Sample Size

A cross-sectional research design was employed in this study (Kothari 2004). Data were collected once at a single point in time involving farmers who were the majority, with far fewer fisherman and pastoralists in the area. Purposive and simple random samplings were used in selecting study districts, villages and respondents. Three districts (Kilombero, Malinyi and Ulanga) were selected purposively because they occupy a larger portion of the river catchment while three villages (Lumemo, Nakafulu and Biro) were selected because they had enormous water resources and accessibility.

Respondents were randomly selected using a sampling frame formed by a village resister. Purposive sampling was also used in selecting participants for key informant interviews (KIIs) from Kilombero Game Controlled Area (KGCA) and Rufiji Basin Water Board (RBWB) in Kilombero and for focus group discussions (FGDs) from the three villages. A total of 120 respondents, forty respondents from each village were interviewed and 7 KIIs and 3 FGDs with 9-12 participants conducted using a checklist.

2.3 Data Collection

The study employed multiple data collection tools, including direct observations, household questionnaire and checklist for KIIs and FGDs.

2.4 Data Analysis

Quantitative data were analyzed using Statistical Package for Social Science (SPSS) version 20 and STATA computer programs. The SPSS yielded descriptive statistics such as frequency and percentage as well as cross-tabulations and Chi-square analyses. The use of weather and climate information was determined by the adoption quotient (Farid *et al.,* 2015). The adoption quotient for an individual respondent was calculated based on the use scores gained by respondents for the use of weather and climate information. Ten decisions on water resources conservation were recorded in the three villages and were all used for calculation of the use quotient.

$$\text{Adoption quotient} = \frac{\text{Total use score gained by respondents}}{\text{Maximum use scores}} \text{ x } 100 \quad (1)$$

On the basis of the adoption quotient, farmers were classified into three categories for Chi-square analysis, such as low use = < (Mean - 1SD), medium use = (Mean ± 1SD) and high use = > (Mean + 1SD). For two-limit Tobit regression analysis in STATA, use/adoption quotient formed a dependent variable and was used as a continuous variable while the independent variables were; climate information attributes (local and scientific forecasts), sources of climate information (radio, television, extension visits, neighbours or relatives, traditional methods and village meetings), wealth status, economic activity, position in community, size of land owned, age, gender and education level (**Table 1**). The model was used in this study because it can measure both probability and extent of use of climate information in each decision while minimizing inadequacies such as heteroscedastic disturbance term (μi) produced inherently by other linear probability models leading to biases of standard deviations of estimates (Sileshi *et al.,* 2012).

The Tobit model used was

$$Y^* = \beta x_i + \epsilon_{i,} \in \sim N[0,\delta^2] Y^* = \beta x_i + \epsilon_{i,} \in \sim N[0,\delta^2] \qquad (2)$$

$$Y_i = \beta 0 + \beta_1 X_{1\ldots\ldots} \beta_n X_{n\ldots} i = 1 \ldots n \; Y_i = \beta 0 + \beta_1 X_{1\ldots\ldots} \beta_n X_{n\ldots} i = 1 \ldots n \qquad (3)$$

Denoting Y_i as the observed dependent (censored) variable;

$$\begin{cases} 0 \text{ if } Y_i^* \leq 0 \\ Y_i = Y_i^* = X\beta + \mu i \text{ if } 0 < Y^* < 1 \\ 1 \text{ if } Y_i^* \geq 1 \end{cases} \begin{cases} 0 \text{ if } Y_i^* \leq 0 \\ Y_i = Y_i^* = X\beta + \mu i \text{ if } 0 < Y^* < 1 \\ 1 \text{ if } Y_i^* \geq 1 \end{cases} \qquad (4)$$

Where;

Yi = observed dependent variable,
Yi* = latent variable (unobserved for values less than 0 and greater than 1),
Xi = vector of independent variables (factors affecting climate information use),
β1 = vector of unknown parameters, and
μi = normally distributed residuals.

