

Research Article

Assessment of the Effects of Upland Stream Watershed, Riparian Forests and Buffer Strip Losses on Watershed, Wetland, Still and Lotic Water Resources at West Harareghe Zonal, Watersheds, Oromia, Regional, National, State, Ethiopia

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Abstract

Currently water quality and quantity are the 21st century issue on the Global scale. In despite to that, today water quality and quantity in Ethiopia is the burden issue of watershed degradation that were resulted from evil anthropogenic activities of local people. These are: deforestation of natural forests, riparian forests and buffer strips. This project will be entitled with: assessment of the effects of upland stream watershed riparian forests and buffer strip losses on watershed, wetland, still and lotic water at west Harareghe zonal watersheds, Oromia, Regional, National, State, Ethiopia. The objectives: of the study includes: to assess the impacts of riparian forests and buffer strip losses on both lotic and still water and wetlands, to identify the challenges prevent the management of watershed to restored into origin without exclude the management of lotic and still water, and wetland ecology, to evaluate the losses of upland whole natural forests losses on watershed recharges; to assess the losses buffer strips and riparian forest on watershed degradation, to identify the factors and causes of losses of natural forests (riparian forests and buffer strip losses) and to observe the relationships between riparian forests and natural forest covers with lotic and still water and watershed recharges or restoration. The hypotheses of the study will be test at significant level of 0.01 or 100(1- α) % or 99% of confidence interval. Data will be collects by constructing both open, closed and semi loused questionnaires and interview the respondents and by prepared checklists. Moreover observation and discussion with key informant using transect walk will be proposed. Using PRA tool the community watershed map will be develop in the field. Statistical stratification of respondents by use simple random stratification sampling techniques in provide equal chance of distribution will be preferable and usable. Community watershed will be dividing into five or more sub-watersheds. Then sub-watersheds will be divided into Gotes. The Gote will be stratified into Gares. Representative sample size of the respondent will be determined by using the Yamane (1997) or Coharn (1977) model from the selected kebeles or watersheds citizens of the stratified Gares. Data analysis will be carry out using pairwise of the t-test, F-test and chi-square test. Homogeneity of the data and closed relationships of the variables will be observing by Goodness fit and the variances, respectively and the results shall be present with table, chart, descriptive statistics, scattered graph or line graph and clustered bar graph.

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Keywords

Upland, Restoration, Watershed, Riparian-forest, Buffer-strip, Wetland, Still and Lotic Water, Respondents

1. Introduction

Through the whole world at present water depletion in quality and quantity due to environmental pollution, overexploitation and mismanagement of upland stream watershed riparian forest, buffer strips and their whole natural forests are a common current issues [10]. Watershed water resources improvement, water depletion improvement in quality and quantity and management and patrolling of losses of forest resources are critical correlation and burden problems [6]. As the past study done by [6], had revealed that, catchments well forested supplies has provides high quantity and quality of water for domestic uses, agricultural, industrial, watershed ecological needs and hydropower generation for upstream and downstream watershed area dwellers as compared to none forested catchments, however, the core challenges that obstacle land, soil, forest, and watershed water resources for managers of watershed management and development that are on the way of maximization of forest ecosystems functions, services and water resources needs are the challenges. So that, accordingly, watershed forests and water resources are direct relationships. Meaning reduction of forest covers are resulted in depletion of water resources.

Protection and improvement of riparian forests and buffer strip forests have play a crucial role on improvement of both lotic and still watershed water resources. It serves as buffer strips are refers as unique ecosystem of land located between water resources and agricultural lands [2]. Losses of buffer strips, riparian forest and upstream natural forests were resulted from evil practices of anthropogenic activities due to human population and livestock pressures that were impaired both water quality and quantity [7]. Deforestation of forests in both riparian forests, buffer strips and upstream watershed natural forests are a common phenomenon in Ethiopia. Even though Ethiopia has the third richest country in Africa with forest resources next to Tanzania the leading country prior to Kenya in Africa with forest resources it is the most affected country in riparian forest, buffer strips and upland natural forest losses in Africa.

Water security is equivalent to food security in this 21st century in Ethiopia and the whole Africa in particular [6]. Clean water which is free from the hygienic problems for household consumptions, agriculture, and industry and hydropower generation in excess is the result of upstream watershed land management issues [7]. According to this author had been described and reported, people live in upland watershed are very poor to give upland watershed protection of forests. *Especially retaining a forest cover that helps to maintain reliable flows of good quality of water to downstream.*

As [15], was described, watershed has the following functions for the wetland securing the quantity of water of major rivers entering the wetland; supporting the bio-diversity of the wetland by provision of habitats for wildlife and maintaining the quality of water of major rivers and streams through reduction of sediment to downstream of watershed. Residents live in the upland watershed at global scale have faced the most difficult living conditions such as long distance from market center and their road, limited arable land, poor economy, and cultural isolation from the whole nations. For instance, as the evidence had been indicated from the world study, the communes' ethnic group who are live in Vietnam in the uplands are the poorer population than who are live in anywhere else in the country and over 30% of people are below the poverty line. Rural incomes found in the tenth in the northern mountain provinces which ranges from 55-90% of the national average [7].

