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Importance of Integrating Beekeeping with Closure Areas in Ethiopia: Status and Future Prospects

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Abstract
The review was conducted to assess the importance, status and prospects of beekeeping integrated with protected area in Ethiopia. The wide climatic and edaphic variability have endowed Ethiopia with diverse and unique flowering plant that is highly suitable for sustaining a large number of bee colonies and the long established practice of beekeeping. The Government has recently focused the need to develop apiculture as one of the strategies to reduce poverty and to diversify national exports. Apiculture plays a significant role in generating additional cash income to millions of farmer beekeepers in the rural areas and to the national economy of the country. Honeybees and flowering plants have a well developed system of interdependence. However, the rich biodiversity of Ethiopia is under serious threat from deforestation and land degradation, overexploitation, overgrazing, habitat loss. The trend of beekeeping in relation to protected area is still slightly increased but it is under threaten. Therefore, there should be strong integration between beekeeping and area closures because area closures are of priceless ecological values.
Keywords: Beekeeping, Closure areas, Trends, Status

1. Introduction

Land degradation has been a major global issue during the 20th century and will remain high on the international agenda in the 21st century. The importance of land degradation among global issues is enhanced because of its impact on world food security and quality of the environment (Eswarn, 2001). On a global scale the annual loss of 75 billion tons of soil costs the world about US$400 billion per year, or approximately US$70 per person per year (Lal, 1998). Nutrient depletion as a form of land degradation has a severe economic impact at the global scale, especially in sub-Saharan Africa (Stoorvogel *et al.*, 1993).

Ethiopia is a country located in the horn of Africa and categorized as one of the least developed countries (World Bank, 2004, CSA, 2012). Ethiopia's forest resources are rapidly disappearing as a result of the ever-increasing demand both for firewood, and crop and grazing land, stimulated by a rapidly growing population (Million, 2011). The majority of the population (85 percent) is rural and engaged in agricultural production, spanning 18 agro-ecological zones and five traditional climatic zones, including alpine (*Wurch*), temperate (*Dega*), subtropical (*Woina Dega*), tropical (*Qolla*), and desert (*Berha*) (Bryant**,** 2009). High population density is not necessarily related to land degradation; it is what a population does to the land that determines the extent of degradation (Lal, 1998). Despite a sustainable long-term economic growth poverty remains a challenge; the socio-economic landscape of the country has significant developments in the last decade. The level and distribution of poverty is declining from time to time and a remarkable economic growth has been observed. According to the interim report on poverty analysis of the CSA (2011/12) shows that the poverty rate has declined from 39 to 29.6 %.

Ethiopia has taken a number of fundamental measures after the ratification of the Convention on Biological Diversity (CBD). Improvements in the conservation status and trends of some endemic mammals; slight increase in the number and size of protected areas; The implementation of area closures resulting in the restoration of some locally extinct fauna and flora; The Ethiopian 3rd Millennium initiative that resulted in the planting of about 1.6 billion tree seedlings in degraded areas and areas designated for Millennium Parks in many localities (Institute of Biodiversity, 2009).

Beekeeping is a long-standing practice in the rural communities of Ethiopia and appears as an ancient history of the country (Ayalew and Gezahegn, 1991). Beekeeping is an environmentally friendly and non-farm business activity that has immense contribution to the economies of the society and to a national economy as whole. Beekeeping can be integrated with agricultural practices like crop production, animal husbandry, horticultural crops and conservation of natural resources. The contributions of beekeeping 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.).Thus, it would be one of the most important intervention areas for sustainable development of poor countries like Ethiopia (Gibbon, 2001). Therefore, transforming enclosure or watershed in to apiary is just one example of a possible "win win situation" for poverty alleviation (Jocobs *et al.,* 2006).

Therefore, the general objective of the study is to overview the importance, status and trends of integrating area closures with beekeeping in the country. The specific objectives of this review are to:

