



# Indigenous and Local Knowledge about Pollination and Pollinators associated with Food Production



- ▶ **Outcomes from the Global Dialogue Workshop  
1–5 December 2014 • Panama**
- ▶ **Edited by P. Lyver, E. Perez, M. Carneiro da  
Cunha and M. Roué**
- ▶ **Organized by IPBES and the Task Force on  
Indigenous and Local Knowledge Systems**
- ▶ **Support from USDA, Smithsonian Tropical  
Research Institute, FAO and UNESCO**



# Indigenous and Local Knowledge about Pollination and Pollinators associated with Food Production

Outcomes from the Global Dialogue Workshop

► Edited by:

P. Lyver, E. Perez, M. Carneiro da Cunha and M. Roué

► Organized by the:

Task Force on Indigenous and Local Knowledge Systems  
Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES)

► in collaboration with the:

IPBES Expert Group for the Assessment on Pollination and Pollinators associated with Food Production

► with support from

United States Department of Agriculture  
Smithsonian Tropical Research Institute  
Food and Agriculture Organization  
United Nations Educational, Scientific and Cultural Organization

► 1–5 December 2014 • Smithsonian Tropical Resource Institute • Panama City, Panama



Published in 2015 by the United Nations Educational, Scientific and Cultural Organization, 7, place de Fontenoy, 75352 Paris 07 SP, France

Organized by the IPBES Task Force on Indigenous and Local Knowledge Systems (ILK) – sub-group for the pollination assessment:

Phil Lyver  
Edgar Perez  
Manuela Carneiro da Cunha  
Ro Hill  
Alfred Oteng-Yeboah  
Marie Roué  
Randy Thaman

In collaboration with the following members of the IPBES Expert Group for the Pollination Assessment:

Vera Imperatriz Fonseca (co-chair)  
Sara Jo Breslow  
Damayanti Buchori  
Maria del Coro Arizmendi  
Mary Gikungu  
Dino Martins

With support from:

D. Nakashima, S. Heckler and J. Rubis, UNESCO, Technical Support Unit for the IPBES Task Force on Indigenous and Local Knowledge  
H. Ngo, Technical Support for the IPBES Expert Group for the Thematic Assessment on Pollination and Pollinators associated with  
Food Production

N. Azzu, Food and Agriculture Organization of the United Nations (FAO)

© UNESCO 2015

SC-2015/WS/13



This publication is available in Open Access under the Attribution-ShareAlike 3.0 IGO (CC-BY-SA 3.0 IGO) license (<http://creativecommons.org/licenses/by-sa/3.0/igo/>). By using the content of this publication, the users accept to be bound by the terms of use of the UNESCO Open Access Repository (<http://www.unesco.org/open-access/terms-use-ccbysa-en>).

The present license applies exclusively to the text content of the publication. For the use of any material not clearly identified as belonging to UNESCO, prior permission shall be requested from: [publication.copyright@unesco.org](mailto:publication.copyright@unesco.org) or UNESCO Publishing, 7, place de Fontenoy, 75352 Paris 07 SP France.

The designations employed and the presentation of material throughout this publication do not imply the expression of any opinion whatsoever on the part of UNESCO concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The ideas and opinions expressed in this publication are those of the authors; they are not necessarily those of UNESCO and do not commit the Organization.

Cover photo: Morguefile

Graphic and cover design, typeset: Julia Cheftel

Illustrations: Nicolas César, Valentinus Heri, James (Tahae) Doherty, Kirituia Tumarae-Teka and Jeronimo Kahn Villas-Boas

Edited by: K. Galloway McLean

Printed by: UNESCO

Printed in Paris, France

To be cited as:

Lyver, P., E. Perez, M. Carneiro da Cunha and M. Roué (eds.). 2015. *Indigenous and Local Knowledge about Pollination and Pollinators associated with Food Production: Outcomes from the Global Dialogue Workshop (Panama 1-5 December 2014)*. UNESCO: Paris.

# Table of Contents

Introduction	5
--------------	---

## **PART I – Proceedings of the Global Dialogue on Indigenous and Local Knowledge about Pollination and Pollinators associated with Food Production** \_\_\_\_\_ **7**

I.1 Indonesian forest communities: Indigenous and local knowledge of pollination and pollinators associated with food production _____	8
<i>Nicolas Césard and Valentinus Heri</i>	
I.2 Ogiek peoples of Kenya: Indigenous and local knowledge of pollination and pollinators associated with food production _____	18
<i>John Samorai Lengoisa</i>	
I.3 Tūhoe Tuawhenua (Māori, New Zealand) knowledge of pollination and pollinators associated with food production _____	27
<i>James (Tahae) Doherty and Kirituia Tumarae-Teka</i>	
I.4 Guna peoples of Panama: Indigenous and local knowledge about pollination and pollinators associated with food production _____	38
<i>Belisario López, Florina López Miro, Atencio López &amp; Elmer Enrico Gonzalez López</i>	
I.5 Indigenous knowledge systems and social-environmental management of pollination and pollinators in the Xingu Indigenous Park, Brazilian Amazon ____	46
<i>Simone Athayde</i>	
I.6 The Kawaiweté people’s traditional knowledge about bees: Xingu Park, Brazil __	55
<i>Jeronimo Kahn Villas-Boas</i>	
I.7 Conservation of the local Black Honeybee ( <i>Apis mellifera mellifera</i> ) and maintenance of traditional beekeeping practices in Cévennes, France _____	73
<i>Carole Pierlovisi</i>	
I.8 From nature to culture, to crises, and back: a reflection on ontological and epistemological aspects of indigenous and academic knowledge systems related to bees _____	76
<i>Julio López and Simone Athayde</i>	
I.9 Indigenous peoples’ and local communities’ valuation and values regarding pollinators: a Mayan perspective _____	80
<i>Edgar Perez</i>	

**PART II – Report on the Outcomes of the Global Dialogue  
Workshop \_\_\_\_\_ 91**

II.1. Background \_\_\_\_\_ 92

II.2. Global Call for Submissions on ILK about pollination and pollinators \_\_\_\_\_ 93

II.3. The Global Dialogue Workshop \_\_\_\_\_ 94

II.4. Organization of the Workshop to facilitate ILK-Science dialogues \_\_\_\_\_ 95

II.5. Lessons Learned for Building ILK into IPBES Assessments \_\_\_\_\_ 97

Annex 1 – Agenda of the Global Dialogue Workshop \_\_\_\_\_ 98

Annex 2 – List of Participants \_\_\_\_\_ 102

# Introduction

The Intergovernmental Platform for Biodiversity and Ecosystem Services (IPBES) includes as one of its operating principles the following commitment:

*Recognize and respect the contribution of indigenous and local knowledge to the conservation and sustainable use of biodiversity and ecosystems.*

UNEP/IPBES.MI/2/9, Appendix 1, para. 2 (d)

This operating principle embeds the recognition of and respect for indigenous and local knowledge in all aspects of IPBES, including in the scientific and technical functions of the IPBES Multidisciplinary Expert Panel (MEP):

*Explore ways and means to bring different knowledge systems, including indigenous knowledge systems, into the science-policy interface.*

UNEP/IPBES.MI/2/9, Appendix 1, para. 15 (g)

To spearhead its work on this challenging objective, IPBES Plenary created at its Second Meeting a task force on indigenous and local knowledge systems (ILK).

The present document is a contribution of the IPBES task force on ILK to the IPBES assessment on Pollination and Pollinators associated with Food Production. Its aim is twofold:

- ▶ To assist the co-chairs, coordinating lead authors and lead authors of the Pollination Assessment by facilitating their access to indigenous and local knowledge relevant to the assessment theme.
- ▶ To pilot the initial approaches and procedures for building ILK into IPBES assessments that are under development by the ILK task force in order to test their efficacy and improve the final ILK approaches and procedures that the task force will propose to the Plenary of IPBES.

To meet these two objectives in the framework of the pollination assessment, the task force on ILK implemented a step-wise process including:

- ▶ A global call for submissions on ILK related to pollination and pollinators associated with food production;
- ▶ A selection of the most relevant submissions from ILK holders and experts;
- ▶ Organization of a Global Dialogue Workshop (Panama, 1-4 December 2014) to bring together the selected ILK holders/experts with a co-chair and several authors of the IPBES assessment report;
- ▶ Development of proceedings from the Global Dialogue workshop in Panama that provide a compendium of relevant ILK for authors to consider, alongside ILK available from the scientific and grey literature, when drafting the pollination assessment report; and
- ▶ Organisation of local follow-up work sessions by the selected ILK holders/experts in order to work with their communities to address additional questions and gaps identified with authors at the Panama workshop.

The Proceedings from the Global Dialogue Workshop held in Panama is presented in Part I. They include a series of case studies provided by ILK holders and experts, and based on indigenous and local knowledge from Brazil, Indonesia, Kenya, New Zealand and Panama. Presented and discussed with a pollination assessment co-chair and authors at the Panama workshop, these case

studies have been further reinforced with ILK from the local meetings organized by ILK holders and experts as follow-up to the workshop. Local follow-up meetings were organized for all of the case studies, except the one from Brazil. However, in the latter case, it was possible to commission supplementary information on the ILK of the Kawaiwete peoples of Xingu, Brazil, and these are also included in the Proceedings. Similarly, as follow-up to the Panama workshop, the local knowledge of a traditional beekeeper from Cevennes in the south of France also diversifies the content and regional scope of the Proceedings. Finally, several task force members and ILK experts who participated in the Global Dialogue Workshop in Panama contributed reflections and analyses that complement and enrich the specific case study materials. These contributions are also included as part of the Proceedings.

The Proceedings from the Global Dialogue Workshop in Panama and its various follow-up meetings, interviews and reflections, provide a compendium of ILK about pollination and pollinators associated with food production that would not otherwise be available to the authors of the pollination assessment. This compendium complements the body of ILK on pollination that the authors are able to access from the scientific and grey literature.

Part II of the present document provides a report by the ILK task force on the piloting of its preliminary ILK approaches and procedures in the framework of the pollination assessment. In addition to a description of each of the steps in the piloting process, it also provides some preliminary lessons learned and recommendations on how to improve the approaches and procedures in subsequent assessments. This report, and an initial draft of the Proceedings, was provided to the IPBES Plenary at its Third Meeting (Bonn, 12-17 January 2015) as Annex 3 of the information document IPBES/3/INF/2.

# PART I



Proceedings of the Global  
Dialogue on Indigenous  
and Local Knowledge about  
Pollination and Pollinators  
associated with Food Production

# 1. Indonesian forest communities: Indigenous and local knowledge of pollination and pollinators associated with food production

NICOLAS CÉSARD<sup>a</sup> AND VALENTINUS HERI<sup>b</sup>

with information from Bapak-bapak Adi Purwoko, Eman Sulaeman, Hamsah, Ramli, Rio Bertoni, Sahali, Sari'i and Tolip

a. UMR 7206 Éco-anthropologie et Ethnobiologie, Muséum National d'Histoire Naturelle, Site du Musée de l'Homme, 17 place du Trocadéro, 75116 Paris, France

b. Executive Director of Riak Bumi Foundation, Jalan Dr. Wahidin Sudirohusodo, Komplek Batara Indah I Block DD No. 18 Pontianak, West Kalimantan, Indonesia

## 1.1. Background – one honeybee species, four regions

The Asian giant bee, *Apis dorsata*, is one of the largest species of the genus *Apis*. The colonies build nests in the open air, hanging underneath the branches of large trees, on rock cliffs, or sometimes buildings. Their nest is formed by a single vertical comb which can reach one to two meters long and a meter and half in height. Colonies are gregarious and one can find more than a hundred nests on the same site. The colony contains one single queen and several males during the breeding season. A single comb can contain up to 10,000 workers grouped in several layers on its surface. The species is known to collectors for its aggressiveness and the high mobility of its swarms. Indeed, colonies often migrate, either according to the season, blooms or disruptions that they may face. Bees then abandon their nest and can fly for several kilometres in search of new food sources. It was observed that after several months or even a year or two, bee colonies return to settle on the same branches of the same tree.

In Indonesia, as elsewhere in South and Southeast Asia, the vast majority of combs are collected on branches by climbers specialized in their collection. These honey gatherers or hunters are more or less regular in their activities according to the number and frequency of seasons, site accessibility or their motives for collecting combs. All take significant risks by going to harvest honey in nests that are often difficult to access. Collectors are not roped and accidents are not uncommon. In Indonesia, some small social groups, most of them composed of honey tree collectors, have developed a form of management of *Apis dorsata* colonies. This is the case in particular on the islands of Bangka-Belitung and in the Sentarum lake region in West Kalimantan. This technique known as the “rafter” technique consists of setting up on the ground or at ground level a slightly inclined support, a hardwood plank (called *tikung*) in Sentarum lake or a tree trunk in Belitung (called *sunggau*), under which the bees establish their colony by building their single-comb nest. The installation and location facilitate the arrival of the bees at the time of their migrations and allow for regular and secure harvests. The technique is directly inspired by the habit of bees to

nest beneath branches and recreates the ecological niche sought by colonies. Combined with detailed knowledge of the species' life cycle and biology (see also Roué et al. 2015) and strong social regulations, the technique allows for a simple but effective beekeeping.

The information compiled here comes from ongoing research work (Nicolas Césard in Bangka-Belitung and Sentarum Lake; Valentinus Heri in Sentarum Lake). They reflect the views of the respondents but rest solely with their authors. Following the meeting in Panama, we organized a discussion seminar on the island of Belitung, Indonesia. We asked eight honey collectors/harvesters from four regions in Indonesia (Banten, Belitung, Riau, Sentarum Lake) to share their knowledge and also integrated them into the text. The four sites introduced are the following:

- ▶ **Banten.** Created in 2009, the Association of Ujung Kulon forest honey harvesters (*Kelompok Tani Madu Hutan Ujung Kulon* or KTMHUK) includes collectors from four villages along the Ujung Kulon National Park (UKNP). The park is located at the western end of the island of Java in the Banten province (district of Pandeglang). Its area is 1,206km<sup>2</sup> (of which 443km<sup>2</sup> is offshore). Collectors are Sundanese Banten (*Sunda Banten*).
- ▶ **Belitung.** Belitung is an island in the Java Sea southeast of the islands of Sumatra and Bangka. With a land area of 4800km<sup>2</sup> it was initially covered by lowland tropical forest but since the development of the palm oil industry in 1992 over half of its surface is covered with plantations. The majority of the inhabitants are Belitung Malays (*Melayu Belitung*) living from fishing and agriculture. Honey harvesting is practiced in many villages.
- ▶ **Riau.** The Tesso Nilo National Park (TNNP) is located in Riau province in the island of Sumatra. Designated as a protected area by the Indonesian government in 2004, its original area of 385 km<sup>2</sup> was extended to 850 km<sup>2</sup> in 2009. The park suffers numerous encroachments from illegal loggers and settlers who clear the park for crops and palm oil plantations, as well as village sites. Since 2009, a local association of forest honey collectors (*Asosiasi Petani Madu Hutan Tesso Nilo* or APMTN) manages harvesting activities (with the help of the WWF). More than 280 trees hosting bee swarms have been listed. Collectors are Riau Malays (*Melayu Riau*).
- ▶ **Sentarum Lake.** Located in West Kalimantan (Borneo), the Danau Sentarum National Park (DSNP) covers an area of approximately 1320km<sup>2</sup> hectares of lakes, rainforests and periodically flooded forests. The park has 39 permanent or seasonal villages. The majority of the population is Kalimantan Malays (*Melayu Kapuas Hulu*) whose main activity is fishing. Almost 10% of the population is composed of Dayak groups, mainly Iban (*Dayak Iban*) whose activity is mainly agriculture, then hunting and gathering of forest products and fishing. Since 1996, most of the region's honey harvesters have joined together in an association (*Asosiasi Periau Danau Sentarum* or APDS).

## 1.2. Value of insect pollinators and of their food source

In Indonesia, knowledge related to the foraging activities of bees and to their interactions with flowers (more than to the process of pollination itself) is fundamental to the organization of forest honey harvesting activities, i.e. honey hunting and beekeeping. Forest collectors have comprehensive knowledge of various bee species, especially the one they observe in their regular practices and use for wax or honey. They give names to bees, to their offspring and to their products, and distinguish honeybees from other bees, including more solitary species. The Asian giant honeybee is the most harvested bee species and the most well-known, even if honey from stingless bees and from *Apis cerana* and from *Apis florea* can also be collected in several regions of the archipelago (mainly from the wild). Honey collectors regularly observe the evolution of their nest, the honeybee activities on the comb, their trips and foraging behaviour on flowers. As with bees and in relation to them, collectors are also attentive to flowers and to their development. In

the four regions, people have developed a good understanding of blooms and flowers producing nectar and pollen. This knowledge, however, may be different from one social group to the other and from one individual to another. Most of the time, knowledge on flowers and flowering periods allows harvesters to prepare for the coming of the honeybee swarms and once the bees have settled on a site to predict at what the time to harvest honey. Honey collectors associate the main migrations of the giant Asian honeybee colonies to their nesting sites to seasonal massive blooms, an ecological phenomenon (known in the scientific literature as General Flowering events) in which most trees of most tree species flower simultaneously at more or less random times of year.

Flowerings constitute the main indicator to harvest honey and although harvesters know approximately from one year to another which trees will bloom and when (by experience but also by watching the buds before they start to bloom), they can hardly predict the abundance of flowers and the duration of the blooming. Plant species harvested by bees change from one region to another and often vary within the same geographical area, in particular depending on the abundance of tree species. Some flowering periods and honey seasons last for months since various tree species bloom one after the other. In other areas, most trees bloom massively during a short period of time and the honey-harvesting period is limited to a few months. In Riau (Tesso Nilo National Park), collectors report that bees find flowers to forage all year around and that a careful harvester (one, as we will see, who do not use smoke) can collect honey almost every month. They observe that *rengas* (*Gluta velutina*), *kuras* (*Ostodes paniculata*) and *laban* (*Vitex pinnata*) trees are among the most productive and some trees bloom twice in a year. Flowers are not the only source of nectar, since bees also collect honeydew from acacia leaves (*Acacia mangium*) in the early morning. In Banten, Ujung Kulon NP, the collection of honey is more seasonal. It usually starts in May with the *salam* (*Syzygium polyanthum*) trees, and lasts a few months. The collectors know that trees bloom during the dry season and that depending on its length and of sites (forest or coastal areas) flowers will change every month until the start of the next rainy season.

In the four regions, bee swarms are known to arrive with blooms and follow their seasonality. Most collectors distinguish tree species producing mainly pollen from those producing nectar (and not certain flowers of the same tree species). They believe that bee swarms come for the nectar source but once they have arrived, they collect pollen first from various sources while waiting for the nectar flowers to open. In Borneo (Danau Sentarum NP), rainfalls almost continuously fill the region's lakes, with the exception of a short period between June and August during which they dry out, some completely. This seasonality has great consequences for the vegetation and for the fauna. The end of the dry season is followed from December to February by a rise in water level, which leads to bud induction and to massive and successive blooms. This period is vital to the honeybees and sees the arrival of numerous colonies. (Collectors also observe bird migrations. They know that the *cincin apai* bird comes to nest when the lakes dry out and that the newborns are ready to fly once the water rises). In the flooded forests then, many species of tree are flowering of which around 20 species are important for honey production such as the *masung* (*Syzygium claviflora*) and the *tahun* (*Carallia bracteata*) trees (see Mulder et al. 2000). Further west, on the island of Belitung, the type of honey harvested also change depending on areas and periods of the year. Collectors report that in the coastal forests, dominated by small-sized trees, the *gelam* tree (*Melaleuca leucadendron*) is prized by honeybees for its nectar and the *jemang* (*Rhodomyia cinera*) and the *betor* (*Calophyllum pulcherrimum*) trees for their pollen. In the island's interior, the bitter honey of the pelawan trees (*Tristania obovata* and *T. whiteana*) is the most sought after.

The regularity of the main flowerings allows harvesters to anticipate the arrival of the swarms and to prepare themselves to harvest the nests. In the lake region of Sentarum, colonies arrive from the surrounding hills in December and settle first on the tall trees (*lalau* or *tapang*) on which their combs are collected. Then, several tree species in the flooded forests come into bloom and the swarms move on low vegetation where they find the honey planks (*tikung*) already set up. In the village of Leboyan, in the southern part, the bees come for the *tahun* flowers, then for those of *putat* (*Barringtonia acutangula*), before moving to *kawi* and *tembesu* flowers. To prepare for the bees in Tesso Nilo NP, like in Sentarum Lake, the base of the large trees where the colonies nest (the tree is called *sialang*) are

cleared of small and fast growing vegetation and metal sheets are installed around the tree trunk to prevent bears from climbing. On Belitung Island, the colonies migrate regularly, especially when the main flowerings approach. According to the harvesters, some swarms come from the island's interior while others migrate from more distant regions like from the coasts of Sumatra and Borneo (those come specially for the *gelam* flowerings and build bigger combs than local swarms). As in Sentarum Lake, the harvesters prepare themselves for the bee arrival: between two blooms, they change the most damaged honey trunks (*sunggau*), build new structures, and clean and prepare the sites by cutting the unwanted trees and branches. When flowers bud, they know that the swarms will look for the best locations. They have observed that the swarm stays on a tree first, from which it sends some scout bees to check if the branch or the structure is suitable for the colony to nest.

Whereas the placing of honey planks and tree trunks relies predominantly on ecological observations which we will not explain in detail here, the harvesting of honey requires the harvesters to understand the development of the comb on the support, and also the bee lifecycle and their interactions with flowers. On nesting sites, and when the distance allows it, harvesters regularly observe the bees' comings and goings and their activities on the comb. Belitung harvesters then notice that the bees stay on their nest during rainy days (and consume their pollen and honey stocks) and that they visit flowers during moonlit nights. Most of the observations are done on the honey planks or trunks taking place around the comb or on its surface, often at ground level, and several indications enable harvesters to know when the honey harvesting can take place. Honey collectors combine several signs that they have observed during previous harvestings. Those include pre-harvesting indications on the comb occupied by bees, and also post-harvesting indications once the colony has been smoked and the wax cells and the brood are visible.

In Belitung, like in the Sentarum lake region, harvesters are paying attention first to blossoms. They know that the swarms arrive when the buds open (*nungkul* in Belitung language), but also that they will leave again soon after the end of the flowering periods. The harvesters rely on the general observation that once flowers are faded (they said once "dry up") bees do not seek nectar anymore and the cells on the comb containing honey are sealed. More precise observations depend on flower species. In the flooded forests of Sentarum Lake, the harvesters are attentive to wilting and to colour change (the *tahun* flowers are known to change gradually from white to red), as well as to the falling of petals in the river (when the *putat* petals fall comes the time to harvest). Likewise, when harvest approaches, direct observation of the comb gives several indications which confirm its development. By regularly viewing the occupied comb in profile Belitung harvesters can deduce the replacement of the pollen by honey on the superior part of the comb, bees expanding the alveoli as they fill them up with honey. At distance again, they observe the bee activity on and around the comb: when worker bees do not move on the pollen cells and that they fly less back and forth, they know that bees do not produce honey anymore and that their stocks of pollen are getting depleted. Bees do not leave their nest in mass to defecate and change position on the surface layer of the comb as they use to do everyday (this periodic flight is called *ngerunsai*).

Some flowerings are short and some harvesters have noticed that those blooms are insufficient for the colony to fully develop. The colony produces new bees, but is living on limited stocks of pollen and honey. Also, the comb is not overcrowded with old and new bees. In the absence of new flowers, harvesters know that bees will swarm to better locations (known in the literature as non-reproductive swarming), according to harvesters some of which may be in neighbouring areas, others may be in far more distant regions. Other flowerings can last longer and the colony has plenty of time to reach maturity ("to grow old" as collectors say). This is the case with the geographically localized *gelam* trees in the south of Belitung, whose flowering period can last two months, or even three in certain areas. Colonies are taking advantage of the abundance of the floral resources available to produce queen cells (a frequent observation in Belitung), and eventually mate and start up new colonies (known as reproductive swarming). Most harvesters did not actually see the scission of the colony, but consider the accumulation of bees on the lowest part of the comb as their last chance to collect honey. Then, if the harvesters can hardly predict the abundance of blooms and their duration (they say because of changing weather conditions), they know how the bees behave during flowerings, the fact in



particular that the bees swarm quickly at the end of short flowering, but also that they can stay on the comb and rebuild their stocks of pollen and honey if more flowers appear in the next days.

In Belitung, the most experienced individuals harvest honey at least one week after the arrival of the swarm (for those who want to harvest quickly), and always a bit before the last flowers of a bloom died. They also have observed that when a flowering lasts (the ongoing one or another one), a second harvest can take place two weeks, and sometimes three weeks, after the bees are settled. The harvest being based on the observation that bees come and go with flowers, the harvesters hurry to intervene since they know that the colony in absence of new flowers is going to deplete its pollen to feed its larvae and to consume its honey to prepare for swarming. They know from experience that without a new flowering the bees will stay only a few days on the comb before leaving. The most conservative action (to obtain a maximum of honey) is then to anticipate the colony departure by proceeding quickly to the harvest. To do so, harvesters smoke the bees (photo below), then take the honey at the extremity of the comb and cut the brood (which is often eaten raw or cooked back home). The situation changes if other flowerings are coming: harvesters know that if they take the honey from the comb, but leave behind the pollen and the brood, they can proceed to a second harvest, and even a third, since the “bees” (note: here the queen) lay eggs again and wait until most larvae change into adult insects to swarm.



Smoking the comb in rafter beekeeping, Belitung, Indonesia, December 2011

Collectors follow flowerings and most of them have a good knowledge of the bee development on the comb and inside the cells. However sometimes it seems easier to count the days once the blooms have started and the bees have settled. In Ujung Kulon NP, the honey season lasts a few months and nests are harvested once they are encountered during collecting expeditions in the forest. Collectors acknowledge that they cannot wait too long for the bees to develop. Once a seasonal blooming starts, they wait two weeks before looking for honey to harvest (even if they know that the larvae still need more days to grow). In Tesso Nilo NP, harvesters have made the choice of taking advantage of the abundance of flowers all year around. They made several samples to determine when to collect and have collectively decided not to harvest before 24 days, 33 days being the ideal time for honey quality (they have noticed that water content is not too high). Harvesters now leave the pollen on the comb so the bees feed their larvae, continue to develop and produce more honey

every month. In general, harvesting honey too fast appears counter-productive, especially when bees are still looking for flowers. According to one collector in Belitung, to avoid honey and pollen being mixed up during extraction and decreasing honey quality, it is always better not to harvest honey when bees are still foraging for pollen. This is unfortunately the case when bees collect flowers producing nectar bloom before those producing pollen.

### 1.3. Non-economic value of insect pollinators and of their products

In the four regions, most collectors harvest honey regularly for sale. Collectors have various methods to reach branches or access combs. In Sentarum Lake, swarms nest on tall trees (honey or bee trees) called *lalau* by the Malay collectors (trees such as *rengas* (*Gluta reinghas*); *tempurau* (*Dipterocarpus gracilis*), and *ran* (*Dipterocarpus tempehes*)) and known as *tapang* by their Iban neighbors (trees mainly from the genus *Koompassia*, *K. malaccensis* or *K. excelsa*, often stand up alone on the hills surrounding the lakes). Harvests take place during moonless nights. One or two days before, collectors meet to build up the ladder that allows them to climb along the trunk. In Sentarum Lake, collectors use two techniques. The first (*jantak*) is to plant every two or three meters bamboo stakes in the trunk and to tie them up with rattan to the ladder. The second one (*pakau*) consists of banding with rattan the ladder around the *sialang* trunk and to fasten wood steps to it, a last method favoured by those who want to preserve the tree. In Tesso Nilo NP, to avoid rebuild the ladder at each harvest, large iron nails are hammered in the *sialang* trunks to make them easier to climb. Collectors also report that since a few years they harvest the nests during the day, protected by mask, gloves and thick clothing. In Ujung Kulon NP, harvest still takes place during night-time. Collectors use a technique they name *sigay rambat*: the collector climbs a more accessible tree in the vicinity of the tree to collect (the harvested tree is called *piodengeun*) and from there throw a rattan rope on the first branches. The climber uses then bamboos to build a rudimentary bridge (*rambat*) to the tree (an ancient harvesting practice which is found also in Borneo and in Palawan).

Once in the tree, the harvesting technique varies little. Collectors want to proceed quickly to harvest the highest number of nests and take advantage of darkness. One or two collectors climb the ladder and once on the first branch start to smoke the colonies using a plant torch (made with the dried roots of *jabai*, *Ficus microcarpa* in Sentarum Lake). When the tree is occupied by several colonies, collectors begin by the highest branches before coming down to the lowest one. Sitting astride the branch, the collector progresses while smoking the surface of the comb with the top of his torch. The majority of bees fly (some will settle on the branches above), but many fall incandescent to the ground (collectors say they follow embers as if it were gold). At the end of the branch, the last comb smoked is the first to be harvested. The climber asks for the collection basket and it is hoisted with a rope. Using a knife (traditionally made of wood, see below) the climber cuts the honey cells and brood (in the four regions, collectors tend now to leave pollen and brood for the next harvest). The collector moves to another branch and the basket is lowered. It is then taken care of by the collectors staying on the ground. The harvest is often teamwork between climbers and collectors below. If at least two people are required (one at the top and the other at the bottom), more than twenty people can participate in the harvest of the trees that host the most nests (over a hundred colonies). In Sentarum Lake, collectors are relatives and each has rights on the *lalau*. Honey is shared between the climber (who takes half) and the heirs. In Ujung Kulon NP, honey or money from its sale is shared equally with the different people participating in the collection.

In Sentarum Lake, the honey planks or *tikung* are placed in the emergent foliage of trees, often facing the hills. The trees are accessible by boat through a small access channel in the forest. As told by the elders, the origin of the planks refers to the observation of a swarm installed under a branch stuck between two trees after a flood. In Belitung, *sunggau* are built in lowland forests near rivers or in mangroves. Occasionally, the collectors also collect combs on various trees (known locally as *sambit*)



they encounter in the forest. Honey trunks are changed regularly (every three or four years) whereas honey planks made preferably of *tembesu* wood (*Fragraea fragrans*) are frequently displaced and can last thirty to forty years. The harvesting method on planks and trunks is not different from large trees, and tools used are the same. In Sentarum Lake the collection takes place at night, but more and more beekeepers try to harvest during the day to allow the bees to rebuild their nest. In Belitung, beekeepers harvest during daytime with a bark smoker (*nyamu*) made of dry branches and fresh leaves which produce abundant smoke. Unlike tall trees, planks and trunks do not always attract swarms. In Sentarum Lake, collectors give an average occupancy rate of one in five in season. In Belitung, harvesters acknowledge that it depends more on blooms and individual expertise: *sunggau* occupancy ranges from one to four (for experienced beekeepers) or one to eight (for those less experienced).

Access to trees as collection sites, but also more broadly the use of natural resources inside a delimited territory, is managed by local rules and/or by customary law. In Sentarum Lake and Tesso Nilo NP, trees belong to old families of collectors. Some harvest them each year, others less often and end up selling their trees to other collectors or for timber or construction lumber. The trees most regularly harvested are maintained: the ground at their base and their branches are cleaned to facilitate the collection, but also for the swarms to settle more easily. In Sentarum Lake, some trees were donated by the local sultan to fisherman families several generations ago (note: some still possess a copy of the document), in return for a tax at each harvest (on wax and honey); other trees, less majestic, have owners but have been harvested since more recently. In general, a tree that hosts a bee swarm for the first time belongs to the person who harvests it, so long as he shows in the future that he takes care of the tree (by some marks or signs). Some owners of a young *lalau* tree, for instance, may try to facilitate its growth by separating it from other trees. In Tesso Nilo NP, if trees are collected for a long time, the regular harvests and the sale of honey have increased their monetary value. In Ujung Kulon, the collected trees do not have owners and anyone can collect the combs from year to year. In the forest, collectors share out between themselves the most suitable sites that they go exploring in small groups of five or six. In Belitung, the first person who comes across a settled swarm in forest owns it and has the (customary) obligation to harvest it (or give the right to someone else to not upset Siti Fatimah, see below). He must mark the location and signal his intention to its neighbours and to the customary authority. Once the comb is collected, the rule applies again the following season.

As for trees and their owners, trunks and honey planks belong to those who build them. In Belitung, as in the lake region of Sentarum, beekeepers report to their neighbours the new locations, sometimes located a short distance from each other. The rule is not to build too close to a structure that does not belong to us, or replace a trunk or a plank of a site because it looks abandoned. Beekeepers often reconstruct the structures in the same location where they have attracted a swarm. In Belitung, the best locations are maintained throughout the year and must meet several criteria. Beekeepers ensure in particular that the trunks are strong enough to support the weight of a comb and vegetation around allows the passage of bees or do not mind the development of the comb (e.g. a branch that strikes the comb). Beekeepers come mostly from the same village and honey thefts are rare. Permission to harvest honey was given to the owner of a *sunggau* (by Siti Fatimah, see below) and a thief will have his belly swollen for his act. An aggrieved owner may use black magic or ask for a customary sanction. In Sentarum Lake, rules and practices concern specific areas and *tikung* owner groups. Areas and groups are called *periau* and correspond to lowland forest areas (flooded in season) limited by rivers and lakes. Formerly attributed by the local authority, sections in each *periau* where *tikung* are installed are family owned and are divided among heirs. Honey planks are marked with notches that allow the various owners to recognize them. Harvesters report several usage rules, e.g. installation of a minimum of *tikung* (25 *tikung* for instance in Leboyan *periau*), the ban on the use of *medang* wood (*Litsea* sp.), obligation to put all its *tikung* in one *periau*, leave an adequate distance between structures (from 10 to 15 meters), and inform the head of the area of the number and location of its *tikung*.

