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Research Article

Determinants of farmers' adoption of rainwater harvesting technologies in Boricha woreda of Sidama Regional State, Ethiopia

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Article Info

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Abstract

Stem diameter distributions is highly needed in most forest management decisions. This study developed some models for describing the diameter distribution of Omo Biosphere Reserve in lowland rainforest ecosystem, Nigeria. Systematic sampling design was used to lay three straight line transects, four temporary plots of 0.25ha (50 m x 50 m) were laid in alternating position along each transect at 100 m interval to make up a total of 12 plots for the study and Diameter at breast height (DBH) was measured for all trees with Dbh $\geq$ 10cm in every plot.A total of fifty-seven species were encountered and exploratory analysis of the collected data showed that the observation was right skewed consequently resulting in the choice of six probability diameter distributions functions using Maximum likelihood estimator. The selected distribution models are Weibull, Lognormal Distribution (LN), Gamma, Logit-logistic (LL) and Burr distribution. The Kurtosis and Skewness are 6.43 and 1.34 respectively with a mean Dbh of 36.40cm. Burr had the least values of Kolmogorov Smirnov (Dn) (0.046), Anderson Darling (AD) (1.102) and Cramer-von Mises (CvM) (0.178). This is followed by log logistics with 0.05, 2.769 are 0.258 for Dn, AD and CvM respectively. High and positive skewness and kurtosis values reflect abundance of trees in the lower Dbh class. These are sufficient to replace the trees in the upper dbh class through regeneration. Hence, the Burr and Log-logistic distributions were adjudged the most flexible to describe the diameter structure of Omo Biosphere Reserve.
Keywords: Omo Biosphere, Diameter Distribution, Parameter estimationn

1 Introduction

In the world, more marginal areas are being used for farming and most of this land is found in the arid or semi-arid belts where rainfall is variable (Mahoo et al., 2007). Water is a critically important and scarce resource in semi-arid and arid parts of the world. Aridity and climate change are the main problems faced by farmers who rely on rain-fed farming in arid and semi-arid areas (Kahinda et al., 2008). Implementing technologies for proper management of water in water-scarce areas could assist the livelihood of inhabitants.

Rainwater harvesting technologies (RWHT) have been applied to cope with water scarcity (Adham et al., 2016). Rainwater harvesting is a method of collecting, storing and conserving surface runoff for agricultural production and domestic use.

In arid regions, farmers face variability and low mean annual rainfall (Mahoo et al., 2007). Nowadays, inhabitants of North and South America employ relatively simple methods of water harvesting for irrigation (Sauerhaft et al., 2010).

Agriculture is the main economic activity in Sub-Saharan African

(SSA) countries, accounting for about 67%, which depends on rain-fed agricultural practices, generating 30-40% of the SSA countries' GDP (Ngigi et al., 2006). Since agriculture is the highest consumer of water in SSA countries, efficient and effective water utilization is necessary to sustain their livelihood (Yemeuu et al., 2014). However, rainfall is poorly distributed in the SSA. The irregularity and variability in the distribution of rainfall have made agriculture unable to sustain food production to meet the increasing demand in the region (Mutiga et al., 2011). Recurrent drought and food insecurity has become a common phenomenon that threatens the lives of millions of poor people in Sub-Saharan African countries (Shiferaw et al., 2005). Rapid population growth, high unemployment, dependence on the primary sector economy, export commodities, and underutilization of natural resources worsen the problems in SSA. These factors may threaten the lives of many people in the region unless rain-fed agriculture is augmented with RWHT adoption (Kahinda et al., 2011).

In Ethiopia, approximately 42% of the country's GDP, 85% of the labor force, and 90% of national export earnings are from agriculture (CSA, 2018). Moreover, in Ethiopia the agriculture sector heavily relies on rain-fed agriculture, characterized by low use of modern agricultural inputs, low output levels, highly vulnerable to drought and low augmenting with RWHT (Degefu and Bewket, 2014). Floods and drought are recurrent, every 3 to 5 years, with increasing frequency compared to two or three decades ago, which forced the country to rely on imports of food and food aid (Awulachew et al., 2005; Tofu and Wolak, 2023).