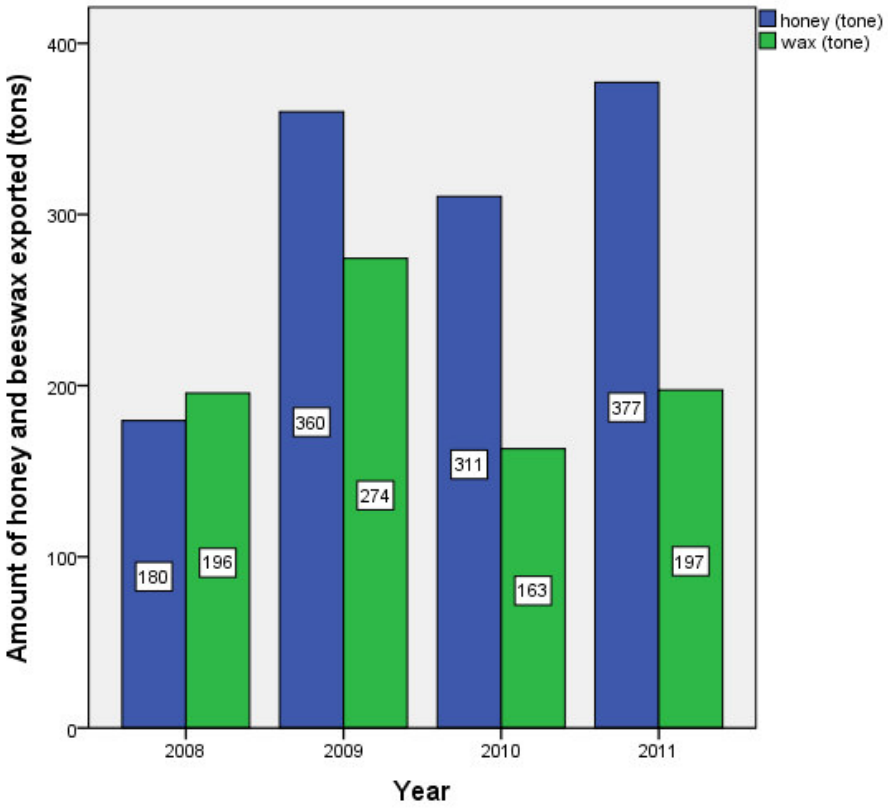
- Identify the challenges and opportunities of integrating protected areas with beekeeping
- Determine the potentiality of beekeeping for rural livelihood and national economy contribution
- Identify the role of beekeeping on ecosystem and agricultural productivity
- Determine the future prospect of beekeeping

2. Importance of beekeeping for national economy

Ethiopia is an important honey and beeswax producing country. The collection and selling of honey and other bee products, is a major economic activity. It is the leading producer of honey and beeswax in Africa, with honey production estimated at 43,000 metric tons per annum (Gezahegne, 2012). On a global scale, Ethiopia is the 4th largest producer of beeswax and the 10th largest producer of honey. The country enabled to take the total share of honey production around 23.58% and 2.13% of the African and world's respectively (SOS-Sahel, 2006, Workneh and Puskur, 2011). The gross value of livestock output as sum of values obtained from estimates of off takes, milk, poultry, honey and manure gives ETB birr 46,671 million, of which honey accounts 553 million birr (1.18 %) (MoFED and MoA, 2011).

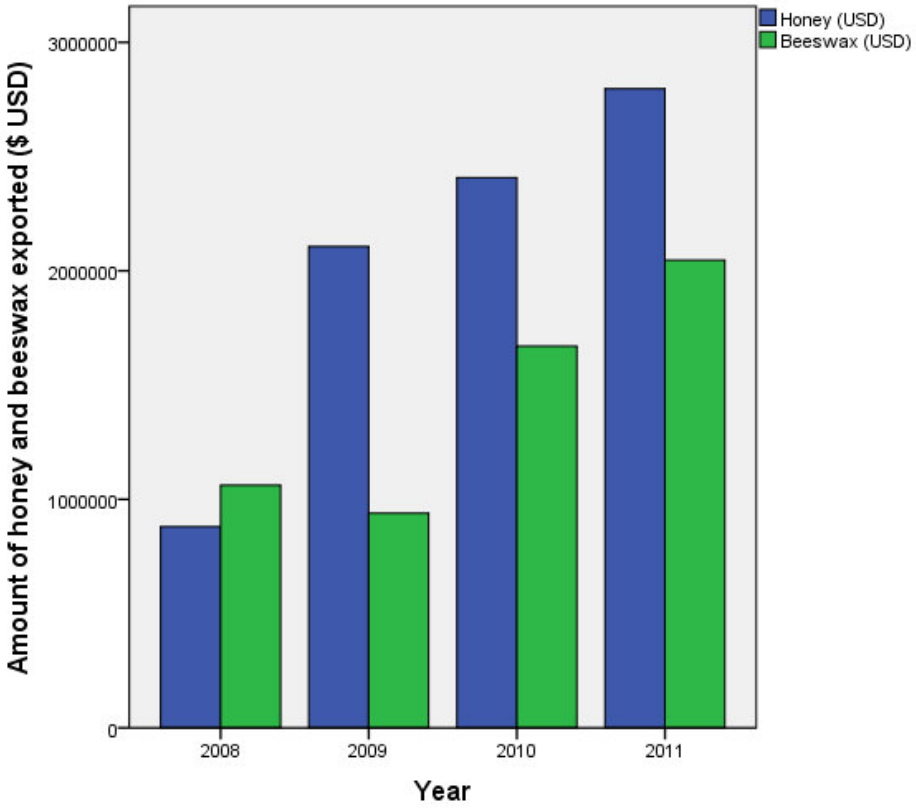
The apiculture sector in Ethiopia is institutionalized with two associations and a board: The Ethiopian Honey and Beeswax Producers and Exporters Association (EHBPEA), The Ethiopian Beekeepers Association (EBA) and Ethiopian Apiculture Board. In 2006 Ethiopia endorsed the 'Ethiopian Organic Agriculture Systems Proclamation' No. 488/2006, with aim of facilitating international acceptance and market access, value addition, ensuring traceability from farm to market through inspection, ensuring that product labels are genuine as well as the harmonization of organic production.

