



## BEEES: ECOSYSTEM SERVICES

*You humans, when you eat, you eat and that's it, when you cultivate you cultivate, when you transform you just transform. Or at least that's what you think, the reality is that you have named and categorized everything: producers, consumers... We tend to do everything together, at the same time, while we nourish our colonies with the nectar and pollen, we help flowers to reproduce, therefore we "cultivate" the plants for the next year, not thinking if those flowers will nurture the next generation of forager bees; we do know –unlike you– that compromising the future means damaging the present, even when it doesn't seem like it...*

–CINZIA SCAFFIDI. *IL MONDO DELLE API E DEL MIELE*<sup>1</sup>

### **On bees**

In the world there are more than 20,000 species of bees, not all of them live in colonies, as a matter of fact, very few live in colonies and even fewer species produce the honey we consume.

Bees belong to the large order of insects hymenoptera, characterized by their 3 segment body (head, thorax and abdomen), two antennae, six legs and two pairs of membranous wings. Unlike other insects from the same order, like wasps and ants, bees are full of plumose hair, have pollen baskets (usually located in their legs or abdomen), which make them amazing pollinators. Their diet is composed by the nectar and pollen from the flowers they visit.<sup>2</sup>

Their ecological impact is absolutely positive, they maintain a mutualism relationship with their local flowers allowing their reproduction and gaining food from them; in fact plants and flowers had been co-evolving with bees for more than 135 million years. Some flowers are so tight to a very loyal bee species that it's reproduction would be almost impossible without the intervention of the insect. A very interesting example is the hermaphrodite vanilla orchid, endemic to Veracruz (Gulf of Mexico) where the beautiful bright metallic blue-green *Euglossa* bees live, providing pollination services that flowers need, and allowing the reproduction of around 100 species of vanilla. When we think of vanilla, we immediately picture Madagascar. Nevertheless, this orchid was introduced in the island during the mid 19th Century because of its climate, which allowed these flowers to grow but in order to produce the vanilla pods, pollination had –and still has– to be done by hand.

Bees, being distributed almost all over the world, from the extreme cold of the arctic circle, where the *Bombus polaris* live, to the burning temperatures of the Colorado Desert only carpenter bee *Xylocopa californica* can survive; the loss of their ecosystem services would be unmeasurable not only for the human kind but for every single living thing on Earth. <sup>3,4</sup>

*Apis mellifera*, the popular honey bee, has historically been in our scope because of the sweetness we benefit from; especially since 2006, when beekeepers and scientists from the US and some European countries started reporting losses in their colonies populations (Colony Collapse Disorder) to their agricultural authorities.

Ever since, media has shown lots of campaigns to save the bees because an enormous part of our food system relies on them. Even Nestlè Cheerios “campaigned” in the US, sending out wild flowers in their cereal boxes for consumers to restore bee habitats, without considering those could be invasive species that could cause ecological disorder, not to mention the impact of the initial source of their grains to produce their popular cereals, which come from intensive agriculture and GMOs, two key elements that kill honey bees and many other species. <sup>5</sup>

## 20,000 SPECIES, 7 FAMILIES

Bee Lab, University of Minnesota <sup>6</sup>

The largest one, *apidae*, includes our well-known honey bees and bumble bees. However, these bees make up only a fraction of total bee diversity even within their own family. The social, honey-producing stingless bees of South America are included here, as well as thousands of solitary species which nest in underground burrows or tunnels in wood. Longhorned bees or digger bees are burrowing bees known for the extremely long antennae of the males. Carpenter bees are the largest bees in North America, and some are primitively social, though they may be undesirable in some cases due to the holes they chew in wood. Orchid bees are beautiful, metallic tropical bees whose males pollinate orchids as they collect fragrant oils. And cuckoo bees are nearly hairless, wasplike bees that stealthily lay their own eggs in the nests of other bees.

*Megachilidae* are solitary, robust bees with large heads and large mandibles, which they use for chewing and handling nest-building material. Unlike other bees, they carry pollen under their abdomen instead of on their hind legs. This family has the greatest diversity of nesting habits among species; building materials can include leaf pulp, mud, resin, gravel, wood pulp, or plant fibers. They also have a wide range of nesting locations including underground burrows, hollow plant stems, wood cavities, rock crevices, and even snail shells in some European species. *Megachile pluto*, the biggest bee in the world, lives inside active

termite mounds in Indonesia. Major groups of *Megachilidae* are the leafcutter bees, large black bees with light hair known for making nests out of leaves; the mason bees, dark, often metallic blue bees known for making nests out of dried mud; the carder bees, black and yellow, somewhat wasplike bees that collect plant fuzz to build their nests; and two groups of cuckoo bees. Many *Megachilidae* are commercially managed for crop pollination as an alternative to honey bees.

