Jimma University

College of Natural Sciences

School of Graduate Studies

Department of Biology (Ecological and Systematic Zoology Stream)

Assessment of Beekeeping Management and Constraints in Termaber and Basonawerena Districts, North Showa Zone, Ethiopia

By: Abadi Berhe

A Thesis Submitted to Department of Biology, College of Natural sciences, School of Graduate Studies, Jimma University, in Partial Fulfillment for the Requirement for the Degree of Master of Science in Biology (Ecological and Systematic Zoology)

February, 2013

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Advisors: Delenasaw Yewhalaw (PhD)

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Dedication

This M.Sc. thesis work is dedicated to my lovely mother w/ro Tekay Hadush Tsegay and my daughter Bitania Abadi with best fever to my wife Nigsti kiros.

Statement of the Author

I declare that this thesis is my original work and all sources of materials used for this thesis have been duly acknowledged. This thesis has been submitted to the department of Biology, School of graduate studies, Jimma University in partial fulfillment for the requirement of masters of science degree in Biology (Ecological and Systematic Zoology) and put at the study districts documentation space and university library to be made available to borrowers under the rules of library.

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Name: Abadi Berhe Signature_____

Place: Jimma, Ethiopia

Date of Submission_____

Biographical Sketch

The author was born at Melbe village, Adigudem district, south Tigray zone, on June 15, 1978. He attended his elementary at Melbe elementary school and high school and preparatory in Atsey Yohanns secondary school in Mekelle capital city of Tigray and completed in 1998 E.C. and then join to Mekelle university completed university education was in 2001E.C. in college natural and computational science department of Biology.

After graduation he was employed by minister of education in September, 2002 E.C. in Debre Birhan University as graduate assistance one (I). He served for two years in teaching profession and also attended master of degree in Biology (Ecological and Systematic Zoology) in Jimma University for two years.

List of Acronyms

AONSSW	Agriculture Office of Semen Shewa
BC	Before Christ
BOA	Bureau of Agriculture
BGR	Benishangul Gumuz Region
BSCIC	Bangladesh Small Cottage Industries Corporation
BWDAO	Basona Werena District Agriculture Office
CSA	Central Statistical Authority
EARO	Ethiopian Agricultural Research Organization
ESAP	Ethiopian Society of Animal Production
ESAT	Ethiopian Society for Appropriate Technology
EU	European Union
FAO	Food and Agricultural Organization
FGD	Focus Group Discussions
GDP	Gross Domestic Product
HBRC	Holota Bee Research Center
HMF	Hydroxymethylfurfuraldhyd
IDE	International Development Enterprises
KTBH	Kenya Top Bar Hive
MASL	Meter above Sea Level
Mm	Millimeter
MoARD	Ministry of Agricultural and Rural Development
NGOs	Non Governmental Organizations
OARD	Office of Agriculture and Rural Development
PA	Peasant Associations
SNNP	South Nation Nationality Region
SPSS	Statistical Package for Social Sciences
TBDAO	Termaber District Agriculture Office
TTBH	Tanzania Top Bar Hive
USA	United State of America

Abstract

This study was conducted in Termaber and Basonawerena districts, North Showa Zone, Amhara National Regional State, Ethiopia with the primary objective of assessing beekeeping management and constraints in these study areas. Personal observation and informal discussion were used to identify the study districts. Two districts and four kebeles from each district were purposively selected for this study. Sample size for this study was calculated to be 384 and Simple random sampling technique was employed to select the respondents among the beekeepers. Key informants were selected by purposive sampling technique. Observations, semi-structured questionnaire, in-depth interview and focus group discussions (FGDs) were employed to gather relevant and pertinent data from study participants. X^2 *(chi-square) test was used to determine association between categorical variables. Descriptive statistics was employed to present frequencies and proportions. Three beekeeping management namely, traditional, transitional and modern beekeeping were documented in the study area. Traditional beekeeping management was the most predominant (86%) practice in both districts. Type and level of technology application were used to identify the beekeeping management systems in the area. There was significant difference* ($P < 0.05$) *in beekeeping management activities between Termaber and Basonawerena districts. Even though honey production was increased, the trends of transfer of traditional beekeeping to either transitional or modern beekeeping management practice showed a decline. Lack of skilled manpower, lack of awareness, low level of technology used, absconding, impact of chemical pesticides, pests and predators, poor quality of honey harvesting and shortage of modern bee hives were some of the reported constraints in the study area. Training and capacity building on hive management, colony feeding, honey harvesting and access to market and credit accessibility are recommended to improve honey production in the study area. From this study it can be concluded that beekeeping creates job opportunity for landless men and women for their livelihood and needs low capital*

Key words: Beekeeping, Honey production, Constraints of beekeeping, Management of beekeeping, Ethiopia

1. Introduction

Beekeeping is an activity in which man keep honeybees and acquires their products (Alexandria, 2004; Gidey *et al.,* 2011). It is the art of caring for, management, nursing and manipulating colonies of honeybees, in order to collect and store a quantity of honey (BSCIC, 2010). Beekeeping is the honey bee colonies maintenance commonly in bee hives (BSCIC, 2010). A beekeeper takes care of bees in an apiary site in order to collect their honey and beeswax, or to produce bees for sale to other beekeepers. Beekeeping provides nutritional and ecological security for both rural and urban communities at the household level beyond contribute to economic of the country (Lepetu *et al.,* 2009; Meaza, 2010). It does not compete with other resource demanding components of farming systems. It has a low cost, sustainable undertaking with a low environmental impact (Meaza, 2010).

Beekeeping is a very long-standing and deep-rooted household activity for rural societies in Ethiopia that stretches back in to thousands of years of the country's early history. It seems as old as the history of the country and it is essential activities of the community (Adebabay *et al.,* 2008). Yet there is no well-documented evidence that indicates when and where beekeeping practice started in Ethiopia. However, according to Giday and Kibrom (2010) beekeeping had started in the country between 3500-3000 B.C. In Ethiopia, beekeeping is an integral part of the life style of the farming communities and except for a few extreme areas; it is a common practice in every place where human kind has settled. It is an important activity for many rural people; both men and women carried out in home gardens in all parts of the country (Giday and Kibrom, 2010).

Adequate forage availability coupled with favorable and diversified agro-climatic conditions of Ethiopia creates environmental conditions conducive for the growth of over 7000 species of flowering plants which have supported the existence of large number of bee colonies in the country (Beyene and David, 2007). Ethiopia's wide climatic and geographical variability have endowed this country with diverse and unique flowering plants, thus making it highly suitable for sustaining a large number of bee colonies and the long-established practice of beekeeping.

In Ethiopia only honey and beeswax are produced. Other high value bee products like propolis, pollen grain, royal jelly, bee venom and others have not been started to be exploited. Despite the suitability of the country for beekeeping and long period of introduction of

improved beekeeping to the country, its expansion was very low and its contribution in honey production and the number of beekeepers participated are very minimum (Abiyu, 2011).

Based on the level of technological advancement, three types of beehives are used for beekeeping practices in Ethiopia. These are traditional, transitional and modern hives (Beyene and David, 2007). According to Amsalu *et al.* (2004) beekeeping that farmers practice in Ethiopia is predominantly traditional. The activity is successfully be adopted by all level of people such as men, women and youth in many parts of the continent and allows for a degree of risk avoidance that enables rural farmers to survive in times of economic crisis (Debissa, 2006).

Regardless, of the long traditional beekeeping practice in Ethiopia having the highest bee density and being the leading honey producer as well as one of the largest beeswax exporters in Africa, the share of the sub-sector in the gross domestic production has never been proportionate with huge numbers of honey bee colonies and the country's potential for beekeeping. Production has been low, leading to low utilization of hive products domestically and relatively low export earnings. Thus, the beekeepers in particular and the country in general are not advantageous from the sub-sector (Tessega, 2009).

Despite its potential of honey production, Ethiopia as one of the sub-tropical countries has been exposed to different constraints such as diseases, pest and predators, droughts, deforestation, chemicals pesticides that underestimated its contribution (Desalegn, 2001). Moreover, lack of knowledge, shortage of trained manpower and equipments, inadequate research and extension service has been well described to reduce the apiculture sub-sector production (Desalegn, 2001; SOS-Sahel, 2006; Kerealem *et al.,* 2011). Termaber and Basonawerena in north Showa zone are not exceptions to the above facts. The districts are covered with natural vegetations, shrubs and man-made forest, annual and perennial crops. Moreover, it has adequate water resources and large bee colonies which create conducive environment for beekeeping.

However, no systematic study has been conducted in the area regarding the beekeeping management and constraints. Therefore, the aim of this study was to assess beekeeping management and constraints in the study area.

1.1. Statement of the problem

In Ethiopia increasing human population pressures and consequent clearing of natural vegetation, intensive cultivation and overgrazing are continuous threat of the natural resource, honey bee colonies and development of beekeeping sub-sector. As a result, it has become a serious challenge in beekeeping management and honey production (Nuru, 2007).

Frequent droughts, environmental degradation and poor awareness are reducing apiculture product (Girma, 1998). Honey is harvested at the time when beekeepers expected that honey is ready for harvest without checking whether the honey is ripened or not (Mammo, 1973; Tesfaye, K. and Tesfaye, L. 2007). These problems are results from inadequate beekeeping management and poor traditional honey harvesting techniques.

Even though long period of introduction of improved beekeeping technologies to the country, the numbers of beekeepers involved in improved beekeeping are very low. This is because of inadequate demonstration of improved beekeeping and unable to convince them due to incomplete package distribution, absence of alternative technology, inadequate training, lack of matched management practices and skills gaps which lead the average annual honey yield per colony to be relatively low (Nuru, 2007).

The study area is endowed with natural resources such as natural vegetation, water, suitable climatic conditions which create favorable conditions to undertake beekeeping activities and make the study area one of the potential for apiculture sub-sector. No systematic study has been undertaken to assess bee keeping management and constraints in the study area.

Hence during this study the following research questions were designed:

- What is the existing beekeeping management in the study area?
- What is the trend of beekeeping and honey production in the study area?
- What are the beekeeping opportunity and honey forage source in the study area?
- What are the main constraints that affect beekeeping in the study area?

1.2. Objectives

1.2.1. General objective

- The general objective of the study was to assess beekeeping management and constraints in Termaber and Basona Werana districts, North Showa Zone, Ethiopia.

1.2.2. Specific objectives

- To identify beekeeping managements in the study area
- To assess the trend of beekeeping and honey production in the study area
- To document the beekeeping opportunity and honey bee forage source
- To identify the major beekeeping constraints in the study area

1.3. Significant of the study

The study area is one of the potential areas for honey production and other beekeeping products. However, beekeeping activities are still at low level in the study area which leads the local beekeepers not to benefit from it in particular and decrease its role in the national economy in general. Therefore, the research assesses beekeeping management and constraints that contributed beekeeping activities in the study area and recommends solution to enhance the beekeeping activities to increase its role in the livelihood of the local community in particular and for the national economy in general.

This study also would provide valuable information on the bee keeping management and constraints to develop strategy to improve beekeeping production and reduce constraints related to beekeeping management. Governmental and non-governmental organizations working on beekeeping activities in the study area and other neighboring districts can utilize the research findings and recommendations. Furthermore, the findings can be used as an input by researchers who are interested in conducting further research in the study area.

1.4. Hypothesis

There is no difference with respect to beekeeping management and constraints in Termaber and Basona Werana district, North Shewa, Ethiopia.

1.5. Scope and limitations of the study

The study focused on the potential areas of beekeeping management and constraints in two districts of Amhara region, North Shewa zone. Because of time and budget constraints the study has the following limitations: Not all the beekeeping potential districts were assessed and not all the beekeepers were exhaustively interviewed. The study was limited to only two Districts and eight kebeles.

1.6. Organization of the study

The first part deals with the introduction, statement of the problems, objectives and significance of the study, hypothesis, scope and limitation of the study. The second part includes of the literature review. Materials and Methods are described in the third part of the paper. The fourth part deals with the results and discussion. Conclusion and recommendations are presented in the final part of the document.

2. Literature Review

2.1. Development of beekeeping

Beekeeping, which is today practiced over a greater area of the earth's surface than perhaps any other single branch of agriculture, passed through different stages of development: honey hunting, traditional (forest and backyard) and improved (movable-frame and movable top-bar) methods of bee keeping. It is likely that man hunted for wild nests of bees and looked for their honey during the whole of his existence. Early man probably took honey from bees' nests wherever he found them, and the collection of honey from wild nests continued except in some regions where it has been entirely superseded by beekeeping (Crane, 1990). There are many references to honey in ancient records and literature, but most of them gave no clue as to whether the honey was obtained by honey hunting or beekeeping. Wherever writing was known, honey was mentioned so many times in the Holy book of the people, and it often held a place of honor in their rights (FAO, 1986).

Beekeeping properly started when man learned to safeguard the future of the colonies of bees he found in hollow tree trunks, rock crevices or elsewhere, by a certain amount of care and supervision (Crane, 1976). Crane (1990) reported that by 2500 BC, before forest beekeeping is known to have existed, fully fledged beekeeping was being practiced in ancient Egypt and the earliest written records that relate to the keeping of bees in hives are from about 1500 BC. Generally, the earliest known evidence of beekeeping has been found in the Africa continent (Crane, 1990).The pattern of modern beekeeping was thus established between 1850 and 1900 AD (Crane, 1976).

2.2. World beekeeping development

Today, 65 million honey bee colonies exist in the world and these produce an estimated 1.5 million tons of honey each year (FAO, 2009). There are an estimated 15 million hives in Europe, the greatest number is to be found in Spain (2.46 million), followed by Greece (1.5 million). France, Italy, Poland and Romania each have more than a million hives. Since 1965 the number of bee colonies maintained by beekeepers in Central and Western Europe has been declining. However, in Southern Europe (especially Greece, Italy and Portugal) the number of colonies showed an increase between 1965 and 2005. The overall trend for Europe has been a decline in the number of beekeepers (ECPA, 2011) due to Pollinators and Agriculture. While managed colonies decreased in some parts of the world (Europe, North

America and Japan), increases occurred in Asia, Africa, South America and Australia (ECPA, 2011). A reduction or increase in the number of colonies in some areas is often simply linked to the number of beekeepers, yet there are many factors that can seriously impact honeybees (Figure 1).

