

Beekeeping for nutrition and income generation in the arid/semi-arid Laikipia region of Kenya

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The non-government organization Bees Abroad aims to alleviate poverty by training local community groups in honeybee husbandry worldwide. The benefits extend well beyond just honey. Studies have shown that pollination is greatly improved, and bee husbandry can be partnered with tree planting and growing more diverse crops. Wax, which is often lost through selling buckets of raw honeycomb, can be the basis for value-added products, providing additional income for basic needs. There is good evidence that honey has nutritional and probiotic constituents, and can be used for both food and drink. An example from Kenya describes how mobile phone-based banking facilitates trading in semi-refined and refined honey, and other hive products, even in isolated communities.

Keywords: beekeeper, honey, income generation, Laikipia, M-PESA, nutrition

IN KENYA AROUND 45 PER CENT of the population live below the poverty line (based on a minimum income of 1,562 Kenyan shillings (US\$15.55) per month for rural households; KNBS and SIDS, 2013). Laikipia region is recognized as a hardship area with a high poverty index (49 per cent). This article takes examples from the Bee Product Enterprise Development (BPED) project funded by the UK Department for International Development (DFID), in which the non-government organization Bees Abroad is working with a local environmental organization called CERA-Rights. Set in this arid and semi-arid region, the project has engaged over 1,400 participants, both new beekeepers and those who have grown up using traditional methods. The enclosure of game parks (which give some employment) prevents the traditional grazing of cattle and goats on much of the land. Bees benefit from this rich enclosed forage, while much of the open land is over-grazed and semi-arid.

Bees Abroad

Bees Abroad works with low-income communities worldwide, alleviating poverty by providing training on bee husbandry, and linking this with environmental initiatives to provide forage for honeybees. In return, the bees provide hive products and increase crop pollination. Volunteer UK project managers, regularly working with paid local trainers, support local community beekeeping groups in learning how to make beekeeping a productive and sustainable activity. Any low-income groups

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<http://dx.doi.org/10.3362/2046-1887.2016.003>, ISSN: 2046-1879 (print) 2046-1887 (online)



Figure 1 Capped larvae and capped honey. Credit: Liz Bates

can apply through the Bees Abroad website and, within its budget and geographic scope, the NGO is currently working with around 20 individual projects and on the DFID-funded initiative in Laikipia region.

The honeybee colony

In a beehive, the queen bee lays eggs in a spherical shape in the central part of the colony on sheets of honeycomb (made by the worker bees). The eggs develop into larvae, which are capped over by the worker bees, and subsequently the larvae develop into bees. Surrounding the larvae (brood) are cells containing pollen and nectar – the outer sheets of comb contain no larvae. Worker bees fan the nectar until it is concentrated – this is honey – and a ‘cap’ is put over these cells too. Unless one can take out sheets of honeycomb and check them, it is difficult to know the extent of the larvae in order to avoid them and extract just the capped honey (see Figure 1).

Migration of bees in semi-arid locations

In marked contrast to keeping bees in more temperate climates, the bees in this arid/semi-arid region migrate to the hills during the hot dry season when forage is scarce, returning only when the rains come, bringing with them an abundance of nectar-bearing flowers. The main type of local honeybee is *Apis mellifera scutellata* (see Figure 2) – the African bee. It has many aggressive predators (such as honey badgers) and is highly defensive of the hive. While the bees are in residence, opening the hive is generally restricted to gathering hive products, while cleaning out and attracting the bees back to the hive takes place when the bees have migrated to the hills.



Figure 2 The African bee. *Credit: Steve Bates*

Wild honey gathering

Cave drawings show honey hunters collecting honeycombs from high in hollow trees or from cliff faces. This type of hunter-gatherer collecting is still carried out in many countries, but it has a number of disadvantages.

- Collection is extremely dangerous, as men and young boys coat themselves in dried-on mud to protect themselves from the stings, and climb up trees or scale down rocks.
- Women are seldom able to take part in these activities.
- Generally, much of the 'brood' of young larvae is taken with the comb honey – thereby destroying much of the future honeybee workforce and reducing the subsequent yield.

