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Households' Water Uses from the Established Water Conservation Projects in Kitui County, Kenya

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Abstract: **This study analyses the water uses from the established Water Conservation Projects (WCPs) in Kituii County, which is one of Kenya's ASALs. The statistical analysis made use 400 randomly selected household heads of Kitui County who responded to structured interviews in between November 2014 and April 2015. The study further made use of purposively selected key informants to augment data generated through structured questionnaires, Focus Group Discussions and field observation. Cross-sectional Survey Research Design was found useful in depicting the state of farm and nonfarm water uses from the Water Conservation Projects. Results reveal that household heads of Kitui County are involved in water uses from the Water Conservation Projects only in areas that have benefited from self-help groups involved in water conservation with the help of external interveners. Field observations noted growing awareness in agricultural water use and scanty nonfarm water use from the WCPs as the best alternative to rain-fd agriculture to meet household food needs.**

Keywords: **Water uses, agricultural water uses, nonfarm water uses, and Water Conservation Projects.**

1. INTRODUCTION

This paper integrates field findings of a study done in Kitui County with reviewed literature from competitive sources. The main purpose of the paper is to analyse ways in which households have made use of water from the Water Conservation Projects in both agricultural and non-agricultural activities in Kenya's dry lands, specifically Kitui County. Water besides being useful for drinking is useful in food production, thus securing the right to food has to be done along with securing the right to water (Gifra and Beltrán, 2013). While Africa's dry lands make an effort to attain food security, climate change, poses a challenge to both water availability and food security strategies; facilitates crop failure, death of livestock and generally disrupts the livelihood of farmers (Barnett and Neil, 2007; Oluoko-Odingo 2011). The 1997-2009 period was characterized by a turn down in maize productivity in the lower Eastern Kenya (Nyandiko *et al* 2012a). The declining agricultural productivity in Machakos, Kitui and Makueni Counties of Kenya is among other things associated with drought (Mwadalu and Mwangi, 2013).

Water uses has an essential influence in the livelihoods of rural areas, especially in the ASALs of developing countries, and it is as well specifically essential for crop productivity (Adeniran *et al* 2010). In line with farm water uses, Merrey and Sally (2008) note that water is essential for agricultural production. One of the water uses, in line with food productivity, is irrigation, which is estimated to provide 40% of global food needs from only 20% of irrigated land while rain-fed agriculture is estimated to provide 60% of global food needs (Thenkabail, 2010).

Owing to the fact that farmers in dry lands rely on rainfall for farming, they can enhance crop productivity through supplement irrigation as is the case of Syria Arab Republic and Morocco where supplement irrigation notably boosts barley production (OECD-FAO, 2012). Supplement irrigation in the dry lands can be done by involving farmers in rainwater runoff harvesting and storage, and then make use of it to irrigate crops (OECD-FAO, 2012). Farm water uses can as well be conceptualized within the framework of sustaining food production through fish production (Dugan, 2005; Shitote, 2013). One of the ways of increasing water productivity is making use of integrated utilization of water in fish production by for instance using existing water-use systems like rice fields to rear fish (Dugan, 2005). Although there is need to use water in food production in the ASALs, water sustainability has to be factored. On the same, Ward (2007) observes that the criteria for realizing sustainable water resource must factor non-declining use per capita, sustained water production, use and ecosystem reliability. Based on this background, the study sought to find out ways in which households of Kitui County use water from the Water Conservation Projects with regard to household food security.

2. MATERIALS AND METHODS

2.1. Study Area

This study was conducted in Kitui County, Kenya during May and December of 2014 period. Going by the 2009 Census Report, Kitui County has a total population of 1,012,709 (KNBS, 2009). Kitui County has six (6) constituencies namely, Kitui Central, Kitui South, Kitui West, Mutito, Mwingi North and Mwingi South (CRECO, 2012; RoK, 2009). This County is one of the drought-vulnerable, water scarce and food insecure parts of Kenya (RoK, 2010; Mbii, 2011; Kaveva, 2011). It is estimated that it takes households two hours or more to reach the water points (Mwema *et al* 2013; Mbii, 2011). The annual minimum temperatures of Kitui County range between 22-28^{0}C while annual maximum temperatures range between 28-32^{0}C, and the inadequate rainfall enhances surface water scarcity (RoK, 2010). Households in Kitui County depend on surface water of seasonal rivers supplemented by underground water accessed via boreholes (KC, 2013).

