Beekeeping and Rural Development

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International Centre for Integrated Mountain Development

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Cover photo
Apis cerana in traditional log hives. *Surendra R. Joshi*

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Contents

Honeycomb from *Apis cerana* shared by the family

Min B. Gurung

People, Bees, and Rural Development

Rural development aims to help people manage their livelihoods better through sustainable use of the available resources. It provides them with greater social and economic power by offering them opportunities to work in line with their capacity, without hampering the eco-services provided by their environment.

Beekeeping and honey hunting have been practised by different societies since ancient times and have always been linked to development. 'Honey hunting' – collecting honey from wild bee colonies – is an ancient practice as shown, for example, in cave paintings dating back to 11,000 BC found in Madhya Pradesh, India (Suryanarayan 2002), and in Ancient Egyptian drawings and paintings (Crane 1999). The history of beekeeping is rooted in and linked to honey hunting and associated practices. As settled farming became common, so too did the idea of keeping bees in hives, but beekeeping complemented rather than replaced wild collection. Gathering wild honey is still a common practice in many parts of the world; in India it is estimated that 22,000 tonnes of wild honey is collected by honey hunters annually – twice the amount of honey produced by the managed beekeeping sector (Wakhle and Pal 2000).

Different societies in Asia, Europe, and North America have evolved their own beekeeping methods, investing in such diverse areas as bee genetics, hive design, management operations, managed pollination, and honey processing and marketing. *Apis mellifera* is a particularly fortunate bee species among hive bees. Scientists and development workers have studied it for more than 150 years; continuous selection and breeding have improved the bee's genetics; and Langstroth's hive design which is based on optimising bee space (the space required for the movement of bees) in the hive has helped beekeepers and bee enterprises to produce more honey in a sustainable manner.

Farooq Ahmad

An apiary of *Apis cerana*

The mass introduction of Langstroth's hive coincided with the start of large-scale application of pesticides in North American agriculture. This phenomenal shift in agricultural husbandry reduced pollinator diversity considerably, and farmers now felt the need to use honeybees as a source of pollination rather than just as a honey producer. Introduction of Langstroth's hive also facilitated the large-scale transportation of bee colonies for managed pollination, honey production, mass queen rearing and overall management of apiaries.

Beekeeping has thus contributed to rural development through the centuries by supporting agricultural production, providing honey, wax, and other products for home use, and by providing income for both farmers and the landless.

Promoting Secure and Sustainable Livelihoods through Beekeeping

Min B. Gurung

Traditional backyard beekeeping with log hives in Nepal

Beekeeping has holistic benefits that relate to health (being used as a medicinal product and as food), the economy (directly through sales of honey and other bee products, and indirectly through increased productivity of pollinated crops, as well as bee enterprise activities), employment (in honey production and pollination services), and the environment (by ensuring pollination of wild species). Beekeeping can contribute to securing sustainable livelihoods by transforming vulnerabilities into security, an idea incorporated in ICIMOD's Strategic Plan 2003-2007. It can be carried out by small farmers, and is particularly suitable for under-privileged,

landless, and low-income groups as well as women as it requires minimal start up investment and generally yields profits within the first year of operation. Some of the different roles played by beekeeping in rural development are described in more detail and discussed in the following pages.

Apis mellifera and indigenous Himalayan bees

Beekeeping with *Apis mellifera* has become an important part of many beekeeping initiatives and programmes from North to South. These initiatives facilitate technology transfer and ensure the constant supply of honey to the world markets. However, as a part of this endeavour, *Apis mellifera* has been introduced and promoted in areas beyond its original natural nesting habitat. In the Himalayan region there are four indigenous honeybee species, one of which (*Apis cerana*) can be kept in hives. These bees have special advantages for farmers at the higher altitudes where they are found naturally. However, the advantages of honeybee biodiversity remained unrecognised for many years, and little was done to conserve the indigenous honeybee resources. As a result of lack of information and ignorance, efforts including beekeeping as a component in rural development were sometimes counterproductive, focusing on a 'Northern' blueprint rather than local wisdom or indigenous knowledge. This is now changing, but while examining the information below, the reader should remember that the benefits of beekeeping depend on ensuring that the approach is locally appropriate – and in some areas this will mean that beekeeping should focus on indigenous species and not the ubiquitous *Apis mellifera*.

