INTERDEPENDENCY OF LIVELIHOOD STRATEGIES ON NATURAL RESOURCES IN BALE- ECO REGION, SOUTHEASTERN ETHIOPIA

MSc Thesis

By: Tilahun Gemechu

Major advisor: Dr. Daniël Van Rooijen (PhD)

Co- advisor: Behailu Legesse (Msc)

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DECLARATION

I, Tilahun Gemechu Bedada, hereby declare that the thesis entitled **"Interdependency of Livelihood Strategies on Natural Resource in Bale- Eco Region** "submitted in partial fulfillment of the requirements for the degree of Master of Science with specialization in Ecosystem and Biodiversity Conservation of the Graduate Program of the Department of Biodiversity and Ecotourism, Madda Walabu University, is may original work and it has not been presented for the award of any other Degree, Diploma, Fellowship or other similar titles of any other university or institution.

Tilahumn Gemechu

Signature ---------- Date----------

APPROVAL

This is to certify that this thesis entitled **"Interdependency of Livelihood Strategies on Natural Resource in Bale- Eco Region** "submitted in partial fulfillment of the requirements for the degree of Master of Science with specialization in Ecosystem and Biodiversity Conservation of the Graduate Program of the Department of Biodiversity and Ecotourism, Madda Walabu University, done by Tilahun Gemechu Bedada. No PGEBE/0003/07 is an authentic work carried out by him under my guidance. The matter embodied in this thesis work has not been submitted earlier for award of any degree or diploma to the best of my knowledge and belief.

Adviser: Dr. Daniël Van Rooijen (PhD)

Signature----------Date----------

Co- advisor: Behailu Legesse (Msc)

Signature----------Date----------

ABSTRACT

Natural resources in developing countries are under great threat partly due to a lack of alternatives and strategies of the livelihood of people in the way they use these resources. During the last few decades, Ethiopia has experienced massive environmental degradation due to natural factors, unwise use of its natural resources, unsound ecological practices and population pressure. The specific objectives of this research was, to identify the existing livelihood strategies pursued by rural inhabitants ;To identify the impact of livelihood strategies on natural resources and To examine the dependency of livelihood strategies on natural resources in three different agro-ecologies of Bale Eco-region. Data was collected from 384 selected sample households of lowland, midland and highland communities of the BER. Data collection was done using semi-structured interviews, focus group discussion, key informant interviews, field observation and review of reports from zonal and districts offices. The collected data was analyzed using descriptive and inferential statistics. Descriptively, socio-economic characteristics of household and other variable were analyzed using averages, frequencies and percentages. In inferential statistics chi- square test was employed for nominal and categorical types of data. The study identified two major (livestock and crop production) livelihood strategies and six supplementary/alternative income sources (livestock production, food crop production, beekeeping, horticulture, non-timber forest product harvesting and petty trading). The study revealed that 52.2%, 81.7%and 89.1% of the households were primarily dependent on food crop production whereas 47.8%, 18.3%and 10.9% were dependent on livestock production across lowland, midland and highland zones of the BER, respectively. The other important finding of this study was regarding the interdependency of people's livelihoods on natural resources. Four types of natural resources (land, forest, water and soil) were identified so as to examine their relationship with the livelihood of the people. Almost all the households in the study area agreed that the aforementioned resources had a direct relationship with the livelihood of the people in one or another way. In addition, the chi-square test confirmed that land, water and forest had a significant relation with the livelihood of the people across the three agro-ecological zones. Based on investigating the interdependency of livelihood strategies and natural resource in the BER, it is suggested to shift from a traditionally- preferred 'cereal crop-livestock mix' dominated livelihood strategy to more specialized or diversified cash income-based strategies, such as off-farm business, honey production, poultry, and horticulture

.**Key Words:** Community, Environment, Land degradation, Forest, Water

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ABBREVIATION AND ACRONYMS

BER	Bale Eco-Region
BERSMP	Bale Eco-Region Sustainable Management Program
BMNP	Bale Mountain National Park
DFID	Department of Food for International Development
EEA	Environmental Impact Assessment
ES	Environmental Services
FAO	Food and Agriculture Organization
FDRE	Federal Democratic Republic of Ethiopia
FGD	Focus Group Discussion
NGO	Non Governmental Organization
NDMC	National Drought Monitor Center
NTFP	Non- Timber Forest product
MoFED	Ministry of Finance and Economic Development
OSFESA	Oromia State Forest Enterprise Supervising Agency
PFM	Participatory Forest Management
REDD	Reduced Emission from Deforestation and Forest Degradation
SHARE	Support for Horn of Africa Resilience
TLU	Total Livestock Unit
USDA	United States Development Agency
USAID	United state of America International Development
WZFEDB	Welayita Zone Finance and Economic Development Department

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1. INTRODUCTION

1.1. Background

Natural resources provide fundamental life support, in the form of both consumptive and public-good services. Ecological processes maintain soil productivity, nutrient recycling, the cleansing of air and water, and climatic cycles. Soils are the foundation of agriculture, which in turn is the basic building block in the livelihoods of all people. At the genetic level, diversity found in natural life forms supports the breeding programs necessary to protect and improve cultivated plants and domesticated animals to safeguard food security. Wild flora and fauna form the basis of traditional medicine and much of the modern pharmacological industry (Ellis and Allison 2004).

Rural natural resource based livelihood diversification may occur in different forms. It may exist in the form of on-farm, non-farm and off-farm activities (McNamara and Weiss cited in Zerihun (2012). Non-farm activities are activities that include petty trading and processing of natural resource products while on-farm activity includes fishing, hunting, etc (University of Greenwich, 2001). According to Cain and Mcnicoll (1988), household level livelihood diversity is not similar to sectoral diversity (agriculture, industry/manufacture, service). They also indicated that there may be a higher degree of household level diversity even in undiversified rural economy in sectoral terms.

In developing countries, particularly in Africa, poverty has been linked with inappropriate dependence on few natural resources particularly on forest. As illustrated by Ellis and Allison (2004) the food security crisis that occurred in Southern Africa during 2001 to 2003, agriculturalists with few options for alternative sources of income generation were highly injured (Ellis and Allison, 2004). Due to this, now a day's developing countries have been trying to diversify rural economic activities and economic options of peoples in sustainable way in order to reduce the above forces on natural resource and to improve the income of the population (Petit and Barghouti; Siamwalla *et al*, sited in Delgado and Siamwalla, 1997).

Experience from Namibia and Kenya, natural resource based diversification shows that the improvement on natural resource conservation and rural income through PFM program (Ashley, 2000). Other studies also support this fact that forest dependent peoples reduce the number of forest products that they use as they become more integrated into the cash economy (Dewi, Puntodewo and Belcher, n.d, cited in Zerihun, 2012). On the other hand other studies reveals that, even though, a high reliance of African people on the natural resource for their main livelihoods (Karki, 2001), natural resource based livelihood diversification is poorly adopted. Still, people have been engaging on those activities that can degrade forest environmental ecosystems because of lack of better alternatives and risks.

According to Badege (2006), nearly 90% of the Ethiopian population relies on natural resource for their primary livelihoods and source of energy for cooking, heating and even lighting. This higher reliance on natural resource has been exploiting fixed types of resources from which available to them abundantly. Even though, enormous amount of natural resource based livelihood potential reported in Ethiopia such as: timber products, forest coffee, essential oils, honey and beeswax, bamboo, eco-tourism, sport fishing, fish farming, trophy hunting as well as medicinal plants, farmers has been driving income from few of them particularly from agricultural products that has been adversely affect forest for their energy need (fire wood and charcoal) and building material (wood pool, timber) (Farm Africa, 2007).

In Ethiopia about 40% of land had covered by forest whereas only less than 3% of the land is occupied by forest (Bedru, 2007), cited in Alemtshay, 2010). Among the major problems indicated for this degradation in Bale zone is expansion of farm land without understanding that the long period environmental impact. Culturally agriculture and livestock are the dominant sources of income that leads to deforestation. In fact, in some places there were a diverse income portfolio that depends on natural resource for example beekeeping, timber production, medicinal plant, but their involvements were not as such strengthening and not considered as a main livelihood. It is simply a means of risk recovery strategy and has not been associated with conservation practice (Zerihun, 2012)

Bale Mountain is one from forest potential area in Ethiopia, and this area has been alarming because of mentioned excess exploitation of few natural resources. According to Oromia State Forest Enterprise Supervising Agency (OSFEA) (2007), around twelve million people live in this region are mainly dependent on the natural resource of the Bale Mountains that has not been conserved well. Due to this fact, the natural resource of this area have been poorly managed and producing less amount of benefit for local peoples and also for national economy for decades. An informal report suggests that the level of illegal trade in the forest products (e.g. bamboo, timber, fire wood and wood pool) have been increasing the level of exploitation. On other hand Coffee has been replacing at the expense of much of its diversity in plant species. No forest protection measures appear to be in effective (environmental protection authority). So that OSFEA articulates the introduction of Participatory Forest Management (PFM) in all of its conception areas.

Having this, the program (Farm Africa and SOS Sahel Ethiopia) had designed two major aims and had been implementing; that were managing biodiversity and ecological processes and securing the social and economic well-being and sustainable livelihoods of communities which mainly dependent on the natural resources of the area particularly for marginalized groups (such as women, the poorest and the youth) (Farm Africa and SOS Sahel Ethiopia, 2007).

By taking the above mentioned problems in to due consideration this study, therefore, initiated the researcher to investigate the interdependency of livelihood strategies and natural resources in the 3 different agro-ecology zones of the Bale Eco-Region.

1.2. Statement of the Problem

Natural resources in developing countries are under great threat partly due to lack of more sustainable alternatives and the type of livelihood strategies of the people. During the last few decades, Ethiopia has experienced massive environmental degradation due to natural factors, unwise use of its natural resources, unsound ecological practices and population pressure. Particularly, about hundreds of thousands of people in Bale mountain area and 12 million people, living downstream in the water basins, are dependent on the ecological services of the Bale Mountains (Oromia State Forest Enterprise Supervising Agency (OSFESA), 2007). However, there is a high rate of forest degradation and fast depletion of natural resources. In 2008 alone, about 1250 hectares of forest in Dello district were destroyed by fire in due to searching for grazing land, honey production and other livelihood activities (FARM/SOS, 2007).

According to Mulat (2000), the depletion of natural resources particularly the continuous loss of forest and the expansion of agricultural land to marginal areas with the increase in agricultural population have led the country to sever climate change from time to time. As the result, the agricultural output is not predictable and, therefore, the country is prone to food shortage as well as famines. At household level, the combined effects of insufficient domestic food production and increasing food prices have eroded the ability to access adequate food by many people (USAID, 2003). Previously, the Bale Mountains was relatively environmentally intact while nowadays-negative pressures on natural resources are rapidly growing. Unsustainable natural resource exploitation and degradation throughout the area is increasingly threatening the sustainability of the environment, food security and sustainable livelihoods. Bale's rural communities are seeking to meet their livelihood needs by expanding exploitation of local natural resources. Current resource exploitation is opportunistic and unregulated. Agricultural land is expanding rapidly, grazing areas are heavily degraded necessitating the search for new pasture, forest areas are being cut and cleared, and water systems disrupted. At same time, as population grows arable land per capita declines and the fragmentation and degradation of land through overuse increases.

Different studies conducted elsewhere in the world in general and in the study area in particular did not focus mainly on the interdependency of natural resources and household's livelihood

strategy. Some of the studies like Thomsen *et al,* (2001) conducted a research on livelihood perspective on natural resource management and environmental change in semiarid Tanzania. The aim of this paper was exploring how social relations influence land use and natural resource management at the local level. Despite they uses the concept of livelihood strategies as an analytical framework, they only analyzed for their impact of sub community processes on intensification and degradation.

The other study also conducted by (Bedru *et al,* 2008) on Household livelihood strategies and forest dependence in the highlands of Tigray mainly focuses on identifying factors that condition a household's livelihood strategy choice with a particular emphasis on forest products. Like as the study conducted by Thomson and other researchers, the above mentioned research also uses livelihood approaches. However, the main limitation of the research was it only focuses on a single resource (forest) to examine its dependency on Household livelihood strategies. Even different studies conducted in Bale zone did not addressed the interaction between Livelihood strategies and natural resources. For instance the study conducted by Alemtshay in 2010 on determining factors for a successful establishment of participatory forest management was undertaken by giving due attention on assessing the effects of economic, social and biophysical factors on participation of the community. Also (Muzayen, 2009) conducted a research at Harana Buluk on the role of non-timber forest products to rural livelihoods and forest conservation. All the above mentioned researches mainly focus on forest resources and their management practice. Therefore, this indicates that there are deaths of empirical evidence related with the interdependency of livelihood strategies and natural resource that need to be addressed, the knowledge of which may help to enhance the conservation of all natural resources.

