Chris Cannizzaro | Kelly Inae | Raywin Ovah | Cooper Schouten
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Beekeeping in the Eastern Highlands of Papua New Guinea

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NARI

HELPING HAND HONEY

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Contents

Contents

Healthy hives

Protective equipment and tools

☑ **Head veil** to protect your neck and face from bees when inspecting hives and harvesting honey

☑ **Smoker** for keeping bees calm while inspecting hives and harvesting honey

☑ **Steel Hive-tool** for removing and cleaning hive frames

Safety around open hives

- Bees can sometimes get defensive when you check their hives
- So make sure to always be safe and stay away if you have no protection

- Keep friends and family at a safe distance from open hives to avoid getting stung and follow the instructions on the next pages to inspect your hives

Healthy hives

Opening hives

☑ **Step 1.** Smoke the entrance of the hive to calm the bees

☑ **Step 2.** Peel the roof seal and smoke from the top

☑ **Step 3.** Lift the roof seal and smoke into the frames

Opening hives

☑ **Step 4.** If you have more than one box, put the extra bee boxes facing the corners of the lid on the ground, this will also keep grass and sticks out of your honey

CAUTION!!

Be careful, the hive may be **very heavy** if it is full of honey, so bend with your knees and look after your back.

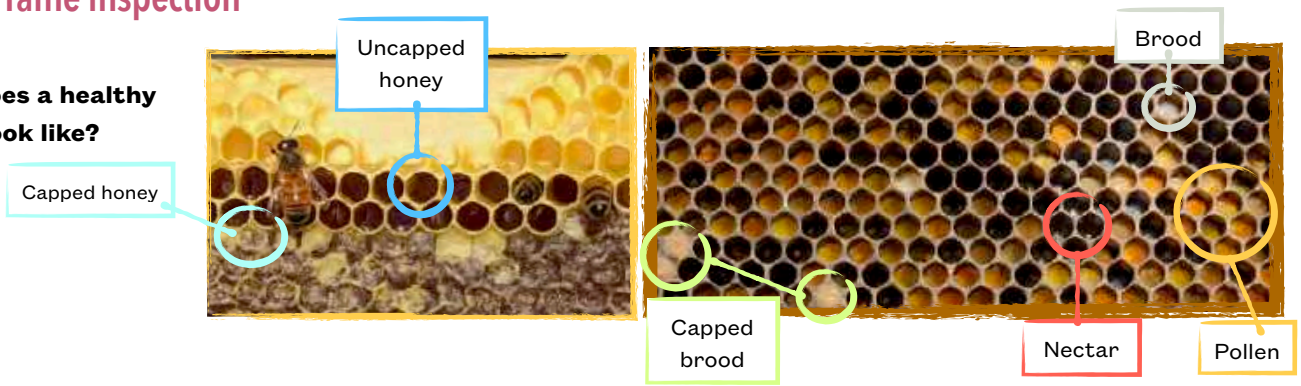
Healthy hives

Opening hives

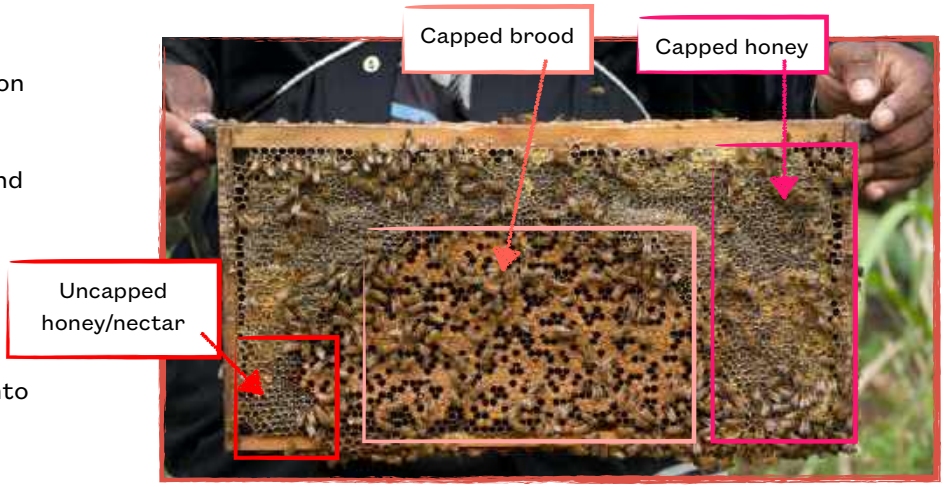
☑ **Step 5.** Wait a moment for the bees to settle then lift the frame from the hive with the hive-tool and

Frame inspection

What does a healthy frame look like?



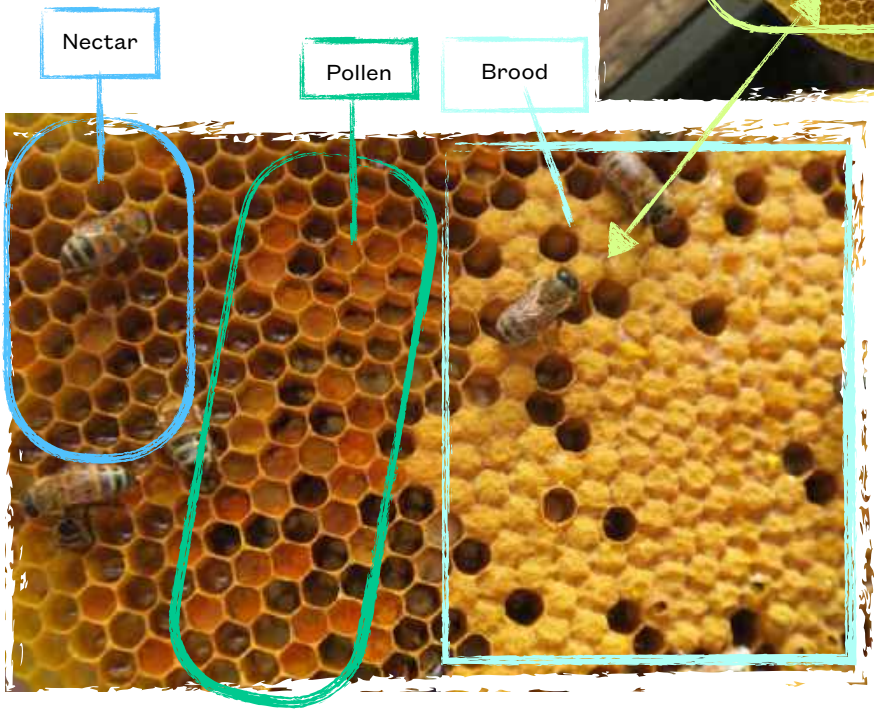
- Healthy frames can have brood, honey and pollen at the same time
- Lots of capped brood means lots of worker bees to collect more honey, so don't disturb them to collect surrounding honey
- Healthy pollen cells should be different colours for good nutrition
- Brood cells will be open at first and have small larvae growing into large larvae before the cell is capped
- Capped brood cells are turning into mature bees so don't disturb the seal! Its a very soft wax
- Capped honey is sealed for storage
- Uncapped honey is not yet full so do not harvest uncapped honey cells!



Healthy hives

Brood frames

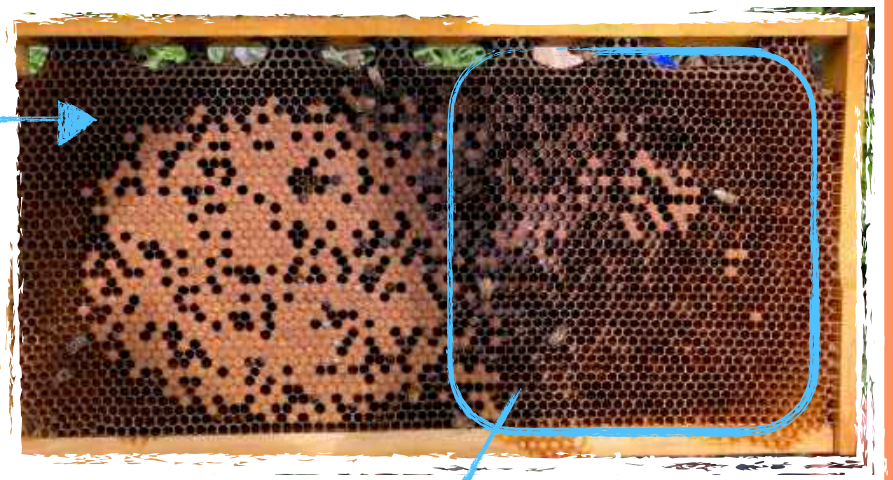
- There are different types of frames in a hive bees will use for different purposes
- You can identify a brood frame by all the soft wax capping. Underneath this there are brood or baby bees growing

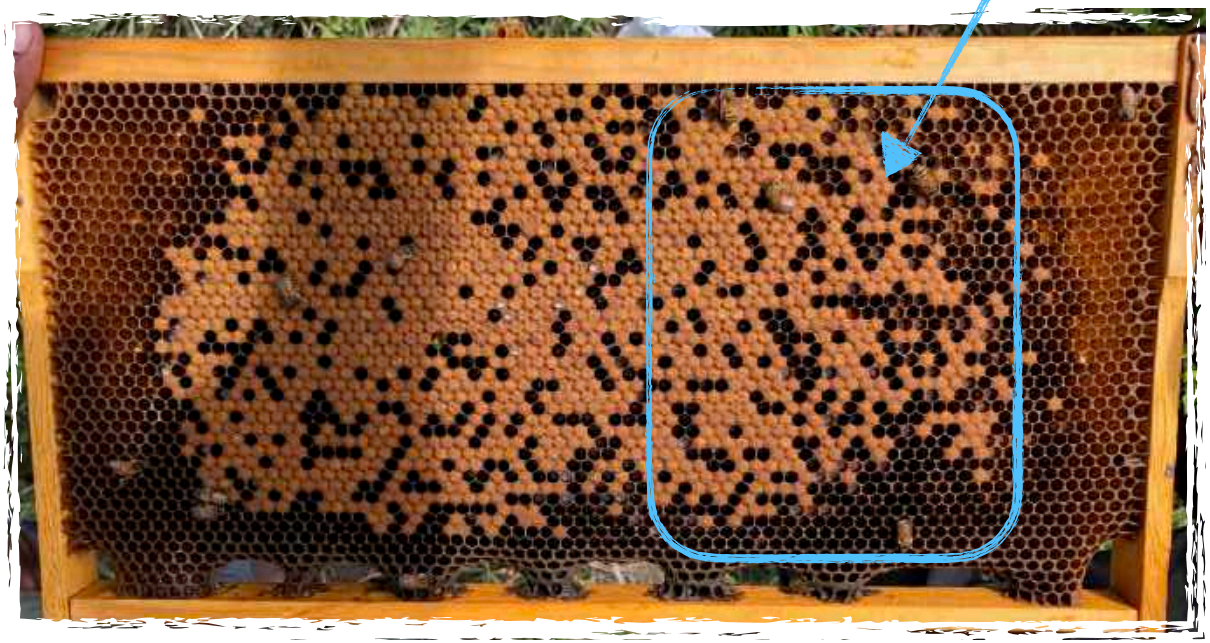


- As you can see there is also some pollen and nectar in the frame. This will be used to feed the bees

