



USAID
FROM THE AMERICAN PEOPLE

CAMBODIA MSME 2/BEE PROJECT

WILD HONEYBEE BASELINE SURVEY

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ABBREVIATIONS

ADB	Asian Development Bank
AFSC	American Friends Steering Committee
BCI	Biodiversity Conservation Corridors Initiative
BEE	Business Enabling Environment
CBCL	Cambodia Biologicals Co. Ltd.
CBO	Community-Based Organization
CCD	Colony Collapse Disorder
CEDAC	Cambodian Center for Study and Development of Agriculture
CF	Community Forestry
CFAC	Community Forestry Alliance for Cambodia
CFi	Community Fishery
CFI	Community Forestry International
CI	Conservation International
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CPA	Community Protected Area
DAI	Development Alternatives, Inc.
dbh	diameter breast height
FA	Forestry Administration
FFI	Flora and Fauna International
FGD	Focus Group Discussion
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (German Technical Cooperation)
HH	Household
INGO	International Non-Government Organization
IUCN	International Union for Conservation of Nature
KI	Key Informant Interview
MC	Moisture Content
M&E	Monitoring and Evaluation
MAFF	Ministry of Agriculture, Forestry, and Fisheries
MFI	Microfinance Institution
MoE	Ministry of Environment
MSME	Micro, Small and Medium Enterprise
MW	Megawatts
n	Number of respondents
NGO	Non-Government Organization
NTFP	Non-Timber Forest Products
NTFP-EP	Non-Timber Forest Products Exchange Program
Pact	Pact Cambodia Program
USG	United States Government
UNDP	United Nations Development Program
USAID	United States Agency for International Development
VC	Value Chain
WWF	World Wide Fund for Nature/World Wildlife Fund

EXECUTIVE SUMMARY

INTRODUCTION

The Cambodia MSME Project funded by the U.S. Agency for International Development (USAID) and implemented by the Development Alternatives, Inc. (DAI), aims to promote economic and private sector growth focused on specific value chains. It supports a component program in line with the USAID/Cambodia Biodiversity Objectives aimed at sound management of areas of biological importance through sustainable conservation practices by local communities and government agencies. The province of Koh Kong falls under the principal areas of biological significance, as it is within the Cardamom Mountains eco-region.

The Cambodia MSME Wild Honeybee Value Chain project recognizes honeybees as keystone species, crucial to the maintenance, sustainability and improvement of biodiversity of habitats. Bees are noted for their role in plant pollination and are key indicators of the health of forest areas. They are important for rural livelihoods from the income derived from the sale of honeybee products, as well as their traditional family use for medicinal purposes. Honey harvesting communities play a large role in conserving, protecting and ensuring sustainable management of forest resources that serve as bee habitat and forage areas, as this will improve the value chain and sustain other crops of value. Work on wild honeybee sustainability is made more crucial with the threat of “colony collapse disorder” (CCD) affecting bee populations in Europe and North America.

The area of Kampong Soam Bay in Koh Kong was found to be the best prospect for a biodiversity conservation program with honey value chain improvement during the Cambodia MSME Honey Value Chain Assessment in May of 2008. This baseline study will further establish the conditions of the honeybee harvest areas and the supply side of the value chain, specifically to characterize and quantify the “value” to both the environment and socio-economy of honeybee propagation and sustainable use.

The study area was in the Districts of Srea Ambel and Botum Sakor in Koh Kong Province within the Botum Sakor National Park and the Dang Peng Multiple-Use Area, both parts of the Biodiversity Conservation Corridors of the Cardamom Mountains. Some 10 villages with a total household population of 1,800 were sampled, using a 120 household sampling frame, with purposive identification of honey harvesting households. Data collection used household surveys, focus group discussions in five communes, key informant interviews and ecological walks through three ecosystems which are honey harvesting sites.

THE BIODIVERSITY SITUATION

The project area in Koh Kong is within significant biodiversity sanctuaries and corridors of the Cardamoms, including the Phnom Aural Wildlife Sanctuary. The river systems support the breeding area of the Royal turtle and the Siamese crocodile. Significant new species abound in the area, such as the wolf snake, the threatened Chestnut-headed partridge and Green peafowl and fifteen new bird species. The corridors are a known habitat of the Indochinese tiger, also known as Corbetts tiger and the Asian elephant. It is characterized by evergreen forests, unique upland and lowland freshwater swamp forests with some semi-evergreen and dry forest; the coast has extensive river estuaries, shallow coastal waters, and mangrove forests backed by lowland *Melaleuca* wetlands.

The wild honey harvesting areas in the communes of Dang Peng, Srae Ambel, and Andong Tuek are adjacent to the Saom River and its mouth at Kampong Soam Bay. These areas are characterized by flatlands, wetlands and areas developed for agriculture mainly on alluvium silt deposited by the river. The upland areas are comprised of *Dipterocarp* and lowland evergreen trees connecting to the upper montane areas of the Cardamoms. The honeybee harvest areas comprise of three designated Community Protected Areas (CPA), Community Forestry (CF) and Community Fishery (CFi) with a total of some 5,302 hectares.

Five bee species can be found in the area: the *Apis dorsata* or giant honeybee, the *Apis florea* or the dwarf Asian honeybee, the Asian hive-bee (*A. cerana*), the stingless bees of the genus *Trigona* and the *Apis andreniformis*. The *A. dorsata* is the most populous and together with the *A. florea* are the more abundant honey sources.

The study area consisting of the *Melaleuca* forest, primary forest and mangroves contain a relatively diverse vegetation of forest, shrubs, vines/lianas and ferns serving as honeybee forage and colonized for hives. The study recorded 51 kinds of trees, 26 shrubs and various vines and ferns as well as various animals. Nineteen kinds of trees were found being used for honeybee propagation, either for the establishment of colonies, use for forage, or for the building of rafters. The bee habitat was seen to be in serious degradation. The diameter and height of trees are relatively thin and low, suggesting secondary growth. The area has faced pressures from deforestation since the late 1980's and is rapidly being turned into farmlands and is continually degraded by the collection of timber and non-timber forest products by the growing population. The community confirmed the continued decline of non-timber products being harvested and the loss of bee forage. Also, within Toub Cheang Community Protected Area, the Kirirom III Hydrothermal Power Plant is now being constructed; occupying some 700 hectares of the protected area where quarrying and blasting has begun.

Household surveys found out major rural poverty concerns related to small-farm sizes, low incomes and rice shortages of at least three months out of the year. Some 27% of households are involved in wild honeybee activities with an estimated 241 households in the project area. The predominant type of honey gathering is opportunistic, meaning harvest is done whenever one is found in its natural hive. The use of rafters to attract bees to set up hives is evident for a third of the honey harvesting households who were the beneficiaries of the training program of Pact for sustainable bee and biodiversity management, also with USAID support. There is now a shift for some 34% of households towards more sustainable practices including: rafter use, honey head harvesting, the use of a plastic bag for transporting the honey head, group harvesting, the collection of honey for bulk sales and the setting up of cluster groups with defined areas for rafter installation.

Honeybee livelihood is supplemental. Most activities are done part-time during the peak harvest months from June to August, mainly by male head of household and male members. Whole hives, the honey head, honey, brood and wax are harvested; honey and wax are commonly sold for their medicinal value and as food supplement. The average volume of honey harvested per household is 5 liters and one kg of wax. The total volume of honey harvested comes to some 2,400 liters, while the total for wax is around 440 kilos. In 2008, the average estimate household income from the honey sold was computed by multiplying the total of households involved with the median price, which showed an estimated US\$37 per household. For the project area where some 75% of produce came, the 241 households sold the volume of honey harvest at \$ 6.12 per liter in 2009 which earned them an estimated income of US\$61 during the entire honey harvesting season. Considering the current low household income from their

main occupation (at US\$25-US\$49 per month), the honey livelihood contributed significantly to offset income and food deficits.

HONEY PRODUCT MARKET

The market for honey products is not well established and is still limited to the local community. Local demand accounts for some 0.5-2 liters per household, with free-sharing and sales at low-cost. Households vend to consumers and the Srae Ambel market. Roving traders account for some 700 liters of honey at US\$3.75-US\$5.00 per liter. The Prang Honey Association served a trader/collector of honey buying at US\$6.50 per liter from its members and selling at US\$9.13 per liter after the raw product has undergone filtration. Currently, its sole buyer is the Cambodian Centre for Study and Development in Agriculture (CEDAC) in Phnom Penh which provided a purchase order for 300 liters in 2009.

CEDAC's current total demand stands at 2,000 liters of honey, but some 1,600 liters are sourced from Mondulkiri. The processing is still very basic from raw product which is filtered, dripped and bottled. Packaging is very basic, using plastic bottle jars with conservative labeling. The quality of the stock is beset with the issue of high moisture content which tends to induce fermentation and product run-off from the sealed container.

CONSIDERATIONS FOR BIODIVERSITY CONSERVATION AND HONEY VALUE CHAIN IMPROVEMENT

This study finds a valid rationale for the honey value chain improvement linked with biodiversity conservation and protection. The project area has very high biodiversity value as it is a known habitat of threatened and vulnerable species of flora and fauna. The honeybee harvest areas are known to support significant species for food and medicinal values. Biodiversity objectives need to be linked with the current effort on the Cardamom Biodiversity Corridor Initiative. Natural resource management should integrate the sustainable practices being espoused by the honey association: to further delineate the community protected forestry and fishery areas, and to effect community protection measures through patrols and actions against illegal activities. The installation of rafters for beekeeping in the forest is a means by which the community can closely monitor and protect the crucial habitat, as it can assert community guidelines for sustainable use of resources, including *a priori* rights which can prevent opportunistic and often illegal forest users.

A conservative estimate of the honeybee resource is approximately 2,000 colonies within the 5,000 hectare harvesting area. This area is found in 3 sites; the Toub Cheang Community Protected Area (3,046 has.), the Prang-Chamkar Kroam Community Forest (859 has.) and the Ta Meak Community Fishery Area (1,400 has.). There are some 40,000 to 60,000 bees in a hive which can produce some 1 to 5 liters of honey in 20-30 days. This affirms a relatively healthy bee resource population, but the forest habitat may be degraded by the concentration of users in an area. A more rational basis for installation of rafters needs to be followed. This study proposes for installation of rafters, one installation for every 1 hectare area. As practiced in Vietnam, this means some 7-10 rafters installed per hectare for *A. dorsata* bees, most of which tend to cluster. This is to assure wider foraging area per colony to reduce low rafter occupancy and to expand areas where honey hunters can monitor and protect wider habitat areas, rather than concentrate in limited areas. This can result in a higher volume of harvest if bees have lesser competition for forage.

The study also proposes for increased public understanding on the role of honeybees as a keystone species. This promotes better awareness of their role, the need to conserve and protect bee habitats and encourages the public to appreciate honeybee products. This awareness raising should be geared towards improving practices to increase honeybee resources through wild culturing or commercial beekeeping which may result in a more equitable division of labor between the sexes. The Honey Association (HA) should also regulate further on sustainable resource practices, such as ensuring the maturity of hives before harvest, ensuring respect of ownership over rafters, allocation of areas per cluster of honey gatherers and equity on the quota for the volume of honey which will be purchased from harvesters. This study also proposes higher level processing, going from raw product harvesting to processing byproducts such as candles and honey soap.

Related to the impact of the Kirirom Hydropower project, this study calls for the affected communities to develop a clear and agreed position as basis for dialogue and negotiations with the company, its consultants and relevant government authorities. The community position should affirm their continued access to the parts of the protected area that fall within the project site.

The quality of the honey products would be improved by locating rafters in higher elevations; expanding the installation area for rafters and ensuring a more disperse distribution of honey colonies. Commercial beekeeping outside of the forest areas should be encouraged. This assures can augment the volume of honey from wild harvest. The quality of honey is also improved when harvest of hives are done when they reach full maturation.

The technology for the reduction of moisture content of the honey should be explored. This can be pursued through improving links between community associations and supporting agencies that have the technical expertise necessary.

The marketing strategy should also be improved through support to expand the community's market. Strategies focused on selling the product based on its uniqueness should be pursued. Further experimentation will also bring out the distinct uses of the product. Better packaging and product advertising should also be done, including government sponsored product exhibits which can be tied to ecotourism promotion. Further market segment potentials should also be researched because there are other honeybee byproducts that need to be processed and marketed—such as royal jelly, pollen, propolis and wax.

I. INTRODUCTION: THE USAID CAMBODIA MSME PROJECT

A. *Cambodia Micro, Small, and Medium Enterprise 2 / Business Enabling Environment (MSME 2/BEE)*

Cambodia MSME is being implemented by the Development Alternatives, Inc., through funding from USAID. The project's overall objective is to improve business productivity in selected value chains; increase the voice of business in policy making; and improve the Royal Government of Cambodia's ability to respond to the private sector in reforming the business environment. The project expanded to a more extensive coverage of twelve (12) provinces. Select value chains may include swine, clay tile, aquaculture, non-timber forest products, water and sanitation services, fruit, vegetables, animal feed, and poultry. It has related mandates on improving natural resource management and access to safe water and sanitation.

A sub-component of the Cambodia MSME is the support program to USAID/Cambodia Biodiversity Objectives. This aims to contribute to the sound management for areas of biological importance through the implementation of activities that reduce threats to biodiversity in priority areas and promote sustainable conservation practices by local communities and government agencies. The DAI support program adheres to USG requirements on the use of the US Congressional earmark for biodiversity by following the following guidelines:

- The biodiversity component has explicit conservation objectives
- Activities target site-specific threats to biodiversity
- Impact is measured in terms of the direct benefits to the conservation of biodiversity
- Site-based activities target areas of biological significance

Cambodia MSME's geographical scope comprises the 12 provinces of Battambang, Siem Reap, Prey Veng, Kandal, Kampong Cham, Kampong Thom, Kratie, Kampot, Banteay Meanchey, Kampong Speu, Takeo, and Svay Rieng. In these provinces, the principal areas of biological significance are areas of the Cardamom Mountains ecoregion in Pursat, Koh Kong, Kampong Speu and Kampot, areas of dry evergreen forest in Kampong Thom, Kratie and Siem Reap, areas of dry forest in Kampong Thom and Kratie, and areas of swamp forests around the Tonle Sap in Battambang, Siem Reap and Kampong Thom. The biodiversity sub-component focuses activities in four "landscapes": Prey Lang (Kampong Thom, Preah Vihear and Stueng Treng Provinces); the Elephants Mountains (Kampot Province); Boeung Per protected area in northern Kampong Thom, Siem Reap and Preah Vihear Provinces; and the Chhloung forest in southern Kratie Province. At this time, it is anticipated that the following non-timber forest product value chains will be supported: honey, rattan and tree resins.

Cambodia MSME engages with stakeholders, representatives of communities, civil society groups and government, in a transparent discussion of governance and tenure. Cambodia MSME works with partner organizations to assist community groups in negotiating formal rights and developing the institutional capacity to meet their responsibilities. Disadvantaged groups, including women, youth, and indigenous minorities are equitably represented through this approach. Key stakeholders include the private sector and government authorities such as the Forestry Administration, the Ministry of Environment, Commune, District and Provincial authorities.

Cambodia MSME targets biodiversity conservation activities in 12 provinces over the first 2 years of the project. The total area under improved management of natural resources in biologically significant areas is set at 17,000 hectares. An estimated 6,000 people will derive increased economic benefits from sustainable management of natural resources and 1,000 people will receive training in improve natural resource management and conservation techniques. Based on the current status of community forest management and protected area management agreements in Cambodia, an estimated four agreements or regulations promoting sustainable management and conservation of natural resources will be negotiated and implemented during the course of the project.

B. Honeybees as a Keystone Species

"It's critical that the public understand that the honeybee is a keystone species that is an indicator of environmental health".¹

Bees are central to the systems that support food production for human beings. An international study of 115 food crops grown in over 200 countries showed that 75% of the crops were pollinated by animals, especially by bees.²

Bees are pollinators and strongly influence ecological relationships, ecosystem conservation and stability, genetic variation in the plant community, floral diversity, specialization and evolution. Bees are essential in the production of seed-bearing plants (grains, nuts, berries and fruits) which are highly dependent on insect pollination. Other pollinators like bats and birds depend greatly on the seed and fruit bearing plants pollinated by bees, although they too have a role to play in pollination, especially in high altitude and cold areas where bees cannot survive.

Many colorful and different looking flowers developed as an adaptation for the bees and other pollinators in a complex interdependence, the production of nectar and pollen is part of that adaptation. An estimated 80% of flowering plants are entomophilous, depending on insect pollination to reproduce, and 50% of pollinators of tropical plants are bees. Bees are efficient due to their great numbers, their physique and their behavior of foraging on only one plant species at one time. Pollen attracts bees but its crucial function is to ensure re-generation of plants. Bee's hairy structure brush off and carry pollen grains to fertilize a flower's stigma down to its ovary where the seeds are formed. Some plants need several successful visits from bees to ensure that all the flower's eggs are fertilized (such as strawberries or apples); the lack of bee visits will result in poorly shaped or incompletely formed fruits or seeds.

The pollination work of bees is extraordinary. Usually, a honeybee can visit between 50-1,000 flowers in one trip, which takes between 30 minutes to four hours depending on the available forage. A colony with 25,000 forager bees, each making 10 trips a day, is able to pollinate 250 million flowers.

There are now serious considerations on the decline of bee population worldwide. This is especially true for the US and the UK where the phenomenon of "colony collapse disorder" or CCD have affected bee populations. The number of hives affected by CCD exploded exponentially in the US in 2006, and if this trend continues it will seriously jeopardize human food production. This problem has put in the limelight

¹ VanEngelsdorp, Penn State senior extension associate and acting state apiarist for the Pennsylvania Department of Agriculture
<http://aqinfo.psu.edu/News/2008/2/BeeResearch.htm>

² "Importance of Pollinators in Changing Landscapes for World Crops", Klein, Vaissiere, Cane, et al, submitted to the Royal Society of London

the hazardous threat to bees brought about by the use of pesticides and the focus by beekeepers on commercial bee species which tends to exclude other wild bee species. Sustainable biodiversity conservation needs to extend to wild bee species whose pollination works are more extensive than commercial bee species.

Beekeeping in the forest, as the Cambodia MSME project proposes, will ensure that beekeepers will be interested in protection of the forests and trees preferred by the bees. In Cambodia, honeybees play a role in rural livelihoods from the sale of honey, wax and brood. Households involved in the honey supply chains are therefore also directly tied to (or dependent upon) conservation management. They will be key players in geo-referenced monitoring of the bee populations and can promote more sustainable practices crucial to both their economic activities in the value chain and in biodiversity conservation.

C. Wild Honey Value Chain Strengthening

An important component of the Cambodia MSME project is to support activities that promote biodiversity conservation within the Wild Honeybee Value Chain.

Although wild honey harvesting is traditionally and widely practiced in Cambodia, there are limited studies on honeybee biodiversity and the honeybee value chain. A reliable estimate of Cambodia's actual and potential honey production is severely missing. Yet there were notable efforts to introduce beekeeping and sustainable honey harvesting. The GTZ and the Angkor Centre for Conservation of Biodiversity initially promoted this in 2003 with non-timber forest product gatherers in Siem Reap, Kampong Chhnang, Koh Kong, Pursat, Banteay Meanchey and Preah Vihear. There was also an effort by the Rotary Club International for beekeeping and biodiversity awareness in selected areas of Pursat (introduced by Alaskan apiculturist Stephen Petersen). Since 2007 WWF and NTFP-EP have been working with two communities honey producing communities in Monduliri.

In 2008, the Cambodia MSME conducted a Honey Value Chain Assessment as an initial effort to study the credible estimate of the number of colonies of the various species of honeybees that are harvested in Cambodia. The study is the largest scale assessment done to date but still concentrated on four "landscapes": Prey Long Forest (Kampong Thom and Kratie Provinces); Kampong Soam Bay and the Elephants Mountains (Kampot and Koh Kong Provinces); Boeung Per protected area (northern Kampong Thom Province); and the Chhloung forest in southern Kratie Province.

The study found out that generally wild honey harvesting is village based, with very low standards of quality and hygiene. Supply chain linkages are informal and lack information flow back to producers. Regulations exist, but are neither appropriately designed nor consistently applied. There are limited non-government organizations and private companies engaged in developing the supply chain. There is lack of access of the supply chain to high-priced niche markets. However, the honey value chain has interesting potential; the initial estimate of volume of production is high given the market demand and the income potential is present.

The study ranked the area of Kampong Soam Bay as the area with best immediate prospects for a biodiversity conservation program with the potential for honey value chain improvement. It recommended further that a baseline survey be conducted in the honey hunting communities in this area. Hence, this baseline study was commissioned by the Cambodia MSME.

II. THE WILD HONEYBEE BASELINE SURVEY

A. Study Objectives

This Baseline Study is in line with the overall Cambodia MSME initiatives to improve on the tradition of wild honeybee harvesting towards a more systematic propagation, ecologically safe harvesting, sustainable use and value-added commercial marketing. The survey would characterize and quantify the “value” to both the environment and socio-economy of honeybee propagation and sustainable use, the cost and benefits and other institutional arrangements related to this economic activity.

The major objective of the baseline survey is to collect baseline information on the:

- Biological and ecological factors such as: number of bee colony locations, size and health, seasonality of occupation, honey yield, percent colonized, type of tree colonized or if a rafter is being used, habitat classification, and floral resources. These data will be direct indicators describing the health of the honeybee population in the area and, by proxy, describes the health of the protected area’s biodiversity, and;
- Socio-economic factors, including: community-based resource management and access allocation, identification and contacts for key participants, commercial details of the value chain, and the socio-economic circumstances of participating households.

B. Study Area

The identified study area is in the districts of Srae Ambel and Botum Sakor (Table 1) in the province of Koh Kong, situated as part of the Botum Sakor National Park and the Dang Peng multiple-use area. The two sites are part of the Biodiversity Conservation Corridors of the Cardamom and Elephant Mountains landscape, currently considered of international biodiversity importance, and where protection and sustainable use initiatives are being undertaken through the Forest Administration and the Ministry of Environment, under the Greater Mekong Sub region (GMS) Biodiversity Conservation Corridors Initiative (BCI) funded by the Asian Development Bank (ADB). The area connects to the western portion (Mondul Seima District) which contains pristine evergreen forest. The coastal section contains recovering mangrove forest and an extensive network of river estuaries, shallow coastal waters, and is backed by lowland *Melaleuca* wetlands. The maps below (Figures 1 and 2) indicate the areas of Srae Ambel and of Botum Sakor.

The actual areas of the study were decided with based on the recommended areas by PACT, formerly known as Community Forestry International (CFI), an NGO that had already initiated organizing community associations for the honey value chain trade. The study areas in the 2 districts and 5 communes comprised of 10 villages. The total number of households sampled in the Baseline Survey was 120 households. A specific query to these households was on how many households in their community were involved in the wild honey harvesting economy; the responses were tallied to indicate some 241 honey harvesting households in the project locality.

