
ADDIS ABABA UNIVERSITY

COLLEGE OF NATURAL AND COMPUTATIONAL SCIENCE

DEPARTEMET OF ZOOLOGICAL SCIENCE

# Ecological Impact of khat(*Catha edulis*) cultivation in Silti Woreda, Southern Nations, Nationalities and Peoples Region (SNNPR), Southern Ethiopia.

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A thesis submitted to the School of Graduate Studies, Addis Ababa University in partial fulfillment of the Degree of Master science in Biology (M.Sc.)

Addis Ababa, Ethiopia

August 2016

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Advisor: - Habte Jebessa (PhD)

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## DECLARATION

I confirm that the work presented in this thesis is my own. Where information has been derived from other source.

Name Kibrom Alem

Signed----------

Date----------

Supervisor Habte Jebessa (PhD)

Signed----------

Date----------

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Table of content page

# List of tables

# List of figures

## Acrimony's

ACMD - Advisory Council on the Misuse of Drugs

CSA- Central Statistical Agency

EMCDDA - European Monitoring Centre for Drugs and Drug Addiction

HDL -High Density lipoprotein

PTSD -Posttraumatic Stress Disorder

UN - United Nation

UNODC - United Nations Office on Drugs and Crime

WCMC -World Conservation Monitoring Center

WHO -World Health Organization

## Abstracts

An investigation of the impact of khat (Catha edulis) cultivation was carried out in Silti woreda in 2015/16 in four purposively selected kebeles. (Boze, Yeteker, Asano, and Senena). The purpose of the study was to investigate the ecological impact of khat cultivation in Silti woreda. In order to accomplish this study objectives were to examine the current status of Khat cultivation in selected Kebele of Silti woreda, Analyses the ecological impact of Khat cultivation, Identify the problems of chemicals uses for cultivation khat and to recommend actions to be taken to improve stakeholders' engagement in Khat cultivation through identifying its negative ecological impact. The research used descriptive method and data were collected using questionnaires, interview and document analysis. Data were analyzed descriptive statistics and response compared with using ANOVA test for different variables. The target population of the study was 1280. From this study uses a sample size of 128 respondents. The survey result has shown that 107 of the respondents has increased their khat cultivation land by performing forest declining, which shows almost all of the respondents have experienced this action as a means of expanding agricultural area for khat cultivation. The study indicates (84%) of the respondents uses different chemicals to prevent pests which attack khat, Most farmers uses chemicals like DDT and other effective chemicals to prevent damage of khat by pests but as data taken from the respondents it has its own contribution for ecological and health impact. Khat cultivation on a large cover of land created a monoculture of vegetation and destroyed any other plants. Therefore, alternative intercropping method should be created with indigenous plants in the study area.



**Key word;** Ecological impact, khat, intercropping, monoculture, indigenous plants

# CHAPTER ONE

## 1. Introduction

## 1.1 Background of the Study

Ethiopia is one of the centers of plant genetic diversity and that its indigenous forests have been repositories of biodiversity including microorganisms, fungi, different wildlife, as well as human beings (Legesse, 2002). The research revealed that Ethiopia is endowed with rich fauna and flora because of its diverse ecological features, which make the country an important centre of diversity and endemism (WCMC, 1992).

Ethiopia has the fifth largest flora in Africa. The flora is very heterogeneous and has a rich endemic element owing to the diversity in climate, vegetation, and terrain. It is estimated to contain between 6,500–7000 species of higher plants, of which about 12% are endemic (Tewolde Brhane, 1990). Endemism is particularly high in the high mountains and in the lowland area, south eastern Ethiopia. However, there is continued exploitation of natural forests without giving due consideration to their propagation, domestication and cultivation has resulted in a vicious cycle where increased forest destruction has led to increased scarcity and/or rarity of resources which in turn have resulted in increased demand and subsequent further destruction (Leul *etal*, 2010). If this trend of deforestation continues unabated, there is a great danger of serious decline or loss of biodiversity. Since the population is growing at alarming rate per year, the need for more arable land to cultivate crops becomes inevitable, further aggravating the rate of deforestation and associated land degradation. In the Silti Woreda area in south central Ethiopia, khat has rapidly become a major source of income. This has profound effects on the livelihoods of the local people as well as on the local environment. From these points of view, it is vital to assess Khat cultivation impact in selected Kebele of Silti Woreda, Siltie Zone, and SNNPRs. Hence, this study was examining social, economic and ecological impacts of Khat cultivation in Silti Woreda.

## 1.2. Statement of the Problem

Khat production influences the production of other crops, the distribution of household incomes (men usually control the khat incomes) and patterns of settlement. This, in turn, influences the state of the forest in the area. The khat habit is a widespread phenomenon which has in the past years spread to parts of Silti Woreda, Zone, and Region. Khat is one of the most lucrative cash crops in East Africa and the horn of Africa. Although the psychoactive alkaloids in khat are restricted under international drug conventions, possession and use of the khat plant itself is not controlled in many countries. In this highly cultivated area a new cash crop, khat, has rapidly become a major source of income. This has profound effects on the livelihoods of the local people as well as on the local environment. However, in Siltie zone, there is no evidence that indicates the status of Khat cultivation impact in the woreda. Therefore, to assess ecological impact of Khat cultivation in selected Kebele of Silti Woreda is the focus of this research.

## 1.3 Research Objectives

### 1.3.1 General objectives

- The main objective of the study is to assess the ecological impact of Khat cultivation in selected Kebeles of Silti Woreda.

### 1.3.2 Specific objectives

The specific objectives in the study are

- Examine the current status of Khat cultivation in selected Kebele of Silti Woreda.
- Analyses the ecological impact of Khat cultivation.
- Identify the problems of chemicals uses for cultivation khat.
- Recommend actions to be taken to improve stakeholders' engagement in Khat cultivation through identifying its negative ecological impact.

## 1.4. Research Questions

Based on the objectives, the study was intended to answer the following basic questions:

- What is the current status of Khat cultivation activities?

- What are the ecological impacts of Khat cultivations?
- What measures can be taken to improve stakeholders' practice in impact of Khat cultivation?
- What solutions recommend for management and conservation problems?

## 1.5. Significance of the Study

It is widely recognized that to assess coverage of plants in selected kebeles of Silti woreda is one of the best vehicle to improve the coverage of plants in selected kebeles of Silti woreda. This study attempts to provide valuable information to decision makers about the impact of Khat cultivation in selected kebeles of Silti woreda. Therefore, this study attempts to compile baseline information on floristic composition and vegetation structure in relation to environmental factors of the Silti Woreda. This study may be important in various ways useful for Silti woreda to improve the coverage of plants in selected kebeles of Silti woreda and this was helps planners and decision makers at various levels to identify the ecological impact of Khat cultivation in selected kebeles of Silti woreda. It may also serve as a valuable source of literature on the subject studied which strengthen the capacity of practitioners to conduct their own research.

## 1.6 Delimitation of the study

This research delimited to in terms of content and area coverage. Interims of area converge, the study is delimited to Silti woreda four kebeles, the study is also delimited interims of content, It asses ecological impact of khat cultivation.

## 1.7. Limitation of the Study

This research would be more effective and valuables if the research did not face the following constraints.

- Lack of sufficient available and easily accessible material.
- Lack of sufficient time to conduct the research.
- Lack of sufficient finical support to cover the costs need to conduct the research

# CHAPTER TWO

## 2. Literature review

This research presents a review of available literature. It provides theoretical and conceptual insights related to the topic. Therefore, definition of Khat, overview of Khat cultivation, explanations of Khat cultivation, current status of Khat cultivation, and impact Khat cultivation on environment and effects of chewing Khat are briefly discussed.

## 2.1 The Definition of Khat

Khat is an evergreen tree cultivated for the production of fresh leaves that are chewed for their euphoric properties. Khat is a high value cash crop in Ethiopia. Recently it has become one of the most important sources of hard currency for the country (Dechassa, 2001). Khat also influences the economic status of local areas. Gebissa (2004), for example, reports that khat production and marketing have made the Harerge province in Ethiopia an example of prosperity and economic development in an otherwise poor country. However, khat is a stimulant crop that incurs negative health and social consequences. Hence, khat is illegal in several countries. Consequently, while in Ethiopia the government takes no action against its cultivation, trade, or use in any form, it does not encourage cultivation (Feyisa and Aune, 2003).

