“He would have liked to discuss his bees and ask everyone why they didn’t hear them, given that they spoke to the others, too, as they did to him. Had he been able, he would have talked about the song the bees sang into his willing ear about flowers on the mountain, faraway encounters, and friends that had not made the long journey home; about the sun that would beat down hard one day but be covered in storm clouds the next.”

-Sofia Segovia, *The Murmur of Bees*

“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 exists in nature.”

-Indigenous teachers of Xingu Park, cited by Athayde et al. (2002)
Author’s Statement
Ava Goodale graduated from Cornell University with a degree in natural resource management. After working in that field, she used those experiences to transition into progressive education and is now the chair of the Millbrook School Science Department in Millbrook, New York. In addition to teaching, she coordinates the department’s place-based and project-based curriculum, facilitates a student research program, and runs the school’s canopy walkway.

Ava has participated in several research and education programs throughout the Tropics, including learning from the Kayapo People of the Xingu River, Brazil. In partnership with the Morpho Institute, she has visited the Maijuna People of Peru yearly since 2017 and facilitates a professional development workshop for educators, titled Inquiry, Conservation, & Sustainability in the Amazon. It is her great honor to translate their lessons with the hope that many more will back their efforts and be part of a global effort to be better stewards of the places we call home. As Tyson Yunkaporta describes in Sand Talk, indigenous patterns of thinking, doing, and being are a wellspring, as we reexamine our own practices and relationships to people and place. This case study is intended to spark that examination and open a door of discovery for readers to see their own place in the context of other world views—to see what is familiar through a new lens.

This case study is part of a forthcoming series. For more information, please send inquiries to: curriculum@morphoinstitute.org

The Morpho Institute is a 501(c)3 nonprofit created to support the key role of K-12 education in realizing the global goal of environmental conservation and sustainability. To achieve this goal, The Morpho Institute provides professional development programs and curriculum resources which support local to global environmental stewardship in K-12 instruction.

In collaboration with US and international partners, The Morpho Institute provides US educators the opportunity to experience the Amazon rainforest as a compelling context for developing a global perspective on biological and cultural resources, participating in conservation, exploring sustainability, and inspiring environmental stewardship. Our field workshops and resources apply key elements of inquiry, STEM, and place-based learning to assist educators in making these critical local to global connections in their classrooms, instruction, and curricula. Learn more at www.morphoinstitute.org

OnePlanet is a 501(c)3 nonprofit that partners with indigenous and traditional communities to build a more sustainable, empowered, and just future through community-based projects, outreach, and technical assistance. We respect indigenous and traditional communities by treating them as equal partners in our projects. We view them as collaborators instead of participants and we work with them rather than for them. We have witnessed that engaging communities and individuals in this way helps to build capacity and local ownership ultimately increasing the long-term sustainability and viability of our programs.

Our work is focused in the Peruvian Amazon with the Maijuna indigenous group. OnePlanet was founded in 2015 and builds on the extensive biocultural conservation work that our President and founder, Dr. Michael Gilmore, started with the Maijuna in 1999. Learn more at www.oneplanet-ngo.org/

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Introduction

Stepping onto the small dock in the Sucusari Village, your senses are scrambling to take in all the unfamiliar scenes. Yet, as soon as a Maijuna leader named Sebastián introduces himself, you are put at ease. He proudly and sincerely says, “Thank you for coming to my home.” You become less aware of the buzzing rainforest sounds and thick tropical air soaking your brow, as you focus on his message, which is translated from Máfikiki to Spanish to English. He continues, “I am Maijuna. It means I am from this place.” Sebastián points to a large sign behind him showing a map of the Maijuna’s ancestral lands in the Peruvian Amazon. He ends his welcome by saying, “The only life you have is within your community.”

Thank you for taking part in this case study. In the pages that follow, you will learn about the Maijuna indigenous people’s use of stingless beekeeping, or meliponiculture, as an approach to community-based conservation and sustainable development in Peru. You will take the perspective of a student visiting the Maijuna village to learn about their conservation success story so you can be an agent of change in your home community. As the story unfolds, you’ll be asked to answer questions, reflect on conservation in your local community, and finally participate in a citizen science project. The icons used throughout are intended to draw your attention to specific features of the case study. The beehive icon above indicates a snapshot from the field, the checklist icon indicates an action item, and the pencil icon indicates questions for you to answer as you go.