Hence, this thesis were attempted to address this research gap with particular emphasis on the interdependency of Livelihood strategies on Natural Resource in Selected Areas of Bale Eco Region.

1.2. Objectives of the study

General Objective

To investigate the interdependency of livelihood strategies on natural resource in the Bale-Eco Region, South-East Ethiopia

Specific objectives

1. To identify the existing livelihood strategies pursued by rural inhabitants in three different agro-ecologies of Bale Eco-region
2. To identify the impact of livelihood strategies on natural resources in three different agro-ecologies of Bale Eco-region
3. To examine the dependency of livelihood strategies on natural resources in three different agro-ecologies of Bale Eco-region

1.3. Research question

- What type of livelihood strategies pursued in the study area?
- What are the impacts of livelihoods strategies on natural resources in the study area?
- How the dependency of livelihood strategies on natural resources exist in the study area?

1.4. Significance of the study

Identifying the interdependency of livelihood strategies and natural resources would help to accelerate the natural resource conservation and contribute for the economic development of the region and the country as a whole. So, this study would be expected to provide baseline information to stakeholders to set future development strategies and as an input for policymaking. Moreover, the study would reveal the extent of interdependency of natural resources and livelihood strategies in BER in facilitating natural resource conservation by people in the Bale Eco-region. Particularly, this empirical evidence is important for natural resources management. The research report would also serve as reference material for scholars and may be used to inform relevant stakeholders. Finally, the output of the study would be expected to significantly contribute for the future intervention plan of SHARE BER project.

1.5. Scope and limitation of the Study

The study was delimited only to five districts that are pilot areas of the SHARE project and used 384rural household respondents to achieve the stated objectives of the study. This study was also conceptually limited to the dependency of livelihood strategies on natural resources and it was not focused on factors that may affect the livelihood diversification behavior of the rural households. In addition to this, the study were not utilized any econometric models which might be essential to analyze the degree to which the households depend on natural resource while taking in to consideration factors that inhibit or facilitate livelihood diversification. However, the main concern of the study was limited to, portraying the interdependency of livelihood strategy on natural resources other than factors that determine household livelihood diversification strategies. The scope of this study was relatively very broad as compared to other studies in Bale Eco-region and includes four renewable natural resources like water, soil, land and forest and did not focused on Non renewable natural resource like air, minerals, oil, etc.

2. LITERATURE REVIEW

2.1. Definition and Concept of Natural resources

The World Bank defines natural resources as "materials that occur in nature and are essential or useful to humans, such as water, air, land, forests, fish and wildlife, topsoil, and minerals." These resources can be classified as renewable or nonrenewable. In most cases, renewable resources such as cropland, forests, and water can be replenished over time by natural processes and—if not overused—are indefinitely sustainable. Non-renewable resources such as diamonds, minerals, and oil are found in finite quantities, and their value increases as supplies dwindle. A nation's access to natural resources often determines its wealth and status in the world economic system (World Bank, 2006).

Natural resources are an integral part of society, as sources of income, industry, and identity. Developing countries tend to be more dependent on natural resources as their primary source of income, and many individuals depend on these resources for their livelihoods (Tylera and Stephen, 2006). It is estimated that half of the world's population remains directly tied to local natural resources; many rural communities depend upon agriculture, fisheries, minerals, and timber as their main sources of income. A developing country's ability to modernize economically is often dependent on access to natural resources. Water is essential for both successful agriculture and manufacturing; for example, the lack of clean water for the labor force can drastically inhibit a country's economic growth (Tylera and Stephen, 2006).

Natural resources become fundamental and important resources in rural livelihoods of Africa (Ellis, 2004, Joshua and Bodin, 2010).The wealth embodied in natural resources makes up a significant proportion of the wealth of most nations, often more than the wealth embodied in produced capital, therefore making natural resources management a key aspect of economic development (World Bank, 2006). Many countries have seen significant rises in revenues from natural resources due to the rise in commodity prices. Natural resources such as oil, gas, minerals and timber are expected to continue to play a significant role in resource abundant economies, as demand from rapidly growing economies increases, and as supplies of non-renewable resources decline and renewable resource harvests approach maximum sustained yield levels. Not surprisingly, countries richly endowed with natural capital have the potential to derive significant

current income from resources. In addition to providing revenues to resources rich countries, natural resources can play a central role in poverty reduction efforts. The poor generally depend upon natural resources directly for their livelihoods, especially the rural poor. Consequently, policies that improve natural resources management can have immediate and meaningful poverty reduction impacts (Ellis 2004).

2.2. Renewable and non-renewable natural resources

There are two forms of natural resource, renewable -like forests or fish populations and non-renewable like oil and minerals. Renewable if managed sustainably yield an increment of resources that can be harvested indefinitely into the future. Non-renewable resources can by definition only be depleted, as they do not regenerate themselves over humanly meaningful time spans. So understood as natural capital, the revenue generated from nonrenewable resource depletion should be measured as a loss of capital rather than as income comparable to the income derived from the flows of renewable resources (IISD and NEAA, 2010).

In addition to renewable and non-renewable natural resources, natural capital is also composed of ecosystem services, such as the capacity to assimilate wastes and the production of vital life supporting functions, such as water purification and nutrient cycling. Ecosystem services are generally not accounted for in national or firm level accounts (Costanza, 1997). Ecosystem services are essential in maintaining life and economic activity, but are difficult to quantify and therefore have in the past received relatively little attention in policy-making circles. With the recognition that the loss of ecosystem services, such as the capacity of the atmosphere to absorb carbon dioxide without becoming dangerously unstable and threatening to societies and economies, there are now intensive efforts underway around the world to include analysis and accounting of ecosystem services in policy-making (IISD & NEAA, 2010).

2.3. Definition and Concept of Livelihood

The concept of livelihood is widely used in contemporary writings on poverty and rural development, but its meaning can often appear elusive either due to vagueness or to different definitions being encountered in different sources (Ellis, 2000)**.** According to DFID (1999) the term livelihood strategies are defined *as* the range and combination of activities and choices that people make in order to achieve their livelihood goals, including productive activities, investment

strategies, reproductive choices, etc. Livelihood strategies are composed of activities that generate the means of household survival and are the planned activities that men and women undertake to build their livelihoods (Ellis, 2000).

The livelihood definition provided by Chambers (2003) has been widely cited in the development literature, and with minor modifications has been used by a number of researchers "A livelihood comprises the capabilities, assets (stores, resources, claims and access) and activities required for a means of living." Chambers and Conway (1992) and Ellis (2000) seeks to build on this definition by bringing in a more explicit consideration of the claims and access issues, and in particular the impact of social relations and institutions that mediate an individual or family's capacity to secure a means of living. In addition to assets and activities, and the factors that mediate access, livelihood considerations must take account of the outcomes of the interaction of these components. Livelihood outcomes would ideally be what people seek and strategize to achieve through their activities, albeit in practice the means or the choice of activities may be restricted or absent and the ends will not always be realized.

The livelihoods approach that seems to be applied to a wide range of issues (Scoones 2009), originated from earlier works on vulnerability and famines and strands of livelihood ideas that developed through 1980s and 1990s (Ellis, 2000). In particular, the approach draws from Adugna (2005) seminal work on famines and food security. The 'asset vulnerability framework' which is the focus of the livelihoods approach arises from the following literature on famines, enabling the approach to engage with factors that make rural households vulnerable to shocks and stresses, and identify policies and processes that can improve their resilience in the face of disaster. The work of Chambers (1983) on the multiple realities of rural poverty also gave inspirational insights to the origin of the livelihoods approach. In addition, insights into what constitutes household vulnerability was also provided by Blaikie *et al*. (1994) through their access model that suggested the level of access to resources determines the vulnerability of households, partly building on Sen's entitlement work. In general, the emphasis of a livelihoods perspective is mainly on the importance of issues of access to productive assets and resources that are essential for increasing the productivity and reducing the vulnerability of rural poor people (Scoones, 2009). Therefore, what remains key in this approach is the concept of multiple and diverse livelihoods that are built on the basis of a combination of capabilities, assets, and activities

required to cope with and recover from stresses and shock such droughts, floods, famines, and epidemics (Chambers and Conway, 1992). Drawing from the work of Chambers and Conway (1992), the concept of 'a livelihood' is understood as comprising "the capabilities, assets (including both material and social resources) and activities required for a means of living" (Carney 1998: 2). The approach hinges upon the recognition of access to assets by the poor, individuals or households, as fundamental element to understanding livelihood options, survival strategies and vulnerability to adverse trends and events (Ellis, 2000). It puts more emphasis explicitly on the different kinds of assets possessed by the rural poor that can be utilized or built upon to enhance the resilience and security of their livelihoods (Carney, 1998; Scoones, 1998; Bebbington, 1999; Ellis, 2000).

Livelihood outcomes are the achievements of livelihood strategies, such as more income (e.g. cash), increased well-being (e.g. non material goods, like self-esteem, health status, access to services, sense of inclusion), and reduced vulnerability (e.g. better resilience through increase in asset status), improved food security (e.g. increase in financial capital in order to buy food) and a more sustainable use of natural resources (e.g. appropriate property rights) (Scoones, 1998).

In addition to assets and activities, and the factors that mediate access, livelihood considerations must take account of the outcomes of the interaction of these components. Livelihood outcomes would ideally be what people seek and strategize to achieve through their activities, albeit in practice the means or the choice of activities may be restricted or absent and the ends will not always be realized. Desired outcomes might include increases in income (monetary), food and water security, health, physical security, independence, knowledge, status, or time – the inverse of various poverty dimensions (Bebbington, 1999). The outcomes in turn will usually have a direct effect on the asset base and activities (and possibly on the access regimes), so in this sense there is a cyclical relationship between assets, activities and consumption outcomes. Most livelihood models focus on the household as the most appropriate social group for the investigation of livelihoods, albeit external measures to manage risk may be social or public in nature. Household livelihoods are however founded on the aggregation and dynamics of its individual members, which suggests that to develop understanding of the pervasive features of rural households some account of the intra-household dynamics (e.g. by gender, age or status) was necessary (Ellis, 2000).

2.4. Rural Livelihood Strategies in Context of Ethiopia

Agriculture still remains the main stay of Ethiopian economy, which contributes 45% GDP, more than 80% of employment opportunities and over 90% of the foreign exchange earnings of the country (MoA, 2010). It serves as the primary means of livelihoods. Though Ethiopia's economy has been growing at an average rate of 7% in recent years (BTI, 2012) the increasing population growth in rural Ethiopia obliged households to cultivate and make their living on extremely small size of land. For instance, 29% of grain farmers in 2006/7 had cultivated a land less than 0.5 ha per household (EEA, 2008). According to recent FDRE (2010) evidence, nearly 55 percent of all smallholder farmers operate on one hectare or less. Due to the smaller farm size and low return from farming activities, majority of rural households are exposed to food insecurity and chronic poverty.

The national survey conducted in 2003/2004 by Ethiopian Economic Association indicated that 63% of surveyed households were food deficit in Ethiopia. This evidence is supported by FAO (2010) in that about 61 percent people were undernourished in Ethiopia. It is increasingly becoming clear that the agricultural sector alone cannot be relied upon as the core activity for rural households as a means of improving livelihood and reducing poverty. One phenomenon that is gaining prominence in the rural development literature is the promotion and support for non-farm diversification opportunities (Stifel, 2010). Non/off-farm economic activities include seasonal migration, off-farm to engage in wage employment, handicraft production, petty trading and processing of agricultural produce, provision of agricultural services etc. Such nonfarm activities provide a way of off-setting the diverse forms of risks and uncertainties (relating to climate, finance, markets etc) associated with agriculture and create a way of smoothing income over years and seasons (Reardon,1997). The rural economy of Ethiopia, similar to developing countries is traditionally viewed as an agrarian economy in which farm households are exclusively engaged in farming with few non-farm activities. However, there is growing evidence that households across the developing world earn an increasing share of their income from non-farm sources. For example, Haggblade, Hazell and Reardon (2010) reported that non-farm earnings account for 30 to 45 percent of rural household income across the developing world, and where available.