Brood frames

- When bees are busy and the queen is productive your brood frames may look like this
- Starting off with an empty looking frame with nectar and pollen and then filling up slowly with brood till it is full
- These frames can be used to start new colonies if needed

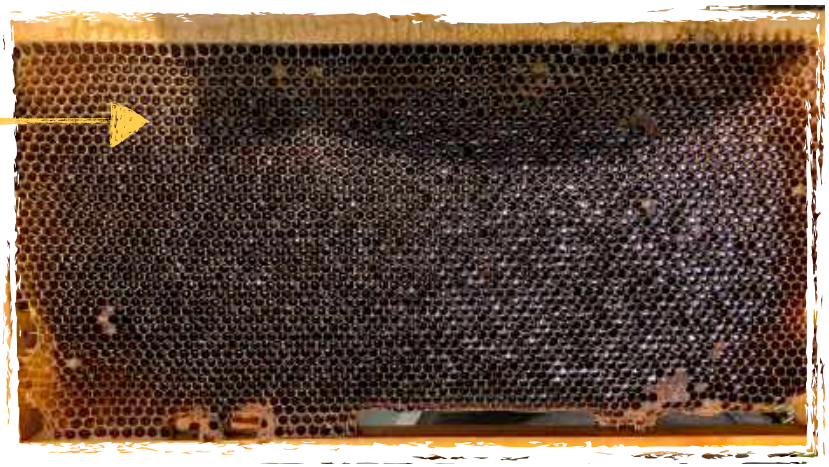


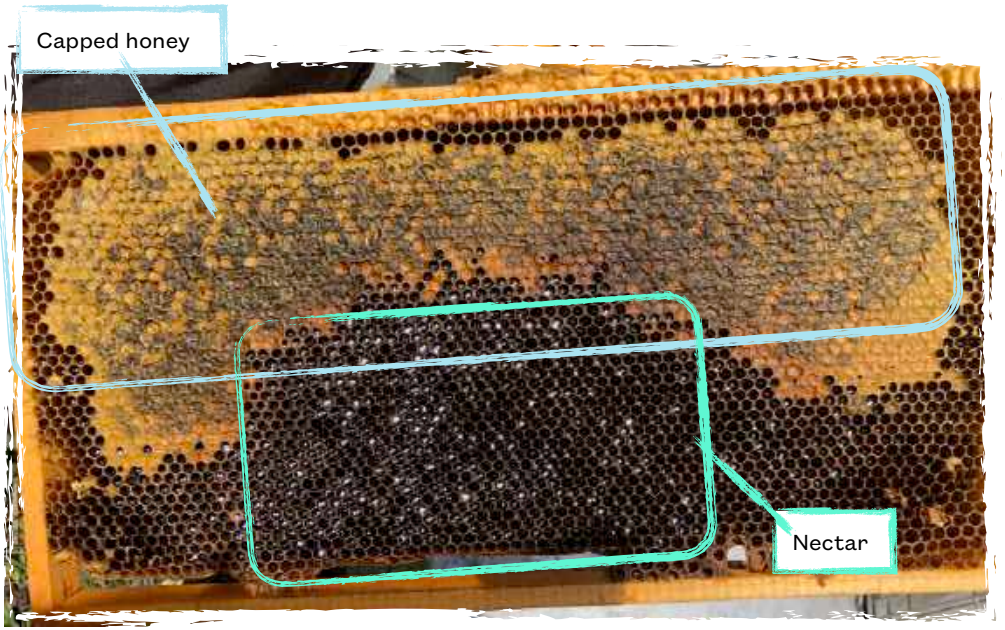


Healthy hives

Nectar frames

- Nectar frames are a good sign there is a honey flow on.
- Nectar is bees carbohydrates like rice and kaukau.
- A honey flow is when there are many flowers and the bees are very busy collecting nectar from them.
- It will look shiny in the sun and can even drip out of the frame so be careful when you hold it so you do not spill all of that precious nectar.

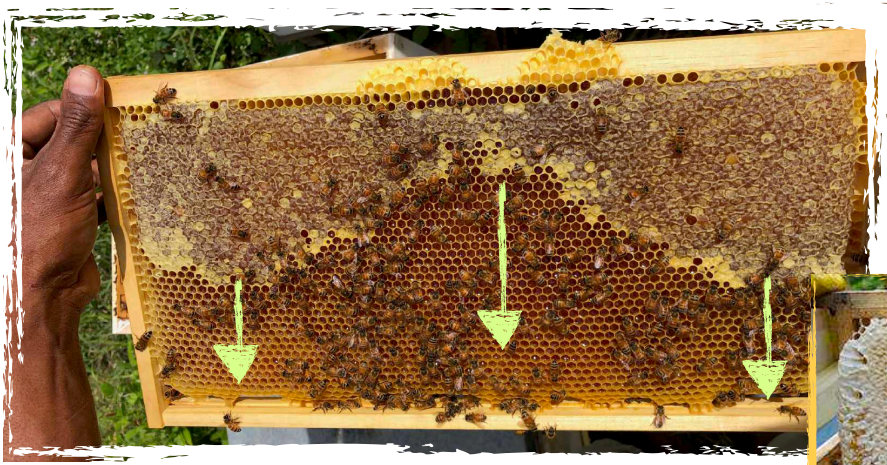




- The bees will slowly turn the nectar into honey by drinking it and spitting it back into the frame like betel nut.
- This dries the water in the nectar and turns it to honey
- When the honey is ready for harvest the bees will cap the cells to protect it and store it long term

Honey frames

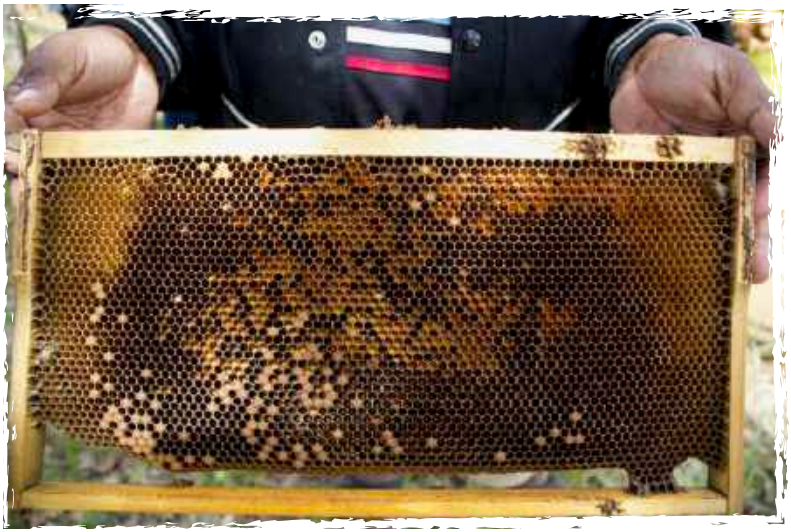
- Once the bees have turned the nectar to honey they will continue to cap the rest of the frame with wax
- Once the entire frame is covered in wax it is ready to harvest
- In cases of emergency you may harvest the honey if it is half to three quarters capped but is best to wait for the whole frame for better honey yields

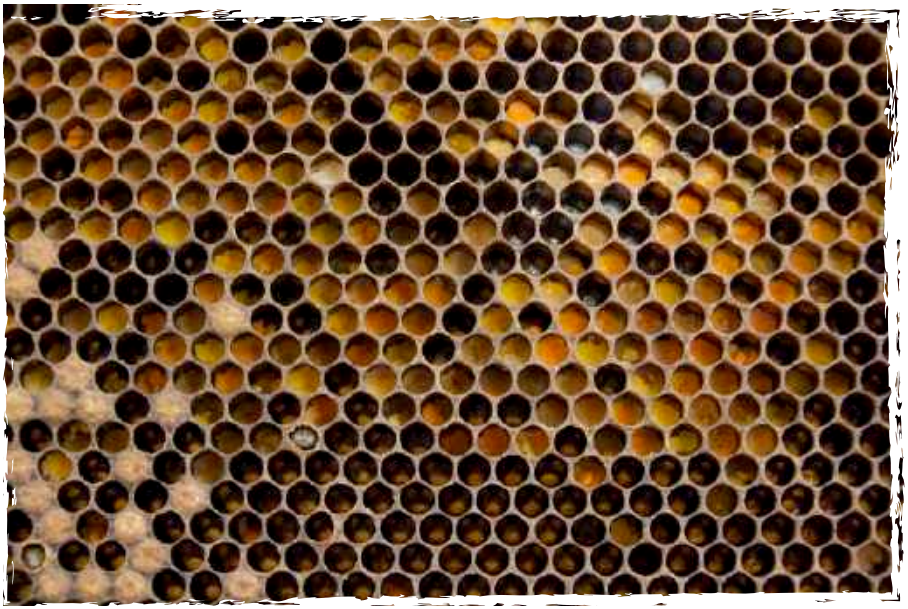


Healthy hives

Pollen frames

- Pollen frames look different from honey frames and brood frames as they are mostly pollen
- Pollen is the protein (abus) like kukaruk which makes the bees strong
- Many different colours of cells show lots of diversity in flowers
- Sometimes the colours will look the same, this is still good as long as there are many coloured cells

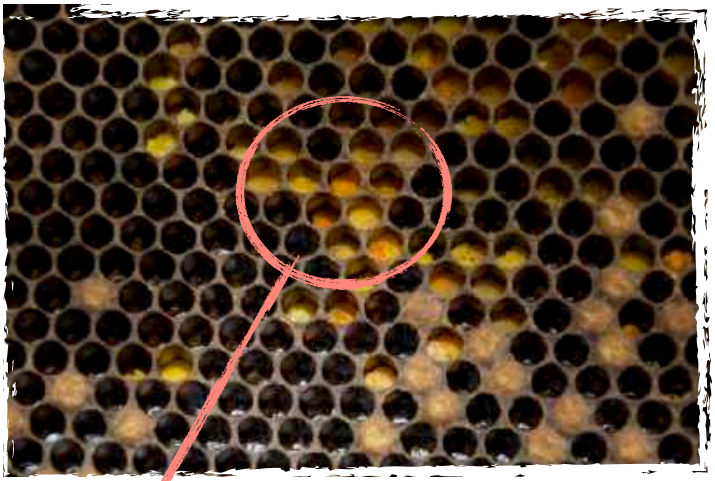


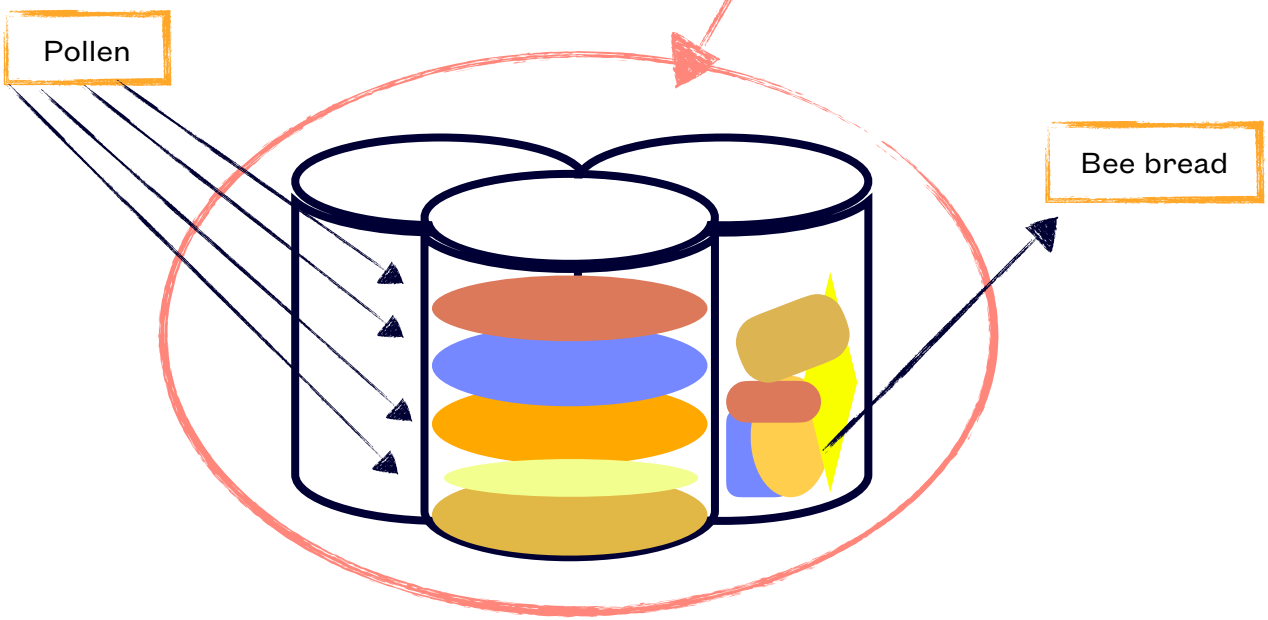


- There will still be some nectar and capped brood cells but most cells will be pollen
- This frame can also be used to start a new hive