Figure 1 Srae Ambel District

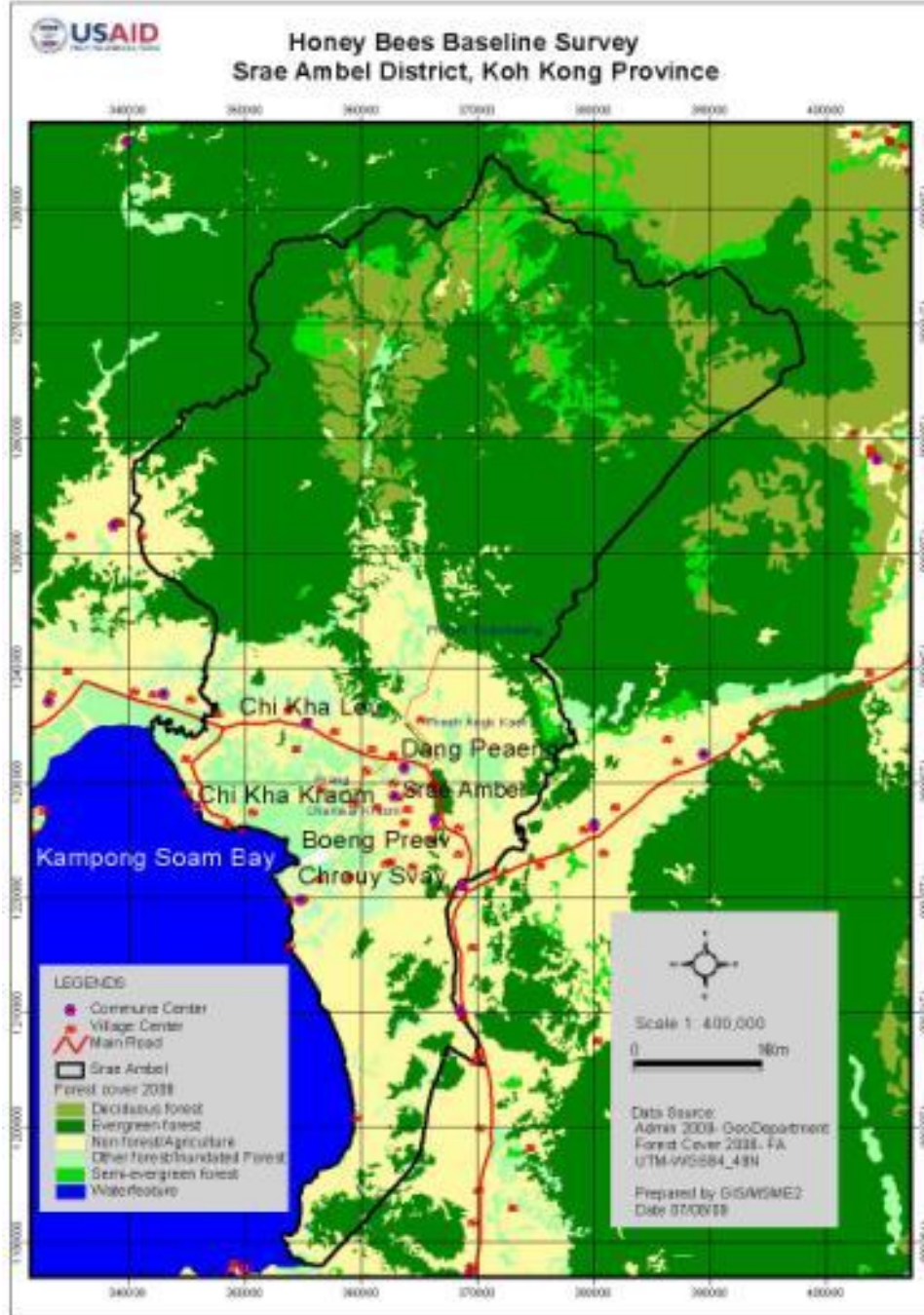


Figure 2 Botum Sakor District

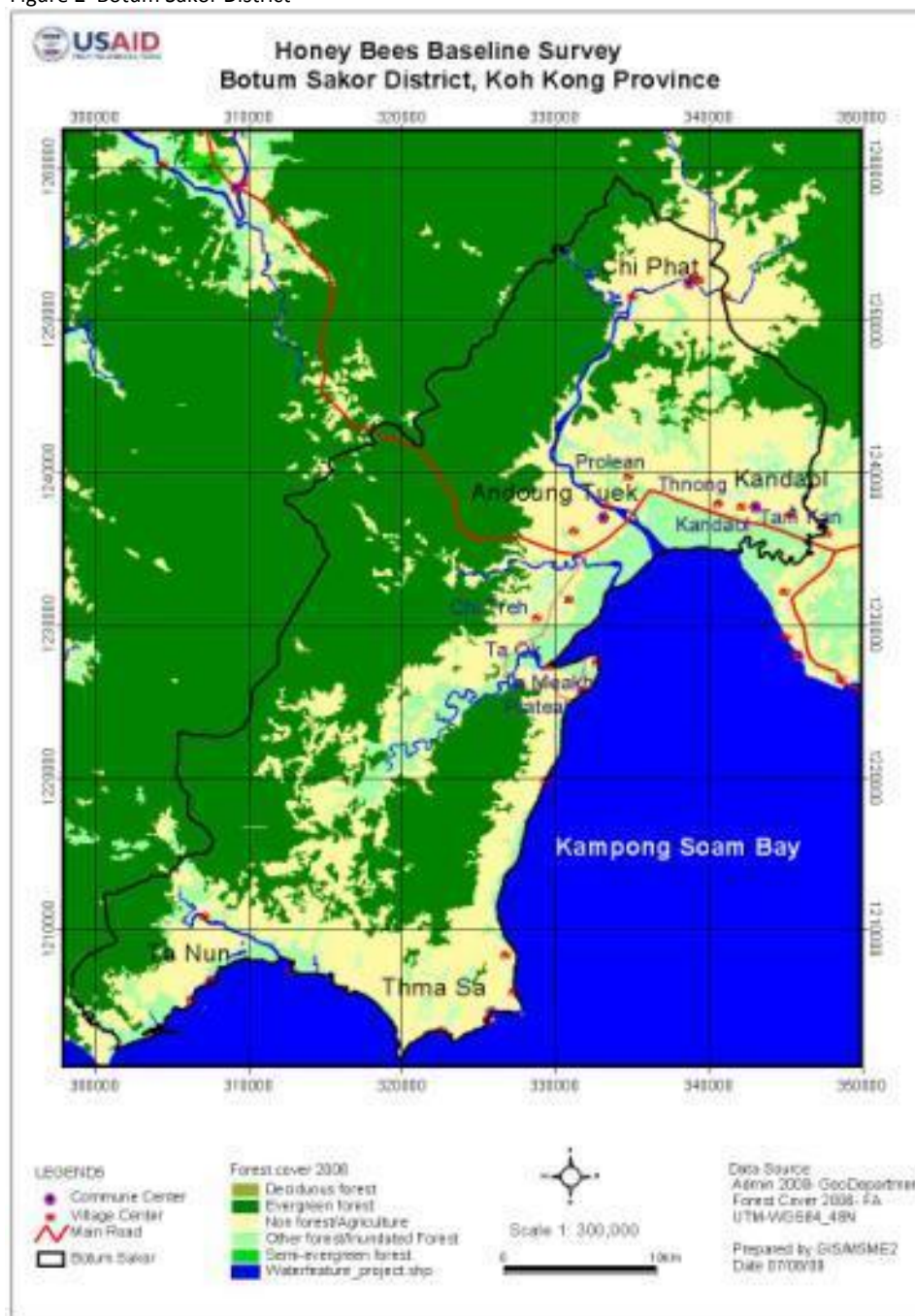


Table 1 Sample Communes, Villages and Households

Classification	District	Commune	Village	N° of Households Sampled
Project Area Villages	Botum Sakor	Andong Tuek	Ta Meak	24
	Srae Ambel	Dang Peng	Prang	13
			Preah Ang Keo	11

		Srae Ambel	Chamkar Kroam	24
Non-Project Area Villages	Botum Sakor	Kandoal	Pralean	9
			Thnong	9
			Ta Kan	5
			Kandoal	1
	Srae Ambel	Chrouy Svay	Chrouy Svay Lech	14
			Chrouy Svay Ket	10
Total				120

C. Data-collection Methodologies and Activities Undertaken

The study comprised of five main activities – review of secondary information; development of data gathering tools; field interviews and group discussions; data compilation, analysis, and report writing; and report presentation, report revisions, and final submission.

The detail on the information collected from stakeholders in the value chain includes the profile on the villages with honey hunting activity, household (HH) demographics and income-earning activities, bee and habitat resource assessment, assessment of supply chain process, assessment of honey, brood and by product value. Participant awareness of the importance of bees and sustainable practices, potentials for community-based management of the resource, and the status of private sector, government or NGO support to developing the honey value chain were also undertaken.

Data collection for this study was conducted within a period of two weeks in the field. The vast majority of data was collected and triangulated by means of questionnaire surveys, semi-structured interviews and focus group discussions in the five host communes. The biodiversity profiling of identified forests for honey harvesting was done through a transect-walk/eco-profiling in three community forest ecosystems. Content analysis of relevant literature served as complimentary sources of information.

The data collection activities undertaken in the study are summarized as follows:

- Household surveys using structured questionnaire were conducted among 120 households in the five communes;
- Five focus group discussions were undertaken in five communes with a total of eighty seven participants (See Annex 3 for the list of participants);
- Nine key informant interviews were undertaken with respondents including honey hunters, collectors, traditional medicine sellers, a honey-wine maker, government agencies such as the Forestry Administration and the Ministry of Environment, NGOs like CEDAC, AFSC, Khmer Ahimsa and CBC Ltd. MAFF, Pact, and others.
- Three ecological walks were undertaken in distinct ecosystems within the study area including the wetland *Melaleuca* forest, the mangrove forest and the upland *Dipterocarp* forest.

D. Limitations of the Study

Limitations of the study which relate to the health of the bee biodiversity and the quality of the honeybee products which are beyond the study's control are;

- i. Firstly, the field visit was short and conducted at a time when the hives for *Apis dorsata* was not yet at its peak season, while that of *Apis florea* was nearing the end of its season. Therefore, there were limited instances for observations of hive population densities and the actual volume of honey production per honey head. For the *A. dorsata* species, the hives observed were largely still immature. The abundance of bee resource was based on trending (projected based upon previous seasons) by the honey hunters. The study was done in the settlement areas and adjacent forests; the upper sections of the Cardamoms were excluded. The ecological study was not tasked to track and record in detail classified threatened species, such as wild elephants, tigers, bears, deer, the *Batagur* soft-shelled turtle, the wolf snake or the green-blooded frog that are known to exist in the area. The eco-walk was limited to the harvest areas adjacent to the community settlements; tracks of deer and presence of monkeys were seen but bee-related flora or bee-predatory fauna was the focus.
- ii. Secondly, the study lacked the instruments for measuring the quality of honey being collected. Moisture content of the honey products was tested using a refractometer in two instances but to get a complete analysis of honey quality there are a set of FAO/WHO standards to follow.³ The May 2009 Honey Value Chain Assessment by Cambodia MSME contracted the sample testing, but it was not comprehensive and not particularly focused on honey from Koh Kong.
- iii. Thirdly, the study area of the bee and related biodiversity is limited to sites already identified. The biodiversity profiling is limited to observation and not actual studies on taxonomy or on more rigorous ecological profiling methodology. The results on the biodiversity are meant merely to identify related tree and floral species which should be protected or conserved as part of the bee habitat. There are several studies on the biodiversity of the area in both zoological and botanical aspects but the actual biodiversity against the ecosystems are not well established. The study focus was not to comprehensively profile the ecology of the protected areas.
- iv. The study focused on the supply chain. Value chain information related to post-harvest processes at the level of the wholesaler and the market outlet were beyond the terms of the study, as this was covered by an earlier preliminary investigation on the honey value chain. Nevertheless, there was an effort to gather information from a few Phnom Penh wholesale buyers of honey from the study area to establish demand at this level. Therefore, there are noted gaps in other stakeholders in the value-chain, particularly the end-market information and candle producers.

³ As per the FAO/WHO Codex of Honey Standards: percentage of water content (< 21 %) ; De-glucosidal content, (> 65 %) ; percentage of Sacaroza content, (< 5 %); Acid content (mlkg) (> 40); Amylaza (diastaza) (< 3 degree goth); indissolubility in water solid content and NMP content. The technical terms apply to the measurement for sucrose content or sweetness, presence of amylace enzyme and the N-methyl-2-pyrrolidone (NMP) solvent.

III. FINDINGS OF THE HONEYBEE BASELINE SURVEY

A. Biodiversity Situation of the Project Area

Biodiversity, health and poverty eradication are interconnected. Biodiversity has a key role in sustaining livelihoods, including the provision of food, medicines and energy as well as services such as, clean water and ecotourism. Biodiversity also provides a means in mitigating environmental degradation such as those resulting from climate change, the foundation on which poverty reduction and sustainable development generally depend on.⁴ At the World Summit on Sustainable Development in 2002, world leaders have made significant international commitments in achieving sustainable development as part of the Millennium Development Goals (MDG) with a target set to significantly reduce the rate of biodiversity loss by 2010 and to achieve environmental sustainability by 2015.

An understanding of biodiversity patterns in Cambodia can lead to a better understanding of ecosystem structure and function, resulting in better management of the area, especially with respect to biodiversity and conservation planning. Different management practices have an effect on species composition and biodiversity and it is important to understand this relationship in order to predict their effects on diversity patterns. In Cambodia, 95% of the population lives in rural areas⁵ and most are dependent on forest and fishery resources to meet their primary needs.

The significance of honeybees to the biodiversity is well known as agents of pollination. As cited by Kasinas in 2007, bees are the main animal pollinators of crops worldwide and feral pollinations maintain the wild forest habitats where most floral and faunal biodiversity abound. Bees are invaluable in the process of cross-pollination and plant reproduction. Honeybees, in turn, need forests in order to survive and produce honey for their brood. The global honey enterprise is only one of the contributions of bees to the human economy. A research conducted by Parker and Torchio stated that bees are good indicators of habitat quality and future agricultural yields of a certain area of land.⁶ Without pollinators, most of the native flowering plants would decline, disappear, or be replaced by non-flowering weedy species.

Honey harvesting is part of the non-timber forest products (NTFP) economic activity where the majority of the Cambodian rural population engages in for income and subsistence.⁷ Forest products play a key role for food security in areas with seasonal food shortages. The improvement of the honey harvesting practice and its value chain responds to the objectives of both biodiversity conservation and protection and poverty reduction. The first ensures that forest ecosystems remain healthy to improve the sources of honey and NTFP products; the latter translates sustainable forest management into viable economic activity which provides added food and income.

⁴ Extracted from a statement delivered by Achim Steiner (former Director-General of IUCN) prepared for the ministerial consultation: Implementation of Internationally Agreed Development Goals of the Millennium Declaration, 23rd Session of the UNEP Governing Council/Global Ministerial Environment Forum, 21 to 25 February 2005, Nairobi, Kenya

⁵ Ma Sok Ta, 2007. The State of Forest Management and Conservation in Cambodia.

⁶ Parker and Torchio (n.d). Management of Wild Honey Bees

⁷ Honey is considered as one of the Non-Timber Forest Products.

1. Background on the Cardamom Area

The project area is situated in the Koh Kong province, in the southwest of Cambodia and within the area of the Cardamom Mountains which is considered one of the few remaining undisturbed and pristine ecosystems in Southeast Asia. The Cardamom Mountains covers an area of 10,000 kilometers. It is known to contain a significant number of the country's known mammals, birds, reptiles and amphibians. This is attributed to a very high diversity of habitats, large expanses of ferns, upper montane forests high elevation marshes, a network of river estuaries and mangrove forests.

The project area is within significant biodiversity sanctuaries and corridors of the Cardamoms. It includes the Phnom Aural Wildlife Sanctuary which is connected to the Central Cardamom Mountain which includes the Saom River system. This contains some of the best evergreen forests in Cambodia and significant large mammal populations, but is under rapid destruction on the eastern and southern boundaries due to illegal logging, land speculators, and charcoal production. The Saom river system supports the breeding area of two of Asia's rarest aquatic species, the Royal turtle (*Batagur baska*) and the Siamese crocodile (*Crocodylus siamensis*).⁸ A new species of wolf snake (*serpentes: colubridae: lycodon*) was found during the reptile survey conducted in 2002.⁹ A bird survey in the Mount Samkos Wildlife Sanctuary in 2000 recorded a total of 166 bird species, including two threatened species, the Chestnut-headed partridge (*Arborophila cambodiana*) and the Green peafowl (*Pavo cristatus*) and 15 species new to Cambodia.¹⁰ The project area is also within the Areng Catchment corridor of the Cardamom Mountains, which is a known habitat of the *Panthera tigris*, Asian elephant (*Elephas maximus*) and Siamese crocodile. The elephants in the area were known to move through a variety of habitats down to Botum Sakor, although no recent sightings have been reported.¹¹

The corridor includes hilly evergreen forest, unique upland and lowland freshwater swamp forest, with some semi-evergreen and dry forest. The corridor is part of the former Silver Road forest concession managed by the Forest Administration. It connects the Central and Southern Cardamom Protected Forests, under the jurisdiction of the Forest Administration and the Phnom Samkos Wildlife Sanctuary which is under the MOE's jurisdiction. The corridor also contains the indigenous minority communities of the Areng Valley. The coastal corridor from Dang Peng to the western side of the Thai border includes an extensive network of river estuaries, shallow coastal waters, and mangrove forests backed by lowland *Melaleuca* wetlands. After heavy exploitation in the 1990s from illegal logging by the communities and subsequent destruction of the surrounding habitat, the mangroves have recovered significantly but still need intensive collaborative management and rehabilitation to restore their productivity (ADB 2009).¹²

⁸ Wildlife Conservation Society (2007). Commune Natural Resources Management Profile-Dong Pean Commune. WCS, Phnom Penh

⁹ Daltrey and Wuster (2002)

¹⁰ Eames, Steinheimer, Bansok (2000)

¹¹ FFI (2000) Biological Survey of the Cardamom Mountains, Southwestern Cambodia

¹² BCI Pilot Site Implementation: Status Report, ADB TA 6289 (Phase I 2006 - 2009)

2. Wild Honey Harvesting Areas

The districts of Srae Ambel and Botum Sakor are considered the major wild honey harvesting areas, specifically in the three communes of Dang Peng, Srae Ambel, Andong Tuek with the villages of Prang and Chamkar Kroam, Dang Peng and Preah Ang Keo and Ta Meak as major honey producers. The villages are all located adjacent to the Saom River and in the flatlands of the river's mouth at Kampong Soam Bay. These areas are characterized by flatlands, wetlands and areas developed for agriculture mainly on alluvium silt deposited by the river. The upland areas are comprised of *Dipterocarp* and lowland evergreen trees connecting with the upper montane areas of the Cardamoms. The harvesting areas were plotted on a map during the household survey (Figure 3). The highest concentration of harvesting area was gathered to be Chamkar Kroam village where 37.5% of the households were said to harvest their honeybee products (Table 2). This was followed by Ta Meak (32.5%) then Prang and Chrouy Svay Lech (16.7%).

Figure 3 Harvesting Areas

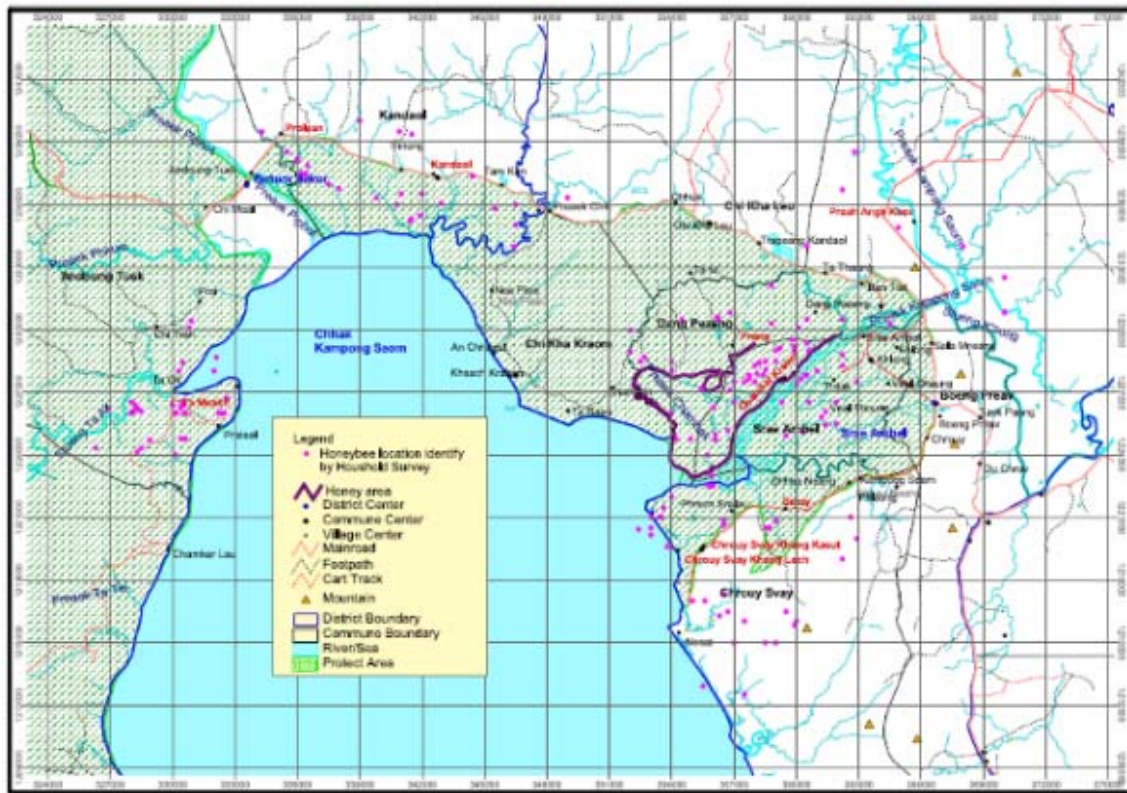


Table 2 Villages Where Harvesting Areas Are Located

	n	%
Chamkar Kroam	45	37.5
Ta Meak	39	32.5
Prang	20	16.7
Chrouy S.Lech	20	16.7
Chrouy S.Ket	14	11.7
Thnong	11	9.2

Prah Ang Keo	10	8.3
Prelean	10	8.3
Ta Kan	7	5.8
Kandoal	1	0.8
Total	120	100.0

The villages of Prang and Chamkar Kroam are located some 20 kilometers from the Srae Ambel district center and situated along the Saom River. This used to be part of the wetland *Melaleuca* and mangrove forest which have been stripped down during the logging done in the late 1980's. The forest areas have rapidly been converted into rice lands. The area can be reached through a dirt road from the ferry crossing near the port of Srea Ambel. However, the area is often inundated by the overflow of the Saom River, especially during tidal flows during the rainy season.

Preah Ang Keo village is situated on the eastern-side of the Prek Kampong Saom Valley, the Bak Angrot village in the north and the Krang Chek Mountain in the east. The vegetation is characterized by grasslands, and open deciduous forest habitats with denser ever-green vegetation found along the edges of large waterways. *Melaleuca* is prominent near the Prah Ang Keo and Prek Stung where saline conditions prevail. Ta Meak village in Andoung Teuk commune is located at the Eastern portion of Botum Sakor District which is about a 30 minute ride using a four wheeled vehicle to traverse the dirt road which leads to the village center.

Generally, the area is characterized by wetland *Melaleuca* stand and deciduous forest habitats with dense evergreen vegetation and flatland where farming takes place in paddy lands. A dominant tree species is the *smach deng* (*Melaleuca cajeputi*) considered as one of the important species from the standpoint of beekeeping because of its flowers' nectar that makes excellent honey. Its feral¹³ appears to attract bees to migrate from the escarpment to the flatlands. Another important geographic feature is the mangrove forest bounded by a network of river estuaries, shallow coastal waters backed by dominant lowland *Melaleuca* forest, shrub lands, vines, lianas and epiphytes.







¹³ Feral means natural habitat. Natural flowers of flowering trees are attractants to bees.

3. Bee Species and Rank by Volume of Honey Harvested

There are five known bee species found in Cambodia: the *Apis dorsata* or giant honeybee, the *Apis florea* or the dwarf Asian honeybee, the Asian hive-bee (*Apis cerana*), the stingless bees of the genus *Trigona* and the *Apis andreniformis* (Table 3). The European bee (*Apis mellifera*) is known to have been introduced in Southeast Asia, including Cambodia, but the species identification process conducted with the honey hunting households established that this species is not present in the study area.

Table 3 Bee Species Found in the Study Areas

Bee Species ¹⁴	Description	% Rank in Bee Population
 <p>Khmom thom (<i>Apis dorsata</i>)</p>	<ul style="list-style-type: none"> • Nests are mainly built in exposed places • Aggressive, extremely dangerous • Colony: single vertical comb from 1m- 1.5 m • Tropical and migrate seasonally • Can be induced to nest on rafters • Produce 3-5 kg or more of honey when colony matures; colony ave. 60,000 to 100,000 bees 	100.0
 <p>Khmom plat (<i>Apis florea</i>)</p>	<ul style="list-style-type: none"> • Small colony size, small bee • Exposed single combs are built on branches of shrubs & small trees • The first abdomen is always red in an old worker • Produce small amounts of honey, colony of around 18,000 -20,000 bees 	94.2
 <p>Pruit (<i>Apis cerana</i>)</p>	<ul style="list-style-type: none"> • Nests in tree holes, fallen logs, and crevices • Many sting with little honey • Can be domesticated 	62.5
 <p>Mroam (<i>Trigona</i>)</p>	<ul style="list-style-type: none"> • Sting-less bee • Small bee • Can be domesticated 	60.8

¹⁴ Khmer name in bold, Latin name in parenthesis



- Small colony size, small bee
- The first abdomen segment is totally black in old bees
- Produce small amounts of honey
- Sister species of *A. florea*

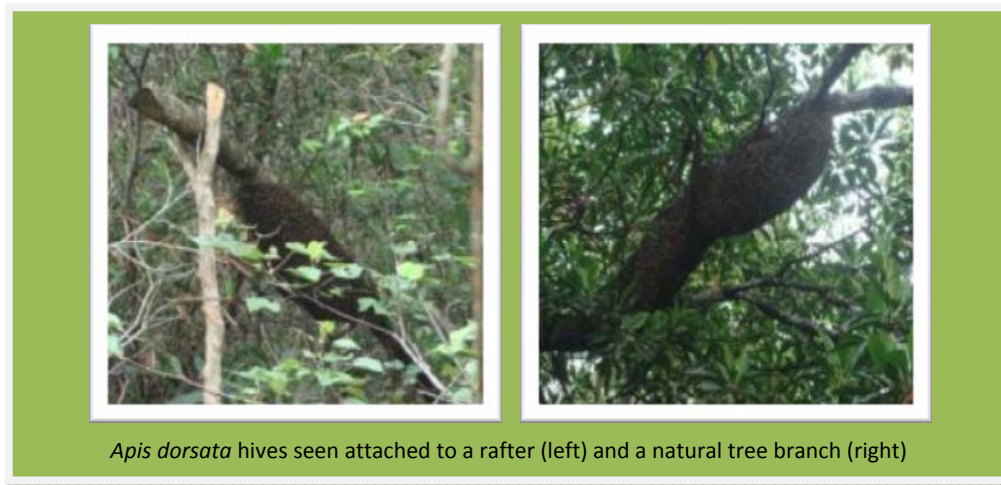
23.3

Khmom kampok (*Apis andreniformis*)

The *A. dorsata* is the most populous species of honeybee found in the study areas as identified by all respondents. This is followed by *A. florea* (94.2%). Both are the predominant bee species in the honey value chain. Respondents identified the presence of *A. cerana* (62.5%), *Trigona* (60.8%), and *A. andreniformis* (23.3%).