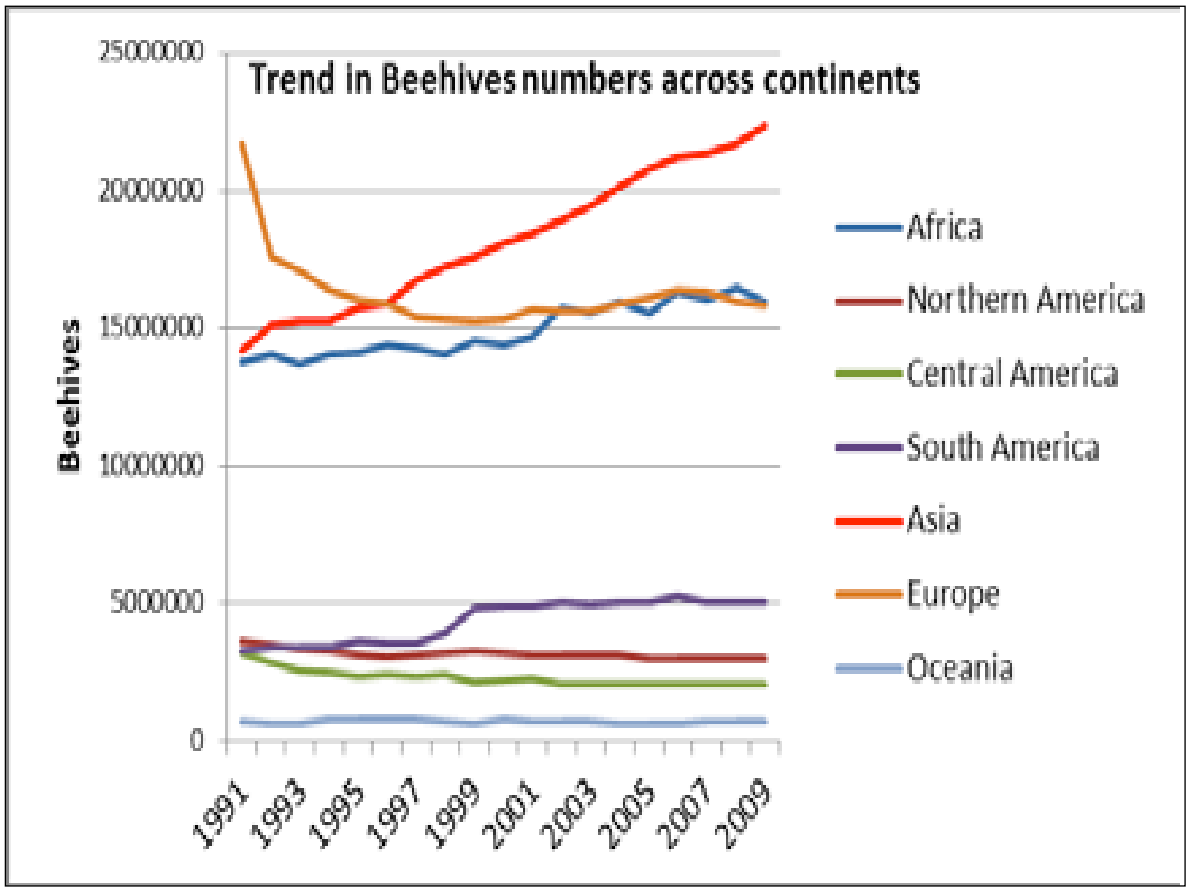

Figure 1: Trends of beehive number in the world

(Source Carpi, 2011)

2.3. Beekeeping in Africa

Beekeeping may be considered sustainable only when examined from ecological, social and economic perspectives. Practised well, tropical African beekeeping is sustainable for both the individual colony and the whole honey bee population. In tropical, sub-Saharan Africa, beekeeping methods have remained unchanged and represent an enduring example of sustainable apiculture. These beekeeping systems are typically extensive, as opposed to the intensive practices of conventional, 'global' beekeeping (Bogdanov, 2010).

Beekeepers in tropical Africa regard their production base to be the whole population of honey bees within their local area, in contrast to intensive beekeepers whose focus is at the individual colony level. Labour is invested in making many no-cost or low-cost hives and spreading them far apart in natural forest areas. The outcome is that tropical, sub-Saharan Africa remains the last place where intact, indigenous populations of *Apis mellifera* thrive and are free from the deleterious effects of imported pests and diseases, and where the forces of natural selection allow the persistence of well adapted populations both in the wild and within the ownership of beekeepers (Bogdanov, 2010).

In Nigeria and Tanzania beekeeping is a useful means of strengthening livelihoods and has been identified as a viable agriculture practice that could alleviate poverty and sustain rural employment (Messely, 2007). It is recognized that the beekeeping sector holds potential for creating sustainable incomes for Africa's rural beekeepers. But this potential is hardly tapped because these producers do not have access to infrastructure and organizational systems to allow them to reach the niche/specialty markets of their products (Messely, 2007).

African honey is harvested by smallholder farmers, many of whom are the poorest in society. Selling bee products can provide a feasible way out of their poverty. Beekeeping is the ultimate environmentally sustainable activity. The indigenous species of honey bees contribute to biodiversity through pollination and provide economic incentive for rural African people to conserve natural forests, which provide an abundance of excellent bee forage.

A study from Tanzania shows beekeeping activities involved both genders at different stages of honey and beeswax processing and marketing. Traditionally, men are responsible for honey harvesting which is normally carried out at night because they are scared of honey bees during the day. In Milola and Kinyope villages in Tanzania, division of labor was evident. While men specialize in the construction of hives and honey harvesting, women are involved in carrying unprocessed honey home from the forest. The dominance of men in beekeeping activities in the Milola and Kinyope villages seemed to have downplayed the role and contribution women have made with respect to managing bee reserves and habitats, harvesting of crude honey, and the processing of bee products (Lalika and Machangu, 2008).

Smallholder beekeepers in Tanzania have rich indigenous knowledge of beekeeping. They also have good knowledge of different types of hives, bee smokers and honey containers. In

terms of hive types, it was found that most smallholder beekeepers use local style gourd hives. The reason is that they are cheaper than other types of hive and are locally available (Lalika and Machangu, 2008). This indigenous knowledge enables smallholders to carry out beekeeping activities at minimal cost, as it does not need heavy investment in terms of financial and human capital, for equipment and extensions. East African nations export tremendous quantities of wax. Ethiopia and Tanzania produce about2.5% and 1.15% of total world honey production, respectively. Keeping bees in beehives as practiced in Egypt, Kenya, Tanzania, is not well known in other part of Africa (Hussien, 2000).

2.4. Beekeeping in Ethiopia

Ethiopia is endowed with various climatic conditions, topography and a wide range of altitudes favoring the presence of different natural vegetation that includes dense forests, bushes, herbs, weeds and undergrowths. These different types of natural vegetation have made the country the best home for honeybees. In the area where there are various kinds of honeybee plants, better honey yield is certain than the area with poor natural vegetation (Amssalu, 2000). According to Mathewos *et al*. (2004), there are 6,000 to 7,000 plants species that have been identified to exist in the country, out of which some are endemic. These plant species are able to support a large honeybee population. Some of these plant species are found predominantly in south and south-west part of the country. In these areas beekeepers can obtain better yield of honey, beeswax and other hive products (Amssalu, 2000).

Beekeeping is the principal source of food and foreign exchange earnings from honey and beeswax (Ayers, 1992). Beekeeping is an inherited tradition in Ethiopia and estimated 1 in 10 smallholders keep bees (MoARD, 2007). Owing to its varied ecological and climatic conditions, the country is home to some of the most diverse flora and fauna in Africa, making it highly suitable for sustaining a large number of bee colonies (Nuru, 2007). The country has the largest bee population in Africa with over 10 million bee colonies, out of which about 7.5 million are confined in hives and the remaining exist in the forest (Nuru, 2007). Ethiopia is the principal honey and beeswax producers worldwide and the regional leader in Eastern Africa in bee product business development due to its highest number of bee colonies and surplus honey flora. In terms of volumes of honey and beeswax harvested and traded, Ethiopia exceeds other countries in Africa by far (MoARD, 2007).

Beekeeping is environmentally sustainable activity that can be integrated with agricultural practices like crop production, horticultural crops and conservation of natural resources (Amssalu, 2004). The exact number of people engaged in the beekeeping sub-sector in Ethiopia is not well known. However, it is estimated that around one million farm households are involved in beekeeping business using the traditional, intermediate and modern hives (Beyene and David, 2007). It is the leader in both bee populations in Africa and in bee product business development. In addition, it far exceeds other African countries in terms of volumes of honey and beeswax harvested and traded, and levels of investment in the formal sector (Beyene and David, 2007).

Beekeeping in Ethiopia is undertaken by the young and old, men and women; it is a gender inclusive activity (Lepetu *et al*., 2009). It is grouped into high, medium and low potential areas. Many of the districts in Tigray, Wollo and Hararege and in some other parts of the country which are covered with marginal forests do have relatively low potential in honey production (Beyene and David, 2007). The principal resource base for beekeeping has, however, become seriously degraded in the course of time. The potential of the Ethiopian landscape for honey and wax production does now, undoubtedly, only constitute a small fraction of its former wealth. Moreover, the destruction of the remaining resource-base can be observed going on at a steadily accelerating pace (Girma, 1998).

Although the annual production of both honey and wax in Ethiopia is large compared to other African countries, the system of production commonly exercised in the country is traditional (Beyene and David, 2007).The huge amount of harvested honey, about 80% of the honey produced in the country, is used for the preparation of the favorite national drink called Tej (Hartmann, 2004). In south and south west parts of the country where there is high vegetation cover and high honey bee population density, apiculture production is a very important activity for the development of the region in general and the rural households in particular (Nuru, 2007).

Based on the level of technological advancement three types of beehives are used for beekeeping in Ethiopia. These are traditional, transitional and frame hives. The traditional beekeeping accounts for more than 95 percent of the honey and beeswax produced in the country (Beyene and David, 2007). Beekeeping is practiced as tradition, which means that most of the farmers in rural areas have traditional hives. As a result, about 4,688,278 beehives are estimated to be found in the rural sedentary areas of Ethiopia, of which,

4,580,303 (97.7%) are traditional hives, 29,421 (0.63%) transitional hive and 78,554 (1.68%) modern beehives (CSA, 2008). Ethiopia produces 42,180,346kg of honey per year, of which 40,075,363kg, 467,187kg, and 1,637,796kg are from traditional, transitional and modern hives, respectively (CSA, 2008).This makes the country rank first in Africa and tenth in the world (EARO,2000; MoARD, 2007).

2.4. 1. Traditional Beekeeping

In Ethiopia, traditional beekeeping is the oldest and the richest practice, which has been carried out by the people for thousands of years (SOS–Sahel, 2006). Several million bee colonies are managed with the same old traditional beekeeping methods in almost all parts of the country. Traditional beekeeping in Ethiopia is categorized in two parts, namely forest beekeeping and backyard beekeeping (Mammo, 1973; Fichtl and Admasu, 1994).

Materials, from which bee hives are made in Ethiopia, are traditionally variants of basic design found throughout the country (Tessega, 2009). Such as Hollowed logs, bark hive, bamboo or reed grass hive, mud (clay) hive, animal dung (mixed with ash) hive, woven straw hive, gourd hive, earthen pot hive. The beekeepers that are experienced and skilful in using these hives could do many operations with less facility. This is rich old traditional knowledge passed from generation to generation and use for bees keeping (Tessega, 2009).

Traditional hives are mainly engaged in multiplying honeybee colonies and providing them to beekeepers engaged in improved beekeeping management. The current price of a honeybee colony is about ETB 550. Currently, beekeeping extension is trying to promote both improved and traditional beekeeping practices. It follows a package approach including provision of credit. They provide training on bee management, hive product and colony multiplication. FAO (1990) documented that for most men and women beekeeper farmers the major sources of knowledge and skills was parents and their previous experience. Very few availed trainings organized by World Vision, FAO and Office of ARD. However, the extension workers in the district, especially the DAs, are not familiar with the practical skills or knowledge required to be able to advise the farmers.

The forests in which the beehives are hanged up are usually near or far from the homesteads. Besides the honey bee flora, which can be found here, the advantage of this is, that the main enemy, the red ant, which is mainly located near the houses, does not occur here, moreover it protects the farmer's families from stings. From the viewpoint of

resource management and biodiversity protection, the most important impact of traditional beekeeping is that it connects the farmers' economies with the preservation of these trees that these trees are forest trees far from the villages and therefore this system guarantees the preservation of wide forest areas. A further advantage of the traditional beekeeping is the high labour efficiency. Except for fixing of the beehives in the trees and the removal of the honey no other work is conducted, as the only necessary investment is a knife to cut the honey (Admasu, 1994).

Nevertheless, the traditional beekeeping has so many disadvantages that probably it will not be possible to maintain it on the long run. Beside the low productivity per hive the main problem is, that during honey harvest by knife brood and larvae are damaged , so that the reproduction rate gets diminished, which might be the main cause of a currently tremendous decline of the bees population, beside ecosystem fragmentation. Beekeepers try to cope with the declining bee population, and thus declining honey production, by hanging up more and more bee hives. However, a high number of bee hives in the trees does not increase yields. Even where more than 100 beehives are hanged in the trees, only 30 – 40% is settled. Many of the beehives in the forests are useless. Instead this coping technique leads to more and more consumption of resources, as for manufacturing traditional beehives, wood or bamboo is necessary, which means that these newly developed techniques of coping with the newly developing decline of the beekeeping population in a traditional way leads to higher consumption of the resources of the forest without additional returns (Alexandria, 2004).

2.4.2. Transitional Beekeeping

It is a type of beekeeping intermediate between traditional and modern beekeeping methods. It is one of improved methods of beekeeping practices. The types of hives are Kenya Top Bar Hive (KTBH) and Tanzania Top Bar Hive (TTBH). Generally, top-bar hive is a single story long box with slopping sidewalls inward toward the bottom and covered with bars of fixed width (Nicola, 2002). Adjare (1990) suggested that for technical and economic reasons, most African countries are not yet in the position to use movable- frame hives, and for them top-bar hive represents a satisfactory compromise.

Top-bar hive in an ideal condition can yield about 50 kg of honey per year (Gezahegne, 2001). However, at zonal level (North Wello) it has been reported that production of 24-26

kilograms crude honey per hive per year and about 10% as much beeswax per kilogram of honey is likely to be obtained (SOS-Sahel, 1999).

Based on this the advancement of transitional hive on traditional hive is: better honey yield than traditional hive, better quality honey, easy to construct using hand tools, allows to use wide range of materials, environmentally friendly, can be used for simple colony multiplication, can be done by women and persons with disability, such hive can serve as one technological options for low income groups, contribute to improve the production and productivity of beekeeping, it will serve as bridge to transferring from traditional to box hive beekeeping(Nicola, 2002).

2.4.3. Frame hive beekeeping

Frame beekeeping methods aim to obtain the maximum honey crop, season after season, without harming bees. Modern movable- frame hive consists of precisely made rectangular box hives (hive bodies) superimposed one above the other in a tier (Nicola, 2002). The number of boxes is varied seasonally according to the population size of bees.

Frame beekeeping in Ethiopia provides for increased honey production potential, management simplicity, avoiding risks of climbing trees, less exposure to honey thieves and avoiding unsustainable cutting of trees for hives construction. Movable frame hives allow colony management and use of a higher level of technology, with larger colonies, and can give higher yield and quality honey but are likely require high investment cost and trained man power. These efforts showed a green light towards sustainable livelihood improvement along with forest resource management (Meaza, 2010). Based on the national estimate, the average yield of pure honey from movable frame hive is 15-20 kg/year, and the amount of beeswax produced is 1-2% of the honey yield (Gezahegne, 2001). However, in potential areas, up to 50-60 kg harvest has been reported (HBRC, 1997). .