Pollen frames

- If you look closer you can see in each cell there are layers of different pollen like a cake
- Every time a bee returns with pollen it makes a layer
- Bees will mix these pollens together and make bread to keep and eat later like they do with honey





Healthy hives

Cleaning frames

- Wax often accumulates on the top of frames
- New wax is light yellow and clean and is valuable to sell
- New wax means new comb that bees will fill with honey so it is a good sign of health

- Clean the wax and collect to sell or make candles and other useful products.
- By cleaning the wax bees will not put honey and pollen in the roof and keep the hive neat and clean
- Hives that are neat and clean are healthy and easier to inspect and manage
- Next we will check for pests

Ants

- Ants can eat your bees honey or the sugar you're feeding your bees
- To keep the ants out, cut some old material up, soak in old car/truck engine oil and tie around the legs of the hive stands
- You can also apply engine grease around hive stands. Make sure there's no grass touching the hives that ants can use as a bridge!

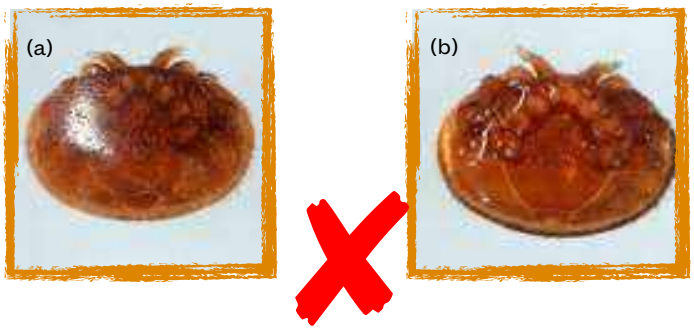
Oil and old material

Soaked material covered in oil and tied around hive stand

Varroa mite

Mites are bad pests for your bees and can make them sick with viruses and even kill the whole colony if not treated.

Varroa jacobsoni is the size of a pin-head, brown in colour and slow moving. They can live on adult bees for weeks but need brood to reproduce. They are most easily found by doing a 'sugar shake' or uncapping drone brood.



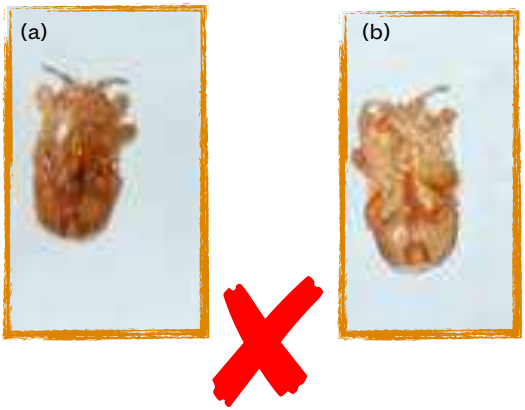
Varroa mite (a) dorsal view and (b) ventral view.

Varroa mites on worker brood

Tropilaelaps mite

Tropilaelaps mercedesae are half the size of *Varroa*, brown in colour and fast moving. They cannot feed on adult bees and need brood to survive. They are most easily found by uncapping worker brood, especially from frames with signs of 'bald brood'.

Tropilaelapse mites on worker brood



Tropilaelapse mite (a) dorsal view and (b) ventral

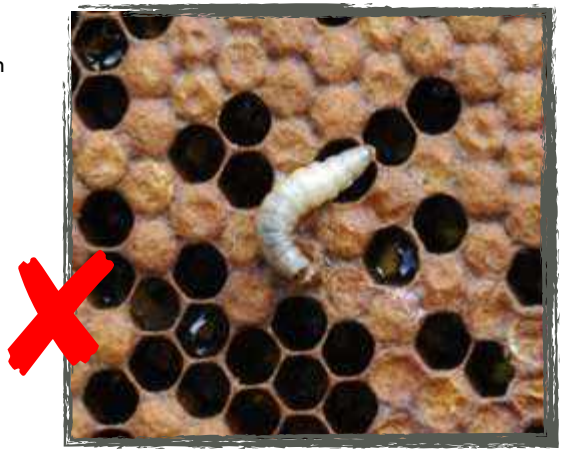
Cane toads

Frogs (Cane Toads) can sit at the entrance to your hives and eat lots of bees!

Put your bees above the ground on hive stands to stop them from eating them all.

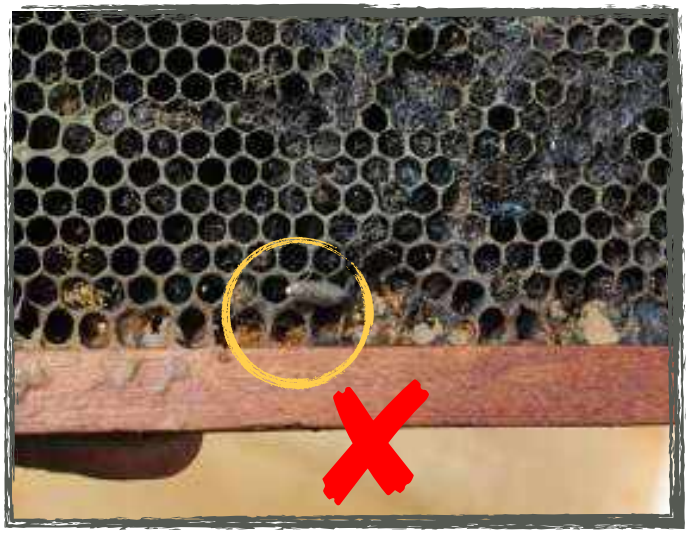
Wax moths

Wax moth can get into the hive at night time and lay eggs. The eggs hatch into larva and start to eat all the wax. They can make a mess of your hive, chew through the timber of your frames and if the colony is weak it may make them leave (**abscond**).



Wax moth larvae.

- Wax that is **NOT** covered by lots of bees is at risk.
- The best way to make sure your colony doesn't get wax moth is to make sure they are strong and healthy and don't have too much space to protect.
- Empty frames and supers laying on top of colonies or around the house are attractive to wax moth.
- Make sure your hive doesn't have too much space
- Fix holes in your boxes so wax moth can't sneak in.
- Don't leave your wax laying around your hives, it attracts wax moth and other pests of honey bees. Store it in a sealed container.
- Keep unused wax combs and frames sealed. On a flat piece of wood, stack your unused boxes and combs and put a lid on it. Wrap it up with cling wrap and sticky tape if there are any holes.



Wax moth adult with damaged

Asian honeybee

The **Asian Honey Bee** (*Apis Cerana*) in PNG is similar to the European Honey Bee (*Apis Mellifera*), but is smaller and darker in colour. It produces less honey and is difficult to keep in hives. It competes with your bees for food and may try to steal your hives stored food.

Walker, K. (2005) Available online: PaDIL - http://www.padil.gov.au.

What to do if you see this bee?

If you see Asian Honey Bees going into your hive (robbing) you should:

- Use robbing avoidance skills, e.g. when harvesting, extracting, keep colonies strong with young laying queens
- Reduce the entrance so the bees can defend their home.
- Don't leave honey, sugar and wax lying about your apiary, it will attract Asian Honey Bees.
- If you find a colony of Asian Honey Bees you can cut it down and

European honey bee (*Apis mellifera*)

Mite monitoring

- It's a good idea to check your hives for mites each time you open them by looking at the brood and opening cells.

- Sugar shake is good for finding varroa, but doesn't work as well for *tropilaelaps*. During a nectar flow it can be hard to do sugar shakes because the nectar makes the sugar clump together.

- Uncapping brood and drone cells. *Varroa* like drone brood. *Tropilaelaps* like both worker brood and drone brood. If the hive is strong it has lots of brood and bees so it can be hard to find mites. But this doesn't mean they are not there! Make sure you check at least 100 cells (you can check 50 on each side of a frame).

- A good way to check for mites is to put a sticky board underneath the brood chamber and treat your hive with bayvarol (2 strips for 5 frames of brood). Come back and check how many mites are stuck to the sticky board after 24hrs. Alternatively you can leave sticky mats in for 3 days and divide the number of mites by 3 to get average daily mite fall. If you don't have sticky boards, you can make a cheap sticky board out of cardboard paper, sticky tape and clear sticky book contact sheet.

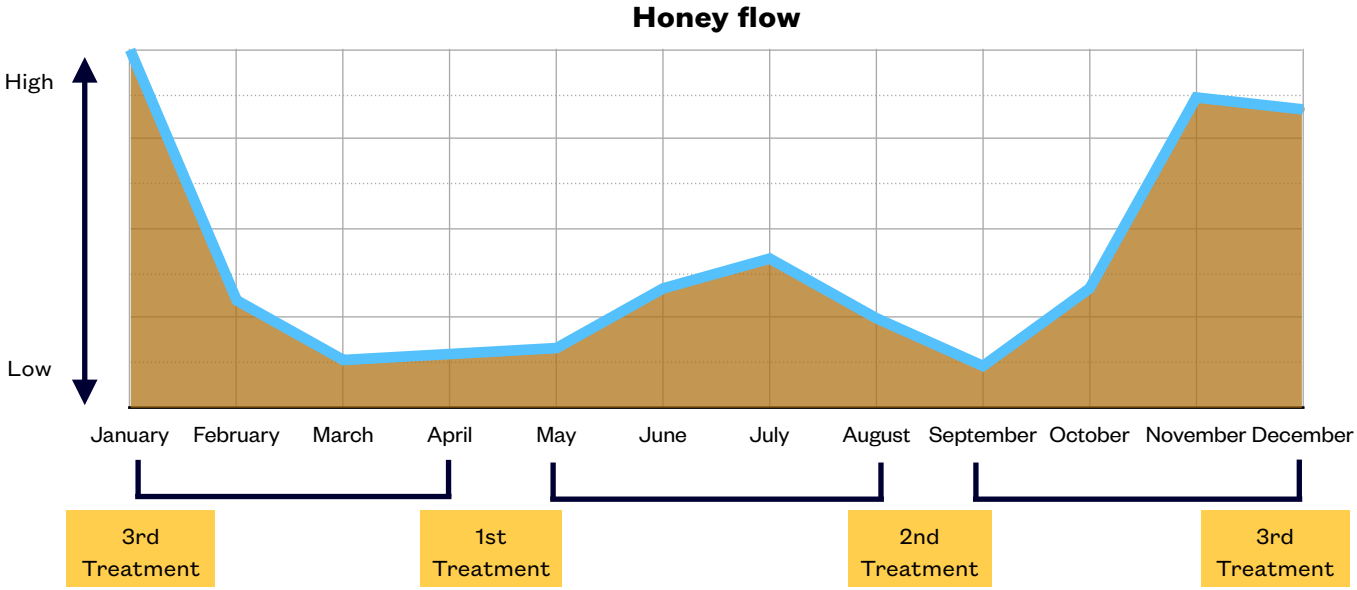
Timing mite treatment

- If you treat for mites, they can come back after four months. It is best not to rely on a single control (e.g., strips), but rather implement a number of different strategies to keep mite populations below damaging levels.