Kitui County was chosen for study because it is one of Kenya's ASALs that have in the past benefitted from a number of government and NGO sponsored water conservation efforts and workshops on water management (Muoko, 2010; Mbii, 2011; van Loon and Droogers, 2006; AHBFI, 2011), thus provided the ground of examining the nexus between the water conservation and use with regard to household food security.

2.2. Research design

According to Kothari (2004), a research design constitutes the blue print for the collection, measurement and analysis of data. Neville (2007, p.8) observes that Cross-sectional Research Design "involves a close analysis of a situation at one particular point in time to give a snap shot result." This research design served as a framework within which data on water uses was collected and analyzed. This research design was found helpful in depicting the agricultural water uses, nonfarm water uses and households' attitudes towards water conservation and use with regard to household food security. The study population comprised household heads, Agricultural and Water Officers; chiefs; opinion leaders; group leaders of water-user projects; Nutritional Officers; Field Officers of NGOs and CBOs associated with water-user projects like green house farming.

2.3. Sample size

This section gives an account of the procedure that was used in selecting the respondents from the entire population of Kitui County. The selected respondents were assumed to have characteristics representative of the entire county population of 1, 012, 709 (KNBS, 2009). Household heads were selected through stratified random sampling using random number tables thus giving the targeted population equal chances of being represented. The stratified random sample size was determined using a web-based calculator of Survey Systems (Zar, 1984).

$$SS = \frac{Z^{2*}(p)^{*}(1-p)}{C^2}$$

Where:

SS = Sample Size

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as decimal (.5 used for sample size needed)

c = confidence interval, expressed as decimal (e.g., .05 = ±5)

A sample size of 384 with a confidence interval of 95% and a margin error of 5% was arrived at. However the sample size was rounded up to the nearest hundred to come up with a sample size of 400. The population of 400 household heads were stratified as follows: thirty (30) household heads benefiting from each of the ten (10) selected WCPs were randomly selected totaling to 300. Another ten (10) household heads who have not benefitted from the WCPs but who are from neighbourhood of the ten (10) WCPs were randomly selected totalling to 100. The rationale of the selecting ten (10) household heads that have not benefitted from the WCPs was to assist in getting the outsider's perspective on water uses with regard to household food security in Kitui County, Kenya, thus serve the purpose of the control group. The study made use purposive sampling to select Staff of the water projects, Agricultural Officers, chiefs, opinion leaders, group leaders of water-user projects, Nutritional health officers, Field Officers of NGOs and CBOs. Quota sampling was used in sampling FGD participants.

2.4. Data Collection

Data collection took place in between November 2014 and April 2015. For the purpose of collecting data from the main informants, the study made use of questionnaires with both closed-ended and open-ended questions to source data. Whereas the closed ended questions were helpful in quantifying data, the open-ended questions were helpful in finding out the informants' perception of the issue under study. Owing to the fact that questionnaire often do not provide ground for probing what the informant had in mind or does not give the informants an opportunity to seek for clarity, the study's questionnaire inquiry was followed by in-depth face-to-face interviews using the Interview Guide. Informed by the assumption that some respondents get the motivation to share their views while in a group, the study conducted FGD using the FGD Guide comprising of household heads and non-household heads. While conducting field research, the study made use of Direct Observations using an Observation Checklist and finally, Document Content Analysis was done using Documentary Checklist. The triangulated research instruments were helpful in having multisource for data triangulation.

2.5. Data Analysis

Babbie (1995) observes that the final stage of research calls for the manipulation of data for the purpose of drawing conclusions relevant to the interests that initiated the inquiry. This study made use of continuous data processing which involved data cleaning and identifying contradictions in the generated data and hot pursuit was made through face-to-face interviews and Focus Group Discussions. The responses given by various respondents were categorized into specific themes and subthemes of either qualitative or quantitative data. Qualitative data was descriptively analyzed and presented in discussion form while quantitative data was analyzed using the Statistical Package for the Social Science (SPSS), and the triangulated data was presented in the form of numbers, figures and charts.