There have been concerns raised about potential individual physiological harms and wider societal harms associated with, or caused by, the use of the naturally occurring plant stimulant khat. Khat (*Catha edulis*) is a woody plant cultivated predominantly in north east Africa and the Arabian Peninsula. Its use is particularly prevalent in Yemen, Djibouti, Kenya, Ethiopia, Eritrea, Somalia and Uganda. The traditional use of khat may be considered largely functional to assist with religious studies, arduous work demands, food shortages, social cohesion, and to self-medicate for a range of ailments including depression (Advisory Council on the Misuse of Drugs (ACMD, 2013). Amongst some populations, chewing khat has a long and documented history (e.g. Yemen), whilst in others its use is novel (Uganda) (Beckerleg, 2006) or burgeoning (Somalia, Ethiopia). Many individuals from the region's Diaspora communities living in Europe, North America and Australia also chew khat. The main active compounds of khat are cathinone and cathine, although over 40 compounds have been identified in khat extract (Halbach, 1972). Cathinone and cathine are scheduled substances under the 1971 UN Convention on Psychotropic

Substances. Similar compounds, cathinones, have been manufactured to create novel psychoactive substances, sometimes referred to as 'legal highs'. Some of these manufactured cathinones have been associated with high levels of harms (UNODC, 2012). In their naturally occurring vegetable state, i.e. in khat leaves, the compounds are not scheduled under the Convention.

## 2.2. Over view of Khat cultivation

Natural forest is an important but diminishing part of the Wondo Genet environment. This montane forest, which nurtures a rich biodiversity, is today an isolated remnant of once extensive forests of the south central Rift Valley. Today the forest covers upstream areas and is in proximity to agriculturally productive valleys with a rapidly growing farming population. Extensive deforestation as a result of human intervention is in progress. Khat production may be an important aspect of this process. (Gessesse and Kinlund, 2008).

In 2006, the World Health Organization (WHO) upheld khats non-scheduled status after reviewing its medical harms (WHO, 2006a). Khat (*Catha edulis Forskal*) is an evergreen tree cultivated for the production of fresh leaves that are chewed for their euphoric properties . However, khat is a stimulant crop that incurs negative health and social consequences. Hence, khat is illegal in several countries. Khat users typically experience increased energy levels, alertness and mild to moderate euphoria on chewing fresh leaves of the plant. The habit forming properties of khat are due to the amphetamine like neurostimulatory effects of its main constituent phenylalkylamines, namely cathinone, Cathie (nor pseudoephedrine) and nor ephedrine. (Patel, 2000).

## 2.3 Expansion of Khat cultivation

Khat is an undemanding crop displaying wide ecological adaptability. It enjoys favorable market conditions and, most importantly, it gives a high return per small area. These advantages are especially important to farmers whose landholdings are too small to yield sufficient income or to produce adequate amounts of food. It may be argued that the fact that khat farming enables a large number of smallholder farmers to earn a good income on small plots may limit the tendency of agricultural expansion into forests. However, the increasing population and the

immigrant farmers still require new land. The economic advantages have attracted farmers from other regions, resulting in increased migration to the study area.

## 2.4 Current status of Khat cultivation

Khat is a plant native to Ethiopia that has been consumed for several centuries for mental and physical stimulation. Its commercialization started at the beginning of the 20th century in eastern Ethiopia, and other growing regions soon followed suit. Today, according to the Central Statistical Agency (CSA) (2010), over 160,000 hectares of land are covered by khat farms and over two million farmers produce khat in all regional states of the country. This crop grows in a wide range of agro-ecological zones between 1,500 and 2,700 meters above sea level. It is mainly cultivated by smallholder farmers on an average of less than one-tenth of a hectare. Khat is sold in almost all concentrated settlement areas in Ethiopia, but the amount of khat collected and traded depends on the proximity of farming areas. There are three export centers in the country, Dire Dawa, Jijiga and Addis Ababa, which send khat to Djibouti, Somalia, the UK and China.

Khat is an evergreen tree cultivated in parts of Ethiopia for of its fresh leaves, which are chewed for their euphoric properties. The study identifies khat in agricultural landscapes, but more importantly addresses the spatial flow of the khat trade and the agricultural value chains connected with the crop from producer to final consumer, the latter often located in Europe and distant countries (Gessesse, 2013). The dynamics of the value chain are analyzed in terms of employment, income generation and financial flows and of smallholder led improvements to khat production in different agricultural landscapes. Such improvements include technical change, innovations and adaptations, capital investments and institutions.

## 2.5 Impacts of Khat cultivation on environment

Ethiopia is not only a country dominated by agriculture; it is a country of small holder farmers. The livelihood decisions of this predominant farming community are largely constrained by diminishing land availability, declining soil productivity, the marginalization of time tested crops, poor access to technology and the volatility of agricultural markets (Fenta and Ali, 2003). In a society so reliant for survival on agricultural land with few other livelihood options, these

constraints are the more pronounced. The smaller the amount of available land, the more complicated it becomes for farmers to maintain their customary diversified cropping regime. Under such conditions, farmers are forced to prioritize crops and intensify management to optimize benefits (Rahmato; 2009). Often, crops with a high cash return take centre stage and farmers become reliant on the cash to access food. Khat (*Catha edulis Forsk*) is just such a crop.

Potential benefits of khat use are many, although just as with the harms of khat these are not un anxiously recognized across khat using communities. People May self-medicate with khat to treat a range of ailments, including depression and PTSD (ACMD, 2013). Some studies report that khat chewers are less likely to have diabetes mellitus, hyper lipdaemia, hypertension, renal impairment, and obesity (Ali, 2010). Other evidence suggests positive effects of khat on the period ontium (Hill, 1987), a possible probiotic effect in the mouth of khat chewers (Al-Hebishi, 2010), possible antimicrobial properties (Elhag, 1999) the production of cardio protective high density lipoprotein (HDL) and lower cholesterol levels in chewers (Al Habori, 2005). Asides from self-medication, khat is also considered by many as an important social lubricant and an important part of cultural practice which demonstrates a host's respect of guests (Gebissa, 2004). Opposition to government control of khat often high lights the role khat plays, particularly to Yemeni communities, in social cohesion. Many Somali's consider khat to be similarly integral to social wellbeing, although opinion appears more divided in the UK and the longevity of cultural practice is disputed (Klein, 2007). Evidence points to other benefits of khat, especially with regards to the livelihoods of African households who produce khat as it offers a regular and reliable income and can be produced on the small plots of land that are typically available (EMCDDA, 2011). Furthermore, in contrast to other crops, regional entrepreneurs rather than multinational companies control the supply chain (Anderson, 2007b). The economic consequences of khat have 'secured the livelihood of millions in one of the poorest regions in the globe' (Odenwald, 2010a).

Evidence shows that some users are harming themselves or others around them by consuming khat in a socially unrestrained and dependent manner, although the nature of the research makes it difficult to quantify or attribute underlying causes of these consumption patterns to khat purse. It is imperative to establish factors which may make people more vulnerable than others to adopt excessive levels of khat consumption. Views on khat use diverge most markedly along user/ non-user lines and gender (Patel, 2005). However, most research does little to tease out patterns

relating to different patterns of khat use. Anderson and Carrier (2011) recommend that research acknowledges the 'super diversity' of people from the traditional khat chewing region and does more to consider the effect such differences as identity and faith may have on khat consumption. Further efforts to identify social health determinants, and pre- and post-migration experiences of study participants with problematic khat use and those with more socially accepted use patterns may also be illuminating.

Approaching problematic khat use in isolation of broader considerations such as barriers to better physical and social health seems an unlikely way to promote positive outcomes for individuals or society. There are many cases where intervention to reduce harms in those most vulnerable to excessive khat use could be attempted which would allow the majority of khat users who chew in moderation (for whom the associated harms are very low), to continue to enjoy a practice that holds social and cultural importance. Also, the other impact of Khat cultivation on environment are the following described below.

## 2.6. International Impacts of Khat cultivation

The only evidence of environmental damage in the UK resulting from khat use is complaints relating to highly localized littering outside marshy and in streets where khat is traded from vehicles (ACMD, 2013). Environmental damage may be addressed by local initiatives seeking to reduce this and other aspects of anti-social behavior associated with khat, as happened in Stratham and Cardiff (ACMD, 2013). Overall, environmental damage in the UK should be considered very low and not insurmountable.

Family breakdown amongst khat consuming communities is widely ascribed in the qualitative literature to khat, although the evidence is entirely anecdotal (Anderson and Carrier, 2011). Reports of men not helping in the domestic setting, being absent from the home for long periods of time, not providing for their families, spending already limited resources on khat, being irritable after khat chewing sessions, not investing in their children, or having reduced libido are all attributed to khat use and blamed for resulting relationship breakdowns (Anderson, 2007a). Although khat use may be implicit in some relationship breakdowns, no evidence was found to support a causal link for these assertions.