- There are about 3 main periods which could be best for managing mites indicated below. You may want to use a non-chemical control in April-May and then a stronger chemical option before the major honey flow in Aust-Sept if mite populations are high.

CAUTION

- Do not manage **one** hive in an apiary at a time. You need to manage **all hives** at the same time.



Bayvarol mite treatment

- If you treat with Bayvarol, you can't harvest honey for 8-weeks so keep a diary record so you can remember when you can harvest honey again.
- Don't leave the strips in the hive longer than 8-weeks because this can cause resistance issues with mites, meaning that treating in future may not hurt the mites!

CAUTION!!

- Make sure you wash your hands after handling Bayvarol strips and wear rubber gloves.

- **2 bayvarol strips are needed for every 5 frames of brood.** If you treat with less you will make mites stronger by creating resistance. If you don't want to spend the money on enough strips, don't under treat, use another method as below.
- If you have a virgin queen, be careful using bayvarol strips as they can damage her development. It may be best to come back after two weeks and check she is mated and laying before treating.
- Currently in PNG only Bayvarol is available, but this chemical needs to be swapped/rotated with another chemical each year (e.g., Mite away strips – formic acid). Enquire with your beekeeping supplier.

Non-chemical treatment

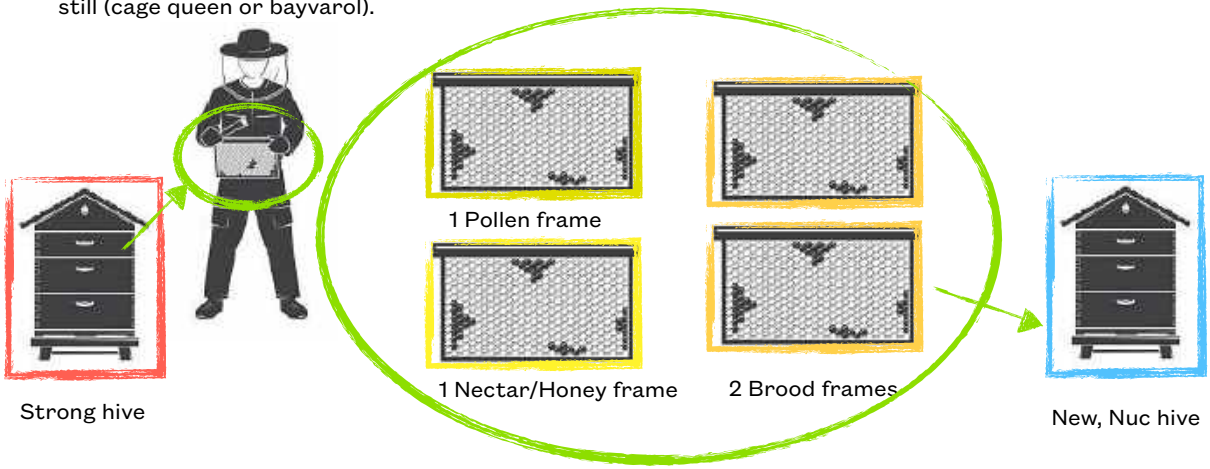
Splitting hives to create new colonies that are free from mites can be a good non-chemical alternative to saving your bees. Here are two ways to achieve this:

1. Walk away split

- Take 1 frame of pollen from a hive
- Take 1 frame of nectar/honey from a hive
- Take two frames of brood (make sure one has 1 day old larvae and check the queen stays in original hive).
- Put these frames in new Nuc, bee box
- Shake some extra bees in if you wish.
- The new colony will raise a queen, so check in 30days she is laying eggs.
- The original hive will need to be managed for mites still (cage queen or bayvarol).

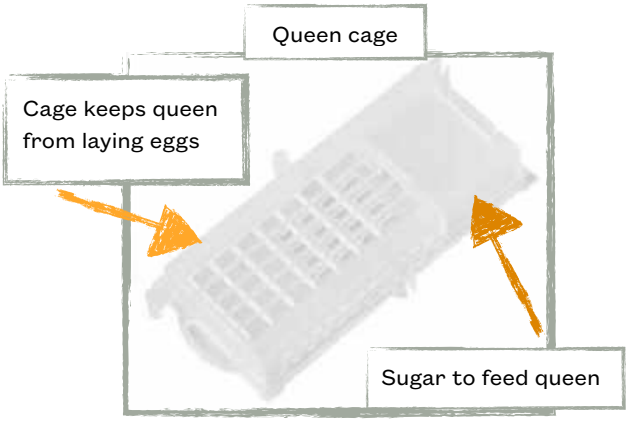
2. Artificial swarm

- Get a new hive with new foundation frames. Remove three frames so you have space to shake bees in.
- Find the queen in the hive you want to treat for mites (put her in a cage or put the frame she is on to the side, see next page)
- Shake all the bees in the hive into the new box with foundation.
- Put the queen into the new hive (pick her up gently/ remove from cage and make sure she goes into the new box)
- Close up the hive with some sticky tape or grass and leave them for 48hrs (so the bees forget their original home), then open the hive. Make sure they don't overheat in the sun.
- If there is no nectar flow, sugar feed.
- Come back and check the original hive has a laying queen after 30days. Re queen this self-raised queen with a quality queen from a bee breeder if not performing.

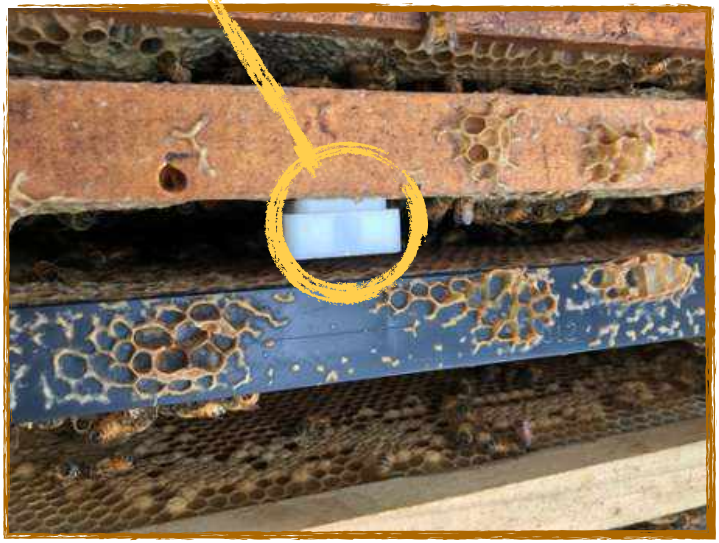


Non-chemical treatment

- You might need to cage your queen if she has mites on her and needs treatment or when your moving her to a new hive and want the new bees to get used to her and accept her as their new queen.



- Find and cage the queen for 28days. Queen cages cost about 5 kina. Find the queen, cage her and place in the middle of the brood chamber. Remember she needs to be fed by other bees so don't squish her in too tight.



- Don't forget what day the queens need to be released! Keep a record of the day/date you cage queens and write dates on top of each hive.

- Queen caging may help with swarm management. Caging the queen during a honey flow won't necessarily result in a decline in honey production because all bees will be foraging instead of taking care of brood.

Identifying the queen

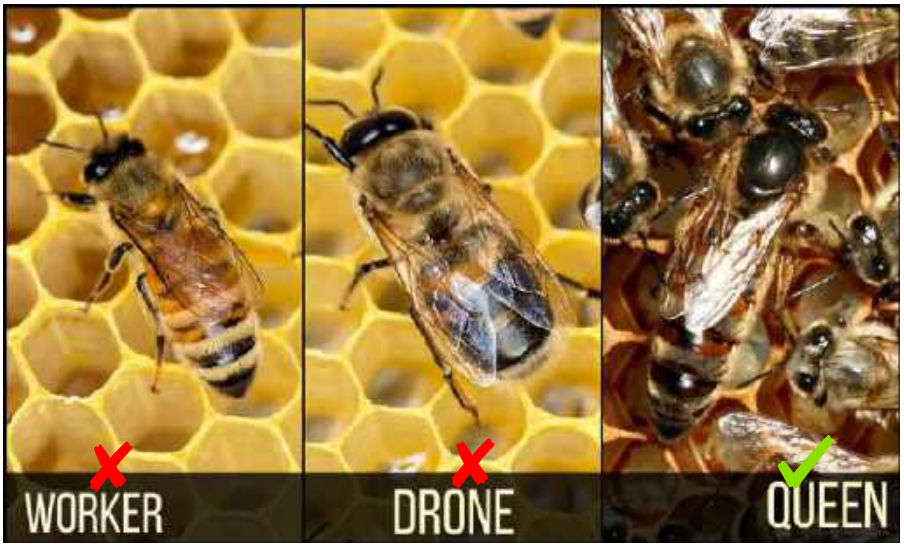


Photo © Sy, John Brandauerl

- Queens are very long and dark compared to worker bees and drones
- Worker bees are the most common bees in the hive and you will see them on flowers
- Drones are the male bees, they don't make honey or collect pollen. They just mate with the queen bee and eat the free food.
- Some times queens will need to be replaced as their egg laying slows down like a chicken
- Replacing older queens will usually bring healthier and stronger hives with more workers
- Aggressive hives can also be replaced by a new queen as her eggs will eventually replace all the aggressive bees and create a new colony in the hive over time