2.6. Study Assumptions

The study was done on the basis of the following assumptions:

(i) The sampled informants were to voluntarily accept to inform this study without expecting monetary compensation for the information they will provide.

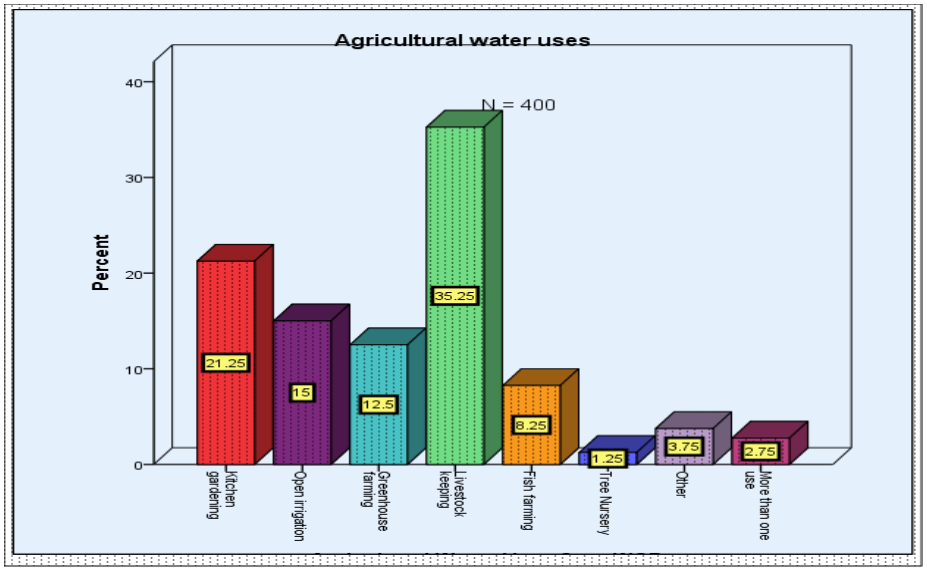
(ii) The selected informants were assumed knowledgeable enough to provide information that can be generalized on the entire Kitui County and other dry land areas of Kenya.

3. RESULTS AND DISCUSSIONS ON HOUSEHOLDS' WATERS USES

The results are divided into two sections: the first section presents findings on agricultural water uses while the second section presents findings on nonfarm water uses with regard to household food security.

3.1.1. Agricultural Water Uses

The study sought to examine ways in which household heads use the water from the Water Conservation Projects for agricultural purpose, and the results are given in Figure 1.



Source: Field Data (2015)

Figure 1: Agricultural Water Uses in Kitui County, Kenya

According to Figure 1, 21% (85) of household heads indicated that water from WCPs is used for kitchen gardening; 15% (60) open irrigation; 12.5% (50) greenhouse farming; 35% (141) livestock keeping; 8% (33) fish farming; 1% (5) tree nursery; 4% (15) other purposes; and 3% (11) more than one use. The key informants noted that agricultural water uses in kitchen gardening and open irrigation has been capitalized by household heads whose land has good soil moisture retention capacity. Much of agricultural water uses observed during field visits are for small scale subsistence farming of capsicum, sweet potatoes, pumpkin, cabbage, kales, water melon, tomatoes, red onions, muriga, citrus fruits and vegetables. This concurs with a study done by Mwema *et al* (2013) which states that the main form of farming in Kitui County is subsistence farming.

3.1.2. Water Uses in Green House Farming

The results in Figure 1 indicate that 12.5% respondents indicated that they use that they use water from WCPs for green house farming. Field observations and key informant interviews noted that some household farmers are involved in water conservation and use in agricultural productivity in an attempt to make them resilient to drought and associated challenges. OECD-FAO (2012) observes that supplement irrigation in the dry areas can be done through involving farmers in harnessing rainwater runoff and store it in ponds, tanks and small dams, and then make use of such water to irrigate crops. Pate 1 shows the researcher standing before a water tank whose water is pumped from a subsurface dam at River Mutende to support farming in the adjacent greenhouse, and the muriga plants around the greenhouse.