A study [7] had disclosed that, in Vietnam land classification of upland watershed areas are based on the slope and those are production forest, protection forest and special use of forest and about 95% was occupied protection forest of the total protection forest of the area. As [6], had reported that, protection forest are protect soil, land and water resources and control from soil erosion and sedimentation. Currently watershed degradation is a common issue in Ethiopia. Lack of water resources in quality and quantity is resulted from upland watershed natural forests, buffer strips and riparian forests degradation in quality and quantity. Riparian forests serve as a buffer strips along the river flow and still water such as ponds and lakes. While buffer strips has also a special land covers with vegetation and grasses and located between water bodies and agricultural land uses [2]. So that filters sediments, soil particles and waste while drain clean water into streams, river, wetlands and lakes [2].

As [7] had reported forests are the general term used to describe the places with trees and shrubs covers. As forest respiration increases soil moisture is deficit in moisture and in dry seasons flow water decreases. But, forests such plantation forestry increases infiltration rate of runoff surface, soil storage water and dry seasons flow water. A forest reduces soil erosion in three principals' interception with canopy against raindrop, barriers with litters and anchorage with roots through slope stability and prevent soil particles detachment and transportation to downstream watershed. Thus, increases watershed recharge. *There is a danger of making land use decisions without adequate scientific evidence. On steep slopes, forestry or agroforestry may be the preferred option, where conventional soil conservation techniques may be insufficient. Secondary forests found that on none-forested land, after logging, soil losses was 3.1 t/ha/yr as compared to*

0.23-0.28 t/ha/yr without logging areas. Natural forests are the better than plantation forests [6, 7]. *International hydrological studies were showed that management of forests is just as important as presence of forests in controlling soil erosion.* Buffer strip along the stream and river flow are control in a better soil losses and *selective rather than clear logging that, are the most important measures to control losses of soil during rains.* Trees and shrubs species selection are the better design to control watershed erosion and floods. Field study done in Vietnam had showed that, flooding may be linked more to weather conditions than to the presence or absence of forest covers. *Hydrological studies show that storm flow volumes are higher from logged slopes than forested slopes in small watersheds. At the scale of small catchments, there is good evidence that forest cover can help to reduce volumes of flood water to downstream watersheds [7].*

Lack of access to water for meeting the basic needs such as health, hygiene and food security undermines development and inflicts enormous hardship on more than a billion members of the human family and its quality reveals everything, right or wrong, that we do in safeguarding the global environment Former United Nations Secretary-General Kofi Annan [6]. *The role of wetlands and forests as water suppliers among the different stakeholders in the whole watershed is an essential watershed ecosystem.* Forests influences the amount of water available from ground water to surface water courses and water bodies through interception of precipitation, transpiration of moisture from vegetative surface, evaporation of soil moisture, capturing of fog water and maintain soil infiltration rate. Forests by improving soil infiltration and soil water storage capacity they can influences timing of water delivery. By minimizing erosion, they minimize impairment of water quality due to sedimentation. According to [6], had reported, as well as protection of water resources needs forests biodiversity conservation; also forests provides carbon fixation from the atmosphere and reduce global warming and greenhouse gas effects. Forest are significant impacts on climate change, water resources and hydrological cycle which manifested in increased of flood, sedimentation, drought and landslides. All of them are influenced by forest covers. *Restoration of damaged/degraded forest ecosystems can help forests to “cushion” the effects of climate change.* Moreover, conserve and restored into origin the degraded watershed [6].

1.1. Statement of the Problem

The 21st century is the issue of available water at right place, at right time, in adequate amount and sufficient quality. In this regards forests play a key crucial role but economic commissions of Europe 2004 was warns [6]. According to those author's *promoting by awareness, for instance through information campaigns and other specific activities, about the role of wetlands and forests as water suppliers among the different stakeholders in the whole watershed (national authorities, the public and the private sector) is an essential. The benefit to upstream and downstream populations should be publicized.*

Deforestation of forest covers are the processes of changing forest land uses into none-forest land uses such as agricultural land, urban land, and industrialization land. Globally deforestation of forest covers had been resulted in climate change

and water resource impaired in quality and quantity. The major factors include: socioeconomic, poverty, population pressure, scarcity of landholding size, poor economy, social interaction, overgrazing, and extensive farming systems, and lack of gender equity, improper land use planning and lack of upland watershed forest covers, buffer strips and riparian forest policy. *The evidence from watershed research worldwide had reported that no causes and effects was demonstrated between forest cutting in the headwaters and floods in the lower basin [6].*

Ethiopian forest covers before 100 years ago was estimated about 40% in 1900; which was decline to 16% since, 1954 to 8% in 1961 to 4% in 1975 and to 3.2% since, 1980s, but currently it is estimated to be less than 3% [8]. Deforestation is a common issue in Africa in particular in Ethiopian constituent. Seriously water quality, quantity and regularity flow of surface water called watershed services and these are requires upstream watershed of flood, erosion and sedimentation protection [7], management through implementation of bottom up approaches of watershed are required and play a key role [10]. *Deforestation is often blamed for floods or other problems with the quantity or quality of water downstream whereas planting and maintaining tree cover is one of the most common management interventions for watershed protection (table 1).*

There are a big gaps existed between watershed services, functions and protection of upland streams of riparian forests, buffer strips and natural forests, planting, patrolling, management and maintenance of protection forests to understanding in scientific basis of information knowledge, skills and positive attitude which requires in understanding of the association between land uses and water regimes. *There are also gaps between knowledge based on scientific evidence, and information that is used in policymaking.* Several past catchment experiments [6, 7, 13, 2], had indicated that decreased run-off surface water from areas under forest covers as compared with areas under agricultural crop areas are very lower. Past study done by [7], had been shown that, runoff water under forests is 2.5 – 27 times less than runoff water under agricultural crops. Natural forest is more effective than plantations forest in reducing runoff water, because of low litter covers for the later. High water flow under forested covers than none forested covers during dry seasons had been shown the positive effects of increasing forest covers. *Forests act as “sponges”, which is soaking up water during the rains and releasing it gradually over drier periods.*

