

ROLE OF BEEKEEPING IN THE CONSERVATION OF FORESTS

S. I. N. AGERA

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ABSTRACT

Beekeeping preserves nature, agriculture, sustains livelihoods and provides food security. These important roles of beekeeping notwithstanding, the potentials of beekeeping are apparently not exploited in forestry activities. Bee products provide healthy, high-nutrient food, safe medicines (apitherapy) and raw material for industries. For example, honey is used in food processing industries as sweeteners or antioxidants and wax is utilized in batik making. Forests, being areas with no direct agricultural activity, provide a source of organic nectar. Without the pollinating activities of bees, over 100, 000 species of plants would have become extinct. *Pterocarpus angolensis*, *Dalbergia nitidula* and *Bethalletia excelsa* (Brazil nut tree) are examples of trees conserved through beekeeping. In the United Republic of Tanzania, bee forest reserves have been established with exclusive access for beekeepers. Also, in Tanzania, woodland is conserved in Mpika and Samfya Districts primarily to train farmers in beekeeping technologies in order to generate income from sale of honey. The Gwalek Forest of Nepal covers an area of 2571 hectares and has diverse flora and fauna with a high potential for beekeeping. Within the Mau Forest in Kenya, the bee has established some symbiotic relationships that have maintained the health of the forests for centuries. These conservation projects are encouraged by the World Wide Fund for Nature. It is recommended that developing countries should establish honey councils within their domains as a way of reinforcing the conservation of forests. These countries should give incentives to enhance active community participation and involvement of all stakeholders in planning and execution of beekeeping projects aimed at achieving the conservation of forests.

KEY WORDS: Forest, Biodiversity, Conservation, Sustainability, Beekeeping.

INTRODUCTION

The role of bees in agriculture, maintaining biodiversity, sustainable livelihoods and food security has been widely demonstrated. Nevertheless, the potential of beekeeping is very often not exploited in forestry activities and development programmes, since the benefits of bees and beekeeping are obscure to stakeholders. This paper sets out to provide farmers and other stakeholders in the forestry sector with information and arguments to convince them to accept beekeeping as a viable commercial and protective measure that should always be considered and integrated into national forest programmes and other development strategies. The paper highlights the role of bees in nature preservation and agriculture, the values of bees to man (economic, health and nutritional) at the national level and how these can be utilised in beekeeping and forestry programmes to contribute to poverty mitigation.

Deforestation and forest fragmentation are two of the most widely recognised, vital factors responsible for the degradation of the environment in Lindi Region (Tanzania) and globally (Lalika, 2008). Available information on the composition of forests, especially in the natural-resource-dependent areas, indicates a gloomy trend. The continuing forest loss is an indication of the imbalance between human needs and wants and nature's capacity. Lindi Region has potential and abundant areas for the development of beekeeping (URT, 2005). Existence of high beekeeping potential is a function of the presence of virgin forests and a low human population density that provides an environment conducive for beekeeping. The development of beekeeping activities for income generation and forest management is handicapped by poor transport,

infrastructure and marketing systems for bee products (Kihwele *et al.*, 2001; Ngaga *et al.*, 2005).

Improved marketing of bee products will enhance increased income and food security at household and national levels thereby achieving the national and UN development millennium goals of poverty alleviation and natural resource management (URT, 2005). Further, the importance of beekeeping as an income-generating activity pivots on the fact that many people use honey as food, medicine and for sale. Beekeeping offers a great potential for development and is comparatively less demanding in terms of investment, labour and time. In addition, beekeeping is advocated to improve human welfare by alleviating poverty through increased household income: it is a source of food and nutritional security, raw materials for various industries, medicine, increased government revenue through levies and taxes, improved biodiversity conservation and enhancing environmental resilience (Kihwele *et al.*, 1999; MNRT, 2004).

Beekeeping gives local people and the Government economic incentive for the retention of natural habitats, and is an ideal activity in any forest conservation programme (Mwakatobe, 2001; Okoso-Amaa *et al.*, 2004). In spite of the significance of beekeeping, there is little or no empirical evidence on the potential of beekeeping for income generation and forest management in most regions of the world. Most of the available research material is in the form of scientific documents with little information in the direction of rural development or forest conservation. Thus, there is need for information on the relevance of beekeeping to forest conservation; this information can be used by stakeholders in both beekeeping and forestry.