Plate 1: The researcher before a water tank next to a greenhouse in Kitui County, Kenya

Informed by Gifra and Beltrán (2013) who content that water besides being useful for drinking is useful in food production, the study sought to know from key informants how they make use of water from WCPs in greenhouse farming. It emerged that greenhouse farming makes use of regulated drip irrigation of tomatoes, red onions, spinach, kale and capsicum, and this is done both at the individual and group level. Face-to-face interviews of household heads at Kyome revealed that some households have benefitted from the Amiran green houses kitty; in which case, the organization constructs for a household a green house with an initial deposit of 36 thousand shillings. The beneficiary is expected to pay back 9,000 shillings per month with a grace period of four months. These findings have a bearing on a study done by Muoko (2010) in Nzauni Division of Kitui County where households were sensitised to make use water from Mavulya Earth Dam for farm productivity like greenhouse farming and tree nursery.

3.1.3. Water Uses in Kitchen Gardening

In Figure 1, earlier explored, showed that 21% respondents indicated that they use water from the WCPs in kitchen gardening. Below is Plate 2 of a kitchen garden before a greenhouse that acts a source of vegetables for consumption and sale.

Plate 2: Vegetable Garden outside Two Green Houses in Kitui County, Kenya

According to an Agricultural Extension Officer, household heads are moving away from their routine farming that depended on rainfall to grow vegetables to now capitalizing on sprinkle irrigation of kitchen gardens. This observation was found to be related with Monteiro *et al*, (2010) who observe that in Africa, sprinkler irrigation and trickle irrigation techniques if replacing traditional surface methods for they are capable of helping farmers to reduce water wastage.

3.1.4. Water Uses in Overhead and Drip Irrigation

In Figure 1, earlier explored, 15.5% respondents indicated that they use water from the WCPs in open irrigation. In line with agricultural water uses for open irrigation, it was found through key informants, field observations and FGD responses that household heads are taken through seminars to engage in growing rapid maturing crops like tomatoes, peas, capsicum, maize, cabbage, kales, spinach, sweet potatoes, pumpkin vegetables and water melon. Such crops not only assist households to access food in less than three months, but also save households lots of water that can be used for other domestic uses.

Part of the literature reviewed indicated that irrigation is useful in the critical stages of crop growth and can be used in altering the plating dates determined by the onset of rains (Faurès 2013). It however emerged from an Agricultural Extension Officer that some areas in Kitui County have low agricultural productivity because of households' inability to afford fertilizer and the poor roads to markets, thus makes them to sale their produce at throw-away-prices. According to Li *et al* (2009), for the purpose of, meeting the growing demand for food, there has to be corresponding increase in crop production globally, increased fertilizer use, technological and infrastructural development.

3.1.5. Water Uses in Tree Nursery Farming

According to the results in Figure 1, earlier explored, 1% respondents indicated that they use water from the WCPs in tree nursery farming. The study sought to know from household head informants the extent to which the provided water has been used in tree nursery farming. It was noted that a few have ventured into tree nursery farming. According to the members of the FGDs and field observations made, the tree nurseries comprise growing fruit and non-fruit trees for household tree planting and for sale to neighbours and in towns like Kitui, Mwingi, Kabati and Mutomo. Below is a Plate 3 of a tree nursery kept before a green house.