Currently Ethiopia has accepted and signature at worldwide the watershed nature or natural resources development leading by reforming itself from agricultural-industry leading of development. Thus, such study to solve the proposed problem; it is paly the crucial role based on the negotiation to solve the problems of this study that will be focuses. This, the past spoken by Former United Nations Secretary-General Kofi Annan [6], was the core evidences for this nature based development that was he had said that, *lack of access to water for meeting the basic needs such as health, hygiene and food security undermines development and inflicts enormous hardship on more than a billion members of the human families. And its quality that reveals everything, right or wrong, that we do in safeguarding the global environment* either affects or develops the water quality, quantity and recharge of

watershed for both still and lotic watershed water resources and wetlands ecology improvement in functions and services.

Thus, this study will be looks in depth the factors, causes and challenges of manipulation of buffer strips, riparian forests, wetland ecology and upland stream watershed natural forest losses on still and lotic watershed water resources and restoration of watershed degradation and wetland ecology functions and services. The objectives to be studying in depth to alleviate the proposed problems based on the stated hypotheses and questionnaires include: to assess the impacts of riparian forests and buffer strip losses on both lotic and still waters and wetlands, to identify the challenges prevent the

management of watershed to restored into origin without exclude the management of lotic and still waters, wetland ecology, to evaluate the losses of natural forests losses particularly the riparian forests and buffer strip losses on watershed recharges; to assess the losses buffer strips and riparian forest on watershed degradation, to identify the factors and causes of losses of natural forests (riparian forests and buffer strip losses) and to observe the relationships between riparian forests and natural forest covers with lotic and still waters and watershed recharges. Therefore, the study will be an open study, but not closed study and serves as a base line for the future for those who are wants to study on similar problems.

Table 1. Permitted land uses in highly critical, critical and less critical protection of forests in Vietnam.

Category	Location	Land uses	Management
Highly critical	Steep slopes at high altitude, near to rivers and lakes, high risk of erosion, or high demand for water regulation.	Mainly for protection. Forest cover must be maintained at 80% (20% for agriculture, fisheries or eco-tourism). Felling prohibited but collection of dead wood and non-timber products allowed.	Under forest management board
Critical	Moderate slope, erosion risk and demand for water regulation	Combination of forestry and agriculture. Minimum 50% forest cover.	Under forest management Board.
Less critical	Less risk of erosion and demand for water regulation.	Agro-forestry with a minimum of 30% forest cover.	Allocated to households under 50-year lease (land tenure certificates).

Source: [7]

1.2. Objectives of the study

1.2.1. General objective of the study

The general objective of the study will be able to assess the impacts of the losses upland stream natural forests of the riparian and buffer strips on still and lotic water resources, watershed degradation and watershed recharge, watershed restoration into origin and the challenges that are prevents watershed management in west Harareghe zonal watersheds.

1.2.2. Specific objectives of the study

1. To assess the impacts of riparian forests and buffer strip losses on both lotic and still water and wetlands.
2. To identify the challenges prevent the management of watershed.
3. To restored into origin without exclude the management of lotic and still water, and wetland ecology.
4. To evaluate the losses of upland whole natural forests losses on watershed recharges.
5. To assess the losses buffer strips and riparian forest on watershed degradation.
6. To identify the factors and causes of losses of natural forests (riparian forests and buffer strip losses).
7. To observe the relationships between riparian forests and natural forest covers with lotic and still water and

watershed recharges or restoration.

1.3. Scope of the Study

The scope of this study will be covers the causes and factors affects watershed recharge, riparian forests, buffer strips, and natural forests losses of upland stream watershed; their consequences on lotic and still waters, wetland ecological functions and services, watershed degradation; challenges prevents from management and intervention of watershed conservation, upland watershed riparian forests, buffer strips and natural forests conservation and sustainable management approaches, and forest patrolling and forests resources utilization.

1.4. Significance of the Study

Of all to update the teacher's knowledge, skill and attitude on teaching and learning processes. It will provides an awareness to government and none government employers who are serve as a guideline to give the direction on the conservation, protection, management, utilization, development and patrolling of upland watershed natural forests, riparian forests, buffer strips, wetland ecology and watershed. They shall guide the local communities and professionals on the challenges of upland watershed degradation and their consequence impacts on still and lotic water resources, wetland ecology and watershed functions and services.

1.5. Study questionnaires

1. What are the factors and causes of riparian forest, buffer strips and upland stream watershed natural forests losses?
2. What are the contribution of riparian forests against wetland ecology, lotic and still water quality and quantity during dry seasons?
3. What are the association between upper stream watershed natural forest losses and watershed recharges in quality and quantity?
4. What are the consequences of losses of riparian forest, buffer strip and natural forest degradation on lotic and still water quality and quantity?
5. What are the factors and causes of upland watershed degradations?