Queen and dummy cells

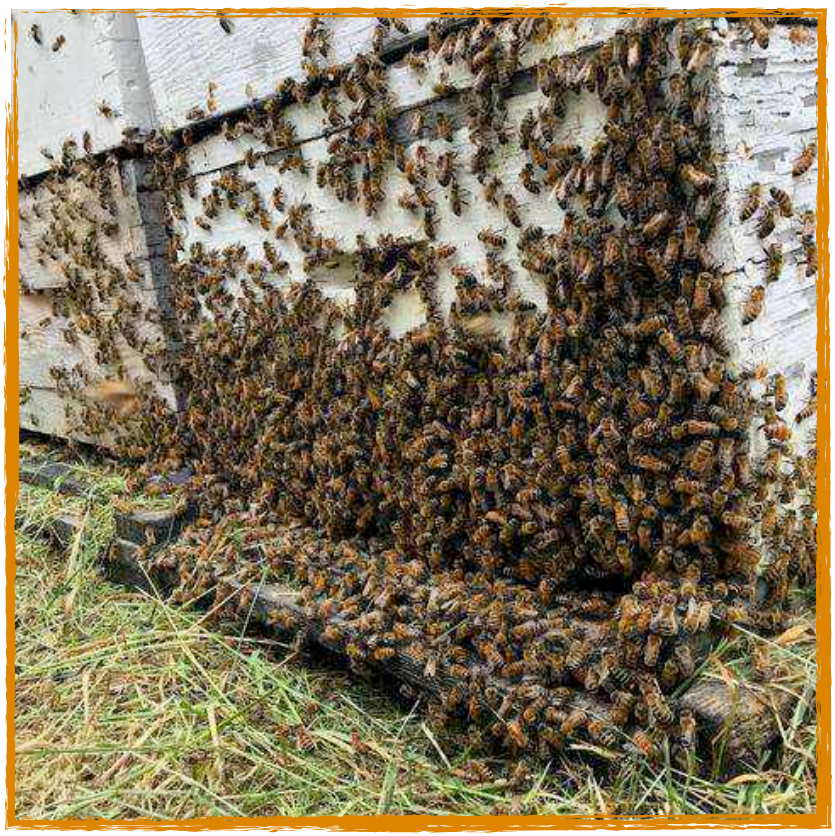
- Your bees will often make queen cells to either replace the queen that is getting ready to swarm or replace an ill or old queen that will soon die
- Queen cells are much larger than brood cells and can produce a new queen if there is an egg inside
- Some times there is no egg inside the cell, this is a “dummy” cell and won’t make new queens or cause your bees to swarm
- There may be multiple queen cells in a hive at one time, some may be dummy cells though so best to check and remove as needed
- Queen cells can also be warning of a swarm if there is an egg inside and may result in losing your bees! So best to check for eggs

Bearding and swarming

- Honey bees congregating on the entrance of the hive is called bearding and can be due to two reasons:

1. In the peak of summer months late in afternoons honey bees will beard to keep the hive and brood cool
2. When food is plentiful and queen cells have not been removed honey bees will beard to get ready to swarm and find a new hive
3. If they are going to swarm, you might want to keep them and make a new hive by splitting them (See next page)

- Bearding to keep the hive cool usually happens late In the afternoon

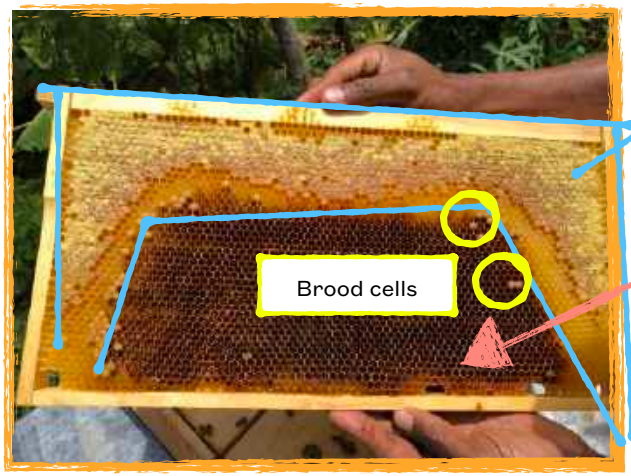


Bearding and swarming

- Once bees have swarmed they will settle somewhere safe until they find a new nest.
- At this time they are calm because they have swallowed honey to bring to a new nest and give them energy
- If you are a new bee keeper call some one more experienced to help you save the swarm of bees

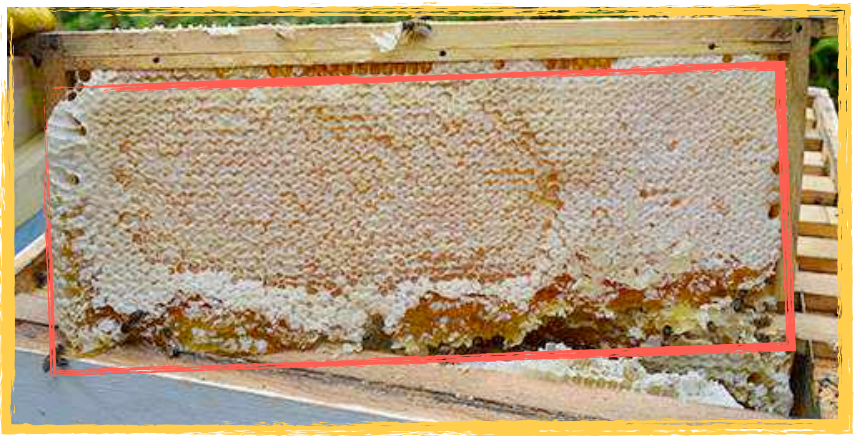
- In a wild swarm a queen will be in the middle of the bees, they are keeping her warm and protecting her
- If your careful you can scoop the bees into a new bee box with some wax foundation frames, keep it closed and start a new colony
- Even though the bees are calm, be sure to wear a veil and long clothes to avoid getting stung

Harvesting honey



- Wax capping on part of the frame and there are still some brood cells.
- Make sure you don't harvest too early, you will rob your bees and make them starve
- There will still be nectar waiting to be turned into honey on this frame and it is uncapped

- Wax capping has covered the entire frame and honey is ripe
- Ripe honey is ready for harvest!
- You can cut the wax from the surface of the frame and extract the honey
- If you don't have an extractor, you can hire one from your local supply store



Harvesting honey

- Honey is extracted using a centrifuge
- The top wax capping on honey frames are cut off with a hot knife and placed in the extractor
- The frames are spun with the hand crank and honey drips down into the tank for collection
- The wax and waste is caught in a filter and pure honey is stored in a container ready for putting in jars or bottles and sold to customers


Honey runs down


Turn the crank


Filter honey


Ready to put in jars

Honey

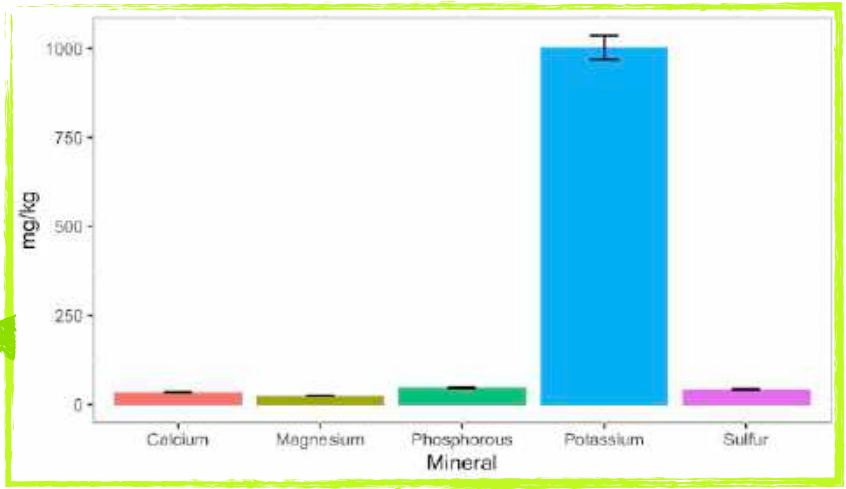
Harvesting honey

- Honey can be stored in jars, for small amounts, bottles for larger amounts and buckets for bulk sale
- Honey can also be sold as honey comb and makes a beautiful, delicious gift

Mineral content

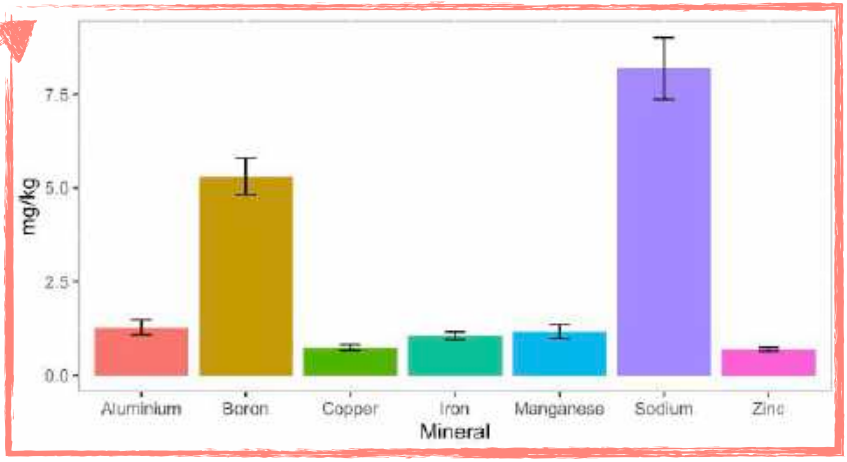
- There are small amounts of minerals in honey samples
- This comes from the nectar bees collect from flowers
- Some trees make nectar with high amounts of Potassium such as Avocado, giving the honey some nutritious value.

Major minerals



- As you can see, some minerals are in very high amounts and others are only small traces
- This will vary depending on the types of flowers your honeybees visit

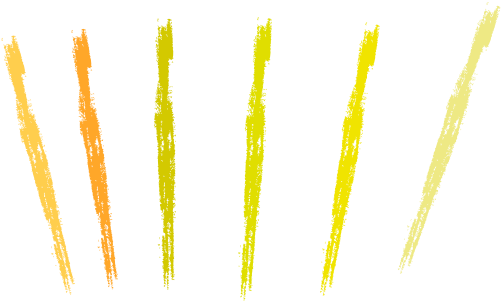
Minor minerals



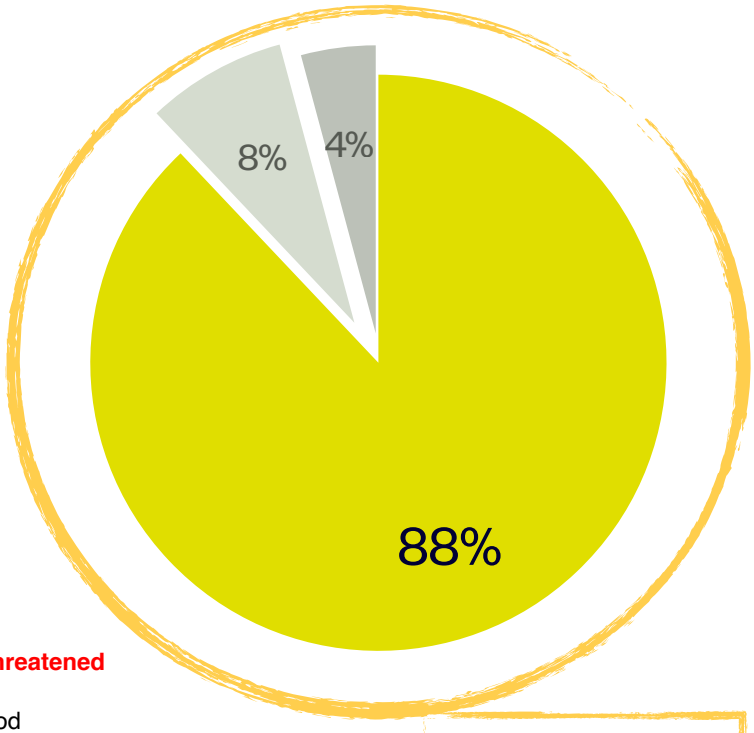
Honey

Colour

- Honey can be many different colours depending on the flowers they visit.
- You might find sometimes your bees make red honey in one season and brown in another, then yellow the next month!
- You might also find your bees make only one colour of honey, this is also good
- If you blend all the different colour honeys together to sell in bulk the colour will change, so if you want to keep a special colour make sure you keep the honeys separate when you harvest