2. 5. Honeybee races in Ethiopia

As a result of genetic and impact of environmental features on the existing *Apis mellifera* species for many years passed, about five sub-species or races of honeybee races were found to exist in Ethiopia (Amsalu and Nuru, 2002). Different scholars have studied identification of honeybee races of Ethiopia. As noted by Smith (1961) cited in Nuru (2002) *Apis mellifera monticola* was the first honeybee race reported to exist in the Ethiopian plateau.

Ayalew (1990) identified the existence of five honeybee races in Ethiopia. These are:-*Apis mellifera adansoni* exists in south and western part of the country, *Apis mellifera jemenitica* founds in the low land areas of eastern Ethiopia, *Apis mellifera monticola* exists in Southeast Mountain of Bale - Dinsho, *Apis mellifera litorea* exists in southwest low lands and *Apis mellifera abyssinica* exists in highland area of central, west and southern parts of the country.

Amsalu and Nuru (2002) reported the presence of five honeybee races of Ethiopia, namely *Apis mellifera monticola*, which exists in northern high mountains part of the country, *Apis mellifera bandasi* in central highlands, *Apis mellifera scutellata* in west tropical forestlands, *Apis mellifera jementica* exists in eastern and western low lands areas and finally *Apis mellifera woyi – Gambela* in the extreme western and southern semi-arid to sub moist lowland areas.

Among these, *Apis mellifera monticola* and *Apis mellifera bandasii* are widely distributed mostly in high and mid altitude of amhara regional state. Behaviorally, the migratory tendencies of *monticola* and *bandasii* are very low. Even in the absences of food they remain in their nest up to starving to death. The reproductive swarming tendencies of these bees are also very low. Some colonies reported to remain 5 to 10 years without having reproductive swarm. Compared to others, these bees are relatively gentle, which may be due to the fact that they have been kept very close to human and livestock for many centuries. The other bee races, *jemenitica* and *scutellata* are found in the western mid and lowland areas of the region. The migratory and reproductive swarming tendencies of these bees are relatively high and are more defensive (Kerealem *et al.,* 2011). Generally the bees of the region are fast in population build up and in exploiting resources in an erratic environment (BoA, 2003).

2.6. Importance of beekeeping in Ethiopia

2.6.1 Economic importance

Beekeeping plays a significant role in the national economy of the country mostly in the part of rural areas (Nuru, 2007). As beekeeping has low start-up cost and requires little land or labor, it is accessible to many rural community and is promoted as a pro-poor income generation activity (APM, 2008). Frequent droughts coupled with environmental degradation have threatened the livelihood of this rural community for several decades. However, regardless of other agricultural activities, bees survive in drought-threatened areas and supplement the vulnerable communities with nutritious food and a source of income.

Therefore ranges of applications emerging from apiculture development are enormous and it is considered a major tool in combating food insecurity and as a strategic means of export income generating, while protecting the environment and apiculture sectors in the country (MoARD, 2007).

Beekeeping, in addition to its economic importance, has high social value in the country. The number of honeybee colonies and hives owned serves as a major wealth ranking in some societies. Honey is highly regarded product and in widely used in different cultural, religious, ritual ceremonies and traditional medication (Habtemariam, 1996). Apiculture has also a great role in natural resource protection. Beekeeping is environmentally friendly activity and beekeepers are more aware about the importance of conservation of natural resource than any ordinary farmers. Integrating natural resource conservation programs with income generating options like utilizing the forest resources, in the form of honey and beeswax, while maintaining the natural vegetation would be an appropriate approach (Nuru, 2007).

Beekeeping contributes to peoples' significant role and one of the possible options to the small-holder beekeepers in order to sustain their livelihood in the country. It does not only serve as a source of additional income, but also quite a number of people entirely depend on beekeeping for hunting wild colonies that plays crucial in rural livelihoods (Abiyu, 2011). The activity offers great potential for development in the countries. It is easy and cheap to start and it is an important cash crop with ready local market. Beekeeping gives local people an economic incentive for the retention of natural habitats such as forests and therefore is an ideal activity in any forest conservation. However, the financial outcome depends on many factors such as skill and experience of the practitioner; the market available to the beekeepers as well as botanical resources available; climate and other factors (Nicola, 2009).

Beekeeping can also raise the livelihoods of many people and farmers including women, youth and underemployed sections of the society as well as rural community and urban traders, carpenters who make hives; tailors who make veils, clothing and gloves and those who make and sell tools and containers (Nicola, 2002). It helps in diversification of source of incomes for rural communities that help minimize the demands of land and pressure on forests (Melaku *et al.,* 2008).

Many people are engaged in the honey production, trading and in production and selling of honey beer (tej). In every town, "tej" production is a big business and it is even served in

some big bars and hotels as special cultural drink. It is estimated that more than 15,000 breweries are operating in different parts of the country which indicates the role of the sub-sector in employment creation for such significant number of people (Nuru, 2007).

Its importance extend also in poverty reduction, sustainable development and conservation of natural resources have been well recognized and emphasized by the government of Ethiopia and non-governmental organizations (NGOs). As the country is endowed with varied ecological zones and different flora, it has a huge potential for beekeeping. The roles of beekeeping are as income generation for subsistence farmers and generating foreign exchange earnings (Gidey and Mekonen, 2010).

Bees are cosmopolitan: they adapt to wide range of environment, in much of lower land, at altitudes below 400 m. a.s.l (Robinson, 1980).Smallholders and landless peasants can practice beekeeping. The hive occupies very little space and bees can collect nectar and pollen from anywhere they can get; so wild, cultivated and wasteland are as all have value for beekeeping. Beekeeping does not compete for resources with other agricultural endeavors and can be run with other agricultural activities(Workneh, 2008).Honeybees play a great role in pollinating plants and contribute to increased crop yield (Admasu and Nuru, 2000). Self-sterile plants (cross pollinated) require pollinating agents to maintain viable seed. According to Crane (1990) honeybees can increase the yield of Citrus sinensis by 30%, water melon by 100% and tomatoes by 25%. Admasu *et al*. (2004) also reported that onion yields increased by 94% due to honeybee pollination. The ecological function of bees has even a higher economic importance than the direct beekeeping products. Although the value of honeybees in crop pollination is under estimated, it has a significant role in increasing national food production and regeneration of plant species.

Beekeeping plays significant role to the agricultural products, colony produces, beeswax and honey (Admasu, 2002). The whole family can become involved since men, women, or elder children can do the work in most cases at home. That means, it can help efficient utilization of family labor. A beekeeper can develop knowledge and skill, which is rewarding and generate self-reliance (Tessega, 2009). The Indigenous knowledge is acquired and handed as lore from generation to generation in the form of stores, tales or proverbs (Abebe *et al.*, 2011). According to the traditional use of honey as medicine they are used by mixing different other elements such as honey + egg + butter + coffee are recommended for cough problem, Honey + barley + flax is a medicine for backside pain, boiling honey with chat

helps for (Gonorrhea) disease, mixture of honey, garlic, *bishops weed*, and *black cumin* is used for eye disease, Honey with coffee also uses for stomach ache (Workneh, 2011).

Enormous agricultural and agro-based opportunities exist in the rural areas to generate income and employment (Meaza, 2010). Some of the economic important of beekeeping are:

2.6.2. Honey production

Honey production is believed to play a significant role and one of the possible options to the smallholder farmers in order to sustain their livelihood. It does not only serve as a source of additional income, but also quite a number of people entirely depend on honey production and honey selling for their livelihoods. Nuru (2002) indicated that honeybee and their products provide direct cash income for beekeepers. In areas where honey production is not attractive, beekeepers can sell their colonies in the market. In this regard honeybees serve as 'near cash' capital which generate attractive money. In some tribes the entire livelihood of a community solely depends on the honey production and honey selling (Tessega, 2009).

2.6.3. Beeswax Production

Different studies indicate that the current annual average productions of beeswax in Ethiopia are estimated 5,000 tons (Tessega, 2009). Despite such potential the apicultural production sector of the country is not yet well developed to fully benefit. From the many factors for such underutilization is the absence of a well developed value chain for the farming, collection and processing and marketing of bee products is the major ones (Tessega, 2009).

In several regions of the country, beeswax collection is not significant and the beeswax produced by bees, which could be harvested by beekeepers, is wasted. The wax is mostly left or thrown way because beekeepers do not bother to collect it since it is of little practical value for beekeepers (Fichtl and Admasu, 1994) and the people do not know the local beeswax is generating attractive money. Beeswax supports the national economy through foreign exchange earnings. Ethiopia is one of the beeswax exporters in Africa and the annual average value of beeswax is estimated at about 125 million Birr (Nuru, 2002). Like honey, beeswax is also a multipurpose natural bee product, which is used in the manufacture of more commodities (Tessega, 2009).

2.6.4. Pollination

Honeybee is also believed to play a significant role in the economy of Ethiopia through pollination services. Pollination is one of the most important factors that affect seed production in agricultural crops. In Ethiopia, an experiment was conducted to evaluate the effect of honeybee pollination on Niger (*Guizotia abyssinica*) and the result revealed that honeybees increased the seed yield of Niger by about 43 percent (Admassu and Nuru 2000). These indicated that honeybees have a vital role in increasing food production and overall agricultural productivity. Self-sterile plants (cross pollinated) require pollinating agents to maintain viable seed. According to Crane (1990), honeybees can increase the yield of Citrus sinensis by 30%, water melon by 100% and tomatoes by 25%. Admasu *et al*. (2004) also reported that onion yields increased by 94% due to honeybee pollination. Although the value of honeybees in crop pollination is under estimated, it has a significant role in increasing national food production and regeneration of plant species.

2.7. Constraints of beekeeping

Ethiopia, as one of the sub-tropical countries, the climate is not only favorable to bees, but also for different kinds of honeybee pest and predators that are interacting with the life of honeybees. Pests and predators cause devastating damage on honeybee colonies with in short period of time and even overnight (Desalegn, 2001).The most commonly known honeybee diseases reported to exist in Ethiopia are Nosema and Amoeba (Desalegn, 2006).

Since the farmer do not have well equipped material the harvesting system is very poor, therefore it is forced to produce crude honey. Some time you can get a mixture of wax and honey includeding other dirty particles (Crane, 1980; Moguel *et al.*, 2005). Honey bees have a limited capacity to metabolize toxins that are contact with agricultural sprays in different ways. Bees may fly through the spray, Sprays may drift to hives via wind and Bees may collect and bring into the hive pollen that contains chemical residue (Gezahegn and Amssalu, 1991).

According to Kerealem *et al.* (2011) shortage of bee forage due to population pressure and the high demand for farmlands mountainous areas to be used for crop production and livestock grazing. These create deforestation, soil erosion and irreversible ecological degradation and reduction of honey producing floras. The elimination of good nectar and pollen producing tree species in many areas makes it difficult to maintain bee colonies

without feeding. However, wild bees habitats are increasingly being destroyed as a result of expansion of farmland and are often suffer from total destruction of their nest. So this is a major problem to start beekeeping management farms and to expand the existing ones (Kerealem *et al.,* 2011).

The natural quality of honey and sanitation is not maintained in the process of harvesting, storing and transporting. Much use of smoking during harvesting and adulteration are underlined as serious causes of problem. Most of the honey produced and marketed is poor quality unsuited for processing and export. At present there is no strong and formally or informally organized market for honey products in the country. This resulted in lack of grades and standards, in poor quality control, inadequate and inconsistent supply to whole sellers, processors and exporters. The low involvement of private sectors in processing and export of honey could be partially attributed to these problems (Beyene and David, 2007).

3. Materials and Methods

3.1. Description of study area

The study area was located in Termaber and Basonawerena district, Northern Shewa zone in Amhara Regional State, Ethiopia (Figure 2). Termaber is one of the districts in Semien Shewa Zone Amhara Region. The distance between Termaber and Addis 190 km and it has a total population of 84,481. The woreda is found at Longitude of 9^0 50'60.000"N and Latitude of 39^0 46'0.120"E. Its altitude is ranging from 1500 to 3100 meter above sea level. The average annual temperature is about 15.5 C^0 and the mean monthly rain fall is about 1200 mm (TBDAO, 2012).

Basonawerana ("Baso and Werana") is also district in the Amhara Regional state of Ethiopia located in Semien Shewa Zone. The distance between Basonawerana and Addis Ababa is 130 km. The district is found at longitude of 9^0 30' 00" and latitude of 39^0 30' 00" E. The district has a total population of 120,930 With an area of 1,208.17 square kilometers, Elevations ranges from 1,300 – 3,650 m.a.s.l, Average annual rainfall ranges from 950-1200 mm, Temperature (C^o) 6 – 20, the mean monthly rain fall ranges 1200-950 mm (BWDAO and TBDAO, 2012).

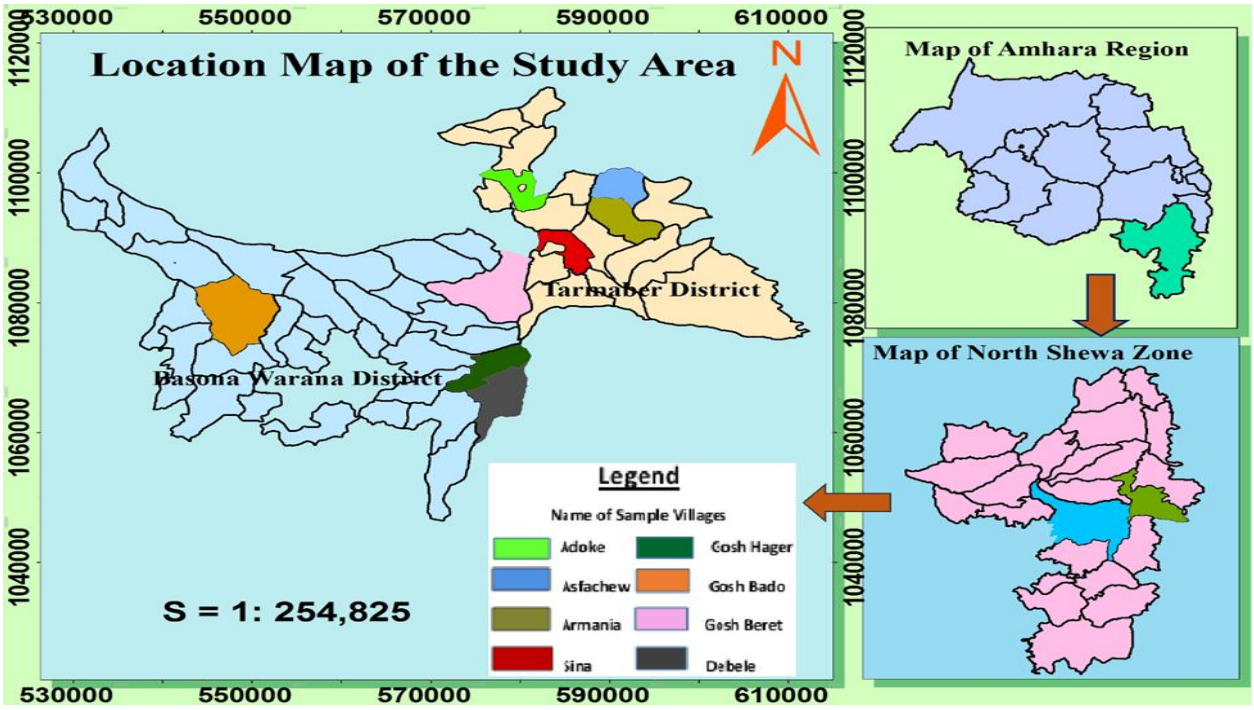

Figure 2: Map of the study area

3.2. Study design

The study design was community-based cross-sectional. This includes the representative respondent of the beekeepers from each kebeles and district. Key informants and supervisors were also participated in giving important information about the beekeeping management and constraints from the study area. The study design considered through the agro ecology zones the study area.