Although the regression parameters do not directly correspond to the changes in the expected level of usage, their signs indicate the direction of change in the probability of use and marginal intensity of use as the respective explanatory variable change (Sileshi *et al.* 2012). Qualitative data were analyzed using content analysis where pieces of information were organized into different themes and compared based on the study objectives.

Table 1: Description of independent variables included in the two-limit Tobit model

Variable	Variable description	Expected sign
X1	Local climate attributes (1 if available, 0 if Otherwise)	+
X2	Scientific climate attributes (1 if available, 0 if Otherwise)	+
X3	Access to the radio (1 if yes, 0 if Otherwise)	+
X4	Access to television (1 if yes, 0 if Otherwise)	+
X5	Extension visits (number and frequency) (1 if yes, 0 if Otherwise)	+
X6	Traditional methods (number) (1 if available/used, 0 if Otherwise)	+/-
X7	Village meetings (number) (1 if often conducted, 0 if Otherwise)	+
X8	Household income (1 if low income, 0 if Otherwise)	+
X9	Main economic activity of respondent (1 if farmer, 0 if Otherwise)	+/-
X10	Position in community (1 if Ordinary citizen, 0 if Otherwise)	+
X11	Size of land owned or used in ha (1 if "3-5", 0 if Otherwise)	+/-
X12	Household age (category) (1 if "40-59", 0 if Otherwise)	+/-
X13	Gender of household head (1 if Male, 0 if Female)	+
X14	Education level in category (1 if primary, 0 if Otherwise)	+/-

3. Results

3.1 Socio-demographic Characteristics of Respondents

The results show that the majority 53.3% of the respondents were aged between 40 and 59 years, 65.8% were males and 91.7% were married (**Table 2**). This indicates most of households in the area are male-headed. Farmers (91%) dominated the study villages followed by far with fisherman (5.0%) and pastoralists 4.2%) (**Table 2**). This indicates weather and climate information attributes related to rainfall are the most prominent in the area. As for land ownership, 19.1% owned less than 3 hectares (ha) 26.7% owned 3 to 5 ha and more than half 54.2% owned more than 5ha (**Table 2**). The large size of land owned by the majority is allocated to them by the village government or inherited from parents (Harrison 2006). Results also indicate that most 77.5% of the respondents belonged to the low-income category 85.0% had completed primary school education (**Table 2**). This has serious implication on climate change awareness issued because education plays an important role in raising awareness.

Table 2: The respondents' socio-demographic characteristics (n=120)

Characteristics	Category	Name of Village			Total (Average)
		Lumemo	Nakafuru	Biro	
Age of respondent	20-39	12.5	27.5	15.0	18.3
	40-59	42.5	50.0	67.5	53.3
	>=60	45.0	22.5	17.5	28.3
Land size (ha)	Less than 3	32.5	10.0	15.0	19.2
	3-5	27.5	25.0	27.5	26.7
	More than 6	40.0	65.0	57.5	54.2
Sex	Male	77.5	42.5	77.5	65.8
	Female	22.5	57.5	22.5	34.2
Marital status	Married	97.5	82.5	95.0	91.7
	Single	2.5	17.5	5.0	8.3
Education in level	Illiterate	10.0	2.5	5.0	5.8
	Primary	67.5	95.0	92.5	85.0
	Secondary & high school	15.0	2.5	2.5	6.7
	Graduate and above	7.5	0.0	0.0	2.5
Household income	Low	62.5	82.5	87.5	77.5
	Medium	37.5	10.0	12.5	20.0
	High	0.0	7.5	0.0	2.5
Economic activity	Farmer	82.5	95.0	95.0	90.8
	Pastoralist	7.5	2.5	2.5	4.2
	Fisherman	10.0	2.5	2.5	5.0

3.2 Status on Use of Weather and Climate Information

Results show respondents in the study area made ten decisions which are to farm or other undertakings, change farming practices, protecting water resources, conservation actions, regulate water use, improve water irrigation systems, construction of small pans/ bore holes, move to other areas, reduce number of livestock and look for off-farm jobs (**Table 3**). Among all decisions, 'farming or other undertakings' use is the highest and 'improve water irrigation systems' is the lowest in nearly all villages (**Table 3**). Significant variations in use are observed in three water conservation decisions in the three villages; conservation actions (X^2=5.992, p<0.05), construct small pans/bore holes for water storage (X^2=6.580, <0.05) and reduce the number of livestock (X^2=5.889, p<0.05) (**Table 3**). The main reason is the variations in the socio-economic characteristics of the respondents of the three villages (**Table 3**). Apart from farming or engage in other undertakings (79.2%), decisions on changing farming practices (74.2%), conservation activities (71.7%) and protection of water resources (70.0%) were used by more than half of all the respondents (**Table 3**).