Evidence suggests that the non-farm share in rural income is increasing overtime. World Bank (2009) also indicated that about 25 percent of rural households in Ethiopia earn some income from non-farm enterprises. Similarly, outside agriculture the rural households in Wolaita zone generate income from non/off-farm wage, petty trading and remittance from migrants. Distant migration as a way to maximize income across seasons and cope with food shortage has been a long history. However, the majority (more than 50%) of the population lives on subsistence margin with little or almost no land and livestock and dependent on marginal non-farm income sources (i.e., casual labor, petty trade). The very poor are often without working labor, with no assets (i.e., land, livestock) and dependent on income transfers (Bush, 2002).

The most recent evidence indicates that about 57 percent of\ households in the zone are possessing less than 0.25 hectare of land which could not help to attain adequately hand to mouth subsistence farming (WZFEDD, 2012). If there are no alternative means of livelihoods substituting this situation the newly born generation will face serious challenges than existing. Moreover, the rural population in the Zone is frequently and increasingly vulnerable to droughts and famine. According to the study by Dessalegn (2007), since the mid- 1980s, farmers in Wolaita have suffered hunger and food shortage almost continuously. The good years in the two decades have been very few. Since then, crisis interventions by government and NGOs have occurred almost every two years or so; and a number of farm households were highly dependent on food aid and other public support programs. The resilience of enset as 'famine crop' has diminished since the major droughts of the mid-1980s (Bush,2002).This situation has reached peak stage and challenging many people at this time due to seasonal climate variation and uncontrolled population growth. Livestock holdings are on decline because of shortage of grazing areas and feed.

2.5. Livelihoods and Natural Resources dependency in Bale Eco-Region

Ethiopia is one among most grounded in poverty due to periodic drought and extremely variable environment making agriculture in a risky economic activity. Drought is considered to be a major instrument driving people into chronic poverty and keeping them in the state for many years even after the breaking of the drought (NDMC, 2005). Like other sub-Saharan Africa countries, the nation is characterized by a complex, diverse and risk prone agricultural production environment (Devereux, 2000; MoFED, 2002). Natural disaster (drought) forced people into alternative livelihood such as the collection and sale of firewood and grasses (Goodrich, 2001). Ensuring households' access to food poses a formidable challenge in view of the fact that chronic food insecure households are predominantly located in drought-prone, moisture deficit, areas and peripheral pastoral areas. These areas are chronically food insecure in several aspects; they do not produce enough food to feed People living in BER are inextricably dependent on the local natural resources for livelihoods. Farming (crop and livestock) is dependent on the Ecosystem Services (ES) obtained from the forests and wooded vegetation of the region. The forests and natural areas provide both fertile cropland when converted and other wise used as natural rangeland for livestock grazing. Furthermore, the rich biodiversity of BER is providing diverse goods particularly non-timber forest product that have been collected and traded by locals to augment their cash and subsistence income needs. For thousands of households inhabiting the BER harvest and trade of NTFPs is an economic necessity (FARM/SO Sahel, 2007).

The conversion and degradation of forest in the region has its root in the property right related arrangements of land and forest resources. While farmers do not have legal claim over the forested landscape, they can readily and easily achieve the title of use right over cropland once they clear and cultivate it. Thus, clearance is a means towards realizing private ownership of land, which is an incentive for the local people to continuous clearance. Nonetheless, whether perceived or not, forest disappearance or any action that limit access to the forest would have greater impact on the livelihoods of the people. To sustain the role of forests in the livelihoods and conserve the resources for other ecosystem services introducing improved management systems such as those launched by BERSMP are crucial (Zerihun, 2012)

3. MATERIALS AND METHODS

3.1. Description of the Study Area

3.1.1. Location of the eco-region

The study was conducted in Bale Eco-region which includes Bale and west Arsi Administrative zone, South-Eastern part of Oromia Regional State. The zonal capital city Robe is located about 420350 km from the capital city of Ethiopia, Addis Abeba to the south eastern part of the country. Bale eco-region is situated between 6º29' – 7º10'N and 39º28' – 39º57'E. Fourteen districts (locally known as Woredas), namely Kokosa, Nensabo, Dodola and Adaba woredas from West Arsi Zone, and Gololcha, Gasera, Sinana, Agarfa, Dinsho, Barbare, Goba, Goro, Harena Buluk and Delo Mena woredas from Bale Zone included in bale eco region. About 1,728,316 people live in the fourteen districts from this 61% live in Bale eco region (CSA population projection, 2013). Bale eco-region receives almost eight months of precipitation (March-October). Temperature varies from the lowest less than 7.5°C at the Sannate Plateau to over 25°C in Delo Mena (Demel *et al.,* 2015). The climate of Bale ranges from tropical in the southeastern lowlands to alpine in the northwestern highlands, the altitude varying between 400 and 4377m a.s.l. Among the woredas, Barbare and Dello mena are lowland areas, and Harena Buluk, Goro, Nensebo and most part of Gololocha and Agarfa are midlands. The remaining woredas are highlands. The Eco-region receives bimodal rainfall

3.1.2. Farming systems

The eco-region is known by having two major seasons, namely Belg and Meher and irrigation is practiced in some areas. Agriculture is the predominant economic sector which is over 95% of the population engaged in this sector. The farming system is mixed both livestock and crop production which was characterized by subsistence methods and it pastoralist system. The overall farming system is strongly oriented towards grain production, Animal husbandry, coffee and honey production to sustain farmers' livelihoods. Types of crops that produced /cultivated in this eco-region is Wheat ,Barley ,oat, Faba been, Field pee ,Maize, linseed, seasom and Mung been are crops, vegetable Potato, Onion, Cabbage, Fruits Papaya, Mango and Banana are produced . In the low land used Forest Coffee as cash crop (Demel *et al.,* 2015).

3.1.3 Vegetation type and Wild animal of the Bale eco region

The forests in the Bale Eco-region are mainly high forests composed of six forests formerly designated as "forest priority areas", namely, Aloshe Batu, Goro Bale, Harana Kokosa, Kubayu, Menna Angetu and Adaba Dodolla. The eco-region is mapped as Afro mountain vegetation and considered to be part of the Afro Mountain. The natural vegetation, called Dega, weyna dega, kola in Amharic, is probably a mixture of closed forest in areas with higher rainfall and grassland, bush land, and thicket in other lower rainfall areas. The forest consists of *Podocarpus falcatus* and *Juniperus procera*, often with *Hagenia Abyssinica*. There is an evergreen broadleaved mountain forest dominated by *Syzygium guineense,* and *Olea africana* .On the moist slopes of the Harenna forest, a shrubby zone of *Hagenia* and *Schefflera* grows along with *giant lobelias*, *Lobelia gibberroa*. The total area of Bale Eco-region is 576,856 ha in 2011, of which 193,000 ha is covered by the Bale Mountain National Park (BMNP) (Demel e*t al*, 2015)

The moist forest comprises the second largest stand in Ethiopia. The Herenna forest, covering the southern part of the massif, is the second largest stand of moist tropical forest in Ethiopia. The forests are host to globally unique and diverse fauna and flora, including a significant number of rare and endemic species. The forests in the Eco-region are threatened by the largely unregulated subsistence livelihood needs of the population, with forest being cleared to procure land for crops and livestock grazing, as well as for timber and firewood (BERSMP, 2006, BMNP, 2007). Between 2001 and 2009 the average annual deforestation rate in the eco-region was 3.44%, ranging from 1 to 8% (Dupuy, 2009). Wild animals are not evenly distributed in the Eco-region. Common wild animals found in the Eco-region are Red fox, Giant mole rat, Mountain Nyala (Alieri, 1994), Hyena, Rhinoceros, Wild ass, Lion, Warthogs, Leopard, Olive, Baboons, Apes, Monkey, Birds, Dickers, Fish, Frog, Snakes and others. These wild animals are found in a scattered way.

3.1.4. Water source

The BER is considered as the water tower of south-eastern Ethiopia, Somalia and Northern Kenya. According to recent studies, the Bale Eco-region supplies water for some 12 million people in the lowlands of southeast Ethiopia, Northern Kenya and Somalia. A total of 40 rivers

arise in the area, contributing to five major rivers, namely the Web, Wabi Shebelle, Welmel, Dumal and Ganale (FARM Africa, 2008). These rivers are the only sources of perennial water for the arid lowlands of the eastern and southeastern Ethiopia, including the Ogaden and Somali agricultural belt (Demel *et al.*, 2015).

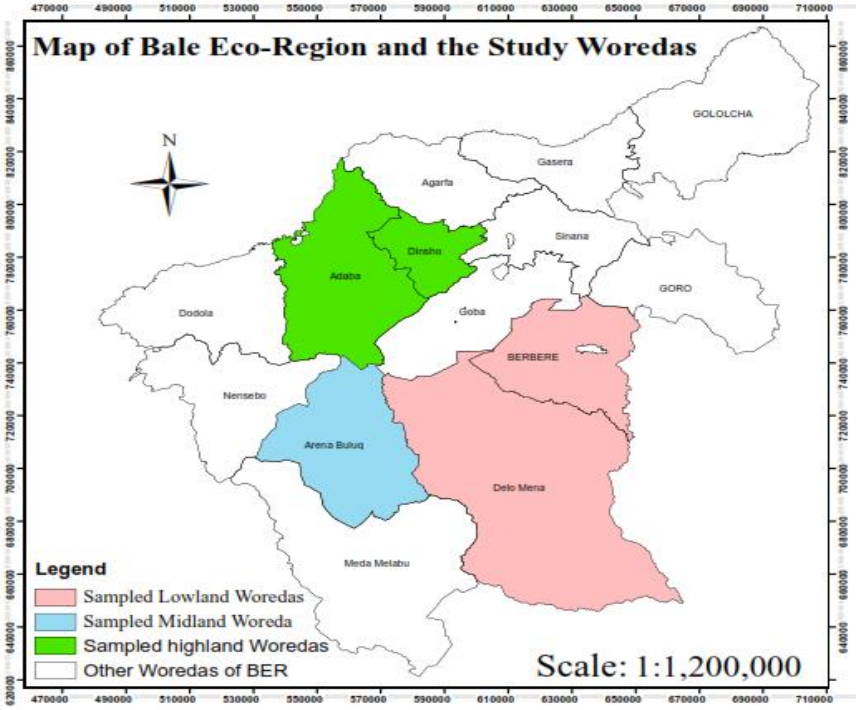

Figure 1: Map of the study area **(***Source: BER Sustainable Management Program Report (2009*

3.2. Study design

Both qualitative and quantitative study designs were employed. Among quantitative study, cross-sectional household survey was used in BER to collect relevant information that addresses the study objectives. Among qualitative study designs, Focus Group Discussion (FGD), in-depth interview and field observations were used.

3.2.1. Sampling technique and sample size

In this study, multi-stage sampling procedure was employed (Figure 2). The districts/woredas in BER that are pilot areas for SHARE project were stratified into highland, midland and lowland agro-ecologies. Out of the total highland and lowland woredas of BER, five woredas (two from highland Woredas and two from lowland Woredas) were selected purposively by expert recommendation from their strata. Accordingly, Adaba and Dinsho from highland woredas, Dello

menna and Berbere from lowland woredas and Harrena-Buluk from midland were selected. From each woredas *two kebeles* that best represents the agro-ecologies of the Woreda were selected through purposive sampling method.

The sample size was proportionally allocated to each kebele to draw the sample households. Hence, sample households were selected from each kebele by random sampling method using lottery technique from the sampling frame (*i.e. complete household lists)* of each Kebele.