1.6. Hypotheses of the Study

A study [16] had revealed that, the first step in research process is the formulation of the hypotheses about specific issues which is very crucial. However, before formulate the hypothesis it must decide the type of issue to be investigating. Decision of issues to study are depend on their knowledge, existed theories and their own everyday knowledge and life. A good hypothesis expressed in terms of the precise and clearly defined. *In some cases a hypothesis may be a formal statement in which it is predicted that a specific change in one thing will be associated with a specific change in another thing.*

According to those authors [16] had stated formulating hypotheses can be based on existing theories and personal experiences whereas testing the hypothesis can be used, different methods such as, for instance, systematic, observation or experiments. Things that can be expected to be change are known as variables. The variables that is manipulated, and whose changes are supposed to produce changes on another variable, is called an independent variable. Change of forest covers in the upland stream watershed should be changes the degraded watershed recharge or restoration in the case of this study. Hypotheses to be test at significant level of $\alpha=0.01$, null hypothesis $H_0: \mu_0 = \mu$

alternative hypothesis $H_a: \mu_0 \neq \mu$

test of confidence interval $Z_{\alpha} = \frac{\bar{X} - \mu_0}{\sqrt{\frac{\sigma^2}{n}}}$

$Z_{\frac{\alpha}{2}} - \frac{\bar{X} - \mu_0}{\sqrt{\frac{\sigma^2}{n}}} \leq \mu \leq Z_{\frac{\alpha}{2}} + \frac{\bar{X} - \mu_0}{\sqrt{\frac{\sigma^2}{n}}}$, called confidence interval

[3].

$H_0 - \mu = \mu_0$ _null hypothesis and $H_a - \mu \neq \mu_0$.

Thus, H_0 rejected

if $|t| > n_1 + n_2 - 2, 1 - \alpha/2$ which stand for the $(1 - \alpha/2)$ quantile of the $n_1 + n_2 - 2$ Normal distribution. However, if $|t| < n_1 + n_2 - 2, 1 - \alpha/2$, H_0 - accepted.

The statistical model used to proof the stated hypotheses will be as follow: $Y_{ij} = \mu_i + \epsilon_{ij}$ ($i = 1, 2, j = 1 \dots n$).

2. Literature Review

2.1. Association of Forests and Watershed Water Resources

Higher evaporation rate had observed for forest and vegetation covers as compared to vary vegetation types and natural forests which had revealed that, the higher infiltration rate as a results of high porous soils, understory, dominant, co-dominant vegetation and decomposed litters and twigs. All of these are factors attended to lower runoff surface water. Thus, floods are less, erosions and runoff is lower from forested areas than others land uses as a result of *bad logging techniques which compact the soil and increase surface flow pre-planting drainage activities which may initiate gully formation; wind throw of trees and the weight of tree crops reducing soil stability; road construction and road traffic, which can initiate landslips, gullies and movement of sediment; excessive grazing which leads to removal of understory plants, soil compaction and greater erosion risk; splash-induced erosion from drops falling from the forest canopies onto bare ground; some broad-leaved plantation species increase rather decrease erosion through this mechanism* [7].

Agricultural and fishing activities in lowland areas could benefit from mid-intensity floods that carry sediments and nutrients from the uplands; however, as the flood intensity increases the risks and hazards of destruction also increases. Forestry activities in upland areas could benefit from political support and funding for their activities in exchange for the *perceived* benefits that forests will have on reducing floods. However, big flood events can cause trees to fall during storms and block waterways. Wetlands located in lowland areas can benefit from the seasonal effects of floods. Engineers benefit from the creation of costly structures to alter the drainage system of the watershed. Scientists (hydrologists, agronomists, soil scientists, economists, and social scientists) benefit from funding for their research in the area (as long as there is a problem, there is a need for research) [6].

2.2. Forest and Watersheds

Although we cannot generalize for all watersheds under all conditions, our current “best-bet” knowledge is that forests do not increase run-off in fact forests usually reduce run-off. Forests may or may not regulate seasonal water flows. Forests are no better than other vegetation types for reducing erosion. Forests are not as important as climate in controlling floods, but can help in small watersheds although our understanding of the links between forests and watershed functions is not well developed, there are a number of useful points of watershed management advice that can draw out from the available scientific evidence: In general, if forests are compared to bare land, then their positive effects on watershed protection are clear and substantial. But compared to other types of vegetation cover, such as grassland or shrubs, the relative benefit of tree cover is less apparent. One of the most important lessons from hydrological studies is that “vegeta-

tion cover” more than “tree cover” is critical for regulating water flows and erosion. “Forest” can mean many different things (according to whether natural forest or plantation, mix of species, age distribution, etc.). Effects of *different types of forest* on hydrological functions vary widely. The effects of different forest types on erosion, for example, can be as great as the differences between forest and other types of vegetation. *Aspects other than land use and vegetation cover* are often far more important in determining certain hydrological effects. For example, soil type may be the principal factor determining the extent of erosion and downstream sedimentation, while the volume and distribution of annual rainfall has more influence than forest cover on the frequency and intensity of floods. At a local level, *specific management interventions* sometimes have greater effects than broad land use on hydrological functions. For example, careful siting and construction methods of roads and drainage ditches can have more positive impacts on erosion than whether the land is under crops or trees. While hydrological data point to the above observations, *generalizations are risky*. Managing watersheds for hydrological functions remains a very site-specific task. Scientific uncertainty reflects both complex natural relationships and the technical challenges of rigorous hydrological studies. Forests do not offer a universal solution to the loss of watershed protection services. The success of forest-based solutions will depend on a range of site-specific factors. In many cases, forests may be best incorporated as a component of a larger watershed protection strategy involving other land uses [6, 9]. To address the increasing, and sometimes competing demands for watershed protection, there is often a need to make trade-offs between particular types of land use and the need for watershed functions. At the same time, it is important to consider not only the downstream “end-uses” of watershed services, but the more immediate needs of those communities charged with managing land in upper watersheds. Changing the type of land use and vegetation cover may provide improved watershed services such as reduced flooding or enhanced dry season flows, but if such changes are to the detriment of upland livelihoods they will not be sustainable [7]. Here is the need for compromise between desirable watershed functions and the requirements of upland livelihoods. Some of Vietnam’s upland communities are extremely poor and do not have the capacity to risk new and different forms of land use. Their livelihoods must be taken into account in any watershed protection initiatives. Looking at much of the international evidence, it appears that over-simplification of the relations between forests and water have led to a state of mind in which the scapegoat of land degradation is linked to a reduction in the amount of forests, and watershed conservation efforts are almost always designed in terms of planting more trees. Challenging some of the commonly held beliefs regarding land use and watershed protection may raise questions as to whether afforestation is in fact the best strategy.