Rain water harvesting technologies can minimize the problems associated with water scarcity for crop production. Adoption of rainwater harvesting is essential in food insecure areas (Tasisa et al., 2020). Since many areas of Ethiopia are characterized by the erratic nature of rainfall and dry spells during the crop growing season, RWHT should support rain-fed farming in order to alleviate the moisture stress during the critical crop growing season. Improving rainwater harvesting can improve agricultural production by making water available during dry periods. The RWHT most practiced in Ethiopia are runoff irrigation (runoff farming), flood spreading (spate irrigation), in-situ water harvesting (ridges, micro basins, etc) and roof water harvesting (Degefu and Bewket, 2014).

According to Dile et al. (2016), small-scale RWHT has been practiced almost all over the world for millennia. Recent research findings indicated that RWHT adoption can increase agricultural productivity, provide an opportunity to stabilize agricultural production, particularly in arid, and semi-arid areas where water is limited and ensure food security (Gowing et al., 2003). The widespread droughts have led to growing awareness of the opportunity for rainwater harvesting adoption that focused on combating the effects of droughts by adopting small-scale rainwater harvesting technologies (Critchley et al., 2013). Some factors including slope, land use/cover, soil type, rainfall, distance from settlement to stream/river, and cost can determine farmers' adoption and management of rainwater harvesting (Adham et al., 2016; Girma, 2020). Although small-scale RWHT adoption has been the center of attention for the water policy of Ethiopia (Eleni et al., 2004), little has been gained to feed those drought-prone areas at household level. The practice of rainwater harvesting technologies has been poorly documented in the country. Problems related to food security and climate variability as well as soil fertility decline have been documented in the rural areas around the study site (Atara et al., 2019; Majo, 2021; Dangiso and Wolka, 2023). However, in the Boricha area, and in the country in general, there are limited studies on rainwater harvesting and factors affecting RWHT adoption, which are important to cope with climate variability and food insecurity. The objective of this study was to document and identify determinants of the adoption of rainwater harvesting technology.

2 Materials and methods

2.1 Description of the study area

The study was conducted in Boricha woreda, Sidama regional state of Ethiopia. Boricha woreda is located at 32 Km from Hawassa (Regional capital city) and 307 km from Addis Ababa. The area is geographically located 6030'–7005' N latitude and 38005'–38025' E longitude. The topography of the area comprises 78 and 22 percent plain lowland and rugged land, respectively. The elevation of the area ranges from 1700–2000 m above sea level. The rainfall distribution of the woreda lies between 700 mm and 1242 mm per annum, which is characterized by erratic distribution.

The rainy season is divided into two major categories i.e. "belg" and "meher". The "belg" season starts in February and ends in May, during which rainfall is erratic. The "meher" season starts in June and ends in mid-September, which is characterized by normal types of rainfall. The rainfall share of the ''belg" season is about 80 percent. The area is considered semi-arid due to high temperature and low rainfall. About 78% of the woreda has usually been affected by drought at an interval of 5 to 10 years.

The main livelihood of the people in the area is mixed agriculture, growing crops and rearing animals. Most of the community members couldn't get enough agricultural produce for their livelihood as they owned less than 0.5 hectare of land. In the normal year, a significant number of the population can get their livelihood by selling maize and haricot bean. The community usually produces potato and haricot beans twice and maize once a year.

2.2 Sampling procedure and sample size

The study employed a mixed research design, which is a combination of qualitative and quantitative approaches. In this study, multistage sampling technique was employed to select sample households. In the first stage, three kebeles (lowest government administrative unit), namely Hanja Chafa, Gonowa Bulano and Aldada Dela were purposely selected based on rainwater harvesting practices in the area. The sample size was determined using 5% degree of precision in the formula below:

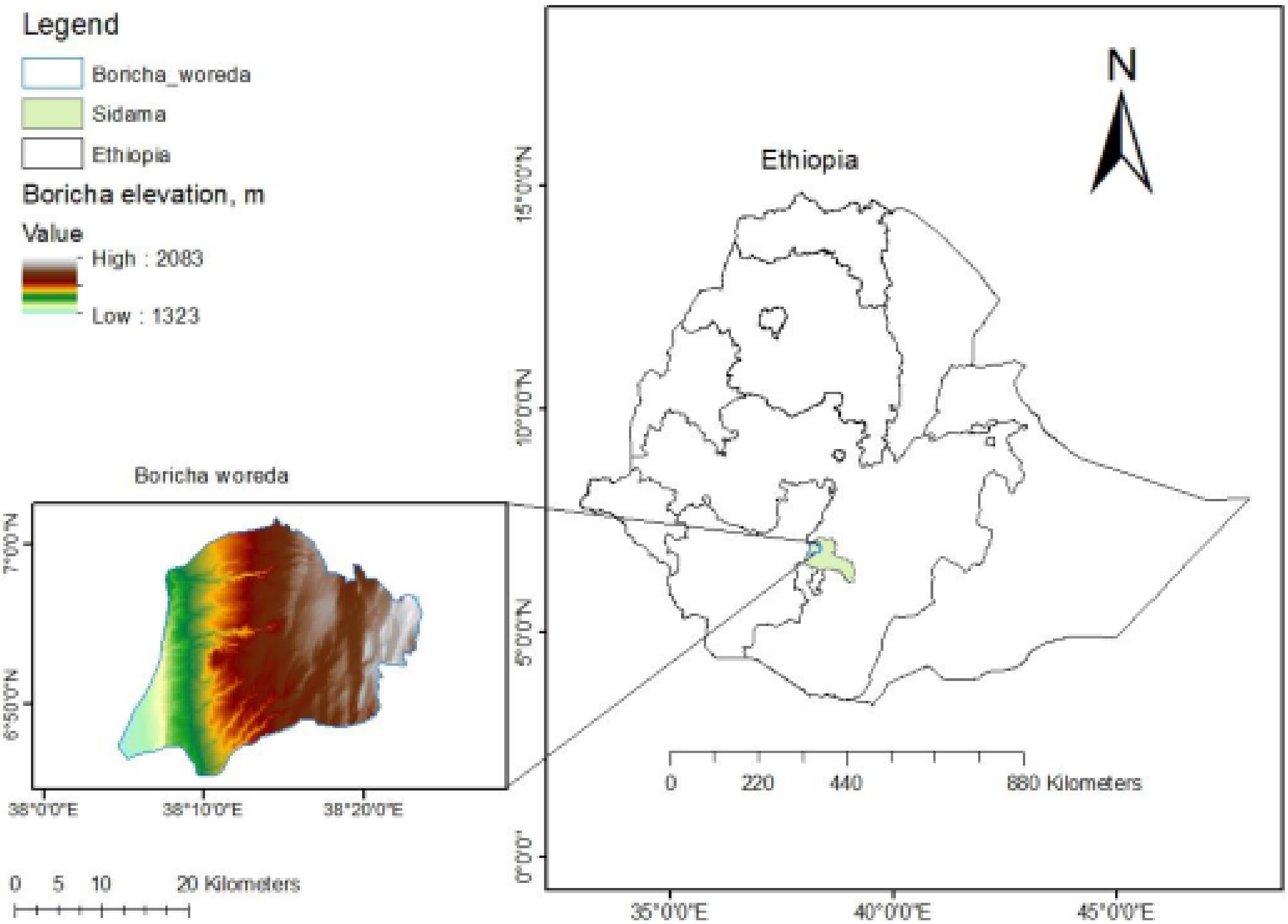

Figure 1: Location map of Boricha woreda in Sidama regional State of Ethiopia

$$n = \frac{Z^2 p \cdot q}{e^2} = \frac{(1.96)^2 0.5(0.5)}{(0.07)^2} = 196$$

Where
n = Sample size
Z = Standard normal deviation, i.e., 1.96 for 95% confidence level
P = 0.5 (The proportion of the population)
q = 1-P = 0.5 (50%) due to unknown variability
e = is margin of error or degree of accuracy desired, i.e., 0.07.

Therefore, by taking design effect and non-response rate into consideration, the researcher took a total of 196 sample households.

To have proportional sample size for each kebele, the following formula is used:

$$n1 = \frac{N1 \times S}{\sum N}$$

Where,
$N1$ = Total households of each kebele
S = Total number of sampled households in the study area
$\sum N$ = Summation of total number of Households in the study area.

In each kebele, the list of households was obtained from the respective kebele office, and the households were selected randomly by using lottery method. Furthermore, in each kebele, one focus group discussion comprising 6-8 farmers were conducted. A total of 18 key informants (kebele leaders, agriculture, and natural resource experts) were selected purposively and interviewed.

