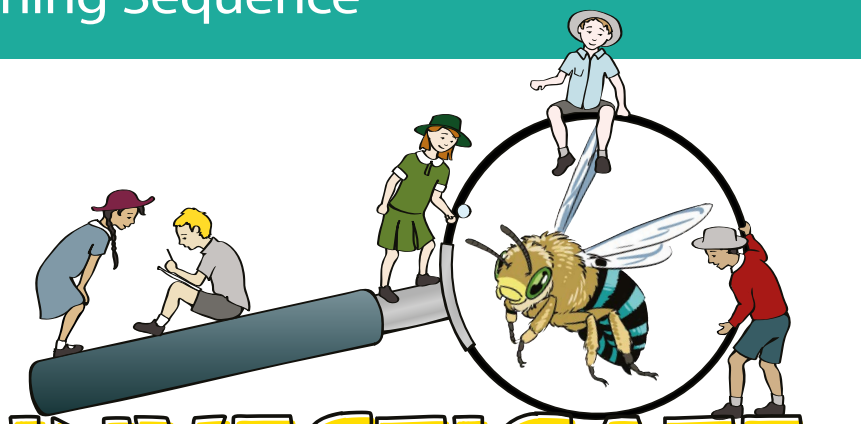
NSW GOVERNMENT
Department of Primary Industries

Stage 3 science and technology unit of work

Teacher's Handbook and Learning Sequence



INVESTIGATE: bees

NSW Department of Primary Industries Schools Program
schools.program@dpi.nsw.gov.au

ACT FOR BEES

coolaustralia.org
Learn for life

www.dpi.nsw.gov.au

14683

Acknowledgements

This resource has been adapted from the Investigate competition - an initiative of the NSW Department of Primary Industries Schools Program.

We would like to acknowledge and sincerely thank Cool Australia and ACT for Bees for permitting the use of their resources in this competition and subsequent unit of work.

Contributing staff from the NSW Department of Primary Industries include:

Education and Regional Services: Jo Hathway (Project Officer, Education), Michelle Fifield (Education Officer, Schools) and , Brianna Callum (Education Officer, Honey Bees).

Designer: Nicole Edwards

Illustrator: Ainsley Seago.

Disclaimer

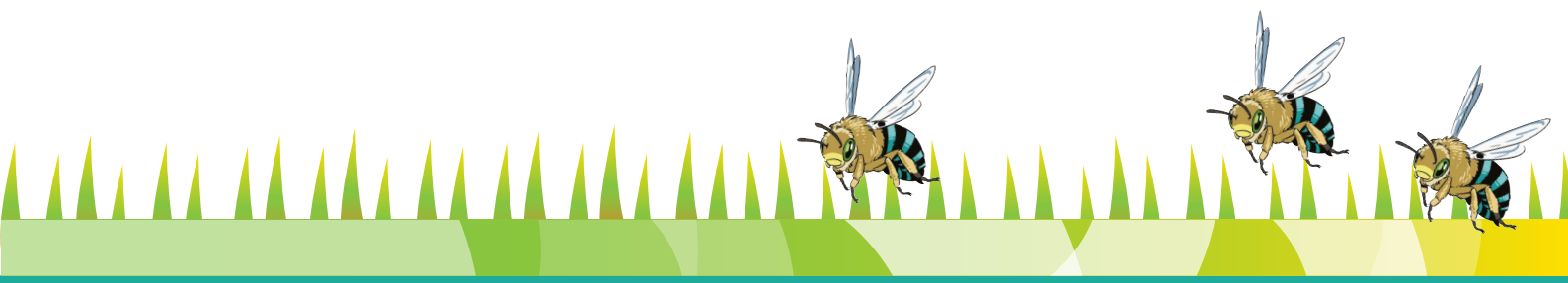
The information in this document is based on knowledge and understanding at the time of writing (November 2017).

Copyright

© State of NSW through the Department of Industry, Skills and Regional Development 2016, except where indicated otherwise.

This work is licensed under a Creative Commons-Attribution- Non Commercial- Share Alike 4.0 International license
http://creativecommons.org/licenses/by-nc-sa/4.0/

Under this license the material is available for free use and adaption. Educators may use, adapt, communicate and re- publish material from the resource. You must include this statement on any copy or adaption of the material.



Contents

Contents _____ 3

About this resource _____ 4

Teaching and learning _____ 8

Learning sequence _____ 13

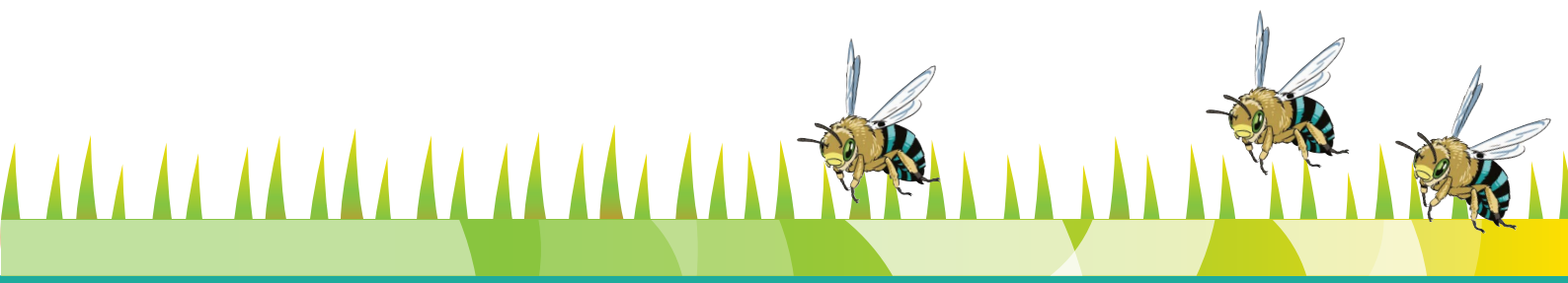
- Beeing curious 13
- Should we worry about bees? 13
- Honey bees or Australian Native bees? 19
- There is a buzz in the air 22
- Consider your results - Beeing Helpful 25
- What could we do better? 27
- What is the role of a beekeeper? 30
- How can we encourage others in the community to support bees? 35
- How will we know if it worked? 35

Portfolio inclusions _____ 36

Marking rubric _____ 36

- Assessment 38

Glossary _____ 40



About this resource

Background and aims

The Investigate: bees science and technology unit of work is an initiative of the NSW Department of Primary Industries.