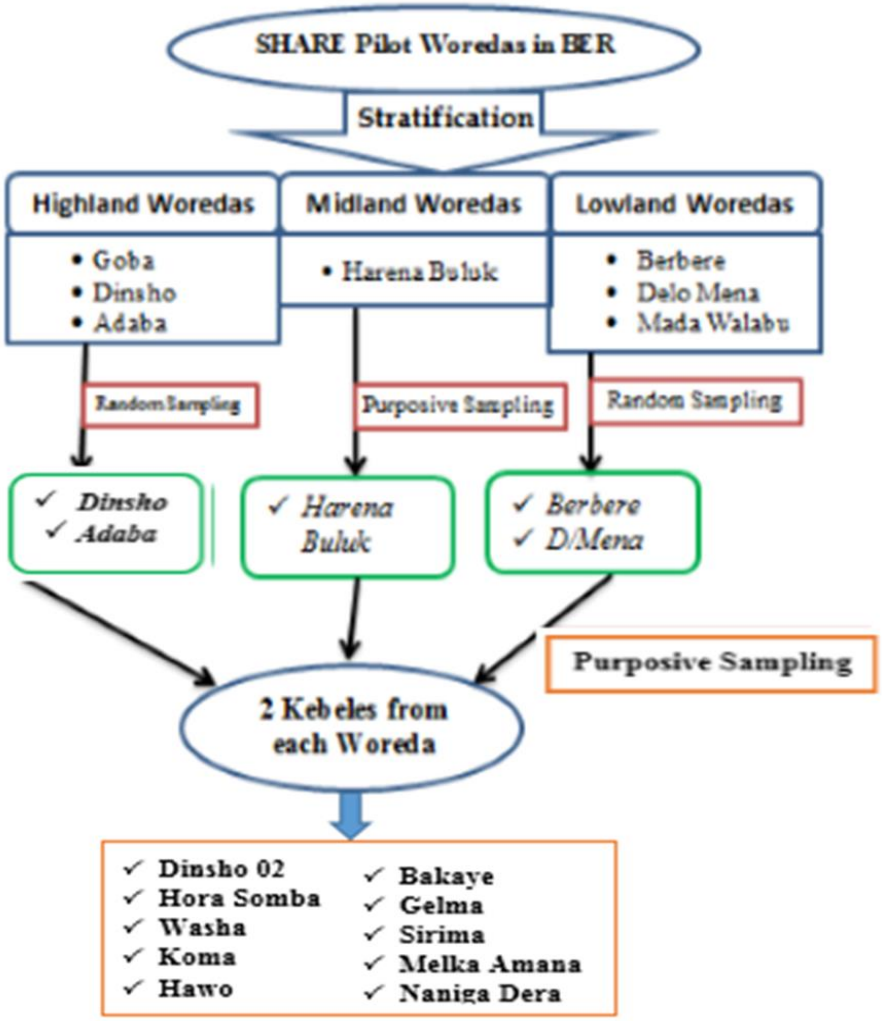

Figure 2: Sampling Procedure for the Selection of Study Kebele

Table 1:-Number of population and sample size per Woreda.

Name of Woreda and kebele	Number of population	Sample size
Dinsho (Dinsh-02 and Hora soba kebele)	47,117	35
Adaba (Koma and Washa kebele)	138,717	121
Harena Buluk (Hawo and Bakaye kebele)	81497	71
Dello-Mana (Nanigadera and Malka Amana kebele)	89670	78
Berbera(Galma and Sirima kebele)	90642	79
Total	**441,283**	**384**

The sample size was calculated using a standard formula of Freund and Williams (1983):

$$n = \frac{(z)^2(pq)}{(d)^2} = \frac{(1.96)^2(0.5*0.5)}{(0.05)^2} = \frac{0.9604}{0.0025} = 384$$

Where: *n* is sample size, *z* is statistical certainty usually chosen at 95% confidence level (*z* = 1.96), *p* is proportion of population having desired characteristics (*p* = 0.5), *q* is 1-*p and d* is error accepted by researcher (5%).

The participants of the FGD were purposively selected among experts, of the study area. Five FGDs that consists an average of seven participants were involved. Moreover, 10 key informants (one from each kebele) were participated in an in-depth interview.

3.2.2. Method of Data Collection

Data was collected from both primary and secondary sources between December 2015 and May 2016. Primary data was collected through semi-structured interview, FGD, field observations and in-depth interviews. The same data collection methods was also used by Garnevska*et al*. (2006) (*i.e. semi-structured interviews*) in Bulgaria; Damianos and Skuras (1996) in Greece while Gary and Wilkinson (1997) used in New Zealand for conducting similar and related studies. The secondary data was obtained from review of organizational reports of study woredas, Farm Africa, SOS Sahel, Bale Forest and Wildlife Enterprise, SHARE and other relevant organizations.

Regarding the household survey, semi-structured questionnaires were employed to collect information on background and socio-economic characteristics of the sample households, on current economic activities of local communities, contribution of natural resource usages to local

communities' economic activities, constraints to use existing natural resources and temporal variation in natural resources in different agro-ecology of BER. The questionnaires that were initially prepared in English were translated to Afan Oromo. The questionnaires were pre-tested to check their validity and adjustments made where necessary on some households in the study woredas. The interviews were conducted by researcher with the help of six local enumerators and close supervision of five researchers from Madda Walabu University. Local enumerators were recruited from the study area and one-day induction training was given to them.

Totally, 5 FGDs (with Woreda experts) and key informants interview were carried out by using checklists prepared on economic activities, usage of natural resource, constraints to use existing natural resources and temporal variation of natural resources and other related issues. Supervisors and researcher were participated to collect information during FGDs and in-depth interview.

In addition, personal observation were employed to identify economic activities, usages natural resources, constraints to use existing natural resources and current situation of natural resources in the study area.

3.2.3. Method of Data Analysis

Descriptive (percentage and mean) and inferential (Chi-square test) statistics were used to analyze quantitative data using SPSS Version 20 at 95% level of significance. Chi- square was used to analyze categorical and nominal type of data. The qualitative data gathered through FGD and key informant interview were transcribed, organized into themes, narrated and triangulated with quantitative data collected through household survey.

4. RESULTS AND DISCUSSION

4.1. Demographic and Socio-Economic Characteristics

4.1.1. Sex of the rural Household Head in Bale Eco Region

In light of below in the figure, it has been depicted that from a total of 384 interviewees 25 of them are females while the remaining 359 are males. When this data is disaggregated in to agro ecological zone, majority of the male Headed Households (40.7%) are from lowland agro-ecologies whereas equal proportion of Female Headed Household (44%) were taken from both lowland and highland Districts of Bale eco region respectively. However, the chi-square test revealed that there was no significant difference in the sex of the household between the three agro ecologies at 5% significance level. On the other hand it has been pointed out that gender of the household heads is associated with better possibility of getting access to livelihoods. This is to say, it has been suggested that female headed households are poorer and more food insecure as compared to male headed households in the area. Presumably this is so, since women headed households are more vulnerable than male headed households as a result of lack of labor and support within the household and outside of the household. This in turn resulted in female headed households to meet their livelihoods to the least extent as compared to male headed households.

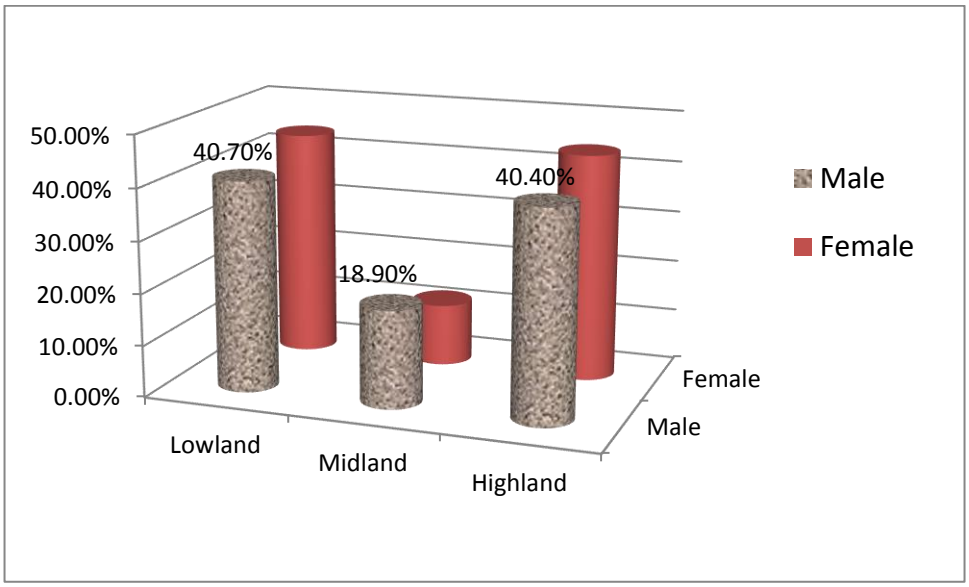

Figure 3: Gender distribution of the Rural Household head in BER

Source: survey data, 2016

According to Mihiretu (2008), both males and females are likely to play different roles in natural resource use and conservation. The household head has a significant influence in the decision making concerning the allocation of resources to improve household welfare Matlosa (1993). Hebinck and Lent (2007) posit that women make up the core of rural household decision making, rural income generating activities and are the principal providers while men have freedom of mobility and participation in different programs.

4.1.2. Age of the Household Head in Bale Eco Region

People of all ages can be natural resource dependent; however young people may be more dependent on forest products than elderly people. The reason for this is that the young people may have multiple uses of the forests and more forest products collection is labor intensive. On the other hand, the elderly people may not take a risk of going into the forest to undertake forest activities particularly that the elderly people may not have the strength to carry out forest related activities (Kohlin and Parks, 2001).

Statistically, age of household head showed no significant differences across the three agro-ecologies of the BER (Table 2).In addition to the above fact, the age distribution indicated that majority (216 or 56.2%) of the respondents were under the middle age class. According to Ellis (1999) many people of this class have access to land resources through individual ownership or communal land use or through inheritance from family members. It therefore means that land is available for majority of the households to carry out their agricultural activities. So diversification to work with the plantation because of cultivable land is an option and not a must to this category of households. From focus group discussion and key informant interview it was found that households-heads of the other age classes especially those below 30 years who have limited or no access to land resources may be compelled to work with the plantation in order to gain access to cultivable land for their family livelihood. However the results indicated low percentage of young people as household heads in BER.

Table 2: Age Distribution of Rural Households in BER

			Agro ecology			Total	Chi-square test P-value
			lowland	midland	highland		
Age of household head	18-30	Frequency	29	19	20	68	6.85NS
		%	18.5%	26.8%	12.8%	17.8%	
	31-46	Frequency	89	36	91	216	
		%	56.7%	50.7%	58.4%	56.2%	
	47 and above	Frequency	39	16	45	100	
		%	24.8%	22.5%	28.8%	26.0%	
Total		Frequency	157	71	156	384	
		%	100.0%	100.0%	100.0%	100.0%	

Source: survey data, 2016

4.1.3. Rural distribution by Household size of household head in Bale Eco region

Families with more labor capacity tend to extract more natural resources (Hedge and Enters 2000). In general large families require more resources to meet their subsistence needs, therefore have a higher propensity to extract resources from the reserve. In addition, families with more labor can mobilize part of it for forest dependent activities while maintaining the labor supply for village-based activities. Household size in this study was considered as the number of individuals who reside in the respondent's household. Cherdchuchai and Otsuka (2006) found that the household size, number of household members and working members, captures the quantity of human capital. Household size has important practical implications for labor availability which acts as the basis for a household to decide whether or not to participate in different activities. In rural areas, labor substitutes for machinery and most rural income generating activities depend heavily on family labor because of limited finance to buy or hire machinery.

Table 3 above presents the distribution of household sizes of the sampled households. The data revealed that the average household size in the three agro ecologies of BER was 5.5 whereas the largest families and were found in Lowland (44.7%) and Highland (37.4%) agro ecologies of Bale Eco region with the average family size of 9.5. In addition 25.9% and 50% of the Household from midland and Highland districts respectively reported that the average size of their family was only two (2). It was statistically confirmed that the family size of the rural Household are significantly different among the three agro ecologies of Bale Zone at 5% significance level.