Table 3: Water resources conservation decisions implemented in Kilombero River Catchment (n=120)

S/n	Water conservation decisions	Lumemo	Nakafulu	Biro	Chi-square	P-value
1	Conservation actions, e.g. trees planting	77.5	80	57.5	5.992	0.05
2	Protecting water resources, e.g. restrict human activities	75	72.5	62.5	1.667	0.44
3	Change in farming practices, e.g. drought resistant crops	72.5	77.5	72.5	0.348	0.84
4	Regulate water use, e.g. reduce the irrigation rate	17.5	10	12.5	1.010	0.60
5	Improve water irrigation systems, e.g. clearing of canals	17.5	12.5	12.5	0.548	0.76
6	Construct small pans or bore holes to store water	30	12.5	10.0	6.580	0.04
7	Farming or other undertakings	72.5	82.5	82.5	1.617	0.45
8	Move to other areas (for many reasons).	42.5	32.5	20	4.698	0.10
9	Reduce the number of livestock	37.5	35	15	5.889	0.05
10	Off-farm jobs e.g. employment on a temporary basis	37.5	15	22.5	6.600	0.06

The least frequently adopted decisions on water resources conservation was the construction of small pans or bore holes for water storage (17.5%), improvement of water irrigation systems (14.2%) and regulate water use

(13.3%) (**Table 3**). These three water conservation decisions were used by less than 20% of all respondents because the majority of respondents had low income and they could not afford such intervention.

3.3 Extent of Use of Weather and Climate Information in Decisions to Conserve Water Resources

Results have shown the mean use score of weather and climate information in decisions on conservation of water resources is 44% with a standard deviation of 23.5% and adoption quotient is 40 for more than 40 respondents interviewed in the area (**Figure. 2**).