Keeping bees as livestock

Log hives

The next step from gathering wild honey is to use log hives – hollowed out logs, hung more accessibly lower down in the trees – which attract bees by being the right shape, in the right place for the return of the migrating bees, and often containing an attractant smell of wax from previous years, or from wax and herbs rubbed into them by the beekeeper (see Figure 3). However, as with collecting wild honey, it is difficult to collect just the honeycomb, and not larvae and eggs, so future worker bees can be lost.



Figure 3 Log hive hung from trees to deter termites. *Credit:* Steve Bates

Kenya Top Bar hive

The Kenya Top Bar hive (KTB) is a close relative of the log hive (see Figure 4). This hive is a long box, made of planks, and roughly the shape of a hollow log, but with a lid on the top, under which removable bars are stretched transversely. Basic manuals have been written on how to manufacture these hives and are available in several languages (Gregory, 2011a).

KTBs are low-cost, they can be made locally, and they address all the needs of the beekeeper. The bees instinctively build comb down from these bars, allowing the beekeeper to lift out each bar consecutively, removing some of the combs with honey, while returning any of the combs that contain larvae and eggs to the hive. In this way, the beekeeper retains the brood to provide his or her future honeybee workforce.

Langstroth hive

Initiatives from earlier NGOs in Laikipia region have involved importing, or manufacturing, a type of hive known as a Langstroth hive. This type of hive allows honey to be taken from a separate upper 'box' while the bees remain undisturbed in the lower box containing brood and surrounded by food (pollen and honey/nectar). Unfortunately, this type of hive is expensive to buy or build, and requires both the hive and the frames within it to be manufactured to close tolerances. Though good and useful, the cost can be prohibitive, and the advantages over the KTB in these regions may not make it appropriate.



Figure 4 Kenya Top Bar hives. *Credit: Steve Bates*

Bees Abroad: how it operates

Engagement with low-income communities

The organization is driven by requests from local communities, many of whom have seen the work done in neighbouring locations. The criteria for support are:

- Use of appropriate, sustainable and affordable beehive technologies using local bees (however, communities already owning any type of hive will be supported).
- Support is only given through local constituted groups who are legally registered by the laws of the recipient country.
- Funding is used solely to provide the training and support needed to build skills to set up and maintain beekeeping projects within a community.
- Poverty alleviation initiatives must be independent of constant external financial input.

Training provided

Training is very much dictated by the needs of each community and cultural practices appropriate to each group. However, training and support can be divided into broad categories:

Basic beekeeper training: For communities that have not kept bees in the past; introducing hive beekeeping to those who have gathered wild honey; more productive beekeeping techniques for improving yield for those with some experience.



Figure 5 A selection of tiny saplings ready for planting. *Credit:* Steve Bates

Improving biodiversity: Training is given in growing crops and planting tree nurseries, for which the bees provide pollination services, increasing the quality and yield of the crops. The communities in the BPED project come from the whole of the Laikipia region. The Bees Abroad team has facilitated the sharing of seeds and different types of shade trees (see Figure 5), and has encouraged the growing of fruit trees and new crops that provide a more varied diet for the community members, which is particularly beneficial to child health. As well as providing different crops, shade trees reduce evaporation and provide the opportunity for vegetation to grow back.

Improved honey extraction and processing techniques: This provides a high-quality product, and techniques ranged from basic straining of honeycombs to introducing extraction facilities for co-operatives.

Making low-cost bee-suits and hive tools: Further information can be found in Gregory (2011b).

Manufacture of value-added products: Wax-based hive products, such as skin creams and polishes, can be sold profitably. This aspect has proved highly successful, particularly for women (see Figure 6). Further information on making value-added products can be found in Gregory (2011b) and Carroll (2006).

Support in sourcing non-hive products: These are used for manufacture, packaging, marketing, and sales.