Impact of beekeeping on forest conservation, preservation of ecosystems and poverty reduction Value of bees for nature

Bees are important pollinators and many ecosystems depend on the pollination of bees for their existence and for increasing their genetic diversity (cross-pollination). A decline in bee colonies and bee species could therefore threaten the survival of plant species that depend on the pollination by bees. Some types of plants depend uniquely on their pollination by bees (FAO, 2007). Research by ecologists indicates that over 100,000 species of plants would become extinct in the absence of the pollinating functions of bees. Invariably, the absence of these plants would dramatically alter the ability of the Mau Forest ecosystem to function optimally. The Ogiek community which loves honey and depends on the Mau Forest for honey production would have lost this potential for producing honey (Mau-Mandela, 2010).

The ecological value of the pollination service of bees in forest communities, however, is often unknown. Honey hunting, for example, is an activity that is widely practiced in some forest areas in developing countries where bees are abundant, but is a direct threat for the bees. The activity consists of plundering wild bee colonies. The honey hunter uses fire to chase the bees away and often kills the bee colony by burning it to enable him harvest honey from wild bee colonies. This is not only a direct threat for the bees but also for the forest as this type of fire is sometimes reported as the origin of forest fires and wild bush fires, destroying large parts of forests, and habitats for bees and other pollinators.

Bees also play an important role in pollinating crops. About one third of all plants and plant products eaten by humans depend directly or indirectly on bees for their pollination (FAO, 2009). In the United States of America, it is estimated that bees contribute to the pollination of over 90 crops for a value of more than \$2.25 trillion (USD 15 billion) a year (Berenbaum, 2007). Crops pollinated by bees have been proven to produce higher yields and better quality, often at no extra cost for the farmer. Yet, many farmers consider bees and other pollinators as harmful insects. The excessive use of pesticides in agriculture can harm bees directly and indirectly. Bees bring the pesticide-contaminated pollen and nectar to their hive and slowly poison their offspring as the pollen and nectar are fed to the bees. Pesticide use may reduce the population of bees drastically by poisoning of the food on which the bees feed. This food poisoning leads to total extinction of members of the colony or drastically reduce the population of most colony castes (queen[s], drones and workers) to a dysfunctional status, a situation that may trigger-off Colony Collapse Disorder (CCD). Pesticide use may cause extinction of population of bees in a colony or drastically reduce the active population of bees. Reduced population of bee colonies could cause the colonies to collapse (CCD), a phenomenon that recently hit many beekeepers throughout the world (COST, 2008). Colony collapse disorder may cause the abandonment or extinction of some bee colonies.

In Tanzania, a milola Division beekeeping officer is quoted as saying: "Beekeeping is very useful and important for forest resource management. This is because where

beekeepers have put their hives they protect and avoid bush fires, and discourage people from cutting timber, poles and other forest resources. After some time these areas become green because the vegetation is allowed to grow. In such areas you find also fresh air due to forest vegetation cover. Not many people pass near apiaries for fear of being stung by bees, consequently giving more room for grass and other plants. Therefore where there is an apiary, forest resources are conserved+ (Lilika, 2008).

Some tree species that are conserved through beekeeping include *Brachystegia spiciformis*, *Dalbergia melanoxylon*, *Dalbergia nitidula*, *Julbernardia globiflora* and *Pterocarpus angolensis* (Lilika, 2008). In addition to their role in forest resource management, bees are important pollinators of wild and agricultural plants. Increased income of small scale beekeepers in the study areas has increased awareness of the value of forest resource management and livelihoods. This argument is in line with the study by Kihwele *et al.* (2001), who opined that individuals, communities and organized groups can safely and effectively respond to the shocks and stresses caused by impoverishing forces, by practicing beekeeping activities.