The collectors find that the sites (branches like rafters) are occupied by swarms from one season to another, an observation that makes them say that the bees return to the same location. In Belitung, elders think that bees return to the sites where they were born, hence the need to leave

the first generation (note: the first larvae being laid on the comb, the highest ones) to hatch and to develop into adult insects. If the collectors are looking for new sites, most return on trees previously collected and maintain the sites for the bees to find the exact conditions that saw them coming (or will make them to come back). In all four regions, honeybees are seen as free and mobile resources that one must strive to preserve (as well as their habitat) once they choose a location. In Tesso Nilo NP, as in Sentarum Lake, a story recalls that before choosing a tree, a few bees (the queen bee in TNNP) go down from the branch to the base of the trunk to ask the spirit of the tree if he is strong enough to support them, and if that is the case, the authorization to install their colony in his branch. While swarms are just passing at each new bloom, it is for collectors to appease the spirits of the large trees that annually attract and retain them. In Sentarum Lake, climbers sing mantras at different stages of the collection. When the scale is ready, they welcome its strength. Once on the branch, while smoking the bees, they sing again to appease the spirit of the tree, and when cutting the comb, they welcome the upcoming harvest. Once honey is harvested, they ask their ancestors to protect the basket in its descent. One last song marks the end of the harvest, the final descent of the climbers and the return to the village. Part of the lyrics is improvised, not without humour (often as honey alludes to a beautiful young woman and to her charms) (Mulder et al. 2000). Several myths evoke the mean tricks of the tree spirit, guardian of swarms. In Tesso Nilo NP, as in Ujung Kulon NP, the use of a wooden knife (*suntit* in TSNP, *baliung* in UJNP, *beladau* in DSNP) can be explained by the ban on the use of iron and iron tools (such as knife) on the top of honey tree and goes back to the story of a climber dismembered by the spirit of the tree. In Ujung Kulon NP, when the climber goes up, a collector remains at the foot of the tree to ensure that a spirit does not follow behind.

In Sentarum Lake, the small trees in which honey planks are attached require no singing, neither mantra, to protect the beekeeper. In Belitung, however, where spirits are everywhere, the use of natural resources (terrestrial and aquatic) within a territory is supported by custom (*adat*) and the village authority (the *dukun kampung*) who acts as an intermediary between villagers and the local spirits. The *dukun* function is to ensure the understanding of his community with the spirits, but also the abundance of resources and their proper use by the group. At an annual ceremony (known as *meras tahun*), he welcomes (economic) resources (those from gardens, but also those from forests and rivers) and never forgets to ask flowers in number for beekeepers. When flowers are there, the *dukun* gives the start of the harvest and prepare the offerings (*jampi*) to spirits. He also intervenes at the request of villagers to repair faults and to restore harmony: after a theft, or when the blooms started but the bees do not come or honey production is limited. In the forest, the collectors are likely to encounter spirits. To ensure their safety, they should thank them and inform them of their intention to cut a tree or take honey. Before building the first *sunggau* of the year, it is customary to ask permission (*kesalan*) to the village *dukun* (and to the spirits). The *dukun* then makes a *jampi* (or activates the one that collectors bring him) and gives to collectors a mantra that they will read in the forest while burning a piece of incense (agar wood usually). In Belitung, mantras as well as customary regulations differ among villages. A popular mantra to drive away the spirit of a tree claims that the trunk one is about to cut belongs to Siti Fatimah and that she shall eat the wax from it (note: Siti Fatimah is the origin of the first *sunggau*, bees feed on her sweat to make honey). Some collectors use private mantras, often inherited ones, to calm bees and avoid stings. Collectors report that in the past *dukun* were more powerful and a village *dukun* could force the swarms installed on another territory to come on his own.

Collectors from the four regions highlight the close relations linking bees to trees and trees to bees. In Ujung Kulon NP in particular, a story relates that bees came from Sumatra after a local mage, Ki Nangkoda, talked to them and made them swear not to damage the trees in the area. More broadly, collectors recognize their own role in the collection of forest resources and highlight the importance of maintaining relationships and appropriate behaviours in their activities. The respect for both trees and bees are reminded through individual and customary rules whose purpose are to maintain balance, but also to satisfy everyone's interests (of spirits, men and bees) and allow bees to come back. In Belitung, beekeepers apologize to the bees before harvesting and ask them not to blame them.

Some say that they develop a relationship of trust with the colony. After smoking out, they use their hands to push the bees from the comb (a collector notices that bees recognize the most caring and gentle beekeepers and do not sting them). Likewise, custom has made patience a virtue. To build and set a honey trunk takes work and the results are random and often do not meet expectations. Beekeepers often try several locations before attracting a swarm. Once the bee swarm is settled, custom in Belitung recommends waiting for the right time to harvest to ensure a sufficient amount of honey but also to allow the colony to grow. The rule is not to take honey before the onset of the first royal cell (*jubel*) (note: and thus allow the bees to swarm and possibly reproduce). A respectful collector will be rewarded in turn by bees (through Siti Fatimah) at a future harvest (note: by the return of the swarm and an abundant production). At the end of blooms, custom recommends taking the brood, since larvae without honey cannot survive, and not to leave out larvae but to eat them.

#### 1.4. Changes affecting insect pollinators and their products

A giant honeybee nest produces on average of six kilos of honey and of half a kilo of wax. Honey had in the past no commercial value and was consumed locally. In all four regions, collectors harvested combs mainly for wax. Honey was consumed on the spot between collectors or brought home. In Sentarum Lake, it was used by the Malays to preserve fish (stored in jars) and to treat minor wounds. The wax being valued, collectors were waiting for the *lalau* and *tikung* combs to be well developed to cut them. They then took the whole comb. The wax was boiled and filtered to form blocks, which were then sold. Until today, the Dayak Iban use local wax to lubricate the threads used in traditional weaving. In Belitung, the *sunggau* were also collected for their wax combs (until the 1950s). Honey was consumed locally or discarded. In the mid-1980s, the price of honey increased to the same price as wax. Honey got expensive from 2009. In 2014, a 250 ml bottle was sold US\$5 by beekeepers and sold back approximately US\$10 in the district capital by the merchants. The quality and preservation of honey is however limited by its extraction process (manual squeezing of the comb). In Sentarum Lake, families exchanged wax with Chinese traders for various goods (salt, tobacco, etc.). Wax was exported, but also sought in Java for its use in the manufacture of batik. The price of honey followed the price of sugar and was very low then. In 1994, a project to develop marketing of honey and wax (to make candles) was initiated with beekeepers. The *tikung* harvesting technique was adapted to allow several harvests (by taking the honey head only and leaving some honey for the bees to reconstruct their stocks). Honey processing was improved with the abandonment of hand squeezing, the practice of filtering, and the use of clean tools and containers. Based on *periau* organization, a local association of beekeepers was created to maintain fixed prices and quality production. Honey is being sold today at seven times more than twenty years ago (US\$10 per kilo), many villagers practice beekeeping (also outside the park boundaries), and even the collection of trees is becoming selective (collectors tend now to leave brood and pollen on the branch).

Three of the four regions (with the exception of Belitung beekeepers who are less organized) have joined the Indonesian Forest Honey Network (*Jaringan Madu Hutan Indonesia*, or JMHI). The JMHI (and its partners) strives to offer honey harvested in a sustainable way (for bees) and quality honey (DSNP honey was the first forest honey in Indonesia to get organic certification). The task is not easy given that forest honey still has the image of a poor quality honey (often processed with water and sugar). Since 2009, the honey harvested by the Sentarum Lake association of beekeepers (APDS) is transported to Pontianak, the capital of the province, before being sent to Jakarta by air-conditioned container where it is filtered again and dehumidified (the degree of humidity being lowered from around 27% to 21%). After processing, the honey is packaged and sold about US\$65 per kilo (mainly in the domestic market). In Tesso Nilo NP, honey collectors are independent and well organized. Their honey production is important and regular (annual potential is estimated at 50 tonnes). Honey is sent to Jakarta, but also to Malaysia to be conditioned. Since 2004, collectors do not collect brood and note that bees come more often on trees. By their own initiative, they harvest honey during the day and no longer smoke the nests to prevent bees absconding. The

association is planting fruit trees in degraded forest areas in the hope of attracting new swarms. In Ujung Kulon NP, honey collectors have created an association and since 2010 have integrated the JMHI. Production is still variable (25 tonnes in 2012, 3 tonnes in 2013).

In Indonesia, natural forest lands decrease to make way for plantations and agriculture. A reality that JMHI shares although many of its members are located in protected areas. In Tesso Nilo NP, a forest company is adjacent to the park, but some *sialang* are on the company concession and collectors have had to negotiate with them to gain access to their trees. Harvesters in Sentarum Lake report that smoke coming from the deforestation of plantations has a direct impact on the arrival of the swarms in season and therefore on honey production (for the years 1997, 1998 and 1999 in particular). Several oil palm plantations were opened in the buffer zone around the lakes since 2004 limiting bee forage areas (18 concessions in total have been granted by the government of the Upper Kapuas regency). Added to this is the fear of the chemicals use in the plantations and transported to the lakes. On Belitung Island, forests are shrinking and are replaced by mines and recently old palm plantations (39 concessions today). Beekeepers have to find other locations and build *sunggau* inside more limited forested areas. Several abandon honey harvesting after the loss of their sites. For lack of forests in their territory, several villages have no more beekeepers working. More broadly, collectors and beekeepers from all regions emphasize the randomness of honey production from one year to the next.

On the contrary, classification as protected area has not only advantages for collectors. In Ujung Kulon NP, the collection is not well received by the park authorities and collectors must negotiate their access with the various administrations. Collectors emphasize that the disappearance of sites is accompanied by a loss of expertise. Whereas in Ujung Kulon NP, young and old are still learning together, in Sentarum Lake experienced climbers are fewer (Iban now call on Malays to harvest *tapang* trees) and few know the songs. Some climbers however try to transmit their knowledge (from father to son usually). The new honey economy also arouses keen interest. In Belitung, in some villages where custom is less strong, beekeepers report theft (harvests done without the consent of their owner). Worried about losing honey from their *sunggau*, some prefer to harvest rapidly (depriving bees of the honey they still need for their development) even though they know that by waiting a bit longer they could get more honey. This is also the case in Ujung Kulon NP where, for fear of losing their chance, those who discover a tree immediately harvest the honey.



Participants of the follow-up meeting during field trip, Belitung, Indonesia, 11 February 2015

## Supporting references

- Césard, N.** 2015. *Les Fermiers du miel. Apicollecte et apiculture à Belitung, Indonésie*. 38 min. SMM CNRS MNHN ([www.canal-u.tv/video/smm/les\\_fermiers\\_du\\_miel\\_apicollecte\\_et\\_apiculture\\_a\\_belitung\\_indonesie.17039](http://www.canal-u.tv/video/smm/les_fermiers_du_miel_apicollecte_et_apiculture_a_belitung_indonesie.17039)).
- Mulder, V., Heri, V. and Wickham, T.** 2000. Traditional honey and wax collection with *Apis dorsata* in the upper Kapuas lake region, west Kalimantan. *Borneo Research Bulletin*. 31:246–260.
- Roué, M., Battesti, V., Césard, N. and Simenel, R.** 2015. Ethnoecology of pollination and pollinators, *Revue d'ethnoécologie* 7 (<http://ethnoecologie.revues.org/2229>)

## 2. Ogiek peoples of Kenya: Indigenous and local knowledge of pollination and pollinators associated with food production

JOHN SAMORAI LENGOISA<sup>a</sup>

*Compiled with support from Marie Roué and Doug Nakashima*

a. Ogiek Peoples Development Program, Nakuru, Kenya

### 2.1. Introduction

The Ogiek are traditional forest dwellers that occupy the highlands of Kenya in the region known today as the Mau Forest. We identify with the forest and are its caretakers. Homes are made without using large pieces of wood, but only branches and twigs. Traditional livelihoods were based on hunting and gathering, eating wild fruits and roots and hunting birds, gazelle, hyrax and other animals. Bees were central to Ogiek culture. Indeed, honey and bees defined everything: as food, medicine, alcoholic beverage, trade good, and even a means to get married. Bees and forest were essential to the Ogiek. This tie was “so clear, so nice”.

We used to gather wild honey – and were not beekeeping or using log hives. Our people were living in most of the highlands and forests in Kenya, including Mount Kenya and Ngong Hills in Nairobi before we were displaced. Today the Ogiek community that depends on honey is making hives and hanging them in the forest, but still when they go to the forest they gather those that nest in the ground and those that nest in the trees. Harvesting and beekeeping go together.

We have three types of birds used as indicators – a honey guide (*kecheiyat*) that makes a noise and guides a honey hunter to a tree where there is honey, and an eagle (*wochewet*), which was used to predict luck in honey gathering. When it faces the hunter with its white breast the hunter knows he is to get lots of harvest, and when it shows its back this suggests that the hunting won't be successful. Another indicator bird has black and red colours; *merewet* (hau falcon) that is used to interpret seasons and migration of bees from sooywo to Mo-o (now Mau). When people go hunting they definitely use these birds.

Ogiek are a religious community. They make prayers. Because honey harvesting in some places was done late in the evening and early in the morning, they had to make a prayer that blessed the forest and asked god to give them honey and give them good eyes as they go through the valleys on their honey gathering. Some lines of the prayer read as follows:

## OGIEK PRAYER

<i>Tororo Ripe-ech,</i>	<i>god of the universe protect us</i>
<i>Konech Konye-eg</i>	<i>give us good sight (eyes)</i>
<i>Konyeg oop Samak</i>	<i>sight to help us in honey gathering</i>
<i>Konech panda nimocheysel</i>	<i>give us a safe path(s) in the forest</i>
<i>Tororo Konech Konye-eg op koriron</i>	<i>god of the universe give us sight in the morning,</i>
<i>Ripwech timtonyon</i>	<i>protect our forest</i>
<i>Emenyon nepo Tirap</i>	<i>our rich land of tirap</i>
<i>Tirap, Tirap nemi tegeltit</i>	<i>tirap tirap where there is tegeltit [valued trees found in the Tirap forest]</i>
<i>Emetop sasaondet</i>	<i>the land of sasaondet [type of tree]</i>
<i>Emenyon nepo setyot</i>	<i>the land of setyot [type of tree]</i>
<i>Emenyon Mo-o netepes</i>	<i>our expansive land of Mo-o [now Mau]</i>
<i>Tororo konech logog</i>	<i>god give us a generation of children</i>
<i>Konech komeg</i>	<i>give us honey</i>
<i>Konech konyegap ongweg</i>	<i>give us eyes to see in the valleys in the forest</i>
<i>Ripwech mosotig, poponik, murguywet</i>	<i>protect our trees (mosotig, poponik...)</i>
<i>Ripwech moingonigchog po mogonjog</i>	<i>protect our hives of hardwood/cedar</i>
<i>Konech keldop kugo nimokinochiy</i>	<i>give us the footstep of our forefathers that had success</i>
<i>Tororo rip kotop ogiot</i>	<i>god protect the house of ogiot</i>
<i>Tororo tomoyon KOTOP SOGOT</i>	<i>god bless our house of leaves</i>
<i>Sere! Sere! Sere! Sere!</i>	<i>Let it be well! Let it be well! Let it be well! [The word 'sere' depicts overall goodness]</i>

## 2.2. Seasonal migration of bees and people

During the dry season we expect the bees to migrate to cooler regions – and the communities move with them. People follow the bees. To understand this seasonal movement, you need to understand the landscape zones that are part of the Ogiek system of landscape use and management<sup>1</sup>.

<sup>1</sup> for more information, see Ogiek peoples' ancestral territories atlas at [ogiekatlas.net](http://ogiekatlas.net)



The Ogiek territory is divided among eighteen *kipkaita* (clans). Ogiek designated three main zones going from the lowlands to the highlands. Each clan had a territory extending across all three zones:

- ▶ **Suywo:** dry and lowland zone
- ▶ **Saapo:** middle ecological zone
- ▶ **Maoo:** highland zone

*Tirap* is the richest part of the highland zone, where you find huge old trees, an abundance of honey, and large animals to hunt. *Tirap* was often referred to in songs and prayers. The name was often repeated three times in sequence to underline its importance: *tirap, tirap, tirap*. These prayers and songs often ended with the invocation *sere, sere, sere* – a request to the spirits to bless *tirap*.

Some of our ecological areas are named after insects. *Logomo* means ‘the place of stingless bees that nest underground’. The entire area is known as *Logomo*. *Saapo* and *tirap* are the areas of white honey. But sometimes people come and try to change the place names. There were many songs to praise those zones. In December, people will harvest in *tirap*, and they will sing and celebrate this moment. Still today, beehives are placed deep in the forest in places where they will not be disturbed, where they will be tranquil, and near a water source for the bees.

Our life was honey gathering and hunting of animals across the zones. We used to follow bees when the bees migrated across these areas. When the bees migrate, then this area will be dry. Then the community would move to the next zone. Before they move they would make sure they had preserved enough food, and then they would have to move to the next zone. In every ecological zone, each clan had a storage site and storage structures called *kesungut*, a long log-like structure (like traditional log hives but longer) in which honey was stored made of cedar wood, as cedar does not decay. It was buried or raised above the ground, sometimes on a stand of double tripods, and left there for later use. *Kesungut* were respected by people; no-one was allowed to tamper with them.

Once the harvest season in a zone ended, some honey and roasted meat from wild game smeared with honey was stored in the *kesungut*. Honey was also a preservative for the meat. We were worried about the future, because we were never sure of how much food would be in another zone. If we had not enough honey when we were in another zone, we could go back to get some food (honey) from the *kesungut*. On the other hand, in a good year, one could accumulate a fair volume of honey across the zones so that when one arrived in the highest and generally most productive zone, it was possible to envisage ambitious goals such as paying bride price if one were to be married.

## 2.3. Honey and the Ogiek

### 2.3.1. Honey harvesting

When people are going to harvest in *tirap* they will sing. Once they get a bountiful harvest - there will be a lot of Ogiek celebrations. Because there is a lot of honey, there will be a lot of marriages.

Honey was also stored in caves because we had so many caves in this Eburu region. Now the caves are in the national park where we do not have any more access. We have still one cave, *Njoro river cave* but it is becoming a historic site and no longer a storage site.

We had different types of honey in different parts of the territory. In the lowlands, bees used to nest in *gepenoig/geringotinik* (cavities in rock cliffs or holes in rocky ground) or in *poonet* (cavities in

the trees). The lowland bees (*Segemik op sooywo*) are smaller, brown-coloured and sting a lot. The type of honey produced by the lowland bees was dark brown and bitter tasting. We also harvest from stingless bees, *Gosomea*, that nest underground and produce a liquid kind of honey that is usually medicinal. There are other bees that do not sting nesting cavities and hives producing honey, and we call them *pusecheeg*.

Now that we can only live in the highlands, we can no longer access the nesting areas of the lowland bees *Segemik op sooywo*. In the highlands there is only forest, no rocks. So here we get stingless bees, *Segemik op Mo-o*, that nest underground. Still other types of bees like the *torurut* nest in the trees and in tree cavities. They produce a good quantity of honey. The highland bees (*Segemik op sooywo*) are slimmer and have yellowish stripes. They are docile. The highland bees produce a yellowish to white honey which is sweet and highly-valued, and that people prefer. The colour of the honey lightened as we went to higher zones.

When harvesting honey there is a special plant (*kurongurik*, a moss-like plant) that is used to create smoke. It is not harmful to the bees but only makes them docile. The smoking mosses were carefully extinguished in order not to risk causing a forest fire. The culture of Ogiek never cut down the trees. They lived under tree canopies. There were also taboos that prohibited the cutting of certain trees, especially the *silibwet* (*Dowbeya goetzene*) trees, which were highly valued because they had a lot of flowers and provided food for bees. It was almost sacred, this tree.

### 2.3.2. Honey uses and values

Honey is highly valued – let me start from the eating of the brood. Harvesters knew when the time was right. When they realized there was brood, but no honey, then the brood was not eaten. If the brood was harvested, then it was given only to children and older people. It is usually milky. For old people it was to give them longer lives, and for children it helped them grow and improved their health. In my experience it works, because I was able to see my great-grandfather who lived in the forest with all the old ways.

Our honey has medicinal values. When children take medicine against infection, they need honey to mix with it. For a woman in childbirth, if she is experiencing pain, then a herbal treatment can be provided to increase contractions. Honey was added so she can take the treatment. I used to see treatments for the newborn from my grandmother: their whole alimentary canal had to be cleansed. Certain plants were boiled, and taken along with honey and given to the child. Honey was given to treat many problems.

Bee stings used to be sought after to help you be resistant to some infections. When boys are young they are encouraged to do harvesting – it hardened them because they had to get stung and get used to it – but once stung it was believed you would be healthy and survive most of the things. These days I still see the same happen.

Honey is used to welcome our leaders and is given to people that are honoured. I remember some senior government officials were given honey as a sign of honour. Today, for graduation, honey is given as a sign of honour.

Ogiek are known to be great herbalists who treat a lot of diseases. So a lot of people come to get our traditional medicines. That is how we can relate well with our neighbours. We have a good relationship with our Maasai, Kikuyu and Kipsigis neighbours because they come for our honey. In exchange, we receive livestock and grains such as maize, beans, sorghum and millet from the Kikuyu. The Maasai give us milk, animal skins, sheep or heifers in exchange for our honey.

The Maasai have been our long time neighbours because they used to occupy the plains, while we used to gather in rocky hills (now a national park). The Maasai referred to us as *Ndorobo*, ‘poor people’, because we did not have cattle (little did they know that we own millions of valuable bees in the vast forest highlands). The Ogiek have traditionally been a small group with small

families. A typical family would have a maximum of two children. The second child was only born when the first was old enough to go hunting. The small family size reduced pressure on the forest. When the Ogiek have not gathered enough food, the Maasai would hire us to graze their cattle. There were kinship ties between Maasai and Ogiek, and ties due to sharing names. Ogiek youth who have been hired to raise Maasai cattle, might be given a Maasai name. After working two years, they come back with a Maasai name. Because of the friendship we had, the Maasai would come for our honey and give us milk. The Maasai also believe that the Ogiek could offer blessings. We speak good things and our tongue is sweet.

People come to buy our honey because it is unique in its kind – white honey, yellow honey from stingless bees. It is a nice almost yellowish liquid and very sweet. Ogiek sell by the tin. The tin is priced at 2.5 or 3 dollars. They present tins labelled as weighing 2 kilos but in actual fact they may weigh more like 5 kilos. That why we are suffering now because a lot of people come for our honey. They order before we harvest, so once harvested, the honey is taken away.

The Ogiek are made up of sub-tribes, including *Tiepkereg*, *Mariashoni*, *Kaplelach* and *Kipchoig*. These are made up of 18 clans, each clan having a different animal (bird or insect) as their totems. These were animals to be cared for by the clan. One clan is assigned lizards and another, snakes. We have a clan called 'birds' and we have a clan that protects gazelles and wild dogs – animals that are in our zones. Only one clan is assigned a bee, a specific type of bee – not all the bees. The clan *kipasesei* (lizards) would never kill lizards. When they saw one, they would say 'an ancestor has visited us'. *Kiptiepoongoi* and *kapshoi* were the names of clans associated with specific birds (cranes). They take care of those birds and would not eat birds. We did not even eat chicken (especially the elders).

The same applied with most of the insects. Suppose an insect lands on you – you are not supposed to hit it or strike it, especially a bee. Just leave it and see it as a good omen, that you are probably going to be wealthy and other interpretations of that kind. When a bee alights on your right side, then we knew that a male visitor is likely to come. If it lands on the left side, it is a female visitor who is likely to come. That is why we don't eat or strike any insects.

### 2.3.3. Honey and bride price

In marriages, honey is important. When the couple is married, they are given hives.

The bride price is provided in honey. Bride price is always negotiated in terms of how many bags of honey – we have a special skin bag (*motoget*) that holds 10-15 kg of honey. So when the bride prices are negotiated, you bring a certain number of skin bags of honey (more than ten sometimes). The honey bag used in payment of bride price was the one made of waterbuck skin, *motoget op sing'oito*. A beehive also given as part of the bride prices – the beehive was big enough to have plenty of honey in all seasons and in which bees don't swarm.

But even before that negotiation, some other honey would have been spent. Some honey must have been involved that is not part of the bride price, because in every aspect of the procedure leading to marriage, honey is required and dispensed in various ways, whether in honey bags, calabashes of honey brew or in hives. During the negotiation – honey beer has to be there. When elders are discussing, where the couples are being blessed in a shrine – honey beer must be there.

The bride price varies depending on how the bride is viewed and how the family of the bride was approached. There is something like a booking or pre-arrangement – a girl would be reserved to be married. She would be tied by some beads on her hand or on her foot and now the two families would take care of her until she is the right age to get married. At the time of the marriage, the husband and his parents have to go to the bride's family. The receiving family is there with their large extended family and clan. It is not the parents who negotiate. The father of the bride would not be involved in the discussion because it is believed that the father is not

likely to negotiate. Instead he will invite his brothers from his clan. The father would be there to receive and distribute to his brothers what is received for the bride.

The couple-to-be will stand on a shrine that has been erected there. They will be blessed by being sprinkled with honey. Then they will be given presents, some of which could be honey. A special well-decorated skin would be given to the bride, made from the skin of the hyrax. After the wedding, she would walk to her husband's place. She has to carry a bag of honey and would get tired. Her husband walks along with her and encourages her when she is walking. To encourage her to walk faster, he promises to give her beehives.

A girl that passed through this process was more valuable than one who was kidnapped (because there was also kidnapping). For kidnapping, you would ask for more bags of honey because kidnapping a bride was considered a crime. For the one who kidnapped, there would be a fine. The family of the girl is notified, there are discussions, and then a fine, for instance 5 bags of honey. If you did not "book" a bride, you kidnap. If it was your intention to marry by kidnapping, then you had to send your parents to the bride's home to ask and solicit and make prayers that you be allowed to marry their daughter. The ones who are married a bit away from the way of booking have to pay more. Many bags may be asked for kidnapping. You are likely to be asked a lot – like to bring 10 bags each holding approximately 15 liters – you are being tested. If you are appreciated it would be normal. The honey bag used for paying bride price was a larger one made of waterbuck skin (*motoget*).

Marriage was a communal affair so it's not you or your family alone that pays. Members of your clan, those that come along, help you raise the number of bags. A hive can produce up to a maximum of 3 bags – not all of this was consumed. There was a portion that was stored during the time that you are in that zone. So you may accumulate a large stock of honey by the time you get to the highest third zone. You would stay 3-4 months in a zone before moving to the next. If there is not much food you may return to the previous zone for food. Honey is not to be stored for a long time because they go on to get supplements.

Honey is no longer as abundant as before. But today, you still need to provide some honey, at least one honey bag. Then honey bags can be substituted with something of equivalent value. Previously, hunting dogs were sometimes given as part of the bride price.

As much as there is done in clans, it is also individual. Everyone has a hive, can harvest and sell when they want. We are trying to be organized so as to harvest honey together and sell it together. The challenge for the market is the remoteness of our area. The available means of transport are very poor. The community is still very far from benefiting from modernity. In fact one of the villages is very much isolated and still living in the most indigenous and traditional manner: honey gathering, hunting, wearing traditional wear.

During dry spells, there was a special clan whose elders would lead a ceremony. They had special rituals – speaking to nature, the forest, the bees telling them certain things – to tell them to come to talk to them. It was as if we were speaking directly to bees – don't go too far, don't deny us food. And the same thing applied to the ancestors. Every time you were going somewhere, going to a forest believed to be dangerous, your parents would tell them your 'ancestor' would go with you (who was long dead) but it was believed his spirit would guard you and you would not be harmed. Then your ancestor would go with you and over time, I appreciated that.

We don't process honey. We are trying to melt honey from the combs by heating – we are not cooking honey. These days we are trying to adopt new methods, but then the honey will be placed in the bag and hung somewhere, and it will come out of the bag and collect somewhere. The combs would be removed and used for the beers. There is no heat used – it relies on gravity.

## 2.4. Responding to change

Many changes are taking place. Humans are unique, as is our community – we are gathering, looking for honey. But things have changed and one thing that has happened is that we started making hives. The Ogiek can no longer go in the lowlands because the lowlands have become Lake Nakuru National Park and are protected and fenced off. That is a major change. Our settlements have been displaced and where we are today, we no longer have the rocks where bees used to nest and make their honey. We can only get honey from hives.

The geographical areas where we practiced our traditions have been reduced. We are trying to find some effective means of continuing our practices in the forest. Customary rules are being reinforced. The traditional governance system (Ogiek council of elders) that sustains our life is being revitalized and has received official government recognition.

In Kenya, many changes relate to the reduction of the forest ecosystem. Before, our gathering used to happen in both lowlands and highlands. But today our gathering area has been reduced. In the lower part of the mountains, the forest has been de-gazetted and subdivided to establish settlements where people now do crop farming. This has reduced the extent of the forest and prevented us from accessing the land areas where we used to gather honey. The introduction of crop farming seriously affected our honey production since indigenous flowering plants have been destroyed, but over time, we had different views about the advantages and disadvantages. Some crops, such as maize, flower during August and September. When this happens, we can expect to harvest a lot of honey during December and January. We are seeing something different now. Hives can be hung in the settlements and in the forest.

Since my grandfather's time, around 1900, we have begun to use hives. Before that time we were hunting, and looking for bee nests and harvesting the honey. Ogiek know that once bees get into a hive it takes about 5 to 6 months to produce honey. They had that knowledge of time.

Ogiek people used to be nomadic. Now this is changing, from nomadic to sedentary life – because our hunting and gathering area was so big and now is so small. The only place left behind for us is the highland and forested area, the *Mau*. We can no longer go to the lowlands and cannot get access. Now we have to do beekeeping because of the sedentary lifestyle.

We tried to organize the people and give them modern hives but it wasn't well received. There are around four beekeeper self-help groups with hives in the area. But only one out of the four groups has managed to use modern hives. The others prefer the traditional log hives. They say it produces more honey. How can we help these people to continue their beekeeping in the traditional hives that they prefer? We could at least improve the honey quality in terms of processing and marketing. We have found that introducing a new practice with modern beehives is not well accepted. The people have their own unique understandings.

How can we react to changes so quickly? Over time we realize something is not right – we are trying to sincerely protect our culture. Many Ogiek think that they must have a hive. Ogiek have hives – probably a traditional one – and they have the artefacts associated with honey like a honey bag made of skin (*motoget*), a honey pot (*poleito*), and fire production tools (*piinet*). And other things you find in the bush because these people are not farmers.

In response to the changes and threats to the forest ecosystem, we have to sit down with the community to find a way to solve this. What we want is to manage the ecosystem because we are caretakers of the environment. We want to lead in the protection of our ancestral land. In 2010, a process has started and we developed a document vividly describing the Ogiek culture and traditions and structures, how we manage conflicts, how we describe plants. Now we are faced with the challenge of protected areas – where we have claims, we are making demands on the benefits arising from there. The government should not ignore us – we have rights in negotiations in ancestral land. We developed this Ogiek Biocultural Protocol (BCP) document

that has guidelines of conservation of ecosystems. We have written it down in a review process and hope to engage in lobby processes and take it to county assemblies and national government so that wherever Ogieks are, they are protected and everyone appreciates Ogiek communities.

In Mau Forest Complex there has been massive degradation. Ogiek were pushed out of the forest. The forest is shrinking every day. Definitely there was that threat of eviction but the people have engaged with the government. We managed to convince the government and got court injunctions, and we challenged the kind of settlement that was taking place there because it was highly politicized and not benefitting the intended recipients. The allocation went beyond the forest boundaries. In 2005, the government set up a Task Force called “Mau TF”, and the report which was read in parliament recommended that in line with conservation of forests, that the Ogiek should be protected. But unfortunately that report was shelved.

Ogiek people have been evicted, but the community as a whole hasn't been evicted. The Ogiek have nowhere else to go once evicted. We moved to the African Court on Human and Peoples' Rights, and in 2013 the court ruled that the Ogiek must not be evicted from their land in the Mau Forest. Now the ruling is ambiguous – we see many threats.

## 2.5. Bio-cultural diversity and pollinators

There are other types of insects that the Ogiek do not call *Segemik* (bees). They produce a yellowish or brown substance that is sweet; we call them *toruruogig*. Children look for them and, by breaking the branches of trees or bamboo where they find them, eat the sweet substance that they find there. But maybe we are not so keen on these other insects.

Birds we associate with some plants. Some are associated with shorter plants while others are associated with tall trees, for example *merewet* are found in high trees. Birds that are associated with wild fruits, they migrate. When they are present – we could tell what fruits would be present the following year, and we know them by local names. However, right now there is a shift in that certain birds are no longer there.

For wild berries, *nguluma* – we no longer have many types any more – one has berries in pods. Another fruit that used to be there but now is not there anymore, it is longer and yellowish. Their number is not there in the forest – Ogiek need to get it from someone else that has planted them, not naturally – and the birds that also fed on them you don't see them anymore.

## 2.6. Knowledge transmission

The bees were so significant to the Ogiek because inheriting a beehive is also inheriting those insects. My grandfather inherited his hives and passed them on. The tradition continues even today. We own the beehives of our grandparents. Whenever they go harvesting I will be asked to go and get my portion – as a clan member.

Learning is kind of in a circle – a circle of life. In our community we have experts – we call them experts because special people would be contacted to make bows and arrows – blacksmiths (*kipirgei*), and those who make beehives and are very well known for that, and again in the education of children from early age to adulthood – genders were different because girls were assigned to mothers and boys to their fathers. We had traditional teachers of both male and female known as *motirenik* who taught mostly initiates in their seclusions called *menjet*. They instilled discipline and cultural elements to the young persons. In Ogiek, most of the time the parents don't reside in the same house (still happening today). Most of the time the wife is in

the kitchen and the husband is in the other house “GOK” and when his friends come they will go there – and if they are almost at that stage stay in that house – but in that house now they get specific education about life. And girls will be educated in the other house.

At earlier ages girls interact with mothers, and after initiation boys can’t go to the kitchen – they will now be interacting with their age-mates and many other adults to continue with the life education. During initiations, it was an opportunity to learn about the culture – what to do in the forest, all the taboos are made clear, and what everyone was expected to do.

Things have changed – metaphoric words for instance. We are taught that now you will not be caned again by a stick – be prepared to shield an arrow or spear so you are going to be prepared for life – in some words that are not so direct. It used to be you were educated alone with friends and there were others that encouraged you to get to the crux of the words that are being said – “we teach the one who is born in the family while the one born out of the family is listening” to encourage the child of the family to pay attention to everything that is being taught – ensuring it is well understood.

We had songs that relayed information of all the knowledge about how to do care about the forest and ecosystem and prayers that it was necessary for us to know – because we survive on nature, we had to really pray to keep our friendship with the nature.

Today things are changing but we are still we go through the initiation stage – we are placed in forests in a seclusion period: boys in the forest not wearing clothes – wearing skin – at that time you now have to by the community rules (you put on the skin you live in the forest and engage with traditional teachers). We had traditional teachers who are called *motirenik* – respected persons in the community – you are not allowed to greet them until they greet you. Those are the people who understand the whole community very well and understand most aspects to teach us. They lead – they don’t teach us everything but they lead us to other people who can teach us. This is the time you are taught how to hunt bees properly – during that time you don’t carry many arrows – only two for testing – and if those two don’t work – you will be hit. So you have to be very careful and they must be very sharp. You are taught forest tactics – how to move.