Forest bees in Mirpur, North Pakistan – an example of problems with exotic bees

Mirpur is a traditional nesting area for the giant honeybee species, *Apis dorsata*. In the two annual honey harvesting seasons, local farmers used to collect more than five tonnes of honey per year. The Department of Agriculture introduced *Apis mellifera* beekeeping in the 1980s and now more than 7,000 bee colonies visit the area in autumn and spring to produce honey from *Zizyphus jujuba, Zizyphus sativus, Adhatoda vasica, Acacia Arabica,* and *Robinia pseudoacacia* flowers. Beekeepers produce more than seventy tonnes of honey in this way.

Farooq Ahmad

Apis dorsata nest in the forest

The local farmers, who are not beekeepers but honey hunters, haven't welcomed this intervention. They believe that the managed beekeeping has taken away their honey and that it is the reason why the numbers of *Apis dorsata* nests are declining. Biologists and entomologists have a different view. They explain that the indigenous bee species migrate from north to south and back following the nectar flow and seasonal changes. Changes in the agricultural landscape and use of pesticides have influenced the regular migratory pattern, reducing both the number of nests and the eco-services to agriculture and the pristine landscape. However, introduction of managed bees may also reduce the amount of nectar available to the wild bees. And conservation apiculturists do believe that the introduction of *Apis mellifera* has had a negative impact on the indigenous species by providing space for multiplication of the mite *Tropilaelaps clarae*, which now breeds permanently in *Apis mellifera* colonies, and weakening of *Apis dorsata's* coping mechanism against it. It seems that the decline in number of *Apis dorsata* nests in the area is at least in part due to the inappropriate introduction of exotic honeybees (Ahmad et al. 2002) as well as to changes in agricultural practices.

Physical Security

Min B. Gurung

Farmer's managed apiary – an example of backyard beekeeping in far-western Nepal benefiting adjoining areas of natural forest

The link between beekeeping development and the physical security of societies and communities may not seem immediately obvious, but it does exist and is based on the pollination services that bees provide. As with all pollinators, bees both from managed apiaries and the wild play an important role in combating soil degradation by enhancing the replenishment cycle: more pollination, more seed sets, more plants, more biomass returned to the soil (Ahmad et al. 2003), leading to less soil erosion, less flooding, and a more conducive environment for sustainable living.

Pristine areas play a pivotal role in maintaining the replenishment cycle by conserving and absorbing water,

Chandra Gurung

Apis laboriosa nest after harvesting (honeycomb)in Kaski district of Nepal

obstructing and regulating flash-floods, disseminating important plant and weed seeds for regeneration, and providing a habitat for a large number of plants and animal species. Wild and feral bees (domestic bees that have escaped to the wild) play an important role in pollinating flowering plants in pristine areas, hence increasing the vitality and viability of these physically secure environments.

The Himalayan cliff bee *Apis laboriosa* is one of the most important pollinators in high altitude pristine areas of the Himalayas. It nests at high altitudes and can fly long distances at heights where many lowland birds and insects have difficulty breathing. This bee not only pollinates a significant number of plant species at high altitude, it also provides food for the local fauna. Monkeys feed on bee brood; wasps, hornets and some bird species eat bees; bears are known to have a soft spot for honey; and lizards also eat fallen bees.

Conservation of Resources through Bee Diversity

Farooq Ahmad

Beekeepers of Afghanistan practising grafting for queen rearing

The natural environment can only be maintained in a healthy state through the interest and active involvement of local people. Beekeeping is a good way for people to earn an income without damaging the environment, at the same time honeybees and other pollinators play an important role in the conservation of plant resources by providing pollination services. These services also support diversification, which is necessary for the process of evolution. Much of the time, conservation of wild flora is an 'unnoticed' activity that happens under the cover of bush, canopy, and the darkness of the forest; pollinators participate by supporting the gene flow, which is a vital process of life.

Resource conservation is an important aspect of rural development activities and it also includes development programmes for bees like the Asian hive bee *Apis cerana* and other wild honeybee species. These activities and programmes mainly aim at conserving bee resources in a way that serves both poverty alleviation and biodiversity conservation. ICIMOD runs one such programme based on conservation apiculture, which focuses on improving the productivity of the Asian hive bee through selection and multiplication. Efforts are being made to involve beekeeping communities: farmers and beekeepers receive economic and social incentives to participate in the selection and multiplication activities. The communities have clearly benefited from this programme: at one of the project sites in Nepal, the number of farmers and beekeepers in the project has increased, and the selected bee colonies produce more honey. The Indian butter tree forest also benefited from this programme as social fencing provided by local beekeeping communities discouraged irresponsible logging of this important bee tree.