The only way to constantly mix genes for plants is by cross pollination, where pollen from one plant is translocated by bees to another plant so that the offspring become genetically different. In that way, there is a greater chance of the offspring surviving. Within the Mau Forest, the bee has set in motion a number of symbiotic relationships that have maintained the health of the forest for centuries. In another region of the world the role of the bee in the life cycle of trees cannot be underestimated. The Brazil nut grows wild in the Amazon Forest. Brazil nuts are one of the economically most important wild-growing trees in the area, with more than 50,000 tonnes exported from Brazil every year (Mau-Mandela, 2010). The Brazil nuts cannot be grown in plantations, because they need to be pollinated by the *Euglossa* bee. This bee is dependent on the presence of an orchard species that is found mainly in the rain forest. In some species of *Euglossa*, the male bee collects some scented material from the flower, which they distribute to attract other males-who do the same and multiply the effect with a scented cloud. The resulting strongly scented environment attracts female bees so that mating can take place. During the collection of the scented material, male bees transfer pollen from orchid to orchid and pollination takes place. The female *Euglossa* bees live on the nectar from the Brazil nut tree and pollinate it. This means that without the orchids, there would be no *Euglossa* bees and no Brazil nut trees (*Bertholletia excelsa*), and none of the many other plants, insects and animals associated with that tree-including the people whose livelihood include the collection and sale of the Brazil nut.

The agouti (*Dasiprocta leporine*), a ground-dwelling rodent, is the only animal with teeth strong enough to open the Brazil nut's grapefruit-sized seedpods. While the agouti eats some of the Brazil nut's seeds, it also scatters the seeds across the forest by burying the seed propagules far away from the parent tree. These seeds then germinate and form the next generation of trees. In this way, there is an interesting symbiotic relationship between the orchard, the *Euglossa* bee and the agouti (Mau-Mandela, 2010).

Wild bees nest in the cavities of trees and in the hollow of old trees. Deforestation, changes in land use, or the clearing of wasteland for agriculture and the excessive use of pesticides, constitute major direct threats for bees (COST, 2008). It is therefore important to increase awareness among farmers, forest communities and communities living around forests, about the important role that bees play in agriculture and in maintaining biodiversity and ecosystems.

The economic value of Bees

Beekeeping has been practiced since ancient times and honey has been considered by many cultures as a valuable and precious commodity that is used in traditional rituals, in healing or as food. Beekeeping can be practiced as an additional source of income for farmers in rural areas and has been successfully implemented in poverty-alleviating projects. In fact, beekeeping requires few resources to commence production. Beekeeping can be practiced by both men and women and it can quickly be taken up again after a crisis period. The necessary beekeeping skills are easily transmitted from one generation to another. Traditional hives are made from locally available material such as hollowed-out tree trunks or clay pots and, in general, are easily stocked with bees during swarming periods, especially in tropical areas and in forest areas where bees are still abundant in their natural habitat.

Beekeeping is not a labour-intensive activity and honey harvesting generally takes place during lean periods in agriculture (when most farmers have reduced pressure from farm work). The collected bee products can be sold to generate additional income to pay for school fees or health expenses, especially during periods of reduced income from agriculture. Beekeeping can eventually also lead to the development of other activities within the community such as making of protective gear, smokers and beehives; or the production of value-added products such as honey beer, beeswax candles or wood polish.

Health and nutritional value of Bees

Specific mention of key people in different cultures throughout history who used bee products in their medical treatments have been documented (Mau-Mandela, 2010). In the first-century A.D., the Roman philosopher Celsus recorded instructions for preparation of honey in topical poultices. Galen, the great Roman physician, considered honey an all-purpose remedy, recommending it to treat many kinds of poisoning and intestinal ailments. The Greek philosopher Democritus, creator of atomic theory, praised the health benefits of honey. Alexander the Great is reported to have used bee sting therapy. Hippocrates, the Greek doctor, prescribed honey extensively and successfully for many diseases. Charlemagne, the 8th century conqueror, was cured of gout through the treatment of bee stings, while Phillip Terc in France is said to have treated thousands of arthritic patients through bee stings therapy over a period of 40 years in the late 1800s and claimed a success rate of over 80 percent.

Bee products are nutrient-rich foods and also have medicinal properties. Honey, beebread and pollen are naturally rich in micronutrients and are a good source of energy. When properly processed and stored,

honey can be kept for up to two years without losing its nutritional value. It can therefore be a valuable source of energy during food-insecure periods and constitute a good source of (additional) essential micronutrients for people with poor diets or for pregnant women and young children, whose adequate micronutrients intake is vital.