Before you continue, please read the background article, The Maijuna: Fighting for Survival in the Peruvian Amazon and answer these empathy reflection questions (Ritchhart et al., 2011):

1. The Maijuna might see <insert an issue that was mentioned in the article> as <insert a description of what their viewpoint might be> because <insert a justification for your thinking>.

2. What do you think a Maijuna person sees, observes, or notices?

3. What might a Maijuna person know, understand, hold true, or believe?

4. What might a Maijuna person care deeply about?

5. What might a Maijuna person wonder about or question?
Part 1: Welcome to the Bee House—Bienvenidos a la Casa de Abejas—Deira Daji Ua We

After walking across the village for no more than five minutes, you enter the shade of a newly-built bee house—a demonstration site for Maijuna beekeepers to share their knowledge and craft. Today’s teachers are Jairo, Marina, Magnolia, and Catalino. As they begin introducing their work, you notice that Jairo and Marina appear as mentors taking the backstage to the younger Magnolia and Catalino, as they take on a new leadership role. There are also young children listening in the background, adding a third generation to the mix.

Magnolia stands next to a hive, as stingless bees travel in and out of the entrance. Gently opening the top, she explains that there are nearly 20 families in her village keeping roughly 15 species of stingless bees near their homes or in their agricultural fields, called chacras. She continues by sharing that the Maijuna have always used wild honey for food and medicine, but today they are partnering with the non-profit organization OnePlanet who is teaching them how to raise bees in their village.

6. What question would you ask these teachers to show your interest, curiosity, and appreciation?

One of your friends asks, “Where do you get the hives from?” Catalino explains that in the past hunters would hear a nest buzzing at night and come back the next day to take the honey, often killing the whole colony. Today, they cut the nest tree down and carry the trunk back to their village, where they can raise the colony and eventually divide it into two. They are able to keep the hive in a section of the tree trunk or move them into a small bee box.

See it in action [here](#).

This makes you curious about traditional stingless beekeeping throughout the neotropics, so you decide to do some background research. These are your notes:
Stingless Beekeeping in the Neotropics

- Mayan Culture: The Mayans (Mexico) considered bees sacred, connected to their cosmology, and had a bee god.
- Guarani People: The Guarani (Brazil) saw bees as interconnected to ecosystems. They used stingless bees’ honey for food, medicine, spiritual life, and crafts.
- Pankara People: The Pankara (Brazil) found that there are no forests without bees and no bees without forests.
- Enawene-Nawé People: The Enawene-Nawé (Brazil) have a honey feast, called Ketecko, which involves hiding wild honey in the village and dancing upon its discovery.
- Quilombola: Stingless beekeeping is a traditional activity that is embedded in ecological knowledge, daily practice, and spiritual beliefs, that is passed from generation to generation.
  “A process of transformation and redefinition of meliponiculture practice has occurred, giving a cultural dynamic to the activity, as a demonstration that tradition is not static and is redefined in each generation.”
- Nukak People: The Nukak (Columbia) harvested products from 43 ethnospecies of stingless bees. ~20 Indigenous groups in Central and South America recognize many species of stingless bees, ranging from 20-50, based on their traditional ecological knowledge. They are 100+ species used by people.
- Uwa People: The Uwa (Columbia) associated honey with fertility and productivity. They believed bees made life evolve.
- Kayapo People: The Kayapo (Brazil) had a semi-domesticated beekeeping system. Some nests were cultivated in their village and some were partially harvested in the wild. Some honey was left as an offering to Bep-Kororoti, which allowed the nest to recover. They know 50 species.
- Stingless bees played a wide and important role in livelihoods and traditions across neotropical Indigenous cultures.

7. After completing this research, you summarize your notes by completing the following sentences:
   a. I noticed...
   b. I wonder...
   c. It reminds me of...
You now leave the bee house and take a walk through the forest to Duglas’ meliponary, where there are 45 hives nested amongst the dense rainforest and an adjacent chacra, maintained by his 17-year-old son, Jeremy. The hives are interspersed with agroforestry crops, such as cacao, papaya, yuca, pineapple, pijuayo, and guayaba. Duglas, his wife Lesli, and their children started this meliponary, or bee garden, in 2016 after a year of training and practice with the support of OnePlanet. In 2018, he started selling honey and by 2019 he had 34 healthy hives at this site.

Each hive produces about a liter of honey a year, which he is now able to sell in 2-oz bottles at a nearby lodge for $3 each. It costs him about $2 a year to operate each hive, and he makes on average $50 per hive per year from this forest-based product, depending on production. Altogether, his family has more than doubled their annual income. Today, in total, there are roughly 300 hives in the four Maijuna communities— quadruple the number since 2018. Duglas hopes to someday start another meliponary and have a total of 100 hives.