3.3. Sample size determination and Sampling technique

3.3.1. Sample size determination

Sample size of the study was determined using a formula for single population proportion formula following Cochran (1977) and proportional allocation was employed to determine the sample size for each district. Hence,

Where $n_0 = \frac{Z^2_{\alpha/2} pq}{d^2}$ $n = \frac{n_0}{1 + \frac{n_0}{N}}$

n = sample size, d= margin of error

N = total population, p= proportion of population

α= level of significance, n_o= standard calculated sample population

q = 1-p Where: d = 0.05 p = 0.5 α=0.05

The sample size for each district was determined based on proportional allocation as follows:

Q= n, x_o = $\frac{x * n}{Q}$

$x = x_o$

Q= Total beekeeper in two districts

n=Total sample in two districts

x = Total beekeeper in BWD

x_o= Total samples in WB districts

A total 384 Beekeepers sample size was taken from the two districts, these 153 from Basonawerena and 231from Termaber districts and the total interviews were 26 beekeepers, similarly, 26 beekeepers were taken for focus group discussion.

3.3.2. Frequency distribution of respondents by study Kebele

The distribution of respondents per each study Kebeles is shown below (Table 1).

Table 1: Distribution of respondents by kebeles

Districts	Kebeles	N
Basonawerena	Gudeberet	30
(n=153)	Debele	33
	Gosheager	31
	Goshebado	59
Sub total		153
Termaber	Asfachew	39
(n=231)	Sina	60
	Adoke	65
	Armania	67
Sub total		231
Total sample size		384

3.3.3. Sampling techniques

The districts and kebeles were selected purposely based on their beekeeping potential. Personal observation, informal discussion with different peoples in the districts and accessibility were also used to identify these districts and kebeles. Secondary data on major beekeeping managements, constraints, agro-ecology, topography, climatic condition and type of hives available in the districts were collected.

Accordingly, 8 kebeles were selected from both districts (Figure 3) by using purposive sampling techniques based on their beekeeping potential and agro-ecology. Simple random sampling and purposive sampling techniques were used in selecting respondents from each agro-ecology zones. The sampling method was used to select respondents based on the representativeness from the four agro ecology. The purposive sampling method was employed for selecting respondents for focused group discussion in consultation with development agents and experts of animal science department in Termaber and Basonawerena.

Operational definition agro ecology zones of Ethiopia: Low land (Kolla) the part of a region with an elevation of 500 to 1800 meter above sea level, mid high land (Weinadega) the central temperature high belt of the plateau, with elevation of 1,800 to 2, 400 meter above sea level, high land (Dega): a place or region with an elevation of 2,400 to 3,400 meter above sea level, extreme high land (Wurch): the part of a region or place with an elevation > 3,400 the part of a region.

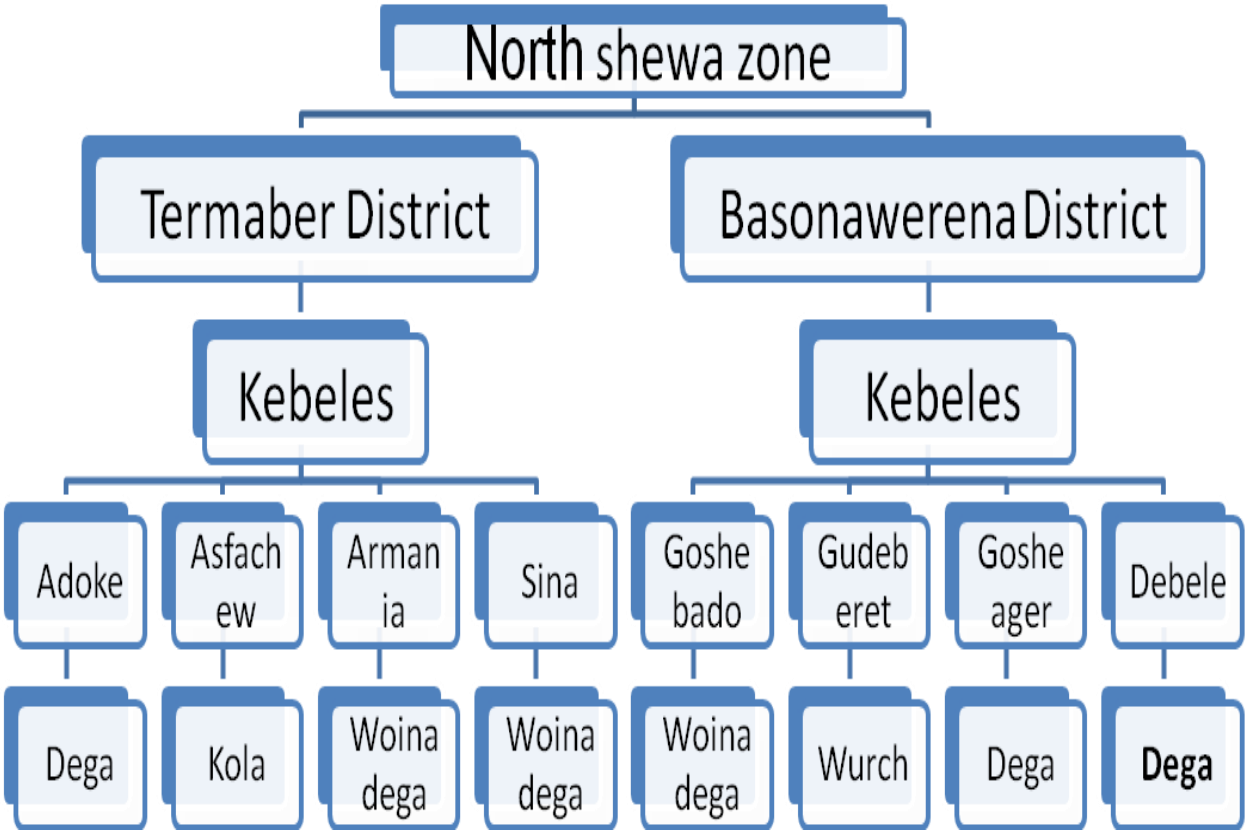

Figure 3: Agro-ecology profile of study kebeles

3.4. Data collection instruments

Quantitative and qualitative data collection methods were used to collect relevant data. Observations, in-depth interviews, semi-structured questionnaire and focus group discussions (FGDs) were used as data collection tool to gather primary data from study participants.

3.4.1. Observations

Observations and household survey was made in both districts in order to get relevant data related to the objectives about beekeeping management and constraints.

3.4.2. In-depth interview

In order to get primary data with respect to research questions and related issues key informant were interviewed on beekeeping management and constraints. The key informants included kebeles peasant associations' development agents, district agriculture and rural development head and experts and district administrator. With the developmental agents, supervisors, model beekeepers, that included all sex, age level, religious and from all agro-ecology kebeles in the study area. Check-list was prepared in advance consisting of different questions in English language and translated to Amharic language for each category of key informants that help to conduct key informant interviews.

3.4.3. Semi-structured questionnaire

A semi-structured questionnaire was developed and used which was prepared in English language first and translated to Amharic language and administered. This included questions about beekeeping management and constraints and comments of beekeepers about beekeeping activities. The respondents were those who engaged in beekeeping activities. Interviewing the sample beekeeper through questionnaire was needed, as the sample beekeeper may not read and write to fill the questionnaire. To conduct the household survey field guide was selected from the study area. The selected respondents were interviewed through semi-structured questionnaire to collect the data

3.4.4. Focus group discussion (FGDs)

To collect data on beekeeping management and constraints focused group discussion was carried out purposely which include developmental agents, supervisors, model beekeepers, that included all sex, age level, religious and all agro-ecology villages to get key information

from the study area. In order to conduct FGDs check-lists which have different leading questions related to research questions were prepared in advance in English language and translated to Amharic language. The beekeepers who were selected for the focus group discussion were those beekeepers who are not included in the household survey and are known by their beekeeping performance and selected with help of development agents.

3.5. Data analysis

The quantitative and qualitative data collected from the primary and secondary sources were analyzed using different stastical tools. The collected data was entered into a computer, checked for consistency, completeness and cleaned. Data was analyzed using Microsoft Excel, SPSS version 16.0 software package. X^2 (chi-square) was used to compare categorical data with respect to beekeeping practices, management and constraints. Descriptive statistics was employed in order to present the data using tables and figures. Percentages and frequency distributions were used to describe socioeconomic characteristics, beekeeping practice, management and constraints. The qualitative data collected from interviews, focus group discussions and direct observations were analyzed using descriptive statistics. Thus the finding results were illustrated; in terms of tables and figures.

4. Results of the study

4.1. Socio-demographic characteristics of respondents

Table 2 shows the profile of respondents with regard to their sex, age marital status and education level. Of the total respondent 84% and 82% in Termaber and Basonawerena district respectively were males while, 16% and 18% were females in Termaber and Basonawerena district respectively. The mean age of the respondents was 45.25 years where as the minimum and maximum age of the respond was 18 to 90 years old respectively. In terms of marital status, 85% and 84% in Termaber and Basonawerena district respectively were married while, 15% and 16% were single in Termaber and Basonawerena district respectively and also the education level of the respondent 62% and 50% in Termaber and Basonawerena district respectively are illiterate.

Table 2: Socio-demographic characteristics of beekeepers in the two study areas

Variables		District			
		Termaber(n=231)		Basonawerena(n=153)	
		n	%	n	%
Sex of respondent	Male	194	84	126	82
	Female	37	16	27	18
	Total	231		153	
Age of the respondent	18-38	90	39	55	36
	39-59	99	43	73	48
	60-80	38	16	18	12
	>80	4	2	7	4
	Total	231		153	
Marital status	Married	197	85	129	84
	Single	34	15	24	16
	Total	231		153	
Education level	Illiterate,	142	62	77	50
	Basic education	46	20	39	25
	Grade 1-4,	33	14	19	12
	Grade 5-8,	7	3	10	7
	Grade 9-12	3	1	7	5
	Tertiary education	00	0	1	1
	Total	231		153	

4.2. Beekeeping in the study area

4.2.1. Beekeeping management

Beekeeping systems in the study area was mostly traditional. Majority (79.34% and 92.64%) of the beekeepers have little knowledge on the modern beekeeping management in Basonawerena and Termaber districts respectively. Even though modern beehive introducing in the study area, it was not put into production due to the knowledge gap of the beekeepers. Most of the respondents did not know the application of intermediate and frame beehives in the study area (Table 3). There was significance difference ($P < 0.05$) in beekeeping management between Termaber and Basonawerena districts.

Table 3: Beekeeping management in the study area

Kind of management in the study area	Districts				p-value
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	
Traditional	214	92.64	122	79.34	0.000
Modern	17	7.36	31	20.64	
	231	100	153	100	

Table 4 shows beekeeping activities in the study area. 100% and 91.5% of the respondents in Termaber and Basonawerena district did not participate in any beekeeping association while, 8.5% of the respondents in Basonawerena district had beekeeping association which is known as “tegulet” honey association. Moreover, all (100%) of the respondents had not personal honey extracting machine in both district and all (100%) of the respondents from Termaber and 93 % from Basonawerena districts were described that they are not trying to find out new market agreement to have got better selling their production. Similarly 87.4% of the respondents from Termaber district and 85.6% from Basonawerena district did not try to conserve the flora type that use as source food fro he honey bees.

Table 4: Beekeeping activities

Beekeeping activities	District								P- value
	Termaber (n=231)				Basonawerena (n=153)				
	n				n				
	Yes	%	No	%	Yes	%	No	%	
Collect enough number of bee colonies	35	15.2	196	84.8	7	4.6	146	95.4	0.001*
Participating in beekeeping association activities	-	-	231	100	13	8.5	140	91.5	0.00*
Find market	-	-	231	100	13	7	140	93	0.00*
Visit & inspection colony	200	86.6	31	13.4	131	85.6	22	14.4	0.790
Conserving flora	29	12.6	202	87.4	22	14.4	131	85.6	0.606
Constructing of personal extractor machine	-	-	231	100	-	-	231	100	
Colony feeding	29	12.6	202	87.4	12	7.8	141	92.2	0.143

4.2.2. Credit service

The majority (97% and 91%) of the respondents in both Termaber and Basonawerena, district, respectively did not get any credit service (Table 5).

Table 5: Credit service

District	Credit service				Total
	Yes		No		
	n	%	n	%	
Termaber (n=231)	8	3	223	97	231
Basonawerena (n=153)	14	9	139	91	153
Total	22		362		384

4.2.3. Experience sharing

Beekeepers with longer beekeeping experience would have a cumulative knowledge of the entire beekeeping environment. Experience sharing among beekeepers would enable them to adopt the use of modern beehives. From these 92% and 84% of the beekeepers had not experience share with beekeepers in both Termaber and Basonawerena district respectively While, 8% and 16% of the respondents were response that they experience share each other about the beekeeping management and honey production in Termaber and Basonawerena district respectively.

4.2.4. Training

Of the total respondents 77.5% and 69.3.8% did not get training to develop their capacity in beekeeping management in Termaber and Basonawerena district, respectively (Table 6).

Table 6: Training offered to the respondents

Type of training	Districts			
	Termaber (n=231)		Basonawerena (n=153)	
	n	%	n	%
Colony split	8	3.5	6	3.9
Honey bee colony management	15	6.5	14	9.2
Processing, handling & storage	2	.9	4	2.6
Market information and net working	6	2.6	3	2.0
Input utilization	4	1.7	1	0.7
Bee forage management	5	2.2	2	1.3
All types of training	12	5.2	17	11.1
No training	179	77.5	106	69.3
Total	231	100	153	100

4.2.5. Feed supply of honey bees

Of the respondents, 7.8% and 12.6% provided supplementary feed their colony in Termaber and Basonawerena district, respectively. The type of food supply reported in the study area was like sugar solution, barley flour, ‘erdi’, honey.