The complex carbohydrates found in honey are made of complex sugars such as glucose, oxidase, invertase, diastase, amylase and acid phosphate. They are considered pre-biotic i.e these carbohydrates are non-digestible, but by consuming them, you encourage the growth of friendly intestinal bacteria in the body, which helps you digest food more easily, thus lessening the work of the digestive system and relieving stress on the digestive process particularly important for convalescing people. Honey, pollen and propolis are also efficient, safe and natural medicines that can be used to treat a variety of diseases and ailments. Honey has been used in traditional medicine for centuries, and apitherapists have been studying the medicinal properties of beehive products for years and have documented empirical findings with scientific research.

Few examples of these medicinal properties are as follows: propolis is a potential natural antibiotic and anti-mycotic and can be used to boost the immune system (Farn, *et. al.*, 2004). Honey can be used for sore throats, it can be used on wounds and burns (Lay-flurrie, 2008), as it cleans wounds and stimulates cell regeneration. Pollen can be used to delay the effects of aging; it is rich in nutrients (Villanueva, *et. al.*, 2002) and, together with honey, it is a beneficial food for sick people (Lietaer, 2007).

If you have been having problems sleeping over the past few days (insomnia), honey has a particular amino acid called tryptophan. It is a natural relaxant that helps alleviate insomnia by inducing normal sleep patterns. It also reduces anxiety and depression, relieves migraine headaches, boosts the immune system and reduces the risk of artery and heart spasms. Mladenov's research using raw honey to treat respiratory problems reveals that out of 17,861 patients treated with honey, there was an improvement in health of between 55-82 percent for the following respiratory problems: chronic bronchitis, chronic rhinitis and sinusitis. Honey is an excellent source of vitamins. Honey is used as food, medicine and for sale.

Honey is added to porridge or tea as a substitute for sugar. In Kinyope village, honey is used mainly as the raw material for brewing. Less honey is sold compared with the other two uses of honey. This is probably due to poor market promotion and prices, poor transport infrastructure and the low quality of honey produced. As medicine, honey is used in Milola and Mchakama villages to cure people suffering from stomach ulcers, burns, and wounds from fire and for children suffering blood shortages.

Research has demonstrated that mind and matter are connected as far as our body immune system is concerned. Stress hormones triggered by infection consume high levels of vitamin C for synthesis; therefore a robust system has higher vitamin C levels, which enable white blood cells to work effectively against the bacteria in infected red blood cells. Honey has the benefit of being rich in Vitamin C, which is essential for the revival of the immune system.

Economic value of Bee Products at national level

Forests provide a unique source and variety of high-quality nectar, pollen and propolis, all of organic quality as no agricultural or industrial activities are carried out in forests. The products are of a unique value and could therefore be sold at premium prices on Western markets, providing foreign exchange to governments. Bee products provide raw materials in industries: honey is an ingredient in food processing as a sweetener or antioxidant, wax in coating of cans, in batik making or for waterproofing fabrics, to name just a few.

Potential role of beekeeping in forestry programmes and policies

Awareness about the valuable contribution of bees to the life of humans as described above can earn respect for bees and human beings will try to protect their habitat and forage area as much as possible. Beekeeping projects are therefore an ideal tool to raise awareness about the value of forests and engage people in conscious protection, conservation and sustainable resource management. Beekeeping could also be employed to deal with the issue of property rights over natural areas, an issue that has been proven to be a *sine qua non* to the sustainable use of natural resources.

Bee-reserves can be established with exclusive access for beekeepers, as has been done in the United Republic of Tanzania (MNRT, 1998). Beekeeping can also be introduced in reforestation projects, paying special attention to the use of native and melliferous plants that provide a rich and varied source of nectar and pollen. Beekeeping can also be promoted as an alternative activity for communities living near forest rehabilitation programmes during which access to the forest may be forbidden or limited. The products of the beehives (honey, pollen, propolis and wax) are a rich source of nutrients that could replace the nutrients which communities would obtain by collecting edible forest products.