*Halictidae* are all ground-nesting bees, but they exhibit extremely diverse levels of sociality. Some species can even switch between being social or solitary depending on their environment. They are collectively called sweat bees due to some species' habit of landing on people to lap up sweat (which they do to obtain salts). Many *Halictidae* are tiny, nondescript black bees with a slight metallic sheen, and are notoriously difficult to identify to species. Others somewhat resemble honey bees with a fuzzy yellow thorax and a black striped abdomen. The most spectacular *Halictidae* are a brilliant metallic blue-green. The alkali bee, *Nomia melanderi*, has beautiful rainbow abdominal bands, and is the only solitary ground-nesting bee commercially managed for crop pollination.

*Andrenidae* are solitary ground-nesting bees which are among the first bees to be seen in early spring. Most *Andrenidae* are mining bees in the genus *Andrena*. These are typically medium-sized, shiny black bees with tan to

reddish hair covering the thorax, and rarely the abdomen too. Other *Andrenidae* can be tiny black or intricately patterned bees, large, hairy, bumble-like bees, or black and yellow wasplike bees.

*Colletidae* are solitary bees that use a clear biological plastic to line their nests and keep water out, which gives them the common name of “cellophane bees” or “plasterer bees”. Many *Colletidae* closely resemble mining bees, and even fly at the same time in early spring. Others include the rarely seen crepuscular bees of the desert, which fly in the dark just before the sun rises. The yellow-faced bees in the genus *Hylaeus* are unique among bees in that they carry pollen in their stomachs, and lack any hair on their bodies. They are also one of the few bees outside of *Megachilidae* that nest aboveground in hollow stems.

*Melittidae* is a very small family of solitary ground-nesting bees. They are typically small to medium-sized, black bees with or without abdominal bands of hair. *Hesperapis*, a common desert bee, can be recognized by its green eyes and flat abdomen, but many *Melittidae* are difficult to tell apart from similar *Andrenidae*.

*Stenotritidae* is the smallest family of bees, and is only found in Australia. These are solitary ground-nesting bees closely related to the *Colletidae*. They are large, hairy, and black, black and yellow-striped, or bright metallic green.



## *Anthropocentric approach: Beekeeping*

*Civilizations rose and fell: the bee flew on regardless. How human has seen bees reflects back an image of each age.*

–HATTIE ELLIS. *SWEETNESS AND LIGHT* <sup>7</sup>

According to the FAO (2019), approximately 80 percent of all flowering plant species are specialized for pollination by animals, mostly insects, and they affect 35 percent of the world's crop production. <sup>8</sup>

Since the beginning of human times, honey has been a sweet and precious prize, therefore we have learned how to keep bees. The eldest evidence of honey hunters was discovered in 1924, rock art in a cave in Bicorp, Valencia. It was painted somewhere between 2,000 and 8,000 years ago. Honey hunting is still ongoing, mainly in Africa and Asia where finding honey is a cross between hunting, gathering and foraging, with a deep understanding –and love– of bees and the territory they inhabit.

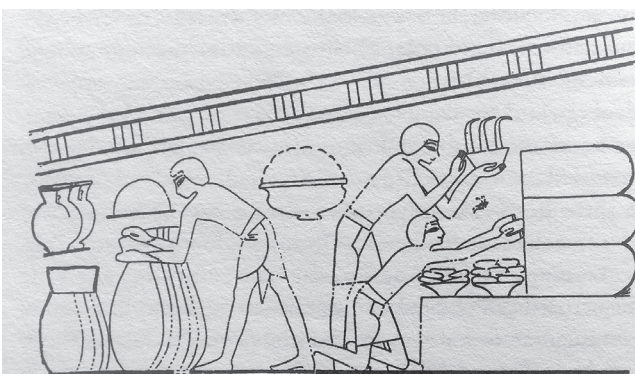


HONEY-HUNTING ROCK ART, BICORP, SPAIN / *SWEETNESS AND LIGHT* <sup>4</sup>

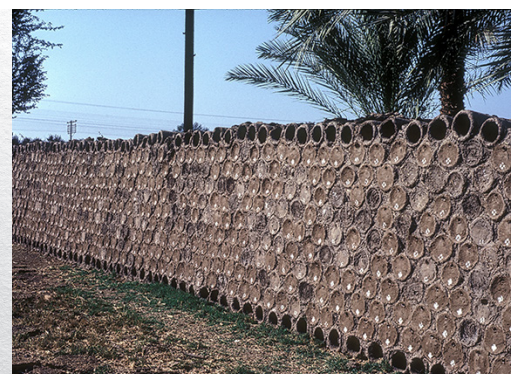


HONEY-HUNTING IN NEPAL / [WWW.GREATADVENTURETREKS.COM](http://WWW.GREATADVENTURETREKS.COM)