Ethiopia exported its first consignment of honey to the European Union (EU) in 2008 after a three year period of preparations towards attaining Third Country Listing status. Based on its 122% growth in exports value and 107% growth in its share of the world exports, Ethiopian honey export was categorized by the International Trade Centre as a 'star' in structural performance (SNV Ethiopia, 2012). The Top Honey Trading Companies/ Associations/ Cooperatives in Africa are-Comel Pvt Ltd.co,Yirgu Food packer Beza Mar Agro-industry Ltd, Rahi Honey Processing and Enterprises, all from Ethiopia (APIMONDIA, 2011).



Sources: Gezahegne, 2012

Figure 1. Export of Honey and Beeswax Quantity in tones



Source: Gezahegne, 2012
Figure 2. Export of Honey and Beeswax Quantity Value in USD

3. Potential of beekeeping as income generating activity

Apiculture is among the effervescent agricultural enterprises practiced throughout the country for its significant contribution to economic and social development at the household and national level (MoARD, 2007). Alleviate poverty and improves the standard and well being of the rural beekeeping community; Income from the sub sector secures financial power for the purchase of necessities (Gezahegne, 2012). The history of the use of honey is parallel to the history of man and in virtually every culture evidence can be found of its use as a food source and as a symbol employed in religious, magic and therapeutic ceremonies (Cartland, 1970; Crane, 1990).

The honey sector is one of the few sectors that had the most inclusive ability to achieve transformation and growth across all categories of rural households. In Ethiopia, more than 5 million beehives are managed approximately 1.4-1.7 million farm households, who are keeping bees as a means of additional income generation (Gezahegne, 2012, SNV Ethiopia, 2012,). Beekeeping has played significant role in household livelihoods in arid and semiarid particularly in drought prune and food insecure areas although the emphasis was not given by concerned bodies to the present (Debissa, 2007). The socioeconomic survey in many parts of the country indicated that beekeeping as major off-farm activity contributing 46.8% of the household income (Admassu *etal*., 2012).

Beekeeping enable for large number of citizens to engaged in trading of honey at different levels and selling of honey wines (local beverage Tej) which create job and self employment opportunities (MoARD,2007, Yirga and Mekonen (2009). Traditionally, the demand for honey in Ethiopia is based on the consumption of honey in alcoholic “tej” and non-alcoholic “birz” beverages. Processing of the honey for such beverages takes place in the households and/or in specialized “tej” houses. This is often operated by women and creates income. An informal set of market channels is used to create linkages between producers and consumers of the beverages (www.ipms-ethiopia.org).

Apiculture in south western Ethiopia provides an opportunity for or low-income people to supplement their earnings by the sale of harvested bee products such as honey and beeswax at a suitable market (Gallmann and Thomas, 2012). According to CSA (2012), of the total 5,207,300 beehives 45,905,201 kilograms of honey was produced during the survey year which showed increment from year to year. Despite Ethiopia’s long history in beekeeping and its endowment with favorable natural resources for honey production, its honey contribution to the beekeeper’s livelihood is very low. Moreover, benefit from yield of honey and beeswax has not satisfactory (Beyene and Davide, 2007). The prominent factors for this low honey productivity is due to the

traditional bee hive, lack of improved beekeeping management techniques and insufficient honey bee forage availability and being it is seasonal (Girma, 1998, Ayalew, 2005, Martin, 2011)

4. Socio-economic and Environmental values of integrating beekeeping with protected areas

4.1. Socio-economic importance

Studies carried out on plant diversity at home garden, woodlots, maintained area showed that about 84% of the beekeeper households grew and conserve plants for their honeybees and for other economic uses however, on none beekeepers indicated that only 16% of them were found growing plants for any purpose (Admassu *et al*. ,2012).

Beekeeping fits in very well to small-scale farming systems. It does not require land to be owned and/or rented and soil fertility is not an issue to consider. Feed is also not an issue as they forage on otherwise unused resources: nectar and pollen. In other words beekeeping does not compete for other resources needed by livestock and crops. Bees complement crops with their pollination of farmed crops and this in turn can increase crop yields (Martin, 2011).