2.3. Watershed and Forestry Policy

Policy makers may want to consider actually reducing interventions on “un-forested land uses” that are carried out in interests of watershed protection and rely instead on regeneration of natural vegetation. A recent policy shift has been towards allowing greater freedom of land use options on less critical protected forest [6]. Hydrological studies suggest that allowing agriculture in important watershed areas does not necessarily compromise watershed functions, and thus support this policy shift. Data from scientific studies also suggest that specific interventions such as placement and building methods for roads, or terracing of fields, may have just as much impact as overall land uses on factors such as erosion. These types of issues are already an important focus of government extension services—perhaps even more emphasis on developing local solutions could be useful for both watershed protection and local livelihoods. Land allocation is a developing area of policy. Land allocation is a developing area of policy in Vietnam. Hydrological studies emphasize one important challenge: matching the scale of land allocation to the scale of watershed management. To maximize benefits at the catchment level, it may be more useful if the management unit has rights and responsibilities at this geographic scale. For instance, it may be more appropriate in terms of watershed management to allocate protection forest areas to communities rather than individuals or households. Hydrological studies also indicate that at the landscape level, for example within a watershed management area, a mix of land uses may be equally effective for watershed protection as block planting of forest. A common worry among policy makers is that when local people are granted rights to use forest resources, they will overuse that right and damage the forests. Thus a strict mechanism of control over forest products has been functioning since before the introduction of protection forest contracts [2]. Perhaps in the new era of a forestry economy with multiple actors and functioning market incentives, it is time to reappraise the system of external control over forest management and marketing of products? Vietnam could benefit from stronger hydrological evidence to back-up and provide guidance for management interventions in watershed protection forest. More practical, policy-focused research is needed – the main priority is better data on the effects of land use on seasonal water flows. Policy makers and practitioners need to increase awareness and understanding of the roles of watershed protection forests in water regulation, flood mitigation and prevention of soil erosion, especially among those tasked with day-to-day management of those forests (e.g. forest management boards, state forest enterprises and small-scale farmers). New mechanisms for financing watershed protection would benefit Vietnam. At present some water users, such as the hydro-electric facility at Hoa Binh, pay fees towards watershed protection, but there are not yet mechanisms in place to distribute these funds in an efficient and accountable way to support upland land management practices proved to benefit water supplies downstream [7]. Now is the time for the various stakeholders involved to formulate and test workable financing mechanisms to maintain watershed functions?

2.4. Forests and Watershed Hydrological Cycle

Degradation of watersheds has led to greater respect of the several ways that is support human well-being through ecosystem services, and consequently to countless value being placed on them. Watershed services may include: provision of freshwater, regulation of both water and sediment flows and maintenance of natural flow regimes, which support entire ecosystems and ways of life. *Payments for watershed services will not solve all watershed degradation problems, but can be an important component of a broader management strategy* [6].

As [6], had reported that forest covers of the land surface and their hydrological cycle of water was concerned as the current issue. Thus, *it provides information for much-needed efforts to maintain and restore water-related ecosystems which identified by the United Nations Commission for Europe as a global priority*. Forests influences the amount of water available from groundwater, surface watercourses and water bodies by intercepting precipitation, transpiration moisture from vegetative surfaces, evaporation of soil moisture, capturing fog water and maintaining soil infiltration which are refers to watershed hydrological cycle [6]. By maintaining or improving soil infiltration and soil water storage capacity, forests influence the timing of water delivery. Forest impacts by minimizing erosion; they minimize impairment of water quality due to sedimentation [12]. Forests can also protect water bodies and watercourses by trapping sediments and pollutants from other upslope land uses and activities. Along streams, forests provide shade, thus reducing water temperature. As watershed land cover, protected or well-managed with forests, riparian forests and buffer strips. As watershed land cover, protected or well-managed forests are without equal in increasing hydrological and erosion safety and water quality: water may well be forests' most useful and important product. Partial or complete removal of the tree cover on land surface increases the total amount of water in streams flowing from the catchment area.