Plate 3: Water Uses in tree nursery farming in Kitui County, Kenya

3.1.6. Water Uses in Fish Farming

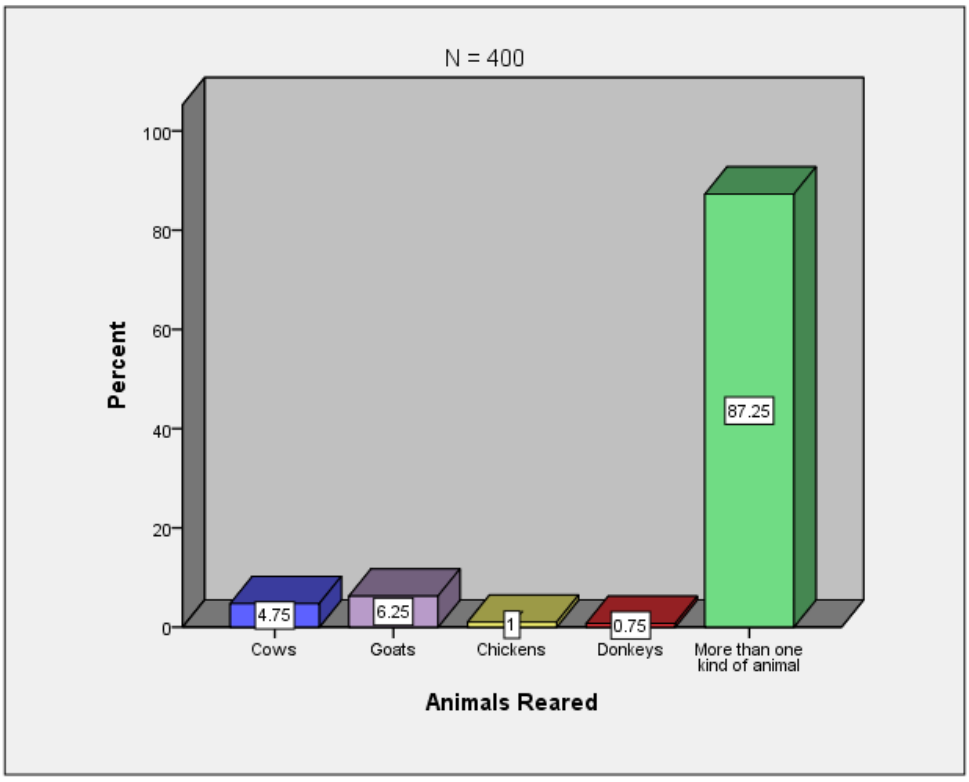
The results in Figure 1, earlier explored, 8% respondents indicated that they use water from the WCPs in fish farming. It however emerged from the key informant interviews that the majority household heads who were engaged in fish farming are members of fish farming projects in the neighboring Makueni County. However field observations noted attempts by some household heads to engage in fish farming. Plate 4 shows a fish pond under construction 3KM away from Mwingi town.

Plate 4: Fishpond under construction near Mwingi Town of Kitui County, Kenya

According to key informant interviews combined with FGDs, many households are not keen on establishing fishponds and fish keeping not only because of the prohibitive cost of construction and maintenance but also due to the uncertainty of drought in the county. Water productivity can be conceptualized within the framework of sustaining food production through fish production (Dugan, 2005). Similar observations were made by Shitote (2013) who found out that in Siaya fish farming has been capitalized on by local farmers.

3.1.7. Water Uses in Livestock Farming

Going by the results in Figure 1, 35.5% respondents indicated that they use water from the WCPs in livestock farming. Field observations, especially in Nzauni revealed that household heads who formed Self Help Group are beneficiaries of dairy goats that are known to endure harsh weather conditions. This is after the decline of indigenous cows and goats with small bodies and which are known to endure drought. From FGD at Kaikungu, it came out that that most farmers opt to engage in livestock farming due to the assured water volumes in the dams to support ranch farming. The conserved water especially in the form of earth dams that was found useful in making water available for goats, cows and donkeys. This observation resonates with assertions by Jewitt *et al* (2004) and FAO (2014) that water scarcity, amid climate change, calls for water conservation for animals, crops and income generation. Results on the types of animals reared are as shown in Figure 2.