Plantation and rehabilitation components contribute for the betterment of the environment which needs more work in the future. Government offices of agriculture, Cooperative, Women's Affairs and Youth and Sport Affairs, different NGOs have been technically and in mobilizing supporting to improve income, employment, nutrition and natural resources management. Examples in Tigray region, about 250 HH (100 Females) organized in 10 cooperatives (www.actionaid.org/**ethiopia**/2011/04/**)** are benefiting from Action Aid initiated and supported beekeeping schemes in Ofla district and 27 beekeepers association (**www. slow food foundation. com**) coordinated by Wukro White Honey Slow Food Presidium project are managing their beekeeping in the protected areas. The 27 beekeepers association at Wukro district, lead by Haleqa Alem Abreha (owners of more than 400 modern beehives) currently selling their honey to abroad countries. Similarly, the project in Ethiopia in titled with "Local Solutions for the Challenge of Unemployment and Food-Insecurity based on Adaptation to Climate Change", focused on beekeeping and multipurpose trees and shrubs as a means to combine the conservation and Sustainable use of rehabilitated hills sides and agro forestry by farmers and landless unemployed youth. Accordingly, 600 unemployed youths have been trained in climate change and food security activities (UNEP, 2011). In Amhara region, about 14088 unemployment youth are organized in beekeeping activities (ABoARD, 2012). The honey producer and processer, Dimma Honey, directly oversees bee farms at 11 sites and 1,000 colonies across Tigray (Bryant, 2009, TBoFED, 2003 E.C).

4.2. For Biodiversity and agricultural productivity

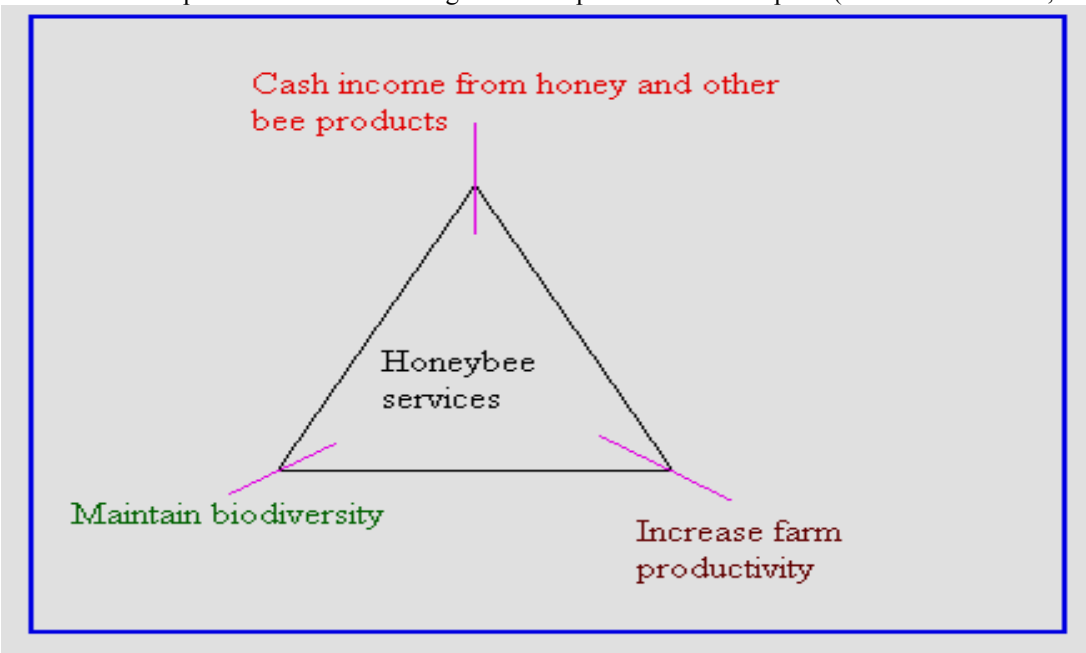
The rural people of the developing countries, whose means of living relied on natural vegetations, are likely to bear the adverse effects of climate change (IPCC, 2007). In aware of the adverse effects of climate change, the study made prior to the national plan of Ethiopia's Carbon Resilient Green Economy (FDRE, 2012) indicated that Ethiopia has become warmer over the past century and climate change will bring further warming over the next century at unprecedented rates. To address the problems of bee flora degradation, a number of interventions have been made in the country. For instance in Tigray region, rehabilitation of areas through reclamation and exclosure coupled with soil and water conservation efforts with improving conditions for apiculture (Bedru *et al.,* 2006). According to annual report of Tigray BoARD (2010), most of the degraded lands are rehabilitated with natural vegetation at faster rate than expected and most natural vegetation are suitable for soil and water conservation and most of them are preferred bee flora.

Beekeeping with its huge potentials to save the natural forests and to earn subsistence income for the rural poor is one of the agricultural sectors believed to serve as an instrument for climate change adaptation (FAO, 2012). Ethiopia has huge potential for beekeeping production because of its endowment with diversity in climate and vegetation resources offer potentially favorable conditions for beekeeping.