The aim of the unit is to stimulate an interest in science, technology and agriculture in young people and to promote the teaching of these subject areas in schools.

Bees face some serious biosecurity threats from diseases and pests including introduced bee species that could out-compete our native bees and insects or honey bees.

Students will design and complete an investigation and create a portfolio of work that aligns with outcomes from the NSW Science and Technology, English and Geography syllabuses.

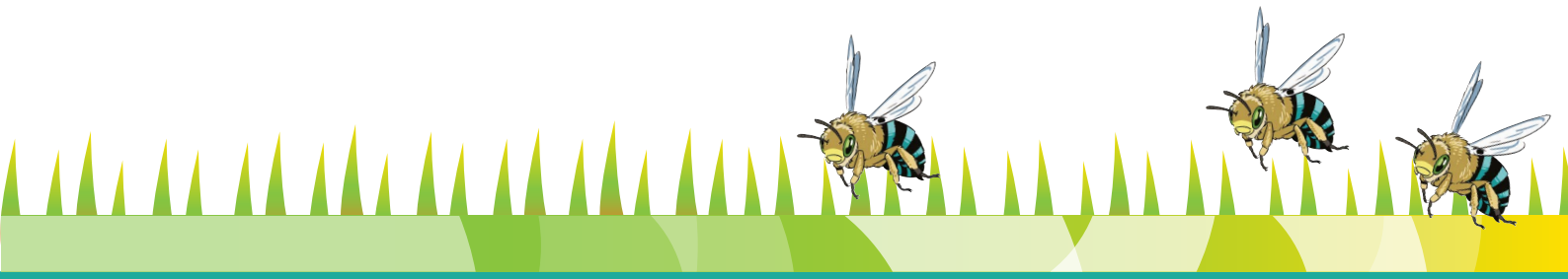
Most students have heard about the plight of bees and the important role that they play in our environment and in food production. This investigation encourages students to take their knowledge a bit deeper and to take action to support bees - both honey bees and Australian native bees.

Students will find out which insects are currently visiting their gardens and what they can do to help bees - so that they can help us! Bees provide important ecosystem and production services so in this unit we are looking at how to support bees including native bees.

The Investigate units of work provide authentic learning experiences to support students' development of science, technology and communication skills. Real-world content guides the application of these skills in a meaningful learning context. By completing in the Investigate units students will understand that science plays an important role in their lives every day. Other Investigate units include Investigate: fire ants and Investigate: aphids.

Intended audience

This Teacher's Handbook and Learning Sequence are intended for teachers of Years 5 and 6 students working towards Stage 3 outcomes in the Science and Technology K-6 syllabus. The activities in this unit assist students to achieve outcomes in the Living World, Built Environment and Information strands and in the skills areas of Working Scientifically and Working Technologically. Cross curricular links are made to Geography, English and Mathematics outcomes.

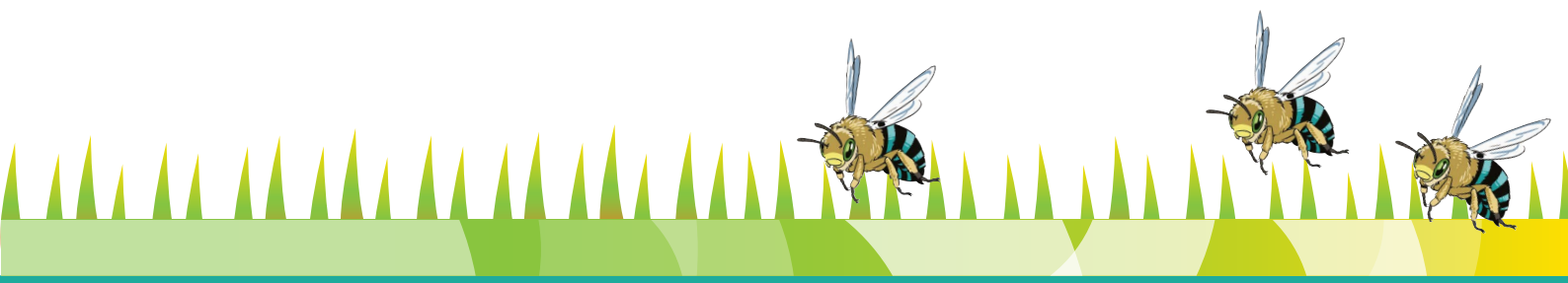


NSW Syllabus links

NSW Syllabus outcomes for the Investigate: bees learning sequence are detailed in the following table.

Stage 3 NSW Science and Technology	
A student:	
ST3-2VA	demonstrates a willingness to engage responsibly with local, national and global issues relevant to their lives, and to shaping sustainable futures
ST3-4WS	investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations
ST3-5WT	plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints
ST3-10LW	describes how structural features and other adaptations of living things help them to survive in their environment
ST3-11LW	describes some physical conditions of the environment and how these affect the growth and survival of living things
ST3-14BE	describes systems in built environments and how social and environmental factors influence their design
ST3-15I	describes how social influences impact on the design and use of information and communication systems