2.3 Data source, type, and collection techniques

2.3.1 Primary data collection

The primary data was mainly collected from interviewed households. Semi-structured questionnaire-based interview, and obser-

Table 1: Distribution of sample kebele and household sample size

No.	Kebele	Total population	Total Household	Formula —	No. of sampled HH
1	Hanja Chafa	9157	682	682*196/1631	82
2	Gonowa Bulano	6540	767	767*196/1631	92
3	Aldada Dela	6283	182	182*196/1631	22
Total	21980	1631	196		

vations were used. Questionnaires were preferred because they were useful instruments to collect sufficient data. The questionnaire mainly contained close-ended questions, which were followed by some open-ended ones to give opportunities for the respondents to explain answer. The questionnaire was prepared in English and then translated into Amharic to ease data collection with the local experts. The questionnaire was administered by development agents and high school graduate enumerators who are familiar with the study area. Enumerators were trained regarding data collection.

The key informants interviewed for this study include elderly people, model farmers, development agents, kebele administrators, woreda officials, and zonal experts. The composition of the kebele focus group discussants included both male and female households, elders and youth. The focus groups discussed the experiences, challenges and prospects of the adoption and intensity of RWHT and possible recommendations for future action. Field observation was conducted during field data collection. Obtaining data from different sources such as observations, questionnaire, documentation and focus group discussion helps to bind diverse ideas about the same issue and assist in tabulating the results.

2.4 Method of data analysis

The collected data were analyzed in terms of the study objectives. The process of analysis was carried out using mixed approach as both qualitative and quantitative data were collected. The qualitative data was analyzed manually by categorizing texts into themes; contents were analyzed and presented with narratives. It served to triangulate data gathered through a questionnaire in a way that helps to improve research reliability. The quantitative data, which were the primary data collected from questionnaires, were analyzed using both descriptive and binary logistic models. Using descriptive statistics, the mean, frequency and percentage values of variables were indicated. The results obtained from descriptive analysis were used as an indicator of the relationship between the independent variables and the dependent variable. Binary logistic (logit) regression analysis was used to determine factors that affect adoption of RWHT. This regression was more appropriate and made it possible to study for confounders affecting the adoption of RWHT. A set of independent variables influences the decisions of adoption of rainwater harvesting (Table 2). The characteristics of sample households such as age, sex, marital status, education, family size, farmland size, knowledge, access to information, access to credit, and social position were hypothesized to play major roles in determining the adoption of RWHT by farmers in the study area. In estimating the logit model, the dependent variable is the adoption status of rainwater harvesting, which takes a value of 1 if the household is adopter and 0 otherwise. According to (Gujarati, 2003), the logit model is specified as follows:

$$P = \frac{e^{Z_i}}{1 + e^{Z_i}}$$

Where P is the probability of adopting rainwater harvesting

$$Z_i = \beta_0 + \sum_{i=1}^{p} \beta_i X_i + u_i$$

Where, $i = 1, 2, 3 \ldots n$
β_0 = Intercept
β_i = Regression coefficient to be estimated
X_i = Household characteristics that affect adoption of the technology
u_i = a disturbance term

The probability that a household being non-adopter is

$$1 - P = \frac{1}{1 + e^{X_i}}$$

3 Results and discussion

3.1 Socio-economic characteristics of the respondents

Many of the respondents (53%) were adopters of rainwater harvesting technology and the rest were non-adopters. This implies that farmers have an interest in solving the problem associated with water scarcity by adopting water harvesting options. The majority (80%) of the respondents were male-headed households as the head of the household was allowed to respond (if present during the interview).

Table 2: Description of variable used in testing adoption of rainwater harvesting technology in Boricha woreda, Sidama region.

Independent variables	Data type	Categories
Age of the household head in years	Continuous	
Sex of household head	Dummy	Male; Female
Marital status	Dummy	Married; Single; Divorced; Widowed
Family size of respondent	Continuous	
Educational status of respondent	Dummy	Illiterate; Elementary; High School; College
Income source	Dummy	Agriculture; Government worker
Social position	Dummy	Yes; No
Size of farmland, ha	Continuous	
Access to credit	Dummy	Yes; No
Knowledge towards RWHTs	Dummy	Yes; No
Training Access	Dummy	Yes; No
Type of RWHT	Dummy	Pond; Flood
Information source	Dummy	Training; Meeting; Observation; Television
Period in using RWHT	Continuous	
Slope of the land	Dummy	Gentle; Steep

Regarding the educational status of the respondents, the majority of the respondents (65.8%) were illiterate, implying the challenge of searching for and using information related to different technologies for water harvesting. About 75% of adopter and 67% of non-adopter households have a family size of 3–9 persons. The size of a family, to a certain extent, implies labor availability as well as the demand for resources. Supplying sufficient basic needs including food from a small area, where 70% of the farmers possess 1–2 ha (Table 3), demands productive management including rainwater harvesting for production of crop and livestock. About 70% of the farmers in the study area (both adopters and non-adopters of the technology) perceived that they got awareness creation opportunities for rainwater harvesting through different means. This could be due to the water shortage in the area where rainwater harvesting technology has been promoted widely.