Attaining certification: In Laikipia, the team have trained groups to reach Kenya Bureau of Standards certification and barcode standard so that goods can be sold to larger stores countrywide – thus increasing the size of the market, to match the increasing number of beekeepers being trained.



Figure 6 Maasai women from a beekeeping group in northern Laikipia making skin cream.
Credit: Liz Bates

Support to local groups in creating co-operatives: Co-operatives can provide ongoing training facilities for new beekeepers, improved centralized processing facilities, consistency of supply, facilities for bottling and labelling, centralized marketing and sales, and negotiating strength to achieve fair prices.

Financial management: The team has linked groups with financial institutions, such as the Equity Bank, which train new beekeepers in book-keeping, financial management, and producing business plans.

Mobile phone banking (M-PESA): This has been introduced in Laikipia, and it allows households to buy and sell without the need for cash sales (see Box 1). These business skills are transferable to other commercial activities.

Box 1 M-PESA phone banking

Incomes in the project areas are low, and beekeepers are likely to sell their raw honey very cheaply at the door for ready cash, rather than taking the honey to a buyer at a later date. In the last few years, even those on low incomes have acquired mobile phones. These can be used to trade honey via an intermediary who collects the honey and delivers it to the buyer.

M-PESA is a mobile money transfer service offered by Safaricom. Anyone can send money all over Kenya with this service. M-PESA stalls can be found even in the small villages, as well as in the towns. An application on the phone allows the phone to be used for money transfer. A purchaser (perhaps representing the local co-operative) can inspect and buy honey 'at the doorstep' for an agreed price, transferring funds 'held' on their mobile phone. The beekeeper can see the money going into their account on their mobile phone before releasing the honey.

The rapid transfer of cash provides an incentive for beekeepers to sell semi-refined honey at a higher price, and retain the wax to make value-added products, which are traded in the same way.

The Bees Abroad website has links to useful publications, including beekeeping manuals, for further information.

Impacts of beekeeping in Laikipia

Health benefits

Local communities in Laikipia are very aware of the benefits of honey (see Box 2). During group discussions, the major benefit identified by virtually all the women was child nutrition, with most of the women's groups saying that having honey for their children was their most important reason for keeping bees. Local demand for honey currently exceeds supply.

Skin cream, containing beeswax, is one of the main products for which training has been given to community groups. It is used by local women and men to deal with minor skin ailments. Women described how it had been used for sores that previously failed to heal, as well as for dry skin. Farmers described how it eliminated rashes and sores on the udders of cows suffering from mastitis and on infected hens' combs. Processing methods for raw wax are given in the *Basic Beekeeping Manual* (Gregory, 2011a), while recipes for creams and other products are given in Gregory (2011b).

Another product, propolis, is a sticky resinous 'glue' collected by the bees, mainly from trees. It is used by the bees to close up small holes and cracks in the hive. Propolis is used as a tincture and in cough medicines worldwide, as it has known antibiotic properties. To date, products based on propolis have not been introduced in Laikipia – but it is under consideration (Carroll, 2006).

Pollination and improved food production

For most rural communities growing their own food, pollination depends on local wild pollinators. Honeybees not only produce honey, but undertake an important role as crop pollinators. Research by Kasina et al. (2009) in Kenya shows that bee pollination enhanced the yield of most crops grown in the Kakamega farmland, and improved the quality of produce immensely. Their study on local produce in this area showed that the quality of tomatoes, capsicum, and passion fruit was an

Box 2 The health benefits of honey

- Honey is rich in easily digestible carbohydrates and contains mainly sugars (including monosaccharides) and water.
- Honey contains vitamins, including B vitamins, amino acids, antibiotic-rich inihbine, proteins, phenol antioxidants, ascorbic acid, pantothenic acid, niacin, and riboflavin, along with minerals such as calcium, copper, iron, magnesium, manganese, phosphorus, potassium, and zinc.
- The consumption of honey, which is rich in antioxidants, can protect against damaging free radicals which can otherwise lead to chronic ailments (Ajibola et al., 2012).
- Honey can be used in fermented milk products without inhibiting the growth of healthy bacteria, such as *Streptococcus thermophilus*, *Lactobacillus acidophilus*, *Lactobacillus delbrueckii* and *Bifidobacterium bifidum* (Sanz et al., 2005).