Major flower sources



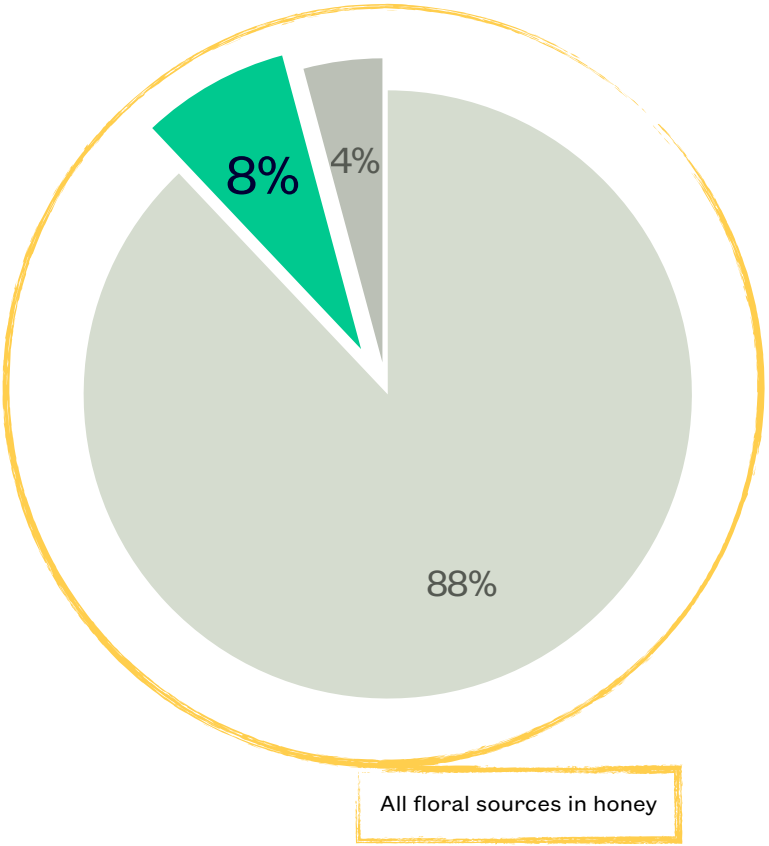
All floral sources in honey

Major sources

- *Actinodaphne nitida* → Rainforest tree
- *Dendrophthoe sp* → Mistletoe
- *Helicia latifolia* → Rainforest tree, **Near Threatened**
- *Horsfieldia hellwigii* → Rainforest tree, hardwood
- *Phaseolus vulgaris* → Green beans
- *Pometia pinnata* → Island lychee
- *Syzygium unipunctatum* → Rainforest tree

Honey

Moderate flower sources



All floral sources in honey

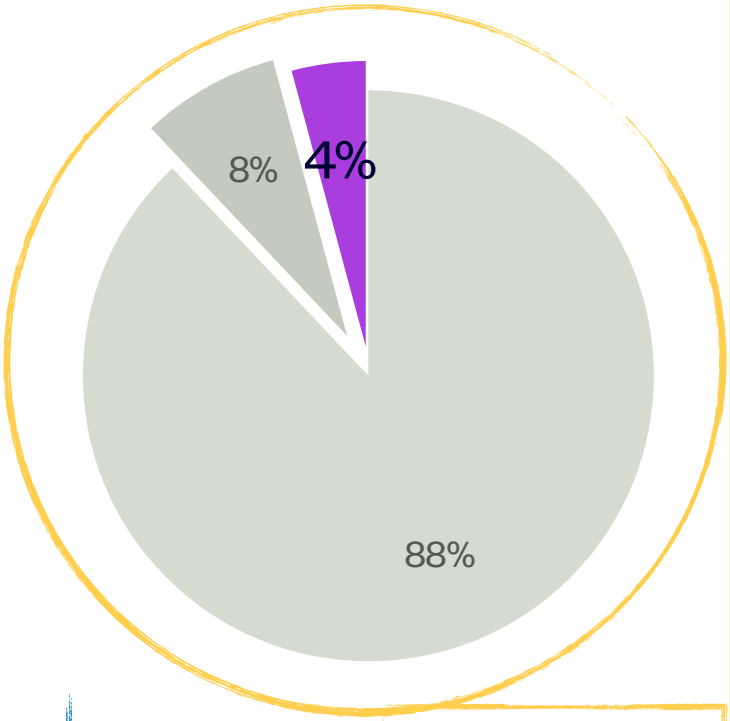
Moderate sources

Ageratum conyzoides	Goat weed
Archidendron glabrum	Rainforest tree
Cucumis sativus	Cucumber
Cyperaceae sp	Sedge
Entada phaseoloides	Box bean
Hylodesmum nudiflorum	Weed
Leucaena leucocephala	Shade tree
Passiflora foetida	Bush passion fruit
Pinus sp	Pine tree
Poaceae spc	Grass
Solanum torvum	Devils fig
Syzygium resa	Rainforest tree

Minor flower sources

Minor sources

Bidens pilosa	Cobblers peg weed
Glochidion novoguineense	Rainforest tree
Passiflora sp	Passionfruit
Graptophyllum pictum	Rainforest shrub
Harpullia arborea	Rainforest tree
Persea americana	Avocado
Callicarpa arborea	Rainforest tree
Hydriastele costata	Palm tree
Piper recessum	Rainforest plant
Clerodendrum infortunatum	Rainforest shrub
Lithocarpus celebicus	Rainforest tree
Pouteria dictyoneura	Rainforest tree
Coffea arabica	Coffee
Loranthaceae sp	Mistletoe
Proteaceae sp	Rainforest shrub
Cuphea hyssopifolia	False heather
Melanolepis multiglandulosa	Rainforest shrub
Prunus schlechteri	Rainforest tree
Nymphaea sp	Water Lilly
Stachys arvensis	Stagger weed
cayennensis	Snakeweed
Galbulimima belgraveana	Rainforest tree
Osmoxylon novoguineense	Rainforest shrub
Timonius timon	Rainforest tree
Cyanthillium cinereum	Iron weed



All floral sources in honey

Millettia pinnata	Rainforest tree
Schefflera setulosa	Umbrella plant
Dracaena angustifolia	Rainforest shrub
Mimosa pudica	Shame plant
Endospermum labios	Rainforest tree
Myrsine involucrata	Rainforest tree
Sida rhombifolia	Arrowleaf sida
Euphorbia glyptosperma	Spotted Spurge
Neoscortechinia forbesii	Rainforest tree
Spathodea campanulata	African tuliptree

Pollen

Harvesting pollen

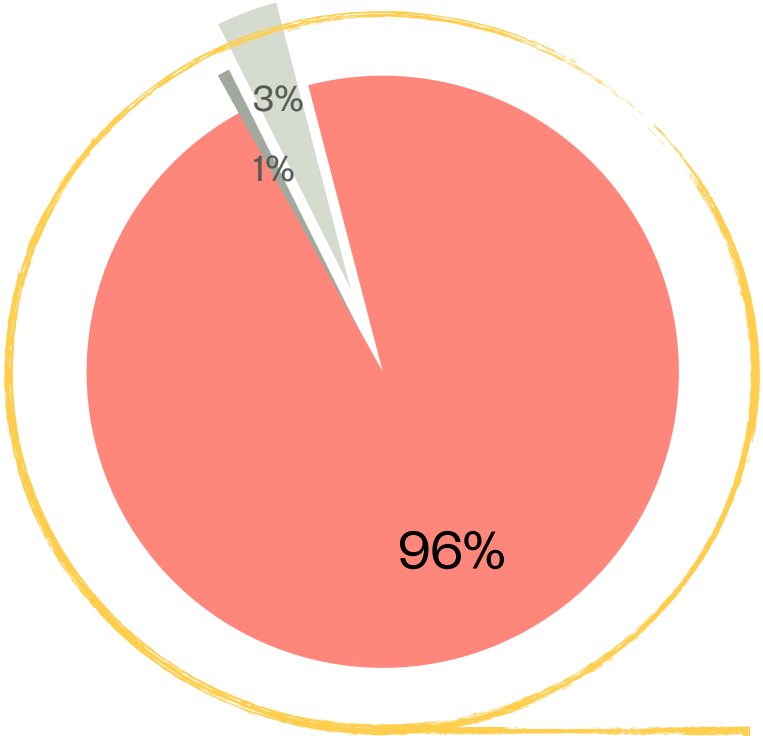
- To harvest pollen a pollen trap must be attached to the entrance of the hive
- The bees enter the hive and pollen falls into the trap for collection

- Pollen can be sold at markets as a nutritious health food
- It is important to only harvest pollen when flowers are plentiful and bees can recover some pollen for themselves
- If you take all the pollen the bees will starve.

Major flower sources

Major sources

Ageratum conyzoides	Goat weed
Archidendron glabrum	Rainforest tree
Bidens pilosa	Cobblers peg weed
Calophyllum soulattri	Rainforest tree
Capsicum frutescens	Capsicum
Coffea arabica	Coffee
Cucumis sativus	Cucumber
Dracaena angustifolia	Rainforest plant
Endospermum labios	Rainforest tree
Entada phaseoloides	Box bean
Helicia latifolia	Rainforest tree
Hylodesmum nudiflorum	Weed
Leucaena leucocephala	Shade tree
Loranthaceae sp	Mistletoe
Phaseolus vulgaris	Green bean
Piper recessum	Rainforest plant
Poaceae sp	Grass
Pometia pinnata	Island lychee
Syzygium unipunctatum	Rainforest tree