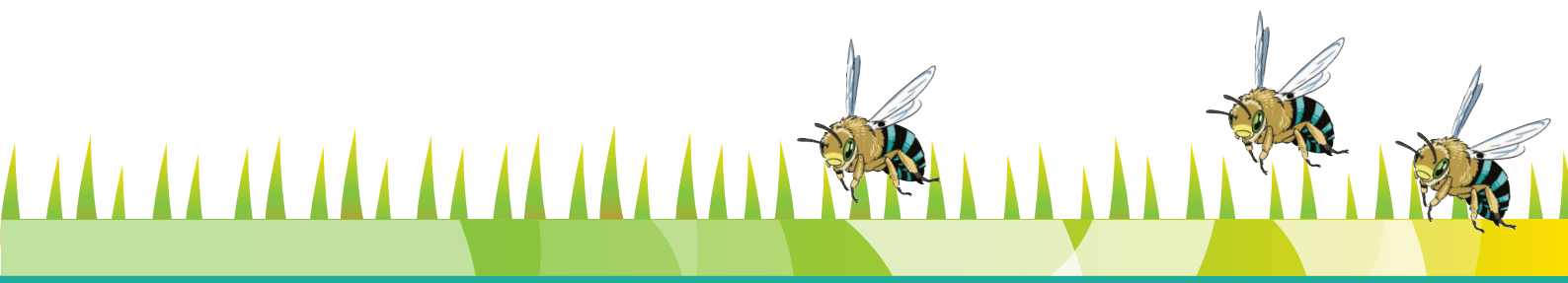
Stage 3 NSW Geography	
A student:	
GE3-1	describes the diverse features and characteristics of places and environments
GE3-2	explains interactions and connections between people, places and environments
GE3-4	acquires, processes and communicates geographical information using geographical tools for inquiry



Stage 3 NSW English	
A student:	
EN3-1A	communicates effectively for a variety of audiences and purposes using increasingly challenging topics, ideas, issues and language forms and features
EN3-2A	composes, edits and presents well-structured and coherent texts
EN3-3A	uses an integrated range of skills, strategies and knowledge to read, view and comprehend a wide range of texts in different media and technologies

Stage 3 NSW Mathematics	
A student:	
MA3-2WM	selects and applies appropriate problem-solving strategies, including the use of digital technologies, in undertaking investigations
MA3-3WM	gives a valid reason for supporting one possible solution over another
MA3-17MG	locates and describes position on maps using a grid-reference system
MA3-18SP	uses appropriate methods to collect data and constructs, interprets and evaluates data displays, including dot plots, line graphs and two-way tables

Stage 3 Literacy Continuum – Cluster 11 (End of Year 5)		
Reading	Vocabulary Knowledge	Aspects of writing
Uses text navigation skills such as skimming and scanning to efficiently locate specific information in literary, factual and electronic texts.	Demonstrates understanding of new words for new concepts.	Writes coherent, structured texts for a range of purposes and texts. Selects appropriate language for eg descriptive, persuasive, topic, technical, evaluative, emotive, and colloquial. Plans and designs more complex multimodal texts.



Safety and ethical considerations

Safety policies are of particular relevance to the activities in this unit. Students and their supervising teachers or parents should ensure that their science investigations are conducted in a responsible and safe manner. It is essential that student activities are conducted according to procedures developed through appropriate risk assessments at the school – particularly if you are aware of students with allergies to insect stings and bites.

Teachers should implement the following safety guidelines:

- No insects should be collected or handled
- Correct cleaning and hygiene practices are followed prior to and following field work.
- It is expected that bees and other stinging/biting insects will be detected in the course of the investigation and the possibility of a student being bitten should be prepared for. For further advice go to https://www.healthdirect.gov.au/insect-bites-and-stings

What should I do if I get stung?

Apply ice to relieve the swelling and pain. Gently wash the area with soap and water and leave any blisters intact. People who experience an allergic reaction after a sting should seek medical attention immediately.

Teaching and learning

Most students have heard about the plight of bees and the important role that they play in our environment and in food production. This investigation encourages students to take their knowledge a bit deeper and to take action to support bees – both honey bees and Australian native bees.

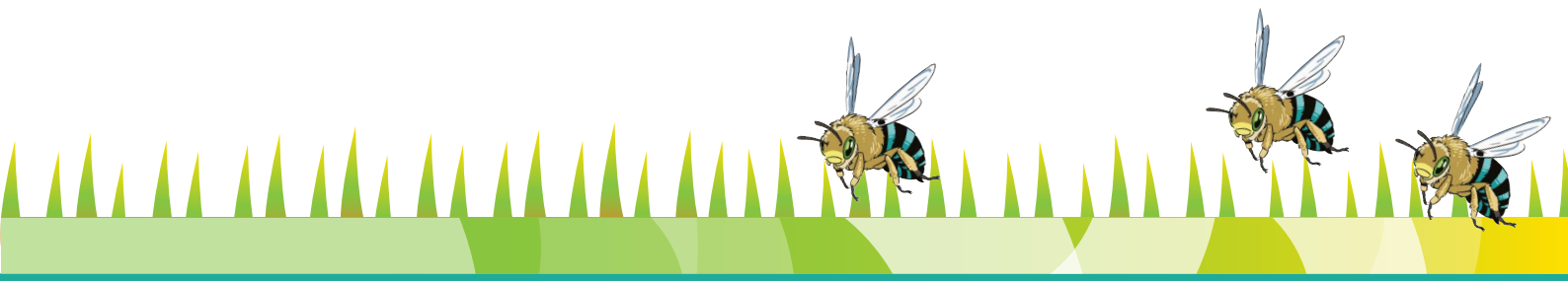
This investigation is an interesting study from a biosecurity perspective because although honey bees are an introduced species they have not become a pest species. In fact they play a valuable role in agricultural production and they appear to live quite happily side by side with Australian native bee species.

Bees do however face some serious biosecurity threats including pests and diseases as well as other bee species that could out-compete our native bees. So in an effort to support bees this investigation encourages students to find out which insects are currently visiting your gardens and what they can do to help bees – so that they can help us!

Ideally students will design the investigation to ensure that it is appropriate to your school and context. However to support your teaching of the unit we have provided sample forms and survey sheets in case you don't have time to develop these in class.