As you tuck under the shade of a large tree, an entomologist, named Randy Morgan begins explaining the biological importance of this group of insects. He jumps off by saying that pollination is a globally important ecosystem service, and in the tropics stingless bees are the most important pollinator of native plants, especially crops like acai, guarana (Zilse and Silva, 2012) and aguaje palm (Absy et al., 2018). As he continues, your attention to his words wanes, but you notice how passionate he is about this topic— you never knew bees could make someone exude so much joy! The glint of excitement in his eye brings your focus right back, just in time to catch that this group of eusocial insects plays a crucial role in maintaining tropical biodiversity. In fact, they pollinate about 80% of tropical plant species (Athayde, 2016) with a study finding 78 pollen types in one bee nest (Absy et al., 2018).
Randy pulls this diagram out of his backpack to explain the scientific classification of a very diverse group with 33 genera and 397 species exclusive to the tropics (Absy et al., 2018), reminding you of how much you remember from your general biology class.

Duglas shares the Mâhihi name for each species and highlights exacting details about each one, almost as if he is describing a familiar friend. Each bee species is known by its shape, size, color, smell, and especially its nest entrance architecture. He continues sharing this *ethnoecological* and *Traditional Ecological Knowledge (TEK)*, noting that each year is different than the last—some years there are many flowers, some years the flowers last only a short time, and some years there seem to be fewer flowers but almost always more during the dry season and usually more nests in floodplains. He says, “I don’t know this from science and books. I know this from living here.” Duglas underscores the importance of conserving biodiversity because of this variation and his role in doing that, as a meliponariast, or stingless bee steward. Randy chimes in by sharing research that shows that indigenous land management practices can enhance landscape *patchiness* and *melliferous* plant diversity, ultimately providing important habitat and food resources for these important pollinators, as well as maintaining “islands of biodiversity” (Athayde, 2016). Randy and Duglas continue this back-and-forth teaching style, making you see them as partners, who are mutually empowered and constructing knowledge together through this community-based and applied-research project (Gilmore and Eshbaugh, 2011). Randy seems to have skills that fall outside of a traditional scientist—diplomacy, civility, dialogue-building and listening (Menzies, 2006)—perhaps traits he has learned from his Maijuna partner.

As you walk back through the forest, you come to see these beekeepers as guardians. They depend on the same resources as the bees, and the bees benefit from their intimate connection to place (Brown, 2006). You take away from today’s workshop that meliponiculture is a feasible and profitable activity that must be done in a sustainable manner so as not to deplete natural resources and contribute to deforestation (Contrera et al., 2011).

Before learning more about the Maijuna, follow these links to increase your own appreciation and knowledge about pollinators in your backyard.

- North American Bee Diversity montage
- Bee Development time lapse
- NRCS on pollination
- Cornell Pollinator Network

8. If you were guiding someone through a local garden or farm, what would you say about the importance of native pollinators, making specific references to the resources above? Write an engaging paragraph, rather than a list of facts.
Part Two: A Good Use

Today, you return to the village to learn more about the Maijuna’s efforts to conserve their ancestral lands. A word jumped out at you when you heard Telmo, a Maijuna beekeeper, use it to describe his practices—sustainable. You asked him what that word means to him, here in the Peruvian Amazon. He responded, “It means a good use. It means working with the bees, not only in this moment, today, but for a long time.” Community elders, Victorino and Sebastián, add by saying, “It means to take care of the forest—maka bese bai ñiasaoyi—by not taking so much that the forest won’t recover—hunhwae.”

As you now know, pollinators are vitally important to plants and animals around the globe, especially humans (Brown and Albrecht, 2001). Developing this resource sustainability, by holistically examining social, environmental, and economic factors is crucial. Read pages 12 and 13 of the “Value-based Practices of Whole Communities” article published by the Center for Whole Communities to understand aspects that might shape sustainable development practices.

9. Given what you know so far, select three “value-based practices” from the article above that highlight ways the Maijuna are effectively managing bees. Explain your selections.

10. Are there any aspects of the current beekeeping model that could be adapted to have a lower impact, and which “value-based practice” (see article) does that relate to? If you are stuck, read back through the vignettes for important details.