Environmental sustainability demands that ecosystems are not damaged beyond their capacity to maintain their own biological processes, functions, biodiversity and natural productivity. Sustainable beekeeping must first consider the place of within an ecosystem and their impact on its ecological services (www.beesfordevelopment.org/portal). Beekeeping is a major integral component in agricultural economy of developing countries and produce much more than food. Current interest in quality of environment is influencing the people to look more deeply at the factors upon which food production, health and aesthetic aspects of the environment depend (Martin, 1976). Beekeeping is exceptionally sustainable as the activity has no negatively impact on the environment and rather it stabilizes fragile areas and help in reclaiming degraded lands and increases biodiversity (Gemechis *et al*., 2012).

Bees and trees are interdependent; trees provide excellent resources to bees. 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*) (Adimasu, *et al*., 2000), *Allium cepa*

(Adimasu *et al*., 2006), *Vicia faba* and the result anticipated 43%, 84% and 28% yield increments respectively with early ripening effect on the *Citrus sinensis* fruit. These indicated that honeybees have a vital role in increasing food production and overall agricultural productivity. Of the 100 crop species that provide 90 per cent of the world's food, over 70 are pollinated by bees (UNEP, 2011). The efficiency pollination of honeybees is due to their great numbers, their physique and their behavior of foraging on only one plant species at one time (FAO, 2009). The well being of bees are highly dependent upon the conservation of the ecology. Unlike other agricultural practices, beekeeping does not disturb the ecological balance of an area. Many experiences have shown that beekeepers not only try to conserve the natural vegetations in their surroundings, but also plant multipurpose trees in their homestead and farmlands as a bee forage sources. Environmentally, bees do not over graze as other animals do; rather, they assist in plant reproduction through pollinating them. Protection and conservation of the remaining natural forests is critical to protect species and biodiversity in Ethiopia. The identification, demarcation, and preservation of the remaining natural forests and wildlife will be beneficial to present as well as future generations (Badege, 2009, Debissa, 2006). Integrating market oriented commodity development in synergy with the conserved watershed resources gradient provides real income to farmers that are relatively resilient to extreme rainfall variability. The honey productivity, sheep fattening, forage biomass yield, income from crop lands ware recorded higher for adopters than non-adopters (Gebremedhin *et al*., 2012).



Source:taken from Debissa, 2006
Figure 3. Role of honey bees on biodiversity, farm productivity and household livelihood

5. Current opportunities and threaten of beekeeping integrating with protected area in Ethiopia

Ethiopia is endowed with an immense diversification of melliferous plants. There are over 7,000 species of flowering plants (Edwards ,1976) existing in the country; of which most are honeybee flora comprising natural trees, forage plants, horticultural and cultivated crops (Reinhard and Admassu,1994). These resources coupled with variable climate, edaphic factors, huge water resources & other favorable ecological factors enable the country to sustain large numbers of bee colonies. In this time, environmental rehabilitation becomes a cross cutting issue to everyone in the country. There are a numerous number of integrated watershed management interventions in every region of the country. The Sothern and Western regions of the country's forest areas are a great potential for beekeeping if proper management is intervened. In the Central and Northern highlands, despite the fact that soil and water conservation is undertaking and beekeeping integrating is evolved; it is under threaten duo to many factors.

Deforestation, accelerated soil erosion, and land degradation are serious problems in Ethiopia. To overcome these problems efforts have been made to launch afforestation and conservation programs; success to date, however, has been limited.

The need for agro-chemicals in modern agriculture is increasing and unsystematic use of these agrochemicals has a subsequent effect honeybees. According to the report CSA (2012) the total pesticide applied cultivated land for the year 2011/12(2004 E.C.) main production season was more than 2.2 million hectares. Every year on average 1262 tons of agro chemicals are imported and used. Yearly, about 541,467 liters of pesticides aerially sprayed on 514,923.6 hectares to control the migratory pests (Amsalu *et al*, 2012). It was

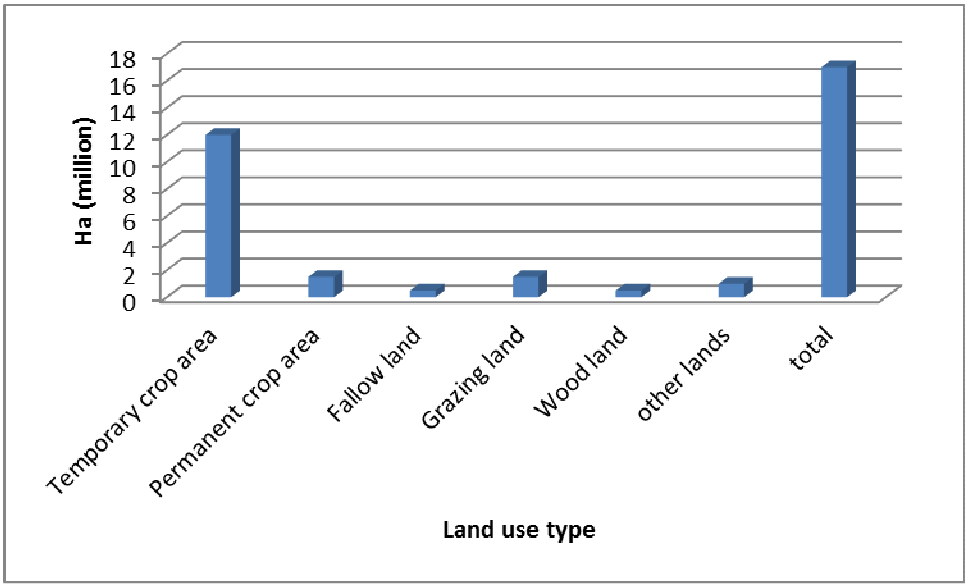
found that there has been a substantial decline of shrub lands, woodlands and forest cover and drastic expansion of cultivated land in the Ethiopian highlands from the 1860s to the 2008s but improvements in vegetation cover in some areas. The land use and land cover change in the Ethiopian highlands has affected the basic natural resources, by causing surface runoff, decreased water retention capacity, decreased stream flow, loss of wetland and drying of lakes (Alemayehu and Ólafur 2011).