important factor in determining local prices, and that bee pollination improved these properties. The overall dependence of the selected crops on bee pollination varied from 25 per cent (tomatoes) to 66 per cent (capsicum). The net benefit accrued to the Kakamega farmers as a result of bee pollination was shown to be around 40 per cent of the annual market value of these crops in 2005. For these reasons, the Bees Abroad project is encouraging local farmers and beekeepers to plant bee-friendly crops and trees and benefit from the services provided by the bees.

Increased household income

The traditional way to sell honey in the Laikipia region is in a completely raw state. Comb, dripping with honey, and often containing larvae and trapped young bees, is placed into buckets and sold 'at the door' to middlemen for ready cash at a very low price (KSh180 = US\$1.76) per kilo. The beekeeper leaves the wax comb in the honey – wax which could otherwise be used for profitable by-products.

Following training from local Bees Abroad staff, community groups have established links with manufacturers of both packaging and the raw materials required to blend with the wax for these products, and the profit margins on their sales, along with the sale of semi-refined honey, has increased household income by around 15 per cent. Around half of this increased income is from value-added products, which are generally made by women (see Box 3). This additional money can be spent on more and varied foodstuffs as well as school fees and hospital bills – the main uses highlighted by the women. Candles are useful, but the advent of solar lanterns and paraffin lamps means that beekeepers can achieve greater added value when the hive products are made into skin creams, polishes, and soaps (see Figure 6). The skin creams not only provide income, but are used by both men and women for dry skin and for skin problems.

Honey-based drinks and beverages

A popular health drink in Kenya is *Dawa*. *Dawa* means 'medicine' or 'magic potion' in Kiswahili. Based on a famous Brazilian drink, it is now widely consumed throughout Kenya. All versions contain lime, sometimes herbs, and sometimes garlic, and are served with a '*Dawa* stick' from which honey can be drizzled in to taste. 'Tourist' versions usually contain vodka.

Honey can be converted to a type of mead, and this alcoholic drink is culturally important in ceremonies, such as weddings and funerals. Honey is added to fruit drinks, both to sweeten them and because people regard the honey as good for their health.

Box 3 Adding value to raw honey

- Raw comb is sold at around KSh180 per kilo, losing valuable wax within the honey.
- Filtered honey sells at around KSh300–350 per kilo, and the beekeeper keeps the wax.
- Honey sold in jars commands a price of around KSh600 per kilo jar.
- Wax can be made into skin creams that sell for KSh50 (50 g jar) and KSh80 (100 g jar) with a profit margin per jar of around 50 per cent.



Figure 7 Chicks kept in a coop beneath a stove and given honey-water to drink. *Credit: Steve Bates*

It is not only humans that appear to benefit from this sweetener. There is some evidence from Nigeria that the addition of honey to drinking water of broiler chickens, at a dosage of 20ml per litre of water, reduces the panting and heart rates in birds during hot weather, improving bone strength and immunity in heat-stressed broiler chickens (Abioja et al., 2012). In Laikipia, one household described how they no longer used antibiotics on their chickens, but rather they make a coop for the tiny chicks beneath their stove, releasing the hen to lay immediately after the chicks have hatched, and feeding the newborn chicks on poultry feed and the honey-water solution obtained from washing out the wax cappings during honey processing (see Figure 7). The chickens appear to thrive on the new regime.