The sustainability of beekeeping in the United States is under keen examination due to dramatic population declines in our own pollinator populations, a phenomenon called Colony Collapse Disorder. Watch this interactive HHMI video to learn more about one possible cause. When you are done with the video, a window will pop up. Click view report, then print, then save as pdf to include with your case study submission.
You enter the maloca, a circular meeting house with thickly-thatched irapay palm fronds providing reprieve from the equatorial sun. You sit next to Marina with her young daughter, trading bashful glances as they welcome you next to them. Behind the wall-less house, lies the forest, creating a formidable hedge. Books have told you this is a threatened ecosystem, but at this moment, it seems everlasting, boundless, and tenacious. In a forest that is constantly proclaiming its health through murmuring frogs, warbling birds, and trilling insects, could pollinators actually be impacted by people here, as they have been in the United States?

A woman named Dorcas stands in the center of the maloca, offering tastes of honey. She dabs one sample that is clear and thick— the sweetness washes easily over your tongue. She offers a second drop taken from the same hive months later, now a deep red— your mouth puckers from its tangy notes, as you accept her gift. She addresses the group— “This is about how we maintain ourselves.” With your system revving up from this shot of natural sugar, you consider the nutritional value of honey. Beyond the calories, it seems that honey is also supporting their cultural identity, well-being, and heritage (Menzies, 2006).

Dorcas continues sharing her observations of how distribution patterns might be changing as they take more bees and trees from the forest, by noting that it is harder to find nests close to the village. In the last two years, they have cut down about 50 trees to use in their meliponaries. These trees are often centennial trees, as there tends to be a positive relationship between tree diameter and nest density (Zilse and Silva, 2012). Dorcas continues by sharing a short history. This seemingly inexhaustible landscape was actually considered a ghost forest not too long ago after loggers invaded the area, void of the fish and game animals the Maijuna depend upon for sustenance. Bees are also harmed by deforestation (Brown and Albrecht, 2001), as well as land conversion and direct extraction (Athayde et al., 2016). As forests are cleared, fragmented, and developed, nesting and foraging habitat for bees is disturbed, suggesting that bee health is a sensitive bioindicator of ecosystem health (Zilse and Silva, 2012). In fact, the local species sisico ua (Melipona refiventris), which produces a premium honey prized for its medicinal value and pleasant taste, has been shown to be highly susceptible to deforestation (Brown and Albrecht, 2001). Without these pollination services, tree reproduction can drop, setting off a cycle of degradation. With this habitat loss, indigenous beekeeping could also be lost through a slow decline in practice (Contrera et al., 2011). As the reciprocal relationship between bees and the land frays, so follows the reciprocity between the beekeepers and bees, potentially leading to a loss of traditional ecological knowledge. In the context of this history, the success of this beekeeping project now multiplies in your head. Illegal logging ended in this area about 10 years ago, demarcating a time of resurgence and rebounding for both a people and their place in concert. To alleviate the allure and pressure associated with logging, meliponiculture appears to be boosting the security of Maijuna livelihoods. Recalling how families like Duglas’ have been able to earn a living, while conserving their forest, while maintaining their traditional culture appears now as a triple threat to keep these global forces at bay.
Dorcas finishes by rhetorically asking, “How can we limit the impact of our activities on bee populations?” To address this question, the Maijuna took an experimental approach and again partnered with researchers from OnePlanet. They sought to test methods for capturing daughter colonies that are in the process of dividing naturally by designing bee traps from readily available materials in the village—locally harvested wood, raw bamboo, and reused soda bottles. The testable questions of this study were: Which trap type will capture the most swarming bees? What are the best locations to capture swarming bees?

11. If you were a partner in this research, how would you design a field investigation to answer these questions? Create an experimental design sketch with an accompanying explanation.

The next thing you know a group of Maijuna beekeepers are inviting you to a minga. You have no idea what this means but you follow suit. You are put right to work—the traps need to be made today! The 15-foot pillar of bamboo is intimidating against your flimsy steel saw. But with the help of this crowd, you have five sections in no time at all. These tubes, along with the plastic bottles and wooden boxes from other groups, go to the next station to have a bee pheromone applied. The sounds of busy tools soon give way to laughter and conversation, as food is brought out to share—a feast! Now you understand a minga as a work party embedded in a celebration of cooperation and community.

This collection of traps will soon travel north of the village to an existing network of transects used in an ongoing mammal conservation project, as shown below. The three trap types will be placed at each location, indicated with a red dot. Five trap clusters will be set out on five parallel transects for a total of 25 trap sites and 75 individual traps.