This unit is developed in cooperation with Cool Australia and ACT for Bees who created the Love Food? Love Bees! unit. Some of the activities in this investigation are Love Food? Love Bees! resources. If you do not already have a Cool Australia account you will need to sign up to access them - it is free and there are heaps of fantastic resources on their website! Please also note that there are a number of other Love Food? Love Bees! activities on the Cool Australia website that are not included in this sequence - they may provide an opportunity for you to broaden student's learning in this unit.

We have included a glossary of bee industry terms and encourage teachers to explicitly teach the terms and definitions to students to encourage the development of their scientific vocabulary.



Biosecurity for the garden and farm – teacher background information

This learning sequence highlights the role of biosecurity in the honey industry and in primary industries more broadly.

What is Biosecurity?

Biosecurity helps to keep NSW and Australian ecosystems, agriculture and communities safe by keeping out and controlling animal and plant diseases and pests such as weeds and pest animals and insects, such as aphids.

How does biosecurity work?

Biosecurity includes measures to:

- prevent new pests, diseases and weeds from entering our country and becoming established
- manage established pests, diseases and weeds to eradicate them where feasible or lessen their impact
- ensure an appropriate preparedness and response capacity that is internationally recognised and meets our trading obligations and international treaties
- maintain or improve the status of Australia's biosecurity systems.

Why is biosecurity important?

- Australian flora and fauna are unique; by protecting them we protect our natural biodiversity, distinctive ecosystems and heritage.
- Australia's domestic and international markets demand products that are free of pests, diseases and contaminants.
- Biosecurity helps to keep food and other products from our primary industries safe from diseases such as Salmonella and pathogenic E. coli. Biosecurity also protects people from diseases that can be passed from animals to humans (called zoonoses), such as Hendra virus and Avian Influenza.

Ways to prevent the spread of diseases and pest animals and plants

- ❑ Vaccinations for us, our pets and livestock
- ❑ Not being allowed to take specific items to specified areas or across state borders, eg. You cannot take oranges into citrus growing areas
- ❑ Having our bags checked at the airport
- ❑ Quarantining animals and livestock in yards or separate areas if they have been moved from a different property to control the spread of weeds and diseases
- ❑ Washing your hands after you have been playing with animals or in soil
- ❑ Controlling weeds to make sure they don't spread

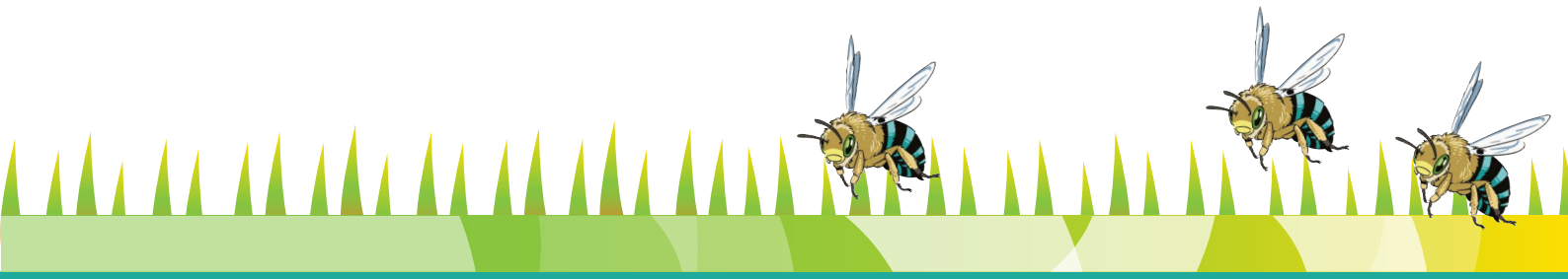
How does biosecurity relate to bees?

Bees face some serious biosecurity threats from pests and diseases. If appropriate biosecurity protocols are not followed and a new pest or disease enters Australia or we lose control of an existing threat then we risk losing our bees and their resulting production benefits. Bees are also at risk from other bee species that could out-compete our native bees or honey bees.

As this unit discusses bees and other pollinators play a huge role in maintaining production levels of a large range of agricultural products and … well … honey! So we don't want to lose them.

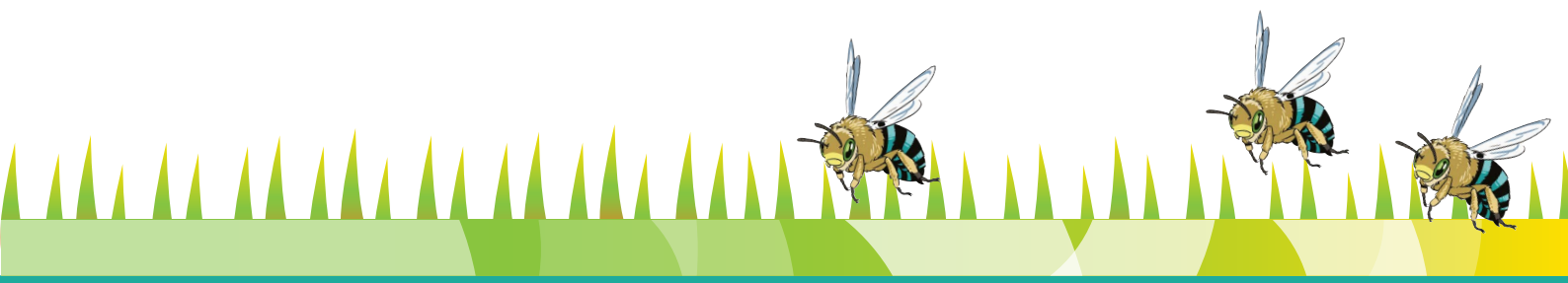
Biosecurity is a shared responsibility

Government, industry and the people of NSW working together to protect the economy, environment and community from the negative impacts of animal and plant pests, diseases and weeds for the benefit of all people in NSW.