Table 3: Household Size Distribution of Rural Household

			Agro ecology			Total	Chi-square test P-value
			lowland	Midland	Highland		
Family size	1-3	Frequency t	14	15	29	58	26.8 ***
		%	8.9	21.1	18.6	15.1	
	4-7	Frequency	85	23	70	178	
		%	54.1	32.4	44.9	46.4	
	8-11	Frequency	55	22	46	123	
		%	35.0	31.0	29.5	32.0	
	12 and above	Frequency	3	11	11	25	
		%	1.9	15.5	7.1	6.5	
Total		Frequency	157	71	156	384	
		%	100.0	100.0	100.0	100.0	

Source: survey data, 2016

4.1.4. Level of Education of the Households

Literacy has been noted to be one of the factors enabling farmers to acquire and process relevant information effectively. Education has the possibility of influencing household's livelihoods strategies and also determines the income derived from the activities undertaken by the household. Yunez-Naude and Taylor (2001) suggest that education is crucial to raising economic productivity and competitiveness and to combating poverty. The researcher collects information on the level of education attained by the household head who was the central decision maker in choosing livelihood strategies of the household. The results are presented in Table 4

The attainment of education in the three agro ecologies of BER appeared to be quite reasonable. The collected data revealed that 52% of household heads from Lowland 23.9% and 33.3% from midland and highland districts respectively have had informal education. When we come to the primary education attainment of the household across the agro ecologies, 26.1%, 47.9% and 31.4% of them from lowland, midland and highland districts respectively attended primary school whereas very little number of households was involved in professional education. In addition to these figure households in lowland accounts (17.8 %), midland (19.7) and highland (14.1) were found to represent the illiterate group of households in BER.

Table 4: Educational Levels of the Household Head in BER

			Agro ecology			Total	Chi-square test P-value
			lowland	midland	highland		
Level of education of household head	No education	Frequency	28	14	22	64	42.96***
		%	17.8	19.7	14.1	16.7	
	Informal education	Frequency t	82	17	52	151	
		%	52.2	23.9	33.3	39.3	
	Primary school (1-8)	Frequency	41	34	49	124	
		%	26.1	47.9	31.4	32.3	
	Secondary school (9-12)	Frequency	6	6	29	41	
		%	3.8	8.5	18.6	10.7	
	Diploma holder	Frequency	0	0	3	3	
		%	0.0	0.0	1.9	0.8	
	BSc degree holder	Frequency	0	0	1	1	
		%	0.0	0.0	0.6	0.3	
Total		Frequency	157	71	156	384	
		%	100.0	100.0	100.0	100.0	

Source: survey data, 2016

4.2.5. Livestock ownership

In Bale Eco Region, livestock holding is an important indicator of household's wealth position. Livestock serves as an important source of cash. In the study area, farmers undertake mixed farming where livestock rearing is one of the important activities. As it is confirmed in many studies farmers who have better livestock ownership status are likely to participate in different income generating activities; because, livestock can provide cash through sales of products which enables farmers to decide to diversify their income source. To indicate the livestock holding of each household in terms of total livestock unit (TLU), the TLU per household was calculated. The result of the survey indicates that livestock holding of the sample ranges from 0 to 10 TLU implying the existence of variation among the households in livestock .From the total Households interviewed 40.4% of them reported that they possessed an average of 2 TLU. When the result is disaggregated across the agro ecologies, the largest amount of livestock ownership goes to lowland (50.9%), Midland (21.1%) and Highland (40%) respectively. However, no systematic association between livestock holding and agro ecology was found.

Table 5: Average Livestock Holding of Households (in TLU)

TLU	Agro ecologies								Chi-square test P-value
	Lowland (n= 157)		Midland (n=71)		Highland (n=156)		Total		
	N	%	N	%	N	%	N	%	33.305***
<1	40	25.5	45	63.4	57	36.5	142	37	
1-3	80	50.9	15	21.1	63	40.4	158	41.2	
3.01-5	25	15.9	8	11.2	21	13.5	53	13.9	
>5	12	7.7	3	4.3	15	9.6	30	7.9	

Source: survey data, 2016

4.2.6 Land ownership of the Household

Land ownership is expected to be closely linked to agricultural production, including both crop and livestock production. It is an asset that is not fungible across a range of activities and has a direct value only in agricultural production, although it can be used for different agricultural activities. It may have an indirect value in other economic activities, however, as collateral for credit and thus is potentially linked to these activities. Farm size or land holding is perhaps the single most important resource as it is a base for any economic activities especially in rural and agricultural sector. Farm size influences households' decision to participate or not to participate in different livelihood diversification activities. The survey result shows that land holding varies from <1ha.Up to >7ha. Majority of the households (39.3%) in the study districts posses less than 1hectare of land whereas a very few (6.2%) number of household possesses more than 7 hectare of land indicating that a skewed distribution of land in Bale Eco Region.

Table 6: Distribution of Household by Their Land Size

Land Size (hectar)	Agro-ecologies								
	Lowland (n=157)		Midland (n=71)		Highland (156)		Total		Chi-square test P-value
	N	%	N	%	N	%	N	%	
<1	79	50.3	19	26.7	53	34	151	39.3	34.789***
1-3	42	26.7	16	22.5	62	39.7	120	31.2	
3.01-5	15	9.6	20	28.3	21	13.5	56	14.6	
5.01-7	11	7	7	9.8	15	9.6	33	8.6	
>7	10	6.4	9	12.7	5	3.2	24	6.2	
Total	157	100	71	100	156	100	384	100	

Source: survey data, 2016

4.2.7. Credit access and utilization of household head in BER

The most commonly reported obstacle to investment and entrepreneurship is inadequate access to capital (Davis, 2003). The availability of agricultural credit to land poor farmers who have little or no capital or savings to invest in other income earning activities is important component to start a small business to improve the living condition.

Access to credit for non-agricultural purposes can relax farmers financial constraints and expected to make farm households willing to participate in different income generating activities other than resource based livelihood activities. In this study the rural households were asked whether they access credit service or not from their surrounding area to expose themselves for various portfolios of income generating activities. Majority of the household (59%) in the three districts of Bale Eco Region reveal that they access credit service from locally available micro-credit and saving institution. Regard to the amount of money the household borrowed from microfinance institution, it was found that among the total sampled respondents, 34.5% households were utilized less than 1000 Birr credit for various purposes whereas only 12.7% of the household were received more than 2000 birr from microfinance institution. When the amount of credit received by agro ecologies are disaggregate, it was found that 43.9%, 25.7% and 26% of the Household from Lowland, Midland and Highland agro ecologies respectively was borrowed less than 1000 ET. Birr whereas 3.5%, 17.1% and 9.8% from Lowland, Midland and Highland agro ecologies were received more than 2,000 birr for various purposes.

Table 7: Distribution of Households by Their Access and Amount of Credit Used

Credit use	Agro ecologies							
	Lowland (157)		Midland (71)		Highland (156)		Total	
	N	%	N	%	N	%	N	%
Yes	82	52.2	35	49.3	92	59.0	209	54.4
No	75	47.8	36	50.7	64	41.0	175	45.6
Total								100
Amount used								
<1000	36	43.9	9	25.7	24	26.0	69	33.0
1000-1500	21	25.6	11	31.5	41	44.6	73	35.0
1501-2000	14	17.0	9	25.7	18	19.6	41	19.6
>2001	11	13.5	6	17.1	9	9.8	26	12.4
Total	82	100	35	100	92	100	209	100

4.2. Major Livelihood strategies of the Household

Livelihood strategies refer to the range and combination of activities that people undertake in order to achieve their livelihood objectives. Strategies are thought to be influenced by people's vulnerability context, the extent of their livelihood assets and the nature of the transforming structures and processes (DFID, 2000). The study identified only two major livelihood strategies

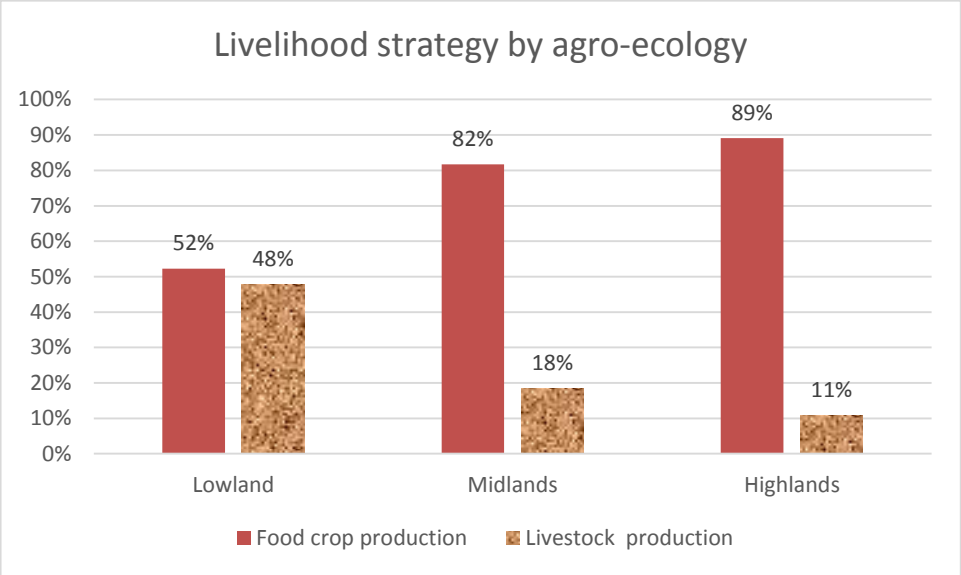

Figure 4: Major livelihood strategies pursued by rural household

Pursued by the households across the three agro ecological zone of BER namely Food crop Production and animal husbandry. As it is depicted in figure 4, food crop production based livelihood strategies were largely undertaken in the highland part of Bale Eco region (89 %) whereas Livestock production based livelihoods were dominated by farm households in Lowland areas (48%). This finding was in line with the study conducted by (Muzeyin, 2009) at Harena Buluke Districts and confirmed that among the sampled households in the district crop production and Livestock production activities were ranked as 1st (49.1%), 2nd.(38.7%) main sources of livelihood activities respectively. Also the Study conducted on Contribution of dry forests to rural livelihoods and the national economy in Zambia ranked livelihood activities in the order of importance as farming (91.4%), followed by livestock (32.9%). In addition to these the statistical test revealed that a major livelihood strategy across the three agro ecologies of BER

was found to be highly significant at 5% percent significance level. This indicates that the policy makers should not similarly treat crop and livestock production across the agro ecologies

4.3. Supplementary livelihood strategies perused by rural household head in BER

Across the three agro ecologies of the study area, in addition to the major livelihood strategies supplementary income sources were identified. These are livelihood strategies like Field crop production, livestock production, beekeeping, horticultural crop production, non timber forest product and petty trading (Figure 5).

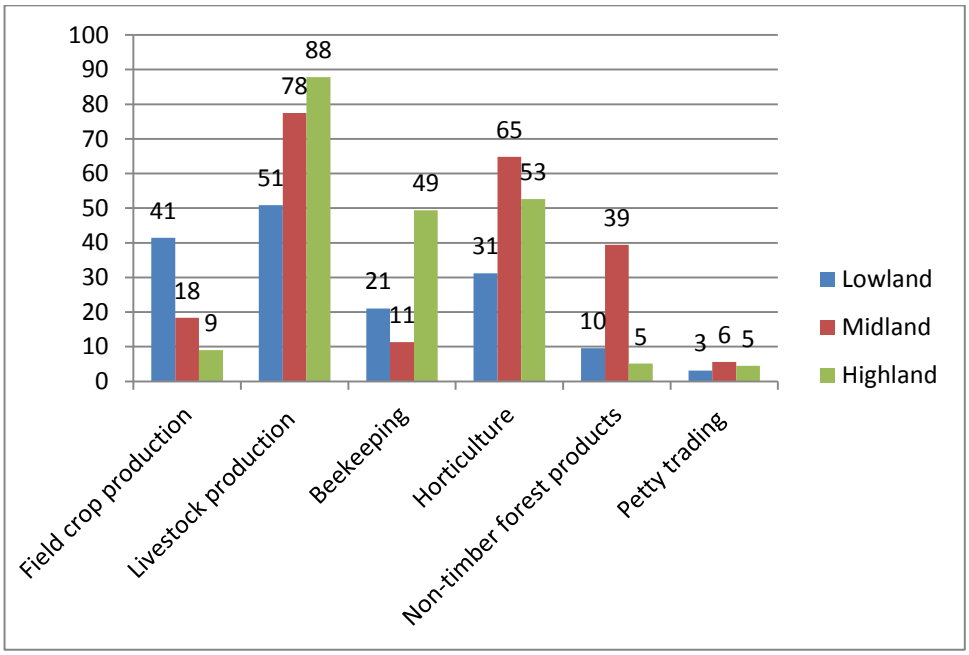

Figure 5: Supplementary livelihood strategies pursued by the rural Household in BER

Source: survey, 2016

During the data collection process the Households were requested to select their major and supplementary income sources. In this regard, the Household were selected one major livelihood activity and other supplementary livelihood options that best fits with their current situation. Accordingly, the above table (figure 5) clearly put forwards the additional livelihood strategy pursued by the rural households in three agro ecologies of Bale Eco Region. The result of the study indicated that among the total respondents from the three agro ecologies of Bale Eco Regions 24%, 70.8%, 30.7%, 46.1%,12.5% and 4.2%, of the household were engaged

additionally in Field crop production, Livestock production, Beekeeping , Horticultural crop production, Non Timber Forest Products and petty trading respectively.

when the above figure 5 is explained separately by agro ecology, the large proportion of the households (70.8%) in the highland parts of bale zone were engaged in livestock production as well as (50.9%) from Lowland were engaged in Livestock production as a supplementary income sources in addition to their major livelihood strategy (crop production).The high percentage of livestock production both in Lowland and highland agro-ecologies as a supplementary livelihood strategies were supported by the study conducted by (Bedru *eta al,* 2008) in Tigray Region. They concluded that livestock production appears to be economically superior in terms of income gain. However, care need to be taken in expanding livestock production, to prevent damage to the already fragile environment. Therefore, targeted livestock extension programmes and quality- and productivity-based production technologies should be disseminated in order to make livestock production environmentally compatible. Households in the study area were combined a number of livelihood strategies which is consistent with literature on rural livelihoods that reports diversification as being predominant (Ellis, 2000, Mamo *et al*., 2007), as no single livelihood strategy is sufficient for households (Sunderlin *et al.*, 2005).