3.2 Water Harvesting Practices and Farmers Perception

Farmers in the study area replied that they have water scarcity problem, which primarily causes food shortages. Due to topographic conditions, knowledge, resources or lack of runoff-inducing precipitation, macro catchment water harvesting techniques may not be appropriate everywhere. Looking for site-specific water harvesting techniques is important. As observed in the field and from the interview and focus group discussions, water harvesting technologies such as run-off and flood water harvesting could importantly support the life and livelihood of the farming community in the area (Table 4). Rainwater harvesting has been vital for livestock, domestic use, and agricultural purposes in Boricha woreda, according to responses from sample households. Farmers practice in-situ rainwater harvesting techniques by furrowing the farmland with oxen-driven traditional 'maresha' plough during sowing seed. This traditional technique could temporarily retain moisture and support crops. Biazin and Stroosnijder (2009) reported the positive role of such practice in crop performance in the Rift Valley area of Ethiopia. In the study area, communal and private ponds are mainly used for livestock since natural springs are either rare or far from place of residence. Farmers travel as far as Lake Hawassa regularly to get water for their cattle when the harvested water in the ponds is used up, which is a burden and time-consuming. Focus group discussions and key informants underlined the importance of traditional as well as introduced water harvesting for livestock as well as for domestic use.

Understanding the perception of the community is basically pertinent for making development endeavors sustainable. Agriculture and natural resource offices promoted water harvesting on a smaller scale on private farms. Large communal ponds that were managed traditionally exist in different areas to supplement water shortage mainly for livestock. According to the view of focus group discussants, water harvesting and making it community-need-based is useful as it is a source of drinking water for their animals. Some focus group discussants and interviewees have claimed that the advantages and sense of belongingness were not in place for communal-based water harvesting and on those introduced by the government. Other study showed less attention of farmers for government introduced and communal resources (Mengistu, 2021).

3.3 Factors Affecting Adoption of RWHT in Boricha

In the study area, rainwater harvesting has been affected by different factors (Table 5). Several factors were hypothesized to influence the adoption of water-harvesting structures in the study area. However, the socio-economic and institutional factors such as family size, source of income, training on rainwater harvesting, perceived benefits of rainwater harvesting, and farmers' perception of rainwater harvesting were significant ($p < 0.05$) and positively influence the adoption of rainwater harvesting technology (Table 5).

Family size was positive and statistically significantly ($p < 0.05$) influence adoption of RWHT. This means that as farmers have a larger family, the probability of using RWHT increases. There could be a larger active worker in a large family. The odds ratio of 0.029 in-

Table 3: Socio-economic characteristics of farm household in Boricha woreda, Sidam Regional Stae of Ethiopia.

Variables	Categories	Adopter, n=102		Non-adopter, n=94	
		Freq.	%	Freq.	%
Sex	Male	82	80.4	76	80.9
	Female	20	19.6	18	19.1
Age, year	19-30	24	23.5	21	22.3
	31-45	29	28.4	32	34.0
	46-60	29	28.4	28	29.8
	¿60	20	19.6	13	13.8
Educational status	Illiterate	70	68.6	59	62.8
	Elementary	16	15.7	19	20.2
	High School	12	11.8	12	12.8
	College	4	3.9	4	4.3
Family size	3-9	77	75.5	63	67.0
	¿9	25	24.5	31	33.0
Farm area, ha	¡1	70	68.6	65	69.1
	1-2	28	27.5	25	26.6
	¿2	4	3.9	4	4.3
Credit beneficiary	Yes	84	82.4	90	95.7
	No	18	17.6	4	4.3
Irrigated farm, ha	0	80	78.4	94	100.0
	0.5-1.5	14	13.7	0	0.0
	1.5-2.5	6	5.9	0	0.0
Received awareness creation/training	Yes	79	77.5	57	60.6
	No	23	22.5	37	39.4
Access to information	Yes	82	80.4	72	76.6
	No	20	19.6	22	23.4

dicated that, keeping other factors constant, the decision in favor of the use of RWHT increases by a factor of 1.016 as family size increases. Mume and Kemal (2014) also reported significant influence of family size on adopting rainwater harvesting in eastern Ethiopia.