Population growth in the densely populated Ethiopian highlands is also one of the most critical drivers of the observed land cover dynamics because the livelihood of almost the entire rural population is dependent on agriculture. Currently, in the Ethiopian highlands, arable land expansion has reached the upper limit of the extent (Alemayehu and Ólafur 2011).

6. Current status and trends of beekeeping

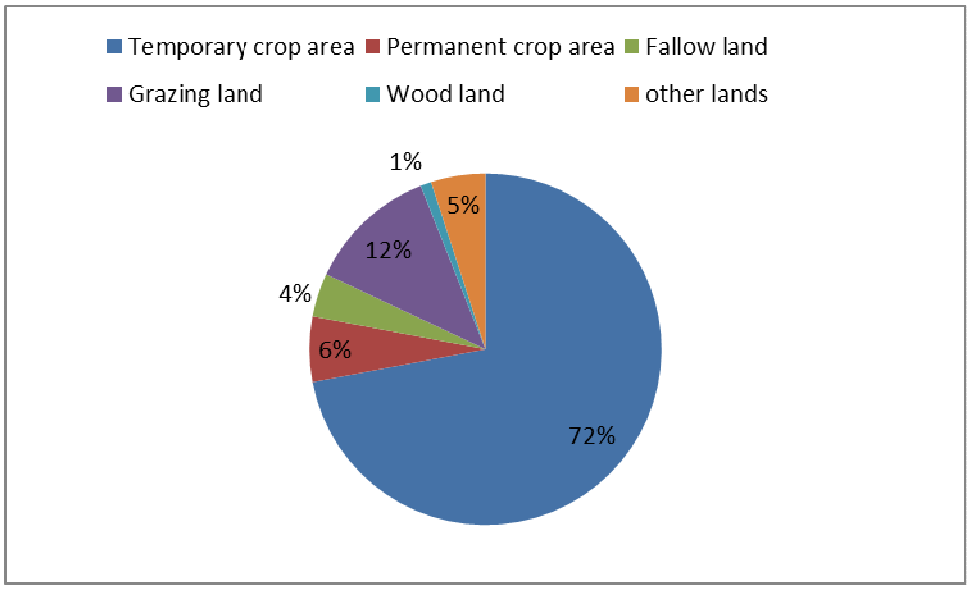
The rich biodiversity of Ethiopia is under serious threat from deforestation and land degradation, overexploitation, overgrazing, habitat loss, invasive species and some water pollution. The underlying causes for these problems emanate from poverty, population growth, lack of alternative livelihoods, inadequate policy support, inappropriate investment and inadequacy of law enforcement. A number of endemic wild animals, birds, trees and herbaceous plants are reported to be endangered or critically endangered. Resettlements and agricultural investment in commercial crop farms are also exerting pressure on the country's biodiversity (IBC, 2009).

According to the Ethiopian CSA, 2011/12, the total land of used for temporary crops cultivation was more than 12.5 million hectares. The land used for cultivation of permanent crops and grazing land were around one and two million hectares, respectively (Fig 4). The percentage share of land area for temporary crops, land area for permanent crops and grazing land is 72%, 6% & 12%, respectively (fig 5). The expansion of cultivated land can cause the decline of honey bee farming activities.