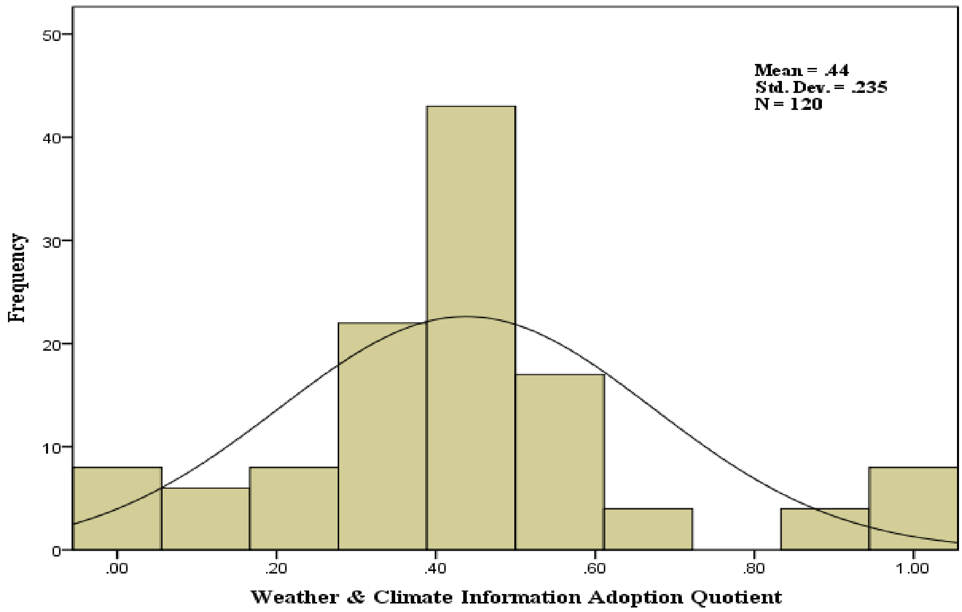

Figure 2. The extent of use of weather and climate information by respondents

There was overall medium use of weather and climate information 34.7%, 33.7% and 31.6% of respondents from Lumemo, Nakafulu and Biro villages, although Lumemo village had a larger portion of respondents 50% in the high use category (**Table 4**). The Chi-square test (5.147, P>0.05) indicates there were associations on weather and climate information use among the three villages; Lumemo, Nakafulu and Biro.

Table 4: Distribution of respondents based on three categories of use

Use category	Study villages			Total	Chi-square
	Lumemo	Nakafuru	Biro		
Low use	2(13.3)	5(33.3)	8(53.3)	15(12.5)	5.147
Medium use	33(34.7)	32(33.7)	30(31.6)	95(79)	
High use	5(50)	3(30)	2(20)	10(8.3)	

Source: Field Survey, 2017. Note: Figures within parentheses indicate percent use

3.4 Factors affecting Decisions to Use Weather and Climate Information in Decisions to Conserve Water Resources

The likelihood ratio χ^2 of 45.98 (14) with a (p<0.05) in two limit Tobit regression model indicates that the model as a whole fits significantly while the coefficient of determination (R^2) of 0.75 indicating 75% of the total variation in use of weather and climate information is attributed to variables fitted in the model. Fourteen explanatory variables were fitted in the model (**Table 5**). Six variables were found to significantly influence the probability and extent of use of weather and climate information (Table 5). Four variables, namely scientific attributes (ß=0.182; p<0.01), extension visits (ß=0.079; p<0.01), traditional methods (ß =0.114; p<0.05) and household income (ß=0.072; p<0.05) were positively correlated while economic activity (ß-0.152; p<0.05) and education level (ß= -0.111; p<0.05) negatively correlated (**Table 5**).

Table 5: Results of Tobit model estimates of intensity and factors influencing decisions to use weather and climate information

Variable	β	SE	t-value	Sig.	Probability	Unconditional Expected Value
Local attributes (X1)	-0.040	0.056	-0.70	0.486	-0.008	-0.038
Scientific attributes (X2)	0.182	0.056	3.24	0.002*	0.071	0.173
Access to radio (X3)	0.125	0.065	1.92	0.058	0.042	0.120
Access to television(X4)	-0.064	0.054	-1.18	0.239	-0.014	-0.062
Extension visits(X5)	0.079	0.022	3.51	0.001**	0.017	0.076
Traditional methods(X6)	0.114	0.057	2.01	0.047*	0.035	0.118
Village meetings(X7)	-0.106	0.065	-1.63	0.106	-0.036	-0.102
Wealth status(X8)	0.072	0.033	2.16	0.033*	0.016	0.070
Economic activity(X9)	-0.152	0.069	-2.19	0.031*	-0.033	-0.147
Position in community (X10)	0.013	0.081	0.16	0.87	0.003	0.012
Size of land owned(X11)	-0.030	0.020	-1.52	0.13	-0.007	-0.029
Age (X12)	0.035	0.032	1.05	0.296	0.008	0.033
Gender (X13)	0.009	0.047	0.18	0.855	0.002	0.008
Education level (X14)	-0.111	0.049	-2.26	0.026*	-0.025	-0.108
__Constant	0.315	0.157	2.01	0.047	-0.007	-0.038
Number of observations	120					
LR chi^2 (14)	45.98 (14)					
Probability> chi2	0					
Pseudo R^2	0.75					
Log-likelihood	-7.52939					
Censoring observation		7 left-censored, 105 uncensored, 8 right-censored				

Dependent variable: Use/Adoption quotient.
β=Coefficient; SE=Standard error.
Note:* and ** indicates statistical significance at 0.05 and 0.001 significance levels.