Protecting shambas from elephants

In Laikipia region, where the DFID project is taking place, elephants are a major problem as they walk through the thorn barriers around the *shambas* (cultivated plots of ground close to the village), damaging the crops and reducing crop yields. In some of these areas, bee fences have been erected, with hives hung at regular intervals along the fences. Further hives are hung in neighbouring trees, and the elephants have learned not to approach the hives as they get stung. Elephants are terrified of bees, so these hives not only provide honey, but provide security for the crops and protection to the trees.

Conclusion

Keeping honeybees can improve nutrition and incomes for communities living in isolated rural areas, improving crop yields and providing an income stream which is particularly appropriate for women as it can take place close to home. With the introduction of co-operatives, beekeepers are getting a fair price for their honey,

improving the honey quality, increasing the quantity of honey, and facilitating its sale and the sale of value-added goods. M-PESA is empowering isolated low-income communities with banking facilities – this particularly benefits women. This DFID project ends in 2017, and there are plans for expansion of the work within the project region and in neighbouring regions. Further applications for Kenya Bureau of Standards certification are in the pipeline. An external review of the project has been agreed, and improvements and revisions suggested by the expert reviewer will feed into beekeeping practices and future projects.

References

- Abioja, M.O., Ogundimu, K.B., Akibo, T.E., Odukoya, K.E., Ajiboye, O.O., Abiona, J.A., Williams, T.J., Oke, E.O. and Osinowo, O.A. (2012) 'Growth, mineral deposition, and physiological responses of broiler chickens offered honey in drinking water during hot-dry season', *International Journal of Zoology* 2012: article ID 403502 <<http://dx.doi.org/10.1155/2012/403502>>.
- Ajibola, A., Chamunorwa, J.P. and Erlwanger, K.H. (2012) 'Nutraceutical values of natural honey and its contribution to human health and wealth', *Nutrition & Metabolism* 9: 61 <<http://dx.doi.org/10.1186/1743-7075-9-61>>.
- Carroll, T. (2006) *A Beginner's Guide To Beekeeping in Kenya* [pdf], Nakuru, Kenya: Apiconsult <https://www.villagevolunteers.org/wp-content/uploads/2011/05/Beginners_Guide_to_Beekeeping_Kenya.pdf> [accessed April 2016].
- Gregory, P. (2011a) *Basic Beekeeping Manual 1* [pdf], 3rd edn, Sand Hutton, UK: Food and Environment Research Agency <http://beesabroad.org.uk/pamsmanuals/bb_english.pdf> [accessed April 2016].
- Gregory, P. (2011b) *Advanced Beekeeping Manual 2* [pdf], 2nd edn, Sand Hutton, UK: Food and Environment Research Agency <http://beesabroad.org.uk/pamsmanuals/ab_english> [accessed April 2016].
- Kasina, J.M., Mburu, J., Kraemer, M. and Holm-Mueller, K. (2009) 'Economic benefit of crop pollination by bees: a case of Kakamega small-holder farming in western Kenya', *Journal of Economic Entomology* 102(2): 467–73.
- Kenya National Bureau of Statistics (KNBS) and Society for International Development – East Africa (SIDS) (2013) *Exploring Kenya's Inequality: Pulling Apart or Pooling Together?* [pdf], Nairobi: KNBS and SIDS <www.knbs.or.ke/index.php?option=com_phocadownload&view=category&download=617:exploring-kenya-inequality-national-report-abridged-small-version&id=114:exploring-kenya-s-inequality&Itemid=599> [accessed 13 May 2016].
- Sanz, M.L., Polemis, N., Morales, V., Corzo, N., Drakoularakou, A., Gibson, G.R. and Rastall, R.A. (2005) 'In vitro investigation into the potential prebiotic activity of honey oligosaccharides', *Journal of Agricultural Food Chemistry* 53: 2914–21.

Websites

- Bees Abroad <<http://beesabroad.org.uk/>> [accessed April 2016]
- Bees Abroad, Beekeeping Manuals <http://beesabroad.org.uk/?page_id=126> [accessed April 2016]
- CERA-Rights <https://www.facebook.com/CERA-Rights-106453392757813/info/?tab=page_info> [accessed April 2016]