There are many taboos that are said to us – it is like we are making a binding covenant – some agreements are made and if you to break them now you are likely to get some consequences. For example, stealing a beehive is wrong and if you do it – such and such a bad thing is likely to happen. You should not kill a dog. You are taught all these things. People follow the rules.

We have gone ahead – local authorities understand our traditional structure – it is being referred to as Ogiek council of Elders. Every clan has a clan head and several clan heads (not all) will come together to form a chief. And it was to lead most of the things – grievances, ceremonies. Like when the boys are undergoing initiation, they will be invited to give insight to them and when they come out of the forest they will be there also.

The last review of the Forest Act was in 2005, and we have notified the government that we want them to undertake a comprehensive review of the Act, as there are clauses that are discriminatory to the Ogiek. The historic appeal by the Ogiek heard by the African Court on Human and Peoples Rights in November 2014 was the first indigenous rights case to come before the court since it began.

## Supporting reference

**Samorai Lengoisia**, J. 2014. Oral presentation during session on ‘Our Knowledge, Our Ways: Indigenous and local knowledge about Pollination and Pollinators associated with Food Production’ at *Global Dialogue Workshop on ILK of pollination and pollinators associated with food production*, Panama City, 1–5 December 2014

# 3. Tūhoe Tuawhenua (Māori, New Zealand) knowledge of pollination and pollinators associated with food production

JAMES (TAHAE) DOHERTY<sup>a</sup> AND KIRITUIA TUMARAE-TEKA<sup>a</sup>

*Compiled with support from Phil Lyver*

a. Tribal affiliation: Tūhoe Tuawhenua region, New Zealand

## 3.1. Background – Tuawhenua people

It was in the homeland at Ruatāhuna, in Te Urewera Ranges, New Zealand, that the original ancestors of the Tuawhenua people, *Hinepukohurangi* (the Mist Maiden) and *Te Maunga* (The Mountain), first came together. These origins keep the Tuawhenua people close to the spirit of the land, the mist and the mountains. This was the beginning in terms of the Tuawhenua people and their history. The importance and relevance of water and purity can never be over-stated for the Tuawhenua people. The belief that water is the blood of the land is at the heart of their worldview and culture. All living things rely on water which highlights the importance of its protection, even for pollination. When Tuawhenua people talk about purity in their culture it reflects the *mauri* (life force of life essence) of the environment. When referring to the purity of any form (e.g., water, lands, plants) – *mauri* is the term that is used frequently by *Māori* (indigenous people of New Zealand). So when the environment has been impacted, the Tuawhenua people refer to the *mauri* being damaged. It is something that they are facing every day. It was recognised that the role of IPBES was to mend the *mauri* of global biodiversity.

The Tuawhenua people recognise the collectiveness in their world – everything is connected in their culture (e.g. bats, lizards, birds, insects, trees, plants, mountains, rivers and lakes). This connectedness is commonly known by Māori as *tātai whakapapa* (connectedness of genealogy) and provides the strength to the ecosystem. As these elements are eroded, so is the resilience and integrity of the environment and the tribe. For the Tuawhenua people it is the *whenua* (land) that defines who you are and where you come from. The land is considered to be your beginning. The term *whenua* is also used for the placenta expelled during the birth of the child – it is your beginning and connection to your mother. So in terms of when Tuawhenua women give birth, wherever they are in the world, the placenta must go home and be buried on the tribal land – likewise with the *pito* (umbilical cord). The action of burying your umbilical cord on your lands signifies your connectedness to *Papatūānuku* (Mother Earth) and your land. It connects you to your place in the world.

Critical to Tuawhenua people were the maintaining of ties and connection to the land and their resources as this was perceived as an expression of their *mana* (authority). Regardless of hardships and downfalls and the diverse happenings of the world Tuawhenua elders recognised the need to always uphold the *mana* of the individual, *hapū* (sub-tribe) and *iwi* (tribe). The elders understood it was hard for some to keep ties and bonds to the land, the waterways, the animals, and the

birds – but these were seen to be all part of what it means to be Tuawhenua. *Mana* was recognised by the elders as being one of the most important principles for the Tuawhenua people. But also reinforcing the principle of *mana* was the concept of *mauri*. For the Tuawhenua people the *mauri* of the forest can never be taken away. As long as the waterways are running, as long as one tree stands, the life force cannot be taken away – every element within the world has a level of *mauri*.

### 3.2. Value of insect pollinators and their decline within Te Urewera

The ecological role of pollinators was recognised by the Tuawhenua people as hugely important for the integrity and well-being of the Te Urewera forests. Insect pollinators were especially acknowledged as being important for the production of native fruit that nourished and supported the birds of the forest. However, a number of highly visible insects were observed to have declined during our lifetimes, indicating a possible decline in pollinators in the forest ecosystem. The large black bush dragonfly (*kākāpohai*, *Uropetala carovei*) has become greatly diminished around the Ngāputahi, Ruatāhuna and Whirinaki (Tuawhenua) regions. This species was still observed but not in the numbers present between the 1950s and 1980s. Blowfly numbers have also declined immensely in Te Urewera. The large variety of blowfly was common approximately 10-15 years ago, but their numbers are much reduced now. They no longer enter our houses in the numbers they used to when a meal was being prepared. Now there are a lot more of the smaller varieties of flies around.

Feral bees were an important part of Tuawhenua life. Our feral bees were quite dark or black in colour. The harvest of honey was a seasonal practice conducted by the Tuawhenua people (see photo p.30). Honey was collected between mid-December and the end of January, but the season could run through to the end of March, or even May, depending on the length of the flowering season of trees in the forest. Our parents would tell us as children to always keep an eye out for the bees if they were out in the forest and report the location of any hives. It was our fathers and uncles of the elders that used to collect the honey.

The honey harvest used to occur once a year in Ngāputahi and Ruatāhuna and was mainly kept for our old people, honoured guests or special people and babies. Our elders used to eat honey comb directly or use it as a sweetener. It was also used in baking toffee or bread from the hinau (*Elaeocarpus dentatus*) fruit. When making bread the hinau fruit were ground up in a stone bowl and mixed with flour, water and honey. However, these types of foods were very seasonal. Honey was also used to assist babies to suckle from the breasts of their mothers. The honey was smeared around the nipple on the areola to help baby latch onto the right place. Also, if a mother's nipple was inverted, smearing honey around the areola would stimulate the baby to latch onto the right place, and the sucking motion would draw the nipple out allowing the baby to latch on easier. It was known that if the baby latched onto the wrong part of the breast or just the nipple it could cause the mother's nipple to become raw and sore stopping the mother from breast feeding. This practice also stopped the mother's nipple from becoming cracked and raw, keeping it supple and good condition benefiting both the mother and baby. When babies were teething, honey also smeared a *rākau* (or stick which was appropriate to go in the mouth) or *kōhatu* (piece of stone that was also appropriate to go in the mouth) for babies to suck and break open the gums and allow the teeth to emerge.

Feral bee hives were normally not found higher in altitude than 1000m above mean sea level (amsl) in Te Urewera. This is also about the maximum altitude for the podocarp trees. Higher than this altitude of 1000m amsl were the beech (*Nothofagus* spp.) forests. The elders reported that feral bee hives were mostly found in cavities of podocarp trees and never in the ground. These cavities occurred as the podocarp trees grew through the tawa (*Beilschmiedia tawa*) canopy (second tier) and the podocarp branches died off from the lack of sunlight leaving a stump. Over time this stump rotted away and the weight of branch caused it to break off leaving a cavity in the trunk which the bees nest in. Because of this process bee hives were not found in tawa trees.

So the first hives occurred between 5-10m off the ground within the first tier of branches. Hives could also be found above second tier of branches around 20-30m off the ground. Podocarps with rātā (*Metrosideros robusta*) growing on them were good because the rātā vines provided your ‘rope’ to assist with climbing. In Ngāputahi, the tawa ceased to grow above 600m amsl (their altitudinal range limited by frosts) replaced by the podocarps which then grew between 600-1000m amsl. Within this 600m to 1000m altitudinal range the different species of podocarps are phased out in the following order: (i) The first trees to be phased out are the kaihikātea (*Dacrycarpus dacrydioides*) and lowland tōtara (*Podocarpus totara*); then (ii) the rewarewa (*Knightia excelsa*; NZ honeysuckle); matai (*Prumnopitys taxifolia*), and hinau; and (iii) then the rimū (*D. cupressinum*), mountain tōtara (*P. cunninghamii*), rata, toromiro and maire (*Nestegis cunninghamii*) (Please note: this list represents only examples of podocarps and other tree species found within in these ranges). The elders recognised that the trees in the Tuawhenua forests do not flower consistently with flowering often having gaps: “One tree may flower this year doesn’t mean it will flower the following year – it usually has a three year gap between flowering times and because of the diversity in terms of the size and type it balances it way out – it is nature’s way of keeping everything in balance within our forests in terms of honey and pollinators” (Doherty 2014).

Our old people knew that December to January was the time when bees in Te Urewera would ‘swarm’ (termed ‘heke’ in the Māori language). The bees would travel and all halt where the queen landed. All the worker bees would then gather and the elders reported seeing them hanging high in the podocarp trees. The swarm would stay there during the day and into the next. Men from our community would then come during the night time with a flax woven *kete* (bag) and shake all the bees into the basket and then take them to an area with standing trees with hollows and then empty the bees into the cavity and then the hive would establish there. It wasn’t really bee management but more like ‘bee relocation’.

An indicator of the appropriate time to collect honey was when the rātā tree was in full flower around Christmas (late December). We also recognised however that harvesting honey was regulated by the different flowering periods of certain plants. When plants such as tutu (*Coriaria arborea*), wharangi (*Brachyglottis repanda*; rangiora), and ongaonga (*Urtica ferox*; tree nettle) were in flower the honey harvest ceased. Tutu plants produce a poisonous plant derivative (tutin) which is picked up by bees and incorporated into their honey when they feed on honeydew exudate from the sap-sucking insect commonly known as the passion vine hopper (*Scolypopa australis*). The tutu flowered mostly around mid-December but could continue right through to May. But at the start of season the tutu flowers prolifically then it wanes so the toxin becomes increasingly diluted in the honey allowing it to be harvested again. The tutu does not grow everywhere in the heavy forest and is mostly confined to disturbed (e.g. slips) or open sites (e.g. river-beds). To avoid harvesting honey contaminated by the toxin of the tutu, our old people would go to regions of the forest where tutu was not growing. The wharangi flowered in December so our people would allow a 2-3 weeks space for flowering, and then a 2-3 week buffer period for toxin to dilute in the honey before harvest resumed.

Access to wild sources of honey began to decline when we were still quite young. The Tuawhenua honey gatherers observed a decline in the abundance of hives over a 20 year period beginning around the mid-1950s to 1960. The abundance of hives around hapū area (such as Ngāputahi) began to decline. Our honey gatherers found the hives harder and harder to locate. Before the decline, we estimate that our fathers and uncles would search and collect honey from 20-25 hives in an area about 1 to 5 km radius around their homes. By the mid-1980s the abundance of hives had undergone a major decline with gatherers collecting honey from 1 to 5 hives in that same 1 to 5km radius area. The hives totally disappeared from the Ngāputahi area over the decade between 1990 to 2000. Honey was collected for three seasons in the late 1950s in the forests around Ruatāhuna, but even by then, our fathers and uncles were noticing declines in the abundance of hives in the area. They had to climb higher in altitude up the mountainsides in each time they wanted to collect honey. In 1961 the honey gatherers failed to get honey from the forest around our home in Parekaeaea (in Ruatāhuna). The only location they could continue to



get it was up at Maungapohatu which was at higher altitude. In the early 1960's the our parents started to buy honey that was produced by commercial bees and available in the store. It was observed that neither the volume (quantity) of honey collected from feral bee hives, nor the size of feral bee hives, declined over that 50 year period – just the abundance of hives. Now only European bee hives in commercial boxes exist in area – these are the only bees that Tuawhenua see now. We both acknowledge we do not know what impact the loss of the feral bees will have on pollination and the forest ecosystem as a whole. For Tuawhenua families it is difficult for them to understand and respond to changes in the abundance of bees in their forests because by the time they had comprehended the whole change it had gone too far to reverse, and by this time there is so much outside influence it was hard to manage.



Collection of wild honey from a feral bee hive by Tūhoe Tuawhenua in Te Urewera, New Zealand, circa. 1950s (see [www.manawahoney.co.nz](http://www.manawahoney.co.nz))

The recently developed *Te Manawa* honey initiative by the Tuawhenua Trust is an important local industry for gaining prominence within the community. The industry is selling both on the national and international markets, providing employment, apiarist and business training and a source of income for local Tuawhenua in the community. In New Zealand, standard floral honey works out to be about roughly \$NZD8-10 per kilogram, while for the high quality medicinal mānuka (*Leptospermum scoparium*) honey this price jumps to around NZD\$70-80 per kilo. However, within NZ local honey producers are struggling in terms of set prices and value. Producers require the backing of the government to regulate and standardize honey quality. For the medicinal honey products there are 'cowboys' that label their honey product as medicinal when it is not. New research opportunities (medicinal compounds in mānuka honey) are also emerging creating new marketing opportunities. For Māori in NZ an important concept for identifying their right to occupy and identify to place is '*ahikaaroa*' which basically translates as to '*keep the home fires burning*' or '*rights to occupy your tribal space are maintained and upheld*'. These

are important concepts Tuawhenua want to portray as part of their marketing strategy for honey. It is the importance of history and cultural and ecological story behind the honey. This brand is yours alone and no one else can use it. It is also helping the younger generation recognise and appreciate the importance of bees in ecosystem.

### 3.3. Value of bird pollinators and their decline within Te Urewera

Different bird species such as the *kererū* (*Hemiphaga novaezealandiae novaezealandiae*), *kōkō* (tui, *Prosthemadera novaeseelandiae* – endemic passerine and is one of the largest members of NZ's honeyeater family) and *pihipihi* (silver-eye; *Zosterops lateralis lateralis* – a small omnivorous passerine bird) were recognised both as important pollinators but also as food species. In particular, the *kererū* is culturally and ecologically significant bird for Tuawhenua people (Lyver et al. 2008; Lyver et al. 2009) and Te Urewera forests respectively. It is involved in pollination and seed dispersal – it is the only remaining bird in NZ forests with the gap capable of swallowing large fruit from trees like tawa.

As a pollinator, the *kererū* had been observed visiting a number of *kōwhai* (*Sophora* spp.) trees where it carefully plucked off the petals and ate the reproductive organs of the flower. It did not however eat the flower every time, so in doing so completed the process of pollination. “I have observed *kererū* with pollen with on its beak and mouth and feathers around the head” (Doherty 2014). Some of the trees that the *kererū* pollinates include the *kōwhai* and *kotukūtukū* (*Fuchsia excorticata*). We acknowledge however that the effectiveness the *kererū* as a pollinator was unknown.

Fruit on native trees (e.g. toromiro, *Prumnopitys ferruginea*) resulting from pollination were hugely important at certain times of the year for fattening birds like *kererū* for eating. In general, Māori commonly recognise that a person is partly a product and representation of the food that they eat therefore the role of pollinators in defining the individual is immense. The *kererū* therefore held a special status within Tuawhenua culture. Unlike the other birds in the forest, our Tuawhenua people do not sing or dance about the *kererū*. Only when it is served as *huahua* (*kererū* preserved in its own fat) on special occasions do the Tuawhenua people refer to it in *haka* (ancestral dance of acknowledgement or challenge). This was a demonstration of how revered the *kererū* is in our Tuawhenua culture. The serving of *huahua* was an expression of who the Tuawhenua people were and a demonstration of their ability to safeguard a healthy environment and look after their resources. To put the *huahua* on the table was partly an expression of the *mana* of the Tuawhenua people and their ability to act as a *kaitiaki* (environmental guardian) to look after that environment. It was recognised therefore that the greatest shame to put on any people was not being able to serve traditional tribal foods to dignitaries or revered visitors.

The Tuawhenua people acknowledge the spiritual significance in everything they do. We stress the importance of our spiritual connectedness to the environment. Adhering to the appropriate protocols and ceremonies for the different stages of the harvesting periods was also important. Some rituals opened the doorway for harvesting the *kererū* and that there were consequences if those practices were not conducted appropriately or followed. For example the *kererū* makes itself unavailable to the people if its *mana* is not respected. If the *mauri* or *tapu* (sacredness) of the *kererū* was disrespected the departure of the flocks could be heard, the noise sounding much like an angry “whoosh” as the birds left the area and moved on. This phenomenon was referred to as “*Kua heke te manu*”. Only with *karakia* (prayer) could the *mauri* of the *kererū* be restored. However, these practices have mostly been lost, following the government placing restrictions on harvests and use of native resources.

Other birds such as the *kōkō* and *pihipihi* were recognised by the elders as having a much clearer role in pollination. *Kōkō* were known to pollinate native trees with tubular-shaped flowers such as

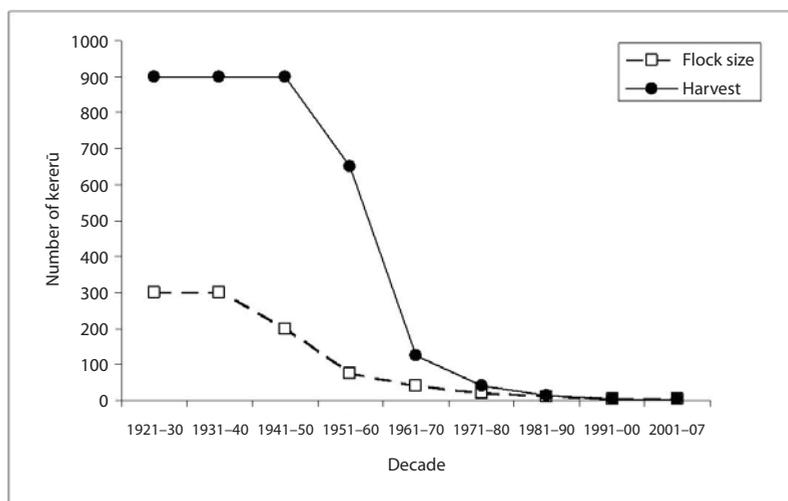


the *rewarewa*, *kotukātukū*, *kōwhai*, mountain *harakeke* (flax), but also introduced shrubs and trees such as the bottle-brush (*Callistemon* spp.) and blue-gum (*Eucalyptus* spp.) in NZ.

Dramatic declines in native birds such as the *kererū*, *kōkō* and *pihipihi* have been observed by Tuawhenua people over the last century in Te Urewera, especially in the last 60 years (see figure 1 below). The *kererū* and *pihipihi* were super-abundant, at times forming large flocks of hundreds, even thousands, of individuals. We recognised a similar pattern of decline in both the *kererū* and *pihipihi* populations. While the *kōkō* have also declined it is believed these birds have adapted quicker than the other species to alternate dietary opportunities presented by shrubs and trees introduced by Europeans which have supported their numbers more.

A range of indicators have been used by Tuawhenua people to monitor changes in *kererū* populations in Te Urewera. For example, prior to 1950 Tuawhenua *kererū* hunters observed the following ecological and social indicators to monitor the abundance of *kererū* in their forests and subsequently changes in those populations:

- ▶ Flocks of *kererū* flying over would shade out the sun like a cloud passing over the sun
- ▶ Rumbling sound as flocks flew over
- ▶ Continuous rustling sound in the forest from the huge number of *kererū* in the forest canopy
- ▶ *Kererū* described “as numerous as fruit on the toromiro tree”
- ▶ Toromiro branches would break from weight of flocks
- ▶ *Kererū* would alight on hunters
- ▶ *Kererū* harvested on a “*marae*” (a *marae* is a meeting house and grounds made up of a number of families) basis
- ▶ *Kererū* feathers used to fill mattresses and pillows
- ▶ A “*hoko*” of *kererū* (collection of 20 birds) could be easily obtained
- ▶ *Huahua* (*kererū* fat) process was used to preserve birds – that is there were enough birds harvested to provide the fat needed as a preserving medium/agent



**Figure 1:** Estimates of *kererū* (*Hemiphaga novaseelandiae novaseelandiae*) flock size and the number of *kererū* harvested per *marae* in the Tuawhenua tribal area each year in decades between 1920 and 2010 (Lyver *et al.* 2008).

After the 1970s the Tuawhenua community observed the following indicators that signalled a decline in the *kererū* populations:

- ▶ Super-flocks of *kererū* no longer observed
- ▶ Hunters required to wait for *kererū*
- ▶ *Kererū* not present in toromiro for entire season
- ▶ Few *kererū* observed in forest at all
- ▶ Hunters harvesting on their own
- ▶ Not possible to harvest a *hoko* in one trip
- ▶ Eating of *kererū* preserved for special occasions
- ▶ Pork fat was used to preserve the birds since not enough fat could be collected from the birds themselves since so few were being harvested

For our Tuawhenua people pollination and pollinators deliver more than just food. Our people recognised that the pollination process delivered wood for building materials and carvings for *wharenuui* (meeting house). The *wharenuui* represents the womb – a place of safety and shelter for the people. Wood is also used for burning for warmth. Mānuka is not a large tree but it was one of the special tree species that our goddess, *Mahuika*, threw fire into. She had embers that she threw it at the mānuka so from then on it was a good wood for burning and making fire. The properties of the mānuka also make it good for healing external wounds. From the trees comes the fruit and foliage upon which the birds and people rely for food, weaving, dyes and medicines. The birds also provide Tuawhenua with food, clothing and warmth. Cloaks made from feathers (bird) bound together by flax offered warmth in the past.

### 3.4. Drivers of change in pollinators within Te Urewera

We believe chemical residues in the environment pose a large threat to biodiversity, pollination and pollinators. The uptake of chemicals within plants passed through the system in the flowers. When it is sprayed directly onto flowering plants it can also then be taken up by the pollinators and other insects. We feel that the wide-spread use of chemicals for controlling weeds in New Zealand had also severely impacted the country's native biodiversity. We acknowledge however that the only control option for weeds is to use chemicals, Those are the types of concerns that Tuawhenua have in their region. New Zealand has thousands of types of chemicals in use in agriculture, and horticulture. Our pollinators are exposed to them all the time.

We also recognise that toxins were also widely used for the control of mammal and insect pests in New Zealand. A number of these toxins are dropped from the air and it is difficult to control where they land or where they go, even with GPS positioning of helicopters. Some years ago, Tuawhenua were part of a group that did trials looking at the uptake of pesticide '1080' (sodium fluoroacetate) by forest *rongoa* (medicinal plants), The study showed that 1080 was present in a number of *rongoa* species following the use of 1080 baits in the forest. We wanted to know what impact 1080 had on the medicinal properties of our plants. Also we enquired about the spiritual purity of the plant once chemicals had passed through it (ERMA 2006).

A range of factors have potentially caused declines in pollinator communities over the last 75 years within Te Urewera. We believe the introduction of exotic invertebrates and vertebrates into New Zealand throughout the European colonialisation period has had a major impact. The full extent is unknown however. The introduction of rodents (e.g. *Rattus* spp.), mustelids (e.g., *Mustela*



ermine – stoat), possums (*Trichosurus vulpecula*), feral cats (*Felis catus*) and wasps (*Vespula* spp.) have directly or indirectly impacted the pollination communities. We believe little thought was given back in the day to the introductions of animals like the possum. What was important was trade in fur it provided. As possum (and other introduced mammal) densities increased within Te Urewera the impact on the vegetation quickly became apparent. When the possum arrived in NZ in 1837, it was a nocturnal vegetarian, and as densities increased the impact on the trees through defoliation became quickly apparent. The possum's appetite for eating the flowers on the native trees also contributed to removing a food source for the native and feral bees (Note: possum was introduced into the Ruatāhuna area in early 1940s). With its establishment, range expansion and increase in densities scientists discovered possums were also eating the eggs and young chicks of native birds. We were also aware that they foraged the feral bee hives during the night. This together with predation from rats, feral cats and mustelids has been a major contributor to the decline in bird numbers and other pollinator species within Te Urewera.

Our observations of dramatic increases in wasp numbers in the Te Urewera area since the 1950s we believe is partly responsible for the decline of the insects. Two wasp species were introduced into NZ: German wasp (*Vespula germanica*) after the Second World War and common wasp (*V. vulgaris*) in the 1970s. One of us believe that the reason for introducing the German wasp was because in the 1940s there were complaints by sheep farmers that excessive blowflies were 'blowing' (laying eggs which hatched into maggots) on their sheep and causing mortalities. To counter-act this, wasps were introduced into the country to control the blowflies. That strategy worked for the first decade until the wasp realized there were better resources than blowflies so attacked feral and domestic bee hives. Feral bees have limited defences against wasps in such high densities, so not only do they have an immediate impact on the bee population but also has an impact on the forest ecosystem – the native trees produce a lot of nectar. In the past the feral bees used to rely on native trees a lot but as their numbers have grown (especially during the warmer summer and autumn months), the wasp populations now remove much of this. In the colder months of winter the queen wasps hibernate until the following season where they emerge to establish another nest. The ideal climate and abundant food supply has meant that wasp numbers have reached very high densities covering the forest. Wasps also remove a large amount of honeydew (sap extruded by the scale insect, *Ultracoelostoma assimile*) which other birds and insects are dependent on. The forests now hum from wasps and this hasn't ever happened in the past. During the flowering season you could not hear yourself before – now this has now been replaced a similar sound from the wasps and it's not only in the forest canopy but also on the forest floor.

Increases in wasp numbers are been observed in the following ways:

- ▶ Numbers of wasps flying into houses have increased
- ▶ When trees are in fruit the trees are covered with wasps
- ▶ No sound in the forest in terms of bee sounds
- ▶ Ruatāhuna: You hear the wasps in the forests
- ▶ Number of wasp nests have increased in the region

Also unknown is the impact that the largest man-made exotic pine (e.g. *Pinus radiata*) forest in the southern hemisphere is having on native forest pollination. At times we have seen the forest was hidden behind a wall of wind-blown *Pinus* pollen grains. We wonder what impact foreign pollination could be having on our indigenous flora.

### 3.5. Protecting and safe-guarding Tūhoe Tuawhenua *mātauranga* (indigenous knowledge)

The protection of Māori knowledge is an issue in terms of our country and our culture. The government has a lot of information and knowledge of Māori but it is held in many places like teaching institutions and museums. In the past *mātauranga* (Māori indigenous knowledge) was passed on *kanohi-ki-te-kanohi* (or face to face) but this practice has become more difficult because of the globalized movement within cultures and people. In terms of the Tuawhenua community, some of our people have gone door to door to sit down around the table with the elders and talk about their knowledge. It was noticed that for some elders is quite difficult for them to discuss their knowledge because it is kind of sacred to them. The Tuawhenua people have had a lot of difficulty to try to persuade their elders to disseminate knowledge this way – that is, using modern techniques. The community is traveling this pathway right now. To get all the people to agree to talk is quite difficult – the process needs to be taken very slowly because one of the first questions that they will ask is “*how safe is the information I give you going to be?*” Our elders reported that it is all about security of knowledge and giving confidence to the people – that by you collecting the knowledge the community and the coming Tuawhenua generations are going to benefit. There is only a small portion of original Tuawhenua knowledge remaining because in the beginning there were people in the community called *tohunga* who held knowledge that was often highly specialised in its nature. Access to that knowledge was often restricted and limited to a few. As time eliminated these learned individuals, helped by government outlawing those people and practices (e.g. *Tohunga Suppression Act 1907*) Tuawhenua knowledge eroded as well. Some Māori are now trying to recover some of the knowledge from the museums and other institutions around New Zealand. Some Tuawhenua elders see imparting their knowledge as a form of disempowerment: “*the Pākehā (white man) has taken our land, taken our natural resources and now he wants to own our minds (knowledge).*”

But with elders passing away, indigenous knowledge studies offer a way to preserve and protect that knowledge through interviews. Some perspectives around contributing knowledge are changing. Tuawhenua knowledge is protected through agreements with different levels of access. *Whanau* (families) can control who can access the knowledge of their elders. The Tuawhenua Trust who holds this knowledge has opened up to the Tuawhenua community and families. But one elder reported that the issue of knowledge access is not black and white – “*you live it*” – passing on this knowledge is not about sitting around the table. This is the part Tuawhenua are having difficulties with because it is not just about what is written on a piece of paper. There is a lot more to it. Often it is about physically demonstrating the knowledge. The importance of technology has now becoming more relevant with families living away from their tribal areas. For example, Skype is used to demonstrate how food was prepared in a *hangi* (traditional Māori oven in the ground). Our grandchildren in Australia even ask us to demonstrate how to put down a *hangi* on Skype. Some of our parents have also instructed us not to write the knowledge down on paper but rather write it in our hearts. It is about living the knowledge – that is the best method of transmission. Our old people would sometimes discuss the spiritual aspects while sitting around the fire. It was also explained, that someone could be looking directly at your face when you’re talking but their mind is straying elsewhere and they are not taking notice whereas someone playing in the background could be hearing more than the person being spoken directly to. That is why the fire is important. Write it in your heart.

For our Tuawhenua women there were protocols around knowledge transmission. For example, it was *tapu* (sacred) to talk about menstruation. In some cases, our elder women felt that the girls did not need to be taught about menstruation but rather it was something that would just come in time. In a few instances, , girls would occasionally be taught like a boy. Sometimes it was the girl that chose to be taught like a boy – they much preferred being outside in the bush rather than in the kitchen and doing domestic chores.

Age-related stages for teaching and imparting knowledge were also important. When a male child was first born they were called a *pepe* (baby – birth to 5-6 years old) and certain levels of information are imparted at that stage. The next level was called a *tamaiti* which simply means a child of that is 8-14 years old – there are several levels of information that is fed in at that level. The following age range is 15-20 years old where the boy is called a *tahae* or a ‘teenager’. The final level is where the male attains manhood around the age of 20-21 years which is called *tangata* (an adult). The elder reported that you start talking about religion right from the beginning. Everything in your daily life is encompassed within religion. As you get older the religion teachings and subjects get heavier and deeper. By the time you reach the *tangata* level you have a good grasp on the teachings. These are the stages that our Tuawhenua people follow in our culture. Impressed on our people right in the beginning is the value of spiritual things the lessons get heavier as you climb the age ladder during that whole process. In the middle of it – the responsibility starts getting pushed in at about the *tahae* or teenage level (responsibilities into the future). This is the easiest way the Tuawhenua culture can be explained. In all our teachings there is great emphasis on responsibility – and of course, there is responsibility for the knowledge handed down to you by your parents, and there is great responsibility to you to pass on that knowledge to your children.

We also recognise a concept called *poutama*, which can be defined as a ‘stairway to enlightenment’. It is a design you will see on *tukutuku* (a traditional latticework) in our meeting houses. Growth of knowledge and wisdom are signified by steps. When you are a small child you climb the first steps and continue this process until you reach the summit towards the middle of your life. At this point you are supposed to know everything. The secret to the success of your family however is being able to go back down the steps and walk back up with your children and your grandchildren. If your approach is to dictate from the top then you can’t come back down to assist them.

Our parents and grandparents explained that to understand the state of knowledge, one needs to understand the colonization process through the schools. Here M ori were taught the European way of life. In Māori culture however as soon as young ones can walk they follow their parents into the forest and into what they are doing. That is how our youth get to know all the trees and plants. This is how our knowledge is passed on. The use of Skype was actually quite effective, rather than saying it on paper which just isn’t the same. We believe that the people might get to the point when they take Skype into the forest to demonstrate practices. Not all grandchildren are taught in this way – there are certain ones that are gifted to learn that knowledge but some of them are not. Knowledge can also be passed down to the ones that show the most interest. They then become the ones responsible for passing on the knowledge to others within the family when the time was right. It is also recognised within Māori culture that knowledge is not always passed down through direct bloodlines. Often knowledge can be imparted from uncles to nephews, or from aunts to nieces, or from grandmothers to grand-daughters. Sometimes it can cross the genders. As a result, if there are major decisions within the family, the elder’s aunts and uncles can come to these individuals and ask for advice and support or whether the proposed decision was appropriate and conformed with the traditional knowledge and information.

We recognise that Māori often have difficulties with the modern European world. However, there are very few, if any, Māori that can say they are genuinely ‘whole Māori’. The mixing of ethnicities places challenges on ourselves in terms of culture and terms of who we are. Our people are faced with choosing their European side or their Māori side. These are the complexities that are evolving in the Māori world. However, the importance of land remains paramount for Māori. It was acknowledged by our elders that those individuals negotiating land settlements on behalf of their people were required to give up their lives and also those of their families for the fight. But this is the responsibility and *utu* (reciprocity) handed down from the old people – when you fight for land you have to give up something you love. You fight for the land you will truly lose something you love and it is not your choice.

The departure of Māori from their knowledge and culture is complex but it has been facilitated by the Crown (New Zealand government) taking control of the *mana* over natural resources and restricting access by Māori to using those resources. The large-scale declines in native bird populations was largely the result of predation and competition from mammals introduced by Europeans but had the effect of limiting access and use of those bird populations (and other natural resources) by Māori. Māori were in fact required to switch foods to introduced species like wild pig (*Sus scrofa*) and deer (*Cervus* spp.) to fill the gap left by the birds. Finally, the large scale movement (migration) of into cities ( rural-urban migration) of the 1950s added to the divorce from their lands, resources and culture. It has taken many of our people away from our elders, customs, practices, knowledge and security of *marae*. Without the regular contact with their *tohunga* and elders and resources the ability to learn was curtailed. It was recognised that these factors all contributed to the erosion of knowledge within our communities.