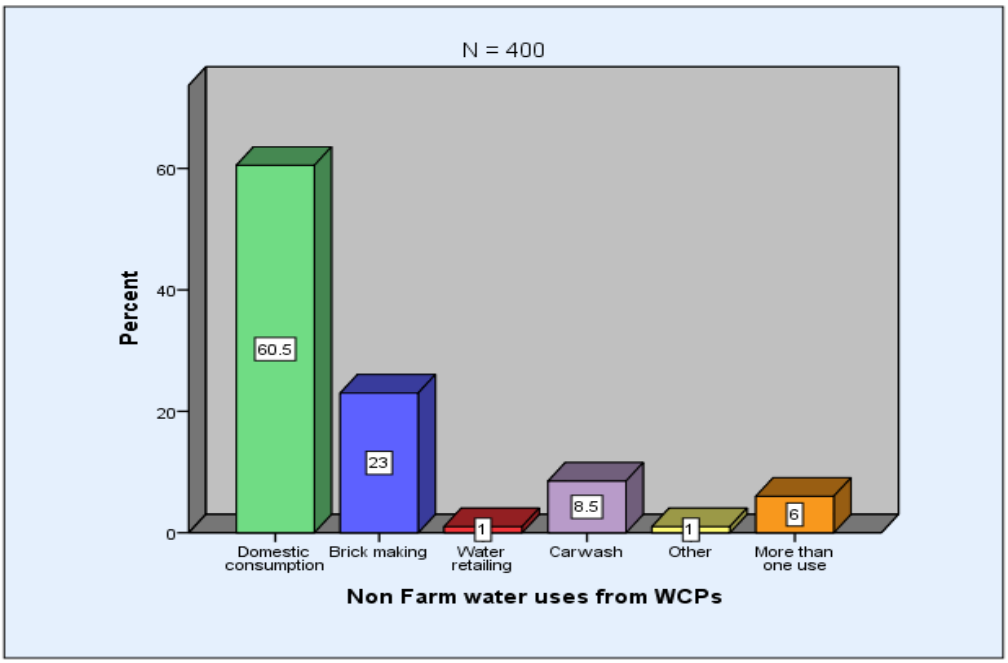
Source: Field Data (2015)

Figure 2: Types of animals read in Kitui County, Kenya

According to results in Figure 2, 5% (19) of household head informants indicated cows; 6% (25) goats; 1% (4) chickens; 1% (3) donkeys and 87% (394) settled for more than one kind of animal. A study done in a water scarce province of Pakistan by the name Balochistan shows that main aim of livestock production was to firstly meet some basic dietary needs and secondly income generation (ICARDA (2010). It however emerged from key informants that most households have not ventured much into livestock rearing in Kitui County as a result of the established Water Conservation Projects because they are not sure of when the elongated drought will strike and scanty feed. The findings on lack of feed agrees with A study done in Balochistan, Pakistan shows that livestock reduction by farmers is attributed to lack of feed, drought and diseases (ICARDA (2010).

3.2. Nonagricultural Water Uses

The study explored households' water use for nonagricultural purpose and the results are as in Figure 3. The rationale of doing this was to find out other water uses, other than farm water uses from the Water Conservation Projects.



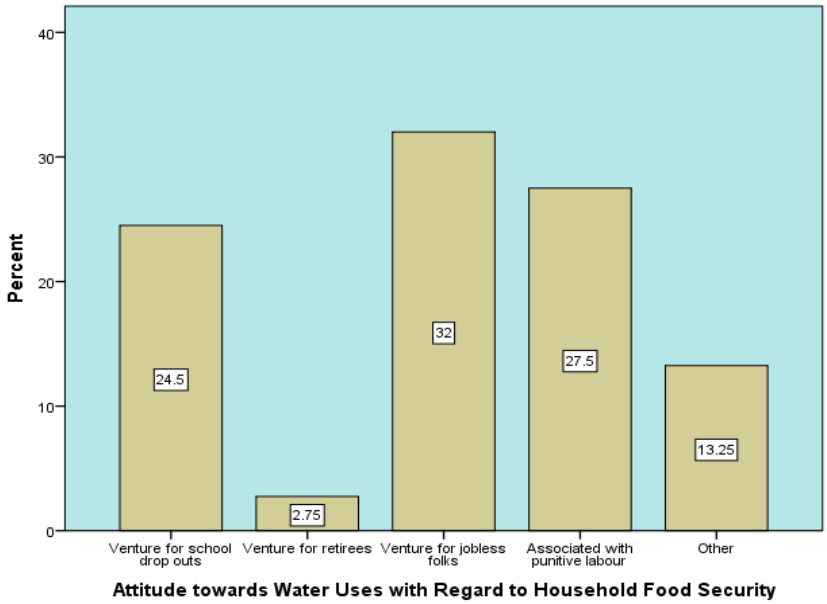
Source: Field Data (2015)