Plate 1: Feed supply for honey bees

4.2.6. Colony migration in the study area

As clearly indicated in table 7 below, the respondents cited that the maximum and minimum mobility of the colony honey bee was ranged from one month to twenty years, but the majority of the respondents also reported that colonies could stay from five to nine years without showing mobility in Termaber and Basonawerena district respectively.

Table 7: Colony migration

Districts	Colony migration in the study area	Hive type in the study area					
		Traditional		Transitional		Frame	
		n	%	n	%	n	%
Termaber (n=231)	In one month	3	2	0	00	0	00
	From one to Four years	11	6	1	10	1	2
	From Five to Nine years	116	65	8	80	28	64
	From Ten to Twenty years	37	21	1	10	11	25
	Greater than Twenty years	10	6	0	00	4	9
	Total	**177**	**100**	**10**	**100**	**44**	**100**
Basonawerena (n=153)	In one month	2	2	0	00	0	00
	From one to Four years	15	16	1	6	10	25
	From Five to Nine years	51	56	12	70	19	47
	From Ten to Twenty years	22	21	2	12	11	28
	Greater than Twenty years	4	4	2	12	0	00
	Total	**96**		**17**		**40**	

4.2.7. Important activities of modern hives over traditional hives

The important activities of modern hives over traditional hives over traditional hives are shown below in table 8. From these honey harvesting, honey extracting, colony transferring and colony split are described important activities of modern hives.

Table 8: Important activities of modern hives over traditional hives

Variable	District							
	Termaber (n=231)				Basonawerena (n=153)			
	Yes		No		Yes		No	
	n	%	n	%	n	%	n	%
Honey harvesting	65	30	153	70	43	28	110	72
Honey extracting	58	25	173	75	58	38	95	62
Colony transferring	200	86	31	14	132	89	16	11
Colony split	198	85	33	15	133	87	20	13

4.2.8. Types of bee hives in the study area

In both districts traditional, transitional and frame hives were found however, 62.7% and 76.6% of the hives in Basonawerena and Termaber districts respectively were traditional hives (Table 9).

Table 9: Types of hives in the study area

Type of hives	Districts			
	Basonawerena (n=153)		Termaber (n=231)	
	n	(%)	n	(%)
Traditional	96	62.7	177	76.6
Transitional	17	11.1	10	4.4
Frame	40	26.2	44	19

Even though the numbers of traditional hives were higher than the number of modern hives, the annual yield honey production from modern hives was higher than traditional hives in the study area. According the respondents, honey yield harvested ranged from 2 - 7kg/hive from traditional, 10-25kg/hive from transitional and 15-35kg/hive from frame hive in the study area.

4.2.9. Type of traditional hive in the study area

According to the respondents, the following traditional hives were cited: Bamboo hive, Tree branch or "hareg" hives, Animal dug and Clay hive. Of these the most dominant type of hive was reported to be bamboo hive which account 70% and 56% in Termaber and Basonawerena districts, respectively (Table 10).

Table 10: Type of traditional hive

Type of traditional hive	District				P_ value
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	
Hive made of Bamboo	161	70	86	56	
Hive made of tree branch and tendril	49	21	44	29	0.014*
Hive made of clay	6	3	2	1	
Hive made of animal dug	15	6	21	14	
Total	231		153		

*significant at $p < 0.05$

4.2.10. Source of getting hives

Table 11 presents means of getting beehives by respondents. The majority of the respondents (65% and 53%) from Termaber and Basonawerena districts respectively bought their hives from the local market while, 24% and 21% of the respondents from Termaber and Basonawerena districts respectively constructed their hives by themselves.

Table 11: Source of getting hives

Getting hives in the study area	District				Total
	Termaber(n=231)		Basonawerena(n=153)		
	n	%	n	%	
Constructed by them selves	55	24	32	21	87
Bought from local market	151	65	81	53	232
Supplied by government on credit basis	00	00	00	00	00
Supplied by NGOs on credit basis	00	00	11	7	11
Supplied by NGOs free of charge	00	00	00	00	00
Buy or construct	25	11	29	19	54
Total	231	100	153	100	384

4.2.11. External hive inspection

Table 12 shows hive inspection by beekeepers. The majority of the respondents (44% and 42%) externally inspected their hives every day in Termaber and Basonawerena districts, respectively. However, there was no significance difference between the districts with regard to hive inspection ($P > 0.05$).

Table 12: Frequency of external hive inspection by respondents

Frequently External hive inspection	District				Total
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	
Every day	103	44	65	42	168
Every two to three days	73	32	59	39	132
Every week.	53	32	29	19	82
Every month	2	1	0	0	2
Total	231	100	153	100	384

4.2.12. Hive ownership

Figure 4 showed hive ownership in the study area. As the survey result indicated that there were differently owned hive among the beekeepers in the study area. From these the number of holding of traditional hives (67% and 56%) in Termaber and Basonawerena district respectively were dominantly owned by the beekeeper where as the others were few in number owned by the beekeepers.

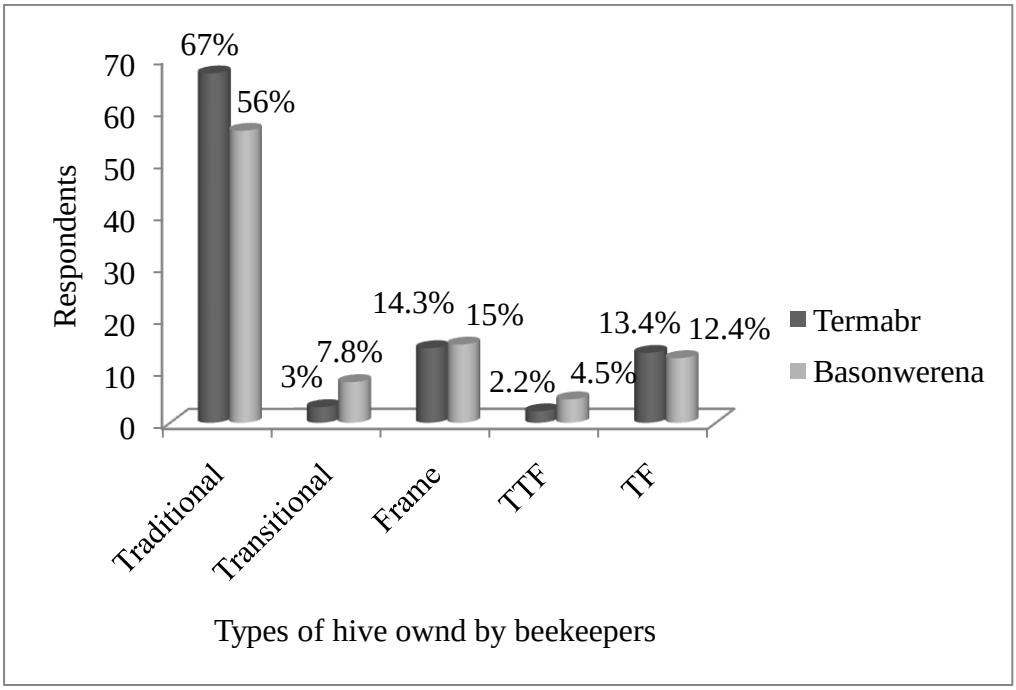

Figure 4: Hive ownership of beekeepers

TTF= Traditional, Transitional, Frame,

TF= Traditional, Frame

4.2.13. Price of hive

The price of hive during the survey period was varying between 20 birr to 1000 birr/hive depending on the types of hive in the study area. The price of frame hive was higher than the price of traditional hives in both districts. Therefore, the price of traditional hives was ranged from 20-50 birr/hive, for transitional hives 700-750 birr/hive and for frame hives 850-1000birr/hive.

4.2.14. Apiary sites

Seventy nine percent and 80% of the respondents from Basonawerena and Termaber districts, respectively reported that backyard as was the common apiary sites and few respondents reported forest as apiary site used for swarm capturing and honey production. There was no significance difference in the apiary sites (hive hanging place) between the two districts ($P > 0.05$).

Plate 2: Backyard apiary site

4.2.15. Methods of colony protection

Sixty seven percent and 71% of the respondents from Termaber and Basonawerena district respectively reported that they protect their colonies by simple protective measures, such as using metal or plastic covering to their hives. However, 33% and 29% of the respondents from Termaber and Basonawerena district respectively reported that they had no significant means to protect their hives from disease (Table 13). There was no significance difference in disease control mechanism in both districts in the study area.

Table 13: Methods of colony protection

Treat of bee colony in the study area	Districts				P-value
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	
Traditional methods	00	00	00	00	0.471
Metal or plastic covering	155	67	108	71	
Modern medicine	00	00	00	00	
Nothing used	76	33	45	29	
Total	231		153		

4.2.16. Swarm capturing

Three swarm capturing methods were reported by the respondents from both districts (Table 14). Forty nine percent and 49.8% of respondents from Basonawerena and Termaber districts respectively cited use of water spring was a common practice in swarm capturing method. There was no significance difference in swarm capturing method between the districts (P > 0.05).

Table 14: Methods of swarm capturing

Methods of swarm capturing	Districts			
	Basonawerena (n=153)		Termaber (n=231)	
	n	(%)	n	(%)
Using water	74	48.5	115	49.8
Using soil	23	15	14	6
Using cloth	18	11.5	38	16.5
Using all methods	38	25	64	27.7
Total	153	100	231	100

4.2.17. Status and trends of colony transferring

Figure 5 showed trends of transferring of traditional bee colonies to transitional and frame hives from 2007 to 2013. In 2007 there was maximum number transferring of traditional bee colonies to transitional and frame hives in Basonawerena and Termaber district However, the trend of transferring showed a decline from 2007 to 2013 in both districts. The least transferring was reported in 2012.

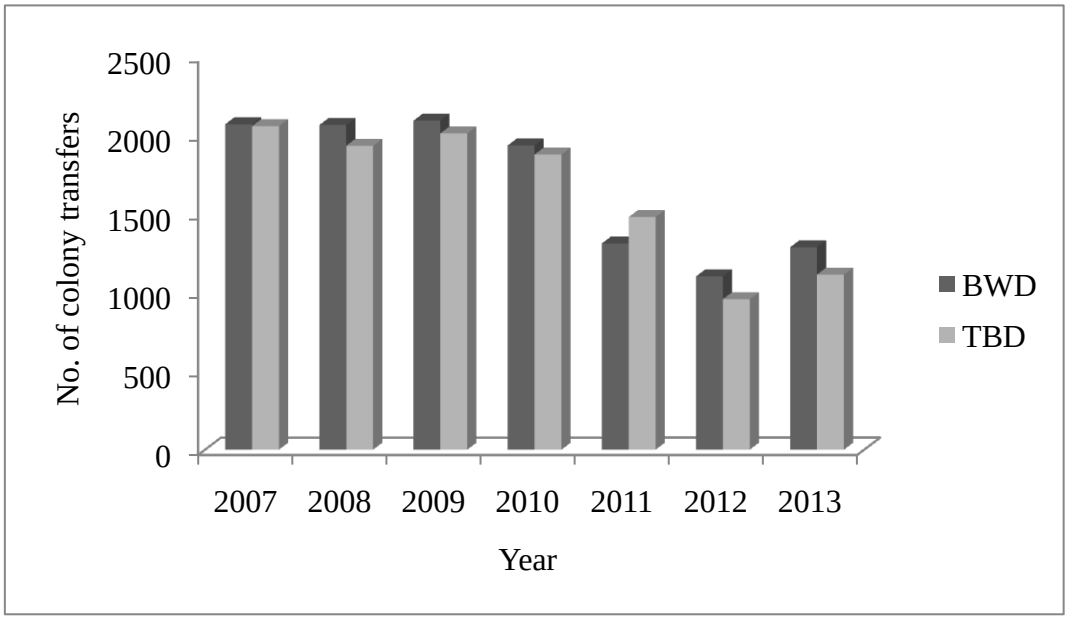

Figure 5: Status and trends of colony transferring in the study area

(Source: TBDAO and BWDAO, 2013)

4.3. Honey production

4.3.1. Honey production season

The peak honey harvesting season of the study area was reported from October to November (76 %and 71%) followed by January to February (21% and 17%) in both Termaber and Basonawerena districts, respectively (Table 15).

Table 15: Honey production period

Production Period	District			
	Termaber (n=231)		Basonawerena (n=153)	
	n	%	n	%
October-November	175	76	109	71
January-February	48	21	26	17
May-June	8	3	18	12
Total	231	100	153	100

4.3.2. Honey harvesting

As shown in table 16 below, 88% and 84% of the respondents from Termaber and Basonawerena districts, respectively reported that they harvested honey once in a year while, 4% and 7% of the respondents reported that they harvest honey three times per year.

Table 16: Frequency of honey harvesting

Frequency of honey harvest per year	District				Total
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	N
Once	204	88	129	84	333
Twice	19	8	14	9	33
Three times	8	4	10	7	18
Total	231	100	153	100	384

4.3.3. Time of honey harvesting in the study area

Eighty five percent and 87.6% of the respondents from Termaber and Basonawerena districts, respectively indicated that they harvested honey at evening or early morning, while 15.2% and 12.4% of the respondents from Termaber and Basonawerena districts, respectively harvested honey during the day time.

4.3.4. Type of bee product

According to the respondents crude honey was the main bee product in the study area which accounts 59.5% in Termaber district and 47.1% in Basonawerena district, while the least product was crud beeswax which accounts 1.7% and 3.9% in Termaber and Basonawerena districts, respectively (Table 17).

Table 17: Type of bee product

Type of bee product	District			
	Termaber (n=231)		Basonawerena (n=153)	
	n	%	n	%
crude honey	137	59.3	72	47.1
Crude beeswax	4	1.7	6	3.9
Crude honey and crude beeswax	16	6.9	19	12.4
Crude honey and colony	45	19.5	17	11.1
crude honey, colony and wax	29	12.6	39	25.5

4.3.5. Purpose of honey production

Eighty percent and 86% of the respondents in Termaber and Basonawerena districts, respectively used honey for food and market as income generation (Table 18). There was no significance difference between the two districts on the purpose of honey production ($p > 0.05$).

Table 18: Purpose of honey production

Purpose of honey production	District				Total
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	
Consumption	20	9	6	4	26
For market	25	11	16	10	41
Both	186	80	131	86	317
Total	231	100	153	100	384

4.3.6. Color of honey in the study area

Eighty one percent and 85% of the respondents from Termaber and Basonawerena district respectively illustrated that the colour of honey they produced is white while 19.5% and 15% of the respondents from Termaber and Basonawerena district respectively reported that the honey they produced is red. There was no significance difference in honey color between the two districts ($P > 0.05$).

4.3.7. Honey price

As showed in table 19, 17% and 10% of the respondents from Termaber and Basonawerena district, respectively described that the highest price of honey was greater than 90 birr/kg while, the least price of honey in both districts was in the range of 61-70Birr/kg.