Kiritiua Tumarae-Teka and James (Tahae) Doherty at Miraflores-Panama Canal, Panama City, Panama, 29 December 2014

## Supporting references

- Doherty, J.** 2014. Oral presentation during session on 'Our Knowledge, Our Ways: Indigenous and local knowledge about Pollination and Pollinators associated with Food Production' at *Global Dialogue Workshop on ILK of pollination and pollinators associated with food production*, Panama City, 1-5 December 2014
- ERMA** (Environmental Risk Management Authority New Zealand). 2006. 1080 Generic Issues Hui : Te Puea Memorial Marae, Mangere Bridge, Auckland, 2-3 November 2006 : Summary Report. Wellington: ERMA.
- Lyver, P.O'B.,** Taputu, M., Kutia, S. T., and Tahi, B. 2008. Tūhoe Tuawhenua mātauranga of kererū (*Hemiphaga novaezealandiae novaezealandiae*) in Te Urewera. *New Zealand Journal of Ecology*, 32: 7–17.
- Lyver, P.O'B.,** Jones, C., and Doherty, J. 2009. Flavour or fore-thought: Tūhoe traditional management strategies for the conservation of kererū (*Hemiphaga novaezealandiae novaezealandiae*) in New Zealand. *Ecology and Society*, 14(1). URL: [www.ecologyandsociety.org/vol14/iss1/art40/](http://www.ecologyandsociety.org/vol14/iss1/art40/)

# 4. Guna People of Panama: Indigenous and Local Knowledge about Pollination and Pollinators associated with Food Production

BELISARIO LÓPEZ<sup>a</sup>, FLORINA LÓPEZ MIRO<sup>b</sup>, ATENCIO LÓPEZ<sup>c</sup> AND ELMER ENRICO GONZALEZ LÓPEZ<sup>d</sup>

*Compiled with support from and translated by Serena Heckler*

a. Sagladummad (Cacique), Panama

b. Indigenous Women's Biodiversity Network for Latin America and the Caribbean, Panama

c. Guna General Congress, Panama

d. Foundation for the Promotion of Indigenous Knowledge, Panama

## 4.1. Introduction and method of compilation

A group of Guna people, as representatives of the host people, attended the *Global Dialogue Workshop on ILK of pollination and pollinators associated with food production*, Panama City, 1-5 December 2014. The following is a compiled and edited report of the oral interventions that they made at the meeting. A four-step method was used for compiling, revising and editing the text for inclusion in these proceedings:

- ▶ Detailed notes were taken of the interventions;
- ▶ During two working sessions on 5 and 6 December 2014, S. Heckler reviewed the notes with the speakers, adding detail, correcting any errors or omissions and clarifying certain points;
- ▶ The revised notes were edited and reorganised for thematic clarity, and shared via email with Florina López Miro and Elmer Enrico Gonzalez Lopez, who were designated by the Guna group, for their comments, additions and final revisions;
- ▶ The approved version of the notes was translated from Spanish to English by S. Heckler.

## 4.2. On Indigenous Knowledge and Biodiversity

*Florina Lopez Miro – Oral presentation 02/12/2014*

I represent the Indigenous Women's Biodiversity Network for Latin America and the Caribbean (RMIB-LAC by its Spanish initials). We formed in 1998 in order to participate in the Convention on Biological Diversity (CBD) process as indigenous women. Since then, we have advanced in the negotiations and been involved in different spaces and at different levels. We can share the experience of our work related to biodiversity and climate change.

Indigenous Peoples always say that everything is related, nothing is separate. In relation to the theme of pollination and indigenous knowledge (IK)—we have observed changes and analysed

the loss of IK in relation to the protection of biological resources. I am a Guna indigenous person and we have seen how many species have been lost. We have also seen that, in many cases, insects like bees and butterflies, that we used to see in great quantities in our communities, are not there anymore. Regarding food production, we have lost our people's traditional seeds and propagules because the work of the pollinators has been affected, perhaps as a result of climate change where the species have migrated elsewhere.

Our knowledge has been eroded by the impact of climate change in our communities, related to the loss of traditional seeds and propagules. Many women in different places manage and control the seeds and propagules, but this is decreasing. Now women are working to recover IK and the seeds and propagules, for example, in the processing of yuca (*Manihot esculenta*). In Colombia, a group of Witoto (Huitoto) women are working to recuperate traditional seeds and are running a restaurant that sells traditional cuisine, but at the same time, they've developed a fruit ice cream [that provides income]. In other words, they are developing projects to support biocultural diversity. In Guatemala, Mayan women are working on orchid production. In El Salvador, they are working with petals of the veranera (*Bougainvillea* spp.) flower to produce a medicinal syrup. We are also working with young people. In sum, we are innovating with IK, looking for ways to improve traditional techniques.

Women are working to see how they can recuperate IK. In South America, they are losing IK, including varieties of potato and other agrobiodiversity. In the CBD context, women analyse how we can recover varieties that are found in seed banks. Today the repatriation of objects is spoken about, but not the repatriation of germplasm from European seed banks. We think about how we can implement social initiatives. These are big questions, but we think that the worst struggle is the one that is not waged.

This theme [pollination] is very important. It is important that women participate in the process. When the authorities use technical terms, we think that something new is being spoken about, but it is not new. When it is explained in terms of daily practice, when these technical terms are linked to our daily practices and livelihoods we can easily understand them. We have been transforming our knowledge and practices for thousands of years.

Mother Earth sends us signals and young people no longer see these signals and no longer know how to handle them because the knowledge of these signals is being lost. Young people no longer learn them from our grandparents. One of the impacts of climate change is related to agriculture, indigenous peoples know when to plant and when to harvest [based on signals]. But now climate change is changing the signals and the agricultural calendar. We have also lost varieties and plants that we used to use in traditional medicine.

We have what used to be considered a sacred seed, cacao (*Theobroma cacao*). It was used in traditional medicine and was a staple food. Our grandparents told us that we didn't need to use other medicines because this fruit would keep us healthy. Before, when the elders would go into the fields to work, they wouldn't get tired because cacao would give them energy and they could work without eating anything all day. Now we have lost the propagules for this plant because of a disease that destroyed it ("witch's broom"). We are now trying to cultivate it again thanks to a project. Cacao is very important to the Guna people, it is a sacred seed. It is also a nutritious food and we use it in our ceremonies and the spiritual guides use it a lot, as do the *neles* (seers), who are people with special gifts.

We speak of bees and pollination, but it is just a tiny element of the whole cycle that gives us life, that gives us the food upon which we survive. We also speak about seed dispersal and climate change—the invasion of exotic species and the extinction of native species threatens seed dispersal as much as it threatens pollination. And seed dispersal isn't just carried out by insects, but also by water, by rivers, by the rain. When rain falls, seeds are transported to different places.

Plenty of species of flowers are not found in our territory anymore because pollinators, hummingbirds and other birds, have disappeared. Some of our medicinal plants have also disappeared. So we

should analyse how much has been lost. Now we have to walk in the forest to find these plants, when before we could find them along river banks or near our communities. It would be important for us to carry out an inventory so that we can work on recuperating these species. But this research must be done by the community (for more on this issue, see below). For example, consider *albahaca* (Guna: *bisep*), which we use as a sacred plant. When a newborn comes home, one of the first things that is done is to bathe it in *albahaca* water to reinforce the spiritual capacity and mental development of the little one. But now, *albahaca* is not found along the river bank. It was never cultivated—seeds were brought by animal dispersers. This is an example of the impact of the changes that we are seeing. Another example is the *neles*. They smoke a pipe or they have a brazier in which they burn cacao seeds. From that, they can interpret a person's condition. But now, we are losing cacao seeds and other plants that the seers use, as well as the practice of forecasting. This is an example of the spiritual interconnection between cultural and biological diversity.

In summary, women are working to find ways to advance the process of revitalizing and recuperating our cultural and biological heritage. We get involved in the communities and we are beginning to work on projects that have to do with bees and with other species in order to recover IK, the traditional varieties and control over our resources and the use of our biodiversity.

### 4.3. On Spiritual and Ancestral Knowledge

Elmer Enrico Gonzalez López – *Oral presentation 03/12/2014*

As a Guna person, I will talk about our spiritual and ancestral knowledge, which is tied to our territory. Our territory is in the Caribbean region and we have access to two main areas: the marine coastal region and the continental region. In the marine coastal region, there are changes and ecological dynamics that are not taken into account in [the pollination] evaluation. The coral needs fish and other animals in order to reproduce itself and to continue to develop, but it is not included in the evaluation. Our people get their food and resources from the sea. The sea is our grandmother, she took us in after we crossed rivers and lakes to Panama from South America when we were fleeing the colonizers. The Caribbean embraced us. When the mother or the father punishes you, it is the grandmother that rescues you. This is what the Caribbean did for us, she rescued us, but now she is changing and she is not producing as she was before. Who will take care of her? Who will ensure that the reef and the sea reproduce?

As regards the continental region, our people travelled from the rivers of Colombia and passed through Panamá. Our [cosmo]vision is rooted in the rivers. Our elders tell us that Guna Paradise is not in heaven, but in the large rivers. And what ensures that nature reproduces and renews itself is the river. As Florina said, it is the river that disperses seeds.

So these are the two habitats in which we live. The ocean provides us with our daily foods: we fish and we know which ones we can eat and which ones we can't eat and this may not be because they are not nutritious. For example, our wisepeople and our authorities tell us that we shouldn't eat shark because sharks are aggressive and people who eat sharks will become aggressive, too. And maybe if I eat a shark, I won't become aggressive, but I could drive sharks to extinction. This is how IK forges the behaviour of our children.

The Cacique [Don Belisario] will speak about our knowledge. What is important about this cultural exchange is what we have learned from our culture. I know that the Cacique, Don Belisario would have loved to welcome you to our Guna General Congress House [where he would have been able to perform the full welcoming ceremony because it can only be done on our territory]. This is the way in which we communicate. As James [Doherty, NZ Māori] noted in his presentation about the importance of the communal house for the Maori as the proper place for dialogue, exchange and mutual respect, the Guna house has the same characteristic, communication should happen in our own territory.

We must respect nature. We must learn through an intercultural dialogue from other indigenous peoples and from nature, this is how to coexist. Because in the end, it is nature that will continue with us or without us. This is the perspective of my people as regards even the smallest plants, bees, turtles, fishes. They teach us not to capture the turtle because they shed tears. Our elders tell us that this is because they are people and that they cry because they have been captured. This is the environmental education of our people. It is an education that teaches how to coexist with and live together with nature. It is the understanding that we like to communicate as a people. Because perhaps nature doesn't need us, but we need nature.

## 4.4. On Indigenous Knowledge

Belisario López – *Oral presentation, 03/12/2014*

Panama national law number 20 protects indigenous intellectual property. This was introduced because of all the studies that people from elsewhere have come and carried out with us. These people have become famous and we indigenous peoples have been left with nothing. Indigenous knowledge holders have never received any prizes or awards for our knowledge. However, we have our knowledge, we have never thought that we are worth less than other people. We have always been self-sufficient. Our ancestors never needed food from other countries. The world was created in such a way that all animals, even the smallest, have their role to play. And humans have a responsibility in this world. Over the years, we have lived together with nature and nature has been the master of all of us. No-one has been created by human beings. No-one has invented anything [only transformed it]—we have only transformed the flight of birds into the flight of airplanes. Before there were no calendars as we have now, but we knew the month when we looked at the trees. We knew when it was time to go fishing. We could hear the grasshoppers call, and we knew that it was 5 o'clock in the morning and time to fish in the mangroves.

Nature was our teacher and we were friends with her and we are here to learn more about this. Listening to you, I was struggling with the concept of pollination. I didn't completely get it. Pollination, there are many pollinators, not just bees. For example, the birds that fly from one place to another. Bees fly from one branch to another and carry with them the pollen and maybe we see a change in the colour of the trees. An ant visits a flower, travelling to another one, carrying the pollen from one to the next. That is how I understand it. Seeing all of this, I have to say that the Guna have a different way of seeing things. We don't see things in their parts, everything is more holistic. When we see a human being, we don't just see two ears, that person has his or her own intelligence. We all need each other—animals, plants and humans. All beings are alive—rocks have their spirit because they help us, perhaps in traditional medicine. Our world is very different, no one dedicates him/herself to just one activity.

Bees are part of Guna subsistence on their own—they don't produce honey. You who are working on beekeeping, you surprise me, how you use the insects so that they produce honey. Yes, we are afraid of the Africanized bees, they have killed many people. How can we use your knowledge to get the Africanized bees to go back where they came from? They have attacked our people, we have to hide under our overturned boats to hide from them. But it is a secret how to harvest honey. If I wanted that secret, I would ask you [respectfully]. It would be a process of mutual exchange, teaching and learning. Maybe you can help us because the world is changing. The majority of our young people don't want to become farmers. Our friend from Kenya says that they live in the canopies and this surprised me. Also my Mayan colleague who works on the ancient Maya codices. Each one of you is an expert in this theme and I am an expert in mine. In my world, there is a small community that guards IK. Our vision is distinct from your vision. We do not see the forest as a business, we see the forests as our friends who help us. You see the forests in a different way, but I can't criticize you, you live in a capitalist world, but we know what we want.

## 4.5. Roundtable discussions

*Group discussions, 03-04/12/2014*

### Themes 1 (social, cultural, biological and ecological change) and 2 (identification of pollinator diversity):

**Elmer:** Further reaffirming what the Cacique said, we do not see pollination as a separate theme. But rather that everything—trees, rivers, the wind, even human beings—participates in the process. We cannot separate them. According to the indigenous way of seeing things, everything is integrated. Pollination for the Guna does not have to do just with land, but also with marine-coastal environments.

**Florina and Elmer:** Africanized bees are a risk for the Guna. Africanized bees arrived more than 20 years ago and people died. A great uncle of Florina's died about 30 years ago. They found him on a path in the forest, swollen.

When I was a girl, *icaco* (*Chrysobalanus icaco*) was being produced, but not now. There are other plants, for example *albahaca*, which is a medicinal plant, that used to be found in the forest and in home gardens, but now is not found. Also avocado and cassava are disappearing. There are a number of factors contributing to this loss, including the fact that the people (men) who used to cultivate these products are now working in other sectors, including tourism. Cacao is a sacred fruit that is disappearing.

**Florina:** It is important to inventory pollinators and pollinated plants to know what is out there and diagnose the situation. But this would have to be a community inventory, which could raise awareness with the people about the importance of pollinators. But it would have to be done in the right way. For a long time, researchers have been coming to our territory, taking away all the information and there is no return to the community, especially when everything is done in another language that is not ours. It is therefore necessary that indigenous researchers be part of the research teams as partners and co-investigators to ensure that the people's priorities and concerns are reflected in the design and methodology of the projects. Also the return of the results of the projects and equitable sharing of the benefits should be part of the basic research plan. In this way, the indigenous collaborators and co-investigators can ensure follow-up and can share the information with the authorities in our language. It also gives confidence to the people that they are part of the initiative. Furthermore, the form of [knowledge sharing] should be appropriate [to encourage transmission and to build trust], to motivate the wisemen and wisewomen to share, you must talk and share with them—in this way, the information can be collected. One UN project that I was involved with sought to collect information from women, but they didn't want to share [quantitative questionnaires did not establish a context of trust and mutual exchange].

**Elmer:** Cacao is disappearing for a range of reasons. In part because of a disease (witch's broom), we don't know whether it has anything to do with pollination. We also see that our red rice is disappearing. This rice has a red grain and you don't need to have meat to accompany it. This is related to the lack of propagules.

A business called CocoaWell learned that the Guna consume a lot of cacao and that they're healthy (a Harvard professor carried out a study to find out why the Guna are so healthy<sup>2</sup>). They started using the image of a Guna woman. But when we found out, it was pointed out that all of Guna intellectual property is protected. The Guna General Congress levied a fine on the company. We came to an agreement that they must pay a percentage of their profits.

2 A long running research project concluded that the Guna have lower heart disease and cancer rates than the general Panamanian population and that this may be due in part to their high consumption of cocoa. See Bayard, V., et al. 2007. *Int J. Med Sci.* 2007; 4(10): 53-58 ([www.ncbi.nlm.nih.gov/pmc/articles/PMC1796954/](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1796954/)) and Hollenberk, NK et al. 2009. *J Am Soc Hypertens* 2009 Mar-Apr; 3(2): 105-12 ([www.ncbi.nlm.nih.gov/pubmed/20409950](http://www.ncbi.nlm.nih.gov/pubmed/20409950))

In the negotiation, the company said that they would support the reintroduction of cacao and brought propagules, but maybe they were genetically modified seeds. But it didn't work, they must reintroduce local varieties. For the Guna, the education system should include traditional agriculture. This was the original idea of the Professional Technical Institute of San Blas that was founded in the 90s. But as the traditional knowledge had already been lost, they began to introduce external technologies (such as cattle, goat, and pig farming).

In Guna culture, there is a sense that because we have not taken care of nature, she has turned against us. This is what our elders say. The reason we don't see certain plants now is because of climate change. The birds that our grandparents used as warnings, that our grandparents knew, when they heard them, that there was a problem at home or a danger on the path. Now those birds are no longer seen and they say it is because of climate change. The birds are migrating.

As regards invasive species: Guna Yala (our territory) is a crossroads. Many species no longer pass through Guna Yala and other species have hybridized with native species. We no longer see *sábalo* [a common name given to a range of fish species in Central and South America]. Aquatic mammals have appeared that are from cold waters, for example whales. We connect the whale with a star. When we see it, we think of it as the best hunter of our history. But it should stay in the firmament, it should not descend to the earth because it is a better hunter than us and can take our food. The lionfish has arrived. Also elephant grass (*paja canalera*, *Saccharum spontaneum*, an aggressive invasive species) has arrived and is causing problems, but is difficult to eradicate. Maize seeds have arrived from Colombia that are suicide seeds.

For indigenous cultures, the preservation of all living beings is necessary for human beings. We believe that everything on earth has a spirit and a function (including rocks, rivers, trees).

Some Guna plants are pollinated by hummingbirds. Pregnant women drink a syrup from hibiscus flower petals. This is being lost... we no longer see the hummingbirds that pollinated hibiscus in Guna territory.

Albahaca, a traditional medicine is also disappearing. It is necessary to look for it in the forest. Other seeds that are being lost include pumpkin and squash, which is also important for food security. It is a traditional food, but there are no longer any animals to disperse the seeds. Normally, these crops are cultivated by men, but they are no longer cultivating.

Governance: innovations should not be introduced without preliminary studies carried out in collaboration with communities because they can have catastrophic effects. Biocultural community protocols can help communities protect their ecosystems and avoid biopiracy.

### Theme 3: Cultural, social, economic values of pollination

#### **Statement by all the ILK holders and their representatives at the Spanish language**

**round table:** IK holders do not see pollination and pollinators as a distinct theme, but we know that life must be preserved and, in order to do so, plant reproduction (from pollination to seed dispersal) is very important. We see it as a holistic process (this is the vision of the Gunas, Quechuas, indigenous peoples of Nicaragua and the Mayas).

**Atencio:** When we speak of pollination, we don't depart completely from the idea of values. For us pollination gives rise to more forests, to more life and this has different values, for example a medicinal value. Ants bring different fruits and seeds and when they begin to accumulate them, for the Guna people, this has a medicinal value and not just food value. Also economically, we have been surprised by the capitalist world by its way of valuing things economically. In our world, the food, medicine, and spiritual values cannot be accounted for economically. The value of our knowledge cannot be counted in numbers. A wise Guna in a conference once said, in the industrial world, your development impoverishes us more even though I am offering my traditional knowledge. The pollination affects the local flora, our

forests are being affected. Guna Yala is a route of migratory birds. How many things are they depositing? There are birds that only existed between Ecuador and Peru, but are arriving here with climate change and are bringing with them the plant species that they eat.

**Elmer:** In keeping with values, it is something that we can't separate from human conduct. In the values that we practice is the window to the Guna world. The environmental theme is a fundamental value for the life of Guna people. Respect for trees, for rivers, for the sea, for the smallest thing. Our grandparents sang to us that even creepy crawlies have a function. This is a respect for life. We are speaking of pollination and we are looking for a solution to the problems that are related to it. We are looking for alternative solutions to problems, for instance the use of traditional knowledge for disease control. We are talking about using nature to repel insects to control diseases. In indigenous cultures, this knowledge exists, but it is being lost, it must be revitalized. Our grandparents collected plants along the riverbank and knew when a plant was not useful because it had a fungal infection, but they would use their IK to repel the fungus so that this plant could be recuperated. This IK has intrinsic value for Guna behaviour, we use strong substances to repel insects. The Emberá people paint themselves a jaguar with their body art, this is part of their identity, but it also protects them from disease-carrying mosquitos (malaria, yellow fever). There are natural repellents that we use. A case study must be done in our communities. To document and put numbers to the uses and values. The elders are going and the knowledge will be lost.

**Florina:** I remember the negotiation over the Nagoya Protocol [on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization]. The central theme was the recognition of the value of traditional knowledge (TK) in the use of genetic resources. A delegate wanted to know how to identify TK? How do we know when we are using TK? We indigenous peoples know, but is difficult to explain. Do we give them numbers? In what sense? I told him it is impossible to understand if you're not indigenous because it is part of our daily practice, this is how we know where it comes from, how it develops, how it is put into practice. It is complicated and is not yet definitively defined.

When we speak of the theme of valorisation, there is also a political value. This touches on the theme of governance systems. It is an important political value for many indigenous peoples right now to speak about food sovereignty and how we can take our own decisions in this respect. This is a complicated theme that we are still working on.

In relation to the question about medicinal and health uses, the Guna people do not produce honey, but my father, a medicine man, gave honey for coughs and asthma, he combined it with medicinal plants. This IK is also for health and for food. Cacao was also used for many things—for food, for spirituality, in ceremonies. It is important to continue to analyse this topic from this angle. How can this language be translated into simple terms to explain to the people?

#### **Theme 4: ILK protection, transmission and challenges**

**Florina:** Returning to governance, from the point of view of the Guna people, we have developed a perspective on how to protect our own norms and processes. The question that we are still struggling with is how to give legitimacy and authority to these processes.

**Atencio:** I summarise the Guna system of governance: Indigenous peoples speak of autonomy, which does not just mean the day-to-day administration, but also governance of resources. In February 2015, the Guna will celebrate 90 years of autonomy. There are 2 systems of authority and control: 1) the communities (52 communities) make decisions on collective rights. There is no private property as it is understood in western culture; 2) the other authority is the caciques: the Guna General Congress is the political administrative organ, while the General Congress of Culture is the spiritual-religious organ, which has the priests. When it is related to natural resources, no project can be implemented in the communities without the approval

of the General Congress. There are also projects that are proposed by the communities that the General Congress must approve. Within the Guna community, there is a law that the government does not officially recognize, but that is respected nevertheless. For example, a mining project had been approved by the government, but the General Congress rejected it. They said that the decision had to be in the hands of the Guna.

We originated in the forest, but now we belong to the ocean. An archaeologist from the Smithsonian said that more than 100 years ago, there were Guna toponyms. Our laws have been recognized and replicated, but we must be recognized as authors. Some of our sacred songs have been taken from their contexts without our intellectual property rights being recognized. We have a great deal of knowledge about medicinal plants, but we don't share it. In the Guna world, knowledge is collective. When we speak of pollination, we are not experts, but we see changes. For example, in the case of maize, the quality and quantity of production has decreased. The women say that a genetically modified variety was crossed with a native variety. Our people have rejected this new maize.

**Elmer:** Amongst the Guna people, knowledge transmission occurs on several levels: 1) Sabbibene-ga (from the mother's womb). Our elders say that children learn from their mother's womb. For this reason, it is necessary to be careful how you speak around a pregnant woman because the baby is listening; 2) we also speak about a more complex and mystical transmission when we speak about how the *neles* (seers) learn, through dreams; 3) another form of knowledge transmission is through lullabies, in which the role of the woman is fundamental, since it is the mothers, grandmothers and sisters that transmit, through their songs, knowledge related to the roles that boys and girls will be expected to play in Guna society; 4) another basic aspect is the Congress house, the place where community members meet and speak about different topics related to daily life, the political struggles of the Guna people or other themes; 5) even after the death of a Guna, through specialized songs that only the specialist in *Masar igar* can sing. This is the expert that must guide the dead through the river rapids whence came the Guna people. It is for this reason that the river is considered sacred. Therefore, if someone does damage to the river, it infringes upon the traditional knowledge of our people. **Florina:** Indigenous women transmit their knowledge through practice, women have an important role, for example in the care of maize, it is the women who administer the production of maize. When the men harvest it, they bring it to the home where the women have the power to decide how much will be saved for the next planting, how much will be distributed to the community and how much will be kept back for the family's consumption. Furthermore, in this way, they practice reciprocity, which is slowly being lost today, because there is insufficient production of maize and other products. In fact, when there used to be hunting, women decided the distribution of the meat, decided how much they would share out and how much they would eat. Mothers teach their children how to do this. Before, the grandmothers would sit down with the children to weave, design and sew the *molas* [a type of Guna art], and at the same time, they explain the significance of the designs. The designs are collective and the mothers teach them to the children. Nowadays, we are losing the transmission of these designs, so we are looking for alternative ways of recuperating this knowledge in some way through intercultural bilingual education.

**Elmer:** It should be understood that knowledge transmission is specific to our culture. There was a FAO study that concluded that we mistreat our children because we take them at a very young age to fish. But boys learn to fish at a very young age, it is their role. We enrich their knowledge with this experience. First, they must learn about their own culture. There should be a balance between the outside world and our world.

# 5. Indigenous knowledge systems and social-environmental management of pollination and pollinators in the Xingu Indigenous Park, Brazilian Amazon

SIMONE ATHAYDE

Leader, Amazon Dams Network<sup>3</sup>, Tropical Conservation and Development Program (TCD), University of Florida Research Associate, Instituto Socioambiental (ISA)<sup>4</sup>, Brazil.

## 5.1. Introduction

In this contribution to the proceedings of the IPBES Global Dialogue workshop, I present some insights and reflections on indigenous knowledge systems of pollinators (mainly bees) and pollination processes gathered through my previous experience working as a practitioner and researcher for Instituto Socioambiental (ISA, a Brazilian NGO). The main work informing my considerations reported in this IPBES document relates to a project developed by ISA among four indigenous groups in Xingu Park, which I helped to coordinate. The “Bees Ecology” project (*Ecologia de Abelhas*) was developed under the Xingu program led by ISA from 2002 to 2004, aiming to identify and contrast indigenous and academic perspectives on the relationship between the Africanized honeybee and stingless bee species in the region. The project was developed responding to a concern raised by a funding agency, related to the potential impact of apiculture development by indigenous peoples, on the diversity of stingless bee species in the Xingu Park.

Research and educational activities were carried out among four indigenous peoples: Kawaiwete or Kaiabi, Yudja or Juruna, Kĩsêdjê or Suyá and Ikpeng or Txicão. It also involved other ISA practitioners and researchers, as well as academic researchers and APACAME<sup>5</sup> (Associação Paulista de Apicultores Criadores de Abelhas Melíficas Européias/Beekeepers Association of the São Paulo State) practitioners. A mixed method approach was developed, which included semi-structured interviews with elders and leaders, community focus groups, field walks and workshops in schools of four villages. Semi-structured interviews and on-line surveys were carried out among academic experts and practitioners. We found that in both indigenous and scientific perspectives, diversity is a key aspect in keeping exotic and native species in balance and thus avoiding heightened competition and extinction. The Africanized honeybee was compared to the non-indigenous westerners who colonized the Americas, and with whom indigenous peoples had to learn to coexist. A combination of artisanal or small-scale apiculture and meliponiculture is viewed as an activity that might maintain biological and cultural diversity in Amazonian landscapes.

<sup>3</sup> Amazon Dams Network: [www.amazondamsnetwork.org](http://www.amazondamsnetwork.org)

<sup>4</sup> Instituto Socioambiental (ISA): [www.socioambiental.org](http://www.socioambiental.org)

<sup>5</sup> APACAME: [www.apacame.org.br/](http://www.apacame.org.br/)

Here, I wish to acknowledge the contribution of indigenous leaders, beekeepers and project participants to this text, and to highlight indigenous peoples' ownership of intellectual property rights. An academic article summarizing the results of research and of the process of transdisciplinary knowledge production developed in this project has been accepted for publication in the *Journal of Ethnobiology and Medicine* (Athayde et al., *in press*).

## 5.2. Change and responses to change in Pollinators and Pollination for Food Production

For this theme, I propose that we might consider organizing our analysis in three main topics:

- ▶ **Drivers of change:** What are the main regional and global drivers of change, which have led or will trigger significant changes in the maintenance of ecosystems and their services, specifically in relation to the diversity of pollinators and food production? What are these drivers from the perspective of indigenous peoples, and how they might relate to existing academic knowledge and relevant public policies?
- ▶ **Understanding and communicating change:** How do we assess and communicate change and risk in different scales, which may be critical to take action to halt, manage or mitigate impacts and processes of change in and across landscapes, as well as across knowledge systems and cultural specificities?
- ▶ **Coping, managing, and adapting to change:** How have people dealt with social-ecological changes in the past, and how can this practical knowledge inform future actions? What are important local, scientific and technical knowledge and practices that might be integrated and applied to manage and mitigate changes related to pollinators and pollinating processes?

### 5.2.1. Drivers of change

Based on my previous work among indigenous peoples from the Xingu Park in the Amazon, drivers of change have historically led to social-environmental transformations, but these drivers have also been very dynamic and have changed along with social, economic and political contexts in Brazil. Drivers that have led to habitat fragmentation and deforestation in the Amazon are expressed through a remarkable "boom and bust" dynamic, and included timber extraction, mining, cattle ranching, soy and other large-scale agricultural production and infra-structural development such as construction of roads and hydroelectric dams (Athayde 2014). A more recent driver of change that has been perceived by indigenous peoples is climatic change, manifested through phenomena such as droughts and flooding, temperature change and seasonal variations (see for instance, Schwartzmann et al. 2013).

The Kawaiwete (Kaiabi), Yudja, Ikpeng and Kisêdjê indigenous groups living in Xingu Park have also perceived the introduction of exotic species such as the Africanized honeybee as a driver of change, but this aspect will be discussed in the next theme. One important driver of change emphasized by Xingu groups relates to the deforestation and land degradation of Xingu headwaters. Riparian forests act as a buffer to fire and other disturbances, protecting watercourses as well as producing important food resources to fish and other animals, and a diversity of native fruits used in human diets. Thus, the removal or degradation of these forests for agricultural or cattle-ranching production have impacted indigenous and protected areas in different ways, causing habitat loss for native pollinators such as stingless bees.

### 5.2.2. Understanding and communicating change

I argue that one way to look at change is to categorize rapid and slow change and how these processes interplay, identifying biodiversity “hotspots” that need special attention or protection. Another aspect relates to establishing proper spatial and temporal scales and methods to study and monitor change.

Indigenous peoples have a long-term experiential knowledge of nature and social-environmental transformations. For instance, the Kawaiwete (Kaiabi) people in the Brazilian Amazon distinguish several ecozones surrounding their villages, identifying indicator species used to recognize them and to predict seasonal change or variations (Senra et al., 2004; Schwartzmann et al. 2013). We could refer to “**indigenous knowledge markers**”, which inform the starting of the rainy and dry season or the appropriate time to burn the agricultural fields, among others. Among the Kawaiwete, knowledge of some “markers” related to crop production originate in myths and stories of immemorial times. According to the Kawaiwete myth of origin of cultivated plants (Silva and Athayde, 2002), there was a time in which crops did not exist, and people had to rely on eating wild honey, fruits and tree barks. A powerful woman, shaman and mother of two kids named *Kupeirup* was worried about the future of her kids, and envisioned the origin of cultivated crops, that would be possible through her sacrifice, being burned in the middle of the first garden plot. She taught her sons how to plant, harvest and prepare each crop food, and after they cleared a patch of land, she told them to look for a flock of birds (a type of parrot) that would announce the right time to burn the fields (Silva and Athayde 2002). This myth is very long, but shows several aspects related to the holistic knowledge that indigenous peoples hold about environmental indicators, changes and interplay between human practices and biodiversity creation and maintenance.

I suggest that human understanding and communication of changes in pollinators and pollinating systems for food production might greatly benefit from an effort to study and engage indigenous with academic knowledge systems. For example, biophysical knowledge on deforestation, degradation and climatic changes might be combined with indigenous knowledge of markers and status of strategic resources and their environmental requirements. This integrated understanding can refer to selected species or resources or to whole biomes and/or watersheds. The establishment of baseline data to monitor changes should be implemented with involvement of indigenous peoples in the definition of variables, processes and variables to be monitored.

We also need to review current policies towards conduction of research to inform environmental impact assessments (EIAs) being practiced by different countries. Currently, there is no coordination of protocols and ethics for important collection of baseline data that could be informing future trends and impacts of various infrastructure, mining and oil projects on biodiversity at large, and more specifically pollinators and pollination processes. We should strive to implement consistent policies that would provide robust data for areas in risk, repositories to store critical primary data and protocols to access and share data. Many times, these EIAs are conducted with funding from both public and private companies and institutions, who should be accountable to the public and especially to affected communities (including indigenous peoples), informing them about the scope, reach and monitoring of impacts of such projects.

The understanding, monitoring and communicating of changes might also happen through the implementation of partnerships between NGOs, academic researchers and indigenous communities, who could help monitor them through both quantitative and qualitative methods using variables defined jointly depending on the problem, process, and species to be assessed (also referred to as citizen science). This is also related to transmission of knowledge and cross-pollination between academic and indigenous knowledge systems. For example, in several Amazonian communities, the role of the indigenous environmental monitor or environmental agent has been increasingly recognized and supported through specific projects that attempt to integrate indigenous, academic and technical knowledge for biodiversity management and conservation (Athayde et al. 2002; Athayde et al. 2006). Related to these initiatives, see also

the example of Comissão Pró-Índio (CPI), for a long-term program for training indigenous environmental agents in Acre, Brazil (Gavazzi 1996; 1998; 1999).

### 5.2.3. Coping, managing, and adapting to change

The long-term experiential knowledge that indigenous groups hold about biodiversity and how to cope and adapt to social-environmental changes may be of great importance in informing policies and processes to address the current crises in pollinators and pollination processes across the globe. But, in order to apply this knowledge, we must first identify the main problems that cause it; research existing literature related to specific processes; and conduct primary research to fill-up gaps of knowledge and understanding. One tangible example relates to processes of displacement and resettlement, and how they might relate to biodiversity management and conservation. It is predicted that geographical displacement will be critically increased in response to climatic changes, infra-structural development, habitat fragmentation and urbanization in developing countries in the future (Oliver-Smith 2009). How have indigenous peoples dealt with displacement in the past and how these practices might inform future policies? In my doctoral study among the Kawaiwete, focusing on the dynamics of weaving knowledge across three groups, including a displaced group, I found that the displaced group have developed different mechanisms and strategies to cope with the displacement situation, in relation to access and management of strategic resources (Athayde et al. 2009). Among the Kawaiwete, adaptation to the new environmental conditions found in Xingu Park has happened in the last fifty years, through diverse mechanisms and strategies, some consciously developed, some institutionally induced, some community coordinated, some unstructured or unconscious responses to the lack of choice.