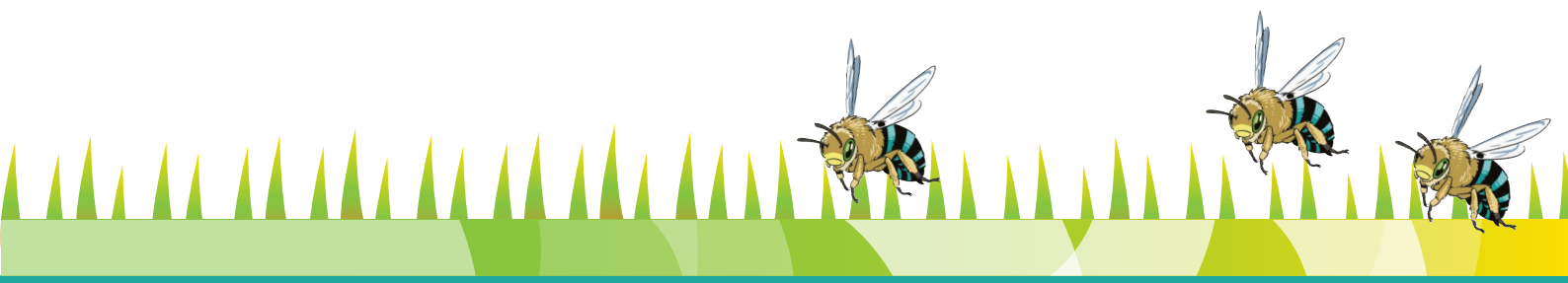


Unit overview

Engage	**Beeing curious**	**Portfolio inclusion?**
	'Stand on the Line' activity, wherein students consider a number of statements and justify their opinion. Watch a compelling short film of bees and other pollinators, then complete a 'See, Think, Wonder' visible thinking tool. Develop a range of inquiry questions to expand their understanding of new concepts and existing misconceptions about bees, pollination, food and farming. Identify and locate a bee friendly plant in their school yard.	No
Explore	**Should we worry about bees?**	
	View a short explanatory video about the symbiotic relationship between bees and plants. Use mathematics skills to explore interesting facts about bees. Create a visual learning display by reading snippets of information about bees, their role as pollinators and our dependence on bees for food production. Complete a mini maths problem to reveal information and then come up with questions that connect to the information they have read. Write a short piece that summarises students' understanding of role of bees in food production.	Yes
	Honey bees or Australian Native bees?	
	If students think they know bees now, wait until you see the results of this research! Research a range of bees – particularly those occurring in Australia. This activity highlights to students the range of bee species and the huge variation occurring amongst species. Share research findings with the rest of the class.	Yes
	There is a buzz in the air	
	It's time to get outside and see what is in your garden or school grounds. Together with students plan a surveillance program that suits your timetable – the number of observations that you carry out is up to you but check the marking rubric as more sessions will give you more data and give students more data to write their reflection about will give students more marks.	Yes



Engage	**Beeing curious**	**Portfolio inclusion?**
	'Stand on the Line' activity, wherein students consider a number of statements and justify their opinion. Watch a compelling short film of bees and other pollinators, then complete a 'See, Think, Wonder' visible thinking tool. Develop a range of inquiry questions to expand their understanding of new concepts and existing misconceptions about bees, pollination, food and farming. Identify and locate a bee friendly plant in their school yard.	No
Explain	**Consider your results – Beeing Helpful**	
	Students discuss and reflect on their findings during the surveillance program. A written reflection is part of the portfolio – you can choose to do a joint or individual piece of writing.	Yes
	What could we do better?	
	As a group students come up with some ideas to make your school grounds more bee friendly – while keeping in mind the need to keep people and bees at a safe distance.	Yes
Elaborate	**What is the role of a beekeeper?**	
	Play the Honey Game and see how students fare as beekeepers. It's OK to make mistakes just make sure you learn from them!	Yes
	How can we encourage others in the community to support bees?	
	Let's spread the word! Discuss ways to ensure that the great work students have done in the school grounds can reach out to the broader community.	Yes
Evaluate	**How will we know if it worked?**	
	Your project isn't finished until you have evaluated the effectiveness.	Yes



Learning sequence

Engage students in the topic

Beeing curious

This tuning in activity is located on the Cool Australia website - https://www.coolaustralia.org/activity/love-food-love-bees-beeing-curious-grade-56/

Cool Australia summary: Bees pollinate at least a third of everything we eat and play a vital role in sustaining our ecosystems, therefore they need to be valued and protected. This tuning-in lesson introduces the topic of bees through a 'Stand on the Line' activity, wherein students consider a number of statements and justify their opinion. To capture students' interest and find out what they already know they watch a compelling short film of bees and other pollinators, then complete a 'See, Think, Wonder' visible thinking tool designed to instil and reinforce a sense of curiosity in students. Students develop a range of inquiry questions to expand their understanding of new concepts and existing misconceptions about bees, pollination, food and farming. Students conclude this lesson with an observation challenge where they identify and locate a bee friendly plant in their school yard.

Agriculture in our area

NSW Local Land Services website provides information on NSW Regions. Select your region and in the 'Our region' tab have a look at your regional profile to find out more about the agricultural production which occurs in your area.

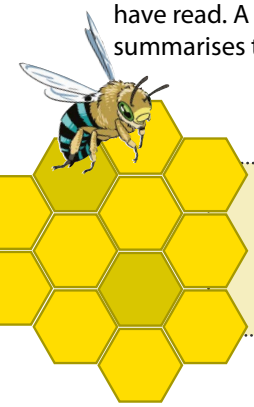
Explore the topic

Should we worry about bees?