Household income has a statistically highly significant ($p < 0.05$) positive effect on the adoption of RWHT. That is, farmers with higher family incomes are more likely to adopt RWHT. The odds ratio for income is 0.537, implying that an increase in households' income increases the probability of adoption of RWHT by 3.238. The results show that many farmers in the study area were low-income earners. A higher level of household income implies a greater incentive for investment in agricultural technologies and the ability to bear the risk associated with their adoption. The results imply that households with better economic standing, measured by the total value of their monthly income, are more likely to adopt labor-intensive technologies such as water harvesting structures. This is because such households are expected to have more disposable income and are therefore able to afford the hired labor required for the construction and management of the technology. As reported by Manyeki et al. (2013), labor costs for construction and maintenance of water harvesting technology are one of the most important factors that determine the adoption of such technologies at the farm level. Our result agrees with the results reported in other areas (Birungi and Hassan, 2007; Katungi et al., 2007; Kelenewerk et al., 2020).

Those households that attend trainings can benefit on implementation of RWHT and can better adopt these technologies and implement more compared to those households who do not attend trainings. The training access was statistically significant ($p < 0.05$). And the odds ratio of 0.648 indicated that keeping other factors constant, the decision in favor of the use of RWHT technology increases by a factor of 3.472 as training access of the farmer increases. Training could provide information and improve awareness. A study in south Africa also reported positive effect of training on RWHT adoption (Campisano, 2017).

The perceived benefit from RWHT was found to significantly influence the adoption of water harvesting structures of the households ($p < 0.05$). When the farm family expect positive and considerable benefit from the harvesting of rainwater, their probability of adopting the technology could increase. This might be affected on the location of the farm household, example, distance from the natural river or lake and other options to access the water.

Age was measured as the number of years since birth of the household head. The age of the household head positively affected the probability of adopting rainwater harvesting of farm households but not statistically significant ($p > 0.05$) (Table 5). Moreover, the odds ratio of 0.215 indicated that keeping other factors constant, the decision in favor of the use of RWHT increases by a factor of 1.208 as age level increases by one year. According to the theory of human capital, young heads of household have a greater chance of being taught new knowledge (Sidibe, 2005) and, hence, are better prepared for the adoption of technological innovations (Akroush, 2017). In contrary, the older farmers might be experienced with the challenge of water scarcity in their life, while the younger farmers inclined to take non-farming options. Young people may also

Table 4: Farmers experience in rainwater harvesting in Boricha woreda, Sidama region of Ethiopia.

Variable	Adopter, n=102		Non-adopter, n=94	
	Frequency	%	Frequency	%
Know RWHT				
practice Male	81	79.4	68	72.3
Female	21	20.6	26	27.7
Types of RWHTs Pond	77	75.5	0	0.0
Flood	25	24.5	0	0.0
How long RWHT				
have been? 1-5 years	62	60.8	0	0.0
6-10 years	36	35.3	0	0.0
>10 years	4	3.9	0	0.0

Table 5: Binary logit model of farmers affecting rainwater harvesting technology in the Boricha woreda, Sidama region of Ethiopia.

Parameters	B	S.E.	Wald	Sig.	Exp(B)
Age	0.189	0.215	0.771	0.380	1.208
Sex	0.288	0.477	0.364	0.546	1.334
Marital status	0.106	0.258	0.168	0.682	1.112
Family size	0.016	0.029	2.162	0.013	1.016
Education status	0.136	0.233	0.342	0.559	1.146
Income source	1.175	0.537	0.581	0.003	3.238
Social position	-0.349	0.372	0.881	0.348	0.705
Land size	0.887	0.713	1.547	0.214	2.429
Credit access	0.483	0.612	0.623	0.430	1.621
Type of RWHT	-0.378	0.405	0.870	0.351	0.685
Training	1.245	0.648	0.876	0.012	3.472
Information source	-0.019	0.498	0.001	0.970	0.982
Perceived benefit of RWHT	-2.782	0.443	39.450	0.000	0.062
Period in using RWHT	0.727	0.478	2.309	0.129	2.068
Slope of the land	0.563	0.694	0.659	0.417	1.756
Farmers perception	1.082	0.695	1.45	0.005	2.95
Constant	1.137	1.138	0.99	0.318	3.118