Pollination deficits and the need for more livelihood options often encourage farmers and entrepreneurs to rear butterflies and moths along with bees. This unique enterprise has a potential for growth as more people become involved in raising these beautiful insects for income generation and conservation. The conservation aspect of this effort is very strong, with people's attitudes towards these important pollinators changing rapidly from elimination to rearing and conservation. The growing trend in this enterprise has brought the natural beauty of these insect pollinators to people's homes in different forms, and market forces have capitalised on their unmatchable beauty.

Economic Security

Surendra R. Joshi

Diversity of bee products

Beekeeping can help economically vulnerable communities achieve economic stability. Honey production, pollination services, agriculture, and forestry are but a few of the economic benefits of beekeeping. Bee products such as propolis, royal jelly, beeswax, and bee venom are also high-value low-volume green products. In addition to the direct income from bee products, beekeeping generates off-farm employment opportunities in many fields including hive carpentry, honey trading, renting and hiring of bee colonies for pollination, and bee-based micro-enterprises.

Honey and other bee products

Poor farming communities and landless farmers in the South have welcomed the introduction of the European honeybee *Apis mellifera* and adopted this bee species as a source of inspiration and a way to alleviate the ills of poverty. Countries in South America, South and South East Asia, Central Asia and Africa have started producing enormous quantities of honey, honey markets have expanded, and the demand for bee products has increased (Figure 1). Central America, Mexico, and the Caribbean alone host 3.5 million bee colonies with an average honey production of 24.7 kg/hive – about 9% of world honey production (Crane 1990). In Central America most honey is produced by small beekeepers. In the Yucatan peninsula, for example, more than 17,800 small beekeepers from the Maya community produce about one third of Mexico's honey (Arce Arce and van Veen, 1997). World honey production increased from close to 900,000 tonnes to nearly 1,400,000 tonnes between 1975 and 2005 (Figure 2). Many of the benefits from the increased honey production have gone to the rural poor who were directly involved in the production, contributing substantially to rural livelihoods, even though major portions of the benefits from marketing and scaling up have gone to traders and managers of large operations.

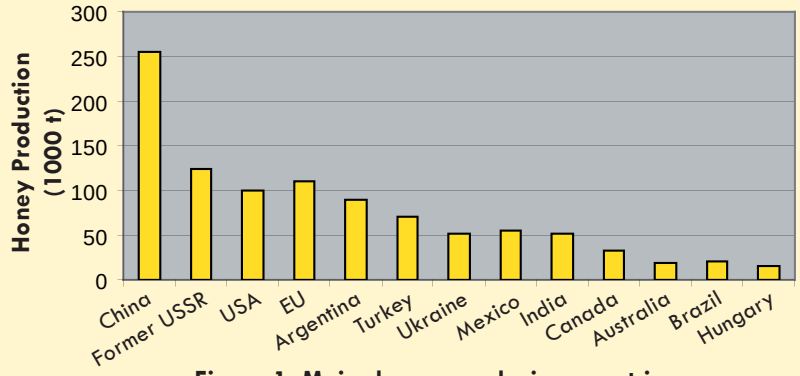

Figure 1: Major honey producing countries
Source: http://www.beekeeping.com

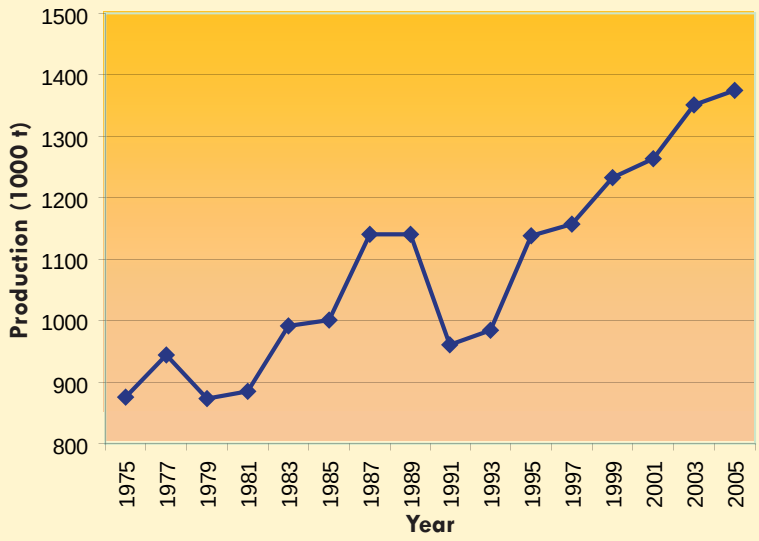

Figure 2: Trend of world honey production, 1975-2005
Source: http://faostat.fao.org