12. Which trap type and which location do you predict would capture the most swarms? Explain your reasoning.

13. After one year of placing the traps out, three colonies were captured or 4% of the traps were occupied, compared to other studies that found a 10% colonization rate. If you were the scientist responsible for collecting data, both from empty and occupied traps, how would you design a field data sheet? In other words, what data would be important to record at each location?
Part 3: Without participation, there is no conservation.

As you help put the minga tools away, you have a feeling that can only be described as your cup filling back up. You never expected that meliponiculture, informed by both traditional knowledge and applied science, could be practiced as a sustainable activity, simultaneously enhancing biological and cultural diversity in Amazonia (Athayde et al., 2016). During your short visit to the Sucusari Village, you feel you have tapped into a reservoir of knowledge that might provide the insight and inspiration to cope with the global environmental change that is occurring in your home community. The Maijuna’s conservation-success story owes its realization to their cumulative and collective know-how about these “forgotten pollinators,” who now serve as a conservation link between people and nature (Kevan and Imperatriz-Fonseca, 2006). The success is also owed to a network of synergies—between insect and plant, people and place, and scientists and stewards. These synergies wed conservation and development into an indivisible binomial (Zilse and Silva, 2012) and create the “ecology of knowledge” needed to rise to the challenges of our time (Santos, 2009).

This story is a model. This model guides the questions you might ask of your own community and inspires you on how to go about finding the answers. The Maijuna model is tactile, place-bound, and embedded. You are struck by the transformative ways the Maijuna have reinvented themselves, their traditional ecological knowledge, and practices to match the real-time context of place. This demonstration of dynamic, never static, activities and traditions are an invitation for you to collaborate and participate in your community (Carvalho et al., 2014). The bees themselves provide another model of holistic processes—cooperation, integration, and adaptation—suggesting that new alternatives are needed to shift our reliance on a single pollinator species (Lyver, 2015).

You are left with more questions than you started with—what can the Maijuna teach us about sustainability and a view of a lasting relationship with one’s home place? How might this exposure to a timeless way of knowing things affect my citizenship? How might I create the synergies that bridge knowledge, better stewardship, and solve problems in my community (Menzies, 2006)? If the Maijuna can revitalize their biocultural heritage (Lyver, 2015) with the help of a mini but mighty bee, certainly you can return to be an agent of change toward the recuperation of your own home.

Sabastian, Victorino, Jairo, Marina, Magnolia, Catalino, Duglas, Telmo, and Dorcas use their words to conclude your visit. With sincerity, they thank you for coming and taking part in their community, if only for a short while. Sabastian draws the trip to a close by saying, “There is no understanding without participation. And without participation there is no conservation.”

It is now time for you to participate in a community of change-makers! As you learned in part 2, agricultural practices are likely contributors to pollinator declines in the United States. But could habitat loss or climate change also play a role? The Great Sunflower Project is trying to answer questions like this by involving citizen scientists like you! Your records “are invaluable data on the state of our pollinators and are helping to build the best data set on plants and pollinators.” Your goal is to record the health of pollinator communities near you by following the directions below.

- Watch this introductory video (scroll down past the header).
- Read the overview of the Pollinator Friendly Plants and Places program and Start Guide.
- Complete your training by mastering your bee identification skills (sign in required).
- Get ready for your field work by printing the multiple count datasheet (item #2).
- Log a total of 30 minutes of observations in as many increments as you wish over 5 minutes in duration.
- Submit your data to The Great Sunflower Project.
- Need help identifying your bees and plants? Try these apps: Wild Bee ID, Leaf Snap, and iNaturalist.
As you say good-bye to your Maijuna allies, you ask, “what is the one message you wish I would share back home.” Marina simply says, “We have everything here.”

Before getting back on the boat to float down the Sucusari River that eventually will start you on your way home, you look over your shoulder one last time to get a faint glimpse of the back of Sabastian’s sun-faded shirt. It reads, “ibese bai nui yomaï ija yoji bayi cama yotu saomaj iibese bai” with the translation, “Conserving and managing the forest, we take advantage to better our resources.”

14. To conclude this case study, please finish with these final reflection prompts by finishing the sentences:
   a. I used to think…

   b. Now I think…
Acknowledgements

Thank you to the Maijuna community for allowing me to share their story with you in this way. Thank you also to OnePlanet and the Morpho Institute, led by Christa Dillabaugh, for facilitating the workshops mentioned in the case study through the Inquiry, Conservation, & Sustainability in the Amazon teacher and student program. And especially to Dr. Michael Gilmore and Elizabeth Benson from OnePlanet for their leadership and dedication to community-based biocultural conservation.

References


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