I have identified seven mechanisms of environmental adaptation among the Xingu Kaiabi: 1) knowledge innovation in development of nomenclature for ecological zones and species; 2) increase in diversity of resources used for different purposes (e.g. to build canoes) due to village sedentarization and scarcity of important forest resources; 3) agrobiodiversity conservation and recuperation of crop diversity; 4) travel to ancestral land to collect resources; 5) substitution by other local species; 6) exchange of varieties and seeds among families, villages and other ethnic groups; 7) semi-domestication or intentional management – through experiments for planting and protecting key resources (Athayde et al. 2006; Athayde et al. 2009; Athayde 2010).

In conclusion, I propose that mechanisms for coping and adaptation must be sensitive to context specificities, building on existing rules and social organization structures, and might combine academic, practical and indigenous strategies. The aspect of semi-domestication or beekeeping of stingless bees and/or agrobiodiversity is another important mechanism of adaptation to lower species population and consequent potential decline of wild honey availability, which is very important in some indigenous groups' dietary repertoire (Athayde et al. *in press*).

## 5.3. Diversity of pollinators

### 5.3.1. Concepts

How do indigenous peoples articulate the concept of pollinators and pollination? This is a question for follow-up research, for which we don't have definite answers.

Based on previous worked developed among indigenous teachers in Xingu Park, a perspective shared by various groups relates to the fact that, for them, all natural resources have spirits. Shamans have the power to communicate with these supernatural beings and cure illnesses provoked by them. We found that many communities were not aware of the process of pollination as academic knowledge defines



it. Rather, the concept of pollination might be compared with the notion of “fertilization”, as referred by the Guna leader and Chief Don Belizário, during the IPBES global dialogue workshop in Panamá.

As Darrel Posey noted, myth is an important vehicle for transmission of ecological knowledge (Posey 1983). In Kayapó cosmology, an ancient shaman called “wayanga” taught their ancestors how to live, work and defend themselves like social insects, gaining his knowledge observing bee, wasp and ant behaviour (Posey 1983). In indigenous Amazonian cosmology, humans and bees have the same status and respect for each other, reflecting a worldview in which animals, plants and humans spiritual and material forms are transitory and dynamic (Viveiros de Castro 2002).

For indigenous teachers of Xingu Park, what defines biodiversity is the presence of spirits, which exist for both biotic and abiotic beings as defined by academic science. They articulate the biodiversity concept as follows:

*“Biodiversity is the variety of living beings that exist in nature. In the indigenous science, all the beings are alive. All the natural resources are alive and have their spirits. For example: rocks, trees, rivers, birds, wind, fish, earth, water, clay and all the kinds of animals. Therefore, all the natural resources must be respected. For various peoples, the spirits of the natural resources that die continue to exist. We have many rules to respect each living being that exist in nature.”*

Indigenous teachers of Xingu Park, November, 2000 cited by Athayde et al. (2002).

### 5.3.2. Appreciation of diversity

Diversity<sup>6</sup> is a key aspect in keeping both exotic and native species in balance and thus avoiding heightened competition and extinction. Keeping diversity in indigenous lands also involves developing economic alternatives for indigenous peoples. Studies that provide opportunities for listing and cataloguing the diversity of pollinators among indigenous groups should be encouraged, along with biological/ecological studies of these pollinators, to inform status and trends, as well as conservation and management options for areas or pollinators in risk.

### 5.3.3. Species at risk

We should prioritize studies of important food species that have specific pollinators and/or pollinator processes (e.g. priority species), such as Brazil nut in the Paquiçamba Indigenous Land that will be impacted by the Belo Monte dam in the lower Xingu watershed.

### 5.3.4. Introduction of exotic species

Policy-makers and managers need to be aware of the risks of introducing exotic species in natural ecosystems, since the combined and long-term results of these introductions might be largely unknown and underestimated<sup>7</sup>. Specific information and reflections about this topic can be found in our paper, that documents indigenous and non- indigenous perspectives on the relationship of the exotic introduced Africanized honeybee and the stingless bees in Xingu Park (Athayde et al. *in press*). Below, I highlight three testimonies of indigenous representatives on this topic, that illustrate the complexity of this discussion and the lack of a general agreement about the positive or negative outcomes of the introduction of the Africanized honeybee in the Xingu Park region.

<sup>6</sup> Mentioned by Manuela Carneiro da Cunha in the Panama workshop

<sup>7</sup> Commented by Manuela Carneiro da Cunha, and by Maori representative James Doherty during the Panama workshop

According to Sutā Yudja, an indigenous woman and leader in the Tuba Tuba village:

*“The European bee caused the disappearance of the bee ‘katī wīla’, because before the arrival of the ‘europa’ it was so easy to find ‘katī wīla’. When you wanted to hunt this bee, you could find it easily and there was abundant honey. After the ‘europa’ came, this bee disappeared, does not exist anymore.”*

Athayde et al., *in press*

Chief Kuiussi Kysêdjê views this as a positive aspect:

*“Right after the arrival of *Apis mellifera*, the other bees probably found its presence odd. However, they got used to the presence of *Apis*. Now there are flowers for everybody and I see no problem with the apiculture activity, once the beekeepers are not increasing the number of bees, only taking the families from the wild and putting in the beehive box. I like apiculture, because there is more honey for consumption by the community and also for sale.”*

Athayde et al., *in press*

Korotowī Taffarel, a young Ikpeng teacher in Moygu village adds:

*“If we want to increase beehive boxes for *Apis* and also have native bees in boxes, we cannot precipitate the results of what is going to happen, that the *Apis* will harm the other bees. But with the experience, watching and doing, we will be able to observe the changes. Nobody knows what happens now, maybe later, as time passes.”*

Athayde et al., *in press*

All four groups involved in the Bees Ecology project were not originally from the Xingu Park's region and, as a result of migration, could be more willing to accommodate new species into their cosmology (cultural specificities/context specific knowledge). Implications for the field of human ecology, and other related scientific areas, lie in the recognition of the dynamic and mobile aspects of indigenous knowledge in contemporary contexts. In Xingu Park, apiculture and meliponiculture are viewed as sustainable activities that can maintain biological and cultural diversity in Amazonian landscapes, while providing food security and income generation (Athayde et al., *in press*).

## 5.4. Values

- ▶ Values are “bundled” or connected, just like pollinators and ecosystems. They are embedded in layers or webs of meaning (Geertz, 1973) – indigenous peoples do not necessarily distinguish diverse types of values, since a species might be synchronously a resource, a product and a spirit in different moments or contexts.
- ▶ “Ownership” of resources and beings – indigenous peoples have a “horizontal” relationship with beings, rather than possessing ownership or control over them. For instance, the production of flowers and honey is controlled by spiritual beings, and not owned or controlled by humans themselves, who have a relative power over nature.

In Kawaiwete cosmology, the bees have their own Master or Spirit, who takes care of them. This spirit regulates the reproduction of the bees and the production of honey. Each indigenous group has their myths and beliefs related to the bees, but interestingly enough, there are some common features in different indigenous cosmologies. First, there are the relationships between bees and heaven, and sometimes with thunder. The Ikpeng sing a song of a bee to avoid thunders during storms. They say that this song is very dangerous and should not be sung in when there are no storms (Athayde et al. *in press*). In Kayapó of Gorotire cosmology, a powerful Kayapó shaman

called *Bepkôrôrôti* was taken into the sky in a flash of lightning, residing in the clouds and having the power to send lightning, thunder and rain. To show respect and reverence for *Bepkôrôrôti*, who is a great honey consumer, the Kayapó leave a portion of the brood comb and honey for him every time they gather honey (Posey 2002).

## 5.5. Transmission of knowledge and intellectual property rights

- ▶ Knowledge transmission is a two-way process between indigenous and non-indigenous peoples and knowledge systems. How do we support and articulate these cross-pollination transdisciplinary processes while respecting rights and different worldviews and epistemologies (Athayde et al. 2013)?
- ▶ All forms of knowing are valuable and equally important (de-colonizing scientific knowledge). We need to be aware of colonizing concepts or concepts charged with a western or academic worldview that conflict with those of indigenous peoples. Some examples of these concepts are “natural resources” for living beings, and ecosystem services.
- ▶ It is also important to reflect on the process of academic or scientific knowledge production within academia, and on power issues that exist across disciplinary fields. In order to address complex problems, such as the crises of pollinators and pollination that we are facing today, we need to foster contributions and integration across diverse disciplinary fields such as humanities, social sciences, and biophysical sciences.
- ▶ If beekeeping practices for both the Africanized honeybee and stingless bees are to be encouraged as an economic alternative for indigenous peoples, it is desirable that such technical knowledge is constructed on the basis of existing knowledge and management practices, valuing and enhancing local knowledge rather than substituting it by technical knowledge taught to indigenous beekeepers by development or NGO agents (Athayde et al. *in press*).
- ▶ It is important that young people are motivated to learn in schools – consider the role of intercultural education.
- ▶ Another important issue refers to indigenous peoples’ intellectual property rights related to ancestral knowledge of pollinators, pollination and associated products. This knowledge needs to be safeguarded and indigenous ownership of knowledge and data acknowledged by specific policies implemented in each country. One recommendation is to use the IPBES platform as a dialogue and learning space, enabling exchange of knowledge and experiences related to intellectual property rights and ethics protocol across indigenous groups and countries around the world.

## 5.6. Reflections and contributions to the workshop evaluation

### 5.6.1. To be improved in future initiatives:

- ▶ Provide opportunities for “on-site” learning and exchanges – by holding future events in or close to indigenous areas/communities;
- ▶ Plan events in advance and advertise broadly, to provide opportunity to diverse groups to participate (problems with passport and VISA requirements for indigenous representatives from developing countries);
- ▶ Have roles and process clarified to participants throughout the process;
- ▶ Create spaces for creative presentation formats and exchanges among the participants;

- ▶ Document discussions and main aspects discussed using visual methods (e.g. flipcharts, graphs, maps), and use them to review what was accomplished every day.
- ▶ Provide name tags to participants.
- ▶ Provide guidelines to note takers, to minimize future work organizing documents and proceedings.

### 5.6.2. Positive aspects:

- ▶ Logistic details, transportation and accommodation of participants well arranged, and good food provided.
- ▶ Edgar and Phil's leadership and welcoming skills were fundamental in creating a positive and safe learning environment.
- ▶ Douglas and Serena's leadership was important in keeping track of time and making sure outcomes were achieved.
- ▶ Presence of diversity of geographical areas, genders, training and experiences provided ground for fruitful knowledge exchange and feedback into the report.
- ▶ Singing, praying and poetry by indigenous representatives critically helped to create and maintain a safe and pleasant learning space.
- ▶ Authors were willing to listen and respectful of indigenous perspectives.

## Supporting references and other materials of interest:

- Athayde**, S. F., R. Stepp and W. Ballester. (In press) Advantage or Prejudice? Engaging Indigenous and Academic Knowledge on Bees in the Brazilian Amazon. *Journal of Ethnobiology and Ethnomedicine*.
- Athayde**, S. 2014. Indigenous Peoples, Dams and Resistance in Brazilian Amazon. *Tipití: Journal of the Society for the Anthropology of Lowland South America* 12 (2): 80-92.
- Athayde**, S. F., W. L. Bartels, R. Buschbacher, and R. D. R. Seluchinesk. 2013. Collaborative learning, transdisciplinarity and social-environmental management in the Amazon: approaches to knowledge production between academia and society. *RBPG* 10(21): 723-748.
- Athayde**, S. F. 2013. Ciências e Tecnologias Indígenas: Tecendo Natureza, Cultura e Sociedade. *Revista de História da Biblioteca Nacional* 8 (91): 30-33.
- Athayde**, S. F. 2010. *Weaving Power: Displacement, Indigenous Knowledge Systems and Territorial Control amongst three Kaiabi groups in the Brazilian Amazon*. Doctoral Dissertation, School of Natural Resources and the Environment and Tropical Conservation and Development Program, University of Florida. Gainesville, 2010.
- Athayde**, S. F., Kaiabi, A., Ono, K. Y. and Alexiades, M. 2009. *Weaving power: displacement and the dynamics of basketry knowledge amongst the Kaiabi in the Brazilian Amazon*. In: M. Alexiades (ed.) *Mobility and Migration in Indigenous Amazonia: Contemporary Ethnoecological Perspectives*. London : Berghahn Books. Ch 11, pp249-274.
- Athayde**, S. F., G. M. Silva, J. Kaiabi, M. Kaiabi, H. R. Souza, K. Ono and E. M. Bruna. 2006. Participatory research and management of "arumã" by the Kaiabi people in the Brazilian Amazon. *Journal of Ethnobiology* 26 (1): 36-59.
- Athayde**, S. F., Silva, G. M., Troncarelli, M. C., Wurker, E., Schmidt, M. V. C., and Ballester, W. C. 2002. Educação Ambiental e conservação da biodiversidade: a experiência dos Povos do Parque Indígena do Xingu (Environmental Education and Biodiversity Conservation: the Experience of Indigenous Peoples at Xingu Park). In: Bensusan, N. (org.), 2002. *Seria Melhor Mandar Ladrilhar? Biodiversidade: como, para que, por que*. Brasília: Editora da Universidade de Brasília/Instituto Socioambiental, pp. 103-117.

- Gavazzi**, R.A. 1998. Chegou o Tempo de Plantar as Frutas – CPI-AC, Rio Branco.
- Gavazzi**, R.A. 1999. Ciências da Floresta- CPI-AC, Rio Branco.
- Gavazzi**, R.A (org.) 1996. Geografia Indígena. Instituto Socioambiental/MEC/PNUD, Brasília.
- Geertz**, C. 1973. *The Interpretation of Cultures*. New York: Basic Books.
- Oliver-Smith**, A. (ed.) 2009. *Development & dispossession: the crisis of forced displacement and resettlement*. Santa Fe: School for Advanced Research Press.
- Posey**, D. 1983. Ethnomethodology as an emic guide to cultural systems: the case of the insects and the Kayapó Indians of Amazonia. *Rev bras. Zool.* 1(3): 135–144.
- Posey**, D. 2002. Wasps, warriors and fearless men: ethnoentomology of the Kayapó Indians of Central Brazil. In: Posey, D. A. *Kayapó Ethnoecology and Culture*. London, Routledge. pp. 82–92.
- Pretty**, J., Adams, B., Berkes, F., Athayde, S. F. Dudley, N., Hunn, E., Maffi, L., Milton, K., Rapport, D., Robbins, P., Sterling, E., Stolton, S., Tsing, A., Vintinner, E. and Pilgrim, S. 2009. The Intersections of Biological Diversity and Cultural Diversity: Towards Integration. *Conservation & Society* 7 (2):100–112.
- Schwartzman**, S., A. Villas Boas, K. Y. Ono, M. G. Fonseca, J. Doblaz, B. Zimmerman, A. Jerolimski, M. Salazar, R. P. Junqueira and M. Torres. 2013. The Natural and Social History of the Indigenous Lands and Protected Areas Corridor of the Xingu River Basin. *Phil. Trans. Roy. Soc. B* 368 (1619) doi: 10.1098/rstb.2012.0164
- Senra**, K. S. F. Athayde and G. M. Silva. 2004. Os Kaiabi hoje: aspectos culturais e ambientais (The Kaiabi today: cultural and environmental aspects. In: G. Grünberg. 2004. *Os Kaiabi do Brasil Central. História e Etnografia*. São Paulo: Instituto Socioambiental/Dka Austria.
- Silva**, G. M. and Athayde, S. F. 1999. *Bases socioambientais para o desenvolvimento de alternativas econômicas sustentáveis na região norte do Parque Indígena do Xingu – MT*. Technical report, Xingu Program, Instituto Socioambiental and Associação Terra Indígena Xingu, São Paulo.
- Silva**, G. M. and Athayde S. F. (orgs.) 2002. A Ciência da Roça no Parque do Xingu – Livro Kaiabi (Indigenous Agriculture Science at Xingu Indigenous Park- Kaiabi book). São Paulo: Instituto Socioambiental/ATIX/Growing Diversity Project/FNMA/RFN.
- Viveiros de Castro**, E. 2002. Perspectivismo e multinaturalismo na América indígena. In: E. Viveiros de Castro (ed.), *A Inconstância da Alma Selvagem*. São Paulo, Cosac & Naify Publishers, pp. 347–399.

# 6. The Kawaiweté people's traditional knowledge about native bees: Xingu Programme, Brazil

JERONIMO KAHN VILLAS-BOAS<sup>a</sup>

*English editing by Jan Rocha*

a. Instituto Socioambiental (ISA), Brazil

## 6.1. Introduction

This report describes the partial results of the systematization of the Kawaiweté people's traditional knowledge about native bees. Conducted by the Instituto Socioambiental (ISA), in the form of a consultancy undertaken by the ecologist Jerônimo Villas-Bôas, the activity forms part of the ISA's Xingu Programme. It is one of a series of initiatives to promote the development of sustainable economic alternatives in the Xingu Indigenous Park (XIP). The programme also includes the commercialisation of forest seeds, peppers and vegetable oils.

The project also qualifies the ISA to collaborate with the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), which is conducting, in 2015, a thematic assessment of pollinators, pollination and food production and public policy support tools and methodologies. An interesting aspect of the IPBES methodology is that it includes non-economic aspects and what it terms "biocultural diversity" in its valuation of pollination services.

Although systematisation of the Kawaiweté's traditional knowledge about bees is a relatively recent initiative, the results presented here are the product of records accumulated by the consultant over many years while providing technical advice in the XIP in support of the stingless beekeeping productive chain.

The approach presented here does not propose to compare traditional knowledge with scientific knowledge, although this is often attempted, but simply to record the rich knowledge of a specific indigenous ethnic group. The data presented is only part of a much larger body of knowledge. The Kawaiweté culture and its relationship with natural resources is both complex and profound and it would require further research to produce comprehensive results.

A glossary of terms is provided in Appendix A.

## 6.2. Methodology

### 6.2.1. Data collection and information sources

The long period over which the information presented here was collected involved the use of different methods: semi-structured questionnaires, open interviews and "participatory



observation". The latter was made possible by the consultant's provision of technical advice and support on the stingless beekeeping productive chain since 2003.

The main sources of information were four Kawaiweté elders, who live in the Xingu Indigenous Park and are recognised there as being very knowledgeable about bees. However, some information was obtained from younger people, especially those directly involved in the stingless beekeeping productive chain, who provided important data on the classification, etymology and spelling of bee names.

Table 1 lists the information sources, their respective villages, the type of information provided and the period in which it was collected.

**Table 1: Information sources, villages, period of collection, type of information**

Information source	Village	Period	Type of information
Arupá Kaiabi	Kwarujá	July 2003	Identification and listing of species, biology, ecology and traditional use
Wareaiup Kaiabi	P. I. Diaurum	July 2003	Collection, identification of species, etymology and spelling
Jero'a Kaiabi	Maraká	June 2006	Species listing, biology, ecology, nomenclature and traditional use
		February 2015	Classification and etymology
Mairatá Kaiabi	Moitara	June 2006	Species listing, biology, ecology, nomenclature e traditional use
		February 015	Classification, nomenclature, etymology and spelling
Kawita'i Kaiabi	Ayporé	April 2008	Habits and traditional use
Pí'uu Kaiabi	Sobradinho	April 2008	Habits and traditional use
Y'areté Kaiabi	Maraká	February 2015	Classification, nomenclature, etymology and spelling

### 6.2.2. Identification and listing of species

The starting point for identifying species was the mounting, in July 2003, of an entomological collection of bees. Three collectors, one of them a Kawaiweté (Wareaiup Kaiabi), collected bees over a seven-day period at the following locations: the Diaurum indigenous post and the villages of Kwarujá and Moitará. Most of the bees were collected from plants that were flowering at the time and described by the Kawaiweté as "good for the bees", such as Café-Bravo (*Tyapiryp*) and Murici-da-Várzea (*Tāgyriyrywa Pirang*). Collection took place between 7am and 11am and between 1pm and 5pm on a daily basis, using an entomological net. Some specimens were collected along riverbanks while they were collecting mud or from flowers in wetlands while travelling by boat.

The activity resulted in the collection of 85 specimens, which were mounted on entomological needles, dried in an improvised dryer, labelled and stored in an entomological drawer and deposited at the offices of the *Associação Terra Indígena Xingu*, ATIX (Xingu Indigenous Land Association).

The collection was taken to the village of Kwarujá for identification, where Arupá Kaiabi named the specimens in the course of a two-day long conversation. As a result, 22 ethno-species were identified as Kawaiweté. However, during the conversation, Arupá Kaiabi mentioned a further 10 species in the Xingu that had not been collected, as well as another five that did not exist in the region in which the village is located (see the results in item 6.3.3). Among the species listed "from memory" was a honey-producing wasp (*Eju*).

The work of listing the species continued in June 2006, in the villages of Maraká and Moitará. However, on that occasion, the entomological collection was not used as a reference. During a semi-structured interview with the information sources (Jero'a and Mairatá, respectively) they only listed bee species they remembered. As a result, some species not mentioned by Arupá were included in the list. After the first stage of the conversation, the consolidated list was shown to the information sources, providing an opportunity to check for synonyms and record information about the biogeography of the species.

### 6.2.3. Recording information about the species

In 2003 and in 2006, information on the biology (nest characteristics and behaviour), ecology (preferred habitats, floral resources and nesting sites) and traditional uses (product characteristics, uses and beliefs) was recorded for each species mentioned by the information sources.

In 2008, another series of conversations contributed more information. This time, open interviews were conducted with the elders Kawita'i and Pi'uu in the villages of Ayporé and Sobradinho respectively about ecology (floral resources and nesting sites) and traditional uses.

Between 2008 and 2015, during technical support visits, “participatory observation” made it possible to record additional information, mainly on the nomenclature used for colony structures. The results are set out in section 6.3.2 (colony architecture and ontogeny). Relevant information on classification was also observed in this period. Of particular importance was the question of the *Jukyratefet* bee (see section 6.3.1).

Recently, in February 2015, new conversations took place with Jero'a, Y'areté and Mairatá with the aim of removing doubts and taking a final decision on some issues prior to writing the present report. These conversations focused mainly on the classification system and the description of the etymology of the names of the bees.

In 2001, the ISA made a first attempt at systematising Kawaiweté knowledge about bees. At that time, it organised an event in the village of Kwarujá entitled “Bee Ecology”. Coordinated by Wemerson Ballester and Simone Athayde, the event also featured Arupá Kaiabi as the main source of information. However, the data on species described on that occasion was simpler and did not provide any further information to add to what was collected at a later date. However, the information on bee morphology was very detailed and has been incorporated into the results presented in section 6.3.2 (morphology).

## 6.3. Results

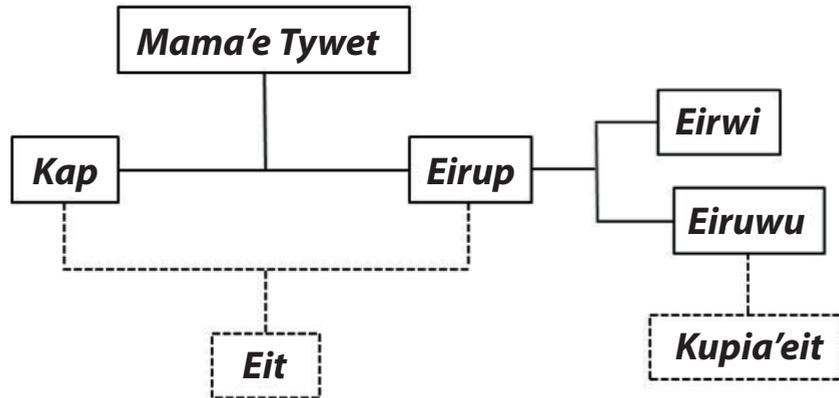
### 6.3.1. Bee classification and diversity

The Kawaiweté believe that bees and other arthropods and venomous animals (including snakes) belong to a major group called **Mama'e Tywet** (*Mama'e* = spirit + *Tywet* = ugly). Stingless bees, a group that science places in the Meliponini sub-family, are called **Eirup**. “Bees” with a sting, including wasps and bumblebees are called **Kap**. There is another general name for social insects that produce honey: **Eit**. This group includes all the *Eirup* and *Kap* that produce honey, including wasps such as **Eju** and *Apis mellifera*. Incidentally, the *Apis* are called **Keweit**, which means “kap that produces honey”.

The word “*eit*” is also used to mean “honey” and “colony”. The word “*eirup*” is used to name an individual bee or swarm.



The major group *Eirup* contains two subgroups: the ***Eiruwi*** (small bees) and the ***Eiruwu*** (big bees). This classification takes a series of factors into account, such as colony size, swarm volume and the size of honey pots. Another group of species classified as *Eirup* nests in anthills. This is the ***Kupi'a'eit*** (*Kupi'a* = mound + *Eit* = honey) group, formed by five species. All the *Kupi'a'eit* are considered to be *Eiruwu*. The term *Kupi'a'eit* is also used to name one of these five species (Figure 1).



**Figure 1:** Kawaiweté classification of stingless bees (*Eirup*).

The morphology of the colony entrance structure (***Eirarakuĩ***) is the primary diagnostic feature used to identify the species. Each species has a particular structure and the word used to describe that structure is often also used to name the species. Morphology (colour, size and shape) and smell are other characteristics used to identify species.

The importance of odour for the identification of species became clear while examining the entomological collection with the old man Arupá. Two types of specimen, which had been dried and preserved in naphthalene, could not be identified because of the absence of their original smell. In the first case, there was a doubt as to whether it was ***Eirun'i*** or ***Myjuí'eit***; in the second case, whether it was ***Eirywy*** or ***Kanine'ku***.

Observation of species in the field during day-to-day technical support work showed that species considered to be different by science are given the same name by the Kawaiweté. One example is the ***Jukyratefet*** bee, represented by a diversity of at least three species of the genus *Melipona* (two in the "*rufiventris* group"). They all have one characteristic in common: the hairs on their thorax are yellow. The data is still incomplete and merits more detailed research.

The three main information sources for the work (Arupá, Jero'a and Mairatá) belong to a branch of the Kawaiweté people who were originally from the Rio dos Peixes region (Juara/MT). Just as there are linguistic variations between the Kawaiweté of different regions, it is possible that they have different concepts of and systems for bee classification.

Table 2 presents a consolidated list of species classified by the Kawaiweté, the etymology of names, the fitting of each one into specific groups and the partial identification of species in accordance with scientific knowledge. There are some synonyms and we have given the same number to these. In addition to the structure of the entrances, mentioned above, morphology and behaviour are other aspects relevant to the etymology of the 37 names investigated.

**Table 2. Stingless bees (Meliponini) known to the Kawaiweté.**

No	Bee name (s)	Etymology	Group	Species
01	<i>Ājurusīng</i>	Ā = vagina + Juru = mouth + Sīng = white	<i>Eiruwuu</i> <i>Kupi'a'eit</i>	Not identified
	<i>Takujurusīng</i>	Takui = penis + Juru = mouth + Sīng = white		
02	<i>'Amype'i</i>	'Amype = nasal mucus + i = small	<i>Eiruwi</i>	Not identified
03	<i>A'warou</i>	'Ap = hair + Wat = eater Ou = large	<i>Eiruwu</i>	Not identified
04	<i>Akykyeirou</i>	Akyky = Bugio (a kind of monkey) + Eirup = bee + Ou = large	<i>Eiruwuu</i>	<i>Melipona fuliginosa</i>
05	<i>Ayapyi</i>	A'y = sloth + Apyi = nostril	<i>Eiruwi</i>	Not identified
06	<i>Eira Tapap</i>	Eirup = bee + Tapap = forehead	<i>Euruwu</i> <i>Kupi'a'eit</i>	Not identified
07	<i>Eirafu'a</i>	Eirup = bee + Fu'a = round	<i>Eiruwu</i>	Not identified
08	<i>Eirun'i</i>	Eirup = bee + Unt = black i = small	<i>Eiruwi</i>	Not identified
09	<i>Eiry'akā</i>	Eirup = bee + Akā = branch	<i>Eiruwu</i>	<i>Tetragona cf. truncata</i>
10	<i>Eirywy</i>	Eirup = bee + Ywy = earth	<i>Eiruwi</i>	<i>Trigona cf. recursa</i>
11	<i>Eit'ka'jām</i>	Eit = honey + Ka'jām = hide	<i>Eiruwi</i>	Not identified
12	<i>Jate'i'i</i>	Jate'i = own name i = small	<i>Eiruwi</i>	<i>Tetragonisca angustula</i>
13	<i>Jate'iou</i>	Jate'i = own name + ou = large	<i>Eiruwi</i>	<i>Tetragonisca angustula</i>
14	<i>Jawakānguu</i>	Jawakāng = bone flute + uu = long	<i>Eiruwu</i>	<i>Melipona seminigra pernigra</i>
15	<i>Jukyratefet</i>	Jukyt = salt + Tyfet = bran	<i>Eiruwu</i>	<i>Melipona cf. paraensis</i> <i>Melipona cf. fulva</i> <i>Melipona cf. melanoventer</i>
16	<i>Kanine'ku</i>	Kanine = macaw + Ku = tongue	<i>Eiruwu</i>	Not identified
	<i>Ku'ape'na</i>	Ku'a = hip + Pe'na = crooked		
17	<i>Kawīta'i'i</i>	Kawī = porridge + Tai = acidic + i = small	<i>Eiruwi</i>	<i>Lestrimelitta sp.</i>



No	Bee name (s)	Etymology	Group	Species
18	<i>Kawitajou</i>	<i>Kawī</i> = porridge + <i>Tai</i> = acidic + <i>Ou</i> = large	<i>Eiruwi</i>	<i>Lestrimelitta</i> sp.
19	<i>Kupi'a'eit</i>	<i>Kupi'a</i> = anthill + <i>Eit</i> = bee	<i>Eiruwu</i> <i>Kupi'a'eit</i>	Not identified
20	<i>Kupi'a'eit Tuwytang</i>	<i>Kupi'a</i> = anthill + <i>Eit</i> = bee <i>Tup</i> = father + <i>Wytang</i> = orange	<i>Eiruwu</i> <i>Kupi'a'eit</i>	Not identified
21	<i>Kururu'eit</i>	<i>Kururu</i> = frog + <i>Eit</i> = bee	<i>Eiruwu</i>	<i>Partamona</i> sp.
22	<i>Mamangairowosing</i>	<i>Mamanga</i> = bumblebee + <i>Eirup</i> = bee + <i>Sing</i> = white	<i>Eiruwu</i>	<i>Melipona compressipes</i> cf. <i>fasciculata</i>
23	<i>Ma'ra'ou</i>	<i>Ou</i> = large	<i>Eiruwu</i>	<i>Frieseomelitta</i> sp.
24	<i>Marumare</i>		<i>Eiruwu</i>	<i>Scaptotrigona</i> sp.
25	<i>Myju'euruu</i>	<i>Myju'i</i> = swallow + <i>Eiup</i> = bee + <i>uu</i> = long	<i>Eiruwu</i>	Not identified
26	<i>Myju'eit</i>	<i>Myju'i</i> = swallow + <i>Eit</i> = bee	<i>Eiruwu</i>	<i>Scaptotrigona</i> cf. <i>polystica</i>
27	<i>Tape'owari</i>	<i>Tape'om</i> = eye secretion <i>Wat</i> = eater <i>i</i> = small	<i>Eiruwi</i>	<i>Leurotrigona</i> cf. <i>muelleri</i>
28	<i>Ma'ra Pypit</i>	<i>Ma'ra</i> = vagina + <i>Pypi</i> = wide	<i>Eiruwu</i>	<i>Tetragona clavipes</i>
	<i>Topemök</i>	<i>Topejop</i> = eyelashes + <i>Mök</i> = mingau		
29	<i>Tape'u'a</i>	<i>Tape</i> = path + <i>U'a</i> = fallen	<i>Eiruwu</i>	<i>Scaptotrigona</i> cf. <i>nigrohirta</i>
30	<i>Tape'u'a Tuwun</i>	<i>Tup</i> = father + <i>Wun</i> = black	<i>Eiruwu</i>	<i>Scaptotrigona</i> sp.
31	<i>Tata'eit</i>	<i>Tata</i> = fire + <i>Eit</i> = bee	<i>Eiruwu</i>	<i>Oxytrigona</i> cf. <i>tataira</i>
32	<i>Tokokysing</i>		<i>Eiruwu</i>	
33	<i>Tymakapemeit</i>	<i>Tymakapem</i> = leg + <i>Eit</i> = bee	<i>Eiruwi</i>	<i>Frieseomelitta varia</i>
	<i>Ma'rau'i</i>	<i>i</i> = small		
34	<i>Uru'i Pepokang</i>	<i>Uru</i> (the bird) + <i>Pepo</i> = wing + <i>Kang</i> = bone	<i>Eiruwi</i>	Not identified
	<i>'Awyt</i>	<i>'Awyt</i> = clitoris		
35	<i>Y'wauwai</i>	<i>Y</i> = water + <i>Wai</i> = tail	<i>Eiruwu</i> <i>Kupi'a'eit</i>	<i>Trigona</i> cf. <i>cilipes</i>
36	<i>Y'waou</i>	<i>Y'wa</i> = fruit + <i>Ou</i> = large	<i>Eiruwu</i>	<i>Trigona</i> cf. <i>amazonensis</i>
37	<i>Ywypy'eit</i>	<i>Ywypy</i> = foot of tree + <i>Eit</i> = bee	<i>Eiruwu</i>	Not identified

### 6.3.2. Biology

#### ► Colony architecture and building materials

The Kawaiweté use specific terminology to describe colonies. They say that most species live in tree cavities called **Eiryp** (*Eirup* = bee + *Yp* = tree). The cavity itself, that is, the hollow in the tree used for the nest, is called **Ywywyĩ** and in some species is delimited by walls or batumen. (**Eirowopypé**). The geopropolis, material used to build the wall or batumen and the entrance structure (**Eirarakuĩ**) in some species, is called **Owopypé**. The honeycombs (**Ryrũ**) have different names: **Ju'yrũ** for pollen pots and **Tyapi'ryrũ** for honey pots. The wrapping, the structure that covers the honeycomb (**Ta'yt**), is called **Ta'ypiat**. The pots, the wrapping and the honeycombs are made of wax, **Etam**.

The Kawaiweté recognise two basic types of honeycomb: those with horizontal brood combs and those whose cells are grouped in the form of a cluster. However, there is no specific name for each one of them. The table in Appendix B shows the type of honeycomb for each of the species listed in the report.

#### ► Ontogeny and castes

Recognition of the stages of larval development is relatively simple and separates the *ta'yt* into two types: **Ta'yraip** for “green honeycombs”, that is, those that house the eggs and larvae, and **Ta'yresagé** for “ripe honeycombs”, which house pupas and adult bees before they are born. After birth, there is no differentiation between young bees that live inside the colony, and the simple term “**eirup**” is used. However, when they leave the nest to carry out external activities, they are called **Ta'ypepo**. The only caste that is given a special name inside the colony is the queen, called **Minu'ou Monat**.