Higher incomes in developed countries have opened up the markets for honey and other organic bee products. A more organic lifestyle has changed the diet of the rich and prosperous, and the demand for honey for the table, bakery, and meat processing has increased tremendously over the last twenty years. The amount of honey imported by the developed countries and amounts exported by developing countries are shown in Figures 3 and 4. In addition to this, beauty and health care products based on beeswax and propolis are becoming more popular. Cosmetics and pharmaceuticals account for approximately 60% of total bee product consumption. Beeswax is used for candles, cosmetics, pharmaceuticals, polishing materials, as a component of modelling waxes, and as a glazing agent for food products. It is also a release agent, stabiliser, texturiser for chewing gum base, carrier for food additives (including flavours and colours), and a clouding agent. In 2005, 8000 tonnes of beeswax were consumed in the countries of the European Union alone.

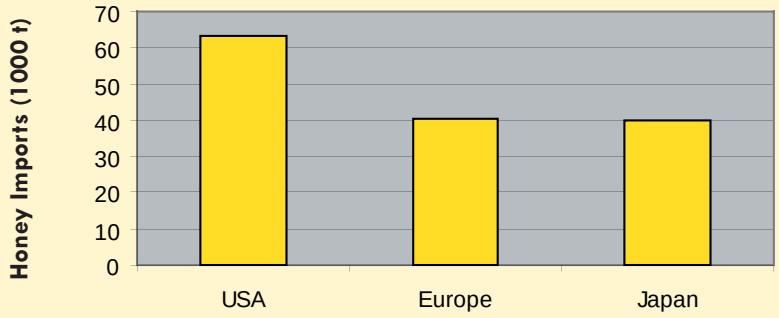

Figure 3: Honey imports of some major developed nations
Source: http://www.beekeeping.com

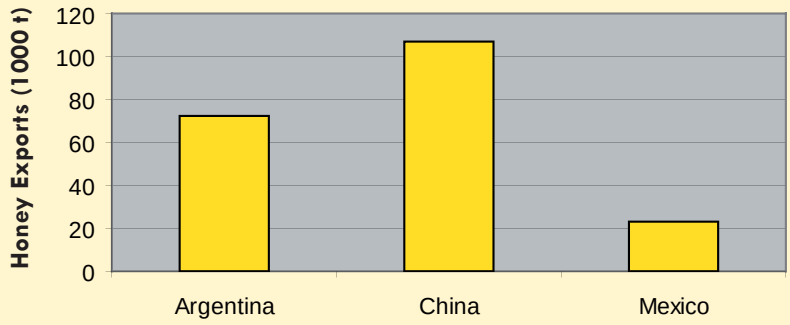

Figure 4: Honey exports of some developing countries
Source: http://www.beekeeping.com

Crop productivity

Beekeeping contributes to economic security in another way, through the positive effect on pollination in agriculture in the rural areas of developing countries. Even though pesticide use is still on the rise in modern agriculture, managed pollination has been able to make up for certain pollinator deficiencies and has increased productivity and thus incomes. Tables 1 to 3 illustrate the importance of managed pollination and the economic value that pollination can have for agricultural and horticultural crops. In places like the USA, Canada, Europe, and Japan, honeybees have long been used for the pollination of crops like apples, almonds, pears, plums, cucumbers, melons,

Christopher Guetemann

Large scale beekeeping: Litchi orchard benefiting from pollination services in Bangladesh

watermelons, and berries. Honeybees were first used for pollination in the USA in 1895, when *Apis mellifera* honeybees were used to pollinate pears in Virginia. But the Himalayan region still lags far behind in making use of honeybees for crop pollination, with the first reports of colonies of honeybees being used for pollination coming from Himachal Pradesh in India, where they were used for apple pollination in 1996 (Partap and Partap 2002).

In the early 1990s, the worldwide annual contribution of pollinators to the value of agricultural crops was estimated to be US$ 54 billion. Honeybee pollination alone accounts for an estimated US$ 15 billion in crop production in the USA. Similar estimates have been made for other countries (Table 4). The increase in income of poor farmers from honeybees also contributes to the success of rural development efforts and activities.