A ranking process in the volume of products from each species established that *A. dorsata* is the lead bee species in terms of honey products generated. This is followed by *A. florea*, *A. cerana*, *Trigona* and *A. andreniformis*. Honey hunters said that they harvest *A. florea* only for household consumption and they rarely harvest *Trigona* and *A. cerana* because production of honey is in small quantity.

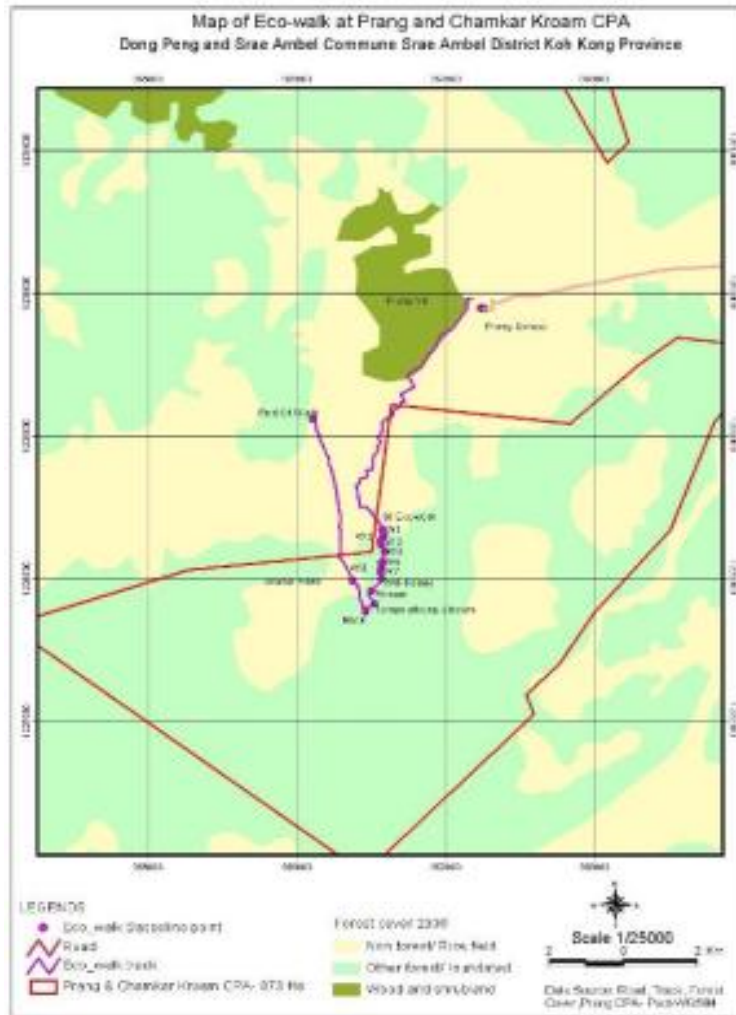
The transect walks through three honey harvest sites identified mainly the swarms of *A. dorsata* and *A. florea*, and five swarms/colonies were seen in total in the study site. The hives of the *A. florea* had already matured at the time of the walks, while that of the *A. dorsata* had not yet fully matured for harvest. One colony of *A. dorsata* was also seen at *Andurikum kudjapi*. A new swarm of *A. dorsata* clustered on the coconut tree at Ta Meak Village and one colony of *A. dorsata* was found nested in *Rhizophora mucronata* in the protected mangrove forest.



Apis dorsata hives seen attached to a rafter (left) and a natural tree branch (right)

4. Identified Conditions of Forest and Biodiversity Through the Transect Walk

Figure 4 Eco-walk Route in Prang Village



The transect walk in the flooded forest in Prang village (Figure 4) confirmed a natural stand dominated by *Melaleuca leucadendron* of the family *Myrtaceae* which is relatively stable in condition. The honey area/bee habitat contains different types of species based on stand composition in association with a number of forest tree species, vines, herbs and animal life found thriving in the undergrowth of the forest canopy. The stand has an estimated average height of 10 meters and with average diameter (diameter breast height) of 28 cm. Five other species of trees of the Family *Euphorbiaceae*, *Moraceae*, *Myrtaceae*, *Combretaceae* and *Dioscoreaceae* have been identified in close association with *Melaleuca* (Annex 1). One of these species, *chrei krem* was identified to be a good colonizer for honeybees and for use as a rafter. Two other tree species, with the exception of *smach*, *chechor* and *kranhob* are excellent forage for honeybees as well as for rafter construction.

On the forest floor thrives four types of shrubs belonging to the Family: *Compositae*, *Euphorbiaceae*, *Malvaceae* and *Melastomaceae*, four types of vines of the Family: *Leguminosae*, *Asclepiadiaceae*, *Convolvulaceae* and *Loganiaceae*, one of these species of the family *Leguminosae* was identified as bee

forage; two kinds of vines belonging to the family *Asclepiadiaceae* and *Vitaceae* for medicine; two kinds of plants, *dumloong chruk* and *trakiet* as source of food, and two kinds of epiphytes growing in association with *Melaleuca* forest. It was also observed that one species of tree, Khmer name *kranhob* and one species of shrub, Khmer name *boeh* were respectively colonized by *A. dorsata* and *A. florea*.

According to honey hunters, the *Melaleuca* forest was also the home of four species of birds, one which was identified through its call, and seven different kinds of crustaceans (crabs) and insects. They said there were four species of birds such as *chab prey* (wild sparrow), *chab srok* (plain-backed sparrow), *kok groung toch* (egrets) and *chab popech*; six different types of crustaceans, *kdarm* such as: *kdarm pakorlann*, *kdarm thmor*, *kdarm khmer*, *kdarm ses*, *kdarm sach*, *kdarm sor* are still present (See Annex 1 for the list of flora and fauna found in the study sites). The bee predators that were observed roaming the bee habitat were dragonflies and ants.

Sporadic cuttings of *Melaleuca* trees by the locals was noted, pole sized *Melaleuca* trees were utilized as fencing material in houses and in germinating beds of the rice fields. Interviews reveal that the expansion of rice paddy lands resulted to the decline of bee population of bees.

Figure 5 Eco-walk Route in Preah Ang Keo Village

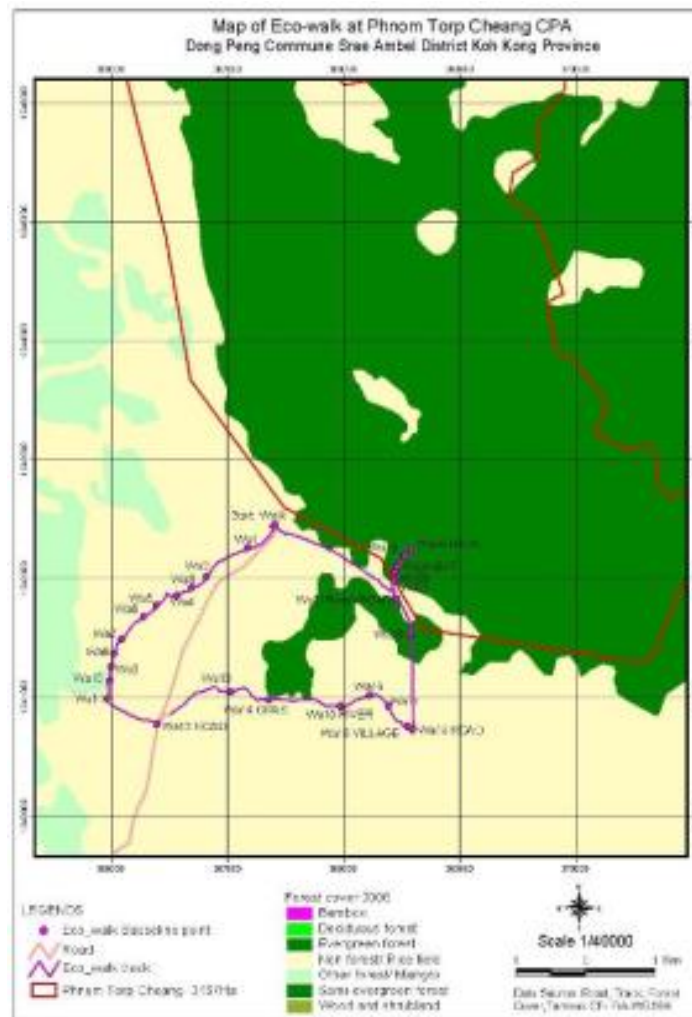


Figure 6 Eco-walk Route in Ta Meak Village



The hilly portion of the primary forest of Preah Ang Keo village (Figure 5) remain relatively, a closed canopy, estimated at 95 percent stand density¹⁵, with low fire risk and promoting natural regeneration. The stand composition at lower elevation (48 meters above sea level) is a combination of moist and mixed evergreen and deciduous forest.

The transect walk in this area observed species composition of some forty trees belonging to the family *Anacardiaceae*, *Anonaceae*, *Bombacaceae*, *Chrysobalanaceae*, *Dellineaceae*, *Dipterocarpaceae*, *Leguminosae*, *Moraceae*, *Myrtaceae*, *Nepenthaceae* and *Simaroubaceae*. Ten of these trees are colonized by bees or are used for forage and rafter construction. For instance, trees of *trach*, *thlok* and *trasek* are colonized by bees and used as rafters; *chrei krem*, *popel* and *chambak* colonized by bee and as bee forage. Trees such as *bay phouveang* and *pring khmun* were identified as forage for bee. Other upland trees identified have economic uses as materials for building, constructions, furniture, posts, medicines; raw materials for varnish, vegetables and food.

¹⁵ Stand density is the number of trees per unit area

Below the forest canopy, lies the vegetation dominated with eleven species of shrubs of the family *Apocynaceae*, *Euphorbiaceae*, *Loganiaceae*, *Melastomaceae*, *Myristicaceae*, *Myrtaceae*, *Rhamnaceae* and *Tiliaceae*; two species *sangkho* and *voer krape* are trees colonized by bees while *kramrek kum* and *dahs kun* are identified as bee forage. Also, one species of climbing liana *Voer paprehs* of the family *Smilacaceae* was identified as bee forage because it produces a lot of flowers.

The transect walk in the mangrove forest of Ta Meak (Figure 6) found seven families of true mangroves. Two of these tree species are colonized by bees. Four species as bee forage and rafter: *bien/ten*, *bon*, *thmenh trei*, *chhe chor* and *kranhob sa* were identified. Three species of vines have also been identified on the basis of their medicinal benefits and household uses. One species of squirrel and five species of monkeys, long-tailed macaque silver langur, pig-tailed macaque, stump-tailed macaque and douc langur were reportedly seen by honey hunters. Species of turtles, crabs, mollusks and five species of reptile/snake, indochine rat snake, and reticulated python, indochine spitting cobra, branded krait and malayan krait were reportedly sighted in the mangrove forests by honey hunters.

Overall, the degradation of the most important and dominant trees (tree stand is indicated by the decline in number of trees and the forest stand density of dominant and important species. The average height of the pure stand of *Melaleuca* forest (est. 10 m) and diameter breast height (28 cm) is well below the mature standards of some 40 cm dbh and 25 m height. This connotes that most are already re-growth stands from once higher and larger trees. The upland area of the primary forest's dominant species of *Dipterocarps* and *Leguminosae* are less than 60 cm dbh and sporadically distributed in the area. There are very few trees with thicker trunks and these are sporadically distributed. This meant that these trees are merely remnants of the sizeable forests in the area, which may have declined from logging since the 1970s to the mid-1990s. The standing trees observed are in the stage of recovery and these bee habitats are currently not yet stable. Other species of trees that are co-dominant and intermediate in stand structure are second growth forest.¹⁶ The mangrove's most dominant species are: *Rhizophora*, *Brugieria* and *Lumnitzera* and few species of ferns and nipa (*Nypa fructicans*) were present.

5. Health of Honeybee Biodiversity

The transect walks through three honey harvest sites identified mainly the swarms of *A. dorsata* and *Apis florea*. Some five colonies were seen in the study site. The hives of the *A. florea* had already matured at the time of the walk while those of the *A. dorsata* had not yet fully matured for harvest. One colony of *A. dorsata* was also seen at *Sandoricum koetjape*. A new swarm of *A. dorsata* clustered on a coconut tree at the Ta Meak village and one colony of *A. dorsata* was found nested in a *kaong kang* (*Rhizophora mucronata*) tree in the protected mangrove forest.

Actual observations of the honeybee species were limited because the movements of bee colonies were just starting at the time of the study. However, honey hunters reported installing an average of 15 rafters per households with an occupancy rate (hive:rafter) at 1:3; this gives us an estimated number of

¹⁶ Codominant trees are trees forming the general level of the crown cover and receiving full light from above but comparatively little from the sides, usually with medium sized crowns. Intermediate trees are trees that that make up a lower mid-storey canopy below the highest canopy of the forest.

1,200 colonies per season in the project areas.¹⁷ Since the bulk of harvesting is conducted by opportunistic hunters, the number of actual colonies, rafter and natural, maybe closer to 2,000 colonies per season. It would also be difficult to establish the number of bees per colony. *A. dorsata* averages some 40,000 to 60,000 bees in an average-sized (1 m) colony but can go as high as 100,000 bees; *A. floreae* with smaller hives average 18,000 to 20,000 bees per colony.

Observed in the transect walk in the villages of Prang and Preah Ang Keo was that rafters are installed close to each other with an estimated distance of 50 meters between rafters. This may result in a lower occupancy rate, since a wide foraging area is needed between colonies. *A. floreae* characteristically have independent hives and *A. dorsata* may tend to cluster several hives in one large colonized tree, but both species need a wide swath of foraging areas, especially *A. dorsata* which is known to have a foraging area of a 10 km radius.

Overall, the presence of some 2,000 colonies in the area is indicative of a healthy bee resource. The forest habitat capacity to maintain the forage necessary for the large number of colonies will be more of a problem, especially for the dwindling area of *Melaleuca* stand, which have been noted as preferred forage for both species, including *A. cerana* and *A. mellifera*.¹⁸ There is a need to sustain *Melaleuca* forests because the trees are a good food source due to its characteristic biannual flowering and its distinct effect on the honey quality which turns it an amber color with a unique smell.

6. Collection of Non-Timber Forest Products (NTFP)

Collection of non-timber forest products is one of the activities for rural inhabitants in the study area. The household survey affirms that all honey harvesting households gather forest products to supplement their income. The household survey and focus group discussions revealed that firewood, plants, animals, birds, mushroom and bees are the most common NTFPs collected.

Since all respondents were honey-related households, the exercise on ranking of the important forest products put honey products as top (100%). But NTFP collection is also primarily identified with firewood collection (82%) and herbs/vegetables (65%). Wild mushrooms (40.8%) were also mentioned together with animals, birds, and fruits. The frequency of NTFPs collection by the household from the forest is at least three times a week (45.8 %) (See Annex 2 for summary tables).

Ninety percent of honey households perceived that the decrease in the volume of NTFP collected is due to logging (82%) followed by conversions of land to plantations or agricultural crop land (51%). Other reasons mentioned were: increase in population, the uncontrolled use of forest resources and slash and burn farming. The focus group discussions affirmed villager's perceptions that the reduction and degradation of natural resources have significantly affected their daily subsistence.

The household survey indicated that most honey hunting households suggested degradation of the biodiversity in the area (81.7%). Almost all affirmed that the state of the forest is changing. Key informants confirmed that cutting of trees have resulted in the degradation of bee habitat. They think that forest degradation will have a negative impact on their livelihoods, notably the loss of food sources

¹⁷ The average rate of occupancy is 1:3 (33%), multiplied by the average number of rafter per household x the 241 households. This gives about 1,200 colonies per season in the project areas for *A. dorsata* and *A. florea*

¹⁸ Apicultural value of species of *Melaleuca* has been established in various studies especially in Vietnam, India and Malaysia

(88%), increased incidences of drought (87%), increased incidences of flooding (21%), and loss of soil fertility (11%) (See summary table in Annex 2).

7. Threats to the Forest Biodiversity

The threat to biodiversity was affirmed during the transect walk where an estimated 100 hectares of *Melaleuca* forest have already been cleared to give way for agriculture in Preah Ang Keo area. According to the honey hunters, the cutting of *Melaleuca* trees started in 2003 by people buying the land from villagers. It was observed that fences have already been installed in the cleared areas. A 40-year old participant in Ta Meak during the FGDs observed that the bee population was high in previous times, but decreased when people cleared land to sell and transformed this into agricultural lands. He estimated that some 400 hectares of forest lands were cleared in their area which diminished the bees' source of food.

The need for households to go into NTFP collection, including honeybee products, can be gleaned from the socio-economic information on the households. There is an expanding household population brought about by growth in family size and population movement. An average household has some 5-7 members. The average farm size is low at about one hectare per household and farm yields from low-sized farms leads to limited household income (US\$25-49 per month). This results to some 85% of households with rice shortages of around three months per year and some 60% of households tend to borrow money to overcome income and food deficits. Honey harvesting increases the household income by as much as US\$61 per season for households in the project area, which can help cover, to a large degree, the income deficits. Collection of NTFP would augment this income and the needed food requirements. It would be important that NTFP collection, especially honeybee products, be made sustainable so as not to reduce the resources and lead to the destruction of common property resources which bring about these benefits.

Another threat brought out is the possible adverse impact of the installation of the Kirirom III Hydrothermal Power Plant in Phnom Toub Cheang Community Forest, where 700 hectares of community forest is of imminent danger of being destroyed as the area lies within the concession of the hydrothermal power plant. Quarrying and blasting of the mountain side have already begun. An assessment made by CEPA in 2005 revealed that the dam will negatively impact the well-being of those people living nearby, including loss of natural resources, loss of animal habitat, loss of business, water pollution, loss of land for farming, plantation and houses. Some of the impact will be likely seen in the reduced area of the Community Forest as it will be used for the facilities connected to the plant (around 700 ha).

8. Institutional Arrangement Covering the Harvest Areas

A variety of local institutions exist in the area to control the management of resources, although a number of resource systems, mainly waterways, are still open access systems or common natural resource where few rules exist. But being in the known biodiversity corridor, there were efforts to designate the contiguous areas as part of the Community Protected Areas (CPA), Community Forestry (CF) or Community Fishery (CFi).

Resource management practices are encouraged among traditional communities, with elements for community voice in decision-making, community and government partnership, cognition of rights and rights to sustainable livelihood and well-being. These sites are planned for community-resource management either within the jurisdiction of the Ministry of Environment (MoE), the Ministry of Agriculture, Forestry and Fisheries (MAFF) under the local Forestry Administration or the Fishery Administration. Community forestry or fishery associations were established through efforts of these ministries and community development initiatives by non-government organizations, such as the American Friends Steering Committee (AFSC) which has been active in the area since the mid-1990s.

The most significant formal institutional arrangement to manage the Toub Cheang Community Forest was initiated in 2003 by local villagers with the support of the AFSC. The Community Protected Area covers 3,046 hectares previously under concession of the Samling International Co., which was suspended in 2002, and reverted back to the status of natural forest protected area. The institutional arrangement is provided for by the Forest Law (2002) which guaranteed traditional user's rights within the area. This law ensures the rights and privileges of the villagers living within or near the community to harvest the natural resources in a traditional manner.

A second initiative was the setting up of the Community Protected Area in the villages of Prang and Chamkar Kroam by the Ministry of Environment, which covers some 859 hectares. This was initiated by the two communities in 2007. Some 151 families are registered as members of CPA.

Ta Meak was included in the community fishery area of 13,384 hectares within MAFF's jurisdiction. This is in line with the development of community fishery groups within the multiple use zones identified as part of the Cardamoms Biodiversity Corridors Initiative. Within the 13,384 hectares, only 1,400 ha are utilized for honey harvesting: some 1,000 hectares of community fishery area and 400 hectare honey harvesting area of mixed *Melaleuca* forest.

The total area of the community protected areas and community forestry/fishery areas where honey harvesting is being done is around 5,302 hectares. The areas and the forestry/fishery tenure status are indicated in the table below, along with the membership in the Community Association.

Table 4 Forestry and Fishery Status and Membership in Community Associations

District	Commune	Village	Forestry/Fishery Tenure Status	Area (Hectares)	No. of HH members of the Association
Srae Ambel	Dang Peng	Preah Ang Keo	CF, MAFF, since 2003	3,046 has	90
	Srae Ambel	Prang and Chamkar Kroam	CPA, MoE	859 has (101.0 honey harvesting area; 758 CF)	Prang =55 Chamkar Kroam=50
Botum Sakor	Andong Tuek	Ta Meak	CFI, MAFF	1,400.0 (400.0 honey harvesting area)	125

B. Supply Chain

This portion of the report presents the findings from the household surveys backed by commune-level focus group discussions and interviews focused on the supply end of the wild honeybee value chain of activities. The data has been disaggregated according to identified project and Non-Project Areas.



1. Honey Harvesting Households

The 10 villages from the 5 communes have a total household population of 1,838 of whom 494 HHs (27%) are estimated to be involved in wild honeybee activities (Table 5). The differences across the villages range from 9% to about 60% involvement during the collection season (See Annex 2 for summary tables).

Table 5 Number of Households Involved In Honeybee Activities (Maximum)

Commune	Village	Est. maximum # of HHs involved in honeybee activities		Total # of HHs*	% of HHs involved in honeybee activities
		Project Area	Non-Project Areas		
Andong Tuek	Ta Meak	21	-	161	13.0
Dang Peng	Prang	70	-	144	48.6
	Preah Ang Keo	100	-	380	26.3
Srae Ambel	Chamkar Kroam	50	-	138	36.2
Kandoal	Prlean	-	30	336	8.9
	Thnong	-	60	102	58.8
	Ta Kan	-	23	157	14.6
	Kandoal	-	10	113	8.8
Chrouy Svay	Chrouy S.Lech	-	70	163	42.9
	Chrouy S.Ket	-	60	144	41.7
Total		241	253	1,838	26.9

*Commune Database 2008

Years of involvement of households in honeybee livelihood activities may be indicative of the mix of old and new settlements in the area. Some 64% of households cite involvement in honeybee-related livelihood activities for a period from 1 to 5 years, 42% in non-target areas. Some 21% of households in the target areas cite involvement from 6 to 10 years, 38% in non-target areas. There are households (15% in target areas and 21% of the non-target areas) who have been doing honey hunting from 6 to 10 years, who are long-time settlers in the area.

2. Household Members' Participation and Activities

The supply chain activities are limited to the hunting of the honey in the forest, along with rafter preparation; the processing of honey head harvested at the household level and the selling of cleaned or pressed product.

Across the study site, 98.3% are hunters, 10% process honeybee products, 5.8% collect honeybee products from other harvesters, while another 1.7% engage in honeybee products trading (Table 6).

Honey hunting is commonly done by the male head of household and the male household members. The majority (98%) of survey respondents said that this done by the father; while 13% mentioned that this is an activity done by male members of households above 18 years old. There are negligible numbers that said hunting is done by the female spouse or the female member of the household.



Community discussions validated male predominance in the honey hunting activity, women participants in Preah Ang Keo village attribute low female involvement because of difficulties involved in harvesting. Women's role in wild honey livelihoods is usually confined to simple processing like extracting the honey, separating the brood and wax if the whole hive is harvested. In Prang and Chamkar Kroam, women deliver the honey head harvested by their husband and children to the buying committee of their honey association. Women also cited involvement in buying from hunters and selling directly to the Srae Ambel market, as itinerant vendors or selling to traditional medicine outlets. There is limited processing of the wax into candles and this too is done by women.

Table 6 Household Members' Honeybee Livelihood Activities

	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
Household members involved in honeybee livelihood?						
Father	65	90.3	47	97.9	112	93.3
Mother	3	4.2	2	4.2	5	4.2
Male youths (18-24)	14	19.4	2	4.2	16	13.3
Female youths (18-24)	1	1.4	-	-	1	0.8
Boy (under 18 yrs)	5	6.9	-	-	5	4.2

Total	72	100.0	48	100.0	120	100.0
Activities involved in honeybee livelihood?						
Hunter	70	97.2	48	100.0	118	98.3
Processor	9	12.5	3	6.2	12	10.0
Collector	7	9.7	-	-	7	5.8
Trader	2	2.8	-	-	2	1.7
Total	72	100.0	48	100.0	120	100.0

3. Household Members' Time Involvement in Wild Honeybee Livelihood Activities

Honeybee livelihood activities are supplemental income earning activities by the majority of the households, as it is a seasonal activity. During its seasons, only some 16% of households have family members spending most of their time in this activity and only 15% engage in it on a full time basis on the activities from hunting to marketing of the product. All other household members cite part-time engagement (Table 7). This is indicative that honey related-activities are largely an opportunistic activity. It also indicates that there may not be a significant number of rafters set up and being monitored or harvested regularly.