2.5. Environmental Services of Forests and Watershed Restoration

As [6], had disclosed that, watershed degradation has led to greater recognition of the several ways of watersheds that support human well-being through ecosystem services and functions. Services may include provision of freshwater for various uses, regulation of both water and sediment flows, and maintenance of natural flow regimes that support entire ecosystems and ways of life. Regulation of land-use practices alone has not ensured continued provision of services. It places a disproportionate share of the conservation costs on upstream land users without giving them corresponding access to benefits. According to the author [6] had stated, *with its flora and fauna, the forest ecosystem is a major user of water, but also provides enormous benefits for humanity: from birds to boards to bears, from fuelwood to medicines, from carbon fixation to orchids and chestnuts, there is a treasury of products from forest biodiversity. Recreation and landscape aesthetics can be added to these, as well as a high*

degree of soil erosion control, and in the right circumstances avalanche hazard reduction. Hence, avalanche protection is an existential challenge for the inhabitants of high mountain regions or upland stream watershed around the world, but their lives and activities face many considerable risks, whereas forests play a significant role in avalanche hazard reduction [20].

A study [6] was revealed that, human being from the ancient to the present day is concerns about both beneficial and deleterious effects of forests on water quantity because of sometimes too much water and sometimes too not enough. This is due to the four M's which refers to many myths and misunderstandings and much misinterpretation and misinformation.

3. Materials and Methods

3.1. Description of the Study Area

Ethiopia land of lies of the land located between the 30 00' N and 15000' N Latitude or 33000'E and 48000'E Longitude [11]. West Harareghe zone of Oromia National Regional State Ethiopia is situated in eastern Ethiopia. West Harareghe zone geographical boundary of the lie of the land is between 8°39'59.99" N latitude and 40°29'59.99" E longitude from the equator [18].

The mean maximum temperature of Ethiopia is 45°C and it covers from April to September whereas the mean maximum temperature is 40°C from October to March is recorded in the Qafar Depression Valley North-East Ethiopia [19]. The mean maximum temperature in the hot area of the country, the north-western lowlands is about 40 °C in June while the western and south-eastern lowlands the mean maximum temperature is between 35 °C-40 °C in April. The lowest mean minimum temperature is 4 °C especially at night it is recorded in the highlands while in valley bottoms occasionally the ground frost is recorded. The annual average of rainfall in Ethiopia is categorized into three groups: 1200mm to 1600mm in the lowland, 1600mm to 2600mm in the midland and > 3000mm in the highlands [19]. [19], had revealed that, Ethiopia has five agro-climatic Zones that are defined by two factors altitude and temperature. Moreover this study had been described that; west Harareghe zone of land lied is under the warm to cool semi-arid zones of the country which it covers the highland temperature of the altitude which ranges from 1500m to 2500m a. s. l. It was also reported that; the annual average rainfall ranges from <700mm in lowlands (Kolla/Gamojji) to 1200mm in Dega/ Battaand WeynaDega/BattaDare agro-climatic conditions. West Harareghe zone agro-climatic conditions are classified the same as others zone of the Oromia region and the entire Ethiopian zones. These classifications are based on the altitude belts. Accordingly 2500 to 4500m a. s. l. are Dega or Badda climate while 1500 to 2500 are Weynadega or Baddadare climate and the rest from 1m to 1500m are Kolla or Gamojji climate [21].

A study [5] had reported that Ethiopian major soils have

about 19 soil types; and grouped into three types: Lithosols which covers about 163, 185 km² (14.7%), Fuvisols (soil deposits of parent materials laid down by Rivers and streams) covers to 882, 61.5 km² (7.9%) and Aluvisols which covers about 640, 63.5 km² (5.8%) areas.

Soil in the Harareghe highlands are severely degraded particularly land without settled and scattered stones on its surfaces; because the fine topsoil is easily eroded by erosion agents, whereas settled stones on the surface held soil grins and scattered the flow concentration of surface runoff water. A soil resource of the Harareghe region is varies in nature as a result of interaction of soil forming factors and their processes [9].

Topography in Ethiopia has classified into five classes; 0-10% which held lowlands (703000km²) area of the country (less than 15000m a. s. l.) without the exception of the flat plain, highland plateau and the valley bottoms. The rest classes are group into the Ethiopian highlands of 11-25%, 26-35%, 36-50% and >50%, which occupies the large areas of the country respectively [5].

The past study did by [5, 14], had stated that Ethiopia has total land area of 1221480 square kilo meter (122,148,000 ha) while the study done by [11], was reported that 1127.127 square kilo meters. Out of this 1119.683 square kilo meter is terrestrial land and 7444 square kilo meter is covers with water bodies [11]. The major land use and land covers encompasses: 1115000 km² (111,500,000 ha) among this total land area of the country: cultivation land is covers about 14.7%, grazing and browsing land are accounted about 56.9%, forestland is covers about 11.7% and bush land is covers about 18.7% [5, 14].

A study [4] had estimated and reporsoted that, total population of west Harareghe zone was accounted about 1871706; among this size total male and female are 958861, 912845 respectively. Total HHs of the zone was estimated about 395127, while the housing units were estimated about 380019. Average population of the zone was increasing with 47.16% in comparison to 1994 Ethiopian population census. Land holding size of the west Harareghe zone is very smaller and in average the size per HH is 0.5ha as compared to Oromia national regional state of landholding size that was estimated about 1.14ha per HH but the zone's landholding size as compare to Ethiopian landholding size; it was estimated that 1.01ha and 0. 6 head of livestock was estimated per HH. None farm population employment of west Harareghe zone was estimated about 16.4% as compared to Ethiopian and Oromia region none farm population employment that were in average they were estimated about 25% and 24%, respectively. West Harareghe zone is the most densely populated zone and held second rank next to west and east of Wellaga zones. It was estimated about 124.23. This is due to cash crop producing area, wider under aged marriage, and high birth rate because of not used family plan. The reason is that for instance majority of the Muslim religious follower have not used contraceptive, while prevented by Islam religious. In general, small holders have <0.1ha to 0.5ha whereas lager landholders have held > 2ha. The ranges were including both east and west Harareghe zones of eastern escarpment of Oromia Regional National State of eastern of Ethiopia.