Beekeeping, Horticulture, Non- timber forest product and petty trading account about 30.7%, 46.1%, 12.5%, and 4.2% of the total livelihood strategies of the household. The result of NTFP which covers 35% of the total income of Harena Buluke households was found to be inconsistent with the result obtained by (Muzeyine, 2009). However, when the obtained result compared with agro ecologies, the current study would be consistent with the study conducted by Muzeyine because, the share of non timber product in midland was found to be 39.4% which is almost similar with Muzeyin's finding. The dominant Non Timber forest product in the study includes fire wood, honey bee production, charcoal and Forest Coffee. According to the discussion made with the district level experts and the community and the data obtained from questionnaire survey, Livestock production was identified as the largest supplementary livelihood strategy pursued by the households in all agro ecologies of Bale Eco Region.

4.4. Impact of Livelihood strategies on Natural resource base of Rural HH in BER

4.4.1. Negative Impact of Livelihood strategies on Natural resource base of Rural HH in BER

The livelihood strategy pursued by the rural household could affect the natural resource bases either positively or negatively. In this section the negative impact of diverse livelihood strategies indicate in Table 5. The rural households in the study area were requested to provide their level of agreement regarding the negative effect of different portfolios of livelihood activities on natural resource bases. The identified negative Impacts of livelihood strategies include Soil erosion, deforestation, drying up of streams, loss of plant and animal species, land degradation, decrease coffee productivity, decrease forage availability, increase crop and livestock damage by wild animals and Limits the expansion of grazing and agricultural crop. The negative impacts of different livelihood strategies on the natural recourses of BER are explained by the respondents and group discussion participants in extensive way. However, forth sake of deep understanding of the concept only few of them is discussed in depth.

Table 8: Negative Impact of Livelihood Strategies on Natural Resources in BER

Negative impact of livelihood strategies on natural resource	Response of Rural HH	Agro-ecology						Total		Chi-square P-value
		Lowland		Midland		Highland				
		N	%	N	%	N	%	N	%	113.22***
Fragmentation of wildlife habitat	Strongly Agree	87	84.5	0	0	16	15.5	103	100	
	Agree	70	24.9	71	25.3	140	49.8	281	100	
Soil erosion	Strongly Agree	92	82.1	4	3.6	16	14.3	112	100	
	agree	65	27	67	27.8	109	45.2	241	100	148.51***
	Strongly disagree	0	0	0	0	31	100	31	100	
Deforestation	Strongly Agree	31	100	0	0	0	0	31	100	92.83***
	Agree	126	39.1	71	22	125	38.8	322	100	
	Strongly disagree	0	0	0	0	31	100	31	100	
Drying up of streams	Strongly Agree	31	100	0	0	0	0	31	100	
	Agree	126	39.1	71	22	125	38.8	322	100	92.83***
	strongly Disagree	0	0	0	0	31	100	31	100	
Loss of plant and animal species	strongly agree	56	77.8	0	0	16	22.2	72	100	
	Agree	101	32.4	71	22.8	140	44.9	312	100	53.27***
Decrease forage availability	Strongly agree	14	100	0	0	0	0	14	100	21***
	Agree	143	38.6	71	19.2	156	42.2	370	100	
Land degradation	Strongly agree	56	100	0	0	0	0	56	100	
	agree	101	34.8	71	24.5	118	40.7	290	100	144.74***

	Strongly disagree	0	0	0	0	38	100	38	100	
Decrease coffee productivity	Agree	1	11.1	8	88.9	0	0	9	100	338.42***
	Dis agree	0	0	1	0.7	138	99.3	139	100	
	Strongly disagree	152	65.5	62	26.7	18	7.8	232	100	
	I don't know	4	100	0	0	0	0	4	100	
increase crop and livestock damage by wild animals	Strongly agree	19	19.8	29	30.2	48	50	96	100	26.206***
	Agree	138	47.9	42	14.6	108	37.5	288	100	
Limits the expansion of grazing and agricultural crop	Strongly agree	0	0	12	52.2	11	47.8	23	100	48.87***
	Agree	157	44.1	54	15.2	145	40.7	356	100	
	Dis agree	0	0	5	100	0	0	5	100	

Source: Own survey, 2016

4.4.1. 1. Fragmentation of wildlife habitat

According to (USDA, anonymous) Fragmentation is the breaking up of large patches of native vegetation into smaller and increasingly isolated patches, driven by an exploding human population and growing demand to produce more food and fiber from a finite land resource. The contemporary rural landscape is the result of the cumulative impacts of past and present human land use practices including urbanization, agriculture, ranching, and logging .In this study, from the group discussion it was explained that, habitat fragmentation is the most serious threat to biological diversity and is the primary cause of the present extinction crisis in different forest belts of Bale Eco Regions. Also the participants of the group discussion explained that many fields are enlarged at the expense of windbreaks, fence rows and other valuable wildlife habitat. Several areas in the study Districts have lost their windbreaks due to the declining health of windbreak trees and expanding field size particularly this was emphasized in Lowland areas of Bale Eco-regions.

The resultant loss of habitat diversity in agricultural landscapes has adversely impacted wildlife populations. Habitat losses will permanently displace many species and dramatically depress the population levels of others. It forces remaining species into the few remnant patches available, increasing competition, crowding, stress, and the potential for disease outbreaks. This study also revealed that majority (84.5%) of the households from Lowland strongly agreed whereas 49.8% from Highland and 23.5% from midland were agreed respectively on the negative impacts of livelihood strategies on natural resources respectively. statistically it was tested across the agro ecologies and resulted in a strong significant relationship between livelihood strategies pursued by the household and the agro ecologies at 5% significance level.

Figure 6: During focus group discussion in Adaba (in the left) and Dello Mena (in the right) Districts (Photo taken by Elsabet Takele, 2016)

4.4.1.2 Soil erosion

The loss of soil from land surfaces by erosion is widespread and reduces the productivity of all natural ecosystems as well as agricultural, forest, and pasture ecosystems (Troeh *et al.*, 2004*)*. The study conducted by (Pimentel and Burgess, 2013) revealed that loss of vegetative soil cover is widespread in developing countries where populations are large and growing, and agricultural practices are often inadequate to protect topsoil. In addition, cooking and heating in these countries frequently depend on the use of crop residues for fuel than on their crop land (Wen, 1993). Soil erosion potential is increased if the soil has no or very little vegetative cover of plants and/or crop residues. Plant and residue cover protects the soil from raindrop impact and splash, tends to slow down the movement of surface runoff and allows excess surface water to infiltrate. crops which provide a food, protective cover for a major portion of the year (for example, alfalfa) can reduce erosion much more than can crops which leave the soil bare for a longer period of time (e.g. row crops) and particularly during periods of high erosive rainfall (spring and summer). In the study districts it was found that the livelihood mechanism they pursued significantly contribute for soil erosion. Result obtained from questionnaire survey, focus group discussion and key informants suggested that erosion occurs when farming practices are not compatible with the fact that soil can be washed away or blown away. These practices are identified by the community as Overstocking and overgrazing, inappropriate farming techniques such as deep ploughing land 3 or 4 times a year to produce annual crops and lack of crop

Figure 7: Soil erosion in Barbare district (Photo taken by Tilahun Gemechu, 2016)

rotation, planting crops down the contour instead of along it. When the people asked about whether they agree or not on the negative impact of the livelihood strategies on natural resources like land, almost all respondents accept only a few (31) 8.0% from the highland agro ecologies agreed on the impact of livelihood strategies on the natural resource bases. The chi square test also reveals that there is significant difference in the response of the household across the three agro ecologies regarding the negative impact of livelihood strategies on soil erosion.

4.4.1.3 Loss of plant and animal Biodiversity

Variety of species and their habitats - plays an important role in ecosystem function and in the many services ecosystems provide. These include nutrient and water cycling, soil formation and retention, resistance against invasive species, plant pollination, climate regulation, and pest and pollution control. In the study districts of BER the escalating biodiversity loss has widespread implications for both human and environmental security. Threats vary both within and between species groups. Although habitat destruction is universally the most dominant threat, over-exploitation (harvesting, trade etc.) is a major threat to the threatened species.

In BER the threatened species like Nyala frequently require a combination of conservation responses to save them. These responses encompass research, species-specific actions, site and habitat based interventions, policy responses and communication and education. It is much more effective and economical to protect habitat in the first place than to try to restore it after it has been destroyed or to reintroduce a species. Evidence to date in the study districts of the three agro ecologies suggests that deforestation for securing livelihood is currently, and is projected to

continue to be, the prime direct and indirect cause of extrication. For example the study conducted by (Navjot *et al*, 2002) was predicted that up to 21% of Southeast Asian forest species will be lost by 2100 because of past and ongoing deforestation. Similar projections exist in other regions. The ecosystem and biological community changes precipitated by invasive species represent another leading cause of biodiversity loss. Of 170 extinct species for which causes have been identified reliably, invasive species contributed directly to the demise of 91 (54%)

4.4.1.4. Increase crop and livestock damage by wild animals

Wildlife crop damage has negative impacts on rural food and livelihood security, resulting from shortages of nutritional supplements and inadequate food reserves. Consequently, crop loses form negative perceptions in local farmers about invading wildlife species, which lead to retaliatory killings of wildlife. Farmers‟ perceptions are, therefore, a critical social dimensional component of human-wildlife conflicts (Hill, 1998). Poor land use practices by local farmers coupled with antagonistic objectives between conservation and agriculture were among underlying causes of intractable crop raiding in Bale Eco Regions. Conservation objectives included protection of wildlife and its habitats while local farmers‟ needs and aspirations in agriculture were to expand crop production, even in wildlife habitats (Nyirenda *et al.*, 2011).

4.4.2. Positive impact of livelihood strategies on natural resource

The livelihood strategy pursued by the household in Bale Eco Region could positively or negatively affect the natural resource bases which might be the major pillars for the survival of the people. The negative effect of livelihood strategy on natural resources has been thoroughly presented in (Table 9). In this section the positive impact of livelihood strategies on natural resource will be briefly discussed. As did in the previous discussion on the negative impact of the livelihood strategy only few and major positive impacts of livelihood strategies like improvement of forest coverage, decrease employment rate , increase wild bee colony and increase access to wood and wood products and limit the expansion of grazing and agricultural crop will be separately discussed briefly .