Table 7 Household Members' Time Involvement in Honeybee Livelihood Activities

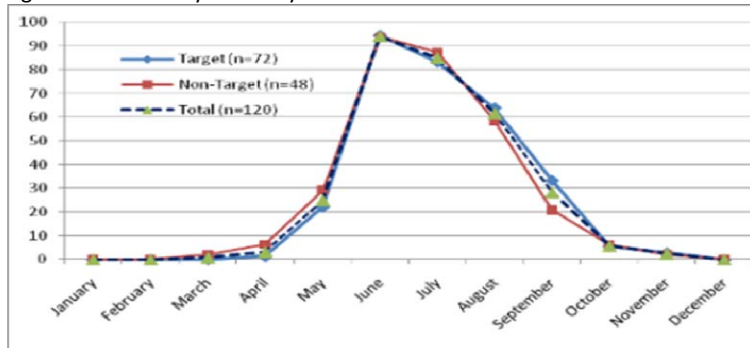
	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
Are there members of your household that spend most of his/her time engaged in honeybee livelihood activities?						
Yes	10	13.9	9	18.8	19	15.8
No	62	86.1	39	81.2	101	84.2
Total	72	100.0	48	100.0	120	100.0
Father						
Full time	9	13.8	8	17.0	17	15.2
Part-time	56	86.2	39	83.0	95	84.8
Total	65	100.0	47	100.0	112	100.0
Mother						
Part-time (total)	3	100.0	2	100.0	5	100.0
Male youth (18-24)						
Full time	2	14.3	1	50.0	3	18.8
Part-time	12	85.7	1	50.0	13	81.3
Total	14	100.0	2	100.0	16	100.0
Female youth (18-24)						
Part-time (total)	1	100.0	-	-	1	100.0
Male children (17 and below)						
Part-time (total)	5	100.0	-	-	5	100.0

4. Seasonality of Honey Harvesting

Honeybees are present in the area from the month of March to November. However, the peak season for harvesting occurs during the months of June/July until August (Figure 7). There are a small number of households (25-28%) which may engage in an early harvest in May or late harvest in September. This may be attributed to opportunistic hunting or the discrepancy in the seasonality of hive production by

specific bee species. The majority of household respondents (62% to 94%) conduct their harvesting activities during the peak seasons.

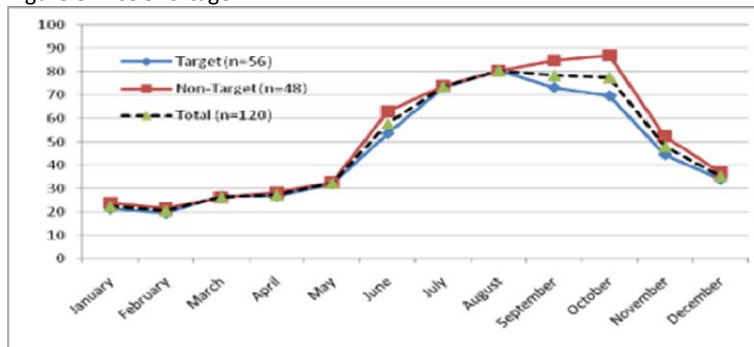
Figure 7 Seasonality of Honey Harvest



Information from professional honey hunters and FGD participants indicated that swarming starts during the flowering of the *Melaleuca* forest before the rainy season, usually within the month of June. Swarming is also triggered by the flowering of *kargneb*, *bro krab*, *bers*, *chhrey*, and resin trees, which are known as food forage and colonized by bees during swarming.

Swarming may be an indication of strong and crowded colonies of wild honeybees in the upper Cardamom forest-congested colonies that rear daughter queens, leading to the formation of new colonies. During the field study in Ta Meak Village, a new swarm of *A. dorsata* was seen nesting to a branch of *Sandoricum Koetjape* and another new swarm of *A. dorsata* clustering on a coconut tree. There is early appearance of swarms in the month of March which is the time for professional hunters to install their rafters. Honey hunters frequent the harvest area more than seven times per season, with higher frequencies (12 times per season) being mentioned in Prang Village.

Figure 8 Rice Shortage



Incidentally, the peak of honey harvesting also falls within the months of major rice shortages (Figure 8). Some 85% of the households experienced rice shortage from July to October. Therefore, income from honey harvesting serves to offset shortfalls.

5. Honeybee Products Harvested and Common Uses

Asked about what products they can process from honeybees, the majority of the households (97%) mentioned honey as the main product (Table 8), followed by the hive (89.2%), the honey head (85.8%), the brood (75.8) and the wax (70%). Overall, the households benefit from honeybee products are that of added income (81.7%), its medicinal value (79.2%) and as a food supplement (75%).

Table 8 Honeybee Products and Uses

	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
What are the products that you can process from honeybee?						
Honey	69	95.8	47	97.9	116	96.7
Honey hive	64	88.9	43	89.6	107	89.2
Honey head	64	88.9	39	81.3	103	85.8
Brood	57	79.2	34	70.8	91	75.8
Wax	53	73.6	31	64.6	84	70.0
Total	72	100.0	48	100.0	120	100.0
What are the uses of these products to you and your community?						
Source of income	59	81.9	39	81.3	98	81.7
Medical value	56	77.8	39	81.3	95	79.2
Food supplement	55	76.4	35	72.9	90	75.0
Wax for candle	1	1.4	-	-	1	0.8
Total	72	100.0	48	100.0	120	100.0

Participants in the focus group discussions shared that honey is used in the households as a direct food and as an ingredient in food preparation. Usually, it is used as a sugar supplement and added to beverages such as tea or coffee, or added to meat and fish dishes or used for the preparation of rice cakes. Men use honey as a mixer with the rice wine they drink. It is also used as a medicine and is said to invigorate the body when one feels weak. Women believe that honey makes them healthier and can cure sickness related to coughing and asthma. It is a traditional practice of the community to apply honey on abrasions, wounds and skin burns. According to those interviewed, healing is faster and infections can be avoided. Almost all households have at least half a liter to two liters of honey stored in their house at all times for such purposes.

Since they harvest the whole hive, the brood nest is divided and usually given for free to their neighbors. However, if there is a trader present, this product is also sold for additional income. Brood is eaten raw or cooked with vegetables. Wax is used for making candles, and to a certain extent some candle-making is done or is burnt in lieu of incense during prayer offerings. However, wax is often accumulated and sold to roving traders.



6. Volume of Honey Products Harvested

The volume of honeybee products harvested per household was estimated by the respondents. These estimates use the median to ease out the outlying figures. In the target areas, a median of 8 kg of hive was said to be harvested this season by each of the 51 respondents (Table 9). Honey head had a median of 7 kg, 5 liters of honey was extracted, 8 kg of brood was sold or consumed, and 1 kg of wax was saved or sold. The non-target areas gathered the same products but their volume was only half of what the target areas harvested.

For overall respondents, both target and non-target villages, harvest of hive has a median of 6 kg, honey head is at median 5 kg, honey is at 4 liters, brood at 5 kg and wax at 1 kg.

Table 9 Volume of Honey Product Collected This Year

	Project Area	Non-Project Areas	Total
Honey head (kg)			
n	62	27	89
Median	7	3	5
Honey (Liters)			
n	67	44	111
Median	5	3	4
Wax (kg)			
n	42	9	51
Median	1	0.5	1

The volume of honey products harvested varies across the villages. The largest volume of harvest is in the villages of Preah Ang Keo, Prang and Chamkar Kroam, which currently has clearly defined market links and hunters are utilizing rafter technology. The maximum harvest of honey by top honey hunters was estimated at 27 liters for the four month period from June-September.

7. Sale of Honey Products and Prices per Product

Honeybee products are usually sold to traders (64%) for the non-target areas. But for the target areas, there are honeybee committees in the villages (54.2%) where harvesters go and sell their products. Collectors (20.8%) also play a role by providing the harvesters easier access to market their products.

Selling products inside the community and to wholesalers were responses from 5.8% of the sample households while 4.2% stated they do not have a market for their products (Table 10).

Table 10 Market Outlets

	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
Where do you sell your honeybee products?						
Trader	35	48.6	31	64.6	66	55.0
Village	39	54.2	23	47.9	62	51.7
Collector	13	18.1	12	25.0	25	20.8
Wholesaler	5	6.9	2	4.2	7	5.8
Community	7	9.7	-	-	7	5.8
None	3	4.2	2	4.2	5	4.2
Total	72	100.0	48	100.0	120	100.0

The prices of honeybee products differ from place to place. Median current prices of honeybee products are shown in Table 11. The honey head which is sold in kilograms has a median price of US\$4, which is customarily bought by the HA for the same amount. A liter of honey has a median price of US\$5 and is sold to local consumers and markets for a range of US\$3 to US\$5. In 2007 to 2008, CBCL bought honey from the areas for an average of US\$7.50 per liter. The brood has a median price of US\$1.30 which is not usually sold to traders. The wax, which is the most expensive, has a median of US\$5 based on the responses from the household survey. However, prices of wax in the local market was said to be US\$6 to US\$7.50 per kilogram.

Table 11 Median Current Prices of Honeybee Products (Market Data)

Product	Median Current Prices Honeybee Products (US\$)			Selling Price to Traders (US\$)		
	Project Area	Non-Project Areas	Total	Local Consumer/Trader/Srae Amble Market	CBCL (2007-2008 only)	Honey Association (2009)
Honey head (kg)	4.20	4.00	4.00	-	-	4.00
Honey (l)	5.00	5.00	5.00	3.00-5.00	7.00-8.00	-
Wax (kg)	5.00	5.50	5.00	6.00-7.50	-	-

8. Household Income from Honeybee Products

Comparing the income earned by the households from honeybee livelihood activities from the previous year against the present season, the data shows that the households fared better from the previous year. The median for the previous season was US\$37.50 while the present only has US\$15.00 (Table 12). However, based on the seasonality of the harvesting activities, this year's season has not yet ended when the study was conducted.

Table 12 Earnings Comparison from Honeybee Livelihood Activities

	Project Area	Non-Project Areas	Total
Earnings from honeybee livelihood activities from the previous season/year (US\$)			

n	69	46	115
Mean	59.2	48.2	54.8
Median	37.5	34	37.5
Minimum	5	4	4
Maximum	375	218	375
Earnings from honeybee livelihood activities from this season/year (US\$)			
n	69	46	115
Mean	33.9	16.9	27.1
Median	20	11.5	15

The FGD participants described that the HA earned a total of US\$7,000 in 2007, and each HH earned from US\$100-150 for the season. But in 2008, the organization earned US\$720 because they didn't have a clear market for their products. Earnings from the current season (2009) are not yet accounted for, but they do have a demand for 300 liters of honey. Earnings from previous honeybee-related products accounted for some 15% of income during this period. This additional income was spent primarily on food, clothes, health, and education.

9. Standard Honey Harvesting Practices and Ownership

The majority of households interviewed (71%) predominantly harvest wild honey by chance, i.e., that if one sees a colony he will harvest the honey by himself or call other harvesters to acquire it (Table 13). In this practice, the honey hunter does not care so much whether the hive is ripe or not. Some 51% of respondents said they also mark the tree and wait for the hive to mature. This presupposes recognition by other harvesters of *a priori* rights. Only a small number (24%) practice the use of rafters to attract bees to set up hives and eventually wait until it matures and can be harvested. The last two ways can also be interpreted as professional ways of harvesting.

Respondents mentioned four standard methods of harvesting honeybees in the wild. The majority (99.2%) of respondents stated that they harvest honeybee hives using smoke. A minority (6.8%) harvest honey by burning the bees to destroy the colony while a smaller number remove the whole nest then collect the honey (2.5%). These methods of harvesting may apply for the *A. dorsata* species, but in practice, for *A. florea*, it was observed that hunters shake off the whole hive and harvest it.

As indicated in the responses, a sustainable way of harvesting in the study area is initially being practiced. This can be attributed to the sustainable harvesting inputs and capability training by the NGOs operating in the area. However, considering that most are opportunistic hunters, it should be ingrained that they should consider appropriate, sustainable harvesting practices like; waiting for hives to mature, keeping the hive intact, harvesting only the honey head and ensuring the health of queen bees for re-propagation.

On the issue of ownership, some 58.5 % of respondents say that open access or "finders-keepers" is still the most accepted way of harvesting honey. However, in the target sites, about 56.8% of the respondents stated that they employ a marking rights system to ensure that other hunters will not harvest their colony. Professional honey hunters and members of the HA are more inclined to respect ownership markings as they know each other. There are also organizational practices amongst members to ensure they respect the markings of other members. But there were also incidences of stealing

marked colonies or hives by hunters from other villages that cause pressures for the professional hunters to harvest their hives earlier.

Table 13 Harvesting Practices

	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
Honeybee harvesting practices						
Opportunistic/chance harvesting	50	71.4	34	70.8	84	71.2
Mark the tree and harvest when the hive matures	38	54.3	22	45.8	60	50.8
Rafter beekeeping	23	32.9	5	10.4	28	23.7
Total	70	100.0	48	100.0	118	100.0
Actual methods of harvesting honeybees in the wild						
Use smoke	69	98.6	48	100.0	117	99.2
Use fire to kill the bees	6	8.6	2	4.2	8	6.8
Remove the nest when collecting honey	3	4.3	-	-	3	2.5
Remove only the honey head	2	2.9	-	-	2	1.7
Total	70	100.0	48	100.0	118	100.0
Most accepted practice of ownership of wild honeybee colonies						
Open access	39	55.7	30	62.5	69	58.5
Marking rights	47	67.1	20	41.7	67	56.8
Group/ informal ownership	4	5.7	-	-	4	3.4
Community/Formal control	2	2.9	1	2.1	3	2.5
Total	70	100.0	48	100.0	118	100.0

10. Group System of Harvesting (Honey Association)

Commonly, honey harvesting involves one to three persons. Some 67 % of respondents cited that they usually hunt with partners (Table 14). Their roles are defined, either as hunter or spotter (96.6%) or as support as climber, smoker or porter, depending on their arrangement.

For households from Prang and Chamkar Kroam, who have a Honey Association (HA), their way of harvesting practices are more defined. They have formulated policies or practices to deter accidents. The association prohibited members from harvesting alone, to ensure someone will be able to assist in the case of an accident. They have divided the members into clusters of about 20 persons in one cluster. Clustering is based on the proximity of their rafters and marked trees, neighborhood and kinships. During harvest, three to four people go together and assist each other in their roles as spotter, climber, smoker, and gatherer/porter. The hunters collect from their own rafters, meet other cluster members to check other members, then proceed to harvest other marked trees where the harvest is divided amongst them. They use indigenous materials: create smoke from wet and dried leaves and use flattened wood or bamboo to harvest the honey. They pack the freshly harvested honey in plastic bags, which are issued by the Honey Association, and put these in baskets of sacks.

Table 14 Number and Roles of Persons Involved in Harvesting

	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
How many persons are involved in harvesting of wild honey?						
Two persons	30	42.9	25	52.1	55	46.6
Three persons	17	24.3	8	16.7	25	21.2
One person	13	18.6	9	18.8	22	18.6
Five persons	7	10.0	3	6.3	10	8.5
Four persons	3	4.3	3	6.3	6	5.1
Total	70	100.0	48	100.0	118	100.0
Role of persons involved in harvesting						
Hunter/ Spotter	66	94.3	48	100.0	114	96.6
Climber	64	91.4	47	97.9	111	94.1
Smoker	58	82.9	40	83.3	98	83.1
Porter	49	70.0	42	87.5	91	77.1
Total	70	100.0	48	100.0	118	100.0

11. Rafter Beekeeping/Rate of Occupancy

Rafter beekeeping is a method of installing two pole rafters on the ground and the rafter is often rubbed with bees wax to encourage new bee colonies to set up a hive. This method was introduced in the target areas in 2007 by CFI and being encourage by Pact among honey hunters up to the time of this report.

As mentioned earlier, only some 34% of the households involved in honey livelihood practice rafter methods. Among those who install rafter, some 76.7% use the two pole rafter; the rest use two pieces of wood that resembles the small letter "r" or a natural tree branch covered with bee wax (Table 15). The median in terms of rafters installed is at 15 rafters in the target areas (minimum of 3 and maximum of 60 rafters). A median of 5 rafters are colonized per season, with a maximum of 40 rafters. The occupancy rate can be seen at around 1:3 rafters or about 33% (using the median of 5 rafters occupied against 15 installed), to a high of 2:3 rafters occupied. Interviews with honey hunters suggested that around a 50% of their rafters are occupied within the season. The predominant species that occupy the rafters are the *A. dorsata* (98%) and the *A. florea* (22%).

Table 15 Types, Number of Rafters, and Rate of Occupancy

	Project Area		Non-Project Areas		Total	
	n	%	n	%	n	%
What kind / types of rafter do you install?						
Two pole rafter	25	78.1	8	72.7	33	76.7
Two pieces of wood that resembles the letter "r"	8	25.0	2	18.2	10	23.3
Natural tree branch wiped with bees wax	2	6.3	1	9.1	3	7.0
Total	32	100.0	11	100.0	43	100.0
How many rafters have you installed/ owned at present?						
n	32		7		39	

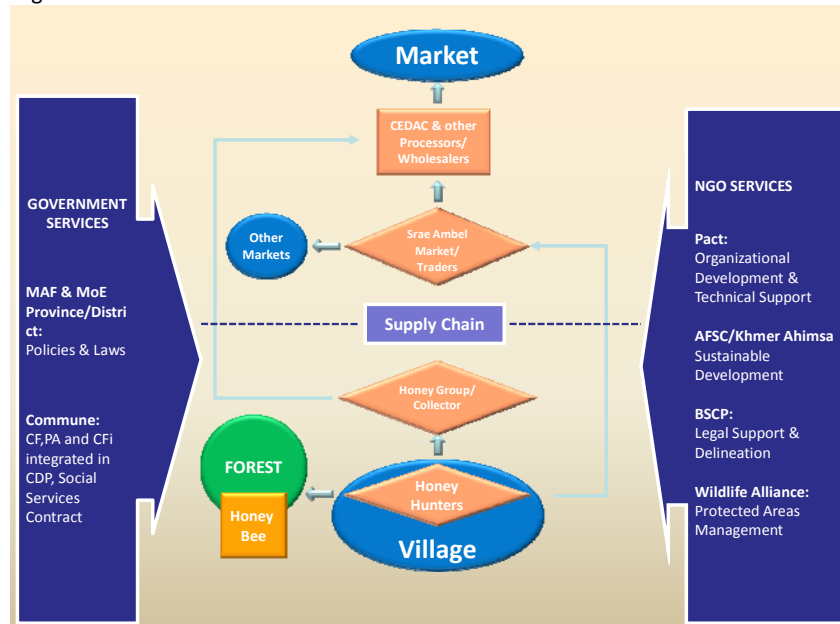
Median	15	10	13
How many of your rafters are occupied in one season?			
n	30	7	37
Median	5	3	5

Almost all the household honey hunters in the target villages of Prang, Chamkar Kroam, Toub Cheang and Ta Meak Villages are practicing rafter beekeeping. The honey association cited around 300 people whom they've trained in rafter beekeeping. Among those who use rafter beekeeping, the common practice of harvesting the honey is waiting for the hive to mature. They use smoke to calm the bees then cut off the honey head and bring them to the honey association to sell.

12. The Honey Supply Chain: Market Linkage

A summary flow chart of the honey value chain suggests that there are government and non-government interventions in the areas of the baseline study (Figure 9). Honeybee products are both consumed by the household and sold. Data from the household survey indicated sale to consumers among villagers and to traders alike. In the case of two project areas (Prang and Chamkar Kroam), members of the honey association sell their harvested honey heads to the association while non-members sell to other traders and markets. The honey association extracts the honey and sells them in large amounts to CEDAC.

Figure 9 Value Chain Flowchart



a. Local Honeybee Products' Market in Srae Ambel

Village or Community Sales: Honey hunters without defined market linkages sell their honey harvest in their village or community stores (Figure 9). The local demand is very low, since it is known that households tend to keep at least 1/2 to 2 liters of honey. There may be elements of free-sharing at this level, since most of the households gather non-timber forest products and may also be opportunistic

honey harvesters. This makes it difficult to estimate the village-level demand. Participants in the FGD in Preah Ang Keo said they sell one kilogram of honey head (equivalent to 0.5-0.75 liters) amounting to 3,000 Riels (US\$0.75) to local consumers in the village.

Direct Sell at Srae Ambel. The second option would be to sell the honeybee product at the Srae Ambel market directly to local consumers, with a price averaging from US\$4 to US\$5 per liter of honey. Chamkar Kroam hunters said that they can only sell 1 liter of honey at US\$3 per liter in the Srae Ambel market. They also can sell 1 kg of wax around US\$7.50 to traders.

Traditional medicine sellers in Srae Ambel market are regular buyers from direct sellers. Interviews with two of the medicine sellers said there are three buyers. Their demand varies but averaged some 100 liters of honey each or 300 liters.¹⁹ The buying price is about 15,000-20,000 Riels per liter (US\$3.50-US\$5). Their selling price is from 30,000-40,000 Riels (US\$7.50-US\$10). They also have an outlet of a honey-wine produce located in Phnom Penh.

b. Local Traders

In the village of Prolean, there are two traders who are regular buyers of honeybee extract or honey head. One buys and sells honey at her stall in the Srae Ambel market. The other buys honey and brings it to sell in Phnom Penh. Both traders combine for some 200-400 liters of honey. This is bought from hunters in Prolean village at the price of 13,000 Riels to 14,000 Riels (US\$3.25-US\$3.50) per liter. The selling price in Srae Ambel market is at 15,000 to 20,000 Riels (US\$3.75 -US\$5). There was no price quoted for the Phnom Penh market.²⁰

The study tracked down the trader from the Honeybee Yin Sin wine with the “rabbit brand”. He confirmed buying honey from Srae Ambel. The business is an informal family-based enterprise based in Phnom Penh. He purchased some 200 to 400 liters of honey per season (average 300 liters). The buying Price per liter is from 15,000 to 20,000 Riel (US\$3.75 to US\$5). The honey is mixed with local wine to produce some 1,000 bottles. This is priced at US\$3 per bottle and sold in informal outlets of mainly traditional medicine sellers in Srae Ambel Market and Phnom Penh.²¹

The combined volume of the three traders above is 900 liters of honey, at US\$3.80 buying price or a total value of US\$3,487.

c. The Community Association

The Prang and Chamkar Kroam honey association also serves as trader/collector of honey. The honey association has some 65 member households involved in honey harvesting. Members are obliged to sell their honey head to the honey association. The committee was organized by Pact (formerly known as CFI) in 2007 and is composed of eight members with the responsibility of collecting the honey head from members of the association only.

¹⁹ Interview with Keo Pao and Dara in Sre Ambel market. One bought 30 liters honey last year, while the other bought 300 liters but still with stock. The selling capacity is estimated at 100 liters each the whole year.

²⁰ Interviews with traders: Horn Ly, from Prolean and Yeay Horn from Andong Tuek.

²¹ Phone interview with Reak Smey, a local buyer for a family owned enterprise.

Last year (2008), Pact linked the honey association to CEDAC. It also lent US\$300 to the honey association to buy honey from its members in 2008, which they already paid at present. For the year 2009, another \$700 was provided as loan. Further, Pact supports the capacity-building of the honey association on financial management and quality control of the honey purchased. It also provides for technology transfer by providing exposure trips to the committee to other areas with the similar wild honeybee livelihood activities to learn more of the trade.

Table 16 Production and Sale of Local Products

Prang and Chamkar Kroam Honey Association	
Assets/Indirect material:	
	Storage room cost US\$250 built inside the community center
	(4 units) 30 liter gallons @ US\$3/gallon = US\$12
	(3 units) honey filters (big) @ US\$50/container = US\$150
	(1 unit) Refractometer = US\$100
	(1 unit) Weighing scale = US\$7.5
	(1 bag@100pcs)Plastic bag = US\$.5
Production/Marketing Cost	
	Transportation cost to market (according to committee)
	Prang to CEDAC: US\$7.5 per 1 gallon @ 30 liter X 4 gal. = 120,000 R or US\$30
	Prang to CEDAC for 300 liters @ 0.15/liter is US\$45
	Labor processing cost for 300 liters of honey = US\$300 (US\$1/liter)
Production/Sale	
	Projected Average Volume/Sales per month
	Volume : 100 liter per month
	Sale : 300 liters
	Buying Price from member: US\$4.00:1 kg
	Selling Price : 1 liter is US\$9.13 (CEDAC)
	Source of honey: 2 villages with 65 HH members

The honey association maintains one storage/drying room facility with an area of 3 X 2 meters inside the community center located at the school compound of the village. This serves as the collection area for honey bought from the hunters. This is usually delivered by household members in the plastic bags given to them by the honey association. There, the honey is weighed, paid for, and placed in two gravity drip containers which serve as filters. Honey is then poured into the plastic gallon containers. Quality control is practiced by the measuring of the honey using a refractometer, which was previously provided by Pact. The agreement with CEDAC provided for the honey to be properly kept in clean containers, with the name of the collector, the date of harvest and the total volume.