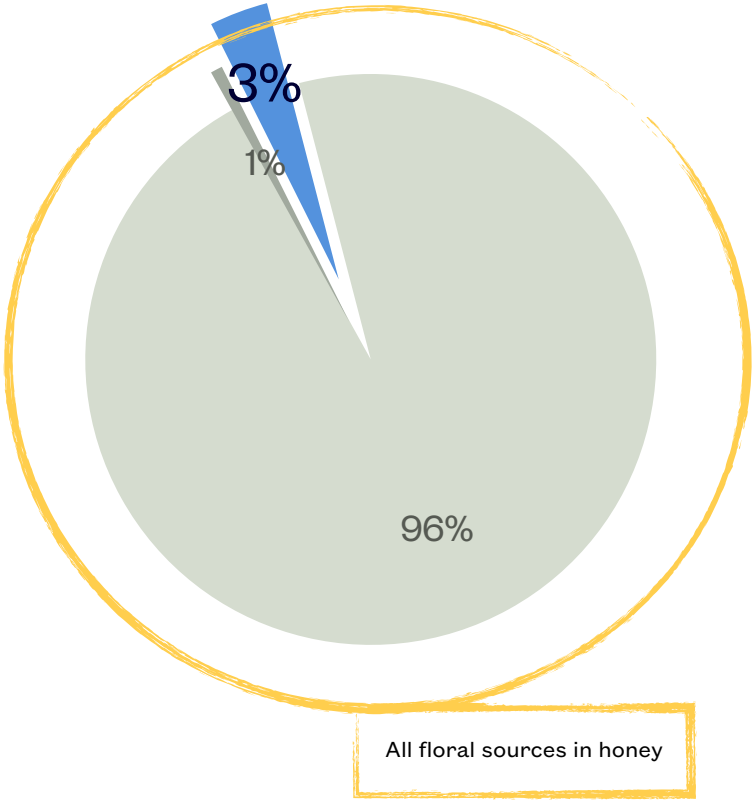
All floral sources in pollen

Pollen

Moderate flower sources

Moderate sources

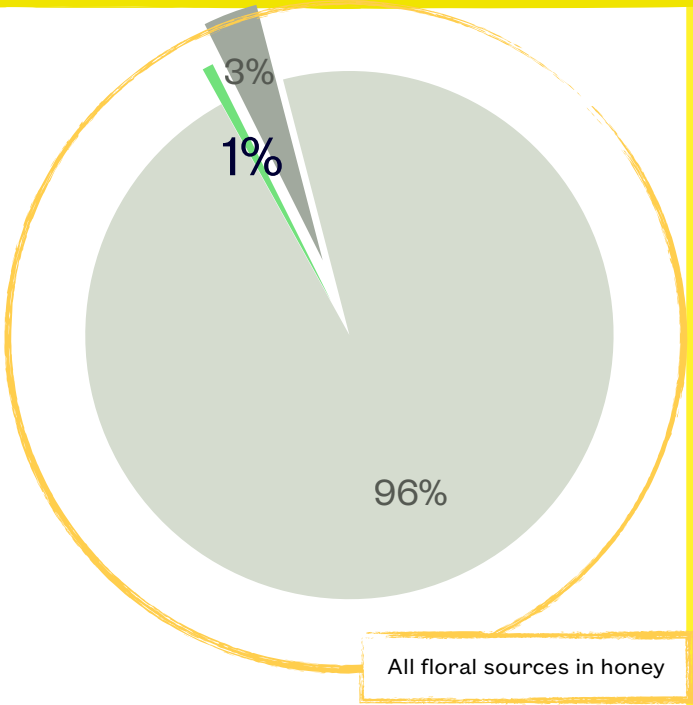
Actinodaphne nitida	Rainforest tree
Angiopteris sp	Fern
Cucurbita pepo	Pumpkin
Dillenia papuana	Rainforest tree
Euphorbia glyptosperma	Spotted spurge
Horsfieldia hellwigii	Rainforest tree
Hydriastele costata	Palm tree
Millettia pinnata	Rainforest tree
Mimosa pudica	Shame plant
Parthenium hysterophorus	Parthenium weed
Pinus sp	Pine tree
Sida rhombifolia	Sida weed
Stachys arvensis	Stagger weed
Syzygium resa	Rainforest tree
Terminalia microcarpa	Rainforest tree



Minor flower sources

Minor sources

Araucaria sp	Hoop pine
Breonia chinensis	Tree
Callicarpa arborea	Rainforest tree
Calopogonium mucunoides	Wild ground nut
Citrus limon	Lemon
Conyza bonariensis	Fleabane weed
Corynandra viscosa	Flower herb
Cuphea hyssopifolia	False heather
Cyanthillium cinereum	Iron weed
Cyatheales sp	Tree fern
Daphniphyllum sp	Shrub
Elephantopus mollis	Tobacco weed
Erigeron canadensis	Horse weed
Gleicheniaceae sp	Fern
Guilandina crista	Legume
Harpullia arborea	Rainforest tree
Liliopsida sp	Lilly
Lithocarpus celebicus	Rainforest tree
Melanolepis multiglandulosa	Rainforest tree
Musa peekelii	Wild banana
Myrtaceae sp	Rainforest tree
Nymphaea sp	Water Lilly
Osmoxylon novoguineense	Rainforest shrub
Passiflora foetida	Bush passionfruit



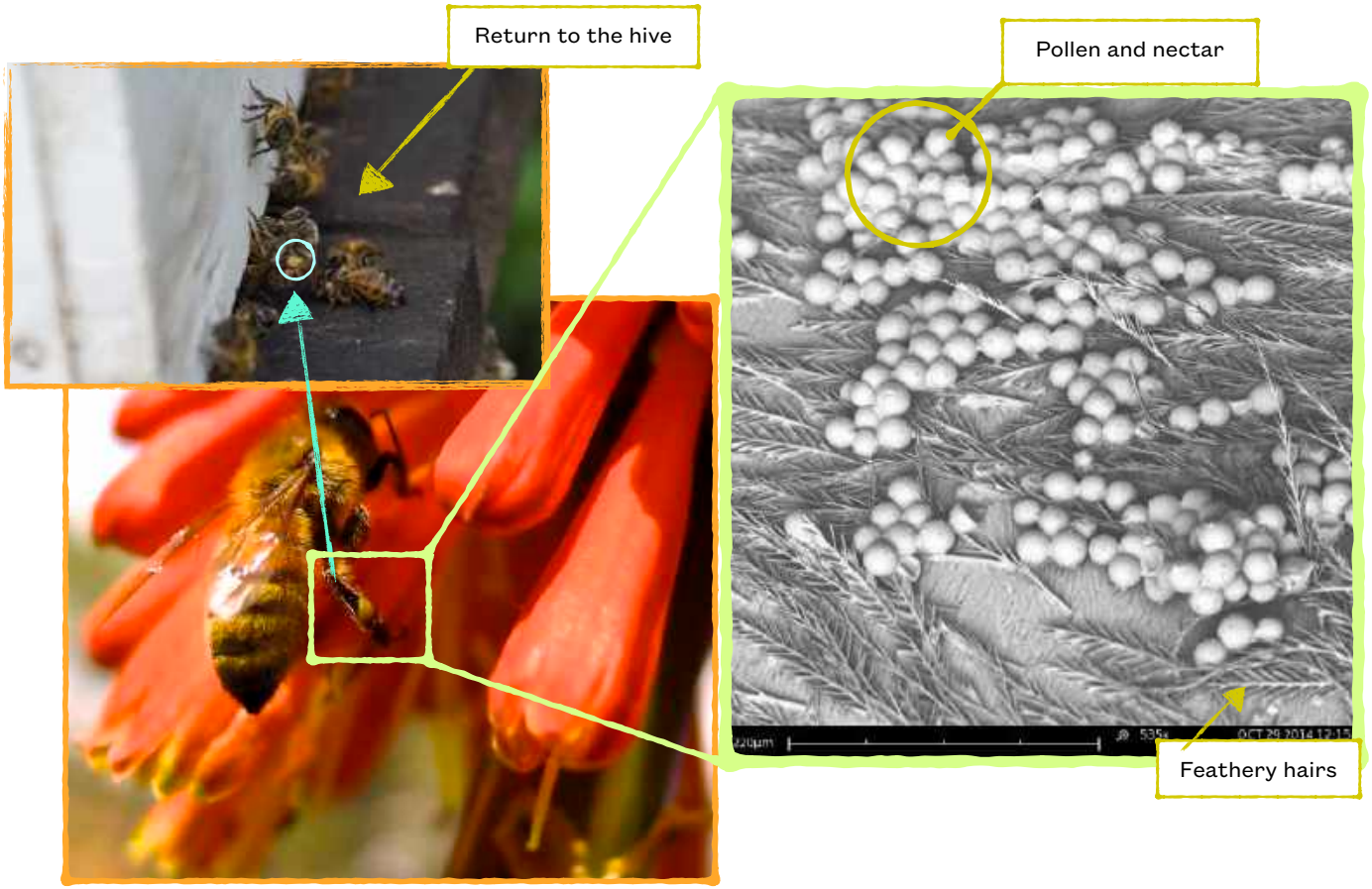
All floral sources in honey

Piper gibbilimbum	Rainforest plant
Pouteria dictyoneura	Pouteria dictyoneura
Proteaceae sp	Rainforest tree
Prunus gazelle-peninsulae	Rainforest tree
Prunus schlechteri	Rainforest tree
Psidium guajava	Guava
Psydrax cymigera	Rainforest tree
Sesbania sp	Legume
Solanum torvum	Devils fig
Sphagneticola trilobata	Singapore daisy
Stachytarpheta cayennensis	Snake weed
Sticherus sp	Fern
Syzygium maire	Rainforest tree

Honeybee foraging

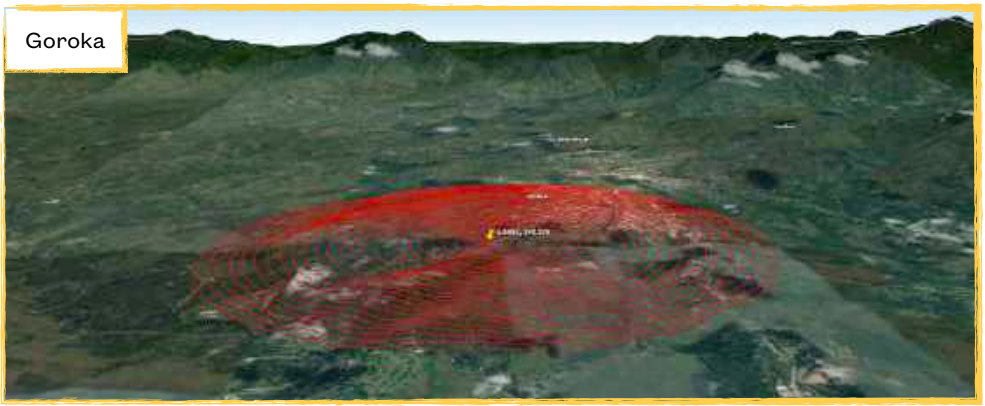
Honey bees collect pollen for food from flowers, and carry them back to the hive in baskets on their legs called corbicula. The hairs on honey bees are like feathers catching the pollen and helping to stick to their body to bring back to the hive.

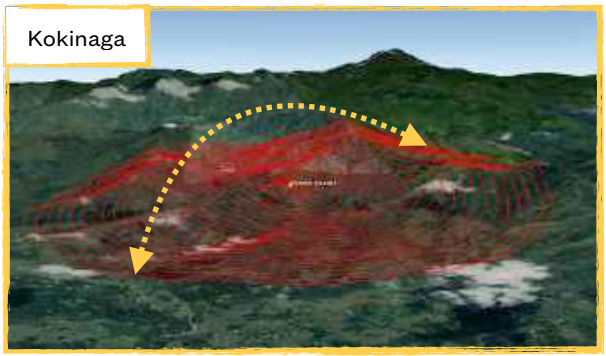
They will fly sometimes up to 6 kilometres to collect food! So forests in the distance are still good for your bees. The closer that forests and trees are to the hive are the easier it is for honey bees to collect pollen and nectar to make honey.