Urban inhabitants of total population were estimated 160895 (9.36%) whereas the total population of pastoralist

was estimated about 10567 (0.56%). A person per HH was estimated 4.74 in the zone. Climate change in the zone is erratic due this, the zone receives long drought seasons and the drought rate is 372. Education rate is higher in the primary school than the high school which was estimated about 55% of the children afforded to primary school and 8% was afforded to secondary school. Concerning the health nearby 92% of the zone was exposed to malaria diseases while none of the citizens'; however livestock was exposed to tsetse fly in particular it is very vast in hot areas of the lowlands of the zone with health cases.

The total population, total male, total female and HHs for the selected study Districts are listed, respectively as follows:

1. Guba Qoricha District: 122335, 62633, 59702 and 24428;
2. Chiro District: total population is about 16 9, 912. Out of this figure about 89909 (52.915%) is female population while about 80003 (47.085%) is male population. A total household was estimated approximately about 9,274 for the Chiro district of the west Harareghe zone [4];
3. Tullo District: total population is about 14 7384. Out of this figure about 72130 (48.94%) is female population while about 75254 (48.06%) is male population. A total household was estimated approximately about 31154 for the Tullo district of the west Harareghe zone [4];
4. Doba District: 133939, 68512, 65427 and 27496;
5. Mieso District: 130709, 66891, 63818 and 27404, Boke District: 151156, 76980, 74176 and 32219.
6. Dendni Woreda total population 165803. Out of this 83988 is male and 81815 is female. Total HHs is 164675.

In Harareghe highlands the ruminant indigenous species, while the most threaten and endangered are include: *Olia african*, *Celtus african*. *Messeoa lacoleta*, *Vernoiea ameglenea*, *Podocarpous flactous*, *Codia africana*, *Croto macrochystiea*, *Juiperous porcerea*, *Acacia Nilotic*, *A. albida*, *A. tortolious*, *A. polycata*, *A. abyssinica*, *A. senegal*. These are as a result of deforestation for agricultural land and others land uses such as investors uses degraded and till not recovered. Due to lack of forest needs human being created plantation forest to fulfill the needs to be obtained from forestry resources whereas mostly planted exotic species because of fast growing than indigenous species. A few of them are *Eucalyptus globlous*, *Eucalyptus camadolosis*, *Cupressous lutanica*, *Graviloa robusta*, *Pineus patula*, *Casurina equestifolia*, *Shainous molle*, *Delexus regia*, *Milliea azandichata*, *Azandrichata indica*, and *Acacia salegna*.

In west Harareghe zone mixed farming systems are a common practices but currently monocropping with intensive fertilizer application to optimize crop yield from degraded soil and land is a common practice due to high population density and smaller holding of land size.

3.2. Methodological Techniques and Sample Size

After all essential data will be collects from a watershed per District selected from west Harareghe zone will be adjusted to

be study. Then, thus that based on stratification of watershed into five strata using simple random stratification of sampling techniques the necessary data will be collects to solve the proposed problems [4]. The stratified watershed will be divided into Gote and then, the Gote will be divide into Gare and then that simply without any obstacles the required data will be collects. Based on the number of Gote available the number of Gare will be interviews and collected the required data (for example. if watershed divided into five sub-watersheds and has ten Gote then the number of Gare will be thirty). The study will be adjust six Districts from west Harareghe zone i.e. two lowlands, two highlands and two middle lands. Per district two community watershed or kebeles will be select and a total of twelve watersheds will be selects.

Sample size determination technique should use the following:

The most popular and adopted method is the method determined by Ethiopian Ato/ Yamane [22], will be preferable model to determine sample size to be interviews.

$$N = \frac{Z}{1+Z(e)^2}$$

Where, Z is the whole population size; e is the significant level and in this case it is 1% which means 99% of the confidence interval and n is representative size for the whole population size of community watersheds Or else the model determined by [1]; will be used. The mathematical formula is as below:

$$n = \frac{NZ^2PQ}{d^2(N-1)+Z^2PQ}$$

Where, n= sample size of housing units (household head); P= Housing unit variable (residential houses); Q= Non-residential houses (different sectorial offices, schools, etc. in terms of percentage) = 1-P; N= Total number of housing units; Z= Standardized normal variable and its value that corresponds to 95% confidence interval d = Allowable error (0.05) and after calculated n is Sample size.

Statistical model

If the factors of the study have only two; the model can be just described the data as it is.

$$Y_{ij} = \mu_i + \epsilon_{ij} \begin{cases} i = 1, 2 \\ j = 1, 2, \dots, n_i \end{cases}$$

Where, Y_{ij} is j^{th} observation from i^{th} factor level I ; μ_i is the mean of response at i^{th} factor level and ϵ_{ij} is a normal variables associated with ij^{th} observation and refer as random error component of the model.