The honey is bought from members at a cost US\$4 per kg. Pact's basis for product price is that one liter of honey is equal to 1.36 kg of honey comb. The amount of honey supply and its delivery to CEDAC is covered by an agreement. Pact has ordered 300 liters of honey for this season with a guaranteed price of US\$9.13 per liter. Last year, they delivered 44.63 kg to CEDAC.

d. Processor/Wholesaler

The honey enterprise of the Cambodian Centre for Study and Development in Agriculture (CEDAC) is with its Natural Agri-Product (NAP) business sub-group under the CEDAC Support to Development Enterprise.²² This includes their business enterprise for organic rice and vegetables which has an outlet in four CEDAC Shops, three in Phnom Penh and one in Sihanoukville. The enterprise is already linked with 17 marketing outlets (including Lucky, Bayon, and Pencil supermarkets). The honey products are also distributed through seven rice dealer outlets along with other CEDAC products on a 45-day consignment. The consignment is for an order for a one month stock, at the end of which the stock is replenished and unsold products are taken out.

CEDAC has two major sources of honey. In 2008, they bought 44.63 liters from the honey association in Prang Village. In 2009 they agreed upon a contract with the honey association to buy 300 liters. CEDAC is also purchasing honey from a community association in Mondulkiri, with some 1,000 liters bought last year and plans to buy 1,600 liters this year.

Generally, the processing done at the CEDAC site is the same filtration and drip process done at the Prang facility. The honey from the plastic containers goes through a gravity drip and is tested for moisture content using a refractometer. The honey is then slowly dripped into 425 ml glass jar containers or to half-liter or one liter plastic bottles. It is cellophane-sealed and a label is added identifying the origin, date harvested and volume. This is then packed into a 40-bottle carton box and delivered to the various outlets. For honey still to be bottled, the honey is put under refrigeration to avoid fermentation.

The CEDAC market for honey seems able to absorb the current supply of around 2,000 liters. The bottled honey sold reached 350 liters last year (2008). The current potential is to increase sales by 50% and the enterprise has plans to increase the supply stock by as much as 15,000 liters over the next five years.

The problems encountered in marketing are related more to the quality of the honey than the supply. There is high moisture content of the honey coming from Koh Kong.²³ This is also visible in terms of the color, with honey from Koh Kong being more translucent and yellow than that from Mondulkiri. The texture of the honey also indicated a caramelized surface film for the Mondulkiri product and a looser surface liquid for the Koh Kong product. The high moisture content poses a problem, as water tends to induce fermentation which builds up surface pressure within the sealed container, causing the bottle or jar lid to pop out. Honey that runs off the lid wets the paper labels and mars the product image lessening the marketability of the product. The consideration of moisture content makes Koh Kong honey unfavorable for CEDAC. The taste of the honey may also be a factor, as the Mondulkiri stock is sweeter while that of Koh Kong is sour-sweet.

Table 17 CEDAC-NAP Processing of Honey Stock

CEDAC-NAP Processing of Honey Stock	
Step 1	Inspection: quality and moisture content using a refractometer on the delivered honey, kept in

²² Interview with Chhay Song Leang, CEDAC-Natural Agri-Product, Honey Product Supervisor

²³ The refractometer reading was done on the Koh Kong and Mondulkiri honey stock. The honey from the Community Association in Koh Kong was water-saturated and it was difficult to get a reading. The Mondulkiri stock has a 23% reading for moisture content. The refractometer readings in the Prang stock facility, which was made previously, indicates a high moisture (27%).

	refrigeration while being stocked.
Step 2	Filtration & Drying : 24 hours through the drip containers
Step 3	2nd Testing : After 24 hrs drying, a second test of moisture content will be conducted
Step 4	Bottling : Slow-drip honey into containers; cover, cellophane seal, pack
	Bottle (Thailand): 1 box (40 bottles/500ml) cost US\$18 @ 2,000 R/bottle.
	Bottle (local) 600 R per bottle (as needed)
	Packing : 40-bottles per box
Step 5	Delivery to Market -consignment basis for 45 days
	<u>Sales</u> :
	425 ml bottle : 29,000R/\$7.25 (label- Mondulkiri Wild Honey; gross sales 2008=350 liters)
	1 liter bottle : \$14.77

Note: CEDAC bought from Koh Kong 44.63 liters at US\$9.13 / liter in 2008; current order is 300 liters



13. Partners That Can Be Tapped and Their Programs

Several organizations and sectors are involved with community forestry and community fishery groups at the local level, including the Forestry Administration, non-governmental organizations and Community Forest Management Committees. According to the household survey, community-based organizations (CBO) are organized in the area and 90% of the villagers are members. The commune council and village officials account for 69.4% of the membership, youth (17.6%) and government officials (15.7%). Police, women, teachers and monks were also said to be members of CBOs.

Also, government agencies, local and INGOs are supporting different programs/activities in the area related to CF and CFi establishment and management, training, and livelihood development. Data generated from key informants revealed some interesting accounts of involvement with the community as discussed below:

a. American Friends Service Committee/Khmer Ahimsa

Khmer Ahimsa is a non-government organization which localized from earlier efforts of the AFSC to put in place peaceful conflict resolution among communities which are related mainly to the access and use of common property resources. Khmer Ahimsa supports a rights-based approach on natural resource management, including an incipient program on sustainable non-timber forest products livelihoods. The organization also supports the current protected area management efforts being implemented through the Wildlife Alliance.

Since 1998, American Friends Service Committee (AFSC) has been promoting sustainable development and community-based natural resource management in the Srae Ambel district, Koh Kong province, an area rich in fishery and forestry resources. The program aims to help villagers improve food security, boost family income, and manage the use and preservation of natural resources that are critical to local livelihoods. Communities set up their own CBO which cooperates with the AFSC team to promote sustainable practices in resource management, including prohibition of illegal logging and fishing. The CBO agreed on community policies for resource use; the use of patrols through the CPA areas to deter illegal logging, deter the construction of illegal houses and working huts, remove fences, seize illegal sawing equipment, dismantle saw mills and charcoal kilns, check boats and land vehicles suspected of transporting wildlife, timber and NTFPs. They also conduct forest fire prevention, and check existing food stalls and markets along Road 48. Most of these activities are done with the cooperation of the Forest Administration and local authorities.

b. Botum Sakor Conservation Project

The Botum Sakor Conservation Project (BSCP) is working in the three districts of Srae Ambel, Botum Sakor and Krosum. Most of their activities are centered in coordinating the activities of organized community forestry and community fishery organizations in three districts and provide assistance in checking and facilitating documents for legal recognition for submission to FA and MAFF. AFSC is a member of the BSCP and currently its funds are provided by the Quaker American Association focused on the provision of training to the management committees of community forestry and community fishery associations. With Pact, the BSCP project is also helping out in the preparation of documents that will ensure official registration of the associations and their community forestry/fishery claims such as: Community Forestry by-laws, rules and regulations, boundary demarcation, CF/CFi agreements and management plans. This is also being coordinated with the Wildlife Alliance.²⁴

c. Pact Community Forestry Partnership (CFP) Program

Pact is implementing the USAID-funded initiative in line with the biodiversity objectives set forth by the US Congress. Its engagement on honey enterprise development with the communities in the Srae Ambel district started in the two villages of Preah Ang Keo in 2006 and Prang in 2008. The marketing of honey started in Prang Village in 2007-2008. Pact works with local NGOs based in the area, particularly with the AFSC and its affiliate Khmer Ahimsa and with Community Forestry International (CFI). Pact has earlier provided technical assistance on rafter preparation in Prang and Preah Ang Keo.

²⁴ Interview with Mr. Tun Gyel, District Director, Ministry of Environment, Botum Sakor

The organization worked with AFSC and Khmer Ahimsa in the development of the Community Protected Area (CPA) by-laws and governing rules and regulation. Their support resulted in the CPA mapping conducted by the community and which was recognized by the Ministry of Environment in 2008. This regulated the CPA area of 859 hectares (Community Protected Area of Dang Peng). Some 859 hectares is used as honeybee harvest area consisting of 101 hectares in Prang; the remaining 758 hectares exist as a CF area in Chamkar Kroam. The honeybee area in Prang and Preah Ang Keo is under social concession under the control of the commune council.

Pact formed the Prang Honey Association in 2008. Of the total 153 families, forty four (44) families were registered as members of the honey group. After the formation, Pact facilitated the training of twenty seven (27) participants in Prang on sustainable harvesting of honey, sustainable collection technique and data collection. Pact facilitated the election of the honey association committee, composed of five people, and jump-started its monitoring activities on honey production during the harvest seasons from 2008 to the present.

For 2009, Pact plans to organize four villages in Kandaol Commune in Botum Sakor District as community forestry areas in close collaboration with the local government and Forestry Administration. Pact has already provided training to community enterprise development on honey and resin in Prang Village. By year's-end Pact will have conducted the same training with 200 participants consisting of 10 sites in the provinces of Kompong Thom and Koh Kong. These trainings will be conducted with the continued support from the Cambodia MSME project.²⁵

d. Wildlife Alliance

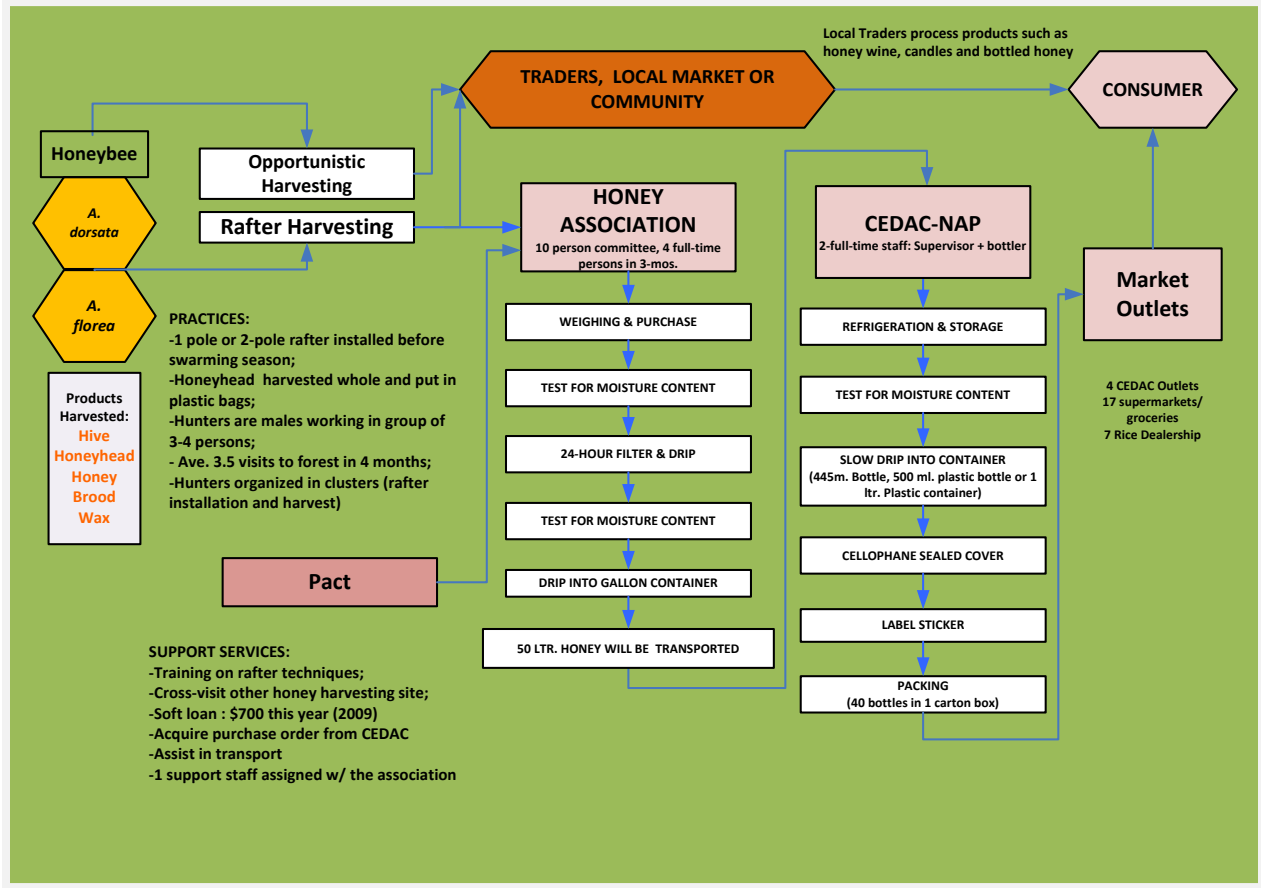
The Wildlife Alliance has an ongoing program in the Koh Kong Province is working on community-based ecotourism and wildlife conservation in Chi Pat. In the past, the Wildlife Alliance has worked on community agriculture, the promotion of sustainable development in rural areas and forest patrol and demarcation of CPA areas in Chi Phat the Wildlife Alliance has also conducted trainings to park rangers in fighting crimes against nature, management of protected areas, provides funds on sustainable development and supported the Government in managing the Wildlife Rescue Center in Chi Phat.

²⁵ Interviews with Ms. Amanda Bradley, Program Director and Ms. Srey Neang Meas, Senior Forest Livelihood Officer of Pact Cambodia

IV. SUMMARY ANALYSIS AND RECOMMENDATIONS

A. Summary of the Value Chain Process

Figure 10 Honeybee Value Chain Diagram



The above honey value chain flowchart shows the honey harvesting economy of Prang, which is characterized as mainly opportunistic hunting undertaken seasonally by households with irregular and disparate volume of harvests. There are two main bee species being harvested, notably the *A. dorsata* and the *A. florea*; but other honeybee species like the *A. andreniformis*, *Trigona* and *A. cerana* exist in the area. The harvest areas are adjacent community forests/protected area which are characterized by degradation brought about by earlier deforestation and encroachment for farmlands. Over harvesting of non-timber forest products by the growing population and by commercial interests also contribute to forest degradation.

The use of rafter technology was adopted in the project area after the training provided by Pact, and currently about a third of households has adopted its use. The main type of rafter is single-pole and two-pole rafters. Those who adopted the technique have organized themselves into a honey association, also with the support of Pact. They have improved on harvesting practices to include the forming of clusters with designated rafter-installation areas, harvesting in groups, using plastic bag containers for

honey head harvested and consolidating the volume harvested by their association to be sold in bulk. Hygienic considerations have been adopted including the filtration of the raw product and containment.

Overall, the raw product has relatively little value-added and is sold directly by hunter households to other households in the community, to the Srae Ambel market or to roving traders.

The honey association serves as the collector in the community. The value-added is on the adoption of more sustainable harvesting practice, the process of filtration and reduction of moisture content. The association maintains a collection facility, uses gravity drip containers, tests for moisture content and amasses smaller volumes into 5 gallon-containers.

The CEDAC Honey enterprise remains the honey association's major market. For 2009, the demand for Koh Kong honey is 300 liters. The honey undergoes the process of refrigeration and storage, then a second filtration-gravity drip before it is bottled, cellophane sealed and packed. The product is marketed to the consumer public mainly through CEDAC outlets.

The value-chain also indicates the support services provided by government agencies and non-government organizations. There is no current economic policy in support of honey as a product. Government support is mainly through biodiversity conservation and protection as translated to ensuring access by communities to common property resources, such as the community forestry, the community protected areas and the community fishery programs. These products are locally-partnered with NGOs such as AFSC, Khmer Ahimsa and Pact.

B. Key Issues/Challenges in the Supply/Value Chain

1. *Biodiversity-Related Issues*

The project area falls within the Cardamom Mountain biodiversity corridor. This is an area of high biodiversity values because it is composed of linked ecosystems crucial to global ecology and to Cambodian socio-economic development. A global initiative under the Greater Mekong Sub-region (GMS) Biodiversity Conservation Corridors Initiative (BCI) is being implemented here. This supports a national framework for the management of the area. Institutional arrangements among government agencies involved with resource management are in place, aptly supported by international donors and organizations. This bodes well in terms of the mix of conservation and protection and sustainable use interventions, from macro-to-micro levels, within government agencies, non-government agencies and with community-based support programs. The challenge on how to fully develop and implement a Protected Area Management framework is daunting. This would entail a clearer policy framework specific to areas in the corridor, a strong institutional capacity by the implementing agencies, and a clear demarcation of areas with community participation, ensuring the functionality of national and local authorities within the policy-mandates and empowering community organizations to manage their own areas/zones. The socio-economic agenda by big business and the state which both emphasize resource utilization rather than conservation/protection will continually challenge the management of protected areas.

However, there are designated community protected areas, community forestry and community fishery areas. This means that several stakeholders would be on hand to assist and work with community

associations on conservation and protection practices along community-based framework. The honeybee value chain project would therefore have a more defined harvest area to work with; currently the total harvest area is at some 5,200 hectares.

However, crucial biodiversity habitats are under threat. There is rapid expansion of agricultural land and residential areas brought about by a rapidly growing population. This is resulting in the unabated cutting of forest for settlement and agriculture. There is conversion of large tracts of forest for plantation agriculture. There is a mega-infrastructure project of the Kirirom III hydropower. Overall, there is a diminishing foraging and habitat areas for honeybees. Even the protected areas have been notably degraded, as indicated by sparse stand density and a reduced number of non-timber products available for harvest, this point to a need to have more definite policies on the management of forest/fishery areas. Policies can be specific to protecting honeybee harvest sites, but also for practical considerations on designated for the gathering of timber and non-timber forest products for domestic use.

Further threats to the health of honeybee resources are still apparent. These threats include: unsustainable harvesting, using fires to kill the colony, the use of pesticides by farmers which has an adverse effect on bee populations, the increasing number of people engaging in opportunistic hunting and the destruction of wild honeybee habitats brought about by the lack of understanding of their value in the ecosystem.

2. Labor and Income Contributed by Honey Livelihood Activities

There are around 494 households engaged in honey harvesting in the study area, with a maximum of 241 households active in honey livelihood activities in the target project areas. These comprise 27% of the total household population of 1,838 households in the study areas.

Honey related livelihood provides for part-time and full-time employment for households for some three to four months of the year. The labor value of the honey hunting activity per households is fifty six (56) person-hours a season. Across the 241 households engaged in honey harvesting, the total person-hours is 13,496²⁶. The female participation is low, at 5%, therefore only some 675 hours participation. However, women participation may be even higher in processing and trading process.

The number of person-hours increases for full-time professional honey hunters and the members of the honey association. There are some 4 persons assigned by the Prang Honey Association who work 4 hours a day during the period of the peak honey harvest season of 3 months or a total of 4,608 hours.²⁷

The average income per household is estimated from US\$15-US\$37.50 (this year and last year, as the season is not yet over). This brings median earnings of between US\$7,410 and US\$18,525 for all the households involved. The target areas may have a higher labor participation rate and earnings since the volume of harvest and the marketing of bee products are more defined. They also practice rafter methods, therefore are less likely to be doing opportunistic hunting.

²⁶ One person averages 3.5 visit per month x 4 hrs per activity x 4 mos.=56 hours x 241 households= 13,496 hours

²⁷ One person x 4 hrs per day= 16 x 24 work days/mo. X 3 months, for a total of 4,608 hours

HONEY HARVESTING CONTRIBUTION TO EMPLOYMENT

For 241 households engaged in harvesting, the period of gainful employment is for 4 person-months, with total person-hours at 13,496 hours or 56 hours/household.

3. Supply and Value of Honey Products

The current volume of honey products harvested for the total study area is placed at 4,400 kg for hive, 3,900 kg for honeyhead, 3,300 liters for honey, 3,300 kg for brood and 592 kg of wax (Table 18). The project areas indicated a volume of harvest estimated at around 75% of the total volume.

Table 18 Estimated Volume Based on Estimated Maximum HHs Involved X Median Volume By Project Area

Village	Hive (Kg)	Honey Head (Kg)	Honey (L)	Brood (Kg)	Wax (Kg)
Ta Meak	168.0	105.0	63.0	157.5	42.0
Prang	560.0	700.0	560.0	350.0	52.5
Preah Ang Keo	2,000.0	2,000.0	1,500.0	900.0	300.0
Chamkar Kroam	350.0	250.0	275.0	500.0	50.0
Total	3,078.0	3,055.0	2,398.0	1,907.5	444.5
Total Including non-project areas	4,394.0	3,940.0	3,279.0	3,272.5	592.0

VOLUME OF HONEY & WAX

The honey byproducts being sold are honey and wax. The total volume of honey from the project area is 2,398 liters. The total volume of wax is 444.5 kg.

The total volume and price of the different products have been estimated according to the estimated maximum number of households (See summary table for comparison in Annex 2) involved in honey livelihood activities in the project and non-project villages using the median for each product, while price is utilized as the multiplier variable (Table 19).

The total volume harvest of hive could reach a total of 4,394 kg that could be sold at US\$6,591. The honey head could reach a total of 3,940 kg amounting to US\$16,371. The honey itself could reach a total of 3,279 liters that could be sold at US\$16,395. The brood can reach to 3,273 kg at US\$4,254 and the wax at 592 kg amounting to US\$3,863. The sum of sales of all products is US\$47,474. This maybe high considering a double count for honey head and honey, therefore, corrected to around US\$31,000 per season for all 10 villages. We can assume here that 75% of these earning are in the target villages.

Table 19 Volume of Honey Products Harvested and Earnings (Household Data)

	Village	Est. Max. # of HHs Involved	Median Volume (Kg)	Median Price (Kg)	Earnings (US\$)
Honey head					
Project Area	Ta Meak	21	10.0	4.0	840.0
	Prang	70	10.0	4.0	2,800.0
	Preah Ang Keo	100	10.0	4.0	4,000.0
	Chamkar Kroam	50	10.0	4.0	2,000.0

Honey					
Project Area	Ta Meak	21	3.0	5.4	338.9
	Prang	70	8.0	5.4	3,012.8
	Preah Ang Keo	100	15.0	5.4	8,070.0
	Chamkar Kroam	50	5.5	5.4	1,479.5
Wax					
Project Area	Ta Meak	21	1.7	-	-
	Prang	70	1.7	5.0	595.0
	Preah Ang Keo	100	1.7	5.0	850.0
	Chamkar Kroam	50	1.7	5.0	425.0

AVERAGE INCOME PER HOUSEHOLD

The average income per household was computed from the total sale of honey and wax (project villages). For honey, total sale is US\$12,901; for wax, total sale is US\$1,870 or US\$14,771 for the two byproducts. For the 241 households, the average household income is US\$61.30 per household.

There is still a large volume of honey being harvested, considering that but 24% of total households practice rafter technology. Encouraging the use of rafters may lead to less opportunistic hunting and more naturally-assisted beekeeping, which in turn, may increase the volume of honey that can be harvested. There is a large volume of harvest left for use by the community but which may be available if there are regular buyers or a fixed market. The volume can also be better defined if rafter-harvesting is augmented by honey production through commercial beekeeping which is more community-based.

4. Marketing

Not all of the estimated 2,400 liters of honey produced are actively being marketed. Local consumption was established (around 0.5 to 1 liter per household) or 1,800 liters, leaving some 1,200 liters to be sold outside the community. The low price at the community level will encourage the sale outside if demand is assured.

The current market links of the community are limited to selling to the Srae Ambel market and local traders. These take up an estimated 700 liters per season but at cheaper buying price. This can be sold directly through local vending at traveler's stops along main highways with a selling price from 5,000 Riels per comb (*A. florea*) to a high of US\$7 for a half-liter bottled honey.

Some 500 liters are readily available for other buyers but only CEDAC provides the sole market for bulk sales of honey but at a limited capacity of 300 liters. For the wax product, the market is through local traders who may sell the same to candle-makers. The production-for-market chain for this has not been traced by the study.

The issues related to marketing are definitely the lack of regular buyers with bulk demand or purchase orders. The current link with CEDAC is still incipient and limited. However, the CEDAC outlet has large potential to increase the demand because of its established product outlets.

The capitalization for the purchase of raw honey products directly from hunters has been initially attended to by soft loans from Pact, specifically for Prang. This is limited to the CEDAC demand and is still relatively small. It is also limited to the purchase of honey from the honey association members. Capitalization for other community associations is necessary but is advisable only after a definitive market. Presently, raw honey is the product being marketed.

5. Quality of Honey

A major concern is the high moisture content of honey from the Koh Kong area. This has significant bearing on the shelf-life, taste, buying price and marketability. The moisture content of the honey in Prang was measured using the refractometer, indicating some 27.5% moisture content. A second reading was done for the honey delivered to CEDAC. The refractor indicated a blue-blot which made it impossible to read any calibrations; this meant that the water content is too high. Any product that is sold commercially are regulated by Code of Export Standards (codex) defined by the World Health Organization (WHO) and the Food and Agriculture Organization (FAO). The current codex standards for moisture content should not be more than 21%.²⁸

The high moisture content can be reduced if there are facilities and equipment. But the Honey Association in Prang is merely relying on a filter and drip method. This does little to reduce moisture since honey is known to naturally sop up moisture when stored. Refrigeration can reduce the moisture and fermentation and temperature-regulated storage is also necessary. But since these are not available on site, the honey bought from hunters has to be amassed in 20-30 gallon containers then delivered immediately to CEDAC which has the refrigeration facilities. Since the entire volume of honey harvested cannot be stocked in bulk at the project site, there is need to transport small volumes of stock several times. Therefore, the transport costs also rises.

There is limited technological support for the post-harvest technology for honey. The current effort was largely through the Pact effort, but this largely focused on rafter and sustainable harvesting. The post-harvest technology is not yet looked into. Post-harvest technology would require investments beyond the current capitalization of the association (Prang and Chamkar Kroam). It also requires electricity, therefore more operational costs. There may be low cost technologies, specifically on moisture reduction, which entails research and linkage with other agencies involved in agricultural technology research.