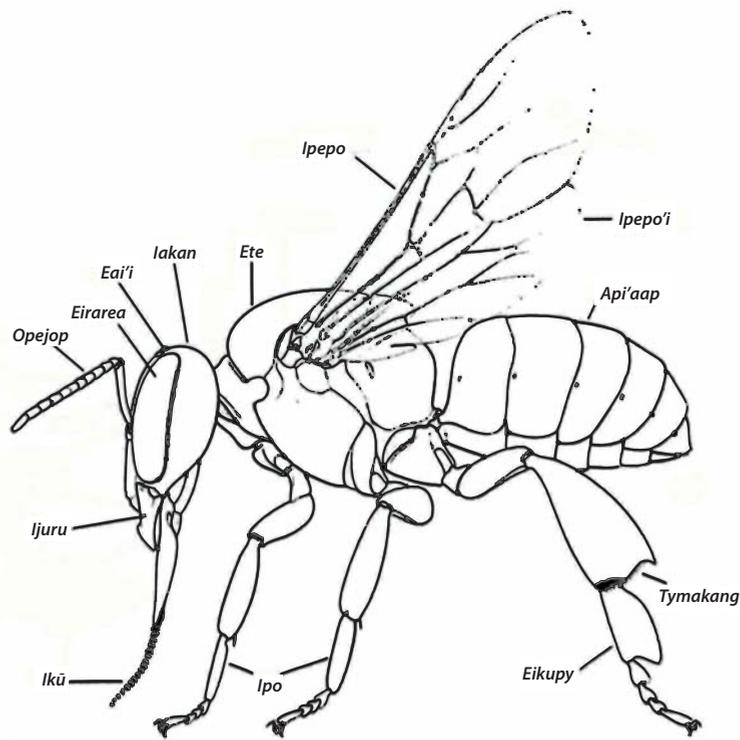
There was no discussion of the external activities and functions of adult bees.

#### ► Morphology

The Kawaiweté's knowledge of the body morphology of bees is complete. Although most body parts are given names analogous to the parts of the human body, some terms are specific to bees. The body is divided into three main parts: **Iakang** (head), **Ete** (thorax) and **Apiá** (abdomen). The wings are named in accordance with their size (not position): the front/large legs are called **Ipepo** and the hind/small legs are called **Ipepo'i**. The two pairs of front paws are considered to be arms and are called **Ipo**. The back paws are considered to be legs and are called **Eikupy**. Each paw (back and front) is made up of three parts: **Ijywa** (equivalent to the thigh or femur), **Tymakapem** (equivalent to the tibia) and **Ifwã** (equivalent to the foot or tarsos). The pollen basket, a structure located on the tibia of the hind paws, is recognised as being exclusive to bees (used to collect pollen and resin) and has a special name: **Tymakang**. The jaws are considered to be the mouth (**Ijuru**), and the tongue, as with all other animals, **Ikũ**. The antennae are called **Opejop**.

The eye (**Ea**) and abdomen (**Apiá**) morphology is known and given special names: the compound eyes are **Eirarea** and the ocellus is called the **Eai'i**. The segments that compose the abdomen are called the **Api'aap**. Figure 2 (adapted from Posey and Camargo, 1990) shows this nomenclature.





**Figure 2:** Morphological structure of bees as recognised by the Kawaiweté. (Adapted from Posey and Camargo, 1990)

### 6.3.3. Ecology

#### ► Biogeography

Although the information obtained indicates that most species occur in several ecological zones, the Kawaiweté have especially good knowledge of the biogeography of bees. This applies at different levels, starting from the local, associated preferentially with particular species for specific habitats, up to a more extensive scale, which recognises that particular species occurs in only some ecosystems of the Xingu. The Kawaiweté are also aware of some species that do not occur in the Park but which were part of the day-to-day life of their ancestors in their original lands.

At the local level, information sources identified five specific habitats, with some bees preferring wetlands, including rivers and lakes (**Yapopet**), forests with dry land woods (**Ka'arete**), forests in the initial stage of regeneration (**Kofet**), fields (**Ju**) and croplands (**Ko**). The table in Appendix B shows the preference of each species.

At the more extensive scale, that is, the territory occupied by the Kawaiweté in the Xingu Indigenous Park, there is an ecotone between a large group of species that live along the River Xingu, in the central part of the Park, and others that occur exclusively along the Arraia River, in the western part of the park. A symbolic case is the **Tapew'a** bee, whose honey is extremely appreciated by all the Kawaiweté (as a result of their memory of the times when they lived in their original lands), but the right to consume this honey belongs to the villages located on the Upper Arraia River, where the bee occurs. Other bees that occur only in this region are the **Eira Tapap** and the **Tokokysing**. This is another issue that has only been investigated superficially and that deserves further research.

Stingless bee species that are not present in the Xingu (nor in the Arraias) but which form part of the memory of the information sources, are listed in table 3, below. Table 3. Stingless bees known to the Kawaiweté that do not occur in the Xingu

N°	Name	N°	Name
01	<i>Jate'i Etami</i>	05	<i>Tapi'weit</i>
02	<i>Taku'sipe</i>	06	<i>Eitouwak</i>
03	<i>Takkujuruu</i>	07	<i>Eirowowosing</i>
04	<i>I'raõ</i>		

### ► Nesting sites

Although most of the species described here nest in the cavities of living trees, the Kawaiweté recognise other nesting substrates. For example, the ***Kupi'a'eit***, described above, and some species that build their nests in dead trees, especially in the *roça*, and others that build nests that are suspended from high in the trees and a subterranean bee, the ***Eirywy***.

In the case of living trees that house bees (***Eiryp***), the Kawaiweté did not appear to know which tree species is preferred by each type of bee. However, they do know about a group of tree species used by ***Eirup*** as a whole for nesting. Table 4 lists the main trees used for nesting in the Xingu. Identification of the species in accordance with scientific nomenclature is pending. The aim is to do this before the end of 2015.

Table 4. Tree species used for nesting by Eirup in the Xingu.

N°	Name of tree	Species	N°	Name of tree	Species
01	<i>'Yrem</i>	<i>Cupiúba</i>	15	<i>Kwaamyp</i>	
02	<i>'Ywapiruru</i>		16	<i>Kwasigyp</i>	
03	<i>'Ywewujyp</i>		17	<i>Kwiagyp</i>	<i>Itaúba</i>
04	<i>Aju'yp</i>	<i>Canelão</i>	18	<i>Monuwý'wa</i>	<i>Cumarú</i>
05	<i>Aju'ytai</i>		19	<i>Munuwiranyyp</i>	
06	<i>Ape'yp</i>	<i>Tamborinho</i>	20	<i>Muwirānyyp</i>	
07	<i>Apinany</i>		21	<i>Paraiup</i>	
08	<i>Arapari'yp</i>		22	<i>Pirāi'yp</i>	
09	<i>Asi'a'yp</i>		23	<i>Takype'yp</i>	
10	<i>Ewoi'yp</i>		24	<i>Wyrajyk</i>	
11	<i>Jaipewap</i>		25	<i>Yagyp</i>	<i>Amarelão</i>
12	<i>Juta'yp</i>	<i>Jatobá</i>	26	<i>Ykyryp</i>	<i>Mangue</i>
13	<i>Jy'a'yp</i>		27	<i>Ypeerowyp</i>	<i>Guarantã</i>
14	<i>Kupewogy</i>		28	<i>Ywunyp</i>	

### ► Floral resources

As with the trees used for nesting, the Kawaiweté did not have any specific knowledge about bee preferences for particular species of plants as a food source. However, they know about “preferred plants” that are visited by many species of bee. It did not prove possible to identify the relationship between these plants and any preferences for the two food sources, pollen and/or nectar (**Tyapi**).

Table 5 lists the plant species identified as food suppliers for stingless bees.

**Table 5: Xingu Eirup – main floral resources**

N°	Name of tree	Species	N°	Name of tree	Species
01	<i>Akajuu</i>	Not identified	11	<i>Pinowa'í'yp</i>	A type of liana
02	<i>Akyranyp</i>	Not identified	12	<i>Siakangyp</i>	<i>Ipê amarelo</i>
03	<i>Inata'yp</i>	<i>Inajá</i>	13	<i>Tāgyriyrywa</i>	<i>Murici do Mato</i>
04	<i>Inata'yp</i>	Not identified	14	<i>Tāgyriyrywa Pirang</i>	Not identified
05	<i>Jakyrā'nyp</i>	Not identified	15	<i>Tamméju'ywémo</i>	Not identified
06	<i>Jujy'wa</i>	<i>Açaí</i>	16	<i>Tyapiryp</i>	<i>Café Bravo</i>
07	<i>Karemu'yp</i>	Not identified	17	<i>Wirio'gyp</i>	Not identified
08	<i>Kupaa'yp</i>	<i>Copaíba</i>	18	<i>Ywa'ypya</i>	Not identified
09	<i>Kwaru'a'i</i>	Not identified	19	<i>Ywewujyp</i>	Not identified
10	<i>Monuwy'wa</i>	Not identified			

### ► Pollination

The informant sources did not appear to have any knowledge about the pollination process, nor of any process analogous to that described by science. The Kawaiweté believe that fruit and seeds grow as part of the natural maturing process of plants. In the words of Jero'a Kaiabi, “from the moment that a tree grows and becomes an adult and is ready to flower, it will give fruit”.

However, they know a lot about the dispersal of fruits and seeds and about the large amount of work done by animals to pollinate plants. “The bats, birds, cotias, macaws, parrots etc. are responsible for spreading seeds and creating forests”.

### ► Predators and natural enemies

The Kawaiweté identify three species of **Eiru** with cleptobiotic habits that take honey and pollen from colonies: **Kawita'i'i** and **Kawitajou** – both of the genus *Lestremellita*, differentiated by the size and structure of their nest entrance – and **Marumare**, a species from the genus *Sacaptotrigona* that is very common throughout the park.

The Kawaiweté say that the bees' biggest enemy among mammals is the *tayra* (*Eira barbara*). Special attention should be given to wasps, ants and birds, some groups of which are common natural enemies of stingless bees in other regions of Brazil.

### 6.3.4. Traditional uses

It would not be too much to claim that bees and their products are among the main elements of Kawaiweté culture. Traditionally, they do not attempt to domesticate bees. They are used in an extractivist way, for food and, sometimes for medicinal products and wax (**Etam**).

Irrespectively of the species and product, there was a consensus among the information sources that the **Eirup** have a strong spirit, represented by an entity called **Ywa'y Jemujãng** (tree + piece + figure). Anyone extracting products must be respectful, careful and silent. Exploiting bees without showing them respect – which they said is common among young people these days – causes discomfort, fever, headache and aches in the body and can be fatal. The reason is that **Ywa'y Jemujãng** “places a piece of wood from the tree that houses the bees into the person”. The medicine man extracts this piece of wood to cure illness caused by bees. This is why honey produced by stingless bees is rarely used as a remedy. On the contrary, people feeling ill are more sensitive and more susceptible to the actions of **Ywa'y Jemujãng**. The rare examples of medicinal use are described below.

#### ► Products

Honey (**Eiryapit ou Eit**), pollen (**Eiru'i fet**) and broodcombs (**Tayt**) are consumed as food. The most common method of consumption is a “honey juice” (**Eiry**), which is a mixture of the ingredients listed above with water added. Honey is essential to prepare **eiry**, but pollen and honeycombs are optional and this depends on availability. The honeycomb has to be “green” and is also called sour honeycomb (**Ta'yraip**), that is, which houses eggs or larvae. Never pupa (**Ta'yresagê**).

Jero'a Kaiabi says that bees form part of the natural environment of the Kawaiweté, who have learned to live with them and use bee products. “It is like mingau, we like to have some **Eiry** before and after a meal”, he says.

Not all species of bee produce edible honey, honeycombs and/or pollen, as set out in the table in Appendix B. In some cases, this is simply a question of taste, but the Kawaiweté are also aware of toxic honey and pollen. A notable case is the honey produced by **Kawita'i'i** and **Kawitajou** (*Lestremellita* sp.) bees, which is known to be dangerous. One of the information sources involved in the research once ate the honey and it gave him a nerve problem in the hands, which led to him being given the name of the bee: **Kawita'i'i**.

Even among species that produce edible resources, not every type is fit for human consumption. The pollen consumed is generally the newest, described as “sweet” and less bitter. Honey can also give off a bad smell or have a disagreeable consistency, which discourages people from eating it.

Although 26 (70%) of known species produce edible honey, observation shows that most honey consumed on a regular basis is produced by eight species: **Jate'i'i**, **Jawakãnguu**, **Jukyratefet**, **Ku'ape'na**, **Mamangairowosing**, **Myju'ieit**, **Tapu'a** (in the region where it occurs) and **Tata'eit**, as well as *Apis mellifera* (**Kaweit**). The Kawaiweté tend to concentrate on taking honey from these species because they produce a lot of honey and are common in the most accessible regions, such as vegetable gardens (*roças*) and brushland (*capoeiras*) near to villages and wetlands, which are regularly crossed when travelling by boat or canoe.

The information sources said they missed preparing the recipes they used to prepare in their original lands and which they are no longer able to make because of the lack of raw materials: Patauá juice with honey, Brazil nut porridge with honey, squeezed cocoa pulp with honey and Inajá porridge with honey.

Some types of wax (**Etam**), especially the wax produced by the species **Myju'ieit**, are widely used for crafts. They make fibres waterproof, are used as glue to make tools, are used to caulk bags, make round-pointed arrows which are used to kill to be used for headdresses. Wax produced by the **Kawita'i'i** and the **Kawitajou** is burned to keep away mosquitos.

### ► Obtaining products

The Kawaiweté do not often organise specific bee “hunting” expeditions. Products are consumed when found in the course of carrying out other regular activities, such as hunting, clearing land for planting and exploiting tree products – firewood or timber for building – or non-timber products, such as fruit, herbs and other raw materials. The Kawaiweté sometimes organise specific expeditions to exploit colonies, but the colonies are generally discovered previously, while carrying out other activities.

Pi’uu Kaiabi says that eating honey keeps him strong when walking in the forest. “My father sometimes went three days without eating in the forest when he was hunting. He ate honey to get his strength back”. Jero’a says that whoever finds honey generally takes the biggest share but that it is common for some to be taken back to share in the village: “people are invited to drink honey-flavoured juice after eating something like porridge. Mainly children, who like sweet things”.

When colonies are located high in the trees, it is common for the tree to be cut down prior to extraction of products. If the tree is very big and cutting it down requires a lot of effort, the Kawaiweté improvise scaffolding out of branches and lianas in order to gain access to the colony. In order to access the cavity that holds the products, a segment is opened in the tree trunk. The main tool used for this work is the axe (formerly, a stone axe). When available, a chainsaw is used, especially for the heavy work of cutting down trees.

Any pots of honey, pollen or honeycombs that are not consumed at the time of removal are stored and transported to the village for use in preparing **Eiry**. When removal is planned, it is common to use bowls or aluminium pans for storage. Otherwise, traditional methods are used: a receptacle made of Banana-Brava leaves.

A piece of leaf is used to protect the ears when removing products from the nests of more aggressive species. Nothing else. Smoke is needed only for the **Kap** and the **Tata’eit**. There are two remedies for the burns caused by the caustic liquid secreted by the **Tata’eit**: the sap of the *Banana-Brava* and a liana called **Muãnge’ê**, which is macerated and put on the affected areas.

### ► Medicinal use

Honey is often used for medicinal purposes. All the information sources mentioned its use for stomachache and diarrhoea caused by eating fish, especially undercooked river fish (as *Pintado*, *Pirarara*, *Filhote*, etc.). Any honey is usable as long as it is fresh. It should be consumed pure and not as in **Eiry**. Two information sources said that honey produced by the **Jate’i’i** is used for infections on the lips of babies. Honeycombs are also used for medicinal purposes. Honeycombs produced by the **Kawita’i’i** and the **Kawitajou** bees are rubbed on the skin to reduce the temperature of people with a fever.

The honeycombs of all species of bee are also rubbed on the heads of children and young people to frighten away evil spirits and protect them against disease. It is believed that this procedure increases the capacity (and luck) of the person in question to find bees in the forest. Only green honeycombs (**Ta’yraip**) are used for this.

### ► Beliefs

Here is a list of beliefs related to the consumption of stingless bee products, all associated with the male custom of abstinence from sex during the pregnancy of their wives:

- Honey produced by the **Ku’ape’na** bee must not be extracted without first destroying the colony’s batume (**Eirowopyé**). Otherwise, there could be problems when giving birth. It would make it difficult for the baby to come out;

- ▶ Honey produced by the **Mamangairowosīng** bee must not be consumed. It could cause mycosis of the skin of the baby about to be born;
- ▶ Honey produced by the **Ma'ra Pypit** bee must not be consumed. It causes a lot of secretion in the baby's nose and eyes;
- ▶ Honey produced by the **Tata'eit** bee must not be consumed. It causes red blotches on the baby's skin;
- ▶ Honey produced by the **Eiry'akā** bee must not be consumed. It could give the child about to be born stomach ache.

## 6.4. Final comments

Despite the need to ascertain certain details, add more information and even conduct further research on the large universe constituted by the relationship between the Kawaiweté and bees, the information presented here is enough to show that material and immaterial values justify making every effort necessary to conserve the knowledge and the associated natural resources.

As a preliminary assessment, the information presented here could be useful in two ways:

- ▶ **As an instrument for cultural transmission:** Providing material for a digital or printed publication able to provide young people, who are increasingly interested in what can be learned from older generations, with the wealth of environmental and spiritual knowledge that the Kawaiweté have about bees.
- ▶ **As a reference for public policies:** In a context of the expansion of agricultural frontiers and the increasing difficulty experienced by indigenous peoples in recovering and demarcating their territories, documentation about the place of bees in indigenous culture could be useful for the creation of new protected areas. Although indigenous lands have proved to act as significant protected areas for the conservation of bees, the preference of bee species for particular habitats, which is fully appreciated by the Kawaiweté, as we have described, could be used as a decisive parameter in anthropological reports used for demarcation. Metaphorically, this is a scenario which can demonstrate the mutually advantageous relationship between indigenous peoples and bees.



## APPENDIX A: Glossary

**Api'aap** – Segment of the bee's abdomen

**Apiá** – Abdomen

**Ea** – Eyes

**Eai'i** – Ocelli

**Eikupy** – Legs (in the case of bees, refers to the hind legs)

**Eirarakuĩ** – Colony entrance structure of stingless bees

**Eirarea** – Compound eyes of bees

**Eirowopypé** – Batumen

**Eiru'i fet** – Pollen

**Eirup** – Stingless bees, equivalent to the scientific Meliponini sub-family. Term also used to name an individual or swarm of bees.

**Eiruwí** – Small stingless bees (classification that takes into account a series of factors, such as colony size and pote de honey size)

**Eiruwu** – Large stingless bees (classification that takes into account a series of factors, such as colony size and honey pot size)

**Eiry** – Honey juice

**Eiryapit** – Honey

**Eiryp** – Trees that give a home to bee colonies

**Eit** – Social insects that produce honey. Term also used to mean honey and colony

**Etam** – Bee wax

**Ete** – Thorax

**Iakang** – Head

**Ifwã** – Feet (or tarsus)

**Ijuru** – Mouth (jaw in the case of bees)

**Ijywa** – Thigh (or femur)

**Ikũ** – Tongue

**Ipepo** – Front wings (large)

**Ipepo'i** – Hind wings (small)

**Ipo** – Arms (two pairs of front legs in the case of bees)

**Ju** – Category of ecosystem: area subject to seasonal flooding

**Ju'iyrũ** – Pollen pots

**Ka'arete** – Category of ecosystem: dry land forest

**Kap** – Flying social insects (wasps and bees) with a sting

**Keweit** – Bee *Apis mellifera*

**Ko** – Category of ecosystem: croplands

**Kofet** – Category of ecosystem: forests in the initial stage of regeneration

**Kupi'a'cit** – A group of bee species that nest in anthills, also used to name one of these species.

**Mama'e Tywet** – A group that includes arthropods and other venomous animals, including snakes.

**Mānge'e** – Liana used to treat skin burns caused by the caustic liquid secreted by the *Tata'eit*

**Minu'ou Monat** – Queen bee

**Opejop** – Antennas

**Owopypé** – Geoprópolis

**Ryrũ** – Food pots

**Ta'ypepo** – Field bees

**Ta'yraip** – “Green” honeycombs that house eggs and larvae

**Ta'yresagè** – “Ripe” honeycombs that house pupas and adult bees prior to birth

**Ta'yt** – Broodcombs

**Tyapit** – Nectar

**Tyapi'ryrũ** – Honey pots

**Tymakang** – Pollen basket

**Tymakapem** – “Canela” or tibia

**Yapopet** – Category of ecosystem: wetland forests

**Ywa'y Jemujāng** – Spirit that rules over stingless bees

**Ywywĩ** – Tree cavity used by bees for nesting



## APPENDIX B: Description of stingless bee ethno-species known to the Kawaiweté

N°	Name	Honey	Pollen	Broodcombs	Nest characteristics	Habitat	Behaviour	Observations by researcher
01	<i>Ājurusing ou Takuijurusing</i>	Inedible	Inedible	Inedible	Anthills; Compact honeycombs	Wetlands		
02	<i>'Amype'i</i>	No information						
03	<i>A'warou</i>	Edible; a lot of honey	Inedible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Aggressive; cut hair	
04	<i>Akykyeirou</i>	Edible	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Aggressive	Rare
05	<i>A'yapy'i</i>	Edible	Edible	Edible	Rotten wood; compact honeycombs	Croplands	Not aggressive	Rare
06	<i>Eira Tapap</i>	Edible; Not very sweet	Edible	Edible	Anthills; compact honeycombs	Anywhere	Aggressive	Occurs exclusively in the Arraias region
07	<i>Eirafu'a</i>	Edible; "thick".	Edible	Edible	Suspended nest; compact honeycombs	Anywhere	Very aggressive	Yellow-coloured bee
08	<i>Eirun'i</i>	No information						
09	<i>Eiry'akā</i>	Edible; "thick" and bitter.	Inedible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Some swarms can be aggressive	<i>Tetragona cf. truncata</i>
10	<i>Eirywy</i>	Edible	Edible	Edible	Subterranean; compact honeycombs	Dry land	Not aggressive	<i>Trigona cf. recursa</i>
11	<i>Eit'ka'jām</i>	No information						
12	<i>Jate'i'i</i>	Edible	Edible	Edible	Rotten wood; compact honeycombs	Croplands	Not aggressive	<i>Tetragonisca cf. angustula</i>
13	<i>Jate'iou</i>	Edible	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Not aggressive	<i>Tetragonisca angustula</i>
14	<i>Jawakānguu</i>	Edible; sweet; "frothy"	Inedible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Some swarms can be aggressive	<i>Melipona seminigra pernigra</i>

N°	Name	Honey	Pollen	Broodcombs	Nest characteristics	Habitat	Behaviour	Observations by researcher
15	<i>Jukyratefet</i>	Edible; sweet	Inedible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Some swarms can be aggressive	More than one species. Yellowish thorax and characteristic smell
16	<i>Kanine'ku ou</i> <i>Ku'ape'na</i>	Edible; sweet	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Not aggressive	
17	<i>Kawita'i'i</i>	Inedible	Inedible	Edible	Hollow in a tree; compact honeycombs;	Dry land	Aggressive; take from other bees	<i>Lestrimelitta</i> sp. (small entrance)
18	<i>Kawitajou</i>	Inedible	Inedible	Edible	Hollow in a tree; compact honeycombs;	Dry land	Aggressive; take from other bees	<i>Lestrimelitta</i> sp. (large entrance)
19	<i>Kupi'a'eit</i>	Edible; Not very sweet	Edible	Edible	Anthills; compact honeycombs	Anywhere	Very aggressive	
20	<i>Kupi'a'eit Tuwytang</i>	Inedible	Inedible	Inedible	Anthills; compact honeycombs	Wetlands	Aggressive	Sweet-smelling bee
21	<i>Kururu'eit</i>	Inedible	Inedible	Inedible	Hollow in a tree or mounds; compact honeycombs	Anywhere	Aggressive, enters the ear	<i>Partamona</i> sp.
22	<i>Mamangairowosing</i>	Edible; sweet	Inedible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Some swarms can be aggressive	Bee with no smell; <i>Melipona compressipes</i> cf. <i>fasciculata</i>
23	<i>Ma'ra'ou</i>	Edible; bitter.	Inedible	Inedible	Hollow in a tree; Honeycombs in "clusters"	Anywhere	Not aggressive	<i>Frieseomelitta</i> sp.
24	<i>Marumare</i>	Edible	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Aggressive; take from other bees	<i>Scaptotrigona</i> sp.
25	<i>Myju'feiruu</i>	No information						
26	<i>Myju'feit</i>	Edible; sweet; "frothy"	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Not aggressive; a number of colonies (up to 20) may occupy the same cavity	<i>Scaptotrigona</i> cf. <i>polystica</i>



N°	Name	Honey	Pollen	Broodcombs	Nest characteristics	Habitat	Behaviour	Observations by researcher
27	<i>Tape'owari</i>	Inedible; causes dizziness	Inedible	Inedible	Hollow in lower branches; honeycombs in "clusters"	Anywhere	Not aggressive	<i>Leurotrigona cf. muelleri</i>
28	<i>Ma'ra Pypit</i>	Edible	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Aggressive; leaves resin in the hair	<i>Tetragona clavipes</i>
	<i>Topemök</i>							
29	<i>Tapeu'a</i>	Edible	Edible	Edible	Hollow in a tree; compact honeycombs; common for the colony to have two queen bees and two entrances	Wetlands, capoiera and dry land	Very aggressive	<i>Scaptotrigona cf. nigrohirta</i> Occurs exclusively in the Aralias region
30	<i>Tapeu'a Tuwun</i>	Edible	Edible	Edible	Hollow in a tree; compact honeycombs	Wetlands, capoiera Dry land	Very aggressive	<i>Scaptotrigona cf. nigrohirta</i> Occurs exclusively in the Aralias region
31	<i>Tata'eit</i>	Edible; much appreciated/liked	Edible	Edible	Hollow in a tree; compact honeycombs	Anywhere	Aggressive; Burns the skin	<i>Oxytrigona cf. tataira</i> Arupá says there are tree types
32	<i>Tokokysing</i>	No information						Occurs exclusively in the Aralias region
33	<i>Tymakapem'eit</i>	Edible; "thick"	Edible	Edible	Dry wood; honeycombs in "clusters"	Croplands and fields	Not aggressive	<i>Frieseomelitta varia</i>
	<i>Ma'rau'i</i>							
34	<i>Uru'i Pepokang</i>	Inedible	Inedible	Inedible	Hollow in a tree; compact honeycombs	Wetlands	Aggressive	
	<i>'Awyt</i>							
35	<i>Y'wauwai</i>	Edible	Inedible	Edible	Mounds; compact honeycombs	Wetlands	Not aggressive	<i>Trigona cf. cilipes</i>
36	<i>Y'waou</i>	Edible	Edible	Edible	Hanging nest; compact honeycombs	Anywhere	Very aggressive	<i>Trigona cf. amazonensis</i>
37	<i>Ywypyeit</i>	Edible; sweet; "frothy"	Edible	Edible	Hollow in a tree; compact honeycombs	Wetlands	Dry land	

# 7. Conservation of the local Black Honeybee (*Apis mellifera mellifera*) and maintenance of traditional beekeeping practices in Cévennes, France

CAROLE PIERLOVISI<sup>a</sup>

a. Muséum National d'Histoire Naturelle, France

## 7.1. Introduction

This text is based primarily on information and data provided by Y. Elie<sup>8</sup>, who runs a local project to conserve an endangered subspecies, the local Black Honeybee (*A. mellifera mellifera*), applying local knowledge associated with the use of traditional tree trunk hives. This was supplemented by several videos (Elie 2005 and Lenglard 2011) and other published materials (Causses and Cévennes 2015, Elie 2009 and Lehébel-Perron 2009).

## 7.2. Traditional beekeeping in the Cévennes

In the Cévennes National Park (southern France), beekeeping is an ancient tradition rooted in an intimate generations-old relationship between people, bees and the environment. Traditional beekeepers from the Cévennes developed skills and knowledge using hives made out of tree trunks (*bruscs* in the local dialect), a hive type that is directly inspired from and thus mimics the habit of local bees to nest in tree hollows, such as those occurring in chestnut trees. By using trunks of chestnut trees topped with schist slabs, traditional beekeepers from the Cévennes have exploited the natural resources available in their immediate environment in an optimal and sustainable way.

Chestnut tree sapwood, which is rich in tannins, has the advantage of repelling wood parasites and also probably other pathogens. These tannins, which continue to be active long after the tree is cut, confer upon the trunk its rot-proof qualities. Apiaries of trunk hives remain in production for several hundred years without any chemical treatment. The heartwood of the tree, devoid of tannins, is easily hollowed out by the beekeeper, even when the trunks are fresh. The top of the trunk hive is covered by a 'lauze', a schist stone typical of the region. The impressive weight of the stone slabs protects the bees from predators while its colour helps minimize temperature variations inside the hive, to which bees are very sensitive. This simple structure has been in use for hundreds of years. For generations, beekeepers from the Cévennes passed on this traditional

---

<sup>8</sup> A traditional beekeeper from Cévennes, France



knowledge linked to trunk hives that allowed them to sustainably manage the local Black Bee. Today, these hives are gradually disappearing with the passing of their last owners.

Traditional apiaries, called *apio* in the local dialect, consist of a variable number of trunk hives. Until the 1970s, the majority of farmers kept trunk hives as they represented an important source of income in the traditional system of Cévenol polyculture. This rural beekeeping, requiring a minimum of energy and equipment, developed in the region from around the 16<sup>th</sup> century. It produced honey that was consumed by the family or sold alongside other farm products. With one or two harvests per year, a trunk hive produces annually up to ten kilograms of honey. Apiaries, which could be composed of up to forty hives, supplied their owners with several hundred kilograms of honey.

The trunk hive is associated with the management of the local Black Bee subspecies that has frequented the area of the Cévennes National Park for thousands of years. This rustic bee is particularly well adapted to its environment: it is able to minimize its energy consumption during the rigorous winters, to develop its population very quickly when conditions are favourable, and to regulate its brood production in accordance with the weather.

### 7.3. Decline and preservation of the Black Bee

In the seventies, modern beekeeping practices encouraged the introduction of the Caucasian bee, *Apis mellifera caucasica*, a lineage of bees that offered interesting characteristics for beekeepers (high productivity, sweetness, disease resistance), but at the cost of other traits such as adaptation to the rigours of the local environment. These artificial introductions of Caucasian bees along with modern beekeeping practices, disrupts the process of natural selection and favours a dilution of genetic material. It results in a loss of the adaptive traits of the local subspecies making the new hybrid less resistant to the rigorous Cévenol environment. Furthermore, the introduction of imported colonies also favoured the spread of new pathogenic agents. According to proponents of the Black Bee, these new pathogens are responsible for the current decline of this subspecies in the Cévennes. Today, the local Black Bee of the Cévennes is considered endangered.

The progressive decline of Black Bees is well known to the traditional beekeepers given their regular and exacting observations of their environment. Cévennes National Park is a protected area. But changes in land use over the past years (landscape closure, silage, decrease of meadows and pastures, etc.) are clearly identified by traditional beekeepers as having a direct impact on bee populations by reducing their vitality, decreasing their abundance and/or modifying their honey production.

In response to this situation, several traditional beekeepers have grouped together to form an association: l'Arbre aux Abeilles ([www.ruchetronc.fr](http://www.ruchetronc.fr)). The goal of the association is to preserve the local Black Bee subspecies from the Cévennes by using trunk hives. Collaborating with the staff of the Cévennes National Park and French scientists, they created a Conservatory where they restore antique trunk hives. They collect Black Bees from abandoned hives and take them to this specific location where colonies can grow in trunk hive following traditional management techniques. In addition, upon the request of the local authorities or at their own initiative, beekeepers also organize various awareness-raising activities (e.g. conferences, workshops) for young people and park visitors about the Black Bee and its traditional management. In this way, they try to reinforce efforts to protect the Black Bee and biodiversity in general. These activities also provide them with an opportunity to pass on their knowledge and skills with respect to trunk hives and traditional bee management with the aim of reinforcing the abundance of the Black Bee populations of the Cévennes.

## References

- Causses and Cévennes**, 2015. *Numéro spécial : Abeille noire et ruche tronc*. Tome 23 : 161–195.
- Elie**, Y. 2005. *L'arbre aux Abeilles*. 30min. [video/movie available at [www.ruchetronc.fr/ruche\\_tronc.php?mn=22](http://www.ruchetronc.fr/ruche_tronc.php?mn=22)]
- Elie**, Y. 2009. *Chronique des ruches tronc, l'Arbre aux Abeilles*. Editions GabriAndre, France.
- Lehébel-Perron**, A. 2009. *Etude ethnobiologique et écologique de l'abeille noire cévenole élevée en ruchers-troncs : Conservation et valorisation dans le cadre du développement durable*. 20p. [Masters Thesis] Université des Sciences et Technologies de Montpellier II
- Lenglart**, D. 2011. *Des racines et des ailes : L'Arbre aux Abeilles sur France 3*. 13'52 min. [video/documentary available at [www.ruchetronc.fr/ruche\\_tronc.php?mn=22](http://www.ruchetronc.fr/ruche_tronc.php?mn=22)]

# 8. From nature to culture, to crises, and back: a reflection on ontological and epistemological aspects of indigenous knowledge systems related to bees

JULIO E. LOPEZ-MALDONADO<sup>a</sup> AND SIMONE ATHAYDE<sup>b</sup>

a. Independent Researcher, Universidad de San Carlos de Guatemala, Guatemala.

b. Leader, Amazon Dams Network<sup>9</sup>, Tropical Conservation and Development Program (TCD), University of Florida Research Associate, Instituto Socioambiental (ISA)<sup>10</sup>, Brazil.

## 8.1. Introduction

This is a preliminary essay developed to inspire reflection on the importance of considering historical epistemological contrasts and power imbalances in attempts to engage indigenous and academic knowledge systems in policy-making initiatives such as the IPBES. The reflections presented below are based in a paper by Lopez on Mayan ethnoentomology, currently under development (Lopez 2015). We suggest that policy-makers need to be reminded of the historical and political underpinnings of the current organization of knowledge and societies, and how it relates to the social-economic and political crisis now confronting humanity.