4. Discussion

4.1 Socio-demographic Characteristics of Respondents

The age group of 40-59 scored by the majority of respondents is considered to have massive experience on local climate changes and adaptation mechanism. Harrison (2006) noted similar results in a socio-economic baseline survey conducted in 19 villages within the Kilombero River catchment. This concludes that most villages in the river catchment share similar characteristics. FGDs conducted in the three villages revealed that a higher percentage of the ageing population in the area is a result of youth moving to the towns to seek for economic opportunities. Farming activity as scored by majority respondents indicates weather and climate information attributes related to rainfall are the most prominent in the area. Similarly, large size of land owned by the majority is a result of allocations from the village government and inherited from parents (Harrison, 2006).

4.2 Status on Use of Weather and Climate Information in Kilombero River Catchment

The study showed weather and climate information is used in the study area to make decisions which conserve water resources. Van Aelst & Holvoet (2017) supports this observation through a study done in Morogoro rural and Mvomero districts which noted common climate change adaptation strategies by women to encompass; engage in undertakings such as work as a casual labourer on someone else's farmland in return for cash, food or a share in crop yields, engage in income-earning activities outside the household and farm such as brick making, charcoal production, own business and changing farming practices by planting crops that are able to cope with drought conditions such as cassava and millet as observed here too.

There was significant variations in use on conservation actions (X^2=5.992, p<0.05), construction of small pans/boreholes for water storage (X^2=6.580, <0.05) and reduce the number of livestock (X^2=5.889, p<0.05). The main reason for the variations in use is socio-economic characteristics of the respondents of the three villages. During FGDs it was revealed that villagers in the study area are aware and take seriously conservation activities such as planting of trees and protection of water resources because of extension visits and village meetings. Individual respondents in the three villages have been implementing these actions under the influence of village governments who use bye-laws and environmental legislation to compel farmers to ensure water resources are protected. FGDs in Lumemo village highlighted the Environmental Management Act (EMA) of 1997 to be the main act used and they went further to cite 'Section 34' of the law which prohibit human activities near water sources to a distance beyond 60 meters as widely used and very useful in protecting water resources.

In Nakafulu village, respondent's awareness of the need to conserve water resources was high as observed by the researcher's in the field through actions taken by pastorals: "Three fishermen were arrested at midnight by pastorals and brought to the village office for further legal action after they were trapped emptying water in one of few remaining water dams/pans in the village to catch catfish easily in November 2017". This implies that communities were aware of appropriate adaptation strategies. KIIs also noted that most water conservation decisions implemented in the area were largely attributed by policies and regulations: "Policies and regulations especially the National Environmental Policy (NEP) of 1997, NAWAPO of 2002, National Wildlife Policy (NWP) of 1997, Environmental Management Act (EMA) No. 20 of 2007, WRMA No. 11 of 2009 and Wildlife Conservation Act (WCA) of 2009 have been central in ensuring water resources such as the Kilombero wetland several rivers are conserved in the Kilombero River catchment" (Field data, KIIs of RBWB and KGCA, 2017).

The construction of small pans/boreholes for water storage (17.5%), improvement of water irrigation systems (14.2%) and regulate water use (13.3%) were least made decisions because majority of respondents were of low income and had no irrigated farms. According to Van Aelst & Holvoet (2017), household income was found to limit adaptations alternatives especially those with higher costs.

4.3 Extent of Use of Weather and Climate Information in Decisions to Conserve Water Resources

The adoption in this study refers to use of weather and climate information on decision to conserve water resources. The mean use score of weather and climate information in decisions on conservation of water resources is 44% with a standard deviation of 23.5% and majority (79%) of respondents in the three villagers were under the medium level of use of the overall adoption quotient. The medium use was evenly distributed (34.7%), (33.7%) and (31.6%) in Lumemo, Nakafulu and Biro villages. The main reason is socio-economic activity which was dominated by farmers. Low use was experienced in Biro while high use was experienced in Lumemo. The probable reason is because Biro village was underdeveloped while Lumemo is was more developed and near urban compared to Nakafulu and Biro villages. Similarly, there were associations on weather and climate information use among the three villages as revealed by Chi-square test (5.147, $P>0.05$).