Table 19: Price of Honey

Honey price	District				Total
	Termaber (n=231)		Basonawerena(n=153)		
	n	%	n	%	
50-60	31	13	36	24	67
61-70	13	6	9	6	22
71-80	78	34	63	41	141
81-90	69	30	29	19	98
>90	40	17	16	10	56
Total					384

4.3.8. Honey market

The majority of the respondents (87% and 78%) from Termaber and Basonawerena districts respectively indicated that they sold the honey at local market followed by selling at home for local beverage. According to the respondents, they neither sold their honey to honey processors nor to honey exporters in both districts (Table 20).

Table 20: Honey market

Market	District			
	Termaber (n=231)		Basonawerena(n=153)	
	n	%	n	%
Sell at home for local beverage	29	13	25	16
Sell at local market	202	87	122	78
Sell at regional market	00	00	00	00
Sell for honey collectors	00	00	11	6
Sell for honey processors	00	00	00	00
Sell for exporters	00	00	00	00
Total	231	100	153	100

4.3.9. Honey production in the study area

As shown in figure 6 below, the production of honey from the frame hive was highest which accounted 790 and 600 kg from Termaber and Basonawerena districts, respectively and the least honey production was from transitional hive which accounts150 and 180 kg from Termaber and Basonawerena districts, respectively (Figure 9).

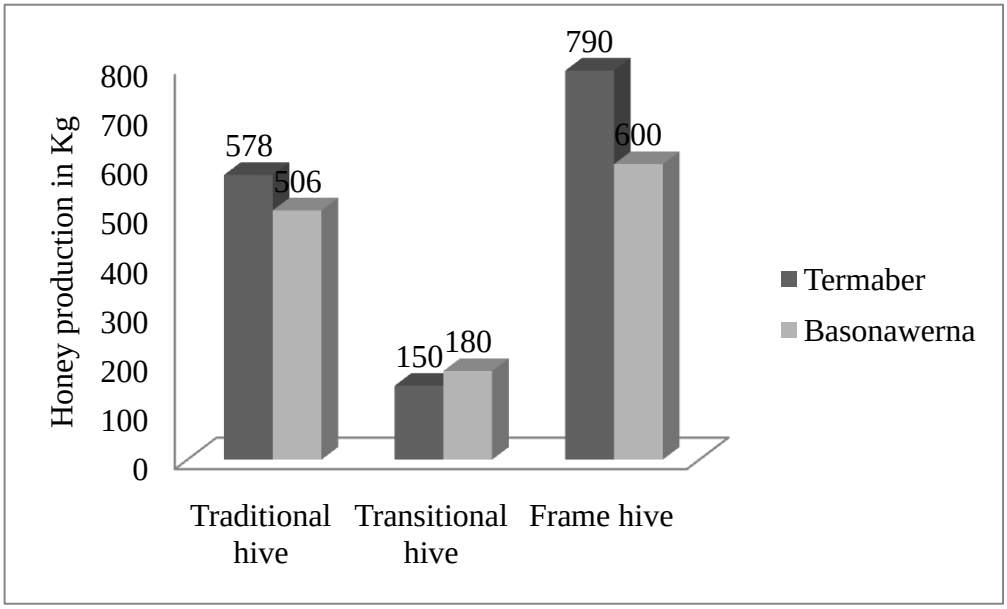

Figure 6: Honey production

4.3.10. Annual income of respondents from honey production

The annual income of respondents from the sale of honey in the study area ranged from 1000 to 10800 Birr. As shown in table 21, 3% and 8% of the the respondents from Termaber and in Basonawerena districts, respectively had the highest annual income from honey (greater than 9000 birr) while, 55% and 48% of the respondents from Termaber and in Basonawerena districts, respectively had the lowest income from honey (1000 to 3000 Birr) . The mean annul income per respondent was about 3491.9 and 4187.1 birr in Termaber and Basonawerena districts, respectively.

Table 21: Annual income of respondents from honey

Income in birr	Districts			
	Termaber (n=231)		Basonawerena (n=153)	
	n	%	n	%
1000-3000	127	55	73	48
3001-5000	57	25	33	22
5001-7000	31	13	14	13
7001-9000	10	4	20	9
>9000	6	3	13	8
Mean in birr	3491.9		4187.1	

4.3.11. Trends of honey production

Even though the trend of honey production showed fluctuation from 2006 to 2012, there was steady increase starting from 2010 to 2012 and 2011 to 2012 in Basonawerena and Termaber districts, respectively (Figure 7).

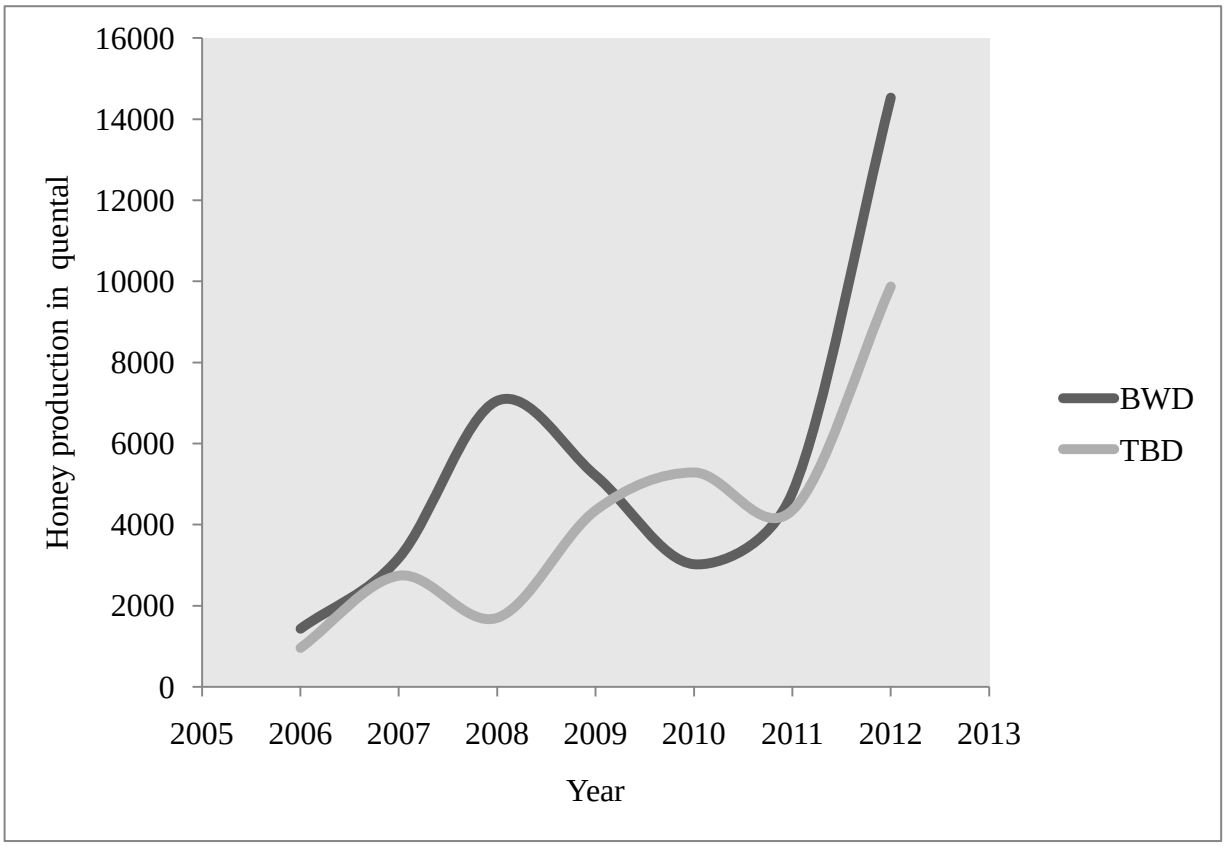

Figure 7: Trends of honey production

Source: TBDAO and BWDAO, 2012

4.3.12. Beeswax production

Eighty five percent of the respondents in Termaber and 82% of respondents in Basonawerena districts did not know the importance of beeswax. Only 15% of the respondents from Termaber district and 18% from Basonawerena district respondents indicated that they processed the beeswax in traditional way for spiritual purpose.

4.3.13. Duration of honey storage

Forty eight percent of the respondents from Termaber district and 40% from Basonawerena district used their honey immediately after they harvested while, 18.5% of the respondents from Termaber district and 23% of the respondents from Basonawerena district indicated that they stored the harvested honey for more than six month at home (Table 22). There was no significance difference in both districts in storing and handling of the honey production ($p>0.05$).

Table 22: Duration of honey storage

Honey storing time	District				p- value
	Termaber (n=231)		Basonawerena (n=153)		
	n	%	n	%	
Do not store honey	110	48	61	40	
One to two months	37	16	16	11	
Two to six months	41	17.5	40	26	
More than six months	43	18.5	35	23	0.069
Total	231	100	153		

4.4. Opportunities for beekeeping development and honey bee flora source

4.4.1. Opportunities for beekeeping development

Beekeeping is a sustainable form of agriculture, which is beneficial to provide economic reasons for increased income and means of food security in Termaber and Basonawerena districts.

According to the report of the respondents there was still huge potential to increase honey production and to improve the livelihood in the study area.

As described from the respondent there are also some NGOs giving attention to the sub sectors provide important interventions in beekeeping management and honey production in the study area.

Based on the response of the beekeepers the beekeeping sub-sector could development environmental resource in the study area. They also report that it is possible even for people with few resources and give an opportunity to landless peasants to practice beekeeping for their livelihood development.

According the description of the professionals honey bee can utilize nectar and change in to the honey to serve as source of food and means of income generating to support the livelihoods economies in the study area.

According the idea of the respondents it will give the opportunity to access improved technologies concerned the knowledge how to run beekeeping management and reduced the constraints which undermine the honey production and made familiarized with resent available equipments.

As the beekeepers reported that beekeeping have the opportunity of work creativities in family labour division starting from keeping the hives to honey harvesting, making hive equipments and trades in the study area.

Similarly the participant stated that bees' culture does not disturb ecological balance, as many agricultural and f animal husbandry in the study area. Rather it is essential pollinators of plants species use bio-diversity control and diversification of flowering plant species in the study area.

4.4.2. Honeybee flora resource

According to the respondents indicated in table 23, flowering plant species used as source of food for the honey bee which flower throughout the year includes: *Schinus molle, Olea europaea, Citrus aurantifolia, Psidium guajava, Buddleia polystachya, Ericca arborea, Carica papaya, Carissa edulis, Rhamnus prinoides and Musax paradisiaca.*

Table 23: Flowering plant species used as nectar source by honeybees and their flowering period

Plants habits	Local Name	Scientific name	Flowering Period
	Bahr-Zaf	*Eucalyptus camaldulensis*	May to June
	Tiqur Berbere	*Schinus molle*	Year Round
	Weyra	*Olea europaea*	April to June
	Lomi	*Citrus aurantifolia*	Year Round
	Zeitun	*Psidium guajava*	Year Round
	Mango	*Mangifera indica*	December to March
	Kinchib	*Euphorbia toritolli*	Year Round
	Girar	*Acacia seyal*	August to February
Trees	Girawa	*Vernonia amygdalina*	December to May
	Besana	*Crotom macrusachys*	April to July
	Kolqual	*Euphorbia abyssinica*	September to November
	Papaya	*Carica papaya*	Year Round
	Muz	*Musax paradisiaca*	Year Round
	Gulo	*Ricinus communis*	Year Round
	Anfar	*Buddleia polystachya*	Year Round
	Avocado	*Persea americana*	October to December
	Wanza	*Cordia africana*	October to March
	Keshushla	*Cirsium schimperi*	August to December
	Tenjut	*Otostegia integrifolia*	Year Round
	Gesho	*Rhamnus prinoides*	Year Round
	Hareg	*Mikaniopsis clematoides*	November to March
	Agam	*Carissa edulis*	Year Round
Shrubs	Atiuch	*Achyranthes aspera*	Year Round
	Asta	*Ericca arborea*	Year Round

	EKtkttaa	*Caesalpina decapetala*	October to January
	Dander	*Centaurea melitensis*	October to January
	Bakela	*Vicia faba*	September to October
	Ater	*Pisum sativum*	September to October
	Senafch	*Esinappis alba*	October to December
	Tosegne	*Satureja spps*	September to December
	Baoiela	*Vicia faba*	September to October
Herbs	Mashla	*Sorghum btcotor*	October to December
	Talba	*Unum usitatissimum*	October to November
	Adguar	*Malvaverticillata*	Year Round
	Shmbera	*Cicer arietinum*	October – February
	Serdo	*Eleusine floccifolia*	August To November
	Kamun	*Anethum foeniculum*	September To November
	Suf	*Carthamus tinctorius*	November – February
	Adey-Abeba	*Bidens pachyloma*	September And October
	Nug	*Guizotia abyssiniea*	September to October
	Mech	*Guizatia scabra*	August – February
	Gomen	*Launaea cornuta*	October to December
	Besobla	*Ocimum urticifolium*	Year Round
	Duba	*Cucurbita pepa*	April to December
	Tosgn	*Thymus schiniperi*	Year Round

4.5. Constraints of beekeeping management

The constraints of beekeeping management according to the response of the beekeepers, which are affecting the beekeeping management in the study area, are stated below in table 24.

All (100%) of the respondents in both Termaber and Basonawerena district indicated that beekeeping management in the study area was run traditionally with shortage of beekeeping technology. Of the total respondents, 97.4% and 99% from Basonawerena and Termaber districts, respectively respond that there was poor community awareness on beekeeping management. According the response of the respondent 95.4% from Basonawerena and 99.5% from Termaber districts were stated that they had a problem of low skilled man power in the study area. Most respondents 95% and 98.7% from Basonawerena and Termaber districts respectively reported that there problem of market to sell their honey in the study area. In addition from the total respondents 94% in Basonawerena district and 95% of the respondents from Termaber district reported that there was the problem of quality of honey production and harvesting.

Ninety three point five of the respondents from Basonawerena district and 97% of the respondents from Termaber district that colony absconding problem existed that undermine the beekeeping management. Moreover of the total respondents, 92.8% and 97.4.3% from Basonawerena and from Termaber districts respectively described that agro-chemical pesticides affected the honey bee colonies in the study area. The majority of the respondents, 98.7% and 91.5% from Basonawerena and Termaber districts, respectively mentioned that there was shortage of bee colony in the study. The low access of modern hive was also a constraint in beekeeping management in the study area which accounts 89% from Basonawerena district and 88.7% from Termaber district.

Of the total respondents 84.3% from Basonawerena and 88.9% from Termaber districts, were describes that bee colony was affecting by drought. Consequently 70.6% from Basonawerena and 78.78% from Termaber district explained that there was shortage of bee colony in the study area. Shortage of enough space for beekeeping was a problem in both districts. Forty seven percent and 38% of the respondents from Basonawerena and Termaber districts respectively reported that there was shortage of enough space beekeeping.

Farther more out of the total respondent 62% from Basonawerena and 46.75% from Termaber district were stated that here was shortage of appropriate enough space for beekeeping management in the study area.