Surendra R. Joshi

Afghan beekeepers observing bee combs during an exposure visit to Pakistan

Table 1: Impact of honeybee (*Apis cerana*) pollination on fruit productivity (Himachal Pradesh, India and Kathmandu Valley, Nepal)

Crop	Increase in fruit set (%)	Increase in fruit weight (%)	Increase in fruit size (length, diameter) (%)
Apple	10	33	15, 10
Peach	22	44	29, 23
Plum	13	39	11, 14
Citrus	24	35	9, 35 Premature fruit drop decreased by 46%, juice increased by 68%, and sugar content in juice by 39%
Strawberry	112	48	Misshapen fruits decreased by 50%

Source: Partap 2002

Table 2: Impact of honeybee (*Apis cerana*) pollination on vegetable seed production (Kathmandu Valley, Nepal)

Crop	Increase in pod set (%)	Increase in seed set (%)	Increase in seed weight (%)
Cabbage	28	35	40
Cauliflower	24	34	37
Radish	23	24	34
Broad leaf mustard	11	14	17
Lettuce	12	21	9

Source: Partap 2002

Table 3: Average increase in crop production from honeybee pollination

Crop	Increase in production (%)
Alfalfa	65
Buckwheat	39
Coriander	35
Cotton	28
Cucumber	11
Cucurbits	25
Flax	35
Grape	29
Linseed	19
Rape	30
Red clover	82
Sainfoin	60
Tree and bush fruit	35

Source: Soldatov 1976; cited in Free 1993

Surendra R. Joshi

The wild bee *Apis dorsata* foraging on a wild flower

Table 4: Economic Value of Honeybee Pollination

Country	Estimated Economic Value
USA	US$ 15 billion
Canada	US$ 1.2 billion
EEC	US$ 300 million
New Zealand	US$ 2,253 million
China	US$ 0.7 billion

Source: Free (1993)

Value Chain for Economic Security

Farooq Ahmad

Honey market place managed by a self-help group

Competition in the honey sector is getting fiercer and several stakeholders have started to use a value chain approach, especially to gain access to organic markets. A value chain can be defined as a sequence of productive processes from the provision of specific inputs for a particular product to primary production, transformation, marketing and distribution, and final consumption. Honey is a major organic product, and is being scrutinised by buyers and other actors in trade and marketing.

A value chain systematically takes all steps of a production process into account. It analyses the links and information flows within the chain and reveals the strengths and weaknesses (and

even losses) in the process. It also analyses the boundaries between national and international chains, takes into account buyers' requirements and international standards, and allows international benchmarking (Richter 2005). The value chain approach addresses the so-called critical success factors that determine whether a product meets market requirements with regard to quality, price, dependability, volume, design, and speed of delivery, and, consequently, improves competitiveness. Value chains generally include three or more of the following: producers, processors, distributors, brokers, wholesalers, retailers, and consumers. The partners in the value chain work together to identify objectives; they share risks and benefits; and invest time, energy, and resources to make the relationship work. The value chain approach is an actor oriented approach and is very effective in tracing product flows, showing value adding stages, and identifying key actors in the chain and the relationships between them (Schmitz 2005).

In the past, most honey and bee-related projects were only active at a particular level of the value chain. They mainly focused on the promotion of beekeeping and the production of honey, rather than on the delivery of a product in a competitive market. The concept of a value chain approach dealing with the whole process is fairly new and there are only a few organisations engaged in scaling up beekeeping by using a value chain.

Beekeepers, packers, and producers may find it difficult initially to adapt to this approach as the beekeeping industry in the developing world is not really prepared for following the requirements of a value chain. But with growing awareness and capacity, many stakeholders are increasingly using value chains to achieve economic security. China, Brazil, Argentina, and Mexico are adopting a similar approach to improve competitiveness and the quality of bee products to harness the benefits of honey trade.

The value chain map in Figure 5 shows the flow of honey and other bee products in the market, and the distribution of

income from consumers to beekeepers and input suppliers. In many cases, it is difficult to find clear vertical lines between each level in the chain. Many beekeeping entrepreneurs and honey traders act as integrated value chain operators and perform two or more functions in the chain. The same company, cooperative, or organisation acts as a service provider (training and technical inputs), beekeeper (maintains apiaries), honey processor, and trader.