## 8.2. Knowledge systems

Philosophy as a disciplinary field has made an enormous contribution to humanity to explain man, his understanding and action on nature. However, historically, western knowledge has undergone a process of fragmentation and objectification of nature along with the development of a capitalist system which has led to the current crisis (Delgado and Escobar 2006). Decolonizing knowledge means an openness and respect to other forms of knowledge. The idea is to advance towards de-colonization of thought and knowledge to truly build bridges between knowledge systems, and to apply knowledge (including practices) towards solving current problems, including the crises of pollinators and food production.

Sousa Santos' formulation on replacing the "monoculture of scientific knowledge" by "ecology of knowledges" (Sousa Santos 2005) can be adopted to meet the challenges of the future. Arturo Escobar (2005) emphasizes *"the need to dismantle the modern dichotomy of nature and culture of*

<sup>9</sup> Amazon Dams Network: [www.amazondamsnetwork.org](http://www.amazondamsnetwork.org)

<sup>10</sup> Instituto Socioambiental (ISA): [www.socioambiental.org](http://www.socioambiental.org)

*western sciences, and consciously reflect about the way through which indigenous societies establish specific ties between nature and the cognitive symbolic and productive experiences."*

This works for both knowledge systems, from the indigenous point of view and categories such as the Mayan *K'ah olil* which means "the intention to have knowledge of the best, fundamental, and the most essential estimate", as well. For instance, indigenous peoples might also learn from academic knowledge. Some practices and techniques used by indigenous people certainly are part of a process where the accumulation and constant observations are objectively experienced and empirically validated in their daily lives. These knowledges and "sabidurias" (wisdoms) are adapted biospherically to specific and local conditions, were informed by agrobiodiversity sources available for them, and adapted to ecological and climatic specificities. Consequently, practices that work in Africa or Asia might not work somewhere else. We shall analyze them from a hyper-dimensional context. This is also a principle for the relationship among governments and biogeographical regions in a global dialogue. Indigenous knowledge has some general philosophical underpinnings, but it is also very context-specific.

### 8.3. Pollinators

Even though changes in native pollinator densities in various regions of the world is the main topic of our discussions, they are strongly correlated with anthropogenic habitat fragmentation through agriculture, logging, urban development, and excessive use of agro biocides, among others (Aizen and Feinsinger 1994). The history of introduction and colonization of the Americas by foreign bee species might be viewed as a metaphor for humanity. *Apis mellifera*, for instance, is a foreign species introduced in the Americas from the Spanish and Portuguese until the 1800s, followed by a second new species (*A. mellifera scutellata*) also known as the Africanized honey bee (AHB). This hybrid was introduced in Brazil in 1956. Both spread out through the Americas, and started to compete with the local native pollinators for resources, displacing and changing interactions with native bees (Cairns et al. 2005). The feral colonies of this AHB generalist bee species also compete with the natural resources of other pollinators (Roubik 1978). This is a metaphor to make us reflect on the colonization of America by Europeans – who also brought epidemics and values which similarly disrupted the social–ecological organization of indigenous peoples.

During the last two decades, there has been a growing awareness from farmers and growers complaining of poor fruit sets despite good blooming, and decreasing agricultural production, and assessing the risks of depending on honey bees for pollination. In many parts of the world this generalist pollinator has contracted diseases such as noseemiasis (*Nosema ceranae*), and Varroa mite infection (varroaosis), with high levels of sensitivity to biocides and pesticides causing a decrease to one third of the world populations over the past two decades. Ironically, this species which became dependent on the extensive monoculture agricultural and economic model of production for capitalist societies, is reaching a natural collapse. In the last decade, the dramatic losses of bee colonies with the syndrome "Colony Collapse Disorder" has revealed the need for new alternatives and not relying on this single species for pollination. Research has been demonstrating that there are many factors contributing to honey bee health, including nutrition, parasitic mites, pest insects, viral, fungal, and bacterial diseases, and environmental chemicals. Studies are finding insecticides, miticides, fungicides, and herbicides in the beehives. Combinations of chemicals and breakdown products of chemicals are often highly toxic to bees in general. Negative effects from the abuse of biocides may be observed not just for nature and their effects in human health as well, but also for impacts on farmers' economic assets and destruction of habitats in developing countries.

There is a call for appreciation and protection of the native bees and other pollinators such as bats, birds, butterflies etc. Also, there is an increased interest to learn from indigenous knowledge



associated with biodiversity, since diversity and traditional knowledge is the answer for many economic and environmental problems. Indigenous communities in Mesoamerica and South America are known for being possessors of knowledge and biodiversity stewards for many species along with cultural values, languages etc. Their traditional knowledge and management practices are holistic and focused on processes rather on parts or species. Local and Indigenous knowledge perspectives have demonstrated that there is no separation between the material, social and spiritual lives. Life is organized from the perspective of organization of knowledge (López 2014 in progress). Matter and energy are manifestations of a single reality (Rist 2005). In many societies, a relationship with nature and beings is often horizontal and situational, and based on interaction rather than on dominance *per se*.

## 8.4. Reflections

Indigenous peoples around the world are very diverse and have developed their own adaptations and relationships with nature and pollinators. In spite of the differences and context specificities, a common overarching aspect related to pollination and pollinators is that the concept of pollination as it is understood by science does not apply directly to the languages and concepts of some indigenous people. Some Mesoamerican indigenous societies such as the Mayan classic people, have left a series of manuscripts, such as *Nahalteob* (codices), polychrome pottery, murals etc. In these materials, the processes of reproduction of life of pollination of plants (maize) are clearly described (López 2014 in Revision). The Mayan *Miatschahales* (philosophers) described the important role of the Mayan stingless bee (*Melipona beecheii*) in modulating their social and political conventions, since their societies reflect the socio biological conventions and the organization of the bees. They use the bees also as an ecological model to predict agricultural trends and conditions, which allowed them to prepare in anticipation of droughts, lack of rain and integrated alternatives for food security. They also use this model to teach an integrated perspective of respect towards nature and learn from nature, adapting elements of bees' behavior in the social development of morals and ecological and political ethics among human societies. For example: a) respect for women during time of menstruation and biological moments; b) cooperation and solidarity; c) adaptation to changes that occur outside the colony; d) optimizing the use of natural resources for the well-being of the group to the detriment of individual well-being; e) avoiding the over-exploitation of natural resources and controlling population size to adapt to variable conditions (López-Maldonado 2006). Just as the Mayan look at nature and bees to inform their social-political organization and relationship with nature, western societies might study and learn from indigenous societies to situate their position and role in the world.

## References

- Aizen**, M. A., and Feinsinger, P. 1994. Habitat fragmentation, native insect pollinators, and feral honeybees in Argentine Chaco Serrano. *Ecol Appl.* 4: 378–392
- Cairns**, C. E., Villanueva-Gutierrez, R., Koptur, S., and Bray, D. B. 2005, Bee Populations, Forest Disturbance, and Africanization in Mexico. *BIOTROPICA* 37(4): 686–692
- Descola**, P. and Palsson, G. 1996. *Nature and Society: Anthropological Perspectives*, London: Routledge, 310 pp.
- Delgado**, F. B. and Escóbar, C. V. 2006. Intercultural and interscientific dialogue for strengthening the sciences of the original peoples in the Americas). Edition Plural, La Paz 2006. Page 15'30.
- Escobar**, C. V. 2005. "Una ecología de la diferencia: igualdad y conflicto en un mundo globalizado", en: Más allá del Tercer Mundo. Globalización y diferencia, Bogotá/Popayán, ICANH/Universidad del Cauca, pp. 123–144.
- Lopez-Maldonado**, J. E. 2006. *Ethnohistory of the stingless bees Melipona beecheii (Hymenoptera: Meliponinae) in the Mayan Civilization, decipherment of the Beekeeping Almanacs part I in the "Madrid Codex" and the study of their behavioral traits and division of labor*: Ph.D Dissertation, University of California, Davis, 2010, 192 pages.
- López**, J. 2015. *Mesoamerican philosophy*. Manuscript in preparation.
- Rist**, G. 2005. Gilbert Rist répond aux contradicteurs de la décroissance ! Courrier de la planète, no. 74. [www.decroissance.info/IMG/pdf/Gilbert\\_Rist\\_repond\\_aux\\_contradicteurs\\_de\\_la\\_decroissance\\_.pdf](http://www.decroissance.info/IMG/pdf/Gilbert_Rist_repond_aux_contradicteurs_de_la_decroissance_.pdf) (accessed April 21, 2011).
- Roubik**, D. W. 1978. Competitive interactions between neotropical pollinators and Africanized honey bees. *Science* 201: 1030–1032.
- de Sousa Santos**, B. 2005. *El milenio Huérfano: ensayos para una nueva cultura política*. Editorial Trotta/ILSA, Madrid.

# 9. Indigenous peoples' and local communities' valuation and values regarding pollinators: a Mayan perspective

EDGAR PEREZ<sup>a</sup>

a. Fundacion para el Desarrollo Rural "Junej T'inam", Guatemala City, Guatemala

*Yo no confundo la vida política con la estética, pero si antepongo la justicia a la cultura – que ella se nos donara también como forma de justicia*

Luis Cardoza y Aragón – Prologo "Informe de una injusticia de Otto Rene Castillo"

ANTES            *Antes,  
Tan atrás  
Que el sol ya no lo recuerda:  
La tierra era dueña del hombre.  
Ahora es al revés.*

Humberto Ak`abal – Poeta Maya-kakchiquel, Guatemala

## 9.1. The Mayans: origin, beliefs, and world vision

The origins of Mayan people are well studied and documented in the *Popol Wuj (Popol Vuh)*,<sup>11</sup> also known as the Sacred Quiché Mayan book of Creation (Raynaud, 1977). Comprehension of the Popol Wuj involves understanding remains in the way of living, the memories, the culture, the oral transmission, the beliefs, the spirituality and worldviews of current Mayan-descendant peoples of Guatemala and South Mexico. The Popol Wuj writes of the divine creators and gods, which included the feathered Mexican god/Serpent deity *Quetzalcoatl*, (Nahua for "Quetzal Serpent"). The Giant Gods of the Sky (Thunder light, the Thundering mark and the Thunderlight splendour) – through their own language, their collective understanding, their power – decided to unify their own words... their wisdom; then at the sunrise, they decided to create the human being, and under the common agreements decided about the production, the trees, the production of life, about the germination, the fecundation of life; the sustain and nutrition of life (Raynaud 1977). Following the creation of the earth and animals, the gods then created people. There were several attempts to create man, the first from clay and wood, and the second from *tz'ite* beans or grains of maize (Raynaud 1977).

In the main text of the Popol Wuj are stories of the hero twin gods, *Hunahpu* ('Blowgun hunter') and *Xbalanque* ('Young hidden/Jaguar Sun'). In Mayan mythology, these two were instructed by the Creators (the Grandfather and Grandmother) to destroy the arrogance of other Gods on

earth and the Gods of the underworld (*Xibalba*). In the myth, the two twins play a ballgame in the Underworld court and defeat these Gods of the Underworld by help of various animals and for their victory, their father, Hun Hunahpu, is resurrected in the form of maize (Raynaud 1977).

Life and nature are the same for the people of Mayan descentance who believe that the natural world is alive and animate. “All animated things, including plants are believed to have a spirit, soul, or essence, a belief that can be traced deep in to the past” (Alcorn 1984, McGee 1990, cited in Morehart et al. 2005). According to the Huastec Mayans, an indigenous community of people from Mexico living in the Huasteca region, plants are *mas t’okat* meaning more pure, sacred and respected than humans (Mariaca 2012). This belief is not limited to the Maya people, in many Latin American cultures such as the Guna and Inca peoples, they view pollination not as a separate concept as understood from science, instead it is part of this idea of fertilization of nature and life<sup>12</sup>. Maya Mam people in the western highlands of Guatemala understand pollination as it affects different varieties of maize; for example, the reason why one of the most precious varieties “the salpor” is cultivated close to their homes to avoid “contamination” (i.e. cross-pollination) from other crop maize varieties.

Maize is an extremely important traditional food for Mesoamerican people for consumption but also for cultural reasons. Agriculture is sacred, as maize is. There is no real separation of nature and culture for the Maya, no word exists that equates with our term nature (Everton 2012:87). The milpa cycle, which is a multicrop polycultive growing system (Wilken 1987, cited in Ford and Nigh 2015), demonstrates the relationship of the Maya to their fields, forests, and gardens.

Maize cultivation and the milpa system are embedded in many aspects of Mayan life beyond traditional food and meals, including the measuring of time, many traditional and religious practices, landscape “management” and social organization (Esteva and Marielle 2003). In Mayan civilisation and with contemporary Mayan-descendant peoples, food production and harvesting food from the forest links them with nature; these practices strengthen spiritual relationship, beliefs, practices, knowledge, action-reactions from nature and multiple values strongly connected with livelihoods and worldviews. Through these connections and with elders (*tata*, *ajk’ib*) within their communities, the Maya peoples sought advice and knowledge about governance, morals, justice and legitimacy, *Q’abaltzij Tinamit* in Mayan Q’eqchi peoples’ (Pu 2012).

## 9.2. Indigenous Traditional Food Production

Indigenous Peoples and Local Communities (IPLCs) occupy traditional land and have distinct traditional practices in order to manage their natural resources, which generally have a low environmental impact on the system and ensure long-term sustainability. These traditional practices include the milpa system (above) and home gardens.

Milpa is the “principal tool of the Mesoamerican and Maya agrarian system” (Ford and Nigh 2010). Small farm holders normally practice the milpa system, which is maize production with a large diversity of intercropping species (>70 species) that combines crop rotation with forest establishment within the system (Ford and Nigh 2010). The milpa system is practiced in almost all Latin American countries with a higher prevalence in northern Mesoamerica (Mexico, Guatemala, Belize and Honduras). Milpa can be found from sea level to highlands above 2,500m, and beyond the Mayan territory, with some similar way of production in Africa and Asia. Forest gardens, also known as tree-dominated home gardens, are gardens surrounding or adjacent to Mayan homes that house a diversity of trees that were used for daily household needs (Rossi 2011). The forest gardens were identical in structure and tree species to those of the natural forest

<sup>12</sup> Elaborated during discussions at the Global Dialogue Workshop on ILK of pollination and pollinators associated with food production, Panama City, 1-5 December 2014

(Rossi 2011). Forest gardens or home gardens are practiced in regions that extended in all the tropical and subtropical zones all over the world (Mariaca 2012).

Both systems house an extremely high plant and animal diversity simply from the way they are managed and conserved. In the case of home gardens, the trees provide perennial habitat for pollinators (insects, birds and bats) and pollination, an important ecosystem service. Both the Milpa System and the Home gardens will be discussed in detail below.

### 9.2.1. The Milpa System

Milpa has a Nahuatl origin, *millipan* where *milli* means “to cultivate” and *pan* means “place” (Nierhorst 1985, cited in Ford and Nigh, 2015), being translated as “cultivated place”. In the ancient Mayan lowland territory, the Mayan Milpa System can be interpreted as a complex rotating, multi-cropping swidden cultivation with maize, beans and squash and consuming (medicine, food) different plants in the surroundings considered by scientific knowledge as “weeds” (Azurdia 2008). Incorporated into this system are the successional stages of woodland vegetations as a way of managing landscapes, at the same time conserving Neotropical woodlands (Gomez-Pompa 1987). In addition to shaping landscapes through forest plant diversity composition, milpa landscapes also shape the culture, world visions, and interactions of people who practice this system of growing crops (Ford 2008, Perez 2013). Normally, any one plot is used for cultivation of crops for a period of two years and left fallow for 6-16 years before coming back to the same plot again (Azurdia 2008, Ford and Nigh 2015).

There are many opinions about the milpa system and the swidden agriculture and their association to the deforestation rates in Mesoamerica. The advantages of the milpa system included that these swidden agricultural practices created fertilizer by the burning and breaking down of vegetation, and reducing the need for synthetic fertilizers for crop production (Ford and Nigh 2015). The Maya had specific individuals tasked to keep the fire controlled to avoid unnecessary destruction of forest patches (Nigh and Diemont 2013). Milpa system and swidden agricultural practices by Maya people remain one of the most ancient and productive and sustainable cultivation techniques practiced to date (Wilken 1971, cited in Ford and Nigh 2015).

The most ancient races of maize originated from Mexico and Guatemala (i.e. Mesoamerica) (Wellhausen 1957). Guatemala has the second highest diversity of maize in the world (CONAP 2015). The first attempts to describe the maize diversity in Guatemala were in the mid 19th century: Wellhausen (1957) reported 13 varieties (*razas*) mainly in the highlands endemic to Guatemala; a place with the highest diversity of maize varieties per area unit. In Guatemala in the region of Huehuetenango, Diaz and Azurdia (2001) reported 47 varieties of maize; 8 varieties and 4 subvarieties, which represents 57% of the Guatemalan varieties (13) previously reported (Wellhausen 1957). In cultivating maize, the selection of seed choice is important. Farmers choose which maize seeds to plant depending on: (i) colour (red, white, black, yellow, or ‘pinto’ (mixed)); (ii) durability of crop cycle; and (iii) suitable growing/weather conditions (CONAP 2015).

Recent controversial strategies (i.e. new hybrid seeds or genetically modified seeds) have arisen as a solution in maintaining high maize productivity. In ancient times, in the Mayan lowlands, maize productivity was reported at 1,100 – 1,300 Kg/ha (188 qq/ha), which did not include the smaller, damaged grains called *molcajete*, *mulca* or *molcate*. These smaller, damaged grains were used to feed domesticated animals (Shwartz 2010, cited in Ford 2008). Current crop average production averages for the Guatemalan highlands ranges from 180–210 qq/ha.<sup>13</sup> This harvest is not only maize but also includes other crops such as ‘chilacayote’ (*Cucurbita ficifolia*), chili peppers (*Capsicum* sp.), hierbamora (*Solanum nigricans*), black beans (*Phaseolus vulgaris*), and wild semi domesticated beans known as *piloy* (*Phaseolus lunatus*). *Piloy* is an abundant and strong plant,

produced without chemicals. All of these aforementioned crops are dependent on pollinators, to varying degrees, for successful fruit production (Free 1993).

A special maize variety known as “Salpor” (or *Saqpor*) is grown in the Guatemalan highlands (Isakson 2009). This landrace produces large, white, round kernels and is used for special occasions and in specialty dishes (Isakson 2009) such like tamales, ceremonial hot beverage (*atol*) and special bread in a syncretic celebration of Easter. Salpor in Guatemalan Eastern Highlands (Huehuetenango) is grown close to homes/households as it is a variety that is sensitive to environmental conditions (Isakson 2009), and to avoid cross-pollination from another maize varieties from the plot cropping areas (CONAP 2015), which provides supporting evidence of the traditional knowledge about wind pollination.

Areas surrounding milpa systems and forest/home gardens also house a wide variety (cultivated and associated) of plant species that are highly attractive to insects (Ford and Nigh 2015), again not considered as “weeds” by Mayans because every one has been used as a food source for animals humans and medicine (Azurdia 2008). Approximately 20% of plant species within home gardens are used for traditional medicines, including 34% of the weeds in the home garden that are medicinal (Azurdia 2008). Examples of some vegetables that Kekchi-speaking people of Alta Verapaz (Guatemala) and Chiapas Mexico; cultivate and consume are: *Cnidoscolus chayamansa*, *Dahlia imperialis* (bell tree dahlia), *Tinantia erecta* Jacq., *Vigna sesquipedalis* Fruwirth (cowpea), *Xanthosoma violaceum* Schott. (malanga), *Amaranthus caudatus* L. (amaranth), and *echium edule* Sw. (chayote) (Booth et al. 1992).

The traditional milpa system in the Guatemalan Central highlands maintains abundant pine trees (*Pinus* sp.) mixed with their crops just like the Maya peoples did in the lowlands since ancient times (Cowgill 1961, Emerson 1953, Hernandez X 1995, Lundell 1937, Nations and Nigh 1980, Arias Reyes 1995, Teran and Rasmussen 2009, cited in Ford and Nigh 2015). The land is cleared using fire, following this indigenous people then cultivate and harvest their crops. This cycle of burning and planting repeat every year until the yield begins to decrease, this signals the time to leave the field fallow.<sup>14</sup> The system of intermixing trees within milpa systems demonstrates milpa systems were not cultivated purely for food production but also components of sacred and spiritual practices and rituals from the ancient Mayan civilization (Morehart et al. 2005) since A.D. 250-900, and contemporary Mayan-descendant peoples’ in Guatemala and Mexico. The pine trees provided pine resin and pitch pine (*ocote*, pine burned as wood) for incense; the incense would be burned for gods to consume (Morehart et al. 2005). Besides pine, 27 hard wood plant lowland species were founded in caves and ceremonial areas in the Mayan Lowlands (See Appendix C); these ritual plants “provide a rich canvas for the portrayal of crucial messages in symbolic code” (Voght 1976, cited in Morehart et al. 2005). Another example of trees within the milpa system is the one used by Lakantun farmers in Mexico – the balsa tree (*Ochroma pyramidale*). The balsa tree is found within milpa systems in order to create thick stands of this early successional, fast-growing tree (Diemont 2006, Douterlungne et al. 2010, cited in Ford and Nigh, 2015). *Ochroma pyramidale* has been used by generations of Lakantun farmers to quickly establish forest regeneration, replenish soil organic matter, and enhance weed control. For example, balsa trees control the common bracken *Pteridium aquilinum*, also known as the eagle fern, which can be a serious invasive problem in milpa systems (Cooper-Driver 1990, Turner et al. 2001, 2003, 2004, Turner and Sabloff 2012, Schneider 2004, Suazo 1998, cited in Ford and Nigh 2015). Another tree species grown within milpa systems is laurel (*Cordia alliodora*). The Qeqchi’ peoples in Livingston; Izabal, Guatemala use this tree for quick forest regeneration and when they reach an optimal size, they are used to build houses or *ranchos* (Perez 2014).



## 9.2.2. Home Gardens

In addition to milpa systems, home gardens are the most common production system in Mesoamerica and in all over the tropical and subtropical regions in the globe (Mariacca, 2014). The home garden is “*an area of the natural environment transformed by the inhabitants in their living quarters*” (CONAP 2008; Mariaca 2012). The home garden is considered one of the most productive, diverse, sustainable, resilient, and energetic efficient agroecosystems distributed at tropical and subtropical latitudes all over the world (Eyzaguirre and Linares 2004). Nowadays the home garden is composed of a diversity of wild and domesticated plants and animals (Jimenez-Osornio et al. 2003); its structure, function and nutrient recycling imitate a natural forest and, in fact, originally was arranged by a sort of plant species selected from the forest including domesticated and wild fauna (Mariaca 2012, Azurdia et al. 2013). The Mayan home gardens are transitioning and adapting to a new structure and function in response to human pressure and development (Rico-Gray et al. 1990, Nair and Kumar 2006, cited in Ford and Nigh 2015). Home Gardens developed out of people’s “*biological and social-cultural interactions that develop around local livelihoods and people’s efforts towards well-being*” (Lope-Alzina and Howard 2012).

In Mesoamerica, home gardening practices date back to 6,000-200 B.C. (Mariaca, 2014). Initially, home gardens were a way to keep cultivated food sources close at the same time attracting wild animals to hunt such as white-tailed deers, wild pigs, peccaris, squirrels and birds (Great Curassow [*Crax rubra*], Ocellated Turkey [*Meleagris ocellata*], Guans [*Cracidae* spp.] etc.). Each indigenous group had their own name for the practice of home gardens, for Mayans in Mexico (Maya-yucateco) terms commonly used in reference to home gardens included: *inn lumel* (“my land, my earth”), *pach nha* (“everything around my house”), *Ac tan’nah* (“in front of the sun”), and *tankabalil ich nah* (“land”) (Mariaca 2014).

A recent literature review involving home garden farms and their diversity reported 811 cultivated plant species: 426 of those plant species had multiple uses; 19 species of domesticated animals; and 25 species of semi-domesticated wild fauna including the “Mayan honey bee” *Mellipona beecheii*, also referred to as *Ko’lel kab*, *yilk’il kab* (Mariaca 2012). Home gardens plant species encompass around 36 categories of anthropocentric use; seven categories for uses associated with animal, and 27 functions (Mariaca 2012). In Belize, the use of species shows high use of species for medicine (over 50%), food production (42%), fuel and construction (27%): intriguing data showing the high percentage of use in medicine compared with food production. Guatemalan highlands, lowlands and semiarid areas, report 35-45% of the plants are used as a food resource among other 13 categories including medicine, cultural and as a firewood (Azurdia 2008).

The function of home gardens and milpa systems are beyond production, they involve food security, cultural heritage, high production in different season during the year and as a genetic and dynamic reservoir (Watson and Eyzaguirre 2001). An example is the Mesoamerican species of chile (*Capsicum* sp.) as the most used form of semi-domesticated species that gave rise to many varieties of chile (Azurdia et al. 2013). Chile or *ik* (in mayan-q’eqchi) is considered the third main component in Maya peoples’ diet (Hosting et al. 1999, cited in Perez 2013). *Capsicum* species include six species with high value at global level: four are widely cultivated and two are native (*C. lanceolatum* and *C. rhomboideum*), which together with wild populations of *C. annuum* var. *glabrisculum* and *C. frutescens*, comprise the wild gene pool. It is important to mention that only 40% of this gene pool is under the traditional “conservation” system – protected areas – the rest remains in the traditional farming system provably under genetic erosion (Azurdia et al. 2013). Key species identified for market and industry include: *Pouteria sapota* (zapote); *Capsicum* sp. (chile) and *Sechium edule* (guisquil/chayote); and *Persea* sp. (avocado), among others (Watson and Eyzaguirre 2001).

### 9.2.3. *Melipona beecheii* and the Mayans

The practice of beekeeping in ancient Mayan Civilization was documented between 50 years before Christ to 300 years AD. During the Proto-classic Period; the Tro-Cortesianus Codex (one of the Mayan codices, also known as the Madrid Codex) in its last 10 pages describes the meliponiculture practices; it is presumed that *Melipona beecheii* is the species described in the figures due to the importance of the species to Mayan civilisation (Stempell 1908, Tozzer and Allen 1910, cited in Sotelo et al. 2012). The clay hollow (*job'on*) was discovered in the city of Nakum, Petén Guatemala – this artifact was believed to be part of an offering to the “descendent God”, the bees' God or *Ahmucenab*, and used in ancient rituals (Thompson 1975:337, cited in Sotelo et al. 2012). This archaeological piece may be evidence for a “bees section” of the Tro-Cortesianus Codex (belonging to the Maya-descendant peoples but kept in Museo de America, Madrid, Spain). The Mayan Yucateco language also has the word *Kab*, which has more than one meaning. One translation of the word relates to honey, bee and hive (Sotelo et al. 2012). Another meaning of the word *Kab* relates to the world, people and regions; therefore, there may be a connection between the two meanings of the word *Kab* that demonstrates an understanding of a connection between the social world of bees and people (Alvarez 1980 cited by Sotelo et al. 2012).

Within Mesoamerica and Mexico, the stingless bee *Melipona beecheii* has been the most extensively managed bee (Villanueva-Gutiérrez et al. 2013). There are 46 stingless bees species in the Mayan region; one stingless bee species, *Melipona beecheii*, has a special history, value and symbolism in the Mayan culture (Sotelo et al. 2012). For example, honey was used to ferment alcohol and produce alcoholic drinks *balche* and *saka* that were important in spiritual rituals and Maya feasting rituals (Imre and Young 2013 and Diego de Landa 1973, cited in Sotelo et al. 2012). These bees were either reared (meliponiculture) within the home gardens or collected from forest gardens and the honey, wax, and larvae from these bee colonies were precious to the Mayans (Sotelo et al. 2012, Gomez-Pompa 1987). The bees were reared in clay pots (*jo'bons*) or in rounded tree cavities, both are protected from the rain by orienting the hives and using *nahil kab* (bee house) (Sotelo et al. 2012).

Unfortunately, in a study assessing the state of meliponiculture in this region, Villanueva (2005, cited in Sotelo et al. 2012) concluded that the state of Mayan beekeeping with these stingless bees is almost extinct, although there are good efforts to recover this practice in Guatemala and south of Mexico from academics and scientific people working side by side with local communities.

### 9.2.4. The Mayans as Forest Gardeners / Gardening the Forest

Within the forest gardens or home gardens 74-90% of tree species have benefits for humans (Campbell et al. 2006; cited in Ford 2008). Examples of tree species managed in home gardens include palm (*Chamaedorea* sp.), whose flowers are food resource, chicozapote (*Manilkara zapota*), which was used for construction material, (fruit) consumption, and chewing gum (Perez, 2014); hunting and chewing gum from chicozapote (*Achras zapota*) and areas for sustainable harvesting of precious wood by locals; still having the practice of gardening; also planting exotic species in camping-common areas in the Mayan biosphere reserve, Guatemala. Also, the common abundance of *ramon* tree (*Brosimum alicastrum*) was used to feed mules and horses in contemporary and ancient days. Within home gardens there were also orange, avocado (*Persea Americana*), lemon allspice (*Pimenta dioica*), achotillo, achiote (*Bixa* sp.), annona (*Annona* sp.), balsa (*Ochroma* sp.), bayal, cacao (*Theobroma* sp.), calabash (*Cucurbita* sp.), cedar (*Cedrella* sp.), ceiba (*Ceiba* sp.), jobo or jocote (*Spondias mombin*), chaya (*Cnidiosculus chayamansa*), copal (*Protium* sp.), corozo (*Orbygnia* sp.), guano (*Sabal* sp.), mahogany (*Swietenia* sp.), guaya (*Talissia olivaeiforme*), among others (Ford and Nigh 2015). These plants are part of traditional Maya forest gardens and are largely pollinated by insects, birds or bats (Ford and Nigh 2015).

### 9.2.5. Nutrition, a way of life among IPLCs

In Guatemala and perhaps also in many other Latin American countries, even smallholder farmers own great maize diversity; although in many cases they can't produce enough to feed their own families. In the case of the association of farmers in Huehuetenango Guatemala, *Asociación de Organizaciones de Los Cuchumatanes* (ASOCUCH), only 8 from 1,200 farmers can produce enough for one year of consumption; basically there is a lack of land access and no strong policies to support farmers' production (CONAP 2015). Trends in international commodities are higher than ever, with 50-200% price increases with great impacts on the poor families that spend between 70-80% of their incomes on food (Nelleman et al. 2009). In this context it can be considered disrespectful to try to combine food production, pollinators and human wellbeing for many IPLCs around the world. It seems that public policies do not make peoples' livelihoods a priority, and big companies that have accessed IPLC knowledge and genetic resources a long time ago are not sharing the benefits; and the current expansion and extensive cultivation of plants such as the African palm is a result of clearly market-driven actions.

New and renovated recognition to IPLCs and smallholder farmers is important. Indigenous and traditional knowledge have delivered worldwide inputs to global market products with high quality, and still maintain the biggest genetic reservoir for cultivated plants. In Guatemala, there have been many independent investigations that indicate that some common globally consumed green vegetables, such as lettuce, have no significant nutrient rewards compared to locally grown Guatemalan green vegetables like *chipilín* (*Crotalaria guatemalensis*). *Chipilín* contains five times more protein, four times more carbohydrates, 16 times more calcium, three and a half times more iron, four times more Vitamin B1 and B2 and 56 times more Vitamin C than lettuce (Molina et al. 1977, cited in Azurdia 2008).

Green vegetables are usually cooked as a soup or *caldo* with other vegetables or meat, or consumed in raw form by humans or by domestic animals such as hens, goats, pigs, rabbits, etc.; this method of consumption is considered the best way to intake a good source of micro and macro nutrients (Perez 2013).

*Nixtamalisation* is an ancient practice of IPLCs in Mesoamerica in which calcium hydroxide ( $\text{Ca}(\text{OH})_2$ ) is added to maize during the cooking process. After cooking, the maize still has between 4–12 hours before the grains are washed and mashed before preparing *tortillas* (Castillo et al. 2009). This process increases the nutrients' availability in proteins (glutenin) and essential amino acids (lysine and tryptophan); and at the same time it eliminates microbial activity and increases calcium due to chemical reactions with gluten (Martinez et al. 2002, Paredes et al. 1989, Katz and Labuza 1981, cited in Castillo et al. 2009). Black maize of the highlands is also a good resource of antioxidants and flavonoids (CONAP, 2015).

The nixtamalisation process through tortilla preparation is accredited to the Mayan women's indigenous knowledge and practice, because women are in charge of making tortillas and other dishes that need the nixtamalisation process.

### 9.2.6. Gender

The contribution of the entire family in the Maya-descendant peoples is recognised through the gender balance of the labour of milpa systems and home gardens; with changes in some areas for which only males are farmers. Many of these gender roles changed after the Spanish invasion (during the 16<sup>th</sup> century), in which the separation of roles was imposed. Nevertheless, there is enough evidence (Robin 2006) that in ancient times the men usually cut and burned the trees and women planted maize (*Popol Wuj*) (Robin 2006), not only in the plot of milpa systems but also around their homes. Women are also responsible for choosing varieties of maize that are easy to prepare, those that are better in taste, their preferences in colour, etc., and also had the lead in much of the daily work in the home gardens as well supporting the work of milpa.

### 9.3. Key messages / conclusions

In developing and practicing assessments based on different systems of knowledge, lessons from the Popol Wuj can be put in to practice; especially in considering the power of words, and the need for common understanding and agreements. IPLCs have a different way of understanding the world that may be new to many end-users or readers of IPBES assessment reports. Many IPLCs would like support for their knowledge to be restored, and to alleviate some of the issues of poverty and hunger that they may face, and for this to be captured in such assessments. The world needs to build new relationships among human beings and nature, states, markets and patterns of production and consumption of food; this extends beyond the commodities approach, beyond knowledge, beyond cultures, beyond subsidies, disadvantage and egos.

The traditional way of production is now faced with the extensive contemporary and commodity-driven vision of production. This form of production results in important genetic reservoirs being endangered, affecting cultures as humans “eat to think and think to eat” (Velez 2013). There is an increasing pattern in the globalisation of food, which may change cultural patterns of consumption and the way of thinking, which offers food without any meaning.

Traditional Mayan farming, still practiced today, has been adapted to people’s own spaces of land, their needs and especially to avoid poverty. The maintenance of livelihoods, culture, knowledge, practices, beliefs and human wellbeing are secondary in extremely poor areas. The current trends in using the land are eradicating traditional practices, and further impoverishing the poorest of the poor. There are virtually no policies to support and protect these traditional ways of food production, although putting these in place was recommended by the World Resources Institute ten years ago (WRI 2005). Local, national, regional and global governing and policy bodies must move from discourse to action and strongly re-orient their policies and international cooperation to support these ways of production for peoples’ own benefits, and for human global benefit. WRI (2005) makes a strong point: “...*The choice between State and Market can turned in to... “what kind of state do we want for the poor?”*”.