Table 24: Constraints of beekeeping management

Constraints	Basonawerena (n=153)					Termaber (n=231)					P-value
	n					n					
	Yes	%	No	%	Rank	Yes	%	No	%	Rank	
Low technology	153	100	-	00	1 st	231	100	-	00	1st	--
Poor awareness	149	97.4	4	2.6	2 nd	229	99	2	1	3rd	0.176
Low skilled	146	95.4	7	4.6	3rd	230	99.5	1	0.5	2nd	0.001*
Market problem	219	95	12	5	4 th	228	98.7	3	1.3	4th	0.176
Quality of honey	144	94	9	6	5 th	219	95	12	5	7th	0.087
Absconding	143	93.5	10	6.5	6 th	231	97	7	3	6th	0.120
Pesticides	142	92.8	11	7.2	7 th	225	97.4	6	2.6	5th	0.001*
Access of modern hives	136	89	17	11	8 th	205	88.7	26	11.3	8th	0.177
Droughts	129	84.3	24	15.7	9 th	159	69	72	31	10th	0.000*
Shortage of colony	140	70.6	13	29. 4	10 th	182	78.78	49	21.22	9th	0.01*
Shortage of space	95	62	58	38	11 th	108	46.75	123	53.25	11th	0.000*

"-"no response; *Significant at p<0.05

4.5.1. Pests and predators of honey bees and local control methods in the study area

The pests and predators of honey bees and local control methods are presented in table 25. According to the respondents, the major predators of honeybees are Hamagot /Shelemetmat and Ants from Termaber and Basonawerena district, respectively. Cleaning the apiary site, putting ash under the hive, painting, use of burned gasoline, destructions of enemy nests and hunting the predators of bee colonies were the common local control method in the study area by dogs.

Table 25: Pests and predators of honey bees and local control methods

Pests and predators	District						Local control methods
	Basonawerena (n=153)			Termaber (n=231)			
	n	%	Rank	n	%	Rank	
Ants	39	26	1st	21	9	4th	Cleaning the apiary site, putting ash under the hive, painting and use burned gasoline
Birds	34	22	2nd	43	19	3rd	By destroy their nests
Spiders	25	16	3rd	49	21	2nd	Cleaning the apiary site
Wax moth	20	13	4th	7	3	8th	Cutting the old wax
Hamagot	16	11	5th	67	29	1st	Hunting by dogs and cuts
Lizard	11	7	6th	17	7	6th	By killing and putting some sharp material around the mouth of the hive
Wasps	8	5	7th	-	00	9th	Cleaning the apiary site and destroy the nest
Beetles	-	00	8th	18	8	5th	Cleaning the apiary site
Snake	-	00	9th	9	4	7th	Cleaning the apiary site

"-"no problem

5. Discussion

In this study both sexes and all age groups greater than eighteen years old were involved in beekeeping and majority of the beekeeper were illiteracy and very few1% and 5% were Grade 9-12 from Termaber and Basonawerena district respectively in the study area. A similar result was reported by Giday and Kibrom (2010) that both sexes and age have great role in beekeeping management. However, in the current study, most of the beekeepers were males and illiterate as compared to females. The involvement of few females and illiterate in beekeeping management could be attributed to the cultural influence existing in the study area. This is also in agreement with the findings of the study by Tesfaye K. and Tesfaye L. (2007) who reported the involvement of few females in beekeeping management in other parts of Ethiopia.

Traditional beekeeping was the most predominant practice reported from both Basonawerena and Termaber districts. This could be due to lack of knowledge, shortage of experience sharing and low awareness to adopt the transitional and frame hives. This is in line with the findings of the study by Amsalu *et al.* (2004) who reported that beekeeping practice in Ethiopia is predominantly traditional.

Beekeeping association is important for beekeepers for collaborative work and for sharing experience. All (100%) from Termaber district and 91.5% from Basonawerena district of the respondents were not participating in any beekeeping association. This might be due to less attention of the district administration and development agents to beekeeping association. Credit access is also important for beekeepers to purchase frame hives, initial capital for start modern beekeeping management and honey production and hence increase honey production at individual and community level. In the current study 97% and 91% of the respondents from Termaber and Basonawerena districts, respectively did not get any credit service. This was a constraint for beekeeping development and adopting the frame hives by beekeepers. This is in agreement with the study of Feder *et al.* (1985) and Workneh (2007) who reported that lack of initial capital hinders the beekeepers particularly the resource poor beekeepers from adopting modern technology.

Beekeepers with longer beekeeping experience would have a cumulative knowledge of the entire beekeeping. Experience sharing among beekeepers enables them to adopt the use of

modern beehives. This is in agreement with the study of Rahman (2007) who indicated that experience helps an individual to think in a better way and makes a person more mature to take right decision. As beekeeper got more experience in beekeeping, it enhances the beekeeping management and honey production. Similar study was undertaken by Assefa (2009); Workneh (2007) who documented that beekeepers with longer beekeeping experience enables beekeepers to adopt the use of improved box beehives than beekeepers with short beekeeping experience. However, there was lack of beekeeping experience in Termaber and Basonawerena district. This might be due to the less transfer of skill and inadequate training in the study area.

Training is an important aspect of beeping development in both national and district level. This helps the beekeepers for proper handling honey, preparing apiary site, understanding the market, understanding the management, understanding the technology and to motivate beginner beekeepers. This is in agreement with the study of Rahman (2007) and Workneh (2007) who stated that training provides technical competency, more exposure to the subject matter and convinced to adopt the improved technologies to the beekeeper. In the present study most beekeepers did not get training to build their capacity in beekeeping management from Termaber and Basonawerena districts. This might be due to less attention to the sub-sector.

Sugar, beso (barley flour), 'erdi' and honey were mentioned to be the supplementary food for honeybees in the study area. This is in line with the study by Workneh (2007) who reported that the supplementary feed for honey bees include sugar, barley flour, peas and beans flour. The following types of hives were found in the study area. These included: hives made of bamboo, hives made of tree branch and tendril, hives made of animal dug and hives made of clay. Of this the most predominant type of hive was hives made of bamboo. This is in agreement with the report by Fichtl and Admassu (1994).

Most of the respondents in the study area indicated that the minimum and maximum mobility of the honeybee ranged from one month to over twenty years. This is in agreement with the study of Kerealem *et al.* (2011) who reported that the migratory tendencies of honey bees around amhara region is very low and can remain 5 to 10 years. Even in the absences of food they remain in their nest starved to death.

The important activities of modern hives over traditional hives by honey harvesting, honey extracting, colony transferring and colony split were described in the study area. This might be due to the fact that the modern hive can be easily checked, have enough space for bee colonies, having separate chambers for broad chamber which enabled honey harvest without damaging the hives and colonies. Three hive types, traditional; Transitional and frame hives were recorded in the study area. This in agreement with the study of Tesfaye, K. and Tesfaye, L. (2007); Nuru (2007); Beyene and David, (2007) Who reported that all the three type of hives area available were commonly practiced in different parts of Ethiopia.

The common means of getting hives by beekeepers was either buying from the local market or constructed by themselves in the study area. The price of hive during the study period was varying between 20 to 1000 birr/hive depending on the type hive in the study area. This is might be due to un availability of the transitional and frame hives and also high demand towards this types of hives. Most of beekeepers in the study area externally inspected their hives daily. This might be due to that most of the apiary site in the study area was close to their homes. Beekeepers had more number of traditional hives than other hive types. The less number of improved hives in the study area might be due to high cost. Most of the Beekeepers in both districts kept their hives in the back yard. This might help them to manage easily their colony, to provide shelter, provide water and feed frequently and protect them from bee enemies. This is in agreement with the study of Meaza (2010) and Nuru (2002) who showed that though some beekeepers try to distribute their hives along all apiary sites, back yard is a common apiary site in most parts of the country.

In the study area the beekeepers protect their bees by simple protective measures, such as metal or plastic covering to protect their hives from pests and predators. However, from both districts it was reported that there was no specialized protection methods in the study area. Similar study was undertaken by Tesfaye and Tesfaye (2007) in Adami Tulu Jido Kombolcha district who documented that beekeepers had no any disease control mechanisms. There were three methods of swarm capturing and settled colony mobility but, the most common method in the study area was water spraying. This might be water spraying easily attracts colony without damaging the bee colony.

The trends and status of transferring honey beekeeping from traditional bee colonies to transitional and frame hives showed a decline in both districts. The possible reason for this could be the high cost of the improved hives and lack of awareness. Eighty five percent of the

respondents from Termaber district and 82% of respondents from Basonawerena district did not know the advantage of beeswax. This might be due lack of awareness, lack processing material, lack of processing skill and absence of market. This was in line with the study by CSA (2008) and Tessega (2009) who describe that beeswax is mostly left or thrown away in Burie District of Amhara Region. In Basonawerena and Termaber districts, honey was harvested once, twice or three times a year. The most harvesting season was reported from October to November. This might be mainly attributed to the offset of the rainy season which results in the flowering of diverse plant species. This was in agreement with the report of Mathewos *et al.* (2004), CSA (2008) and Tesfaye and Tesfaye (2007) who indicated that the major honey flow season was November to December in different parts of Ethiopia.

Honey production in the study area was important as source of income and means of food.. Beekeeping product in the study area is mostly dominated by crud honey. This might be due to the less accessibility of modern technology and equipments to processes honey. Similar result was also reported by Nuru (1999) who described that low productivity and poor quality of bee products in Ethiopia was due to lack of skill to manage bees and bee products. Most of the rural beekeepers cannot afford to invest inputs, process, pack, and transport their products to market to maximize profit. White honey is more predominant over red honey in the study area. This is in agreement with the study by Abebe *et al.* (2011) who reported that types of honey (White, Yellow, Red and Black honey) produced in Ethiopia varies according to type of flora. As the respondents from Termaber and Basonawerena district, respectively reported that the highest price of honey was greater than ninety birr/kg while, the least price of honey in both districts was in the range of 61-70Birr/kg. The difference price of the honey between the two districts might be due to the quality and attractiveness of the honey to the market availabilities.

Market is one of the most important factors that affect for the beekeeping management and honey production activities. This in agreement with the study of Workneh (2007) who reported that the availability of market for the hive products enhances the adoption of improved box hive However, 87% and 80% of honey produced was sold at local market in Termaber and Basonawerena district respectively, they did not sell their honey for regional market and honey processor agency. This might be due to the less quality honey harvesting, absence of honey collector, absence of market agreement of beekeepers with honey processer and lack formation of beekeeper organization in the study area. Moreover, similar result was

reported by Nuru (2007) there is no well established honey marketing channel that allows small-scale beekeepers to access regional and national markets in Ethiopia. Similar study was also conducted by Gedey et al. (2010) in the central part of Ethiopia marketing channel for honey is poorly developed due to lack of marketing organizations.

The maximum honey production was from frame hives which accounts 790 and 600 kg from Termaber and Basonawerena districts, respectively. The annual income of beekeepers from the sale of honey in the study area ranged from 1000 to 10800 Birr. And the mean annul income per beekeeper during the study time was about 3491.9 and 4187.1 Birr. This variation might be due to the number of colonies, availability of honey bee flora and way of colony treatments in the study area.

In the present study the trend of honey production was fluctuated from past to present. Even though the trend of honey production showed fluctuation from 2006 to 2012, there was steady increase starting from 2010 to 2012 and 2011 to 2012 in Basonawerena and Termaber districts, respectively. There were similar reports from studies by Bezabih, (2010); Edessa (2005) and Girma (1998) which showed that the current honey production in Ethiopia was increased. This might be due to the introduction of transitional and frame hives and policy guidance.

The majority of beekeepers in Termaber and Basonawerena district respectively did not know the importance of beeswax and never processed it as product; this might be due to lack skills, market availability and absence of awareness for beeswax collection and processing. Fichtl and Admasu (1994) also reported that in several regions of the Ethiopia, beeswax collection is not significant and considered as waste. The wax is mostly left or thrown way because beekeepers do not bother to collect it since it is of little practical value for beekeepers and the people do not know the local beeswax is generating attractive money. In this study most bee keepers do not store honey after harvest in both districts while, few beekeepers stored their honey more than six months. . This is in line with the report by Tessega (2009) that the majority of beekeepers do not store honey primarily because of high demand for cash and secondly because of lack of storage facilities.

Beekeeping is a sustainable form of agriculture, which is beneficial to provide economic reasons for increased income and means of food security in Termaber and Basonawerena districts. This in agreement as noted by Robinson (1980), among the relative opportunity of

beekeeping one is that whole family can involve in beekeeping activities since men, women or elder children can do the work at home. According to the respondents, there are various flowering plants species used as source nectar for honeybee. Some of the plants species that flowering though out the year are; *Schinus molle, Olea europaea, Citrus aurantifolia, Psidium guajava, Buddleia polystachya, Ericca arborea, Carica papaya, Carissa edulis, Rhamnus prinoides, Musax paradisiaca.* Similar results was reported by Mathewos *et al.* (2004) major pollen and nectar source for honeybees in Manasibu districts and also explained by Azage *et al*. (2006) one of the critical factors that drive apiculture development is the availability of adequate quantities and quality of bee forages and identification of Ethiopian honey bee flora by Fichtl and Admasu (2007) were discussed.

In the current study, lack of skilled manpower and training institutions, low level of technology, poor quality of honey harvesting, absconding, lack of enough space, drought, poor community awareness on beekeeping management, shortage of bee flora, pesticides poisoning, shortage of bee colony, shortage of frame hives and market problems were reported to be the major constraints that undermine the beekeeping practice in the study area. This is in agreement with study by Gezahegn *et al.* (1991); Desalegn (2006); Kerealem *et al*. (2011) who documented that shortage of bee forage due to population pressure and the high demand for farmlands around mountainous areas to be used for crop production and livestock grazing, the existence of pests and predators, problem of swarm control were the factors which endangered the health of local honeybees and production of honey in different agro ecology zones in Amhara region, Ethiopia. This is also in line with the study by EARO (2000) as cited in Kerealem *et al.* (2011) which indicated that prevailing production constraints in the beekeeping development of the country are complex and to a large extent vary between agro-ecological zones and production systems, variations of production constraints also extend to socio-economic conditions, cultural practices, climate (seasons of the year) and behaviors of the honey bees.

6. Conclusion and Recommendation

6.1. Conclusion

On this study conclude that beekeeping plays a significant role as source of additional cash incomes and nutrition in the study area. It can exercise in all level of agro-ecology zones. However, in spite of its contribution and potential for sustainable development to beekeepers the attention given to the sector still not satisfactory as the high level of the apicultural resources would allow in the study area.

As the research indicated that there are three types of beekeeping management were found in the study area. These are traditional, transitional and frame hives. Traditional (86%) was commonly practiced. The common type of traditional hives was bamboo hive, tree branch or "hareg" hives, animal dug and clay hive. The most means of getting hive was by bought from local market and price of hive was ranged 20 birr (traditional hive) -1000 birr/hive (frame hive). The preferred apiary was back yard. Beekeeping association, experience share, credit service and training program were limited. Modern hives were give high production than than traditional in the study area. Water spraying was also the most preferable method of swarm captures and settled colony absconding.