Table 9: Positive Impact of Livelihood Strategies on Natural Resources in BER

	Response of Rural HH	Agro-ecology						Total		Chi-square P-value
		Lowland		Midland		Highland				
		N	%	N	%	N	%	N	%	
Improves forest coverage	Agree	0	0	0	0	52	100	52	100	145.62***
	Strongly disagree	114	39.4	71	24.6	104	36	289	100	
	I don't know	43	100	0	0	0	0	43	100	
Decrease unemployment rate	Agree	145	51.2	32	11.3	106	37.5	283	100	116.28***
	Dis agree	12	24	30	60	8	16	50	100	
	Strongly dis agree	0	0	9	0	42	100	51	100	
Regular rainfall distribution and amount	Disagree	0	0	0	0	42	100	42	100	116.58***
	Strongly dis agree	122	39.7	71	23.1	114	37.1	307	100	
	I don't know	35	100	0	0	0	0	35	100	
Increase access to wood and non-wood products	Strongly agree	20	100	0	0	0	0	20	100	107.43***
	Agree	137	43.6	63	20.1	114	36.3	314	100	
	Strongly dis agree	0	0	8	16	42	84	50	100	
Increase wild bee colony	Agree	0	0	0	0	31	100	31	100	63.44***
	Disagree	0	0	0	0	8	100	8	100	
	Strongly dis agree	157	45.5	71	20.6	117	33.9	345	100	
Improves soil fertility	Strongly agree	10	100	0	0	0	0	10	100	116.55***
	Agree	0	0	8	10	72	90	80	100	
	Strongly dis agree	147	50	63	21.4	84	28.6	294	100	

Source: survey data, 2016

4.4.2.1. Improve forest coverage

It has been mentioned previously in the livelihood strategies pursued by people in Bale Eco regions that the household participates in diverse portfolios of livelihood diversifications. They tend to choose one or more strategies on the bases of resource endowment like natural, financial, social and physical resources. There might be a number of entry barriers that hinder the household from participating in luxurious livelihood strategies. Nonetheless the household must select a livelihood strategy which could undoubtedly increase their level of satisfaction and

income. If the household selects the natural resource based livelihood strategy, the probability of conserving and protecting the forest resource will be very minimal.

However, non-natural resource livelihood strategies enable the forest resources to be preserved and protected by the local community, as it is indicated in the group discussion. On the other way round the participants of group discussion suggested that engaging in off-farm and non -farm activities which did not require much resources would facilitate the emergency of protected forest area in tern it improves the forest coverage. The study further investigated the issues under discussion and come up with concrete result. However, the dearth of information/empirical regarding the topic under discussion limits the researcher for further discussion. Rural households in Bale Eco Regions were asked to indicate their level of agreement regarding the positive impact of Livelihood strategies on natural resource bases. Among the agreed households across the agro ecologies, only households from the highland part of the region expressed their agreement whereas the majority (39.4%) of the house hold in the lowland area of BER followed by 36.2% and 24.6 from midland and highland respectively expressed their higher level disagreement regarding the positive impact of livelihood strategies on the natural resource base. The statistical test also revealed that there is a significant association between the responses of the Households across the three agro ecologies at 1% significance level.

4.4.2.2. Decrease unemployment rate

The diverse portfolios of livelihood activities are believed to create job opportunity for a large segment of the people especially for youths. Households who engaged in agricultural land cultivation, livestock production and beekeeping are more likely to create job opportunity for the local community. During group discussion with different groups of individual including youth, women and elderly people, they practically elaborated how a diverse livelihood strategy reduces the employment rate. If the rural households chooses livestock production as their livelihood strategies and want to run livestock fattening program. Individuals who are responsible for the day to day operation of the farm must be hired if maximum profit is sought from the enterprise. The number of individuals hired in the firm depends on the capacity of the owner and the size of the enterprise. Apart from the group discussion the respondents were asked to portray their attitude regarding the positive aspect of livelihood diversification in decreasing employment rate within their vicinity. Majority of the households in lowland (51.2%), midland (11.3) and highland

(37.5%)agreed that the livelihood strategies has a positive impact in decreasing unemployment rate whereas in Lowland (24%), in midland (60%) and in highland (16%) of the household reported that they agreed on the positive impact of livelihood strategies and its relationship with unemployment reduction. The chi-square result revealed that there is a significant difference in the response of the household across the three agro ecological zones at 1% significance level.

4.4.2.3. Increase access to wood and non- wood products

Forests provide a range of wood and non-wood products, as well as social and environmental services, such as the conservation of soil, water and biological diversity. Wood and wood products as the main commercial products of forests include fuel wood and charcoal. Trees, forests and woodlands provide materials for housing, roofing, and lighting. They provide fuel wood which is essential for cooking, as well as drying and heating. Poor households often rely upon tree and forest products such as wild food plants, leaves and roots, to complement their diets.

4.4.2.4. Increase wild bee colony

Pollination services from wild insects contribute to crop productivity but are at risk of decline in agricultural landscapes. Monoculture plantings of crops lack floral diversity and can limit the provision of resources for pollinators throughout the season. Compared with more diverse landscapes, the lack of resources in intensively managed agricultural landscapes can reduce insect pollinator diversity (O'Toole 1993) and potentially decrease wild bee contributions to crop pollination (Potts et al. 2010). Plants that are dependent on bees for pollination can benefit from the proximity of floral resources at the field scale and from greater resources for bees at landscape scales. Larger flower plantings can support greater bee density and diversity plus improved wildflower pollination (B.R. Blaauw and R. Isaacs, unpublished), and higher proportions of natural area within landscapes are associated with improved crop pollination (Dudenh€offer and Tscharntke 2012). All the above mentioned explanation about floral increment to attract a large colony of bees were discussed largely and come to common consensus that livelihood strategies like horticultural crop production especially flower farming attracts a large colony of wild bee.

In addition to the above facts and discussions, the attitudes of the household were examined with regard to the positive impact of livelihood strategies on the increment of wild bee colony. Despite various literatures believes on the increment of wild bee colony when the household fully engaged in horticultural crop production, majority of the household were found to oppose its relationship with livelihood strategies. This might be due to the household's observation in the substantial reduction of bee colonies as a result of chemical application in areas where honey bees resides.

4.6. Levels of dependence on natural resources among rural Communities at BER

4.6.1. Household Livelihoods dependency on land and water in BER

Across BER, the fate of the rural poor is closely tied to the land and water resources they rely on for food, water and economic security. The rural poor remain dependent on the benefits provided by ecosystems. Land and water resources are the foundation for the agricultural production, fisheries and aquaculture that provide nutrition and income. These resources also support the production of livestock and forest products that provide food, fuel, and fodder and building materials crucial for the livelihoods of impoverished families. At the same time, these ecosystems provide critical services to a wider rural and urban population, including surface and groundwater restoration, regulation of flooding and maintenance of biological diversity, among others.

According to (Agarwal, 2002), land has inherent value, and it creates value. A plot of land can provide a household with physical, financial, and nutritional security, and provide a laborer with a source of wages. Land is a basis for identity and status within a family and community. Land can also be the foundation for political power. Land for Ethiopians in general and BER in particular remains their single most important asset, the majority of BER households largely depend on land-based activities especially agriculture related activities for their livelihoods.

Rural households in the study districts are highly dependent on Land resource. The households were requested to identify their level of dependency on natural resources. Among the total respondents filled out the questionnaire 91.7 % from lowland 97.2% from mid land and 100% from the highland believed that they are highly dependent on land resource for their livelihood whereas 8.3% people from Lowland, 2.8% from midland and nil from highland suggested that their dependency on land is rare. This indicates these household might have alternative livelihood

Table 10: Dependency of livelihood strategies on natural resources in BER

Natural resource	Extent of dependency	Agro-ecology						Total		Chi-square P-value
		Lowland		Midland		Highland				
		N	%	N	%	N	%	N	%	
Land	Highly	144	91.7	69	97.2	157	100	369	96.1	
	Rarely	13	8.3	2	2.8	0	0	15	3.9	14.568***
Water	Highly	157	100.0	71	100.0	142	91	370	96.4	
	Rarely	0	0.0	0	0.0	14	9.0	14	3.6	21.236***
Forest	Highly	157	100.0	67	94.4	134	85.4	358	92.2	
	Rarely	0	0.0	4	5.6	22	14.1	26	6.8	24.832***
Soil	Highly	153	97.5	71	100.0	155	98.7	298	77.6	
	Rarely	4	2.5	0	0.0	2	1.3	6	1.6	2.198NS
Total		**157**	**100**	**71**	**100**	**156**	**100**	**384**	**100**	

Source: Own survey, 2016

Options other than land resource based livelihood strategies. The chi square test revealed that there is a significant difference among the responses given by the households across Lowlands, Midlands and highlands at 1% significance level. In addition to the Land dependency, the households were requested to portray their level of dependency on water resources as it is indicated in the table 12. Among the total respondents 100% from lowland and mid land and 91% from the highland confirmed that they are highly dependent on water resource for the attainment of their livelihood whereas a very few individuals (3.6%) suggested that their dependency on water was rare. A chi square test were conducted and revealed that there exists a significant difference between the responses of the household across the three agro ecologies at 1% significance level.

4.6.2. Household Livelihoods dependency on Soil in BER

Since majority of the household in BER are leading their livelihood in agricultural activities, they must be dependent on soil in one or another way. It is obvious that soil is a medium for agricultural crop production and nothing would be possible without its existence. Majority of the households, regardless of the agro ecologies believes that they are dependent on natural soil. However, the statistical test confirmed that the responses of the households across the three agro ecologies are insignificant. It means that we are not confident enough to conclude that the levels of dependency on soil across the study districts (BER) are different. But this does not mean that the rural households across the study districts are dependent on the aforementioned resource. But precisely it means that Households who resides in each agro ecologies have equal level of

dependency on soil resource. Therefore, during any intervention by the government or development partners to benefit the rural household in terms of fertility enhancement or natural resource rehabilitation program, there should not be any differential treatment for all districts in BER.

4.6.3. Household Livelihoods dependency on forest BER

Trees, forests and woodlands provide materials for housing, roofing, and lighting. They provide fuel wood which is essential for cooking, as well as drying and heating. Poor households often rely upon tree and forest products such as wild food plants, leaves and roots, to complement their diets. In addition forests and trees provide fiber, timber and fodder which can be used to generate income and develop alternative sources of livelihood, such as handicrafts, furniture making and bee keeping. Cognizant of the fact, this study uncovered that the majority of the Households from the lowlands (100%), midlands (94.4%) and highlands (85.4%) agreed being highly dependent on forests for their livelihood. This finding was found to be in agreement with the result of (MUZAYEN, 2009) which states that 77.1% of the respondents in Harena Buluke districts emphasized the importance of forest to their livelihood as a source of income in terms of cash and household subsistence. The statistical test confirms that the responses of the households regarding their dependency on forest resource in the three agro ecologies were found to be highly significant at 1% significance level.

Figure 8: Interdependency of livelihood strategies and natural resource in BER

Source: Own survey, 2016

5. CONCLUSIONS AND RECOMMENDATIONS

5.1. Conclusion

Understanding natural resources and its dependency in rural households' livelihoods is an on-going debate. However, information on the quality of natural resource is still considered difficult and costly to obtain. For instance, in the context of Vietnam, the dependency of natural resources on livelihood strategies has been investigated at the national level. At the household level, information on the impact of natural resources availability on the livelihoods of rural households is limited.

To formulate effective poverty-related policies, information about what livelihood strategy a household pursues and why he/she chooses to pursue that strategy is very important. This information is not only crucial for policy makers to evaluate which strategies and policies they should aim for but it is also invaluable for understanding why some households could not get out of poverty even though they chose optimal strategies. Therefore, this study aimed to understand the household dependency on natural resource across three agro ecologies and examine who engage in different livelihood strategies. This study also investigated the negative and positive impacts of livelihood strategies on natural resource bases.

Individual characteristics: Rural household heads have some distinct individual characteristics, compared to female headed households. The majorities of them are male and are in the productive working age group of 31-46 years. Their educational level is generally low with a high proportion of household heads that leave school after completing their secondary education without having attained professional education. The variation in individual characteristics is seen across the agro-ecologies. It can therefore be concluded that gender and educational gaps still remain in the rural areas of BER. Households in rural areas of BER are more likely to have higher numbers of household members and children compared to national averages. Therefore, they are more likely to be under financial pressure to maintain basic household needs.

Agricultural activities and extraction of common property resources: Crop production remains the most important agricultural activity, complemented by livestock production in rural communities. Most of the crop products are used only for household consumption, while the level

of commercialization is higher for livestock and forest products. Unsurprisingly, better-off households have higher levels of commercialization of their agricultural products.