## 2.7. Impacts of Khat cultivation in Ethiopia

Environmental damage associated with the global trade in khat includes the over exploitation of water resources in Yemen and deforestation in parts of Ethiopia (Odenwald, 2010b). In Yemen its cultivation is reported to consume 40% of the country's fresh water supply. (Almas and Scholz, 2006). Dessie and Kinlund (2008) look at khat expansion and forest decline in the Wondo Genet area in south central Ethiopia. They find that khat expansion does not explain forest decline in the study area pares, but it does influence increased human activity in proximity to forests resulting in a reduction of forest area, forest resilience and forest regeneration, for example through settlement and collection of wood for fuel. The study found khat expansion contributes to about 30% of the natural forest decline in the major khat producing areas.

There is concern that in parts of Ethiopia, Kenya and Yemen farmers switch from growing food crops to khat, with potential implications for food security (EMCDDA, 2011; German Agro Action, 2009), although this phenomenon is disputed and others suggest a positive role of khat production on local food security (Gebissa, 2010). Also, land conversion to khat production does not only come from food crops, but also coffee another naturally occurring plant stimulant to which khat has frequently been likened, and which requires more water in cultivation than khat (Cox and Rampes, 2003).

## 2.8 Effects of Chewing Khat

The use of khat (*Catha edulis*) has been associated with a large number of physiological and societal harms. Some individuals have developed excessive consumption patterns, either using khat daily or in binge-sessions, though daily consumption is not necessarily problematic per se. The majority of users seem to use khat in moderation, where the associated harms appear low. For excessive users, harms associated with khat are greater, particularly relating to mental health. Social harms also seem to be largely related to excessive khat use rather than khat use itself. Even in cases of excessive khat use, however, causal relationships between chewing and harms have not been described. More research is required to establish the role of khat in liver disease, coronary problems, and cancers of the digestive tract and incidents of domestic violence. Studies should consider the likelihood that certain users are more vulnerable to developing patterns of excessive khat use due to an interwoven set of factors such as social health determinants and pre-

and post-migration experiences. In the preceding sections are presented some of the literatures encountered.

### 2.8.1 Social and Economic Effects of Chewing Khat

Khat, as a stimulant drug, presents an interesting case in the study with regard to farmers' rationale in cultivating it, of forest change, particularly its input to livelihood improvement and the social processes it steers. A study of khat production requires a focus on both underlying and direct causes of forest decline. (Angelsen, and Kaimowitz, 1999).

#### 2.8.1.1 Social Effects of chewing Khat

Social gatherings for purposes of khat chewing; typically, starts in the afternoons, but few khat users blamed khat for low productivity, inefficiency and absenteeism at work. Khat is seen by many chewers as contributing to an increase in social cohesion amongst khat using communities by way of helping to maintain identity and cultural closeness, and act as a means to reinforce self self-esteem and a forum for information and news exchange and support (Anderson and Carrier, 2011). Cassanelli (1986) recognized that the intensity of the bond between khat users could alienate those who did not participate in sessions. The use of khat by women, largely considered to be on the increase (Hoffman and Al-Absi, 2012), also seems to be an issue which some believe is unhelpful both to social cohesion and community reputation.

Drug abuse has emerged as one of the main causes of antisocial behavior, particularly among the youth. Despite the growing public concern about increasing consumption of khat and other drugs in Kenya, few systematic studies have been conducted on the socio-economic effects of khat chewing, particularly at the grass roots level. Some of the reasons cited for initiation into drug abuse include: peer pressure, inappropriate use of finances, unstable family backgrounds and ignorance.

#### 2.8.1.2 Economic Effects of Chewing Khat

Khat production is a profitable activity that may benefit a large number of people, but it is also highly dependent on market conditions. On the one hand, improve the livelihood of the farmers, while on the other hand expose the farmers to the risks imposed by market and

economic forces operating at various scales and levels. Moreover, as a profitable activity, it can encourage farmers to alter their farming systems Expansion along the forest frontier leads to land-use competition between khat farming and forestry; the outcome is partly determined by the farmers' evaluation of the relative advantage of the two land uses. Therefore, an analysis of khat production can help to understand composite social, economic and market related causes of forest decline in progress. In the study area at different scales, This provides an opportunity to analyses forest decline as a process that depends both on the consequences of the actual khat production, as well as on the factors that promote khat production. Apparent differences in khat consumption between men and women may be explained by cultural restrictions on khat chewing and economic dependency among the women. In most of the homesteads surveyed, the family income was earned by men who therefore controlled the domestic budgets, although unemployment was widespread. The majority of khat chewers spent more than half of their domestic budget on their daily habit, at the expense of vital needs such as education and medical care. Currently, the realized economic costs of khat use to healthcare systems are low, with low numbers of people being treated for khat related health problems (ACMD, 2013). This does not necessarily reflect the true cost of khat as it is clear that many individuals are not receiving the health assistance they require in relation to reducing khat associated harms. However, as a causal link between the health needs of khat using communities and the use of khat is not established, it is difficult to assess the true economic costs of khat. A number of local authorities are establishing bespoke support services for khat users or seeking to encourage khat support within existing drug services, although some services have since been shut down due to under use or lack of funding (Sykes, 2010). Since almost the amount of birr is raised annually from taxation of khat, there is an argument that this could/should be invested in health provision to offset costs of addressing the needs of khat users. (Klein, 2009). Liver transplant is a costly medical intervention. As evidence relating to the extent of liver damage amongst khat users emerges, the known economic cost of khat may rise significantly.

### 2.8.2 The Harms of Khat to Individual Users

Khat chewing is also associated with a wide range of health problems including ischemic heart disease, gastritis, liver toxicity, oral cancer, hypertension, sperm a torrhoea and hemorrhoids. Concurrent habits such as tobacco smoking may further precipitate the risks associated with khat.

### 2.8.2.1 Drug specific mortality

No evidence was found presenting evidence of an intrinsic lethality of khat and no reliable reports were found of deaths relating to khat toxicity. The psychoactive ingredients are extracted slowly and the buildup of toxic and intoxicating chemicals in the body is moderate (EMCDDA, 2011). There is general consensus that the method of khat consumption chewing bulky plant material means that intoxication is self-limiting (ACMD, 2013).

### 2.8.2.2 Drug-related mortality

The evidence indicates there are two main areas where khat may contribute to a shortening of life: in cases of liver failure and myocardial infarction. There is limited evidence relating khat use to incidents of stroke and cerebrovascular accidents, although studies demonstrating a causal link are lacking (Al Suwaidi, 2006). Evidence relating to other aspects of this harm, for example road traffic accidents, is inconclusive.

### 2.8.2.3 Liver damage

There is emerging evidence from outside of the traditional khat consumption region, in the form of case studies and journal letters, of severe liver damage amongst some khat chewers (Alsubee, 2009). Long term use of khat may be associated with repeated episodes of subclinical hepatitis, with evolution to chronic liver disease over time, (Chapman, 2010). Although there has been concern expressed in the literature about the dangers associated with the use of chemicals in khat production, the authors considered it unlikely that the liver injuries were related to contaminants such as herbicides, pesticides, heavy metals or toxigenic fungi.

### 2.8.2.4 Cardiovascular diseases

Khat use has been associated with a number of coronary problems including acute coronary vasospasm and myocardial infarction (Al-Habori, 2005), although the quality of evidence is varied. No evidence demonstrating a clear causal link was found. One case controlled study showed that khat chewing was associated with an increased risk of myocardial infarction in a dose-dependent manner (Al-Motarreb, 2005). Heavy chewers increased risk of myocardial

infarction. ‘Mild’ chewers were not shown to be at risk, while ‘moderate’ khat chewers were shown to be at high risk. Several other papers of varying quality have suggested higher incidents of cardiovascular problems amongst khat chewers than non-chewers, although most are compromised by their failing to account for confounding risk factors such as tobacco smoking (Al-Motarreb, 2002).