Egyptians were among the first civilizations to centralize and organize food production, agriculture and livestock, including beekeeping and grain storage. The earliest archeological evidence of a hive and honey production –including jaring– was found in the tomb of Rekhmire in Luxor, around 4,400 years ago. Even today, traditional beekeeping in Egypt resembles the one from ancient times, their hives have cylindrical form and are placed on top of each other.



PAINTING IN REKHMIRE'S TOMB, LUXOR / *SWEETNESS AND LIGHT* <sup>4</sup>



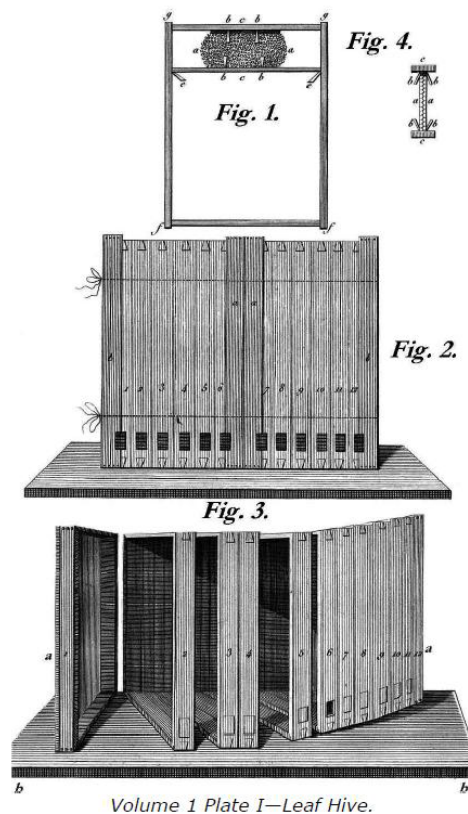
EGYPT WALL APIARY / [WWW.PRI.ORG](http://WWW.PRI.ORG)

In Mesoamerica, the *Tro Cortesiano Codex* (or *Madrid Codex*, 14th Century) keeps the history of Mayan Civilization and their understanding of astronomy, nature, territory, religion, rituals and agriculture, including a section focused on stingless bees, meliponines, or *xunáan kaab* in Mayan language. These bees are kept in a *jobón*, a hollowed-out log sealed with red clay. A guardian bee will keep a pierced hole on the log, only big enough for meliponines to enter and exit the hive. The only way to harvest this precious liquid without destroying the beehive is by opening the log and delicately piercing the sealed honey combs and letting it flow and drip thanks to gravity. Today this almost sour honey is still being harvested in this same traditional way and, besides its health benefits, it is extremely precious for the preservation and conservation of the territory, the traditions and the culture itself.<sup>9</sup>