Another concern would be the lack of transportation equipment for the Prang and Chamkar Kroam honey association. In the current system, the bulk of products are picked up by Pact. It may be necessary for the association to invest in community transport. Especially since the area has limited public transport system and tends to be isolated during the tidal flows during the rainy months.

6. Other Product Processing

The processing of raw honeybee products into other by-products has not been really looked into. There are other market segments which should be tapped as well but would require investments in technology. For example, wax can be transformed into candles and sold separately and at higher prices,

²⁸ The codex is indicated in the FAO Corporate Depository, Agriculture and Consumer Protection, Value-added products from honey, Revised 1987. The United States export standards accepts less than 21% of moisture content.

as there is a substantial volume of wax being brought raw by traders in the area. The products can also be marketed direct, but would require going into the processes for bottling, packaging and linking to alternative markets or product outlets.

C. General Recommendations

1. *Intensify Awareness Raising On the Role of Wild Honeybees as a Keystone Species*

There is still need to heighten the understanding of the community involved in honey harvesting and the supporting agencies for biodiversity conservation. While wild beekeeping has been adopted by a third of households in the project areas, opportunistic harvesting is still predominant. Even among members of the community associations there is still a need to encourage sustainable harvesting, in terms of not collecting the whole hive but the honey head and waiting out hive maturation for more harvest. There is also need to promote more extensive areas for the use of rafters.

There is also need to encourage awareness raising about the role of honeybees amongst the entire population of the project site and nearby villages. Education modules on the role of wild honeybees in their ecosystems should be formulated and taught as part of environmental discussions in the different schools (nursery, primary, secondary) in the project area and surrounding districts or communes of the study site. There is also a need to document the best practices of professional honey hunters and distribute them as reading materials for other communities. Community leaders that are using best practices will be tapped to engage others in conservation projects.

2. *Continue the Link of the Honey Value Chain Enterprise to the Cardamom Biodiversity Corridor Initiative*

The Cardamom Biodiversity Corridors Initiative (BCI) in Koh Kong Province involves the Phnom Samkos Wildlife Sanctuary and the Central Cardamoms Protected Forest in the north, the Coastal Cardamoms Protected Forest and Peam Krasop Wildlife Sanctuary, Botum-Sakor National Park and Dong Peng Multiple Use Area to the south, and parts of Kirirom and Bokor national parks to the east. This is being implemented by the Koh Kong provincial government with support by the Ministry of Agriculture, Forest, and Fisheries, the Ministry of Environment and three international conservation organizations: Conservation International (CI), Fauna and Flora International (FFI), and WildAid.

The initiative will improve on the ecological profile of the Cardamom Mountains through various researches on the area's flora and fauna to get an updated record of its biological values. The project has done the initial demarcation of related zones which defines what areas are restricted and what areas will there be regulated use of resources. For the latter, the initial demarcation needs to be in consultation with people who access the common property resources. The provincial government, relevant ministries and the communities still have to define further the terms for access and use of resources through a community protected area management scheme.

The interface of the wild honey value chain project with abovementioned initiative would be in defining sustainable resource use management for honey hunting areas within the protected areas. The communities would be enabled to fast-track delineation/approval of identified protected areas and develop comprehensive and integrated forestry resource management plans that will ensure clear roles

of stakeholders towards the protection, conservation, maintenance and expansion of identified potential and approve forestry resources in the project study site and immediate ecology corridors. The advocacy of honey harvesting as a strategy for biodiversity conservation is a valid platform within the whole concept of biodiversity conservation.

3. *A More Defined Resource Profiling and Resource Use System for Honey Associations*

The rafter installed by the honey hunters were situated in small and adjacent harvest areas. The tendency is to crowd the number of rafters. There is a need to make more efficient the practice of installing rafters. The Prang and Chamkar Kroam honey association made a good effort in defining installation areas by dividing its membership into clusters of 4-5 persons; each cluster is then assigned an area. This cluster system should also be adapted for Toub Cheang and Ta Meak associations.

There is still a need to expand the areas where the rafters can be installed and the number of rafters installed per area. Expanding the area increases the forest areas which will be protected against illegal loggers and deforestation. It brings in actual forest monitors since the honey hunter assigned will serve as steward of the area. A systematic grid of areas assigned per cluster of members can also be adapted. This will improve on the maintenance records on the movement and location of colonies. Inventories of bee colonies can be conducted and bee populations can be monitored.

A standard for the distances between rafters can be agreed on. This study proposes a minimum of 1 hectare grid with 7-10 rafters installed per hectare.

The sustainable practices of wild honey beekeeping should be improved further. The number of colonies can be increased by ensuring that harvest of honeybee done when the hives mature. This gives a chance for the colony to come up with other queen bees which results to more colonies. This study also proposes that beekeeping be adopted in the village. This will reduce the number of hunters going into the forest. This can benefit women since they can oversee the hives when nearer their homes. Village-based beekeeping can also be done with youth. Such project can also support awareness raising on the value of bees to biodiversity conservation. For such projects, it is proposed that other bee species, such as *Trigona* and *A. cerana* species will be used.

Commune/village councils in the project site ought to adopt local policies in regulating wild honey harvesting in the fragile ecosystem. Small projects to establish a tree nursery for trees to be colonized and used as forage in the future should be conducted. Planting of such species should be done in the protected areas.

4. *Negotiating With the Kirirom Hydropower Project for Continued Access to the Forest*

The Kirirom III Hydropower project will encompass a considerable portion of the Toub Cheang Community Protected Area, some of which are honey harvesting areas. It will bring in contract workers who tend to set up their own family's settlement during and after the hydropower plant's construction.

The Toub Cheang community, with support from the honey associations in Prang and Chamkar Kroam villages, should come up with a common position towards the construction and operation of the Kirirom III scheme. They should prepare a declaration which can be the basis for dialogue and negotiations with

the company, its consultants and relevant government authorities. Villagers from Toub Cheang reported that they have prepared a petition and submitted it to the provincial governor but the outcome is not known. There are still differences in opinions among the community members as to the anticipated benefits and negative impacts of the project. To forge a common position, there should be conducted more information dissemination and discussions. The management committee of CPA and CF areas with support from local and international NGOs and relevant government institutions operating in the area should exert efforts to mediate and negotiate with the Kirirom III Hydropower for information exchange, and negotiations over mitigation and compensation for the affected communities.

5. Encourage Bee Product Processing

Community members should improve on the honeybee product from its raw form to processed products. There should be an effort to look into honey processing and marketing associations at the commune level, with potential products such as: wax candles, honey-wine or honey-soap. Additionally, simple and informal group clustered could be formed at the village level that could jointly own and operate any necessary processing equipment.

6. Quality of Honey Improvement

The bulk of honey harvested in the project area is from colonies situated in the wetlands. This is because these areas are easier to access. The rafters installed in the wetlands are also low. Since bees do take water, and honey itself sop up moisture, the moisture content is quite high. Honey from higher elevations may be dryer and the mix of wetland and upland harvest may improve the quality. The quality of honey may be improved on by harvesting from rafters built on higher ground, in the deciduous and ever-green forest and not only in the wetlands.

The harvesting practice can also be regulated to ensure that this is done when the honey head has matured, when the combs are capped and natural drying has occurred. From the time a 3-week wait period should be observed by the honey hunter before harvesting.

The quality should be improved to ensure that the product will not ferment, run or effervesce while bottled. Technology for the reduction of moisture content of the honey should be explored and brought into the community. The current technology uses a plain filtration-and-gravity drip system which does little to reduce moisture content. There are possible methods which may need more practical research or pilot tests in the project area or in Cambodia, such as:

- **Rotating Apparatus with Regulated Air:** This apparatus includes housing for the honey, a rotatable high surface area body upon which the honey forms a thin film and means for supplying a non-turbulent stream of ambient pressure at 40° C to 75° C. The thin film of honey is rotated and air is regulated to reduce the water content. This apparatus may require electricity in the area, the absence of which may require additional power-source technology such as a household turbine, solar energy or a pedal powered generator
- **Regulated Storage:** Categorically, heating the honey product is not advised as this may result to the removal of its natural antibiotic properties and natural flavor. However, honey can be

naturally stored in room temperatures which can induce the evaporation of moisture yet not result to fermentation. Regulated thermal equipment can be used for this process.

There is a need to establish and strengthen the partnerships of all interested parties in the wild honeybee value chain to address the current and future production, processing and trade issues (including any weaknesses and threats) and to come up with clear and unified responsibilities for stakeholders at all levels of the industry.

7. *Selling Strategies Focused On Distinctness of the Product*

The marketing of the honey products needs to be improved in terms of improving the label design. The current label of honey products of CEDAC is conservative as it does not make the product stand out. The labeling should highlight the origin of the product and the floral plant source (*Melaleuca*) as part of its own distinct character. The selling point should be its own naturalness, its relatively milder sucrose content²⁹ and its distinct taste.

At present, the product being marketed is raw honey. But other byproducts can be developed, such as honey wine, pastries or medicines. This requires experimentation.

The packaging of the honey product is through glass jars and plastic bottle containers. The latter is not advised, as it tends to cheapen the product rather than extol its distinct value. The use of glass bottle is recommended. The pricing scheme on honey products sold on the market (at US\$15 per liter) tend to support that higher costing packaging material can be accommodated.

CEDAC should also pursue a more aggressive marketing strategy of honey products. The tendency is to place the honey products with other CEDAC products at identified market outlets. This does not provide a good opportunity for the honey products to catch buyer's attention. There is also the lack of any active advertisement of the product which extols its distinctness as a Cambodian food and a health supplement.

The community, support agencies and the local government of Koh Kong should also make an effort to market their honey products. Koh Kong is strategically near the Thai border and is a noted tourism area because of its coastal and evergreen forests, and location to Sihanoukville. Honey products can be conspicuously marketed through provincial government product fairs or trade exhibits.

8. *Undertake a Future Study on Other Market Segment Potentials*

The market segment study has not been comprehensively undertaken by the Cambodia MSME project, in terms of the volume of sales and consumption from key outlets. There is also no information on other segments which may use honey as a raw material for the production of other products, such as candle, traditional medicines, pastries and beverages. Other market segments and products which need further evaluation include the following: honey, royal jelly and pollen in the food industry, and honey, propolis and wax for the pharmaceutical and cosmetic industry (on the basis of the apitherapeutic properties) as

²⁹ The sucrose content needs to be established by scientific test. But the taste of Koh Kong *melleuca* honey is relatively sour-sweet compared to other honey products in the market.

key ingredients e.g. creams, balms, etc. There is also no information on the prospects of exports, notably in the growing Vietnamese and Thai honey markets.

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ANNEXES

Annex 1 List of Identified and Recorded Flora and Fauna in the Eco-Walk

List of Forest Species as Identified and recorded in the Eco-walk

Khmer Name	Scientific Name	Family Name	Uses	Description
Smach	<i>Meleleuca leucadendron</i>	<i>Myrtaceae</i>	Rafter construction and as bee forage	Most dominant tree species, 8-15m tall, diameter ranging from 5 cm to 50 cm mangrove. Being able to grow far from the coast. Mixed with secondary trees.
Krâ:nhöb	<i>Lumnitzera racemosa</i>	<i>Combretaceae</i>	Rafter construction and as bee forage	Tree, 5-10 tall, growing vigorously with reproductions.
Tramoung	<i>Garcinia schomburghiana</i>	<i>Euphorbiaceae</i>	Cure for hemorrhoid	Few trees that grow in association with Melaleuca.
Chhë chor	<i>Excoecaria agallocha</i>	<i>Euphorbiaceae</i>	As forage and for rafter. Roots used as traditional medicine in treating swelling of hands and feet.	Small tree, 6-10m tall,. Not so many populations sporadically distributed.
Chréi krëm	<i>Ficus benjamina</i>	<i>Moraceae</i>	Colonized by bee and used as rafter. The root used in treating wound.	Small sized trees growing below the canopy.1-8 m in height and diameter 3-10 cm
Trach	<i>Dipterocarpus Intricatus</i>	<i>Dipterocarpaceae</i>	Colonized by bees and used as rafter. Wood used for construction	Tree 15-30 m tall, dominant trees
Pôpél	<i>Hopea recopei</i>	<i>Dipterocarpaceae</i>	Colonized by bee, for forage and for rafter. The resin is used for the manufacture of varnish.	Large tree, 20-25m tall that dominate the crown canopy
Châm 'bâk'	<i>Irvingia malayana</i>	<i>Simaroubaceae</i>	Colonized by bee, forage and construction materials.	Tree, 15-20m tall, of the open formations. Few trees
Thlô:k	<i>Parinari annamensis</i>	<i>Chrysobalanaceae</i>	Colonized by bee and used as rafter. Edible fruits. The wood is used to make boards.	Tree, 6-15m tall, only few trees growing
Pri:ng Khmum'	<i>Syzygium cochinchinenses</i>	<i>Myrtaceae</i>	The flowers are much attractive to the bees as forage. The fruits are edible. The wood is used in carpentry.	Tree, 11-20m tall, only few trees are found
Kânsaèng ,or Pumsaèn	<i>Xanthophyllum glaucum</i>	<i>Xanthophyllaceae</i>	Colonized by bee and rafter material. The infusion of the bark is effective against chicken pox.	Tree, 8-15m tall, dominant species
Ba:y phouvèang	<i>Aglaia spectabilis</i>	<i>Meliaceae</i>	Bee forage, edible fruit, wood material in making wheel for oxen driven cart.	Tree, 25-30m tall also a dominant trees
Trâsé:k	<i>Peltophorum dasyrrhachis</i>	<i>Leguminosae</i>	Colonized by bees and used as rafter.	Tree, 10-30m tall, dominant trees

Phlu:ba:t	<i>Dillenia hookert</i>	<i>Dellineaceae</i>	Edible fruits, barks are used as medicine for sprains.	Tree 1-5m tall, grows in clearings as second growth.
Kaông Ka:ng	<i>Rhizophora apiculata</i>	<i>Rhizophoraceae</i>	Species colonized by bees, for construction, use as tannin	Tree 5-8 m tall most dominant in the area and covers the upper canopy of the forest. Plenty of reproductions
Doeum Prasak	<i>Rhizophora mucronata</i>	<i>Rhizophoraceae</i>	Species colonized by bees and forage, for construction, use as tannin	Tree 4-7m tall one of the dominant species. A lot of reproduction
Biền Tiên or Krápén tük	<i>Hydrolea zeylanica</i>	<i>Hydrophyllaceae</i>	Bee forage , rafter and used as construction material	Tree, 10-16m tall. There have many growths in mangrove forest.
Thbaèng	<i>Diptertocarpus Obtusifolius</i>	<i>Dipterocarpaceae</i>	It's used for construction. It also provides resin.	Tree, 8-15m tall. Growing vigorously, dominant tree species
Bun			Bee forage and used as construction materials.	Tree, 10-16m tall, not many growth in mangrove forest.
Krâ:nhöb sã	<i>Lumnitzera racemosa</i>	<i>Combretaceae</i>	Rafter construction and bee forage	Tree, 5-10 tall, growing vigourously with reproductions.
Thmé:nh tréi	<i>Bridelia ovata</i>	<i>Euphorbiaceae</i>	Edible fruits and as bee forage.	Straight tree, 10 to 20m tall, not many growth in mangrove forest.
Chhë chor	<i>Exoecaria agallocha .</i>	<i>Euphorbiaceae</i>	For Rafter construction and as bee forage. The leaves are toxic; roots are used in traditional medicine to treat swelling of hands and feet.	Small tree, 6-10m tall. Only few trees
Khlong sã:	<i>Dalbergia cochichinensis</i>	<i>Leguminosae</i>	Wood used for the making furniture	Tree, 5-20m tall, one of the dominant species
Russéi préi	<i>Dendrocalamus giganteus</i>	<i>Bombacaceae</i>	Edible shoots. Stem used as construction materials (walling)	3-5m tall, and growing in abundance
Krâ:nhu:ngsva:	<i>Dalbergia cochinchinensis</i>	<i>Leguminosae</i>	The very expensive wood used in furniture making	Codominant tree species growing vigorously in the area
Lovië préi	<i>Ficus hispida</i>	<i>Moraceae</i>	For construction	Tree, 9-10m tall, few trees growing
Sé:moèn	<i>Nephelium hypoleucum</i>	<i>Sapindaceae</i>	The ripe fruits are edible. Wood used to make tool handles.	Tree, 10-25m tall, of the dense forests of plain and thrive in moderate altitude. Dominant species.
Chrey/Kra:y	<i>Polyalthia cerasoides</i>	<i>Anonaceae</i>	Wood used as construction materials	Small tree, 6-10m tall growing vigorously as intermediate species in the canopy
Mak'prang'	<i>Bouea oppositifolia</i>	<i>Anacardiaceae</i>	Ripe fruit are sold as component of sweetened products, wood used in making furniture. Trunk sap used as raw material in making varnish	Tree, 8-10m tall, only few species are found.

Tromu:ng	<i>Garcinia oliveri</i>	<i>Guttiferarae</i>	Leaves and fruits as food	Tree, 20-30m tall, growing in abundance
Sbaèng	<i>Caesalpinia sappan</i>	<i>Caesalpinaceae</i>	Barks give a red dye. Wood is used against stiffness or blood diseases.	Tree 7-10m tall with bough having short conical thorns. Few trees
Popu:l thmâ:	<i>Vitex pinnata</i>	<i>Verbenaceae</i>	The bark is used to make tonic drink. Boiled leaves and barks have the reputation to activate the growth of hair and beard.	Big tree, 15-25m tall, one of the dominant species
Phlô:ng	<i>Ternstroemia penangiana</i>	<i>Theaceae</i>	Barks are used to make ropes. Wood is used in construction.	Tree, 6-12m tall, dominant species
Pruhs	<i>Garcinia schefferi</i>	<i>Guttiferarae</i>	Wood is used in construction.	Tree, 10-15m tall with a bark blackish outside, not many of them found.
Trâbaèk prèi	<i>Lagerstroemia floribunda</i>	<i>Lythraceae</i>	Wood is used in construction. As shade trees	Tree, 8-40m tall, very few
Kânndaôl	<i>Careya arborea</i>	<i>Lycithidaceae</i>	Wood used as building materials, dye and bark used to stop bleeding and cure against diarrhea.	Small sized tree, 7-15m tall, very few.
Thkow	<i>Anthocephalus chinensis</i>	<i>Rubiaceae</i>	Edible fruits. Boiled stem and barks is a cure against body pains. Also used as shade tree	Tree, 8-15m tall, few trees
Phdièk	<i>Anisoptera costata</i>	<i>Dipterocarpaceae</i>	Wood is used for making furniture and construction material	Big tree, 20-35m tall, found in lowlands evergreen forest up to 850m altitude, few trees, Dominant
Ph'ô':ng prèi	<i>Calophyllum pulcherrimum</i>	<i>Guttiferarae</i>	Used as material in making furniture.	Tree, 15-20m tall. Few trees
Ph'ngièhs	<i>Memecylon laevigatum</i>	<i>Melastomaceae</i>	Barks used to make ropes. Wood used in construction.	Tree, 6-12m tall one of the dominant species
Kroël	<i>Gluta laccifera</i>	<i>Anacardiaceae</i>	As post and construction material. Material in making lacquer.	Tree, 25-30m tall, very few trees
Puënto:léi	<i>Terminalia corticosa</i>	<i>Combretaceae</i>	For house posts and dyeing materials for fishnets.	Tree, 8-20m tall, of the open formations on rocky soils, abundant
Sva:y prèi	<i>Mangifera duperreana</i>	<i>Anacardiaceae</i>	Young leaves and fruits eaten as vegetables. The bark is a cure against pharyngitis and syphilis.	Tree, 30-40m tall, one of the dominant species.
Thuëng	<i>Pterocarpus indicus</i>	<i>Leguminosae</i>	Wood used in constructions. Resin of bark is used for dyeing fabrics.	Tree, 15-30m tall thrives in altitude below 600 m above sea level. Few trees.
Rung	<i>Garcinia hamburgi</i>	<i>Guttiferae</i>	Gums used to treat colds and bronchitis. Wood used as construction materials,	Tree, 10-20m tall, dominant trees

			gums are used to treat colds and bronchitis.	
Tunloâb'préi	<i>Disopyros hasseltii</i>	<i>Ebenaceae</i>	Wood used as construction material. Sap of bark as material in making varnish.	Tree, 15-30m tall, very few trees found
Chhê tiêl thôm	<i>Dipterocarpus alatus</i>	<i>Dipterocarpaceae</i>	Used in construction	Tree, 25-40m tall, dominating the upper canopy of the forest
Spuêng'	<i>Tetrameles nudiflora</i>	<i>Datisceae</i>	Young plants Can cure convulsion. Bark is cure for liver disease and rheumatism.	Tree, 10-30m tall, co-dominant trees
Thband	<i>Avicennia officinalis</i>	<i>Verbenaceae</i>	Barks used against skin diseases. The aerial root is a component for aphrodisiac medicine.	Small sized tree 4-6m tall, another dominant species that covers the second story of the mangrove forest.
Kâkâh	<i>Sindora siamensis</i>	<i>Cesalpiniaceae</i>	The fruits are edible. The roasted seeds are used to make a tea-like drink. Wood is used as constructions materials.	Tree, 6-10m tall. Growing below the canopy of mangrove forest.
Cha:r	<i>Butea monosperma</i>	<i>Leguminosae-Papilionoideae</i>	The leaves are used as roofing materials.	Small sized tree 5-8m tall growing abundantly with reproductions.

List of Shrubs as Identified and Recorded in the Eco-walk

Khmer Name	Scientific Name	Family Name	Uses	Description
Bai remeas	<i>Gardenia Cambodiana</i>	<i>Euphorbiaceae</i>	Young leaves and fruits are edible. Stalks can be prepared as pickles.	Shrub, 2-5m tall, not so many population sporadically distributed
Phrèah ânluëk	<i>Pluchea indica</i>	<i>Compositae</i>	Root is used as medicine for women after delivery	Shrub, 2-3m tall, of the open formations.
Boëhs	<i>Hibiscus tiliaceus</i>	<i>Malvaceae</i>	Colonized by bee and used as rafter. Leaves as antiseptic for wound.	Shrub, 2-7m tall, they grow both in flooded and mangrove areas but few.
Trâchiëk kra:nh	<i>Antidesma cochinchinensis gagnep</i>	<i>Euphorbiaceae</i>	The leaves used as tonic.	Shrub, 2-4m tall, many growths in mangrove. Invasive species.
Rumduël	<i>Mitrella mesnyi</i>	<i>Annonaceae</i>	The yellowish flowers, mixed with oil and wax used as scenting pastes.	Shrub, 5-8m tall, abundant in the ground canopy of the forest.
Krô:ch préi	<i>Atalantia citroides</i>	<i>Rutaceae</i>	Fruits eaten like lemon.	Shrub, 2-8m tall, as second growth found in the forest floor.
Pôphlië	<i>Microcos tomentosa</i>	<i>Tiliaceae</i>	Fruit is edible. The barks are used to make ropes; sap of roots is cure against cough.	Shrub or small tree, 4-15m tall, dominate the understory
Kântuët préi	<i>Phyllanthus emblica</i>	<i>Euphorbiaceae</i>	The barks, leaves, and fruits used as dye. In traditional medicine, cure for diarrhea.	Shrub, 2-8m tall, only few are growing as second growth.
Sva:y chan'ti	<i>Anacardium occidentale</i>	<i>Anacardiaceae</i>	The young leaves are eaten raw as salads.	Shrub, 2-8m tall, found mostly at the lower

			The bark used as dyeing material	canopy
Srâ ngam'	<i>Tristaniospis burmannica</i>	<i>Myrtaceae</i>	Fencing materials and trellis for pepper plants.	Shrub, 2-6m tall, many found in the forest floor
Sma:krâbèi	<i>Knema globularia</i>	<i>Meristicaceae</i>	Woody parts used in construction.	Shrub, 2-8m tall, growing abundantly in the forest floor which form a very dense thicket of the underbrush
Tumpu:ng	<i>Croton joufra</i>	<i>Euphorbiaceae</i>	Leaves as raw material in the treatment of scabies	Shrub, 1-4m tall, few trees found in the lower canopy
Krô:ch préi	<i>Atalantia citroides</i>	<i>Rutaceae</i>	Fruits eaten like lemon.	Shrub, 2-8m tall, as second growth found in the forest floor.
Nhind	<i>Melastoma sanguineum</i>	<i>Melastomaceae</i>	Remedy for liver diseases.	Shrub, 1-2m tall, located in open spaces of the forest. Growing in abundance.
Puëch	<i>Rhodomyrtus tomentosa</i>	<i>Myrtaceae</i>	Fruits are edible. Leaves are made into brooms.	Shrub, 1-2m tall, growing in abundance as second growth.
Dâhs kun	<i>Tetracera indica</i>	<i>Dilleniaceae</i>	Bees forage, the leaves used as sanding material	Climbing shrub in dense formations.
Lo-ngië:ng	<i>Cratoxylum formosum</i>	<i>Guttiferae</i>	For food, leaves and floral buds are edible	Shrub, 1-8m tall, form a dense thicket in the forest floor
Kâm rëk Kum	<i>Spirolobium cambodianum</i>	<i>Apocynaceae</i>	Bee forage. Used as lotion for broken limbs.	Shrub, 1-2m tall, as second growth found in forest floor.
Chum'pu: préi	<i>Ardisia helferiana</i>	<i>Myrsinaceae</i>	Edible fruits and wood for construction material.	Shrub, 1-3m tall with grouped leaves at the top of stem. Few population
Plö:ng	<i>Memecylon laevigatum</i>	<i>Melastomaceae</i>	Rafter construction and bee forage	Shrub, 1-6m tall, many of undergrowth of the dense, secondary and clear forests.
Voër Krâpë	<i>Fagraea auriculata</i>	<i>Loganiaceae</i>	Colonized by bee and sometimes used as rafter.	Bushy shrub often epiphyte on trees but taking root in the ground.
Dai rohat'	<i>Allophylus serrulatus</i>	<i>Sapindaceae</i>	The fruits are edible.	Shrub, 1-2m tall, much undergrowth.
Bampông löng/ Bampung sramaoch	<i>Nepenthes thorelii</i>	<i>Nepenthaceae</i>	As plant décor and predators to insects and ants.	Shrubs found in Melaleuca clearings as second growth
Voër Traök	<i>Ventilago harmandiana</i>	<i>Rhamnaceae</i>	The sap of roots is a cure to urinary tract infection	Shrub climbing in the trees, very few

List of Vines/Lianas as identified and Recorded in the Eco-walk

Khmer name	Scientific name	Family name	Uses	Description
Voert ampil	<i>Dalbergia horrida</i>	<i>Leguminosae</i>	Bee forage, roots used to treat vomiting and headache	Large liana reaching 30 m in length. Numerous populations in the forest floor.