### 2.8.2.5 Cancers

Possible links between khat use and oral and gastrointestinal tract cancers are difficult to isolate as poly substance use with tobacco or snuff may be confounding issues which render conclusions unreliable (ACMD, 2013). For example, (Gunaid, 1995) found a high frequency of khat chewing and water-pipe smoking amongst people in Yemen with tumors’ of the gastro esophageal junction or cardiac, but were unable to identify independent effects of khat. Some studies suggest that the evidence for khat chewing as a risk factor for oral cancer is limited and larger controlled studies needed (Al-Hebshi and Skaug, 2005). Some research has involved small numbers of subjects and present circumstantial evidence with confounding issues such as snuff uses. However, the World Health Organization (WHO, 2006a) and ACMD (2005) suggested that there was growing evidence that oral cancer may be a significant issue related to khat chewing due the widespread development of precancerous growths in the mouths of regular khat chewers. Hassan et al. (2007) consider the evidence to suggest a possible link between long term khat use and oral malignancies. However, in 2013, the ACMD concluded it was not aware of any robust evidence relating to increased oral cancer in khat users. El-Wajeh and Thornhill (2009) reviewed literature on oral health from the past 20 years, finding chronic tobacco smoking and alcohol consumption to be the most important of the known predisposing risk factors for the development of oral squalors cell carcinoma in the UK. They conclude that there is insufficient evidence in the literature that khat chewing alone is carcinogenic or plays an independent direct role in the development of head and neck cancers. Khat chewers showed more genetic damage in buccal mucosa cells when compared to non-chewing controls (Kassie, 2001). Kassie et al. consider risk of genetic damage (pre-cancerous changes) to be eight times higher in heavy users of khat (100–160 g/day) than background level. The study accounts for alcohol and tobacco use and suggests that the risk for cancer in heavy khat chewers is similar to that of heavy smokers who consume

alcohol regularly. Other studies have also found khat to be associated with free radical production (Al-Akwa, 2009)

### 2.8.2.6 Drug-specific damage

The literature lists several adverse effects considered to be associated with khat use, such as blood vessel constriction, prolonged malnutrition, gastritis, duodenal ulcer formation, increased blood pressure, stomatitis, oesophagitis, apoptosis and mitochondrial damage, cytotoxic effects on kidneys, keratotic lesions in the mouth, cerebral hemorrhage, pulmonary oedema, tachypnoea, bronchitis, polydipsia, dental caries, periodontal disease, chronic gastritis, constipation, hemorrhoids and paralytic ileus. (Al-Habori, 2005). However, the scientific evidence for many of these adverse effects is 'inadequate' and evidence is often equivocal or contradictory (Al-Hebshi and Skaug, 2005). Some pre-clinical studies used dose levels considered unrealistic for daily human consumption (Al-Habori, 2002). There is evidence relating to damage caused to male fertility, for example reduced semen volume, sperm count, sperm motility, motility index and percentage of normal spermatozoa (Mwenda, 2003), although evidence relating to this and male sexual function is mixed (Al-Hebshi and Skaug, 2005). There are calls for more case-control studies to ascertain the role of khat in cardiomyopathy, vascular disease such as cerebrovascular ischemia and thromboembolism, diabetes, sexual function, duodenal ulcer and hepatitis (Al-Motarreb, 2010; Al Suwaidi, 2013).

### 2.8.2.7. Drug-related damage.

There is an increased prevalence of respiratory problems reported amongst male khat users, which may be attributable to tobacco use (ACMD, 2013; Kennedy et al., 1983). A Khat Research Program is currently undertaking research into khat tobacco relationships so that these issues and potential additive effects can be better understood (Al'Absi and Grabowski, 2012). High levels of sugar may be consumed through fizzy drinks and tea to counter the bitter taste of the khat leaves during a chewing session. However, no evidence demonstrates harms caused indirectly by khat in this manner, but fears over increased risk of tooth decay and developing diabetes are cited (Douglas, 2011). Evidence relating to diabetes and dental health amongst khat chewers is inconclusive (Al-Motarreb, 2010)

### 2.8.2.8 Dependence

Physical dependence on khat may be considered in terms of withdrawal effects or the development of tolerance, whilst psychological dependence relates to craving and compulsive use (Kassim et al., 2010). The WHO considered data regarding the dependence potential of khat to be inconsistent, but dependence potential is largely considered to be mild and associated with daily khat consumption (WHO, 2006b) As it takes over two hours for maximal plasma concentrations of cathinone and cathine to be reached, many consider khat to have less reinforcing properties than other stimulants such as cocaine and amphetamine (ACMD, 2005). One study found the effects of khat chewing on increased blood pressure, heart rate, and body temperature to be lesser amongst habitual users than native users suggesting the potential to develop a degree of tolerance to the sympathetic activation induced by khat (Nencini, 1984). The physical limits on the amount of khat that can be chewed are proposed as an explanation for the lack of evidence of tolerance to khat (Al-Hebshi and Skaug, 2005). To stop chewing khat one would not only suffer the minor physical withdrawal symptoms but also, and more importantly, miss out of the companionship, friendship, information and social networks that are part of chewing practices. As such, from the perspective of consumers, the most severe withdrawal symptoms should be understood as socially defined, that is as the experience of being deprived of social networks and companionship. (Hansen, 2010: 593)

### 2.8.2.9 Loss of relationships

Evidence relating to links between khat and loss of relationships has been generated largely through focus group discussions and interviews during which links are made anecdotally by participants. The vast majority of reports pertain to loss of relationships with a partner or children, rather than with friends. Indeed, many cite the use of khat as enhancing relationships with friends and peers. Whilst most reports relating to loss of relationships are by women expressing frustration of absent fathers/partners, occasional reports were found expressing similar frustrations towards women who chewed khat. (Dhaifalah and Santavy, 2004; Khalil, 1997). Due to the familial nature of this harm, it is considered more fully below under the section on family adversities.

### 2.8.3 The Harms of Khat to Others

### 2.8.3.1 Fetal harm.

Evidence suggests around 40% of women in Yemen chew khat during pregnancy (Khawaja, 2008). Khat chewing mothers in Yemen were shown to give birth to lower birth weight babies than non khat chewers, but there was no increase in stillbirths or congenital abnormalities of the babies born to khat chewing mothers (Eriksson, 1991). (Abdul- Ghani, 1987) study on the foetal effects of khat established that lower birth weights appeared in both the habitual and occasional chewer's sampled compared to non khat chewers. A dose relationship was found for boys but not for girls, such that occasional users gave birth to lighter girls than did habitual users of khat. Lower birth weight has been suggested as a result of inhibition of uteroplacental blood flow (Mwenda, 2003). Some evidence suggests that the positive economic impact of the khat industry has resulted in increased birth weight in khat production areas in Africa (Seyoum, 1986). No evidence was found from the UK or other Diasporas populations, but this finding may suggest that low birth weight, and its associated risks, could be less relevant in the UK context. Reports of teratogenic effects of khat have been shown in rodent experiments, but no human evidence supports this (Pennings, 2008). Only one case study was found detailing a pregnant woman requiring medical attention following khat use. (Kuczkowski, 2005). Kristiansson (1987) found that cathamines are excreted in breast milk and can be detected in the urine of breast fed babies. It is not known if this causes harm, but it has led to recommendations in The Netherlands that women avoid khat chewing whilst breastfeeding (Pennings, 2008).

### 2.8.3.2 Crime

Patel (2008) asserts that there does not appear to be any link between khat use and acquisitive offending and that this might be attributable to the relatively low cost of a bundle of khat and the relatively non addictive nature of the substance. In addition, as khat is legal, users do not have to liaise with dealers offering illicit substances (ACMD, 2005). The ACMD notes that crime rates detected are particularly low considering the financial status, social situation and location of many of the khat using communities (ACMD, 2005). Sharing and lending amongst the khat using community may serve to prevent acquisitive offending. khat use was seen as an activity

that actually prevented people from offending as it is time consuming and makes them feel relaxed' (Yussuf, 2007).

In other areas where khat is uncontrolled, similarly low levels of crime were associated with khat use. In Australia, where khat is grown in gardens, trespassing to gather khat leaves is seen as the main offence (Douglas, 2012). In the Netherlands, where khat was legal until recently, low levels of anti social behavior such as spitting of khat leaves on the street, yelling, and fighting are reported. There were no indications of khat trade being related to organized crime whilst the drug was legal (Pennings, 2008). In contrast, a 2005 Swedish investigation (where khat is illegal) showed that the trade of khat was related with smuggling of MDMA (3, 4-methylenedioxy methamphetamine), whilst Klein et al. (2012) assert that the prohibition of khat in Sweden has created an opportunity for the formation of transnational crime groups and Somali traders have reacted to the increase in penalties by diversifying their drug imports into drugs with a substantially higher profit margin such as cannabis and cocaine. (Balint, 2009) note an18-month Drug Enforcement Agency operation in the USA to dismantle an international smuggling operation which took 25 tons of khat into the country. Currently, around 50 tons of khat is legally imported into the UK each week (ACMD, 2013).

# CHAPTER THREE

## 3. Research Design and Methodology

## 3.1. Description of the study area

### 3.1.1 Location

Silti Woreda is one of the eight Woreda in Siltie Zone of SNNPRs state. It is located at $55^{o}$N and $38^{0}$12"E. The Woreda is found in the North East part of Siltie Zone and located South of Meskan Woreda of Guraghe Zone, North of Dalocha and Ulbareg, East of AlichoWiriro and West of Lanfiro Woreda of Siltie Zone and Adami-Tulu Woreda of Oromiya region, Kibet is the administrative center of the woreda which is found 27 km from the Zone center, Werabe, 177 km from the region capital, Hawassa, and 147 km from the Federal center, Addis Ababa. The Woreda has a total of 40 kebeles, Also 4 kebeles was being selected in Silti Woreda for the purpose of the study. As it has been well explained in the above, the Silti woreda in SNNPRs has a total number of population 205,027 among them 100,589 are males and 104,436 females are living, (1996, National population census within 40 kebeles).