TRO CORTESIANO CODEX / WWW.MIELADICTOS.COM

MAYAN BEEKEEPERS / WWW.YUCATAN.COM.MX



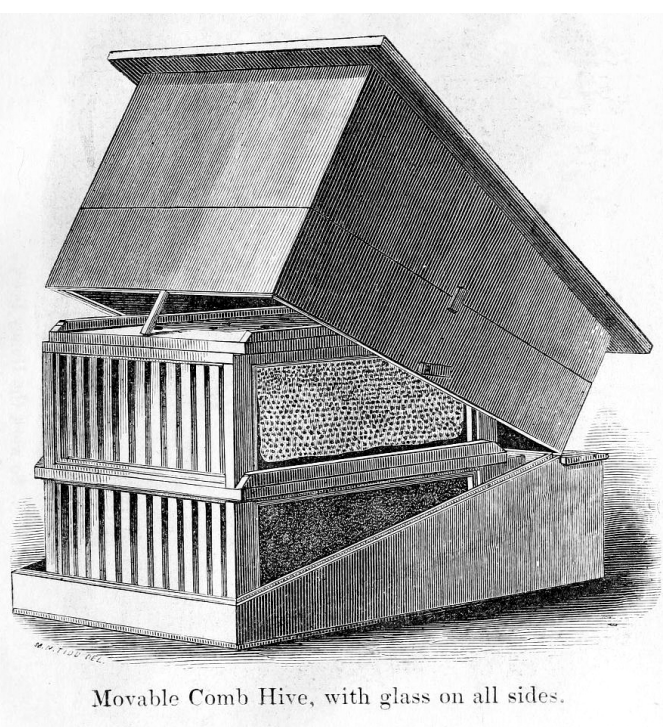
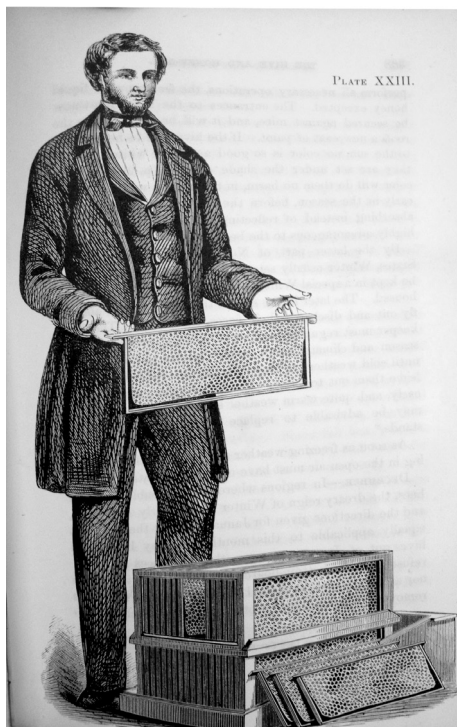
Since the Middle Ages, in Europe, monks have kept bees, both for honey and beeswax to make candles. This activity remained in the monasteries until the Enlightenment, when scientists, aristocrats, farmers and philosophers were fascinated by the insects' rational and productive ways. From that moment, bees became the symbol of a perfect society. In the late 1700's the Swiss inventor François Huber and his servant Burnens created the Leaf Hive, which allowed the behavioural observation of *apis mellifera* and inspired the beehive revolution the following century.

In the US bees were kept in hollowed-out logs and boxes where, in order to harvest the honey, the beekeeper had to cut the comb, destroying it most of the time. In the nineteenth century Lorenzo Langstroth, a

large scale beekeeper from Philadelphia, started experimenting with removable frames inside the box. By doing so, he discovered bees would never build comb in a space not bigger than two worker bees wide: the bee space, which allows beekeepers to examine colonies and harvest honey easily. Otherwise, bees would either keep building or fill empty space and gaps with propolis and beeswax and the comb would need to be broken for harvesting.

Langstroth patented his invention and started building and selling hives. This venture took the pleasure of keeping bees away from him, and caused mostly pain as a businessman instead, because his discovery was being adapted by beekeepers and competitors in order to avoid paying royalties.

Langstroth's modern way of keeping bees spread all over the world and changed the way humans relate to these working insects, triggering the proliferation of beekeeping associations and organizations as well as beekeepers.



THE HIVE AND THE HONEY BEE / LORENZOLANGSTROTH.WORDPRESS.COM

After World War II, the *Green Revolution* started, technologies were developed with one goal in mind: feeding the world, saving it from starvation. Monocultures, intensive agriculture, machinery and later on GMOs took over enormous pieces of land, selling the idea of never ending progress and success. In order to flourish, these new developments –in the US and some European countries specifically–, relied on the very basic prehistoric mutualistic relationship between bees and flowers: pollination. *Apis Mellifera* became an exchange currency for beekeepers, not as much for the honey they could harvest but for the money they could get by renting their bees to pollinate monocrops, taking them hundreds of kilometres away. This means bees can only forage a single species of flowers, the absence of wildflowers –product of a dead soil–, besides having to deal with travelling stress along with a corn syrup, sugar, pesticides and agrochemicals diet.

### *Holistic approach to promote bees' diversity*

Over the last 100 years, biodiversity has decreased at an alarming rate: the shift to monocultures in order to supply the industry has limited people's choices to the few varieties of foods suited to this production model. There are more and more acres of land used for growing mono crops and less and less people working in the fields. We have lost our connection to the soil.<sup>10</sup>

Agriculture is an interruption of the natural system but it can be done thoughtfully by protecting the land around us, the soil underneath us and every single being that inhabits this planet. According to the United Nations, small scale localised farming can feed the world. Growing food this way means we could grow food without poisons, preserving bees' diversity across the globe.

Only if we see ourselves as part of nature, rather than above it, we would be able to experience our connection with every other single being. According to Mayan priests today, bees' and humans' destiny is one, that's why these communities still keep bees in the same way shown in the *Tro Cortesiano Codex*: **preserving bees is maintaining the community alive.**





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