3.3. Source of Data

The data will obtain from both secondary and primary sources of data. The primary data will be collects through observation by using transect walks and discussion with key informant, Interview of questionnaires and discussion with respondents. Secondary source of data will be collects from

natural resources management office, agricultural and rural development office, internet website, theses and magazine,

3.4. Method of Data Collection

Questionnaires will be constructed both in open, closed and semi-closed; check lists must be constructed. And then interview the representative respondents to be collects the basic and essential data to solve the problems. Field observation and record the fact to be observing through transect walk from E-W and N-S direction. Capture the photograph in associations with observation, then that describes the reality will be observes and discuss with key informant.

3.5. Data Analysis

All of the data that will be collects; using two general sources of data shall be carry out the analysis of data. However, before carry out analysis of data they shall be provide the codes. Steps of data preparation for analysis: recognizing the collected data by types; giving codes either 0 or 1; filling into proposed software the coded data and then, analyzed; Interpreted the analyzed data results and discuss the interpreted results, conclude and given alternative recommendations.

A study [17] had revealed that before carry out to analysis the data; the collected data will be classified into three categories: nominal scale, ordinal or rank scale and metric or interval scale. After that, the classified the data they shall be coded or given the codes. Interval data may be represented by ordinal scale and ordinal data by interval scale. The theory of log linear regression will be applied which is referring to the pareto principles. The analysis of the data will be in the form of:

$$Response = f(X_1, \dots, X_k)$$

Where X_i –represents the exogenous influences of variables.

A pareto chart is a special form of bar-graph which help to determine the importance of problems. Pareto chart which influence variables interactions are ordered according to their relative importance. A special coding of variables as dummies is yield estimate of the effects of independent measurement units. The data after give the codes based on their classification using the t-test of variance of equivalence to be test the equality of the expected values of samples by using t-test. Overall the data will be analyzed using SAS software computer based and the relationships between both dependent and independent testify by uses the test procedures of chi-square (X^2), t-test and F-test. The homogenous of the results will be test by uses the Goodness fit [17].

Test statistics in case of two independent sample sizes for example i and j is given by:

$$t = \frac{\bar{X} - \bar{Y}}{S} \sqrt{\frac{n_i n_j}{n_i + n_j}} \sim t_{n_i + n_j - 2}$$

$$S^2 = \frac{\sum_{i=1}^n (X_i - \bar{X})^2 + \sum_{j=1}^n (Y_j - \bar{Y})^2}{n_i + n_j - 2}$$

It is the pooled estimate of variance

$$S = \sqrt{S^2} = \sqrt{\frac{\sum_{i=1}^n (X_i - \bar{X})^2 + \sum_{j=1}^n (Y_j - \bar{Y})^2}{n_i + n_j - 2}}$$

These will be help the researchers to observe the relationships between dependent and independent variables. Analyzed and output results will be presented using table, chart, bar-diagram, scattered grape and line graph. However, the study will use the pairwise comparison or paired t-test. For instance, it will be considered two factors level and then, statistical model of data analysis.

$$Y_{ij} = \mu_i + \mu_j + \epsilon_{ij} \text{ where } Y = \int_{j=1, \dots, n}^{i=1, 2}$$

Abbreviations

Etal	Extras
FSIV-IIED	Forest Science Institute of Vietnam International Institute for Environmental Development

Appendix

t/ha/yr	Tone per Hectare per Year
FAO	Food and Agricultural Organization
UNESCO	United Nation Education Scientific and Cultural Organization
H ₀ and H _a	Null Hypothesis and Alternative Hypothesis
SMWHZ	Satellite Map of West Harareghe Zone
UNDP	United Nation Development PROGRAMME
a.s.l.	Above Sea Level

Author Contributions

Mussa Abdula Ibro is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

No conflicts of interest in declare of this manuscript. Reared, review and revised the whole manuscripts by himself. The author is taken all of the responsibility of the ethical of the study conduct and clarity of the approval of this manuscript.

Table 2. Activity schedule and budgetary requirements.

Activities	Months of the year
Field surveying Site selection	September
Proposal preparation	October-end of November
presentation and defence of proposal	December
Preparation of questionnaires and checklists	January
Data collection through transect walk, observation and discussion with key informant	February
Interview of respondents and collection of data using PRA tool	February
Women and girl group	
Youth of female and male group	
Key informant such as kebele leader, religious leader, edire leader, agricultural expertise and office leaders	
Influential group in the societies or stakeholders	
Educated group (Grade 1-6, Grade, Grade 9-12, Level 1-4, Universities, BSc degree and above)	
None educated group	
Wealth status data collection (Very poor, Poor, Medium, Rich and Very rich	
Gender equity	
Secondary data collection from office	February
Preparation of watershed community mapping and photograph	February
Primary data organization by types	March

Activities	Months of the year
Secondary data organization by types	March
Providing code for primary and secondary data	March
Data analysis	April
Presentation of analyzed data using bar-graph, table, pi chart and scattered data	April
Interpretation of results	April – May
Discussion of interpreted results	June –July
Conclusion	August
Recommendation	September
Submission of report	December
Presentation of report	January
Rewrite of whole paper based on commits	February
Finalized and submission	April

Table 3. Budgetary requirement.

Activities	Estimated costs (Ethiopian Birr)
Field surveying and site selection	15,000
Proposal preparation and presentation	25,000
Preparation of questionnaires and checklists	30,000
Field data collections, secondary data collection and preparation of watershed community mapping and photograph collection	
Primary and secondary data organization; giving codes	15, 000
Data analysis, interoperation of results and discussion of interpreted results	50,000
Conclusion and recommendation	
Subtotal	120,000
Contingency 10%	132,000
Msselenous costs	30, 000
Grand total	162, 000

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