### 3.1.2 Climate

Climate is one of the elements of the physical environment that should be analyzed carefully during the process of a given study. It has paramount impact on the people's way of life, settlement pattern, economic activities, the special distribution and variety of plants and animals. This in turn trends to influence the natural resources endowment and development potentials of the study region. So analyzing these two elements of climate for the study region is crucial.

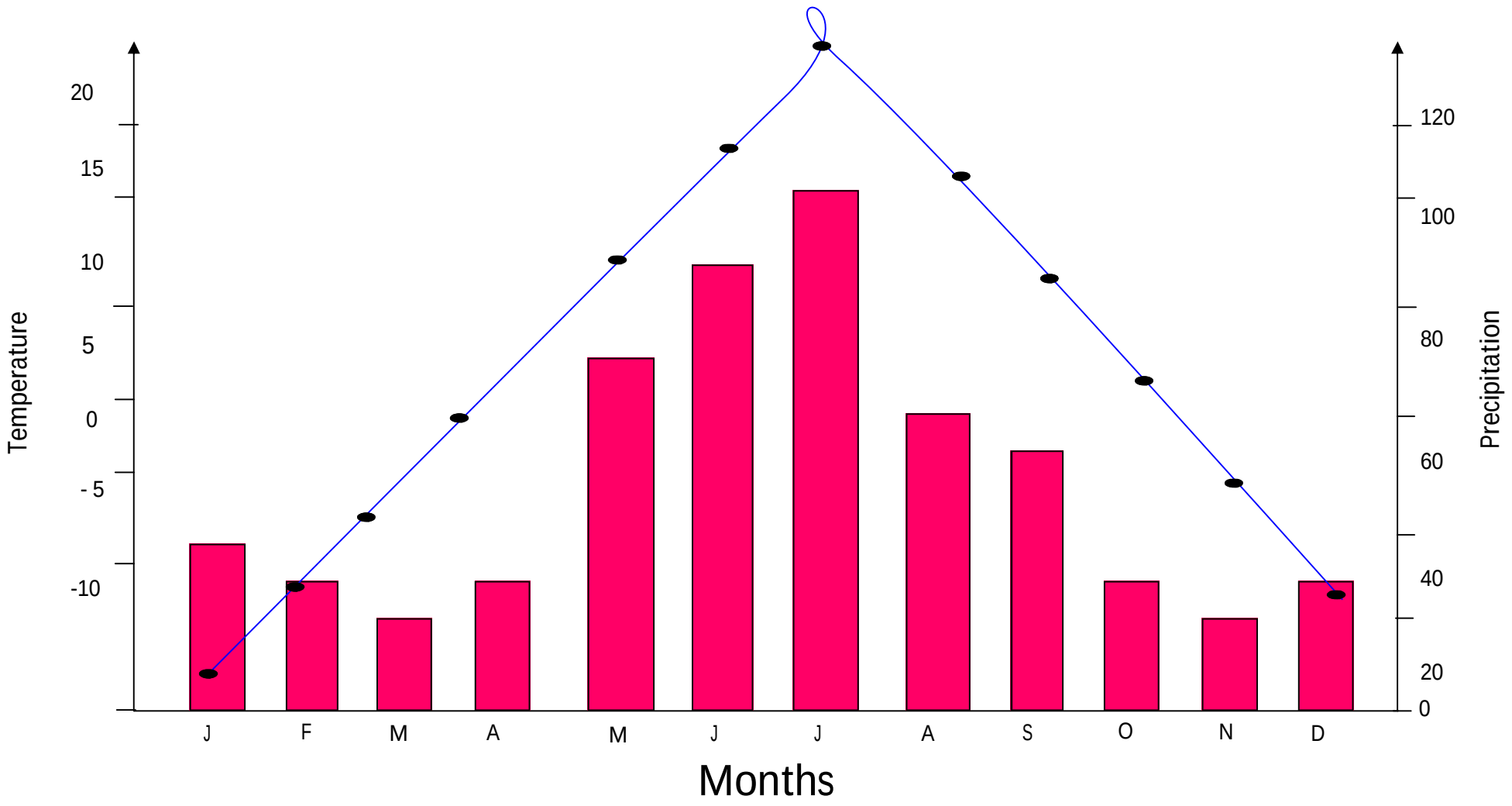


Figure 1 - Climatic diagram of Silti woreda 2007

### 3.1.2.1 Temperatures

Temperature is an important aspect of climate and can be used to grade climatic zones on scale of five; - cold with mean annual temperature of < $15^{O}$C, cool temperature with mean annual temperature from 10-$15^{O}$C, temperature with mean annual temperature from 20-$30^{O}$C, desert with mean annual temperatures from $30^{o}$C (Ethiopian geography, 1995 E.C). The study area monthly average maximum and minimum temperature is $19^{O}$C and $14.5^{O}$C respectively. The months with highest temperatures are December to February. Here in these months the amount of cloud is very tin. On the other hand, July and August are months with the lowest temperature (SWARDO, 2011).

### 3.1.2.2 Rainfall

The mean annual rainfall of the study area is > 1500 mm. Here in the study area there are possibly two growing season that are kiremt (summer) and Belg. The belg season rainfall amount is relatively lower than that of the kiremt (summer) season (from June – September). In reverse the season with little rainfall is winter or belg (from December – February). (SWARDO, 2011)

## 3.2 Sampling Design

For the achievement of the objective of the study mixed multi stage sampling technique was used. In the first stage purposive sampling technique was used to select four kebeles from 40 kebeles administrations form Silti woreda. Among these kebeles found in Silti woreda four kebeles namely Boze, Senena, Yeteker and Asano was selected through systematic random sampling for this study. The study district was selected as the area represents one of the highest coverage of khat cultivations in the whole kebeles. The survey method was used to collect data from peoples of selected kebeles through questionnaires and Interviews were used to collect in-depth data from Woreda agriculture experts, peoples of selected kebeles and documents in the office regarding the assessment of ecological impact of Khat cultivation.

## 3.3. Sample size determination

The sampling size determination and methods of data collection, sampling procedures and the methods of data analysis used in this study are all outlined. The sample has taken 4 agricultural officers and the interviewers by using purposive sampling. Based on the information obtained from Silti woreda agricultural and rural Developmental office (WADRO), there exists about 1280 hose holds have khat farms in four kebeles. Taking to account the financial problem and lack of time for these study 10% khat growing farmers which are 128 households have been taken and randomly selected to represent the age, economic status and gender issue in the study area. After the sample size determined simple random sampling techniques were used to select the respondents from the total population of 1280 (364 from Boze, 360 from Asano, 274 from Senena and 282 from Yeteker). Allocation of the number of sample farmers to each kebeles was proportional to the number of farmers head living in each kebeles, accordingly 36 farmers from Boze, 33 farmers from Asano, 31 farmers from Senena and farmers 28 from Yeteker were selected for this study. (AbdulAziz, 2010).

## 3.4. Method of data collection

To achieve the objective of the study three complementary data collection methods namely individual interview, direct observation and key informant interview are used during present study. Secondary data which obtained from written documents, internet and books were also used to collect detail information on the ecological impact of khat cultivation in the selected kebeles. (Abdulaziz, 2010).

## 3.5 Sampling procedures

The sample for the farmers taken from four kebeles which is known for its quantity as well as quality khat production and was selected after assessing which farmers to produce more khat with based on farm land size. In the selected kebeles 128 farmers were interviewed to get the ecological impact of khat cultivation. Relevant photograph was used to enrich the information collected. (Tadele, 2013)

### 3.5.1. Questionnaire

The questionnaire was being prepared in English. It was included both open and closed ended questions for gathering information from farmers demographic data(sex, Age, Marital status, And religion), ecological impact of khats and other problems caused by khat in order to answer the research questions and achieve objectives of the study. The questionnaire was distributed to the peoples of selected kebeles in translating to Amharic. (Abdulaziz, 2010).

### 3.5.2. Interview Guides

A semi-structured interview guide was prepared to gather complementary information from Silti Woreda Agricultural and Rural Development office (SWARDO) experts. The interview was held according to the convenience of the interviewers at their working places.

## 3.6. Methods of Data analysis

Data collected by different methods and form different data source was analyzing using SPSS version 20, table, percent, chart and some by qualitative data analyzing method.

# CHAPTER FOUR

## 4. Result and Discussion

The data have been gathered according to the method stated in the preceding chapter and it was analyzed as follows in this chapter.

### 4.1. Back ground of the respondents

Table.1 Gender distribution of respondents

| | N= no. of respondents | Percent |
|---|---|---|
| MALE | 105 | 82.0 |
| FEMALE | 23 | 18.0 |
| Total | 128 | 100.0 |

Table.1 indicated the gender of the respondents. From the findings, it was indicated that 82% were male and 18% of the respondents were female.