The report on the Environmental Food Crisis (Nellmann 2009) brought to the forefront important political, ethical and economic recommendations to regulate food prices, including the removal of subsidies to agriculture. In addition, this report provided recommendations for support to farmers who were developing diversified and resilient eco-agriculture that helped critical ecosystem services (water, habitat for wild plants and animals, genetic diversity, pollination, pest control and climate regulation). Both traditional systems – milpa and home gardens – would benefit from implementation of these recommendations. The question is: “*How can governments and international multilateral bodies move forward an integrated agenda, beyond business as usual?*”. And finally, a pollination assessment must review the economic, non-economic and other values that flow from traditional ways of production and compare these to extensive industrial production; it is clear that biodiversity contributions are much stronger from the former than the latter. Economic valuation should also deliver guidance on the Access and Benefit Sharing regime in ecosystem services such as pollination in order to emphasize the importance of the traditional ways of production as guardians of nature, genetic resources and ecosystem services.

## References and recommended reading

- Azurdia.** 2008. Agrobiodiversidad de Guatemala. In: CONAP. 2008. Guatemala y su Biodiversidad: Un enfoque histórico, cultural biológico y económico. Consejo Nacional de Áreas Protegidas, Oficina Técnica de Biodiversidad. Guatemala. 650 pp.
- Azurdia, C.,** Scheldeman, X., & Van Zoneveld. 2013. The conservation and use of the *Capsicum* genepool in Mesoamerica The use and conservation of the *Capsicum* genepool in Mesoamerica. Wallace Conference, Costa Rica, September 30 – October 4th. 31p.
- Beach, T.,** Dunning, N., Luzzadder-Beach, S., Cook, D. E., & Lohse, J. (2006). Impacts of the ancient Maya on soils and soil erosion in the central Maya Lowlands. *Catena*, 65(2), 166–178.
- Booth, S.,** Bressani, R., & Johns, T. (1992). Nutrient content of selected indigenous leafy vegetables consumed by the Kekchi people of Alta Verapaz, Guatemala. *Journal of Food Composition and Analysis*, 5(1), 25–34. doi:10.1016/0889-1575(92)90005-5
- Castillo, V;** Ochoa M., Figueroa C.J.D., Delgado L.E., Gallegos I.J.A, and Morales C. J. 2009. Efecto de la concentración de hidroxido de calcio y tiempo de coccion del grano de maiz (*Zea mays* L.) nixtamalizado, sobre las características fisicoquímica sy reológicas del nixtamal. Archivos latinoamericanos de nutrición, *Organo oficial de la Sociedad Latinoamericana de Nutricion*. Vol. 59 No 4 425- 432.
- CONAP.** 2015. Memorias del Taller sobre Maiz en Guatemala. Programa de Naciones Unidas para el Medio Ambiente. Guatemala ciudad. 27p
- CONAP.** 2008. Guatemala y su Biodiversidad: Un enfoque historico, cultural biologico y economico. Consejo Nacional de Areas Protegidas, Oficina Tecnica de Biodiversidad. Guatemala. 650 pp.
- Colop, S.** 2008. *Popol Wuj [translation]*. Guatemala: Cholsamaj.
- Diemont.** 2006. *Ecosystem Management and Restoration as practiced by the Indigenous Lacandon Maya of Chiapas, Mexico*. [PhD Dissertation]. Food, Agricultural and Biological Engineering Ohio State University, Columbus. (\*cited in Ford and Nigh 2015)
- Douterlungne, D.;** Levy D.; Golicher J., and Roman, F. 2010. Applying Indigenous Knowledge to Restoration of Degraded Tropical Rian Forest Clearings Dominated by Bracken Fern. *Restoration Ecology* 18(3):322-329 (\*cited by Ford and Nigh 2015)
- Esquit, E.** 2001. *Otros poderes, nuevos desafíos*. (A. Ribeaux, Ed.) (pp. 1871–1935). Guatemala: Instituto de Estudios Interétnicos, Universidad de San Carlos de Guatemala.
- Esteva, G.** and Marielle, C. 2003. *Sin Maíz no hay País* (Culturas P). MÉXICO: CONCAULTA. 152pp.
- Everton, M.** 2012. *The Modern Maya: Incidents of Travel and Friendship in Yucatan*. 1ed. University of Texas Press, Austin.
- Eyzaguirre, P. B.** and Linares, O.F. (Eds) 2004. *Home Gardens and Agrobiodiversity*. Smithsonian Institution. 296 p.
- Ford, A.** 2008. Dominant plants of the maya forest and gardens of El Pilar: implications for paleoenvironmental reconstructions. *Journal of Ethnobiology* 28(2): 17-199.
- Ford, A.** and Nigh, R. 2010. The Milpa Cycle and the Making of the Maya Forest Garden. *Research Reports in Belizean Archaeology* 7:183-190.
- Ford, A.** and Nigh, R. 2015. *The Maya Forest Garden Eight Milennia of sustainable Cultivation of the tropical Woodlands*. Left Coast Press: California. 256p.
- Gomez-Pompa,** 1987 Tropical Deforestation and Maya Silviculture: An Ecological Paradox. *Tulane Studies in Zoology and Botany* 26(1):19-37. (\*cited by Ford and Nigh 2015)
- Isakson, S. R.** 2009. No Hay Ganancia en la Milpa: The Agrarian Question, Food Sovereignty, and the On-Farm Conservation of Agrobiodiversity in the Guatemalan Highlands. *Journal of Peasant Studies* 36(4):725-759. (\*cited by Ford and Nigh 2015)

- Lope-Alzina**, D. and Howard, P. 2012. The Structure, Composition and Functions of Home Gardens: Focus on the Yucatan Peninsula. *Etnoecologia* 9(1):17-41
- Mariaca**, R. 2014. *El Huerto del Sureste de Mexico*. Secretaria de Recursos Naturales y Protección Ambiental del Estado de Tabasco. El Colegio de la Frontera Sur. Impreso en Mexico. 536p
- Martinez-Reyes**, J. E. 2014. Beyond Nature Appropriation: Towards Post-development Conservation in the Maya Forest. *Conservat Soc* 2014;12:162-74
- Morehart**, T., Lentz, D. L., & Prufer, K. M. 2005. Society for American Archaeology. Wood of the Gods : The ritual use of pine (*Pinus* spp.) by the ancient lowland Maya. Source: *Latin American Antiquity*, Vol. 16. No. 3. pp. 255-274.
- Nelleman**, C., MacDevette, M., Manders, T., Eickhput, B., Svihus, B., Prins, A.G., and Kaltenborn, B. P. (Eds). 2009. *The environmental crisis – The environment's role in averting future food crises: A UNEP rapid response assessment*. United Nations Environment Program.
- Nigh**, R. and Diemont S. 2013 The Maya Milpa: Fire and the Legacy of Living Soil. *Frontiers in ecology and the environment* 11(1):45-54. (\*cited by Ford and Nigh 2015)
- Perez**, E. 2013. Gastronomía Garifuna y Q'eqchi. Proyecto Código 6651621002GUA. Fortalecimiento de las expresiones artístico-culturales Garifunas y Maya Q'eqchi en el Caribe Guatemalteco. UNESCO. Ministerio de Cultura y Deportes. 51pp.
- Perez**, E. 2014. Estudio de la viabilidad legal, ecológica y socioeconómica del proyecto: Agroforestería y restauración del bosque para la conectividad ecológica, reducción de la pobreza y conservación de la diversidad biológica en Cerro San Gil, Caribe de Guatemala. Reporte. Fundación para el Desarrollo y la conservación, FUNDAECO.
- Pu**, H. 2012. Conocimientos ancestrales sobre la biodiversidad de la madre tierra. Wajxaqib' No'j Defensoría Indígena. Impresos Unión Maya. 59 pp.
- Raynaud**, G. 1977. *Popol-Vuh o Libro del consejo de los indios quichés*. Traducido al español por Miguel Ángel Asturias y J. M. González de Mendoza. Sexta edición. Buenos Aires, Argentina.: Editorial Losada, S.A. 104 pp.
- Robin**, C. 2006. Gender, Farming, and Long-Term Change: Maya Historical and Archaeological Perspectives. *Current Anthropology*, 47(3), 409–433.
- Sotelo**, S.; Guerrero E. Y. and Alvarez C. 2012. El cultivo tradicional de la abeja *Melipona beecheii*. Una constante en el huerto familiar entre los mayas de Yucatán. In: Mariacca, R. 2012. El Huerto familiar del Sureste de Mexico. Secretaria de Recursos Naturales y Protección Ambiental del Estado de Tabasco; el Colegio de la Frontera Sur. 544pp.
- Vélez**, Luz. 2013. Del Saber y el Sabor. Un ejercicio antropológico sobre la Gastronomía. *escritos / Medellín - Colombia / Vol. 21, N. 46 / pp. 171-200 enero-junio 2013*. ISSN 0120 - 1263
- Watson**, J. W., and Eyzaguirre, P. B. (eds). 2001. *Proceedings of the second International Home Gardens Workshop: Contribution of home gardens to in situ conservation of plant genetic resources in farming Systems*, 17-19 July 2001, Witzenhausen, Federal Republic of Germany. International Plant Genetic Resources Institute, Rome.
- Wellhausen**, J., Fuetens, O., Hernandez, X. P. C. and Mangelsdorf, P. 1957. *Races of Maize in Central America*. Nat. Acad. Sci. Nat Res. Council, Washington D. C. Publ No 511
- Wilkes**, H. 1967. *Teosinte: the closest relative of maize*. The Bussey Institute, Harvard University, Cambridge, Mass.
- World Resources Institute (WRI)** in collaboration with United Nations Development Programme, United Nations Environment Program, and the World Bank. 2005. *World Resources 2005: The Wealth of the Poor – Managing Ecosystems to fight Poverty*. Washington, DC:WRI.

## APPENDIX C: Plant species used in spiritual rituals by the ancient Mayans

No.	Species	No.	Species
1	<i>Pinus</i> sp.	15	<i>Albizia</i> sp.
2	<i>Aspidosperma</i> sp.	16	<i>Alvaradoa amorphoides</i>
3	<i>Byrsonima</i> sp.	17	<i>Andira inermis</i>
4	<i>Allophylus</i> sp.	18	<i>Enterolobium</i> sp.
5	<i>Cassia</i> sp.	19	<i>Licania arborea</i>
6	<i>Ficus</i> sp.	20	<i>Licaria</i> sp.
7	<i>Cordia</i> sp.	21	<i>Lysiloma</i> sp.
8	<i>Lonchocarpus</i> sp.	22	<i>Matayba</i> sp.
9	<i>Persea</i> sp.	23	<i>Quercus</i> sp.
10	<i>Piscidia</i> sp.	24	<i>Rheedia</i> sp.
11	<i>Pouteria</i> sp.	25	<i>Tabebuia</i> sp.
12	<i>Protium</i> sp.	26	<i>Terminalia</i> sp.
13	<i>Taberanemontana</i> sp.	27	<i>Theobroma</i> sp.
14	<i>Zantoxylum</i> sp.	28	<i>Cedrella</i> sp.

**Source:** Morehart, T., Lentz, D. L., & Prufer, K. M., 2005

# PART II



Report on the Global Dialogue  
Workshop on ILK about  
Pollination and Pollinators  
associated with Food Production

# 1. Background

The first meeting of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES) task force on indigenous and local knowledge systems (ILK) took place in UNESCO Headquarters in Paris from 16-20 June 2014. At this meeting, the task force members reviewed their responsibilities and deliverables, one of which is the development of approaches and procedures for building ILK into IPBES assessments. In order to tailor approaches and procedures to the specific needs of IPBES, the members underlined the importance of piloting and testing proposals that they would make. For this reason, it was decided that a working group of seven task force members [M.Carneiro da Cunha, R. Hill, P. Lyver (coordinator), A. Oteng-Yeboah, E. Pérez, M. Roué and R. Thaman] would pilot ILK approaches and procedures within the first IPBES assessment: the assessment of pollination and pollinators associated with food production.

To this end a proposal was formulated and submitted to the fourth Multidisciplinary Expert Panel (MEP) and Bureau meeting that took place in Bonn (6-10 July 2014) highlighting the following expected outcomes from the engagement of the ILK task force with the pollination assessment:

- ▶ Facilitate an initial contribution of ILK to the IPBES fast track thematic pollination assessment from select sites in multiple IPBES regions;
- ▶ Build capacities of ILK holders and scientists to mutually understand and respect diverse knowledge systems, and foster dialogue and knowledge exchange;
- ▶ Pilot the operationalization of the initial procedures and approaches for building ILK into IPBES assessments in general, and thematic assessments from select sites;
- ▶ Better understand barriers and possible solutions to synergising ILK with science in a real-life IPBES assessment.

The proposal outlined a step-wise process including:

- ▶ A global call for submissions on ILK related to pollination and pollinators associated with food production;
- ▶ A selection of the most relevant submissions from ILK holders and experts;
- ▶ Organization of a Global Dialogue Workshop that brings together the selected ILK holders/experts with authors of the IPBES assessment report;
- ▶ Development of proceedings from the workshop that provides inputs, along with those gleaned from the scientific and grey literature, that reinforces ILK materials available to authors for development of the first-order draft (FOD) of the pollination assessment report;
- ▶ Upon returning to their communities and networks, targeted work sessions by ILK holders/experts to address gaps ILK identified with authors at the workshop;
- ▶ Contribution of these additional ILK inputs during the review phase of the FOD;
- ▶ Further engagement at the Second Authors meeting for the pollination assessment between co-chairs and authors, ILK holders/experts, and ILK task force members, to enhance the quality of ILK inputs in the assessment report.

The present document reports on the outcome of the Global Call for Submissions, the selection of ILK holders and experts, and the Global Dialogue Workshop (Part II: points a to c above). Also included are the Proceedings produced by this global dialogue (cf. Part I), supplemented with contributions from local work sessions that followed the Dialogue Workshop.

## 2. Global Call for Submissions on ILK about pollination and pollinators associated with food production

A global call seeking submissions on ILK relevant to the assessment was released in three languages (English, French and Spanish). The wording of the call was carefully formulated in order to communicate in a succinct, informative and accessible manner the nature of the ILK being sought. This was quite challenging for the pollination assessment due to the relatively specific and technical nature of the information being sought. An online form, again in three languages, was created in order to guide and structure inputs.

The global call was launched on 12 September 2014 with a closing date of 10 October 2014. It was circulated through multiple networks identified by ILK task force members and the TSU. The four week window for submissions was judged too short. However, the rapidly approaching dates for the global dialogue workshop did not allow for a more lengthy submissions period.

Nevertheless, a total of 45 submissions were received of which 8 had to be eliminated as off topic. The remaining 37 submissions were distributed among regions as follows: 13 from Africa; 13 from Latin America and the Caribbean; 8 from Asia-Pacific; 4 from WEOG; and none from Eastern Europe<sup>1</sup>.

The ILK task force reviewed the 37 submissions and selected ILK holders from India (unfortunately unable to attend due to problems obtaining a visa), Indonesia, Kenya and New Zealand, and ILK experts from Brazil, France (working in Indonesia) and Guatemala (an indigenous scientist). FAO supplemented this selection of ILK holders by bringing from Nicaragua and Peru, two members of their Indigenous Network on Food Sovereignty. An important delegation of Guna men and women from the host country further reinforced the representation of ILK holders at the workshop.

---

1 One submission included case studies in both Africa and Asia-Pacific regions and therefore is listed under both regions.

### 3. The Global Dialogue Workshop

*A Global Dialogue Workshop on ILK of pollination and pollinators associated with food production was convened in Panama City, Panama, from 1 to 5 December 2014. It was organized by the ILK task force in close collaboration with the expert group for the Assessment on pollination and pollinators associated with food production.*

The dialogue workshop brought together one of the co-chairs of the pollination assessment report (V. Imperatriz Fonseca) and five Coordinating Lead Authors (CLAs) and Lead Authors (LAs) responsible for four of its chapters (S. Breslow, D. Buchori, M. del Coro Arizmendi, M. Gikungu and D. Martins), with 10 ILK holders from Indonesia, Kenya, New Zealand, Nicaragua, Panama and Peru, and three ILK experts from Brazil, France and Guatemala. The co-chairs of the ILK Task Force (P. Lyver, E. Pérez) and two of its members (M. Carneiro da Cunha, M. Roué) guided the process with support from the Technical Support Units (TSUs) for the ILK task force and the pollination assessment, as well as a representative (N. Azzu) of the Food and Agriculture Organization of the United Nations (FAO).

The meeting was organized with generous support from the United States Department of Agriculture, hosted by the Smithsonian Tropical Research Institute that also provided the venue and equipment. FAO provided for the travel costs of two ILK holders from the Indigenous Network on Food Sovereignty. New Zealand's National Commission for UNESCO also provided travel and accommodation costs for two Māori ILK holders.

## 4. Organization of the Workshop to facilitate ILK-Science dialogues

The first challenge for the workshop was to move away from a conventional 'science-structured format' that past experience has shown hinders the engagement of ILK holders. A particular effort had to be made to create an environment in which ILK holders would contribute freely and in confidence. At the same time, the meeting was bound by timeframes and deadlines which meant the process had to have a degree of structure and focus. English-Spanish interpretation was provided.

To aid this process, a considerable amount of time was invested at the beginning of the meeting with introductions and discussions led by the ILK holders and experts (cf. agenda in Annex 1). This was followed by presentations from each of the ILK holders and experts/scientists on aspects they determined were relevant to the assessment theme. Assessment authors were purposefully placed in a listening role so as to avoid that ILK inputs would be constrained by the format, content and organization of the current assessment report draft.

Following the plenary presentations by ILK holders and experts, themes to be focused upon were identified in the following manner:

- ▶ First each ILK holder and expert was asked to identify 2 to 4 themes related to the assessment topic that they would like to say more about.
- ▶ Second, each assessment authors and co-chair was asked to identify 2 to 4 themes related to the assessment about which they would like to learn more from the ILK holders/experts.
- ▶ The most prominent issues raised during these two round-the-table sessions were selected as the core themes for further discussion.

**The following 4 major themes were determined for in-depth exchange over the coming days:**

- ▶ Social, cultural, biological and ecological change associated with pollinators and pollination (including how change is observed/recorded; adaptation to change)
- ▶ Identification of pollinator diversity (including different biocultural and ecological roles of pollinators; diversity of environments);
- ▶ Cultural, social, economic values of pollination (to aid discussions around this theme we did ask the Chapter 5 authors to present a brief outline on the scope of their task)
- ▶ ILK protection, transmission, and challenges.

Thematic discussions on the identified four themes were conducted first in plenary and then in extended break-out sessions (cf. agenda). Detailed note-taking by at least two persons per break-out group provided a baseline recording of discussions and the information provided by ILK holders and experts. ILK holders and experts then worked individually, with support from task force members or the TSU, to correct, revise and expand upon these initial texts. The revised versions of these texts became the Proceedings from the workshop.



Through these processes, the workshop was successful in establishing a productive dialogue between ILK holders and experts and assessment authors and the co-chair, providing relevant ILK input to the first-order draft of the assessment report. The detailed accounts of the ILK on pollination and pollinators associated with food production are included in the Proceedings in Part 1 of this document. The Proceedings were circulated to all pollination assessment authors.

At the start of the workshop, an in-depth discussion was held on prior and informed consent and intellectual property rights, and how that would be handled with respect to ILK in this workshop and for the pollination assessment. It was agreed that ILK holders and experts should only share the knowledge that they felt to be appropriate to be shared in this specific forum. At any point in the workshop, an ILK holder or expert could specify that certain elements of knowledge were not to be shared or distributed. These elements would not be included in the Proceedings and reports. Several ILK holders specified that they had been mandated by their communities to participate in the workshop and share knowledge on the workshop theme (including the Guna, Tūhoe Tuawhenua (Maori), Quechua). ILK experts specified that they would be sharing indigenous knowledge that was already published and therefore already cleared with the communities for wider distribution.

The workshop outputs were supplemented by a regional case study review and analysis of the scientific and grey literature on ILK related to pollination and pollinators associated with food production. This review screened more than 450 sources in three languages (English, French and Spanish) and identified 251 references that made some mention of indigenous and local knowledge (including 146 journal articles, 66 book chapters, reports and theses, and 39 sources from the grey literature). Of these 251 references, 70 proved to be of major interest for the assessment theme, 59 had some useful content and almost half (122) were judged to be only marginally relevant to the topic. The relevant content from these regional case study reviews was made available to the CLAs of the IPBES assessment for their consideration in the preparation of the first order draft of the pollination assessment, including for easy access a Dropbox with copies of all relevant articles, reports, chapters and grey literature.

## 5. Lessons Learned for Building ILK into IPBES Assessments

The workshop allowed for the successful piloting of several approaches and procedures of relevance to reinforcing ILK in IPBES assessments, including the use of a global call for ILK contributions coupled with regional reviews of relevant ILK in the scientific and grey literature, as well as appropriate procedures for selecting ILK holders and experts for dialogue workshops with authors, and for establishing an equitable relationship and context for productive knowledge sharing.

The following initial listing of lessons learned from the global dialogue workshop on ILK about pollination and pollinators associated with food production can be expanded further:

- ▶ Workshop and its follow-up would have greater impact if conducted earlier in the assessment process;
- ▶ The global call for submissions needs to be open for at least six weeks.
- ▶ Greater emphasis on bringing ILK holders to the workshop with more time prior to the workshop to engage them in the process;
- ▶ Invite a greater range of ILK holders and scientists – this funding dependent however;
- ▶ Greater dissemination and communication of objectives to participants prior to the workshop;
- ▶ Hold the workshop in an indigenous community to assist with embedding the process in a culturally relevant and holistic environment. It allows participants to not only speak with their minds, but also their heart;
- ▶ Hold the workshop in an indigenous community as this will expose authors to greater number of ILK holders, rather than those that attended the workshop. Allow the process to take full advantage of experiential knowledge;
- ▶ Engage different knowledge transmission procedures (i.e. take authors onto the land with ILK holders to discuss the relevant themes);
- ▶ The lack of assessment authors with direct ILK expertise is a major limiting factor that can only be partially compensated for via the global dialogue workshop and related procedures. Ultimately, IPBES needs to ensure the nomination and selection of a core set of CLAs and LAs with in-depth expertise on ILK in each assessment.
- ▶ Greater clarification around the process of knowledge collection and FPIC with regard to the workshop and the relevant assessment;
- ▶ Nurture an iterative process – the workshop is only part of the process of engaging ILK in assessments;
- ▶ Break into small case study groups (3-5 people) earlier in the process as this facilitated a greater depth of enquiry into particular themes;
- ▶ Use national/regional case studies ahead of the workshop to prepare knowledge and contributions;
- ▶ Use this process to engage communities afterwards.



# ANNEX I

## Agenda for the Global Dialogue Workshop

Monday, 1 December 2014

10:00 to 12:30	Final preparations by meeting organizers and hosts	ILK Task Force and TSU
1:00 to 2:00	Lunch	
2:00 to 5:00	<p><b>Preparatory/coordination meeting among indigenous and local knowledge (ILK) holders and experts, with ILK Task Force members and Pollination co-chair as observers (UNESCO and FAO as technical support).</b></p> <p>Welcome from the host indigenous peoples</p> <p>Introductions by ILK holders/experts</p> <p>Open exchange among ILK holders/experts</p> <p>Q&amp;A on the week's work</p>	ILK holders/experts, ILK Task Force, Pollination co-chair, TSUs

Tuesday, 2 December 2014

9:00 to 10:00	Opening Ceremony	Plenary
10:00 to 11:00	Introductions	Plenary
11:00 to 1:00	<p><b>Our Knowledge, Our Ways: Indigenous and local knowledge about Pollination and Pollinators associated with Food Production</b></p> <p><b>... your experiences and concerns</b></p> <p><i>Presentations by ILK holders and experts from different world regions</i></p>	Plenary
1:00 to 2:00	Lunch	
2:00 to 2:30	Presentation of pollination issues emerging from ILK in the published literature	Plenary

2:30 to 4:00	<b>Collective identification of emerging themes/issues for dialogue sessions between ILK holders/experts and chapter authors</b>	Plenary
4:00 to 5:00	<b>STRI Presentation:</b> <i>Indigenous and Scientific Knowledge in IPBES and its Pollination Assessment</i> <i>Presentation by the ILK Task Force and Pollination Assessment co-chairs</i>	
5:00 to 8:00	<b>Reception</b> <i>Including with scientists and staff of STRI</i>	
Evening/morning session	Finalization of themes/issues for dialogue sessions. Planning for Day 2	ILK Task Force and TSUs

## Wednesday, 3 December 2014

9:00 to 9:30	Joint planning for Day 2: Agree on dialogue themes Agree on organization of sessions	Plenary
9:30 to 10:30	<b>Scoping ILK theme 1: ILK holders/experts outline major issues (problems, changes) on this theme</b> <i>Brief reflections and comments by each ILK holder/expert</i>	Plenary
10:30 to 12:00	<b>In-depth Dialogue on ILK theme 1:</b> <i>Dialogue among ILK holders/experts, Pollination authors and Task Force members on promising topics that emerge from the scoping</i>	Focused discussion groups (2)
12:00 to 12:15	Touch-back on process: is it working?	
12:15 to 1:00	<b>Scoping ILK theme 2: ILK holders/experts outline major issues (problems, changes) under this theme</b> <i>Brief reflections and comments by each ILK holder/expert</i>	Plenary
1:00 to 2:00	Lunch	
2:00 to 3:30	<b>In-depth Dialogue on ILK theme 2:</b> <i>Dialogue among ILK holders/experts, Pollination authors and Task Force members on promising topics that emerge from the scoping</i>	Focused discussion groups (2)
3:30 to 4:30	<b>Scoping ILK theme 3: ILK holders/experts outline major issues (problems, changes) under this theme</b> <i>Brief reflections and comments by each ILK holder/expert</i>	Plenary

4:30 to 6:00	<b>In-depth Dialogue on ILK theme 3:</b> <i>Dialogue among ILK holders/experts, Pollination authors and Task Force members on promising topics that emerge from the scoping</i>	Focused discussion groups (2)
Evening/ morning Session	Compilation of ILK inputs/comments for the pollination report and planning of follow-up work	ILK Task Force and TSUs

## Thursday, 3 December 2014

9:00 to 9:30	Overview of progress and planning for next steps	Plenary
9:30 to 10:30	<b>Scoping ILK theme 4: ILK holders/experts outline major issues (problems, changes) under this theme</b> <i>Brief reflections and comments by each ILK holder/expert</i>	Plenary
10:30 to 12:00	<b>In-depth Dialogue on ILK theme 4:</b> <i>Dialogue among ILK holders/experts, Pollination authors and Task Force members on promising topics that emerge from the scoping</i>	Focused discussion groups (2)
12:00 to 1:00	Stock-taking of Dialogue Sessions	Plenary
1:00 to 2:00	Lunch	
2:00 to 3:30	<b>Collective review of workshop outcomes:</b> What was accomplished? What was missed? What still remains to be done?  How to optimize ILK inputs from the workshop to the Pollination report  Required follow-up	Plenary
3:30 to 5:00	<b>Issues/questions to take back to ILK holders and communities</b>  Taking workshop outcomes and outstanding issues back to ILK communities  Process to feed ILK community inputs into the Review Phase of the First-order Draft of the Pollination Report	Plenary
5:00 to 6:00	Departures of authors meeting Final comments from authors	Plenary
Evening/ Morning Session	Compilation of ILK inputs/comments to the pollination assessment first-order draft	ILK Task Force and TSUs

## Friday, 5 December 2014

9:30 to 12:00	<b>Final Meeting among ILK holders/experts</b> , with ILK Task Force members and Pollination co-chair (UNESCO, FAO and Pollination TSU as technical support)	ILK holders/experts ILK Task Force Pollination co-chair TSUs
12:00 to 1:00	Closing Ceremony	
1:00 to 2:00	Lunch	
2:00 to 5:00	<b>Final work session</b> of ILK Task Force members and technical support (UNESCO, FAO, Pollination TSU) to compile outputs from the Global Dialogue workshop to the drafting of the Pollination Assessment first order draft	ILK Task Force, TSUs

# Annex II

## List of Participants

### ILK Holders and Experts

**John Samorai Lengoisia**

*Ogiek Peoples Development Program, Biashara Street, Nyamakoroto Hse, 2nd floor Office,  
No. 210/211, P.O BOX 424-20115, Nakuru, Kenya*

Email: [jsamorai@ogiekpeoples.org](mailto:jsamorai@ogiekpeoples.org)

**Robert Leo (unable to attend)**

*Keystone Foundation, Post Box 35, Groves Hill Road Kotagiri, Nilgiri District,  
Tamil Nadu, 643217, India*

Email: [leo@keystone-foundation.org](mailto:leo@keystone-foundation.org)

**Simone Athayde**

*Amazon Dams Network and Tropical Conservation and Development Program,  
University of Florida. 930 NW 36th road, Gainesville, FL 32609, USA*

[www.amazondamsnetwork.org](http://www.amazondamsnetwork.org)

Email: [simonea@ufl.edu](mailto:simonea@ufl.edu)

**Julio Edgar López**

*Independent Researcher, Universidad de San Carlos de Guatemala, Guatemala*

Email: [jumelipona@gmail.com](mailto:jumelipona@gmail.com)

**James Doherty**

*c/o Tuhoe Tuawhenua Trust, Private Bag 3001, Ruatahuna, Via Rotorua, New Zealand*

Email via: Phil Lyver – [LyverP@landcareresearch.co.nz](mailto:LyverP@landcareresearch.co.nz)

**Nicolas Césard**

*UMR 7206 Éco-anthropologie et Ethnobiologie, Muséum National d'Histoire Naturelle,  
57 rue Cuvier, 75231 Paris cedex 05, France*

Email: ncesard@mnhn.fr

**Kiritua Elsie Teka**

*c/o Tuhoë Tuawhenua Trust, Private Bag 3001, Ruatahuna, Via Rotorua, New Zealand*

Email: via Phil Lyver, LyverP@landcareresearch.co.nz

**Valentinus Heri**

*Executive Director of Riak Bumi Foundation, Jalan Dr. Wahidin Sudirohusodo, Komplek Batara Indah I Block DD No. 18 Pontianak, West Kalimantan, Indonesia*

Email: herivalens@yahoo.com

**Raquel Garcia**

*Cruz Roja Masaya 75 varas al oeste, Masaya, Nicaragua*

Email: araque1585@hotmail.com | consejopueblosindigenaspcn@yahoo.es | mairena@cadpi.org

**Pedro Rivera Cea**

*Ayacucho, Peru*

Email: willkawaman@gmail.com

**Belisario Lopez**

*Congreso General Guna, Guna Yala, Panamá*

**Atencio López Martínez**

*Congreso General Guna, Guna Yala, Panamá*

**Elmer Enrico Gonzalez López**

*Fundación para la Promoción del Conocimiento Indígena, Guna Yala, Panama*

Email: enrico\_gonz@yahoo.es

**Florina López Miro**

*Red de Mujeres Indígenas sobre Biodiversidad de America Latina y el Caribe, Guna Yala, Panamá*

Email: florina.lopez@gmail.com

**Nicanor Smith**

*Viceministerio de Asuntos Indígenas, Panamá*

Email: nsmitha.0985@gmail.com

## IPBES ILK Task Force

**Phil Lyver**

*Landcare Research, Gerald Street, Lincoln 7608, New Zealand*

Email: LyverP@landcareresearch.co.nz

**Edgar Perez**

*Guatemala City, Guatemala*

Email: chijunilito@gmail.com

**Manuela Carneiro da Cunha**

*Brazilian Academy of Science, Rua Itapitangui 56 01250-030 São Paulo, Brazil*

Email: mcarneir@uchicago.edu

**Marie Roué**

*UMR 7206 Éco-anthropologie et Ethnobiologie, Muséum National d'Histoire Naturelle,  
57 rue Cuvier, 75231 Paris cedex 05, France*

Email: roue@mnhn.fr

## IPBES Expert Group on Pollination, Pollinators and Food Security

**Vera Imperatriz Fonseca**

*University of Sao Paulo, Biosciences Institute, Rua do Matão, travessa 14, n. 321,  
CEP 05508-901, Brazil*

Email: vlifonse@ib.usp.br

**Mary Gikungu**

*Museum Hill, Nairobi, 00100 GPO, Kenya*

Email: mgikungu@yahoo.com

**Maria del Coro Arizmendi**

*Coordinación del Posgrado en Ciencias Biológicas, Edificio D, Primer Piso, Circuito de Posgrados,  
Ciudad Universitaria, CP 04510, México*

Email: coro@unam.mx

**Sara Jo Breslow**

*NOAA Northwest Fisheries Science Center, 2725 Montlake Blvd E, Seattle, WA 98112, USA*

Email: Sara.breslow@noaa.gov

**Damayanti Buchori**

*Department of Pest and Plant Disease, Bogor Agricultural University (IPB),  
Jalan Ahmad Yani 82 kavling 20, Bogor, Indonesia*

Email: dami@indo.net.id

**Dino Martins**

*Insect Committee of Nature Kenya*

Email: insects.eanhs@gmail.com | dino.martins@gmail.com



## Technical Support

### **Douglas Nakashima**

*Technical Support Unit, IPBES ILK Task Force, UNESCO,  
1 rue Miollis, 75732 Paris cedex 15, France*

Email: [D.Nakashima@unesco.org](mailto:D.Nakashima@unesco.org)

### **Serena Heckler**

*Technical Support Unit, IPBES ILK Task Force, UNESCO,  
1 rue Miollis, 75732 Paris cedex 15, France*

Email: [s.heckler@unesco.org](mailto:s.heckler@unesco.org)

### **Hien Ngo**

*Technical Support Unit, Expert Group on Pollination and Pollinators related to Food Production,  
IPBES Secretariat, UN Campus Platz der Vereinten Nationen 1, D-53113 Bonn, Germany*

Email: [hien.ngo@ipbes.net](mailto:hien.ngo@ipbes.net)

### **Nadine Azzu**

*Food and Agriculture Organization of the United Nations (FAO),  
Viale delle Terme di Caracalla, 00153 Rome, Italy*

Email: [Nadine.Azzu@fao.org](mailto:Nadine.Azzu@fao.org)