be more receptive to new ideas and are less risk averse than the older people. Young household heads have exposure for information and higher acceptance of the technology. Other studies revealed that age of household head negatively influence adoption of RWHT (Lutta et al., 2020). About 80.6% of the total household heads were male and 38 (19.4%) females. Whereas the proportion of the male-headed households for adopter and non-adopter were about 51.9% and 48.1%, respectively. In Boricha, sex of the head of household was statistically non-significant at ($p > 0.05$), which is in line with Tizazu (2017) Traditionally, in Ethiopia, sex determines access to resources (Omollo, 2010). Male headed households have more access to productive resources such as land and livestock compared to female counterparts who are constrained by low access to natural resources (Wasonga, 2009). Male headed households were therefore expected to adopt the water harvesting structures more than their female counterparts (Kelennewerk et al., 2020).

Education level of household head was positive and not statistically significant ($p > 0.05$) in influencing adoption of RWHT. This positive coefficient implies that farmer's access to education increased the ability of farmers to acquire important RWHT information as well as other related agricultural information which in turn increases farmer's ability to choose the RWHT. Therefore, the probability of adopting RWHT is increased with farmer's education level. Moreover, the odds ratio of 0.136 indicated that keeping other factors constant, the decision in favor of the use of RWHT increases by a factor of 1.146 as education level increases by one year. Mume and Kemal (2014) reported significant positive influence of education in RWHT in eastern Ethiopia.

The result of present study showed that the farmland size in the study area was insignificant ($p > 0.05$). The odds ratio of 0.713 indicated that keeping other factors constant, the decision in favor of the use of RWHT increases by a factor of 2.429 as farmland size of the farmers increases. The large farm size could give opportunity for farmers to test different technology. On one hand, lack of farmland would make people reluctant to invest in water harvesting structures.

Access to credit was not significantly affect the adoption of RWHT. The odds ratio of 0.612 indicated that keeping other factors constant, the decision in favor of the use of RWHT increases by a factor of 1.621 as credit access of the farmer increases. Household's endowment of financial capital (e.g. household saving and access to credit service), is obviously expected to have a positive relationship with agricultural input intensity (such as labor, oxen, seed, and fertilizer), and a farm household's investment decision on RWHT. That is, households with savings and/or credit access could hire labor during farming and/or construction of the RWHT, and have the purchasing power to buy oxen, seed, and fertilizer Campisano, 2017. The likelihood of level of adoption of RWHTs was higher among respondents who have access to training, credit and information via meeting compared to their counterparts. The finding was supported by the study report from Kenya (Recha et al., 2015), in which these accesses escalate their knowledge, perception towards adoption and sustainable practices of RWHTs. As a similar study revealed in Tanzania farm size was more significant and positively explained the level of adoption (Senkondo et al., 1998). Other study reported in South Africa revealed that a credit access (finance/income) is positively associated with the adoption of RWHT (Deressa et al., 2009).

Farm experience of household head showed positive and insignificant effect on the adoption of rainwater harvesting technology. This implies that farmers who have longer years of experience in farming have adopted RWHT than those who have fewer years of experience in farming activities. Moreover, the more experienced farmers recall the historic challenges of water scarcity and may use the advantages of rainwater harvesting during the rainy season. The odds ratio of 0.478 indicated that keeping other factors constant, the decision in favor of the use of RWHT increases by a factor of 2.068 as farm experience increases by one year. Aziz and Tesfaye (2013) reported a positive relationship of farm experience with adoption of RWHT.

4 Conclusions

This study aimed to identify factors influencing smallholder farmers' adoption of rainwater harvesting technologies for enhanced resilience to drought and thereby improved welfare. RWHT are important in semi-arid areas such as Boricha woreda. Farmers opinions were analyzed using descriptive statistics and the binary logistic regression model. The result showed that many of the farmers have been practicing traditional rainwater harvesting systems in Boricha Woreda. Different technologies exist for rainwater harvesting, but implementation and management could be affected by socio-economic and environmental factors. The result of the binary logistic regression model indicates that family size, income, training access, and perceptions on benefits of RWHT were statistically significant in explaining farmers' adoption of RWHT in the study area. Therefore, there is a need for development planners to target farmers' socio-economic situations when assisting and promoting adoption. Sustainable utilization and effective implementation of RWHT require continuous technical and awareness-creating support. Thus, the government and development partners need to understand the socio-economic situation of the farm household at grass-root level.

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