Livelihood strategy analysis: In this study six livelihood strategies were identified; namely, sole crop production sole livestock production, beekeeping, horticultural crop production non timber forest product and petty trading. The livelihood strategy pursued by the households across different agro ecologies vary based on their natural settlement and resource availability. The study brought one important conclusion that both crop and livestock productions are more important in low land areas than the rest of agro ecologies. Households engaging in various livelihood strategies differ in their asset endowments. Households engaging in the natural resource dependent strategy are more likely to be abundant in labor, land and physical capital. However, more remunerative livelihood strategies, such as the mixed-income and beekeeping are more likely to be endowed with financial and social assets.

Impact of livelihood strategy on natural resource: the households in the three agro ecologies of BER were identified and expressed their level of agreement on the impact of Livelihood strategies on natural resource bases. In addition to this the households differentiated the positive and negative impacts of livelihood strategies on natural resources. The mostly reported negative impacts are fragmentation of wildlife habitat, soil erosion, deforestation, loss of plant and animal species, decrease forage availability and increase crop and livestock damage by wild animals whereas the positive impact includes enhance diversity of forest and plant species, improves forest coverage, increase bee forage availability, increase wild bee colony and increase access to wood and non-wood products. All positive and negative states regarding the livelihood strategies and natural resource bases of the household were found to be statistically significant at 1% significance level except soil. Therefore, it is possible to conclude that all interventions for the betterment of the household should not be equally geared towards lowland, midland and highland areas of BER because it was found that households exposure across the three agro- ecologies for various natural resources were different.

Interdependency of natural resource and livelihood strategy: The study identified four important natural resources, namely forest, water, soil and land. Since land and water in the BER remains their most important asset, the majority of households largely depend on land-based

livelihood diversification activities especially agriculture related activities for their livelihoods. Therefore, it is possible to conclude that land and water are much more important than any other natural resources in BER despite cannot compromise actual benefit of other resources for the livelihood of the people.

5.2. Recommendation

Large family sizes may help households with labor demands in agricultural activities. However, as household size increases, the agricultural land may not satisfy the demand from large household sizes, making it difficult for these households to maintain food security as well as good health and education for their families. However, due to their low educational levels, they usually end up the in low-paid employment sectors. Therefore, programs to encourage public awareness of family planning, as well as the effects of population growth are recommended.

The positive influence of education on the probability of households' engaging in high-return activities became clear in this study. The majority of household heads in rural areas of BER have completed primary (32.3%) or secondary school (10.7%) and very few of them (1.1%) obtained a professional education. Meanwhile, activities that are more remunerative normally require higher education. For that reason, there is a priority to promote professional education in rural areas (i.e. short and long-term vocational schools, professional high schools, and colleges/universities) to enhance the quality of education at all levels.

Beekeeping and horticulture provide supplementary source of income for most households and are considered the two most lucrative livelihood strategies. However, they are also the most cost-intensive activities among the six strategies identified in this study. Credit accessibility can influence the decision of households to get involved in these activities. In relaxing credit constraints in rural areas, the government should consider a proper credit allocation regime to reduce the transaction costs as well as support target households with adequate credit loans.

Since forest is degrading and its area is reducing with time in the BER, the participation of the general public in tree planting and conservation of the natural forest is very important in order to achieve the goals set under sustainable forest conservation programs of the government. This

participation can be done through a participatory process where farmers and local people are involved in planning, design and implementation of the management plan. This in general it is the role of government and NGOs.

One of the overall goals of SHARE BER project is to enhance drought resilience, food and nutrition security of vulnerable populations in Southern and Eastern Ethiopia, through achieving the project's specific objectives such as improving biodiversity conservation and ecosystems functions and services. To do this, it should take into consideration an eco-regional approach that addresses natural resources degradation at scale by considering the interdependence and interaction between livelihood strategies and natural resources. Cognizant of the above fact, SHARE BER project should take its own stake in reducing the pressure on natural resources via facilitating and supporting alternative income generating activities and launching alternative livelihood diversification schemes across different agro-ecologies of BER.

In a nutshell, the researcher suggests a shift from a traditionally- preferred 'cereal crop-livestock mix' dominated livelihood strategy to more specialized or diversified cash income-based strategies, such as off-farm business, honey production, poultry, and horticulture. As it is clearly depicted in (table 10), 100% from lowland, 94.4% from midland and 85.4% of the household from highlands primarily depend on forests. This indicates that the pressure on forests was found to be very intense compared to other natural resources. Therefore, it is believed that a shift in livelihood strategy will ultimately result in outcomes that are compatible with both economic and environmental objectives of the area (Bale Eco region).

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7. APPENDIX

7.1. Woreda Household questionnaire for local people in Bale Eco-Region

This interview schedule is prepared to collect data from villages, for the purpose of studying Interdependency of Livelihood Strategies and Natural Resource in Bale Eco-Region, South East Ethiopia.

Introduction: The aim of this studying is only for academic purpose (for partial fulfillment of master's degree). Therefore, I will keep this information confidently and will not be transferred to the third parties without prior consent of you.

Thank you for your cooperation!

PART I General Information

Region_____ zone_____ Name of the district: _____ village/sub village: _____

Number of the respondent/code/----------date of the interview----------

Demographic characteristics of respondents

1	Sex	Male	0
		Female	1
2	Age	----------	-----
3	Religion	Muslim	1
		Orthodox	2
		Protestant	3
		Wakefeta	4
		Others	5
4	Marital status	Single	1
		Married	2
		Divorce	3
		Others	4
5	Family size	Male	----
		female	-----
	level of education	Non educated	0
		Informal education	1
		Primary school (1-8)	2
		Secondary school (9-12)	3
		Collage or diploma holder	4
		University or 1st degree holder	5
	Educated family member	Male	1
		Female	2

	Non educated family member	Male	1
		Female	2
5	Occupation	Government employment	1
		Farmer	2
		Pastoralist	3
		Student	4
		Unemployment	5
		Others	6

2. Land size

2.1 Do you own land? 1= Yes; 0=No

If yes how much is it in Hectare ---------- (total land size)

If you use your land for cultivation purposes fill the following

Plot no	**Size**	**Ownership**	**Means of acquisitions**	**Years acquired**	**Crops grown**

4. Livestock Ownership

4.1. Do you own domestic animals? ..... 1= Yes; 0=No. If 'yes': Go to form:

4.2. Animal form

Types of livestock	**No. owned in the last 12**	**Months**	**Use Reason for sale**
Chicken			
Goat			
Sheep			
Donkey			
Cattle			
Mule			
Horse			
Cow			
Ox			
Other			

5. Credit use

5.1 Do you face problem of working capital? Yes=1, No =0

5.2 Have you received any type of credit in 2004? 1= Yes; 0=No

5.3 If yes fill the following table

Source borrowed	Purpose borrowed	Amount borrowed	Interest paid	Amount paid

6. Of the following alternative which are your family`s livelihood mechanisms? Make tick √ mark

Sr. No	Types of livelihood strategies	Major livelihood	Additional livelihood	Others
1	Field Crop production			
2	Animal husbandry			
3	Horticultural crop production			
4	Beekeeping			
5	Non-timber forest product harvesting and selling			
6	Small scale trading			
7	Employment			
8	Others (specify)			

7. Indicate your consensus by making tick mark on factors limiting you to diversify your livelihood mechanisms. Make tick√ mark

Livelihood mechanisms	**Land scarcity**	**Shortage of labor**	**wildlife damage**	**Lack of knowledge and skill**	**Drought**	**flooding**	**Land degradation**	**Shrinkage gazing land**	**Inaccessibility of market and information**	**Lack of credit facilities**	**Government Regulation**	**Absence of irrigation scheme**	**Lack of inputs**	**Lack of technologies**	**Lack of membership**	**Others**
Code	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**
Field crop production																
Horticultural crop production																
Livestock production																
Beekeeping																
Non-timber forest product harvesting and selling																
Small scale petty trading																
Employment																
Others (specify)																

8. Is there relationship between the natural resources and your livelihood mechanisms? Make tick√ mark Yes ☐ No ☐

   a. If yes, what are the effects of your livelihood mechanisms on natural resource?

No	Effects of livelihood mechanisms on natural resources	Strongly agree	Agree	I don't know	Disagree	Strongly disagree
1	Enhance diversity of forest animal and plant species					
2	Improves soil fertility					
3	Sustains stream flow throughout the year					
4	Increased bee forage availability					
5	Increase wildlife population					
6	Regular rainfall distribution and amount					
7	Increase availability of wood and non-wood forest products					
8	Increase wild bee colony					
9	Improves forest coverage					
10	Unavailability of wood and non-timber forest products					
11	Scarcity of rainfall					
12	Fragmentation of wildlife habitat					
12	Soil erosion					
13	Deforestation					
14	Drying of streams					
15	Loss of plant and animal species					
16	Decreased forage availability					
17	Land degradation					
18	Decreases productivity of land					

Extent code: Strongly agree=1, Agree=2, I don't know=3,Disagree=4, strongly disagree=5

8.2. How the natural resources affect your livelihood mechanisms?

No	Effects of natural resources on livelihood mechanisms	Strongly agree	Agree	I don't know	Disagree	Strongly disagree
1	Increases crop and livestock damage by wild animals					
2	Pest infestation					
3	Limits the expansion of grazing and agricultural crop lands					
4	Increased dependency on natural resources and products					
5	Water logging effect					
6	Decrease creativity to diversify livelihood mechanisms					
7	Unavailability of wood and non-timber forest products					
8	Shade effect					
9	Decrease coffee productivity					
10	Increase income					
11	Increase access to wood and non-wood products					
12	Increases fish products					
12	Decrease employment rate					
13	Increase income sources					
14	Increase income					
15	Increase family income from forest products					
16	Improves benefit from tourism					
17	Increase bee forage availability					
18	Others (specify)					

Extent code: Strongly agree=1, Agree=2, I don't know=3,Disagree=4, strongly disagree=5

9. What is the interrelationship between the livelihood strategies and natural resources in your locality? Make tick √ mark

Livelihood strategies	**Level of dependency of Livelihood mechanisms on natural resources**							
	Land		**Water**		**Forest**		**Soil**	
	H	**R**	**H**	**R**	**H**	**R**	**H**	**R**
Field crop production								
Horticultural crop production								
Livestock production								
Beekeeping								
Non-timber forest product harvesting and selling								
Petty trading								
Employment								
Others (specify)								

Status code's=Highly, R= Rarely

7.2. Checklist for Farmers group discussion

General focus group discussion guide

This discussion is prepared to collect data from communities, for the purpose of studying Interdependency of Natural Resource and Livelihood Strategies within Bale Eco-Region. The aim of this studying is only for academic purpose (for partial fulfillment of master's degree).Therefore, I will keep this information confidently and will not be transferred to the third parties without prior consent of you.

Thank you for your cooperation

Discuss the following points in context to your farm plot or locality

1. What are the existing livelihood strategies in this area?
2. What are the major natural resource types in this area that related to the livelihood strategies of in habitant of this area?
3. How much and in what way the interdependency of livelihood strategies and natural resources of this area?
4. In what way and what benefits have been realized until now from the natural resource?
5. Degradation of natural resources is that affect livelihood strategies of in habitants in this area?
6. To what extent the livelihoods strategies pressure natural resource degradation?
7. How you conserve natural resources and improve livelihood of inhabitants in this area?
8. In this area what are the best practice to conserve natural resource?
9. Do you think natural resource use cause temporal change? In what way?
10. To increase the local community benefits from the natural resource and at the same time to decrease natural resource degradation, what do you suggest?

Annex: Plots

During discussion with local community in Dinsho district (photo by: Elsabet Takele, 2016)

During data collection in Adaba district (photo by Elsabet Takele, 2016)

Challenges during data collection in Barbare District (photo taken by: Workaleny Assefa, 2016)

Interdependency of livelihood strategies and natural resource in BER (modern irrigation scheme and beekeeping (photo taken by Tilahun Gemechu, 2016)

Interdependency of livelihood strategies and natural resource in BER (livestock and crop production) (photo taken by Tilahun Gemechu, 2016)

Field observation and discussion with local community in Harena Buluke district t (photo by Tilahun Gemechu, 2016)

During data collection in Dinsho district (photo by Elsabet Takele, 2016)