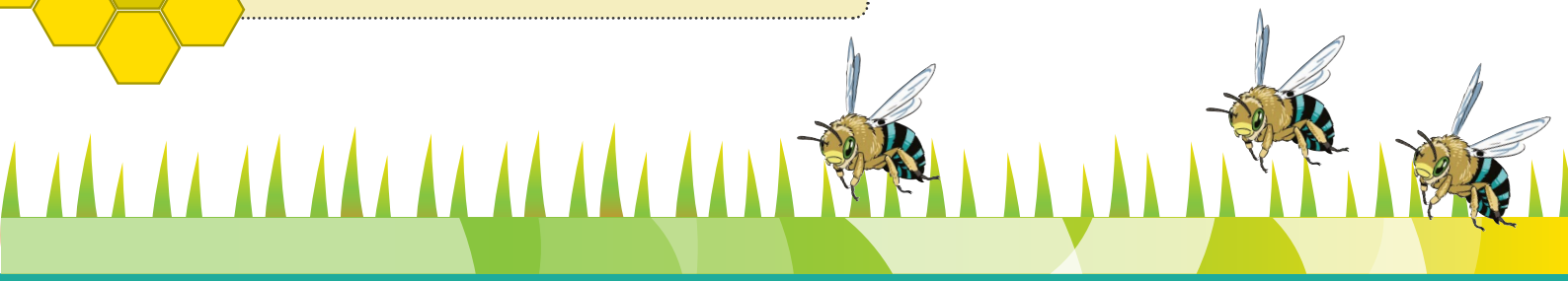
This activity is located on the Cool Australia website - https://www.coolaustralia.org/activity/love-food-love-bees-bees-pollination-and-food-grade-56/

Cool Australia summary: In this lesson, students will be introduced to the connection between bees, flowering plants and food through a range of activities. They will view a short explanatory video about the symbiotic relationship between bees and plants. Students use mathematics skills to explore interesting facts about bees. The class will then create a visual learning display by reading snippets of information about bees, their role as pollinators and our dependence on bees for food production. Students complete a mini maths problem to reveal information and then come up with questions that connect to the information they have read. A set of visual prompts is provided to guide students to write a short piece that summarises their understanding of role of bees in food production.

***Improve your students science vocabulary** – the language of primary industries includes a lot of words that may be new to students. Share the glossary at the end of this document with students and encourage them to use the words in their writing.*



Portfolio inclusion: reflection of the relationship between bees and plants (section 2 of the Love Food? Love bees! activity)



Love Food? Love Bees! – Bees, Pollination and Food – Year 5 & 6

Thought Starter: We once grew food without chemicals. We never grew food without bees.

1. Observe each of the pictures below. In the space next to each picture, describe what you see:

© 2017 Cool Australia

© 2017 Cool Australia

© 2017 Cool Australia

2. How do you think the pictures are linked? Write 2-3 paragraphs that explain your thoughts.

Hint: Think about bees, their (symbiotic) relationship with flowers, and how humans benefit from it.

You could use the list of words below to help you decide what to include in your paragraphs. Try to include as many as possible in your paragraphs.

- bees
- pollination
- food
- nectar
- pollen
- flowers
- fruit
- vegetables

© 2017 Cool Australia

Reflection

Connect: How do the ideas you learnt today connect to what you already knew about bees, pollination and the food we eat?

Extend: What new facts and ideas did you come up with today that extended your thinking or moved it in a new direction?

Challenge: What is still challenging or difficult for you to understand?
What questions do you now have?
What are you wondering?

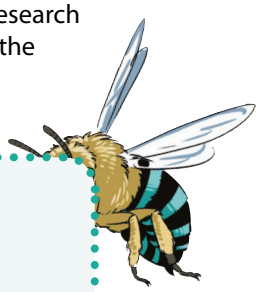
© 2017 Cool Australia

Honey bees or Australian Native bees?

We don't have to choose! Honeybees and native bees live side by side and share resources really well. In this activity students will consider the huge range of Australian native bees - both solitary and social species - all of which contribute to the valuable work that bees carry out.

Research: in groups or pairs carry out research on a range of bee species. You may choose to use the Research Template provided to support students to record their research, summarise the information found and think about the quality and authenticity of resources being used for research. If you would like to allocate bee species to groups for the research there is a list of bees found in Australia on the Aussie Bee website and on page 5 of the Valley Bees document (see breakout box for links).

Allow time for groups to present their information to the rest of the class.



Resources for research and learning:

Planting and Creating Habitat to Attract Bees
(http://mrccc.org.au/wp-content/uploads/2014/02/Attract-Bees.pdf)

This document contains a huge amount of information and students may need help to focus on the pertinent points for this activity - it will also be useful later in the investigation.

Some other sources of information about native bees include:

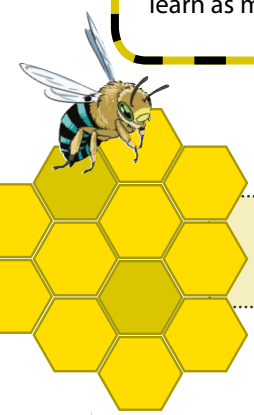
Aussie Bee: http://www.aussiebee.com.au/beesinyourarea.html

Amazing Bees: http://amazingbees.com.au/australian-native-bees.html

Careers in Schools

Make connections between small group research and workplace collaboration. Explain that in workplaces each person or small group will take on different responsibilities or research and then share their learning with the others in the team. This means that more can be done in less time and everyone works together.

Explain that your class is like a workplace team and you are all going to work together, by researching different questions and sharing your learning, in order to learn as much as you can about bees as quickly as you can.



Portfolio inclusion: completed research forms

INVESTIGATE: bees

Research template

Name: _____

Date: _____

Species of bee: _____

Native or introduced? Do they occur in Australia? If yes, where do they live?_____

_____

_____

Do they live in hives/colonies [social] or individually [solitary]?_____

_____

_____

Where do they prefer to live?_____

_____

_____

Do they store honey? _____

_____

_____

Do they pollinate plants? _____

_____

_____

Are they attracted to particular plants? _____

_____

_____

INVESTIGATE: bees

What do they prefer to nest in? _____

_____

_____

Do they need water nearby? _____

_____

_____

Tell us something unique about this species: _____

_____

_____

_____

_____

_____

_____

Sources of information::_____

_____

_____

_____

_____

_____

_____

There is a buzz in the air

Now we know a bit more about the different bees that may be visiting our gardens, it is time to consider how bee friendly our school grounds are.