### 4.2 Age of respondents

Table.2. Ages of farmers who cultivate khat

| | N= no. of respondents | Percentage |
|---|---|---|
| 20-30 year | 28 | 22 |
| 31-40 year | 63 | 49 |
| 41-50year | 22 | 17 |
| 51-60year | 9 | 7 |
| above 60 | 6 | 5 |

In terms of age the study also sought to establish the respondent's age group. From the findings 22% were shown in the age of 20-30 years, 49% of the respondents were between 31- 40 years, the respondents in the age of 41-50 years were shown by 17%, 7% of the respondents were between 51- 60 years and only 5% of the respondents were above 60 years. This indicates that

majority of the respondents highly concentrated under youth and adult age who are in the productive group are involved in expand of khat cultivation by making deforestation.

## 4.3 Marital statuses of respondents

Table.3. Marital status of respondents

| | N= no. of respondents | Percentage |
|---|---|---|
| Married | 66 | 51.6 |
| Single | 16 | 12.5 |
| Separated | 32 | 28.1 |
| Divorced | 10 | 7.8 |
| Total | 128 | 100 |

Out of 128 respondents, 66 (51.6%) of them are married and 32 (28.1%) of are separated. The rest 26 of the respondents are single and divorced. The background data has shown that most of the respondents are married and settled farmers in the study area. The separated ones are also farmers who live there in the area permanently the divorced ones are also farmers who had got marriage and have been living there before which shows that the respondents had lived there so that relevant data can be collected from the sample as they are aware of the area.

## 4.4 Religion of respondents

Table 4 religion of respondents

| | N= no. of respondents | Percentage |
|---|---|---|
| Muslim | 82 | 64 |
| Orthodox | 16 | 12.5 |
| Protestant | 18 | 14.1 |
| Others | 12 | 9.4 |
| Total | 128 | 100 |

Religion of the respondents denomination was as follows 82(64.1%) were Muslims, 16(12.5%) were orthodox, 18(14.1%) were protestant and 12(9.4%) are others.

## 4.5. Educational back ground of the respondents

Table.5.educational back ground of respondents

| | N= no. of respondents | Percentage |
|---|---|---|
| Illiterate | 14 | 11 |
| 1-4 grade | 61 | 48 |
| 5-8 grade | 21 | 16.4 |
| 9-10 | 30 | 23 |
| Others | 2 | 1.6 |
| Total | 128 | 100 |

The educational level study sought to know the level of the respondents from the finding, 14(11%) of the respondents were uneducated, 61(48%) of the respondents were grade 1 – 4, 21(16.4%) of the respondents indicated they had reached grade 5-8, 30(23%) of the respondents were educated in 9-10, and 2(1.6%) of the respondents are others. This indicates that most of the farmers who expand khat cultivation areas are able to read and write. Generally the results shows that the majority of the farmers in the area were do not understand the ecological impact of mono culturing of khat.

## 4.6. Number of family of the respondents

Table 6 Number of family of the respondents

| | N= no. of respondents | Percentage |
|---|---|---|
| 1-3 year | 14 | 10.9 |
| 4-5 year | 26 | 20.3 |
| 6-7 year | 68 | 53.1 |
| Above 8 | 20 | 15.6 |
| Total | 128 | 100 |

Many of the respondents indicated have more than 6 families as the survey indicated 68(53.1%), 26(20.3%) of the respondents has they have 4-5 member families, The rest 20 (15.6%) of them have greater than 8 families while others do have 1-3(10.9%) families in number. From this

finding of family size many farmers tends to specialize on khat and this depend heavily on the financial outcomes.

## 4.7. Years of the respondents lived in the area

Table.7. Years of the respondents lived in the area

| | N= no. of respondents | Percentage |
|---|---|---|
| 1-10 year | 14 | 10.9 |
| 11-20 year | 26 | 20.3 |
| Above 20 year | 68 | 53.1 |
| Total | 128 | 100 |

In terms of residency 62(48.4%) of the respondents have lived in the area were for more than 20 years, 46(36%) of the respondents have lived in the study area for 11-20 years, 26(15.6%) of the respondents also have lived there for about 1-10 years.

## 4.8. Khat Cultivation Experience of the Farmers

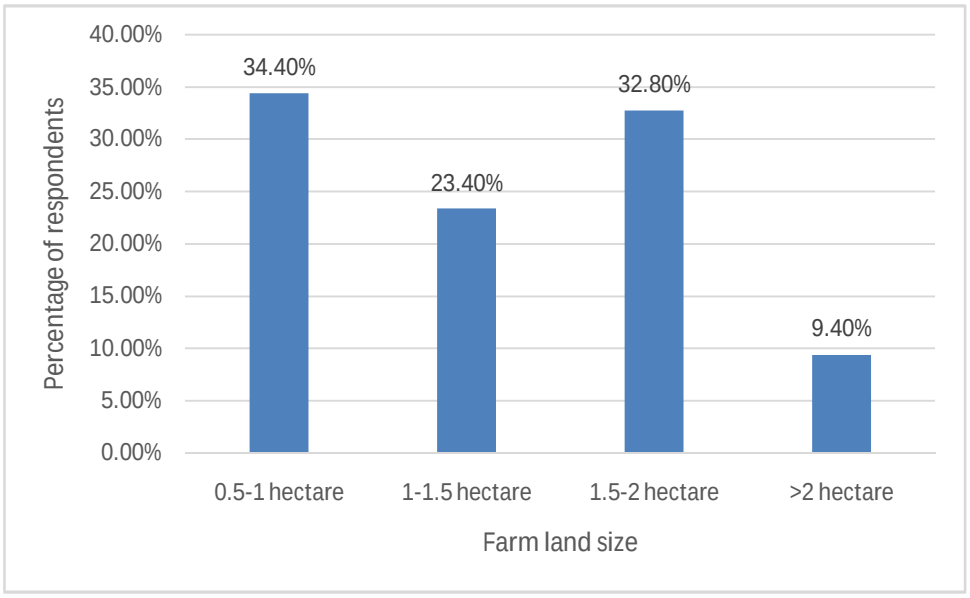


Figure 2 Size of farm land of respondents per hectare

Out of 128, 44(34.4%) of the respondents have 0.5-1 hectare of lands, 30(23.4%) of the respondents were with the land of 1-1.5 hectare, 42(32.8%) of the respondents have 1.5-2 hectare

and 12(9.4 %) 0f the respondents have land above 2 hectares. However the respondents have its own farm land and renting lands for khat cultivation most of them cultivate khat 0.5-1hecatre while the remaining farm lands are used for other crops. The smaller the amount of available land, the more complicated it becomes for farmers to maintain their customary diversified cropping regime. Under such conditions, farmers are forced to prioritize crops and intensify management to optimize benefits (Rahmato; 2009). Often, crops with a high cash return take centre stage and farmers become reliant on the cash to access food. Khat (*Catha edulis Forsk*) is just such a crop.

## 4.9. Khat cultivated land area

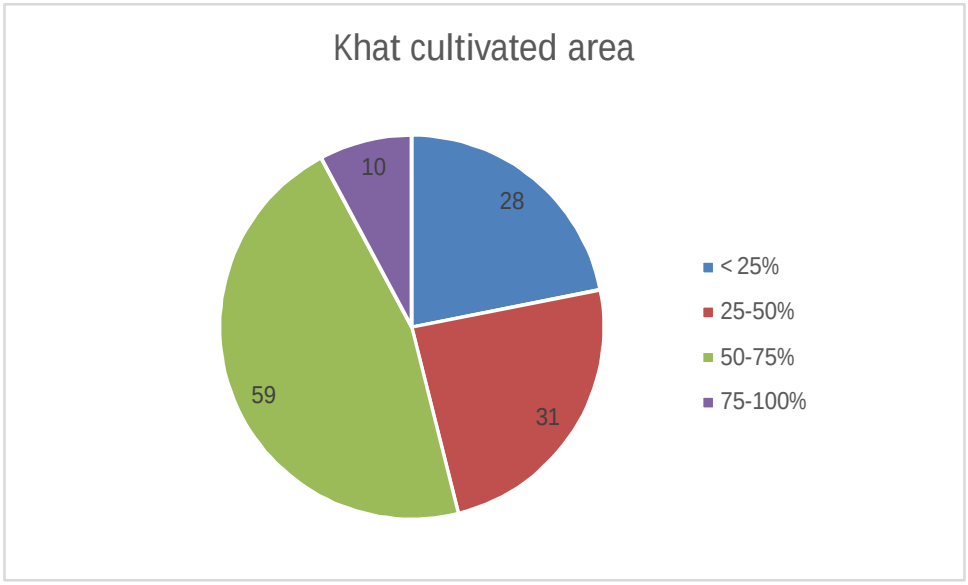


Figure.3. Khat cultivated land area

From the above outcome, in terms of area of land cultivated for khat with the percentage of the total land, 28 of the respondents have said less than 25% of the total land they do have. 59 of the respondents (70.3%) of the total population have cultivated khat within a range of 50-75 % of the total land they have. The rest 10 (7.8%) of the respondents have said that they cultivate chat about 75-100% of the total land. This is an implication that how large the society cultivates khat which is majority of the society. There is concern that in parts of Ethiopia, Kenya and Yemen farmers switch from growing food crops to khat, with potential implications for food security (EMCDDA, 2011; GermanAgroAction, 2009), although this phenomenon is disputed and others

suggest a positive role of khat production on local food security (Gebissa, 2010). Also, land conversion to khat production does not only come from food crops, but also coffee another naturally occurring plant stimulant to which khat has frequently been likened, and which requires more water in cultivation than khat (Cox and Rampes, 2003).