BDS	Bee Development Section
DFTQC	Department of Food Testing and Quality Control
GTZ	German Technical Assistance
ICIMOD	Int'l Centre for Integrated Mountain Development
MEDEP	Micro Enterprise Development Programme
MOAC	Ministry of Agriculture and Cooperatives
NBSM	Nepal Bureau of Standards and Metrology
PSP	Private Sector Promotion
UNDP	United Nations Development Programme
VC	Value Chain

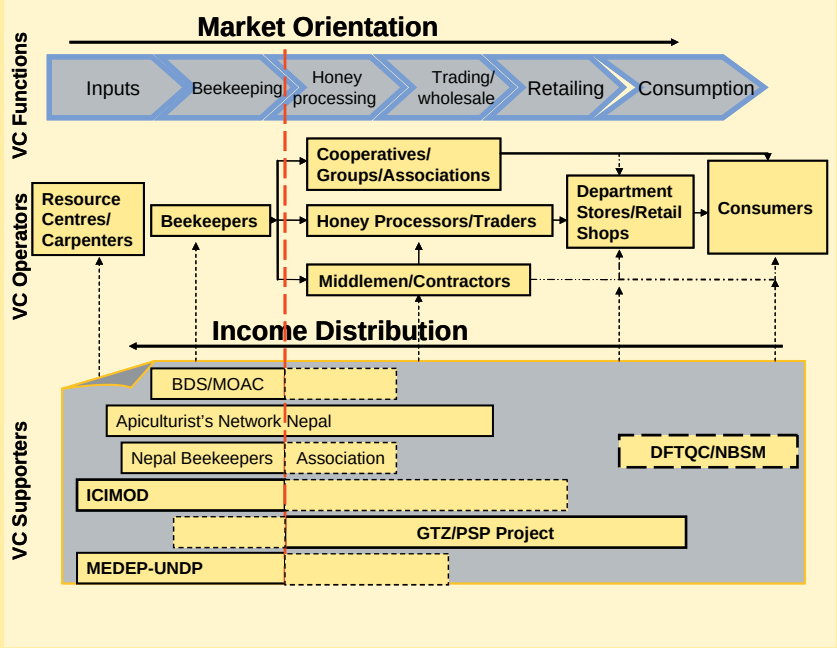

Figure 5: Value chain map of honey in Nepal

In order to improve the economic situation of the rural poor, government agencies and many international organisations are supporting rural farmers to make use of locally available resources to produce commodities for income generation. The value chain map reveals that in beekeeping most of the supporting agencies focus more on the promotion of beekeeping itself than on products for processing and marketing (Figure 5). However, experience from Nepal suggests that producing commodities alone does not help rural farmers or producers if they cannot sell their products or if there is little value added at their end of the value chain. It is equally

Min B. Gurung

Honey marketing in Nepal

important to link rural producers with markets and sustain and grow these links so that they form a perpetual growth cycle of production and consumption. Connecting rural producers with markets on a sustainable basis is a very challenging task that can be helped by value chain promotion.

Globalisation has brought unique opportunities for developing countries in terms of access to markets for their products. However, in order to benefit from these opportunities, these products must be competitive in global markets. Value chain promotion helps to develop systemic competitiveness by looking at the whole chain of production activities and strengthening the overall production chain. To enhance the competitiveness of the commodities and generate more income, it is essential to strengthen linkages between value chain operators. Value chain supporters can make a greater impact if they plan intervention strategies and facilitate the implementation of activities in close cooperation with the various stakeholders in the industry.

Empowerment

Farooq Ahmad

Extension and promotion efforts in Pakistan

Empowering communities and societies is one of the major prerequisites for achieving secure and sustainable livelihoods. Beekeeping can play an important role in empowering the poor, and it also introduces the concept of fair and equitable sharing of benefits in societies. Beekeeper communities understand the structure of a beehive where life organises itself in a more meaningful and disciplined way. Beekeeping in a community inspires people to organise and work collectively for their common benefit and to trade their product in a systematic way. Empowered communities are able to demonstrate their economic and social power. Most small beekeepers belong to the more disadvantaged groups in society and it is important for development workers and projects to help them achieve better economic returns for their hard work, which in turn will contribute to their empowerment.

Organisation and mobilisation are a central part of community empowerment, and help communities to access resources and achieve economic prosperity. ICIMOD's programmes in Nepal have not only helped beekeeping, they have also helped honey hunting communities to organise themselves and to understand better the importance of cliff bee resources. This has led to the relative stabilisation of cliff bee (*Apis laboriosa*) populations, better income through the establishment of 'bee watch tourism' and improved eco services like pollination for their crops and overall biodiversity management. Figure 6 shows the dynamics of *Apis laboriosa* populations in the Kaski district of Nepal, and the stabilising trend in bee populations as a result of the hard work of the communities during the project period.