It is important however, to realize that for beekeeping to become a sustainable activity, beekeepers need to be trained on best practices. The necessary financial, extensional and technological support to fully exploit the great potential of beekeeping in the conservation of forest and natural ecosystems and in poverty-reduction programmes should therefore be allocated and deployed.

Potential role of beekeeping in poverty Alleviation

Livelihoods strategies in rural areas in developing countries typically depend on agriculture and are often vulnerable to food insecurity. Emergencies such as floods, illness, political unrest or rising food prices can easily affect the household's ability to produce and purchase food. Beekeeping can be practiced as a safety net, providing households with extra income from the sales of honey and other beehive products. At the same time, bee products are nutritious food that can be an extra source of energy and nutrients. Honey can be easily stored, and sold or consumed in times of need. Beekeeping can be started up with few resources, even by landless households, as bees collect nectar where they can. It is not a labour-intensive activity and can therefore easily be combined

with the other daily activities. Beekeepers can organize themselves in Beekeeping Associations, improve their techniques, increase production and strengthen their position on the market. The returns for beekeeping will eventually contribute to the wellbeing of the whole community.

Forest conservation efforts through beekeeping Gwalek Forest Conservation Project, Nepal

Gwalek forest lies in Baitadi district and is one of the biggest forest patches in the remote hilly region of far western development region of Nepal covering an area of 2571 hectares. Approximately 24000 people of adjoining villages are directly dependent on this forest to meet their demand of leaf litter, fuelwood, fodder, and timber. The Gwalek forest is also the main watershed of various streams, which are used for the supply of drinking water. The project site is a valuable ecological treasure, full of various flora and fauna representing middle mountain region of Nepal and also a sacred site for the Hindus. Its conservation and management is imperative for the National environmental protection strategy. The project is focused on poor agricultural households of the community where the potentiality of the bee-keeping is quite high because of its diversified flora and fauna. The project package also consists of encouraging the farmers to cultivation of bee-flora namely mustard and sunflower. This engages farmers in extraction of oil from the seeds of these plants. Thus the project tries to integrate the conservation of forest via natural pollination through bee and income generation, bee keeping enterprise and mustard and sunflower oil production.

Woodland Conservation Technology in Zambia

Beekeeping is an income-generating venture which has been practised in many developed and developing countries for many years. In Zambia, beekeeping started many years before independence under the Portuguese influence. Portuguese were trading in bees wax from Angola, (Chishala, 2010) Bee keeping is practised mainly in two ways either traditional using bark hives, clay pots etc and modern methods using frame hives and top bars hives. In both cases there are many advantages as well as disadvantages. The bottom line here is to choose the best method of beekeeping which does not harm the environment to a large extent. Some people gather honey from wild bees either from tree cavities or from the ground. This is not beekeeping. Woodlands in Zambia have been destroyed indiscriminately mainly to charcoal burning traditional beekeeping (bark hives), honey gathering (cutting down trees) and poor farming methods.

World Wide Fund (WWF) aims at conserving the natural resources in various ways and forest ways and forest conservation is one of them. It is in this vein that prompted the World Wide Fund and the Mpongwe Bee Keeping Enterprise (MBE) to sign a memorandum of Understanding (MOU) for the conservation of forests through bee keeping technologies. The programme started in July 2009 for one in Mpika and Samfya districts. One of the objectives of the project is to train farmers in modern bee keeping technologies in order for them to generate some income through the sales of honey and other bee products. In this manner, the forests are protected.

Chief Chiundaponde of Mpika District is also concerned about forest depletion in this area and has started demarcating areas to beekeeping groups as diary sites under the support of WWF. What is worrying is the manner in which the forests are being destroyed in some places in Mpika and Samfya and other parts of Zambia. Many trees are destroyed through the Chitemene system of farming, caterpillar gathering and honey hunting (Chishala, 2010). These activities are going on at an alarming rate. Caterpillar gatherers and Chitemene system of cultivation are ranked as the worst in terms of forests depletion. Both ways, however, provide food in one way or the other but it is the method in which they are done which destroys the forests because small and big trees are felled indiscriminately every year.