## 4.10. Years of khat cultivation experience of respondents

Table.8. Years of khat cultivation experience

| | N= no. of respondents | Percentage |
|---|---|---|
| Less than five years | 8 | 6.3 |
| 6- 10 years | 30 | 23.4 |
| 11-15 years | 64 | 50 |
| Above 16 years | 26 | 23.3 |

From the data taken from the respondents 6.3% have an experience with less than 5 years, 23.4% of the respondents were shown with the experience of 6 – 10 years, 50% of the respondents have an experience with 11-15 years and 20.3% were with the experience of above 16 years of khat cultivation in the study areas. The data presented above implies that most of the farmers (50%) have experienced in khat cultivation.

## 4.11. Trends of khat cultivation based on respondent reply in the study area

Table.9. Trends of khat cultivation

| Kebele | N= no. of farmers | Increases | Decreases | The same |
|---|---|---|---|---|
| Boze | 36 | 32 | 2 | 2 |
| Yeteker | 28 | 21 | 2 | 5 |
| Asano | 33 | 29 | 1 | 2 |
| Senena | 31 | 27 | - | 4 |
| Total | 128 | 109 | 5 | 13 |

The current finding showed that cultivation of khat crop increases from time to time. Out of 128 respondents 109(85%) noted increases their khat cultivation, 13(10%) of the respondents responded cultivation of khat were the same and only 5(5%) of the respondents respond the khat

cultivation were decrease. So according to ANOVA test association applied on the association between trends of khat cultivation of the farmers and the size of farm lands, since the (F=196.077, p-value = 0.0001) there is statistically significant association between them. Environmental damage associated with the global trade in khat includes the over exploitation of water resources in Yemen and deforestation in parts of Ethiopia (Odenwald et al., 2010b). In Yemen its cultivation is reported to consume 40% of the country's fresh water supply (Almas and Scholz, 2006)

## 4.12. Comparison of khat cultivation with other crops in terms of economic value

Table.10. Comparison of khat with other crops in terms of economic value

| crops | Frequency of harvest | Birr/0.1ha |
|---|---|---|
| Khat | 3 times a year | 4000 – 5000 birr |
| Enset | 2 times a year | 700-900 birr |
| Maize | 1 times per year | 400-500 birr |
| Sorghum | 1 times per year | 300-500 birr |

From this data shows that comparison of khat with other crops, it gives high economic values than other crops. Since it is very difficult to get exact information on prices it is possible to compare their income on is consider to profitable, khat gives a steady income two or three times in a year. The expansion of khat cultivation decreases the amount of Maize, Enset, Sorghum and other plants. In east Ethiopia it has been observed that khat is depleting the soil. (Adane, 2005). The increased a passing out of food crops and this can be seen as a threat to food security. Khat medley replacing the cultivation of trees which has been almost destroyed except a few trees between the thick vegetation of khat. Khat based economy with its important cash flow is affecting a wider range of on and off farm income possibilities compared to others crops. Khat is an ideal plant for the plants to push it to cultivate it further forward since enables stable cash.

## 4.13. Harvesting time of per year

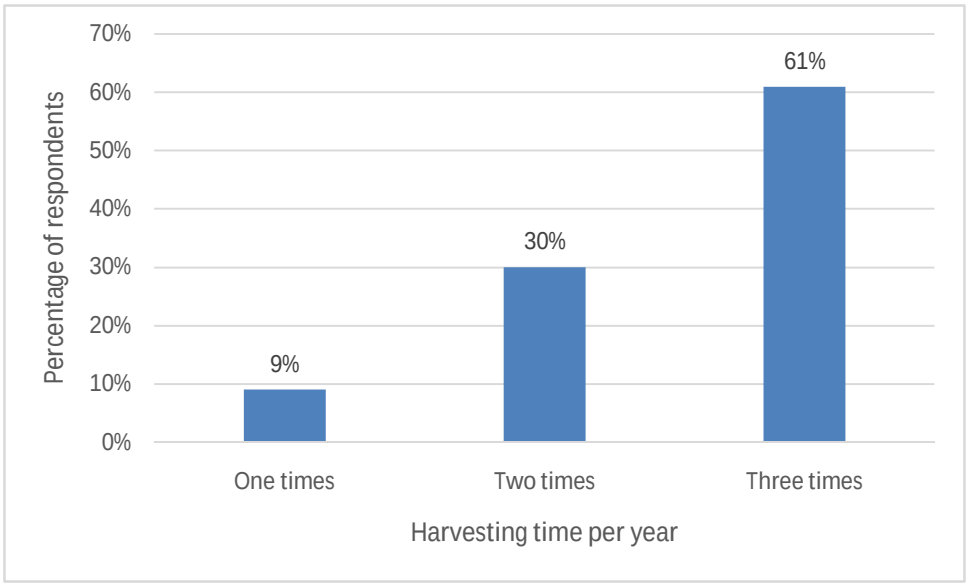


Figure.4. khat harvesting time of year

From the above data 9% 0f the respondents said that they harvest khat once a year, 30% of them said, they harvest two times per year and the remaining 61% of the respondents said they harvest three times per year. Because most of the farmers (that is 61%) harvest khat three times per year they need another source of water especially during the dry season. To solve this problem due to the scarcity of water in the area the farmer's could not only use irrigation but also they undergo deforestation to reduce computation for water. This indicates that khat has high consumption of water for harvesting of khat in the area. Khat with much water can grow too fast, become soft and high and collapse. This depends on the verities; some kinds of khat drop their leaves when they become heavy, (Driver, 2006). The irrigation system made the introduction and expansion of commercial agriculture possible (wolde, 2003). Farmers with access to irrigation have to face the challenge of harvests per year and the price they receive. Irrigation uses by the farmers to harvest khat during the dry season when the majority of the farmers cannot harvest. Khat with irrigation can be harvested 3 to 4 years and without irrigation can be harvested two times per year. Additionally, the farmers also cut trees and remove the forests in the near bye area so that they can expand their land for khat cultivation in the study area.

## 4.14. Expand farm of land for khat cultivation

Table.11. Expand farm land for khat cultivation

| village | Number of respondents | Forest declining | Changing lands of other crops | Intercropping with other crops |
|---|---|---|---|---|
| Boze | 36 | 30 | 4 | 2 |
| Yeteker | 28 | 23 | 4 | 1 |
| Asano | 33 | 28 | 3 | 2 |
| Senena | 31 | 26 | 2 | 3 |
| Total | 128 | 107 | 13 | 8 |

The survey result has shown that 107 of the respondents has increased their khat cultivation land by performing forest declining, which shows almost all of the respondents have experienced this action as a means of expanding agricultural area for khat cultivation. Forest declining has been highly experienced by the society in the study area of this research. Only 13 of the respondents have replied that they expanded their land by replacing other crops and the remaining 8 respondents noted that they expand by inter cropping with other crops.

Figure.5. Cultivated khat in the study area

## 4.15. Khat and Pesticides

According to UNICEF (2004), pesticide run-off from the fields growing Khat around Haromaya area is poisoning the lake's diminishing ecosystem which clearly shows the application of pesticides in the area. Similarly, Workshop report on information dissemination on the status of DDT use in the Ethiopian Rift Valley by Institute for Sustainable Development (ISD), (2009), reported that farmers in Zeway area also use DDT to grow their Khat. The result of the workshop strongly recommended integrated regulation and inspection of the issue is needed which otherwise leads to great problems in the future.