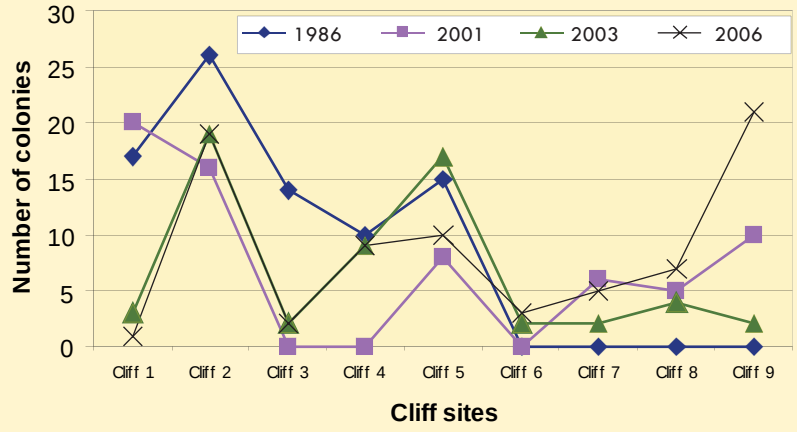

Figure 6: Change in number of bee nests per cliff, Kaski district, Nepal

There are many other examples from managed beekeeping. The Yucatan peninsula was mentioned above, where more than 17,800 small Maya beekeepers produce about one third of Mexico's honey output and earn a significant amount of money (Arce Arce and van Veen, 1997). In Pakistan some very poor sections of society adopted beekeeping in the 1980s, and reports indicate that their overall economic situation changed within the first ten years. They organised themselves and were eventually able to manage 400,000 bee colonies. Honey sales and exports expanded into the niche markets of the Gulf

countries bringing prosperity to these Pakistani beekeepers. Beekeeping in Nepal is still at a preliminary stage, and most beekeepers keep *Apis cerana* colonies in log and wall hives without any management except honey harvesting once or twice a year. Beekeeping also includes protecting wild bees and bee cliffs as part of the family or community ownership. This means that most of the honey produced in Nepal, both from wild bees and backyard beekeeping, is 'organic'. According to Neupane (2003) there are a total of 145,000 colonies of honeybees in Nepal including 110,000 colonies of the Asian hive bee *Apis cerana*, 15,000 colonies of *Apis mellifera,* and 20,000 colonies of other wild bee species (Table 5). The Beekeeping Development Section (BDS) of the Ministry of Agriculture, quoted by Apinet-Nepal in 2006, recorded some 124,000

Table 5: Total number of bee colonies and production of bee products in Nepal

Description	Honeybee species			
	Asian	European	Wild	Total
Bees				
Bee colonies (No.)	110,000	15,000	20,000	145,000
Honey				
Honey production (kg per colony per year)	3	25	20	-
Total honey production (tonnes per year)	330	375	400	1105
Farmer's honey price (NRs per kg)	100	100	150	-
Total honey sales ('000 NRs)	33,000	37,500	60,000	160,500
Beeswax				
Production of processed beeswax (tonnes per year)	2	5	20	27
Farmer's price (NRs per kg)	200	200	200	-
Total sales of beeswax ('000 NRs)	400	1,000	4,000	5,400

Source: Based on data collected by BDS from District Agricultural Development Offices and estimates made by Neupane (2003).
In 2003, US$1 = NRs 71

Satananda Upadhaya

Exhibition and sale of bee-based beauty and healing products

colonies of *Apis cerana*, three-quarters of them kept in traditional fixed comb wall or log hives. Managed and modern beekeeping with *Apis mellifera* is more commonly practised in the central and western development regions of Nepal.

Women in developing countries tend to be disadvantaged, and beekeeping can provide them with a way of improving their position. In Ghana, Africa, the position of women beekeepers changed with changes in the beekeeping business. Now women beekeepers control the cash flow and post harvest processes of honey, including the trade in bee products. In other words beekeeping has given them a chance to prosper and become empowered (Kwame Sarkwah Aidoo 1997).