Source: *CSA, 2011/12*

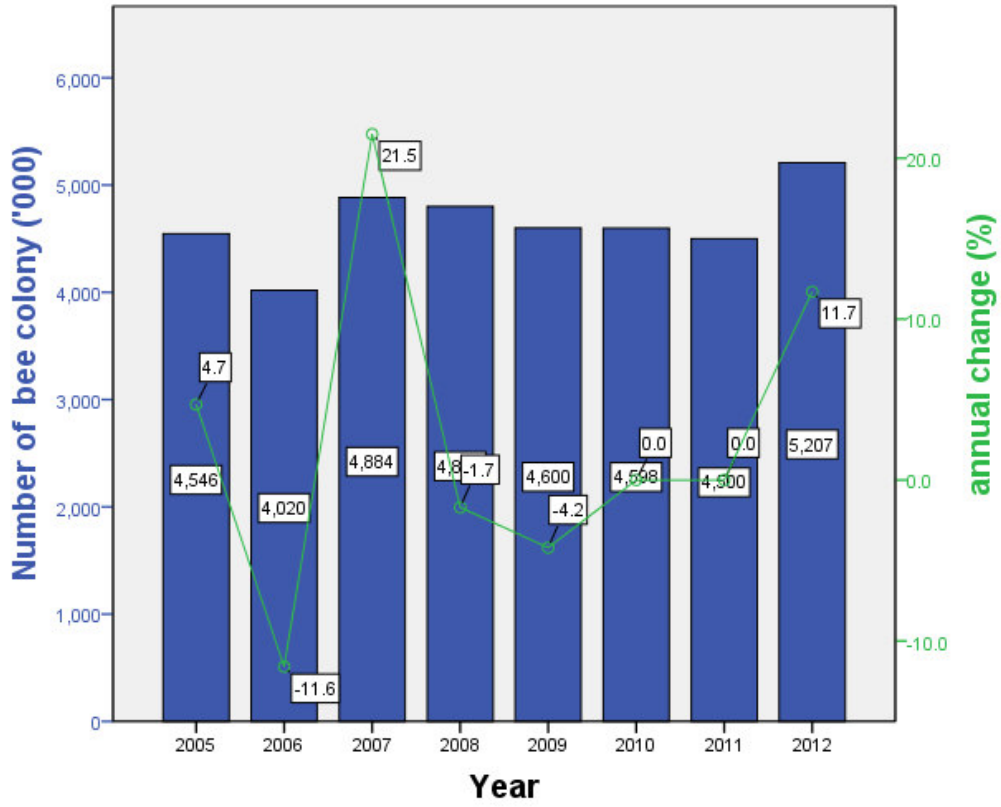
Fig4. Total land use area by type for private peasants in Ethiopia



Source: *CSA, 2011/12*

Fig5. Percentage share of land use area by type for private peasants in Ethiopia

Fig 6 sows that the number of bee colonies or beehives has increased only slightly during some years. The substantially large variations in annual growth rates could partly be explained by destructions in the livestock population due to recurrent droughts in some years and recoveries during the subsequent years (MoFEd and MoARD, 2011). The vegetation cover in the Ethiopian range land (grass land and bush land) were declined from the years 1973-2005 to about 80 % (Abule *et al*., undated).

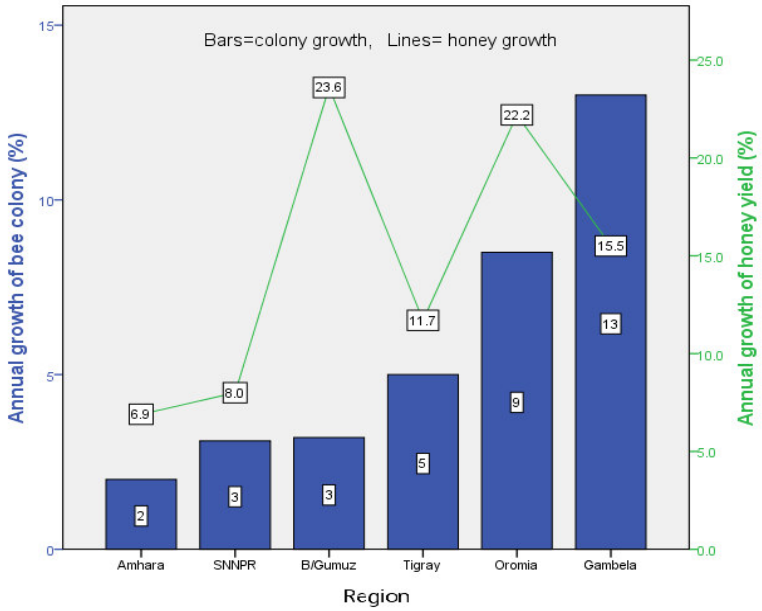


Sources: SNV, 2008, CSA, 2005, CSA, 2011/12, MoFED, 2011

Fig6. Number of Bee colony and annual growth rate by year

However, different year data indicated that honey production showed a slight increment in recent years (Fig7). This might be attributed to the recent efforts of federal and regional governments in promoting improved beekeeping as one of their regional development and food security strategies. Information obtained from regional BOARD indicates disseminations of improved beehives, mainly movable frame beehives, has increased since