Table.12. Comparison of crops that attacked by pesticides

| Village | Number of respondents | Khat | Enset | maize | Sorghum |
|---|---|---|---|---|---|
| Boze | 36 | 26 | 4 | 5 | 1 |
| Yeteker | 28 | 18 | 2 | 3 | 3 |
| Asano | 33 | 24 | 3 | 2 | 4 |
| Senena | 31 | 23 | 2 | 3 | 3 |
| Total | 128 | 91 | 11 | 13 | 11 |

The data in the above table shows most of the respondents, 91(72%) noted that khat were attacked by pests, next to khat, maize 13(10%) were attacked, 11(9%) of the respondents responded sorghum and Enset were attacked. Pests and other constraints Khat is subject to a wide range of insect pests, diseases, weeds and animals that damage its leaves, newly growing shoots, stems and roots. At worst, the result could be a total destruction of the plant but mostly the damage is to the quality of the harvested material, which affects the economic gains from the crop. In most cases, traditional pest control practices like hand picking, spraying a solution of hyena faeces, botanical or plant origin solutions such as an infusion of crushed garlic, tobacco and soap are commonly used. Nevertheless, the occurrence and severity of pest damage has increased and therefore synthetic insecticides are becoming increasingly common. (Dechassa, 2001).

## 4.16. Protect a pest that attacks khat

Table.13. pesticides uses for khat protection

| Village | Number of respondents | Chemicals | Local materials |
|---|---|---|---|
| Boze | 36 | 28 | 8 |
| Yeteker | 28 | 25 | 3 |
| Asano | 33 | 27 | 6 |
| Senena | 31 | 28 | 4 |
| Total | 128 | 107 | 21 |

The study in the above table shows, 107(84%) of the respondents uses different chemicals to prevent pests which attack khat, 21(16%) of the respondents uses local materials to prevent their khat from pests. Most farmers uses chemicals like DDT and other effective chemicals to prevent damage of khat by pests but as data taken from the respondents it has its own contribution for ecological and health impact. Studies conducted on the exposure of animals shows that eating food with large amounts of DDT over a short time, mostly affects the nervous system (UNEP, 2003). Tests in laboratory animals confirm the effect of DDT on the nervous system. Animal studies show that long term exposure to DDT may affect the liver. There is a problem with worms on the khat and Malathione is used to kill them. A second purpose of using pesticides is to increase the growth of the khat so that it can be harvested earlier. For this DDT is most commonly used soon after harvesting if there is no rain.

## 4.17. Fertilizers used for crops

Table.14. Fertilizers used in crops

| Crop | No. of respondents | Percent |
|---|---|---|
| Maize | 16 | 12.5 |
| Khat | 110 | 86 |
| Sorghum | 2 | 1.5 |
| Enset | 0 | 0 |

From the above table 86% of the respondents responded that they use more fertilizers for growing khat, because of its high cultivation area, they provide most of the fertilizers to this crop and there is few or no fertilizers for other crops. So due to the scarcity of fertilizers, the diversity of other crops in the area is limited.

## 4.18. Forest declining to expand cultivation of khat

Table.15. Forest declining to expand cultivation of khat

| Village | Number of respondents | Strongly agree | Agree | Strongly disagree | Disagree |
|---|---|---|---|---|---|
| Boze | 36 | 22 | 12 | 1 | 1 |
| Yeteker | 28 | 13 | 8 | 2 | 5 |
| Asano | 33 | 18 | 8 | 3 | 4 |
| Senena | 31 | 15 | 11 | 1 | 4 |
| total | 128 | 68 | 39 | 7 | 14 |

The in the above table show that 68(53%) of the respondents responded that they strongly agree increases their khat cultivation was by making forest declining, while 39(31%) of the respondents were responded that they agree the process of forest declining, 7(6%) were strongly disagree by the forest declining process of expand khat cultivation and 14(11%) of the respondents disagree. Monocrop management can have negative implications for the agro-biodiversity of the agricultural landscapes of the khat growing regions. With regard to soil, both negative and positive implications are reported. The permanency of khat bushes and accompanying soil conservation structures positively impact the soil, but the constant and frequent mining of soil nutrients by the leaves harvested can be negative.

# 5. CONCLUSION AND RECOMMENDATION

As described above the general objective of this thesis is to assess the ecological impact of khat cultivation in Silti woreda in four selected kebeles and this study shows that khat cultivation has increased from time to time and has a wide ecological effect. This research has come up with some relevant findings which are an indicative of the actual phenomenon of the area under study concerned with the ecological impact as a result of khat cultivation. The data analyzed from this research be concluded here under and recommendations are forwarded both for the society so that the ecological impact can be reduced.

## 5.1 Conclusion

The ecological impact in Silti woreda due to expansion of khat cultivation area is highly intensive that there are many aspects through which it brings people in the area to act towards forest decline. Khat cultivation had been known that it is the main income source in the society. Thus the society in one or the other way they primarily tend to get land for khat cultivation.
Land owners expand their land so that they can grow khat. Forest decline intensity is practiced in Silti woreda due to the need for additional land. Forest decline is not only for land expansion but also the khat cultivators cut big trees in the area they cultivate khat. This is to reduce the water absorption of these big trees in the dry season. As khat expansion increases water being highly needed in the dry season, so there is a need to cut the big trees which has resulted forest decline and left the area without other crops and plants. Khat with irrigation can be harvested 2 to 3 years and without irrigation can be harvested two times per year. Additionally, the farmers also cut trees and remove the forests in the near bye area so that they can expand their land for khat cultivation in the study area.

The other ecological impact of khat cultivation is that the farmers who grow khat use different chemicals for the production process. These chemicals were found to be harmful to the land on which it has been used. The soil becomes acidic and the natural fertility of the soil would be reduced.

## 5.2 Recommendation

Based on the results of this research, the following recommendations can be forwarded:

- Khat cultivation on a large cover of land created a monoculture of vegetation and affects any other plants. Therefore, alternative intercropping method should be created with indigenous plants.
- The concerning bodies should work hard to increases the awareness of the local people towards the negative impact of monoculture
- The local environmental authority need has to interfere in the area and record the indigenous trees not to be cut for khat cultivation.
- More awareness and training about protective measures concerning pesticides that uses for khat were important for framers
- The attitude of the society need to be changed towards crop production and rather than khat cultivation so that the impact can be reduced.
- Awareness about the impact of expansion of khat cultivation has to be introduced by the woreda stake holders.
- Further investigation must be conducted to identify alternative crops that give high economic values

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## Appendixes; Questionnaires for farmers

The purpose of these questionnaires is to gather primary data in order to assess ecological impact of khat cultivation in kebeles of Silti woreda. The researcher is grateful for your cooperation and assures you that all the information gathered will be kept confidential if necessary you do not need to write your name on the questionnaire and since the data is processed and analyzed in aggregation your individual answer cannot be separately identified. Your cooperation in giving genuine and frank answers in the questionnaires is highly crucial to obtain relevant and reliable information for the success of this study. Thank you for your cooperation.

Part I

1 Gender A. male B. Female

2. Age A. 20-30 Year B. 31- 40 C. 41-50 D. 51-60 E. >60 year

3. Marital status A. married B. single C. separated D. divorced

4. Educational back ground A. illiterate B. 1-$6^{th}$ C. 7 – $12^{th}$ D. colleague E. others

5. Religion A. Muslim B. Orthodox C. protestant D. other

Part II Socio economic status

6. How large is your family size A. 1-3 B. 4 - 6 C. 7-9 D. 10 and above

7. How many hectares of land do you have cultivated khat?

A. 0.5 – 1 hectare B. 1 – 1.5 hectare C. 1.5 – 2 hectare D. 2 – 2.5 hectare E. 2.5 and above

8. Do you have your own khat cultivated land?

A. Yes B. No

9. If your answer for question 8 is yes how many hectares do you have?

A. 1/$4^{th}$ hectares B. 2/$4^{th}$ hectares C. 3/$4^{th}$ hectares D. 1 and above

10. For how long time of growing khat after you are cultivated?

A. 1 year B. 2Year C. 3years D. 5 years and above

11. For how long do you cultivate khat?

A. <3 year B. 3-6 year C. 6 – 10 year D. 6 – 10 year E. 11 and above

12. How do you see the trends of khat cultivation?

A. increase B. decrease C. the same

13. Comparison of khat with other crops in terms of economy

| crops | Frequency of harvest | Birr/0.1ha |
|---|---|---|
| Khat | | |
| Enset | | |
| Maize | | |
| Sorghum | | |

14. How many times do you cultivate khat in last production per year?

A. 1 times B. 2 times C. 3 times D. 4 times

15. How do you expand your farm land for khat cultivation?

A forest declining B. changing lands of other crops C. intercropping

16. Which type of crops does affects by pests?

A khat B. Enset C. maize D. sorghum

17. What types of solution do you use to protect khat from pests?

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18. For what types of crop do you use more fertilizers?

A. Maize B. khat C. Enset D. Sorghum

19. Does forest declining happened in your area?

A. Strongly agree B. agree C. strongly disagree D. disagree