Common caterpillars breed on Muombo trees which are the main source of nectar and pollen for honey harvest around May - June. However, WWF and MBE are not only concerned with forests depletion but also join the nation and the world over in trying to reduce global warming or climate change. The world has observed that there is an escalation of temperatures due to many human activities such as the ones alluded to above. Just recently in December last year, world leaders convened in Denmark's capital city Copenhagen for two weeks discussing possible ways of reducing Global warming.

Developing countries were urging industrialised nations to reduce on green house gases which are the greatest contributor to environmental challenges currently being faced. On the other hand developed nations are accusing developing countries for being responsible for deforestation and other related human activities which are contributing to global warming. But a WWF representative at the summit wondered why developed nations still import timber, especially from developing countries if the practise is condemned. Possible causes of climate change results from imbalances in the environment caused by production of heat and green house gases including the processes of fossil fuel combustion while forests which were supposed to absorb green house gases form a blanket layer over the atmosphere that prevents excess heat from escaping into space causing the earth to warm.

Scientists estimate that an increase of just about two degrees will put as many as 30 per cent of the world species at risk of extinction. In addition to warming, increases in sea level and changes in the precipitation including more frequent.

Biological Programming of Beekeeping to save the Mau Forest, Kenya

As the beekeeping livelihood of the Ogiek community in Kenya continues to be threatened, one may ask why bees have any direct importance to conserving the Mau Forest in Kenya. The Ogiek are traditionally beekeepers, the honey from the Mau Forest is arguably the best honey in the country. There is need for creating a market for this honey as a means to empower the community by providing an alternative source of income. Mass purchasing of the Mau Forest Honey will support the restoration of Mau Forest.

The reproduction of plants is the simplest as vegetative reproduction . new trees could come from a root shoot. The new tree would be genetically identical

to the mother tree. Vegetative reproduction would not be a problem if the environment was stable, but most environments such as the Mau are unstable over time. The Mau Forest has experienced a number of anthropogenic changes through the proliferation of farming, translating into deforestation and increased use of synthetic fertilisers and pesticides in the region. To be able to adapt to environmental changes, genetically different plants need to be available. In that way, there will be some plants that are better adapted than others because of their special genetic constitution.

Within the Mau forest, the bee has set in motion a number of symbiotic relationships that have maintained the health of the forest for centuries. The Ogiek Community are perhaps strategically positioned to provide a sustainable form of Community-based forest management through beekeeping.

Research by ecologists indicates that over 100, 000 species of plants would die out and become extinct without the pollinating action of bees. Invariably, the absence of these plants would dramatically alter the ability of the Mau Forest ecosystem to function optimally. This is 100% organic honey with a negligible ecological footprint. Each hive can reap as much as ₦12, 000 - ₦15, 000 per month during the honey harvesting season (June-December). The aim of the project is to ensure each farmer has as many as ten hives or more, thus creating a viable alternative livelihood. From the beeswax, products such as lip balms, skin salves, candles and hair products can be manufactured. With an amount of ₦450000, a honey refinery and packaging venture can be started to produce the market chain listed above (Mau-Mandela, 2010).

CONCLUSION

This paper has narrated the many roles that bees can play in nature preservation and agriculture as well as the positive impact that beekeeping can have on the lives of humans. Recognizing the contribution of bees to the livelihoods of communities, beekeeping can be used as the tool in forestry programmes to make communities aware of the precious value of forests and the need to safeguard them. By learning about the unique role of bees in the complex mechanism of ecosystems, and the contributions of beekeeping to their daily life, people can better understand and appreciate the value of forests and ecosystems, and recognize the importance of bees and the need to protect and safeguard them. Beekeeping can therefore be considered a viable commercial and protective measure which can be integrated into national forestry and other strategic planning Programmes. Beekeeping can contribute to attainment of Millennium Development Goals 1, 4, 5 and 7.

RECOMMENDATIONS:

- Bee keeping communities, non-governmental organisations (NGOs), Government ministries and other stakeholders should combine efforts in the conservation of woodlands, thus reducing global warming to some extent.
- Honey Councils need to be constituted (especially in developing countries), supported and encouraged to promote modern beekeeping technologies throughout the world

- Other interested parties should also emulate the efforts being made by WWF by supplying of beekeeping equipment and assisting in marketing of bee products.

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