2003/2004 production year, which had a significant impact on honey yield increment (MoA, 2007). Currently, with 45, 905 tons of honey production, the country is the leading honey producer in Africa and one of the ten largest honey producing countries in the world (CSA, 2012). Amhara region showed (Fig 7) less annual average growth rate of 2 % and 6.9 % for colony and honey production respectively. This is due to the fact that the shortage of bee forage is the first constraint in the region (Kerealem *etal*, 2012). The mixed farming systems in Ethiopia possess indigenous and traditional on-farm trees growing practices, such as parkland agro forestry, homestead tree planting, woodlot, and farm boundary tree planting, combined with apiculture (EFAP, 1994). However, human population is higher with more crop land and resources depletion. For this reason Amara region accounts 45 % midland area (ABoARD, 2012 E.C). The potential areas for honey and beeswax production in the country include south western, western and north-western parts of the country (Gezahegn, 2001). Many of the districts in Tigray, Wollo and Hararege and in some other parts of the country which are covered with insignificant 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 route of time. Tigray region is the most degraded region in Ethiopia. Despite this, a number of remarkable changes have been recorded in integrated watershed management, which is about 80% of the area is protected but still rain fall is variable from 20 up to 40 % (Kifle, 2012, Nyssen, J etal.,2007).



Sources: SNV, 2008, CSA, 2005, CSA, 2011/12, MoFED, 2011
Fig7. The Percentage of average annual bee colony and honey productions by regions

*Sources: www.actionaid.org/**ethiopia at Ofla district, Tigray region***
Fig8. Approaches used for watershed management

7. Future prospects of beekeeping

Ethiopia has a large natural and cultural diversity with a big range of climates which result from of its topography and latitudinal position (CBD, 2011). Ethiopia is experiencing the effects of climate change. Besides the direct effects such as an increase in average temperature or a change in rainfall patterns, climate change also presents the necessity and opportunity to switch to a new, sustainable development model. The Government of the Federal Democratic Republic of Ethiopia has therefore initiated the Climate-Resilient Green Economy (CRGE) initiative to protect the country from the adverse effects of climate change and to build a green economy that will help realize its ambition of reaching middle-income status before 2025 (EPRDF,2011). Beekeeping with its huge potentials to save the natural forests and to earn subsistence income for the rural poor is one of the agricultural sectors believed to serve as an instrument for climate change adaptation (FAO, 2012). The forested area of Ethiopia decreased from originally 40% of the total area to 3% with catastrophic consequences on food and drinking water supply. Aware of this problem, the Ethiopian government made different efforts for afforestation and protection of the remaining forests (Ingrid H., 2004, Tesfaye, 2007).Watershed rehabilitation is recovering and or restoration of the previous natural condition; and aims to increase the productivity of agricultural and other natural resources through a combination of re-vegetation and soil and water conservation (Alemtsehay Teklay (2011).

According to the strategic plane of CBD (2011), all the remaining natural ecosystems outside of the protected areas under sustainable use and management by 2020 will help the beekeeping sustainable.

As part of the community-based conservation of natural resources, initiatives to establish and manage protected areas are currently underway throughout the country.

8. Conclusions and recommendations

In general, Beekeeping is the most widely spread practice in the farming communities of the country and it is an integral part of the smallholder farming system. It is one of the most important income-generating activities in the rural communities.

There is still huge potential forages to increase honey production and to improve the livelihood of the farmer beekeepers. The Government has recently put in its agenda the need to develop apiculture as one of the strategies to reduce poverty and to diversify national exports. Since recently, the users of improved hives and appropriate beekeeping equipment and accessories are increasing. The presence of micro finance institutes at grass-root level and some NGOs are also giving more attention to the sub sector. The effort of the government tackled towards environmental rehabilitation of areas through reclamation and area-closure coupled with soil and water conservation efforts could be appreciated as an opportunity for beekeeping purpose. Accordingly, a number of landless youths were organized and under taking beekeeping activities as a means their income sources.

Ecologically, Bees and trees are interdependent with perfect relationship bringing about pollination and the production of viable seed. Trees do not need bees simply for their own reproduction but for maintenance and regeneration of the whole system within which trees exist. Rural people can generate income from this symbiosis while at the same time helping to safeguard natural habitats by the sustainable use of bee resources.

However, the loss of natural plant species or deforestation in most regions of the country, has undoubtedly affected the bee forage availability, diversity and flowering pattern, and finally honeybees products and productivity.

Recommendations

- There should be strong integration between beekeeping and area closures because area closures are of priceless ecological value; they prevent soil erosion, control flooding, affect rainfall, store and recycle nutrients, and provide habitats for vast numbers of plant and animal species. Keeping bees is one way of exploiting forests without destroying them. Beekeeping is therefore central to community forestry activities
- Because of current threats to bee flora, the beekeepers have to come up with alternative measures to conserve the important bee-plants within their farms and in the surrounding natural habitats.
- The beekeepers should be encouraged to plant multipurpose tree species that are not only nectar and pollen sources but also good trees in terms of timber and of medicinal value.
- Emphasis has been put on woody species, the role of herbs and shrubs remains poorly understood and appreciated by most beekeepers because most of these herbs are multipurpose and flower throughout the year.

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