The present study revealed that the trends and status of transferring traditional hive in to transitional and frame hive was becoming decrease. Even though the trend of honey production showed fluctuation from 2006 to 2012, there was steady increase starting from 2010 to 2012 and 2011 to 2012 in Basonawerena and Termaber district respectively, but processing and selling of beeswax in the study area was low. The peak harvesting and honey flow season was from October to November. The type of honey product in the study area was crud honey which is dominantly by white color and widely used for consumption and selling. Most of the beekeepers were used their honey immediately after harvesting. Beekeeping had many opportunities for beekeepers and cause of plant species diversification in the study area.

The result obtained from study indicated that, lack of skilled manpower and training institutions, low level of technology used, poor quality of honey harvesting, absconding, drought, poor society awareness on beekeeping management, shortage of bee flora, pesticides poisoning, shortage of bee colony, shortage of modern bee hives and marketing problems were find out to be the major constraints that affect the beekeeping management and honey production in the study area.

6.2. Recommendations

- Government and nongovernmental institutions should provide technical assistance, financial support and assist in creating local market.
- Beekeepers should be encouraged to use transitional and frame hives to enhance honey production.
- Beekeepers should have a means to get financial assistance from credit services and regular training to improve beekeeping management.
- Efforts should be needed to reduce the main constraints of beekeeping such as pesticide use, low skilled manpower, inadequate apiary site, use of low level of technology, and lack of awareness.
- Further research should be promoted on beekeeping management, the major constraint of beekeeping and means of minimization their effect, the traditional knowledge of beekeepers in beekeeping should be scientifically examined by scientific research.

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Appendices

Appendix: I

Plate 1: Interviews with best beekeepers and administrative parts

Plate 2: Type of hive in the study area

Plate 3: Traditional hive

Plate4: Transitional hive

Plate5: Modern hive

Plate6: Group discussion participants in the study area

Plate 7: Observation during study

Plate 8: Inappropriate putting of modern and traditional hive in the study area

Plate 9: Traditional protective material

Plate 10: Types of honey produced in the districts

Plate 11**:** Type of traditional hives in the study area

Appendix II

JIMMA UNIVERSITY

College of Natural Sciences, School of Graduate Studies

Department of Biology (Ecological and Systematic Zoology Stream)

The main objective of this questionnaire is to assess Beekeeping Management and Constraints in Termaber and Basona Werana Districts, North Showa Zone, North East Ethiopia

Household survey questionnaire

1. General information

1.1 Name of respondent _____1.2

Region _____

1.3. Zone _____ 1.4. Woreda _____1.5. Kebele _____

1.6. Village (Got) _____1.7. Sex _____1.8. Age _____

1.7. Marital status: 1. Married 2. Single

1.8. Education level of house hold:
1. Illiterate, 2. Basic education 3. Grade 1-4, 4. Grade 5-8, 5. Grade 9-12. 6. Tertiary level

2. Bee Keeping Practice survey questionnaire

1. When did you start beekeeping? Since _____

2. What kinds of hives do you have? 1. Traditional 2.Transitional 3.Modern

3. Where do you hang your hive 1. Back yard 2.Under the caves of the house 3. On trees near homestead 4. Hanging on trees in forests

4. How many times in a year do you harvest and months?

1. Once, from _____to _____Month

2.Twice, From _____to_____ Month

3. Three times, from _____to_____ Month

5. When is the most honey production period? From _____to_____ Month

6. How much honey do you harvest from a single hives per harvest?

1. Traditional Maximum/hive_____ Kg Minimum /hive____ Kg

2. Transitional Maximum/hive_____ Kg Minimum /hive____ Kg

3. Modern Maximum/hive_____ Kg Minimum /hive____ Kg

7. How many honeybee colonies you owned?

1. Traditional_____ 2.Transitional_____ 3.Movable-frame_____

8. What was the trend of beekeeping product since your beginning operation?

1. Sharply increased 2.Increased 3.Decreased 4. Significantly decreased 5. No change

9. For how many years your colony remains or stays in the hive?

1. Traditional: Minimum _____year (s) Maximum _____years

2. Transitional: Minimum _____year (s) Maximum _____years

3. Movable-frame: Minimum _____year (s) Maximum _____years

10. List the main types of traditional beehives you used.

No	Types of materials made	Shape	Diameter	Length
1				
2				
3				
4				
5				

11. What was the average honey price (Birr/kg honey) for the top quality honey in 2012?

12. What kind of beekeeping products did you produce using traditional hives?

1. Crude Honey 2. Crude Beeswax 3. Honey bee colony

4. Crude honey & beeswax 5. Honey & Colony 6. Honey, Colony & Wax

7. Any other (specify) _____

13. What kind of beekeeping products did you produce using modern hives?

1. Pure Honey 2. Pure Beeswax 3. Queen rearing 4. Pure honey and beeswax

5. All products mentioned above

14. What kind of honey is produced in your village?

1. White honey

2. Yellow honey

3. Red honey

4. Black 5. All can produce

6. If other_____

15. Did you ever get beekeeping training? 1. Yes 2. No

16. If your answer for 19 is yes, from where did you have the training?

1. Research center 2. Agricultural and rural development 3. Non Governmental Organization (NGO) 4. Any other (specify) _____

17. If your answer for Q.19 is yes, on what area did you get training?

1. Colony split 2. Honey bee colony management 3. Processing, handling & storage 4. Market information and linkage 5. Input utilization 6. Bee forage development 7. In all aspects 8. Not at all

7. In all area 8. Other specify_____

18. What benefits have you gained due to training?

1. Understanding effective beekeeping management using modern hives

2. Understanding improved beekeeping management (eg. feeding, inspecting, supering swarm control) 3.Any other (specify) _____

19. Indicate the advantages of improved modern hives compared to the traditional hive. Show in table using ` √ `

Advantages	Very low (1)	Low (2)	Medium (3)	High (4)	Very high (5)
Honey yield					
Quality honey					
Cost					
Skill					
Supply					

	Very easy (1)	Easy (2)	Medium (3)	Difficult (4)	Very difficult(5)
Honey harvesting					
Honey extracting					
Transferring					
Inspection					
Colony split					
Feeding					

20. Is there enough number of bee colonies in your area? 1. Yes 2. No

21. Is there a beekeeping association in your village? 1. Yes 2. No

22. If your answer to the above question is yes, are you a member of the association? 1. Yes 2. No, if yes since when? _____

23. Is there a rural credit institution in your village? 1. Yes 2. No

24. If yes, what kinds of supports are you getting from them?_____ _____ _____

25. Do you have any contract agreement with the buyers/processors? 1. Yes 2. No

26. Do you have willing to enter in to contact agreement with the processors/exporters in the future? 1. Yes 2. No

27. Do you know any company exporting honey and or beeswax to abroad? 1. Yes 2.No

28. Where did you get your hive?

1. Constructed by him/her self
2. Bought from local market
3. Supplied by the government on credit basis
4. Supplied by NGOs on credit basis 5. Supplied by NGOs free of cost

29. What are the costs of the bee hives you are using?

1. Maximum_____ 2. Minimum_____

30. For what purpose do you use your honey? 1. Consumption 2. Selling 3. Both

31. If you sale, where/for whom do you sale the majority of your honey

1. At home for local beverage 2. At local market 3. Regional market 4. For honeycollectors 5. For processors 6. Other (specify)_____

32. What is the annual income from sale of hive product and bee colonies?

No	Type of product	Quantity	Unit price	Total
1	Honey			
2	Beeswax			
3	Bee colonies			

33. According to your opinion what kinds of interventions are required to improve the beekeeping in your area?

_____ _____

_____

_____

34. If you have any comments or suggestion?

_____ _____

35. What kind of management has been applied for safe honey storage? _____

36. Do you have protective cloths/equipments that can be used during honey harvesting?

1. Yes 2. No

37. Do you make experience sharing with beekeepers based on the managements of beekeeping practice? 1. Yes 2. No

38. If your answer for Q.51 is yes, on what occasion do you undertake?

1. during formal PA meeting □ 2. During beekeeping training 3. during `idir` meeting □

4. Any other_____

39. How could you treat colonies when they are affected by disease?

1 By traditional medicine 2. Modern medicine 3. Nothing is used 4.Metal or plastic covering

40. How do you settle your colony when they are absconding?

1. Using water 2. Using soil 3. Using cloth 4. If others_____

41. How do you keep your colony from any enemies?

_____

_____

42. For how long do you store your honey? (Circle one or more)

1. It sale immediately after harvesting
2. One to two months
3. Three to six month
4. More than six months

43. Do you visit and inspect your beehives and colonies? 1. Yes 2. No

44. How frequently do you examine your hive?

1. Every day 2. Every two to three days 3. Every week.

45. During harvesting do you remove all honeycombs? 1. Yes 2. No

46. Do you have extractor that separate honey from its comb? 1. Yes 2. No

47. When do you harvest your honey? 1. At night 2. At day time

3. Why? _____

48. What is the mechanism of honey harvesting in the traditional beekeeping practices?

_____

_____

49. What is the mechanism of honey harvesting in the modern beekeeping practices?

50. How much bee colony do you owned?_____

51. Do you identify the best flora that important for bee forage?

1. Yes 2. No

52. If yes for Q. 67 list below in the table the type of flora that important to your bee

No.	Local name	Scientific name
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

53. Have you ever feed your bee colony during the dry season?. 1. Yes 2. No

54. If yes for Q. 69 what kind of food do you prepared for your colony

55. Have you ever consider the factor pesticide on your colony? 1. Yes 2. No

56. Which mechanism of beekeeping practices is easy for you?

1. Backyard 2. Forest 3. Under the roof 4. In the house

57. Is there colony absconding following the main honey fallow season and through the dry season? 1. Yes 2. No

58. If your answer is yes, what do you think is the reason?

1. Shortage of food and water 2. Pests and predators 3. Poor bee management during

4. Other (specify)_____

59. Do you process and sell beeswax? 1. Yes 2. No

60. If your answer is no, what is the reason?

1. Lack of awareness about its importance2. Lack of processing skill

3. Lack of processing material 4. Lack of beeswax market in the area

5. Other (pleasspecify)_____

61. What are the major pests and predators found in the area that threat your

colonies? List in order of their importance.

No	No Pest /Predators	Rank	Local control methods
1	Ants		
2	Wax moth		
3	Bee lice		
4	Beetles		
5	Spiders		
6	Wasps		
7	*Prey mantis*		
8	Toads		
9	Lizard		
10	Snake		
11	Monkey		
12	Birds		
13	Hamagot /Shelemetmat/		
14	Others (specify)		

62. Is their these challenge faced that undermine beekeeping practices in your local area?
1. Yes 2. No

63. If your answer is yes/no for Question 80 please circle form Question 81-92 questions.

64. Land clearing for agriculture; 1. Yes 2. No

65. Replacement of felled trees with pine and low pollen and nectar yielding eucalypt plantations 1. Yes 2. No

66. Fires, including back burning and natural bushfires; 1. Yes 2. No

67. Reduction in vehicle access to quality apiary sites; 1. Yes 2. No

68. Droughts, which reduce flowering and interrupt growth cycles; 1. Yes 2. No

69. Control of weed species that provide pollen and nectar for honey bees; 1. Yes 2. No

70. Shortage of Bee Forage 1. Yes 2. No

71. Pesticides Poisoning 1. Yes 2. No

72. Lack of Skilled Manpower and Training Institutions 1. Yes 2. No

73. Low Level of Technology Used 1. Yes 2. No

74. Honeybee Diseases 1. Yes 2. No

75. Shortage of Bee Colony 1. Yes 2. No

76. Marketing Problems 1. Yes 2. No

77. Poor Quality of Honey Harvesting 1. Yes 2. No

78. Shortage of bee hives 1. Yes 2. No

JIMMA UNIVERSITY

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Department of Biology (Ecological and Systematic Zoology Stream)

The main objective of this questionnaire is to assess Bee Keeping Management and Constraints in Termaber and Basona Werana Districts, North Showa Zone, North East Ethiopia

Interview guideline for both Basona worena and Termaber District Agricultural office

1. General information

1.1 Name of respondent _____1.2 Region _____

1.3. Zone _____ 1.4. Woreda _____1.5. Kebele _____

1.6. Village (Got) _____1.7. Sex _____1.8. Age _____

1.7. Marital status: 1. Married 2. Single

2. What are the total number beekeepers in the district? Male _____ Female _____

3. What is the average productivity of the different hives in the District?

1.Modern hive_____(kg) 2.Transitional hive_____(kg) 3.Traditional hive _____(kg)

4. What are the major materials used for hive construction in the study area order them

1. Tree branch or hareg, 2. Clay, 3. Animal dug 4. Bamboo

5. Do you think that have advantages the different type of beehives materials? 1. Yes 2. No

6. How are the trends in the number of honey bee colonies in the District?

1. Increasing 2. Decreasing

7. Is there out grower scheme and honey collection centring in the District? 1. Yes 2. No

8. What are the main problems in honey production and marketing in the District?

1. Market price, 2. Traditional production system,

3. Inaccessibility of the area due to poor road infrastructure,

9. Did the concerned body give any training program to increase efficiency of honey production for the beekeeper in the study area? 1. Yes 2. No

10. How are the opportunities do exist in your area to improving your beekeeping activities?

1. Strong 2. Medium 3. Weak

11. What kind of problems is it observed?

1. Honey production problem 2.colony production problem 3. Bee forage problem

12. Are your colonies affected by disease? 1. Yes 2. No

13. Do you think these disease reduced the potential of beekeeping management in your local area ? 1. Yes 2. No

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Interview guide line for focus group discussion questionnaire

1. General information

1.1 Name of respondent _____1.2 Region _____

1.3. Zone _____ 1.4. Woreda _____1.5. Kebele _____

1.6. Village (Got) _____1.7. Sex _____1.8. Age _____

1.7. Marital status: 1. Married 2. Single 3.

2. How is the trend in the number of bee colonies and honey yield over the years in your village?

3. How is your access to markets (market information, road condition, alternative market places, etc)?

4. What are the main problems in honey production and marketing in your village?

A, Market price,

B, Traditional production system,

C, Inaccessibility of the area due to poor road infrastructure

5. How is your access to improved beekeeping technologies (modern hives, credit facility, harvesting equipments, etc)?

6. What are the main problems in adopting and use of modern beekeeping technologies?

7. What you suggest for future improvement of honey production and marketing in your area?

9. Have you understand the difference b/n traditional, transitional and frame beekeeping practices

10. What is the limitation of using these type hives?

11. What is the status of honey beekeeping practice?

12. What do you expect the significance of honey beekeeping in the district?

13. What are the economic importance of beekeeping and honey production in the district?

14. How could you tackle the existing constraints in your locality?