Figure 3: Nonfarm Water Uses in Kitui County, Kenya

The study outcome in Figure 1.3 shows that majority 61% (242) of household head informants indicated that water from WCPs is used for domestic consumption; 23% (92) is used for brick making; 1% (4) is retailed to greenhouses; 8% (8) is used for carwash; 1% (4) represents other uses and 6% (24) represents more than one use. A Community Based Organization Development Officer observed that there is a growing trend of nonagricultural water use like brick making due to the established WCPs but they actively discourage water withdrawal from WCPs for brick making to elongate its availability for essential use like domestic consumption and micro farming.

3.3. Attitude Issues On Agricultural Water Use

The study sought to know from household heads the specific attitude households have towards water uses with regard to household food security, and the results are as in Figure 4.



Source: Field Data (2015)

Figure 4: Attitude towards Agricultural Water Use in Kitui County, Kenya

Out of the total targeted study population, 24% (98) perceive agricultural water use as a venture for school dropouts; 3% (11) perceived it as a venture for retirees; 32% (128) perceived it as a venture for jobless folks; 27% (110) associated it with punitive labour while 13% (53) indicated other. It emerged from face-to-face interviews and the specification for the indicated "other" on the questionnaire represents households who perceive agricultural water uses as a necessary venture for the realization of food security. According to the participants of FGDs conducted at Ilalambyu, Mavulya, Athi and Mutende, water uses for agricultural output is obstacle by the negative attitude that young households have towards, first of all, farming and, secondly, agricultural water uses. One of the FGD participants indicated that

Some youngsters perceive farm water uses with regard to food production as a venture for school dropouts or those who did not excel in school, thus deserve to engage in "punitive" farm water use… and indeed most of us involved in farm water uses are not well educated.

An NGO Agricultural and Water Officer argued that the noncommittal tendencies to farm water use negatively impacts on agricultural productivity, and in turn exposes poor household to hunger which in turn perpetuates dependency on relief food. A study done by Wambua *et al* (2014) in Tseikuru Division of Kitui County indicate that household cope with food insecurity through short term labor in neighbouring towns like Meru, Chuka and Mbeere.

4. CONCLUSION

It emerged that increased water uses in food production has only been realized in places where households engage in collective water conservation and use. For instance 21% (85) of household heads indicated that water from WCPs is used for kitchen gardening; 15% (60) open irrigation; 12.5% (50) greenhouse farming; 35% (141) livestock keeping; 8% (33) fish farming; 1% (5) tree nursery; 4% (15) other purposes; and 3% (11) more than one use. The results on non agricultural water uses shows that majority 61% (242) of household head informants were of the idea that water from WCPs is used for domestic consumption; 23% (92) indicated that it is used for brick making; 1% (4) indicated it is retailed to greenhouses; 8% (8) indicated it is used for carwash; 1% (4) represents other uses and 6% (24) indicated more than one use. Successful water use from the established WCPs in some parts of Kitui County is hampered by, among other things, the backpedal attitude that households have towards water use. For example 24% (98) of household heads noted that water use is perceived as a venture for school dropouts; 3% (11) noted that it is perceived as a venture for retirees; 32% (128) perceived it as a venture for jobless folks; 27% (110) associated it with punitive labour while 13% (53) indicated other.

With regard to the objective of determining the various agricultural and nonfarm water uses in Kitui County, the study concludes that for the intention of farm water uses to be realised with regard to household food security, negative attitude towards the water uses can be reversed through exposure trips to farms in Kenya farmed by well educated people. The study too hypothesizes that as longs there is no alternative means of income for households, hunger will persist because households sell proceeds of agricultural water uses to cater for other household items while some lease out their land once a project has been established. The study recommends an establishment of county follow-up mechanisms on the outcome of water uses from the established WCPs with regard to household food production so as to make written records available and in turn act as a guide for future performance appraisal of water uses with regard to food security.

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