Voër pâprëhs	<i>Smilax glabra</i>	<i>Smilacaceae</i>	Bees forage. The stalks are used as tying material.	Thorny, climbing liana under the forest canopy, very few.
Voer taraëk	<i>Merremia hederaceae</i>	<i>Convolvulaceae</i>	Used for tying/string	Vines as undergrowth but few population
Voër (yiëv*) (vaèk**)	<i>Strychnos axillaris hemidesmus indicus</i>	<i>Loganiaceae asclepiadaceae</i>	Cure for hemorrhoid	Vines as undergrowth but few population
Voër trädët	<i>Cayratia trifolia</i>	<i>Vitaceae</i>	Cure for measles.	Vines, numerous population, as medicinal plants
Voër toëhPréi	<i>Gymnema sylvestre</i>	<i>Asclepiadaceae</i>	The leaves is a laxative, stimulate the heart and womb of pregnant women.	Vines, very few population, medicinal
Voër triëlsva:	<i>Uvaria rufa blume</i>	<i>Annonaceae</i>	Edible fruits	Large liana reaching 20m long, growing in the forest floor
Voër ângku:nhsva:	<i>Bauhinia bassacencis pierre ex gagnep., var. Bassacencis</i>	<i>Leguminosae-caesalpinioideae</i>	Leaves used as cigarette-paper. Seeds macerated in alcohol are used as a remedy against stomachache.	Big liana with spiral hooks growing densely in the forest floor
Voër âmpoë	<i>Bauhinia harmsiana</i>	<i>Leguminosae</i>	Solid barks used for making strings.	Big ligneous liana found along the edges of the mangrove forest.
Voër trâhs'	<i>Combretum trifoliatum</i>	<i>Combretaceae</i>	It's used for traditional medicine. Its resin is used to cure dysentery.	Vines growing in numerous number below the forest canopy
Voër rômiëtsâ	<i>Combretum latifolium</i>	<i>Combretaceae</i>	The fruits are considered as astringent and tonic	Ligneous, liana, climbing on the trees.

List of Ferns, Palm, Epiphytes as Identified and Recorded in the Eco-walk

Khmer Name	Scientific Name	Family Name	Uses	Description
Phdau Kraëk	<i>Calamus viminalis.</i>	<i>Palmae</i>	Used to make baskets, ropes and canes.	Climbing rattan with 2-15m long stalk, grow abundantly
Pâprâk	<i>Drynaria fortunei</i>	<i>Polypodiaceae</i>	Plant used in traditional medicine against various diseases such as sprain, fracture, urinary tract infection and inflammation of the gums.	Epiphytes fern that thrive on trees and crevices of rocks
Chak	<i>Nypa fructicans</i>	<i>Palmae</i>	Thatching materials and wine	Ferns thriving along estuaries of mangrove
Dâmlông Chru:k	<i>Dioscorea oryzetorum Prain & Burkill</i>	<i>Dioscoreaceae</i>	Edible tubers can be eaten and fodders for swine.	This plant usually grow as tubers, they thrive in association with other trees.

List of Birds per Interview with Honey Hunters

Khmer Name	English Name	Scientific Name	Type	Remarks*
Chab taet Prey	Wild sparrow (Dark-necked Tailbird)	<i>Orthotomus atrogularis</i>	Bird	Least concern species
Popech Khmaov	Black Bulbul	<i>Hypsipetes leucocephalus</i>	Bird	Least concern species
Chab srok	Plain-backed sparrow	<i>Passer flaveolus</i>	Bird	Least concern species
Kok ground Toch	Little Egret	<i>Egretta garzetta</i>	Bird (was identified through its call)	Least concern species
Toteat	Partridge-sp	<i>Arborophila sp</i>	Bird	Endangered
Kroch ëot	Barrel buttonquail	<i>Turnix suscitator</i>	Bird	Least concern species
Kroling Krolong	Black-collared starling	<i>Sturnus nigricollis</i>	Bird	Least concern species
Kanh Chhreak	Vinous-breasted starling	<i>Sturnus burmannicus</i>	Bird	Least concern species
Charp Kolong	Olive-backed sunbird	<i>Cinnyris jugularis</i>	Bird	Least concern species
Trodavich	Red-wattled lapwing	<i>Vanellus indicus</i>	Bird	Least concern species
Pör Péch	Black Bulbul	<i>Hypsipetes leucocephalus</i>	Bird	Least concern species
Teav	Dollarbird	<i>Eurystomus orientalis</i>	Bird	Least concern species

* IUCN/SSC 2006, 2007 and 2008 Red List Categories

List of Animals per interview with Honey Hunters

Khmer Name	English Name	Scientific Name	Type	Remarks*
Sva:	Monkey			
Sva Kdarm	Long-tailed Macaque	<i>Macaca fascicularis</i>	Animal	Least concern species
Sva Pream	Silvered Leaf Macaque	<i>Semnopithecus cristatus</i>		Not threatened
Sva Traos	Pig-tailed Macaque	<i>Macaca nemestrina</i>		Vulnerable
Sva Angkut	Stump-tailed Macaque	<i>Macaca arctoides</i>		Vulnerable
Sva Kravat	Douc Langur	<i>Pygathix nemaeus</i>		Threatened
Kam brok	Variable squirrel	<i>Callosciurus finlaysoni</i>	Animal	Not threatened
Chör chörk	Golden Jackal	<i>Canis aureus</i>	Wild animal	Not threatened
Tun sa:y	Rabbit		Animal	
Chru:k préi	Common wild pig	<i>Sus scrofa</i>	Animal	Least concern species
Brëhs	Sambar deer	<i>Cervus unicolor</i>	Animal	Vulnerable
Chhlu:hs	Common barking deer	<i>Muntiacus muntjak</i>	Animal	Not threatened
Brâ ma:	Malayan porcupine	<i>Hystrix brachyura</i>	Animal	Vulnerable
Kla: Tréi	Fishing cat	<i>Felis viverrina</i>	Animal	Near threatened

Phé	Common otter	<i>Lutra lutra</i>	Animal	Near threatened
Kla: Khmom'	Malayan sun bear	<i>Helarctos malayanus</i>	Animal	Vulnerable
Sam'Pou:ch	Otter civet	<i>Paradoxuros hermaphroditus</i>	Animal	Endangered
Tho:ch	White-handed gibbon	<i>Hylobates agilis</i>	Animal	Endangered

*IUCN/SSC 2006, 2007 and 2008 Red List Categories

List of Insects per Interview with Honey Hunters

Khmer Name	English Name	Type	Remarks
A:ping	Spider-liked	Insect	Many
Ka:ndeahs	Ant-liked	Insect	Many
Réi	Cicada	Insect	Many
Mé am'baw	Butterfly	Insect	Many
Körn Dö:b	Grasshopper	Insect	Thrives on grasses and forage of birds
Kan Tomruy	Dragonfly	Insect	Bee predator

Crustaceans, Reptiles and Amphibian present per Interview with Honey Hunters

Khmer Name	English Name	Scientific Name	Type	Remarks*
Kdarm	Crabs	<i>Scalopidia spinosipes</i>	Crustaceans	Threatened
Poursh	Snake			
Poursh Prey	Indochinese Ratsnake	<i>Ptyas korros</i>	Reptiles	Least concern species
Poursh thlan	Reticulated Python	<i>Python reticulatus</i>		Least concern species
Poursh Vaek	Indochinese Spitting Cobra	<i>Naja siamensis</i>		Threatened
Poursh Kray	Banded Krait	<i>Bungarus fasciatus</i>		Least concern species
Poursh Porplaek	Malayan Krait	<i>Bungarus candidus</i>		Critically endangered
Andeok	Turtle	<i>Indotestudo elongata</i>	Amphibians	Endangered
Kar-chorng	Snail	<i>Nassarius sp.</i>	Mollusks	Threatened but not in IUCN red list

*IUCN/SSC 2006, 2007 and 2008 Red List Categories

Annex 2 Household Survey Summary Tables

Socio-demographics

Age of sample households' members

Age Group	Male		Female		Total		Mean Age
	n	%	n	%	n	%	
<5 yrs	35	10.3	32	10.6	67	10.5	2.2
5 - 9 yrs	44	13.0	38	12.6	82	12.8	7.1
10 - 14 yrs	55	16.2	31	10.3	86	13.4	11.9
15 - 17 yrs	29	8.6	32	10.6	61	9.5	15.9
18 - 24 yrs	45	13.3	45	15.0	90	14.1	20.5
25 - 29 yrs	35	10.3	28	9.3	63	9.8	26.7
30 - 34 yrs	12	3.5	15	5.0	27	4.2	31.9
35 - 39 yrs	21	6.2	28	9.3	49	7.7	36.9
40 - 44 yrs	23	6.8	17	5.6	40	6.3	41.6
45 - 49 yrs	13	3.8	12	4.0	25	3.9	47.0
50 - 54 yrs	16	4.7	11	3.7	27	4.2	51.7
55 - 59 yrs	2	0.6	3	1.0	5	0.8	56.8
60 - 64 yrs	2	0.6	3	1.0	5	0.8	61.4
65 - 69 yrs	3	0.9	2	0.7	5	0.8	67.6
70 - 74 yrs	3	0.9	3	1.0	6	0.9	71.2
75+ yrs	1	0.3	1	0.3	2	0.3	81.0
Total	339	100.0	301	100.0	640	100.0	39.5

Household size

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Household size						
2 - 4 members	27	37.5	20	41.7	47	39.2
5 - 7 members	34	47.2	22	45.8	56	46.7
8 or more members	11	15.3	6	12.5	17	14.2
Total	72	100.0	48	100.0	120	100.0

Mean household size

	Male headed	Female headed	All
Project Areas			
n	65	7	72
Mean	5.3	6.4	5.4
Minimum	2.0	3.0	2.0
Maximum	10.0	9.0	10.0
Non-Project Areas			
n	47	1	48
Mean	5.2	7.0	5.3
Minimum	3.0	7.0	3.0
Maximum	9.0	7.0	9.0

Total			
n	112	8	120
Mean	5.3	6.5	5.3
Minimum	2.0	3.0	2.0
Maximum	10.0	9.0	10.0

Literacy and education of sample households' members

	Male		Female		Total	
	n	%	n	%	n	%
Educational attainment						
Primary	200	59.0	158	52.5	358	55.9
Secondary	30	8.8	14	4.7	44	6.9
High School	8	2.4	5	1.7	13	2.0
Not eligible (still too young)	54	15.9	80	26.6	134	20.9
Did not go to school	47	13.9	44	14.6	91	14.2
Total	339	100.0	301	100.0	640	100.0
Can Read						
Yes	200	67.8	150	56.6	350	62.5
No	95	32.2	115	43.4	210	37.5
Total	295	100.0	265	100.0	560	100.0
Can Write						
Yes	199	67.5	146	55.1	345	61.6
No	96	32.5	119	44.9	215	38.4
Total	295	100.0	265	100.0	560	100.0

Primary occupation of the sample population

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Main Occupation						
Farmer	103	30.4	108	35.9	211	33.0
Fisherman	38	11.2	25	8.3	63	9.8
Small business/enterprise	11	3.2	12	4.0	23	3.6
Unemployed	10	2.9	7	2.3	17	2.7
Homemaker	-	-	13	4.3	13	2.0
Employed	5	1.5	2	.7	7	1.1
Student	108	31.9	70	23.3	178	27.8
Too young/old to work	64	18.9	64	21.3	128	20.0
Total	339	100.0	301	100.0	640	100.0

Tenure of sample households

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Years of stay in current residence						
1 to 4 years	2	2.8	2	4.2	4	3.3
5 to 9 years	7	9.7	3	6.3	10	8.3

10 years or more	63	87.5	43	89.6	106	88.3
Total	72	100.0	48	100.0	120	100.0

Household asset ownership

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Do you own any household asset?						
No	7	9.7	6	12.5	13	10.8
Yes	65	90.3	42	87.5	107	89.2
Total	72	100.0	48	100.0	120	100.0
Household assets						
Radio	32	49.2	22	52.4	54	50.5
Cellular Phone	31	47.7	15	35.7	46	43.0
Bicycle	18	27.7	18	42.9	36	33.6
Motorcycle	16	24.6	17	40.5	33	30.8
Television	23	35.4	9	21.4	32	29.9
Boat	13	20.0	7	16.7	20	18.7
Other	4	6.2	-	-	4	3.7
Total	65	100.0	42	100.0	107	100.0

Land Ownership

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Does your household own land?						
No	2	2.8	-	-	2	1.7
Yes	70	97.2	48	100.0	118	98.3
Total	72	100.0	48	100.0	120	100.0
Residential land						
No certificate	53	76.8	41	89.1	94	81.7
With land title	2	2.9	1	2.2	3	2.6
With land certificate	14	20.3	4	8.7	18	15.7
Total	69	100.0	46	100.0	115	100.0
Paddy rice land						
No certificate	47	88.7	31	93.9	78	90.7
With land title	-	-	1	3.0	1	1.2
With land certificate	6	11.3	1	3.0	7	8.1
Total	53	100.0	33	100.0	86	100.0
Chamkar Land						
No certificate	23	79.3	9	100.0	32	84.2
With land title	1	3.4	-	-	1	2.6
With land certificate	5	17.2	-	-	5	13.2
Total	29	100.0	9	100.0	38	100.0

Average Land Area

	Project Areas		Non-Project Areas		Total	
Residential land (m ²)						

n	69	46	115
Mean	4,491.0	2,653.0	3,756.0
Median	750.0	1,600.0	1,200.0
Minimum	14.0	40.0	14.0
Maximum	42,000.0	10,000.0	42,000.0
Paddy rice land (m ²)			
n	53	33	86
Mean	12,143.0	6,464.0	9,964.0
Median	10,000.0	5,000.0	5,000.0
Minimum	100.0	100.0	100.0
Maximum	80,000.0	30,000.0	80,000.0
Chamkar Land (m ²)			
n	29	9	38
Mean	12,060.0	12,222.0	12,098.0
Median	7,000.0	10,000.0	10,000.0
Minimum	100.0	2,000.0	100.0
Maximum	40,000.0	30,000.0	40,000.0

Ownership of Livestock

	Project Areas	Non-Project Areas	Total
Cow			
n	14	5	19
Mean	2.6	2.4	2.6
Median	1	1	1
Minimum	1	1	1
Maximum	10	6	10
Carabao/Buffalo			
n	34	23	57
Mean	2.1	2	2.1
Median	2	2	2
Minimum	1	1	1
Maximum	9	5	9
Pig			
n	24	24	48
Mean	2.5	2.9	2.7
Median	1	2	2
Minimum	1	1	1
Maximum	8	10	10
Goat			
n	1	0	1
Mean	4	-	4
Median	4	-	4
Minimum	4	-	4
Maximum	4	-	4
Chicken			
n	57	40	97

Mean	12.9	6.8	10.4
Median	10	5	8
Minimum	1	1	1
Maximum	50	16	50
Duck			
n	18	10	28
Mean	6.9	4.3	6
Median	7.5	3	5
Minimum	1	1	1
Maximum	12	12	12

Description of residence

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
What materials are the floors of your house made of?						
Wooden Planks/Bamboo strips	66	91.7	44	91.7	110	91.7
Cement	1	1.4	2	4.2	3	2.5
Others	2	2.8	1	2.1	3	2.5
Earth/clay	1	1.4	1	2.1	2	1.7
Tiles	1	1.4	-	-	1	0.8
No house (live on boat)	1	1.4	-	-	1	0.8
Total	72	100.0	48	100.0	120	100.0
What materials are the walls of your house made of?						
Plywood	37	51.4	27	56.3	64	53.3
Bamboo/thatch	23	31.9	13	27.1	36	30.0
Galvanized iron or aluminum	5	6.9	6	12.5	11	9.2
Wood/logs	2	2.8	1	2.1	3	2.5
Local tree Leaves(SLEK CHAK)	3	4.2	-	-	3	2.5
Concrete/brick/stone	1	1.4	1	2.1	2	1.7
No house (live on boat)	1	1.4	-	-	1	0.8
Total	72	100.0	48	100.0	120	100.0
What materials are the roofs of your house made of?						
Galvanized Iron or Aluminum	57	79.2	37	77.1	94	78.3
Thatch	12	16.7	10	20.8	22	18.3
Tiles	1	1.4	1	2.1	2	1.7
No house (live on boat)	1	1.4	-	-	1	0.8
Local tree leaves	1	1.4	-	-	1	0.8
Total	72	100.0	48	100.0	120	100.0
Floor area of residence (m ²)						
n	72		48		120	
Mean	32.6		31.2		32	
Median	30		26.5		30	
Minimum	9		12		9	
Maximum	77		108		108	

Monthly income

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
What is the monthly income of your family from all the livelihood activities?						
< \$25	19	26.6	13	27.1	32	26.6
\$25 - <\$50	24	33.4	23	48.1	47	39.1
\$50 - <\$100	19	26.4	10	20.9	29	24.2
\$100 +	10	14.0	2	4.2	12	10.0
Total	72	100.0	48	100.0	120	100.0

Monthly income (US\$)

n	72	48	120
Mean	48.7	33.1	42.4
Median	37.5	25.0	25.0
Minimum	5.0	2.5	2.5
Maximum	250.0	125.0	250.0

Credit/borrowings

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
During the past year, how many times have you borrowed (money, rice, equipment, seedlings, etc.) from a neighbor or a private moneylender?						
Have never borrowed	21	29.2	26	54.2	47	39.2
Once	11	15.3	9	18.8	20	16.7
Twice	15	20.8	4	8.3	19	15.8
Thrice	10	13.9	2	4.2	12	10.0
Four times	5	6.9	3	6.3	8	6.7
Five times	4	5.6	1	2.1	5	4.2
Six times	3	4.2	-	-	3	2.5
Ten times	3	4.2	1	2.1	4	3.3
Thirteen times	-	-	1	2.1	1	0.8
Twenty times	-	-	1	2.1	1	0.8
Total	72	100.0	48	100.0	120	100.0

Last time you borrowed from a private moneylender or a neighbor, how much did you borrow? (US\$)

n	48	22	70
Mean	220.8	112.2	186.7
Median	50.0	75.0	50.0
Minimum	3.8	15.0	3.8
Maximum	1,250.0	600.0	1,250.0

Rice shortage

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Did your household experience rice shortage last year?						
No	16	22.2	2	4.2	18	15.0
Yes	56	77.8	46	95.8	102	85.0
Total	72	100.0	48	100.0	120	100.0

What month/s of the year has your household experienced rice shortage?

January	12	21.4	11	23.9	23	22.5
February	11	19.6	10	21.7	21	20.6
March	15	26.8	12	26.1	27	26.5
April	15	26.8	13	28.3	28	27.5
May	18	32.1	15	32.6	33	32.4
June	30	53.6	29	63.0	59	57.8
July	41	73.2	34	73.9	75	73.5
August	45	80.4	37	80.4	82	80.4
September	41	73.2	39	84.8	80	78.4
October	39	69.6	40	87.0	79	77.5
November	25	44.6	24	52.2	49	48.0
December	19	33.9	17	37.0	36	35.3
Total	56	100.0	46	100.0	102	100.0

Honeybee livelihood activities (Supply/Value Chain)

Length of involvement and activities

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
How long have you been involved in honeybee?						
1-5 yrs	46	63.9	20	41.7	66	55.0
6-10 yrs	15	20.8	18	37.5	33	27.5
11 and over	11	15.3	10	20.8	21	17.5
Total	72	100.0	48	100.0	120	100.0

Computed number of years of involvement in honeybee livelihood activities

n	72	48	120
Mean	7.4	9.6	8.3
Median	5	7	5
Minimum	1	2	1
Maximum	50	40	50

Household members' honeybee livelihood activities

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Household members involved in honeybee livelihood?						
Farther	65	90.3	47	97.9	112	93.3
Mother	3	4.2	2	4.2	5	4.2
Male youths (18-24)	14	19.4	2	4.2	16	13.3
Female youths (18-24)	1	1.4	-	-	1	0.8
Boy (under 18 yrs)	5	6.9	-	-	5	4.2
Total	72	100.0	48	100.0	120	100.0
Activities involved in honeybee livelihood?						
Hunter	70	97.2	48	100.0	118	98.3
Processor	9	12.5	3	6.2	12	10.0
Collector	7	9.7	-	-	7	5.8

Trader	2	2.8	-	-	2	1.7
Total	72	100.0	48	100.0	120	100.0

Household members' time involvement in honeybee livelihood activities

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Are there members of your household that spend most of his/her time engaged in honeybee livelihood activities?						
Yes	10	13.9	9	18.8	19	15.8
No	62	86.1	39	81.2	101	84.2
Total	72	100.0	48	100.0	120	100.0
Father						
Full time	9	13.8	8	17.0	17	15.2
Part-time	56	86.2	39	83.0	95	84.8
Total	65	100.0	47	100.0	112	100.0
Mother						
Part-time (total)	3	100.0	2	100.0	5	100.0
Male youth (18-24)						
Full time	2	14.3	1	50.0	3	18.8
Part-time	12	85.7	1	50.0	13	81.3
Total	14	100.0	2	100.0	16	100.0
Female youth (18-24)						
Part-time (total)	1	100.0	-	-	1	100.0
Male children (17 and below)						
Part-time (total)	5	100.0	-	-	5	100.0

Honeybee products and uses

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
What are the products that you can process from honeybee?						
Honey	69	95.8	47	97.9	116	96.7
Honey hive	64	88.9	43	89.6	107	89.2
Honey head	64	88.9	39	81.3	103	85.8
Brood	57	79.2	34	70.8	91	75.8
Wax	53	73.6	31	64.6	84	70.0
Total	72	100.0	48	100.0	120	100.0
What are the uses of these products to you and your community?						
Source of income	59	81.9	39	81.3	98	81.7
Medical value	56	77.8	39	81.3	95	79.2
Food supplement	55	76.4	35	72.9	90	75.0
Wax for candle	1	1.4	-	-	1	0.8
Total	72	100.0	48	100.0	120	100.0

Seasonality

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%

What month/s does your household earn money from honeybee livelihood activities?