Elevation

- In PNG the landscape changes in elevation and how the land is used and honeybees can use these different landscapes in different ways
- Some areas have lots of forest and gardens and not so much roads and houses, others are different





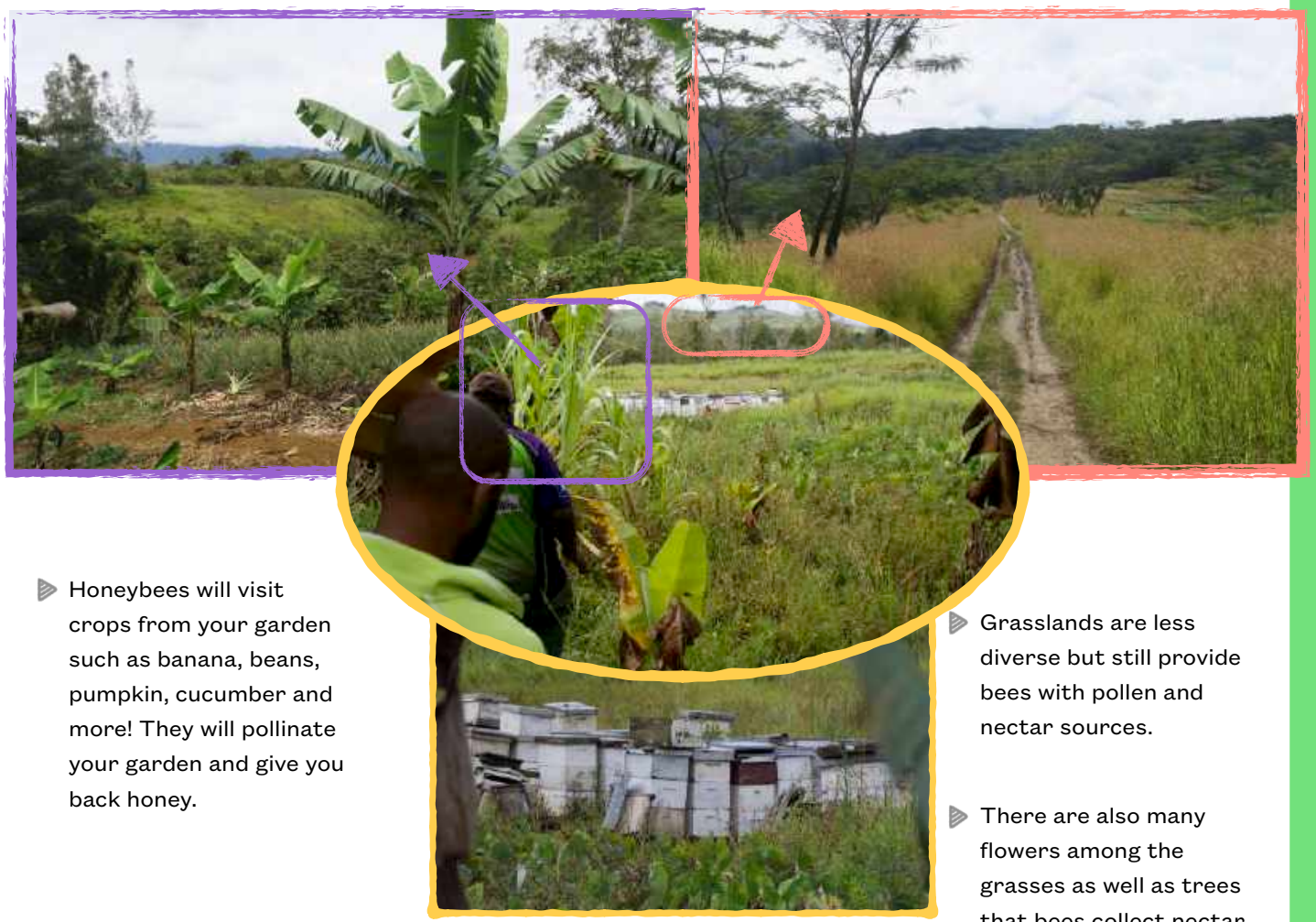
- Honey bees can travel this whole distance just to find pollen and nectar

Landscape

Forest farming

- Shade trees provide the most abundant pollen for bees as well as keeping crops and houses cool!
- Crop trees like coffee underneath shade trees surrounding houses are also good for honeybees.
- Surrounding forest cover gives bees great diversity of pollen to keep hives healthy and ensure lots of honey for harvest.
- The closer the forest or trees are to your hives the easier it is for bees to make honey.

Open farming



- Honeybees will visit crops from your garden such as banana, beans, pumpkin, cucumber and more! They will pollinate your garden and give you back honey.

- Grasslands are less diverse but still provide bees with pollen and nectar sources.

- There are also many flowers among the grasses as well as trees that bees collect nectar and pollen from.

Timber trees for bees

Honeybees visit timber trees

- Many of the plants bees visit for nectar and pollen are also valuable to people and the economy

- Some trees we found are important for honey bees pollen and nectar are:

Commercial hardwood: *Dillenia papuana*
Major exportable hardwood: *Terminalia macrocarpa*
Occasional timber species: *Harpullia arborea*
Softwood pine species: *Araucaria sp. & Pinus sp.*
(Used for making bee hives!!)

Bee boxes made from local timber by Kelly Inae at Helping hands honey

Instead one harvest from the timber you could have harvests every year for the life of the tree

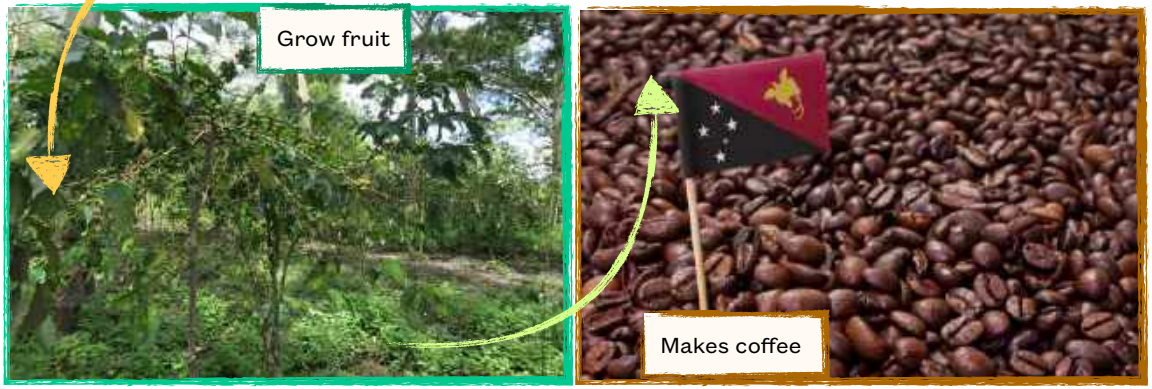
Honey bees visit the flowers of the tree many times every year and makes honey

Shade trees for bees

Honey bees love big shade trees like *Leucaena leucocephala* because they have lots of nectar and pollen and they are close to the hives.

Gardens for bees

Bees will help to pollinate your garden fruits and vegetables. These are some of the crops we found in honey and pollen but they are known to visit many more.



- ☑ green beans (*Phaseolus vulgaris*)
- ☑ box bean (*Entada phaseoloides*)
- ☑ pumpkin (*Cucurbita pepo*)
- ☑ wild banana (*Musa peekelii*)
- ☑ cucumbers (*Cucumis sativus*)
- ☑ peppers (*Capsicum frutescens*)
- ☑ passion fruit (*Pasiflora foetida*)
- ☑ lemon (*Citrus limon*)
- ☑ Longan (*Pometia pinnata*)
- ☑ coffee (*Coffea arabica*)
- ☑ Avocado (*Persea americana*)

Gardens for bees

- Many flowers around the garden are also good for honeybees
- Bees are most healthy with many different flowers so lots of colours shapes and sizes will be good for your bees and bring you honey

Bees also collect nectar and pollen from flowers to cut for sale, so you can make money from flowers and honey.

Bees also like flowers from weeds between the garden and side of the road

Rainforest for bees

- In the highlands of Papua New Guinea, honey bees travel far to reach the many rainforest flowers to make honey and pollen

- When there is rainforest surrounding the hives they can visit many flowers that keeps them healthy and producing lots of honey

Rainforest for bees

- Trees in rainforests have many more flowers than plants on the ground
- A tree takes up a small area on the ground but may have thousands of flowers!
- When there are many trees in flower honeybees can produce lots of honey even if there are not many flowers on the ground

Rainforest for bees

- In the rainforest, it looks green, but there are flowers everywhere!
- On the floor, on the trees, in the canopy and bees will find them all

The forest looks green but there are flowers!

Rainforest for bees

- In the rainforest, flowers come in all shapes and sizes and honey bees love this. They are stronger and healthier when they have many different types of flowers and this is what the forest gives them.

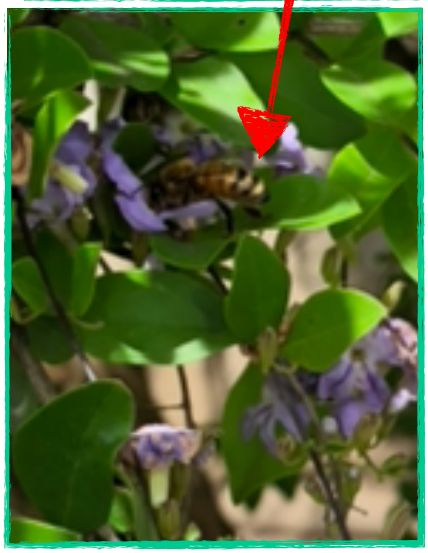






Journal example

- Look in your garden and around the trees and flowers.
- Learning what your bees like and sharing that knowledge with other beekeepers can help get better harvests.
- You can use this book to record your observations and photocopy or make your own records if you run out of space.



Province: Goroka

Date: 01 / 02 / 2021

Weather: Dry (Wet)

Plant: Tree | Palm | (Shrub) | Vine | Herb | Crop | Weed

Flower: **Colour**: Red, Pink, (Purple), Yellow, Orange, Blue, White, Grey, Green

How many flowers: 1 | 5-10 | (more than 20)

How many bees: 1 | (5-10) | more than 20

Long or short bee visit: (Long) Short

Journal entry

Province:
Date: / /
Weather: Dry Wet
Plant: Tree | Palm | Shrub | Vine | Herb | Crop | Weed
Flower: **Colour**: Red Pink Purple Yellow Orange Blue White Grey. Green
How many flowers: 1 | 5-10 | more than 20
How many bees: 1 | 5-10 | more than 20
Long or short bee visit: Long Short

Province:
Date: / /
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Honeybee journal

Journal entry

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Honeybee journal

Journal entry

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Province:
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How many bees: 1 | 5-10 | more than 20
Long or short bee visit: Long Short

Thanks and acknowledgement

Thank you to all the farmers who let us on their land and gave us pollen and honey samples. Without your help we could not have made this book.

Thanks and acknowledgement

Thank you to our team from NARI who got us through the highlands highway safely. Thank you to Kelly Inae and Raywin Ovah for all your tireless efforts translating for us to local farmers and communicating our project to Papua New Guinea.

Beekeeping in the Eastern Highlands of Papua New Guinea

This book is a guide to bee keeping for the eastern highlands region of Papua New Guinea and includes instructions on maintaining productive, European honeybee colonies (*Apis mellifera*), harvesting honey and pollen and treating pests in hives using evidence based research. This guide also serves as a 'trees for bees' manual for people of PNG and other Melanesian countries who share a similar climate and flowering plants. We hope this book will help beekeepers successfully manage their colonies and encourage the planting of trees for bees and other bee friendly plants so that this ancient symbiotic relationship can benefit the environment, the families and the honey bees.