Capacity building can provide an important route to empowerment. In the Hindu Kush-Himalayan region, ICIMOD's capacity building programme on indigenous honeybees

Farooq Ahmad

Processing honey in a kitchen

triggered a chain of events in empowerment. More than 6,000 poor men and women were trained in *Apis cerana* beekeeping, which changed the art of beekeeping in many project areas. Beekeeping activities increased the communities' direct cash income by 25% on average, and there were further benefits from pollination in terms of agricultural productivity and eco-services. Women's income in the different project areas increased, which provided them with better opportunities for health care, nutrition, and education, also supporting empowerment. Some 27% of the women benefited from the capacity building programmes of the project in the region. The poorest of the poor in particular were trained to organise themselves better, and the setting up of cooperatives and grass root organisations, and management of small grants and endowment funds triggered the growth of the beekeeping industry through the establishment of hive carpentry and other bee-based enterprises.

Social Security

The definition of social security depends on the level of social and economic development of communities and nations. In the developed world, pension schemes, health care, and insurance policies give people a sense of security. In developing countries, social security has a different meaning for different people and communities. In most cases the rural poor rely on livestock, a piece of land, or their beehives or bee colonies in the nearby forest to provide them with a sense of social and economic security, as cash flow is not reliable and often inaccessible. In these situations, beekeeping development is also integrated into rural development efforts.

In southern China, special efforts are being made to conserve local and indigenous honeybee species. A comprehensive conservation and development programme for *Apis cerana* has been initiated, which is facilitating the conservation of 780,000 colonies of *Apis cerana* in Yunnan province alone. Ethnic and other communities keep these honeybees in log, wall, and moveable frame hives. As a result of regular selection and breeding programmes, the bee species in this area produces an average annual yield of 10 to 15 kg of honey, 1 to 2 kg of pollen, and 1 kg of wax per colony. In the best case scenario, honey production of *Apis cerana cerana* can reach 90 kg per colony (Kuang et al. 2002). This example shows clearly how beekeeping development using indigenous resources can contribute to social, economic, and environmental security.

Beekeeping as a Contribution to Improved Rural Livelihoods

Farooq Ahmad

Beekeeping, a source of inspiration for the poorest of poor

We have discussed how beekeeping contributes in a balanced way to rural development efforts, leading to secure and sustainable livelihoods. This supplementary model of development consists of five major elements: physical security, economic security, empowerment, social security, and conservation of resources. These elements are intricately linked and interdependent, which means they are all essential in order to achieve secure and sustainable livelihoods.

The major gains from beekeeping development efforts originate from agricultural husbandry, replenishment of forest resources, and human satisfaction – bringing economic benefits to people, particularly to the poorest of the poor. Below we suggest a few approaches that should be incorporated in future rural development strategies for achieving the goal of sustainable livelihoods.

- Sustainable policies to regulate the import and export of bees and bee products and control the spread of diseases between continents, countries, and within bee species
- Improvement in trade policies to remove trade barriers and facilitate cross-border and cross-continent trade of bee products and enhance the understanding of the value chain at all levels
- Harmonisation and adoption of international honey quality standards
- Incorporating managed pollination through honeybees as an important input in agricultural husbandry, to be strictly followed by the government departments concerned
- Improvements in training curricula to include conservation apiculture as an important element of beekeeping development; this change will provide space and opportunity to understand the holistic honeybee phenomenon, which includes all bee species including *Apis mellifera*
- Enhancement of nectar and pollen producing plant species in reforestation and urban beautification projects for the promotion of beekeeping.
- Encouraging the beverages and bottling industry to promote honey-based drinks for people's well-being.
- Development of a database on the nesting habitats of wild honeybee species for the promotion of green businesses like bee watch ecotourism
- Awareness-raising campaigns for conserving wild honeybee habitats through public and private partnership.

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Some Useful Terms

Apiary	Bee colonies, hives, and other equipment assembled in one location for beekeeping operations
Beeswax	Complex mixture of organic compounds secreted by special glands of the worker bee's abdomen and used for building the comb
Bee venom	Poison secreted by special glands attached to the bee sting
Colony	A social community of several thousand worker bees usually containing a queen and a few drones
Honey	Natural sweet substance produced by honeybees from the nectar of flowers, from secretions of living parts of plants, or from the excretions of plant-sucking insects
Hive	A man-made structure for housing bees, especially honeybees, or a container in which bees build their nest
Pollination	Transfer of pollen from an anther (male part) to the stigma (female part) of flowers
Pollinator	An agent that helps transfer pollen, thus enabling pollination
Propolis	Sap or resinous substance collected from trees or plants by bees and used as a cement or sealant in the construction of their hives; also called bee glue
Royal jelly	Highly nutritious glandular secretion from young worker bees, used to feed the queen and young brood
Pollen	Male reproductive cell bodies produced by flower anthers and collected and used by honeybees as a source of protein

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