January	-	-	-	-	-	-
February	-	-	-	-	-	-
March	-	-	1	2.1	1	0.8
April	1	1.4	3	6.3	4	3.3
May	16	22.2	14	29.2	30	25.0
June	68	94.4	45	93.8	113	94.2
July	60	83.3	42	87.5	102	85.0
August	46	63.9	28	58.3	74	61.7
September	24	33.3	10	20.8	34	28.3
October	4	5.6	3	6.3	7	5.8
November	2	2.8	1	2.1	3	2.5
December	-	-	-	-	-	-
Total	72	100.0	48	100.0	120	100.0

Volume of honey product collected this year

	Project Areas	Non-Project Areas	Total
Hive (kg)			
n	51	24	75
Mean	14.2	6.7	11.8
Median	8	5	6
Minimum	1	2	1
Maximum	85	15	85
Honey head (kg)			
n	62	27	89
Mean	12.6	4.6	10.2
Median	7	3	5
Minimum	0.5	0.5	0.5
Maximum	75	20	75
Honey (Liters)			
n	67	44	111
Mean	9.5	4	7.3
Median	5	3	4
Minimum	0.5	0.5	0.5
Maximum	60	17	60
Brood (kg)			
n	51	21	72
Mean	12	4.9	9.9
Median	8	3	5
Minimum	0.5	0.5	0.5
Maximum	80	30	80
Wax (kg)			
n	42	9	51
Mean	3.5	1.1	3.1
Median	1	0.5	1
Minimum	0.3	0.3	0.3

Maximum	50	4	50
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Changes in volume of harvest in the past year

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Have there been changes in the volume of honeybee products that you have collected from the season/year prior to this year?						
Yes	61	84.7	46	95.8	107	89.2
No	11	15.3	2	4.2	13	10.8
Total	72	100.0	48	100.0	120	100.0
Hive (kg)						
n	41		23		64	
Mean	11.7		23.2		15.8	
Median	8		17		10	
Minimum	0.5		3		0.5	
Maximum	70		90		90	
Honey head (kg)						
n	52		26		78	
Mean	9.6		12.7		10.6	
Median	7		6.5		7	
Minimum	1		1		1	
Maximum	50		50		50	
Honey (Liters)						
n	59		40		99	
Mean	8.4		10.8		9.4	
Median	6		7.5		6	
Minimum	1		1		1	
Maximum	60		40		60	
Brood (kg)						
n	42		19		61	
Mean	10		15.6		11.8	
Median	4.5		7		6	
Minimum	0.5		2		0.5	
Maximum	50		63		63	
Wax (kg)						
n	35		10		45	
Mean	2		3.5		2.4	
Median	1		4		1	
Minimum	0.2		0.5		0.2	
Maximum	10		6		10	

Market outlets

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Where do you sell your honeybee products?						
Trader	35	48.6	31	64.6	66	55.0

Village	39	54.2	23	47.9	62	51.7
Collector	13	18.1	12	25.0	25	20.8
Wholesaler	5	6.9	2	4.2	7	5.8
Community	7	9.7	-	-	7	5.8
None	3	4.2	2	4.2	5	4.2
Total	72	100.0	48	100.0	120	100.0

Current prices honeybee products

	Project Areas	Non-Project Areas	Total
Current prices of honeybee products			
Hive (kg)			
n	30	4	34
Mean	1.5	1.7	1.5
Median	1.5	1.5	1.5
Minimum	0.8	1.3	0.8
Maximum	2.5	2.5	2.5
Honey head (kg)			
n	44	14	58
Mean	4.4	3.8	4.3
Median	4.2	4	4
Minimum	1.3	2	1.3
Maximum	10	5	10
Honey (Liters)			
n	64	33	97
Mean	5.5	4.6	5.2
Median	5	5	5
Minimum	2	2	2
Maximum	11.3	8.7	11.3
Brood (kg)			
n	22	0	22
Mean	1.5	-	1.5
Median	1.3	-	1.3
Minimum	0.6	-	0.6
Maximum	4.5	-	4.5
Wax (kg)			
n	33	6	39
Mean	6.8	5.7	6.6
Median	5	5.5	5
Minimum	5	5	5
Maximum	15	7.3	15

Earnings comparison from honeybee livelihood activities

	Project Areas	Non-Project Areas	Total
Earnings from honeybee livelihood activities from the previous season/year (US\$)			
n	69	46	115
Mean	59.2	48.2	54.8
Median	37.5	34	37.5
Minimum	5	4	4
Maximum	375	218	375
Earnings from honeybee livelihood activities from this season/year (US\$)			
n	69	46	115
Mean	33.9	16.9	27.1
Median	20	11.5	15
Minimum	0	0	0
Maximum	250	75	250

Species and rank in volume of bee harvested

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Honeybee species found in the study area						
Khmom Thom (SN)	72	100.0	48	100.0	120	100.0
Khmom Plat (SN)	67	93.1	46	95.8	113	94.2
Pruit (SN)	47	65.3	28	58.3	75	62.5
Mroam (SN)	46	63.9	27	56.3	73	60.8
Khmom Kampok (SN)	20	27.8	8	16.7	28	23.3
Total	72	100.0	48	100.0	120	100.0
Mean rank of bee species according to the volume of honey products						
Khmom thom			1			
Khmom plat			2			
Pruit			3			
Khmom kampok			4			
Mroam			5			

Volume against time comparison

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Honeybee products at most of abundant						
Before Year 2000	7	9.8	2	4.2	9	7.4
Year 2000-2005	20	27.9	7	14.7	27	22.6
Year 2006-2009	45	62.5	39	81.3	84	70.0
Total	72	100.0	48	100.0	120	100.0

Harvesting practices

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Honeybee harvesting practices						
Opportunistic/chance harvesting	50	71.4	34	70.8	84	71.2
Mark the tree and harvest when the hive matures	38	54.3	22	45.8	60	50.8
Rafter beekeeping	23	32.9	5	10.4	28	23.7
Total	70	100.0	48	100.0	118	100.0
Actual methods of harvesting honeybees in the wild						
Use smoke	69	98.6	48	100.0	117	99.2
Use fire to kill the bees	6	8.6	2	4.2	8	6.8
Remove the nest when collecting honey	3	4.3	-	-	3	2.5
Remove only the honey head	2	2.9	-	-	2	1.7
Total	70	100.0	48	100.0	118	100.0
What is the most accepted practice of ownership of wild honeybee colonies?						
Open access	39	55.7	30	62.5	69	58.5
Marking rights	47	67.1	20	41.7	67	56.8
Group/ informal ownership	4	5.7	-	-	4	3.4
Community/Formal control	2	2.9	1	2.1	3	2.5
Total	70	100.0	48	100.0	118	100.0

Harvest areas

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Location of harvesting areas						
In the community protected area	46	65.7	27	56.3	73	61.9
Both in protected area and outside of the community	16	22.9	11	22.9	27	22.9
Outside the community	8	11.4	10	20.8	18	15.3
Total	70	100.0	48	100.0	118	100.0

Number and roles of persons involved in harvesting

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
How many persons are involved in harvesting of wild honey?						
Two persons	30	42.9	25	52.1	55	46.6
Three persons	17	24.3	8	16.7	25	21.2
One person	13	18.6	9	18.8	22	18.6
Five persons	7	10.0	3	6.3	10	8.5
Four persons	3	4.3	3	6.3	6	5.1
Total	70	100.0	48	100.0	118	100.0
Role of persons involved in harvesting						
Hunter/ Spotter	66	94.3	48	100.0	114	96.6

Climber	64	91.4	47	97.9	111	94.1
Smoker	58	82.9	40	83.3	98	83.1
Porter	49	70.0	42	87.5	91	77.1
Total	70	100.0	48	100.0	118	100.0

Types, number of rafters, and rate of occupancy

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%

What kind / types of rafter do you install?

Two pole rafter	25	78.1	8	72.7	33	76.7
Two pieces of wood that resembles the letter "r"	8	25.0	2	18.2	10	23.3
Natural tree branch wiped with bees wax	2	6.3	1	9.1	3	7.0
Total	32	100.0	11	100.0	43	100.0

How many rafters have you installed/ owned at present?

n	32	7	39
Mean	18.9	9.9	17.3
Median	15	10	13
Minimum	3	5	3
Maximum	60	20	60

How many of your rafters are occupied in one season?

n	30	7	37
Mean	7	5.1	6.6
Median	5	3	5
Minimum	1	2	1
Maximum	40	15	40

Rafter beekeeping harvesting practices

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%

Methods of harvesting of rafter honeybees?

Use smoke	32	100.0	11	100.0	43	100.0
Use protective clothing or nets when harvesting	1	3.1	-	-	1	2.3
Remove only the honey head	1	3.1	-	-	1	2.3
Total	32	100.0	11	100.0	43	100.0

What are the honeybee species that colonize your rafters?

Khmom Thom (SN)	31	96.9	11	100.0	42	97.7
Khmom Plat (SN)	7	21.9	-	-	7	16.3
Total	32	100.0	11	100.0	43	100.0

Estimated average number of households involved in honeybee livelihood activities in the study area

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Number of household involves in honeybee activities in the community						
n	71		48		119	

Mean	22.6	21.8	22.3
Median	20	15	20
Minimum	3	5	3
Maximum	100	70	100

Beneficiaries of USAID

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Is your household is beneficiary of USAID, MSME/DAI honeybee livelihood assistance project?						
Yes	20	27.8	-	-	20	16.7
No	52	72.2	48	100.0	100	83.3
Total	72	100.0	48	100.0	120	100.0
Training were provided by USAID MSME/DAI						
Installing rafter	19	95.0	-	-	19	95.0
Ways of harvesting honeybee products	1	5.0	-	-	1	5.0
Total	20	100.0	-	-	20	100.0

Number of households involved in honeybee activities in your each community (Maximum)

Commune	Village	Maximum # of HHs involved in honeybee activities			Total # HH*	% HH
		Project Areas	Non-Project Areas	Total		
Andong Tek	Tameak	21	-	21	161	13.0
Dang Peng	Prang	70	-	70	144	48.6
	Prah Ang Keo	100	-	100	380	26.3
Srae Ambel	Chamkar Kroam	50	-	50	138	36.2
Kandoal	Pralean	-	30	30	336	8.9
	Thnong	-	60	60	102	58.8
	Ta Kan	-	23	23	157	14.6
	Kandoal	-	10	10	113	8.8
Chrouy Svay	Chrouy S.Lech	-	70	70	163	42.9
	Chrouy S.Ket	-	60	60	144	41.7
Total		241	253	494	1,838	26.9

*Commune Database 2008

Volume of harvest per household collected this season/year (Median)

	Village	Hive (Kg)	Honey Head (Kg)	Honey (L)	Brood (Kg)	Wax (Kg)
Project Areas	Tameak	8.0	5.0	3.0	7.5	2.0
	Prang	8.0	10.0	8.0	5.0	0.8
	Prah Ang Keo	20.0	20.0	15.0	9.0	3.0
	Chamkar Kroam	7.0	5.0	5.5	10.0	1.0
Non-Project Areas	Pralean	5.0	3.0	2.0	6.0	1.0
	Thnong	4.0	5.0	3.0	4.0	0.3
	Ta Kan	12.0	5.0	7.0	30.0	1.5

	Kandoal	-	-	10.0	8.0	-
	Chrouy S.Lech	5.0	2.0	2.0	2.5	0.5
	Chrouy S.Ket	5.0	4.0	4.0	-	0.5
Total		74.0	59.0	59.5	82.0	10.6

Current (Median) prices of honeybee products

		Hive (Kg)	Honey Head (Kg)	Honey (L)	Brood (Kg)	Wax (Kg)
Project Areas	Ta Meak	2.5	4.0	6.0	-	-
	Prang	1.2	4.0	6.0	1.2	5.0
	Prah Ang Keo	1.3	4.5	5.5	1.1	5.0
	Chamkar Kroam	1.2	3.6	4.0	1.3	5.0
Non-Project Areas	Pralean	-	2.5	7.5	10.0	6.2
	Thnong	1.5	2.5	12.0	9.8	6.1
	Ta Kan	1.0	3.5	10.5	-	5.0
	Kandaol	-	-	12.0	-	-
	Chrouy S. Lech	-	4.0	9.0	-	-
	Chrouy S. Ket	1.2	4.5	5.5	5.0	4.4

Estimated volume based on maximum HHs involved x Median volume by village

	Village	Hive (Kg)	Honey Head (Kg)	Honey (L)	Brood (Kg)	Wax (Kg)
Project Areas	Tameak	168.0	105.0	63.0	157.5	42.0
	Prang	560.0	700.0	560.0	350.0	52.5
	Prah Ang Keo	2,000.0	2,000.0	1,500.0	900.0	300.0
	Chamkar Kroam	350.0	250.0	275.0	500.0	50.0
Non-Project Areas	Pralean	150.0	90.0	60.0	180.0	30.0
	Thnong	240.0	300.0	180.0	240.0	18.0
	Ta Kan	276.0	115.0	161.0	690.0	34.5
	Kandoal	-	-	100.0	80.0	-
	Chrouy S.Lech	350.0	140.0	140.0	175.0	35.0
	Chrouy S.Ket	300.0	240.0	240.0	-	30.0
Total		4,394.0	3,940.0	3,279.0	3,272.5	592.0

Biodiversity

Gathering of NTFP

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Types of NTFPs gathered by sample households?						
Honeybee	72	100.0	48	100.0	120	100.0
Firewood	60	83.3	38	79.2	98	81.7
Herbs/vegetables	45	62.5	33	68.8	78	65.0
Mushrooms	31	43.1	18	37.5	49	40.8
Animals	25	34.7	13	27.1	38	31.7
Birds	14	19.4	3	6.3	17	14.2

Fruit	1	1.4	-	-	1	.8
Total	72	100.0	48	100.0	120	100.0
How often does your household gather NTFP?						
Daily	9	12.5	1	2.1	10	8.3
Three time per week	34	47.2	21	43.8	55	45.8
Weekly	9	12.5	5	10.4	14	11.7
Two time per month	15	20.8	14	29.2	29	24.2
Monthly	4	5.6	7	14.6	11	9.2
Rarely	1	1.4	-	-	1	.8
Total	72	100.0	48	100.0	120	100.0

Observation and perception on the decrease of NTFP

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Have you observed a decrease in the volume of non-timber forest products that you gather?						
Yes	62	86.1	46	95.8	108	90.0
No	10	13.9	2	4.2	12	10.0
Total	72	100.0	48	100.0	120	100.0

Reason for decreasing in volume of NTFP

Logging	46	74.2	43	93.5	89	82.4
Land conversion into plantations	28	45.2	27	58.7	55	50.9
Increase in the population that has the same activities	25	40.3	5	10.9	30	27.8
Uncontrolled use of forest resource	16	25.8	4	8.7	20	18.5
Slash and burn farming	7	11.3	1	2.2	8	7.4
Total	62	100.0	46	100.0	108	100.0

Presence of CBOs and membership representation

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Is there a protected area network/organization in your community?						
Yes	66	91.7	42	87.5	108	90.0
No	6	8.3	6	12.5	12	10.0
Total	72	100.0	48	100.0	120	100.0

Member of Organizations

Villagers	47	71.2	36	85.7	83	76.9
Commune/village officers	49	74.2	26	61.9	75	69.4
Youths	12	18.2	7	16.7	19	17.6
Local government staff	10	15.2	7	16.7	17	15.7
Police	4	6.1	-	-	4	3.7
Women	4	6.1	-	-	4	3.7
Teachers	3	4.5	-	-	3	2.8
Monks	1	1.5	-	-	1	.9
Total	66	100.0	42	100.0	108	100.0

Knowledge and perception on forest biodiversity

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
What is the current state of forest biodiversity?						
High density	3	4.2	1	2.1	4	3.3
Medium density	18	25.0	-	-	18	15.0
Degraded	51	70.8	47	97.9	98	81.7
Total	72	100.0	48	100.0	120	100.0
Is he status of forest biodiversity stable or changing?						
Yes, stable	5	6.9	-	-	5	4.2
No, changing	67	93.1	48	100.0	115	95.8
Total	72	100.0	48	100.0	120	100.0
If the status is changing, what is direction of the change?						
Growing	3	4.5	1	2.1	4	3.5
Growing but now degrading	3	4.5	1	2.1	4	3.5
Degrading	52	77.6	44	91.7	96	83.5
Degrading but now growing	9	13.4	2	4.2	11	9.6
Total	67	100.0	48	100.0	115	100.0
Possible impacts of forest degradation						
Loss of sources of food	59	81.9	45	93.8	104	86.7
Loss of soil fertility	10	13.9	3	6.3	13	10.8
Loss of livelihood	64	88.9	41	85.4	105	87.5
Increased drought	19	26.4	6	12.5	25	20.8
Increased flood rate	14	19.4	3	6.3	17	14.2
Total	72	100.0	48	100.0	120	100.0

Tree species

	Project Areas		Non-Project Areas		Total	
	n	%	n	%	n	%
Tree species that bee colonize						
Doem Kra Nheob	19	26.4	6	12.5	25	20.8
Doem Koang Kang	35	48.6	33	68.8	68	56.7
Doem Bun	18	25.0	14	29.2	32	26.7
Doem Boes	42	58.3	24	50.0	66	55.0
Doem Chambak	38	52.8	24	50.0	62	51.7
Doem Chrey	18	25.0	14	29.2	32	26.7
Chheu Choir	10	13.9	6	12.5	16	13.3
Doem Ploang	17	23.6	7	14.6	24	20.0
Doem Khmer	7	9.7	3	6.3	10	8.3
Doem Tra Sek	34	47.2	26	54.2	60	50.0
Doem Phlea	3	4.2	-	-	3	2.5
Doem Thlok	10	13.9	-	-	10	8.3
Doem Kasya	1	1.4	-	-	1	.8
Doem Chompou Thma	1	1.4	-	-	1	.8
Doem Mdam	2	2.8	-	-	2	1.7

Doem Khmorng	2	2.8	1	2.1	3	2.5
Doem Smach	9	12.5	-	-	9	7.5
Doem Sé Morn	4	5.6	-	-	4	3.3
Doem Ambok	3	4.2	-	-	3	2.5
Mango Tree	2	2.8	-	-	2	1.7
Doem Trabek	1	1.4	-	-	1	.8
bomboo	1	1.4	-	-	1	.8
Deom Doh Krobei	1	1.4	-	-	1	.8
Doem Rompé	1	1.4	-	-	1	.8
Doem Pring	2	2.8	1	2.1	3	2.5
Deom Angkounhsva	3	4.2	-	-	3	2.5
Doem Kor	1	1.4	-	-	1	.8
Doem Sompea	1	1.4	1	2.1	2	1.7
Doem Yorng	3	4.2	-	-	3	2.5
Doem Chrey Kroem	1	1.4	-	-	1	.8
Doem Pratoang	1	1.4	-	-	1	.8
Doem Rangris	1	1.4	-	-	1	.8
Deom Kloam	1	1.4	-	-	1	.8
Doem Laboes	1	1.4	-	-	1	.8
Doem Koh	1	1.4	-	-	1	.8
Doem Rang	1	1.4	-	-	1	.8
Doem Kril	3	4.2	-	-	3	2.5
Doem Plaeng	1	1.4	-	-	1	.8
Doem Kansaeang	1	1.4	-	-	1	.8
Doem Smach Doam	2	2.8	-	-	2	1.7
Kann Te	1	1.4	-	-	1	.8
Chheu Das	2	2.8	2	4.2	4	3.3
Doem pong Kdor Chhnous	1	1.4	-	-	1	.8
Doem Popea	-	-	1	2.1	1	.8
Doem Ros	-	-	1	2.1	1	.8
Doem Bien	-	-	1	2.1	1	.8
Doem Sak	1	1.4	1	2.1	2	1.7
Total	72	100.0	48	100.0	120	100.0

Overall Indicators for Each MSME2 Value Chain

Wild honeybee	Producer	Trader	Honey group	Processor (CEDAC)
Investments				
Total investment value	-	-	585.00	-
% change in investment value	-	-	-	-
Volume of production & value of sales	-	-	-	-
Total volume of production (honey in liters)	2,398.00	900.00	300.00	300.00
Total value of sales	12,949.20	3,960.00	2,739.00	4,431.00
Total volume of production (wax)	444.50	-	-	-
Total value of sales	2,222.50	3,960.00	3,652.00	-
Over-all total value of sales	15,171.70	3,960.00	2,739.00	4,431.00
% change in volume of sales	-	-	-	-

% change in value of sales	-	-	-	-
Costs of business	-	-	-	-
Total cost of production	-	3,420.00	2,621.00	3,852.00
Gross profit/income	-	-	-	-
Gross profit/income	15,171.70	540.00	831.00	579.00
% change in gross profit/inc.	-	-	-	-
Employment	-	-	-	-
Family-total ft equiv jobs	-	-	-	-
Hired-total ft equiv jobs	-	-	4.00	2.00
Family-total pt equiv jobs	241.00	-	-	-
Family-total pt equiv jobs	241.00	-	-	-
Number of ft equiv jobs created	-	-	-	-

Annex 3 FGD Attendance Sheet

Location: Prang village, Dang Peng Commune, Srae Ambel District, Koh Kong Province

Date: 19/06/2009

Name	Gender (M/F)	Role in honeybee Industry/community	Name of village	Contact number
Mek Houll	M	Hunter	Prang	
Sok Leng	M	Hunter	Chamka Kroum	016 410793
Heng Ben	M	Hunter	Chamka Kroum	
Chum Pov	M	Hunter	Chamka Kroum	015 675379
Heng Brounj	M	Hunter	Chamka Kroum	016 710680
Sor Vutthey	M	Hunter	Chamka Kroum	016 330180
Kun Kum	M	Hunter	Chhruoy Svay Lich	
Rean Run	M	Hunter	Chhruoy Svay Kert	
Seav Ryn	M	Hunter	Chhruoy Svay Kert	
They Teoun	M	Hunter	Prang	
Chean Pech	M	Hunter	Prang	
Chum Louk	M	Hunter	Prang	
Heng Neoun	M	Processor	Prang	016 520940
Chhorn Chhan	M	Hunter	Prang	
Bav Koen	M	Vet	Prang	
Reoung Sok	M	Teacher	Prang	
Pheng Chan	M	Village Chief	Prang	016 458055
Ben Echapito	M	DAI	Prang	
Duk Phen	M	DAI	Prang	012 983523
Ponreag Phoung	M	DAI	Prang	016 593777
Tith Sareoun	M	Commune council member	Prang	015 518163
Yean Mein	M	Chief of bee community	Prang	099 654766
Seng Bough	M	Hunter	Prang	
Ly Muong	M	Member of community	Prang	
Kuon Kuy	M	Hunter	Prang	
Chean Sophat	M	Hunter	Prang	
York Uong	M	Hunter	Prang	
Pech Sary	M	Community council member	Prang	017 491608
Sok Vet	M	Hunter	Prang	
Sok Lan	M	Hunter	Prang	
Sok Mao	M	Hunter	Prang	
Sok Kov	M	Hunter	Prang	

Location: Top Chheang Forestry Community, Dang Peng Commune, Srae Ambel District, Koh Kong Province

Date: 20/06/2009

Name	Gender (M/F)	Role in honeybee Industry/community	Name of village
Seang Vuon	M		Preah Ang Keo
Thet Neit	M	Krobey Bank	Preah Ang Keo
Long Thek	M	Member of Community	Preah Ang Keo
Earng Ban	M	Member	Preah Ang Keo
Chang Sorosney	M	Member	Preah Ang Keo
Tes Yem	F	Committe	Preah Ang Keo
Long Suorn	F	Member	Preah Ang Keo

Ma Sai	F	Committe	Preah Ang Keo
Sang Krouy	F	Member	Preah Ang Keo
Chhorn Ruorn	F	Member	Preah Ang Keo
Ty Bay	F	Member	Preah Ang Keo
Nov Sokhea	M	Member	Preah Ang Keo
Ban Sarorn	F	Member	Preah Ang Keo
Meas Chuorn	M	Member	Preah Ang Keo

Location: Tameak village, Andong Terk Commune, Botum Sakor District, Koh Kong Province

Date: 21/06/2009

Name	Gender (M/F)	Role in honeybee Industry/community	Name of village	Contact number
Thorng Heang	M	Hunter	Ta Meak	
Num Seang	M	Hunter	Ta Meak	
Uon Kim	M	Hunter	Ta Meak	
Din Chem	M	Hunter	Ta Meak	
Morm Lajn	M	Hunter	Ta Meak	
Ly Hong	M	Hunter	Ta Meak	
Hang Sothea	M	Hunter	Ta Meak	011 950731
So Samnang	M	Hunter	Ta Meak	016 703326
Neam Thuok	M	Hunter	Ta Meak	
Nuon San	M	Hunter	Ta Meak	016 763235
Tou Ek	M	Hunter	Ta Meak	
Chhay Key	M	Hunter	Ta Meak	
Ouch Chhorn	M	Member of Community	Ta Meak	
Rin Neat	F	Member of Community	Ta Meak	011 692843
Kuon Yung	F	Member of Community	Ta Meak	015 643241
Sean Sopat	M	Member of Community	Ta Meak	016 256218
Seng Noeun	M	Hunter	Ta Meak	015 548001
So Rat	M	Hunter	Ta Meak	016 380775

Location: Chhrouy Svay Lich village, Srae Ambel Commune, Srae Ambel District, Koh Kong Province

Date: 22/06/2009

Name	Gender (M/F)	Role in honeybee Industry/community	Name of village
Ang Pey	M	Hunter	Chhruoy Svay Lich
Sok Kemry	M	Hunter	Chhruoy Svay Lich
Suo Tha	M	Hunter	Chhruoy Svay Lich
Keng Kean	M	Hunter	Chhruoy Svay Lich
Kuon Kun	M	Hunter	Chhruoy Svay Lich
Soun Jhon	M	Hunter	Chhruoy Svay Lich
Le Sey	F	Member of commune	Chhruoy Svay Lich
Peb Cheaun	M	Village Chief	Chhruoy Svay Kert
Py Sameaun	M	Village Chief	Chhruoy Svay Kert
Sok San	M	Hunter	Chhruoy Svay Kert

Location: Pro Lean village, Andong Terk Commune, Botum Sakor District, Koh Kong Province

Date: 19/06/2009

Name	Gender (M/F)	Role in honeybee Industry/community	Name of village	Contact number
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In Meng	M	Village Chief	Pro Lean	085 293541
Yen Chuon	M	Hunter	Pro Lean	
Huot Kev	M	Hunter	Pro Lean	
Min They	M	Hunter	Pro Lean	
In Mai	M	Hunter	Pro Lean	
Seng Sok	M	Hunter	Pro Lean	
In Nget	M	Hunter	Pro Lean	
In Mom	F	Hunter	Pro Lean	
Sam Chhav	F	Assistant of village chief	Pro Lean	
Seang Brujn	M	Hunter	Pro Lean	
Tong KuCh	M	Hunter	Pro Lean	
In Kit	M	Hunter	Pro Lean	
Heoung Hean	M	Hunter	Pro Lean	