4.4 Factors affecting Decisions to Use Weather and Climate Information in Decisions to Conserve Water Resources

The two limit Tobit regression model revealed six variables; scientific attributes, extension visits, traditional methods, household income, economic activity and education level out of 14 fitted explanatory variables significantly influence the probability and extent of use of weather and climate information. The information from scientific sources such as TMA are important in influencing the probability of use in decisions which conserve water resources. This variable was significant and positively correlated (ß=0.182; $p<0.01$) with the use of weather and climate information. This implies more weather and climate information from scientific sources increases the probability of its use by 7.1% of farmers in decisions pertaining to farming which contributes towards water resources conservation by 17.3% of the entire sample. Hansen *et al.* (2007) noted historic climate records obtained from real-time monitoring reduces uncertainties to farmers thereby increasing their use.

The extension visits had a significant and positive relationship with use of climate information in the area (ß=0.079; $p<0.01$). This implies access to extension services and frequency of visits determines decisions made by farmers on conservation of water resources and environmental protection in general. The model's results suggest each additional contact increases the probability of use by 1.7% and intensify of use on water resources conservation decision by 7.6% of the entire sample. These findings are in line with Idrisa *et al.* (2012) who noted in Nigeria that farmers with access to extension contact adopt farming technologies by 72% more than farmers without access to extension contacts. In the study area, extension visits involve educating farmers on environmental conservation, environmental legislation and by-laws formulated by the village government to conserve water resources. Maponya & Mpandeli (2013) also observed that extension services expose farmers to new information and technical skills which enhances them to make decisions. The use of traditional ways in disseminating climate information emanates from the fact that many people do not depend on radios and televisions as a source of information due to lack of power for operating these sources in the study area. This variable was significant and positively correlated (ß =0.114; $p<0.05$). The model suggests an exchange of information through traditional ways increases the probability of use by 3.5% and intensity in decisions making on water resources conservation by 11.8% of the entire respondents. Onyango *et al.* (2014) observed high spread and use of traditional forecast through traditional means in absence of scientific forecast. In these areas, traditional forecast and previous experience remain the only basis for farm-level decisions pertaining to the coming season. The wealth status was significant and positively correlated (ß=0.072; $p<0.05$) with the use of weather and climate information for water resources conservation decisions. Even though the majority of the household had low income, the model suggests that they had the probability of use by 1.6% and increased intensity of decision to conserve water resources by 7% of the entire sample. This could be explained by other factors such as the size of land used for agriculture which when positively managed, it has a positive impact on conservation of water resources.

Farming was the main socio-economic activity in the area which was hypothesized to influence negatively water resources conservation (ß-0.152; $p<0.05$). If farmers are not educated enough they may opt to maximize farming output at the expense of water resources which they solely depend on especially during dry season. For a unit increase in farm costs, the probability of use of weather and climate information declined by 3.3% and intensity in water resources conservation affected by 1.47%. The education level had significant and negative influence on the use of climate information in conserving water resources (ß= -0.111; $p<0.05$). For a unit decrease in education level, the use of weather and climate information declines by 2.5% and the intensity of decisions appropriate for water conservation are affected by 10.8%. Farid *et al.* (2015) support this observation through a study in Northern Bangladesh which noted increase in education level has a significant effect on use of technology, that is, rate of use is higher with the increases of level of education and vice versa. About 85 percent of people in study villages are low adopters because they have a primary school education; hence the negative sign of coefficient implies that these farmers had lower probability and intensity in using weather and climate information to conserve water resources.

5. Conclusion and Recommendations

This study has found that the majority of respondents in Kilombero River catchment use weather and climate information in decisions on conservation of water resources with ten decisions identified in the area. The extent of use was medium and evenly distributed in the study area. Scientific climate attributes, extension visits, traditional methods, wealth status, economic activity and education level were the main factors identified to best explain the use of weather and climate information in decisions on conservation of water resources. Most of these decisions are, however implemented through legislation. The study recommends policy makers to emphasize these factors which best explain climate information use in the area. Future research is also essential in order to unravel the actual contribution of each approach to the overall use of weather and climate information in water resources conservation.

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