Review the role of bees by viewing the video on the Australian Museum's Pollination page: https://australianmuseum.net.au/pollination

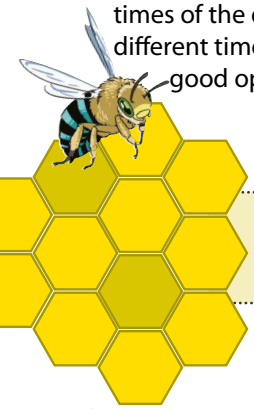
Discuss: Production of honey and pollination as two important roles of bees.

Decide: Is the future of bees something we should be concerned about? If it is then how can we find out how well our garden is currently doing?

Guide students to plan an investigation about the bees (and other pollinators) that visit the school grounds and gardens. Include in your discussions:

- What are the questions that you will be investigating? Some options include:
  - » Which bees live in our area?
  - » What is their preferred habitat?
  - » How can we support them?
  - » What sort of bees and insect pollinators do we already have in our school or local garden?
- Observation schedule (how many times will you observe a particular area, ensure a few visits are made at different times of the day)
- Best locations for observing insects? (flowers and leaves, including underneath and amongst foliage)
- How will you record your observations: Survey form / nature journal / recording sheet (time of day, location, weather, type and number of insects observed).
- What you are hoping to see. Note that students are unlikely to know all the bugs found in your garden so we recommend having them record groups that they are likely to be able to identify ie bees, butterflies, beetles, aphids, ants, caterpillars, flies. If there is a large number of a particular type of bug it may be an idea to record it – photograph, draw or describe it – and find out what it is and if it is a problem in the garden.

Observe which insects occur in our school garden (or a local garden that you have easy access to). Spend some time- half an hour is suggested - observing the insects and other animals in your school garden. Ensure students visit a range of areas ie grassed areas/ flowers/vegies. Return to the same area several times over several sessions and at different times of the day. Discuss why it is important to observe the area more than once and at different times of the day to get a good indication of the insects visiting the site. This is a good opportunity to talk about the reliability of science investigations.



Portfolio inclusion: observation forms

INVESTIGATE: bees

You may choose to assign different roles for different students to allow them to contribute their strengths to the investigation. Depending on group size you may need:

- ☑ coordinators to complete time keeping and ensuring all areas are surveyed several times,
- ☑ entomologists to identify the insects (there are several websites that provide identification keys to assist students in identifying insects),
- ☑ record keeper to complete survey forms or data logs,
- ☑ illustrator or photographers to record details of the survey sites and insects and
- ☑ you may also decide you need a cartographer to map the survey area.

Next level learning

View the scientific illustrations on the NSW DPI website. Discuss the history of the artist EH Zeck and the role of illustrations such as these in the historical development and understanding of our natural world and agriculture.

Try your hand at creating your own scientific illustrations of the insects you see in your garden

Observation template

INVESTIGATE: bees

Name: _____

Date: _____

Location name, features and description _____

Describe the area (ie plants, buildings, water nearby, shelter or shade etc) or draw a map_____

_____

_____

_____

Time of day _____

Weather_____

Type of insect	Number observed	What were they doing?

Observation record number _____ of _____

Next observation planned: _____

Explain

Consider your results - Beeing Helpful

Discuss: the results of your observation.

Some questions to consider:

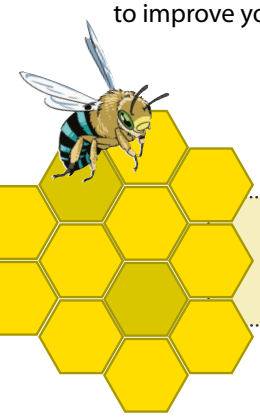
- What did your survey reveal?
- Is your garden visited by a range of pollinating insects?
- What time of the day are they most active?
- Which parts of the school are they particularly active in?
- Could the area be improved?

❑ Yes: how? Is this possible?

❑ No: What are the features that already make your garden well suited to supporting bees and other pollinators? Or is it limitations on the site that mean it is as good as it can be?

View: the Beeing Helpful activity on the Cool Australia website: https://www.coolaustralia.org/activity/love-food-love-bees-beeing-helpful-grade-56/. This will help you to plan ways to improve your school or garden area.

Get your local community involved by asking a nursery or gardening professional from your local area to work with and advise students on plants to encourage bees and other pollinators and to discourage pest insects.



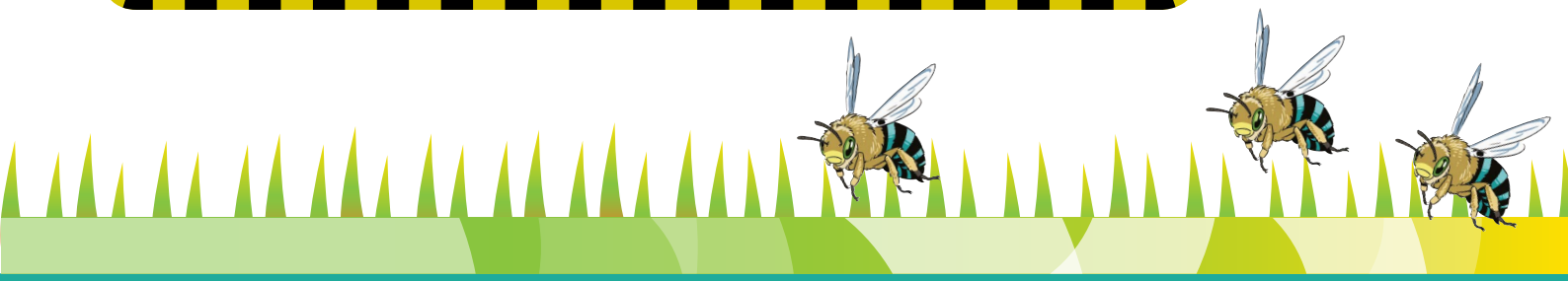
Portfolio inclusion: reflection on the results of the surveillance program.

Next level learning

Broaden students learning and understanding by incorporating mapping skills and knowledge.

View your school and location on Google Maps and/or SIX Maps and talk about the different views of the maps e.g. street view, google earth.

Create your own map of your school grounds incorporating mapping tools such as scales and keys. Locate the major features of your school on your map and record the surveillance sites using a key.



Reflection on the results of the surveillance program.

Some questions to consider:

- What did your survey reveal?
- Is your garden visited by a range of pollinating insects?
- What time of the day are they most active?
- Which parts of the school are they particularly active in?
- Could the area be improved?

❑ Yes: how? Is this possible?

❑ No: What are the features that already make your garden well suited to supporting bees and other pollinators? Or is it limitations on the site that mean it is as good as it can be?

What could we do better?

Bees are some of the many important pollinators in our gardens - some insects also play a role in maintaining the populations of beneficial insects over harmful pest species in gardens and on farms. It is important to encourage a greater range of insects in order to increase the biodiversity and to support local food production – particularly through pollination. How can your school ground be more bee friendly?

Research tips for bee friendly gardens. View images, websites and videos that provide hints on gardening to support a range and diversity of bees and other pollinators and ways to encourage them into our gardens and farms. Some good sources of information are listed on the next page.

Brainstorm measures which could be put in place to ensure bees are protected in your local area. Remember that biosecurity measures to protect the bees already here are an important part of supporting bees. See the Biosecurity Teacher Background information earlier in this document.

Discuss and include some biosecurity measures which you think you should or could implement in your school to help keep your gardens and produce safe from pests and diseases and protect the bees!

Complete this task as a Round Robin activity. Have the students draw sketch maps of different parts of your school grounds and place them on separate tables. As small groups move around the tables students add suggestions for changes that could be made and feedback on how suggestions might work.

Discuss the data recorded as a class and complete the table on the next page to record your plans for your school grounds.

Keeping animals responsibly

Conflict sometimes occurs between agricultural industries and local residents or users of an area. This can be because unexpected impacts arise or when the needs of others are not carefully considered. Bee keeping is no exception – when considering ways to be more bee friendly make sure that you are also student and visitor friendly! Don't place a hive or a bee hotel where it will increase the risk of bee stings to students or where the day to day school activities impact on hive activity.

And remember – not all native bees are stingless!

INVESTIGATE: bees

Some good sources of information include:

Local Apiarist groups for example the Hunter Valley Amateur Beekeepers http://www.hunter-valley-amateur-beekeepers.org/ - some groups may have people available to come and talk to your students and give some advice on your garden and school grounds.

Bee Business website: http://beesbusiness.com.au/garden.html

ACT for Bees: https://actforbees.org/resources/gardening-for-bees/ and https://actforbees.org/resources/pesticides-and-bees/

Attract Bees document accessed earlier in the investigation contains a lot of information (http://mrccc.org.au/wp-content/uploads/2014/02/Attract-Bees.pdf)

Instagram accounts:

https://www.instagram.com/beekeepclub_/

https://www.instagram.com/urbanhum/

https://www.instagram.com/nswfarmersbeehive/

Useful websites:

https://www.science.org.au/curious/everything-else/bees

https://actforbees.org/resources/australian-native-bees/

https://australianmuseum.net.au/bee-scene1

Keep in mind and discuss with students the importance of maintaining the safety of visitors and students in the school who may have allergic reactions to bee stings. Plans for making your school grounds more bee friendly should also consider the needs of people!

Portfolio inclusion: plan for supporting bees in your school grounds

INVESTIGATE: bees

Plan for school grounds

Area of the school or garden?	**What will you do? Or change?**	**Does it need to be discussed or approved?**	**Who will you approach?**	**When would you like this to be done by?**
Eg empty garden bed at front gate	*plant flowers that flower at different times of the year*	*Yes*	*Principal and GA*	*End of term 1*

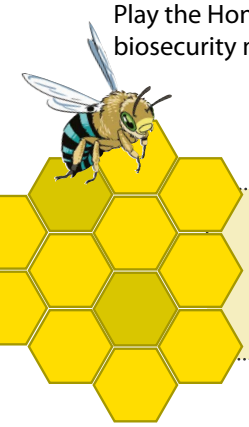
When will you review this plan? _____

Elaborate

What is the role of a beekeeper?

Beekeepers plan the location, number and health of their hives all year round. They move their hives to make the most of flowering plants, to encourage honey production and often to support agricultural industries.

Play the Honey Game. Score points along the way and in the end tally the success of your biosecurity measures and hive management by the level of your honey production.



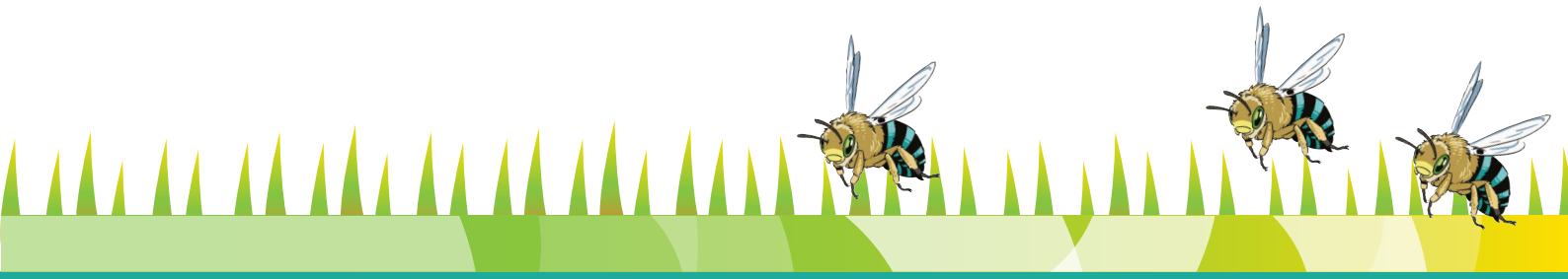
Portfolio inclusion: One game board and student reflection are to be included in the portfolio - the marking rubric asks you to judge the reflection that students record in their journal not the amount of honey production.

Take it further:

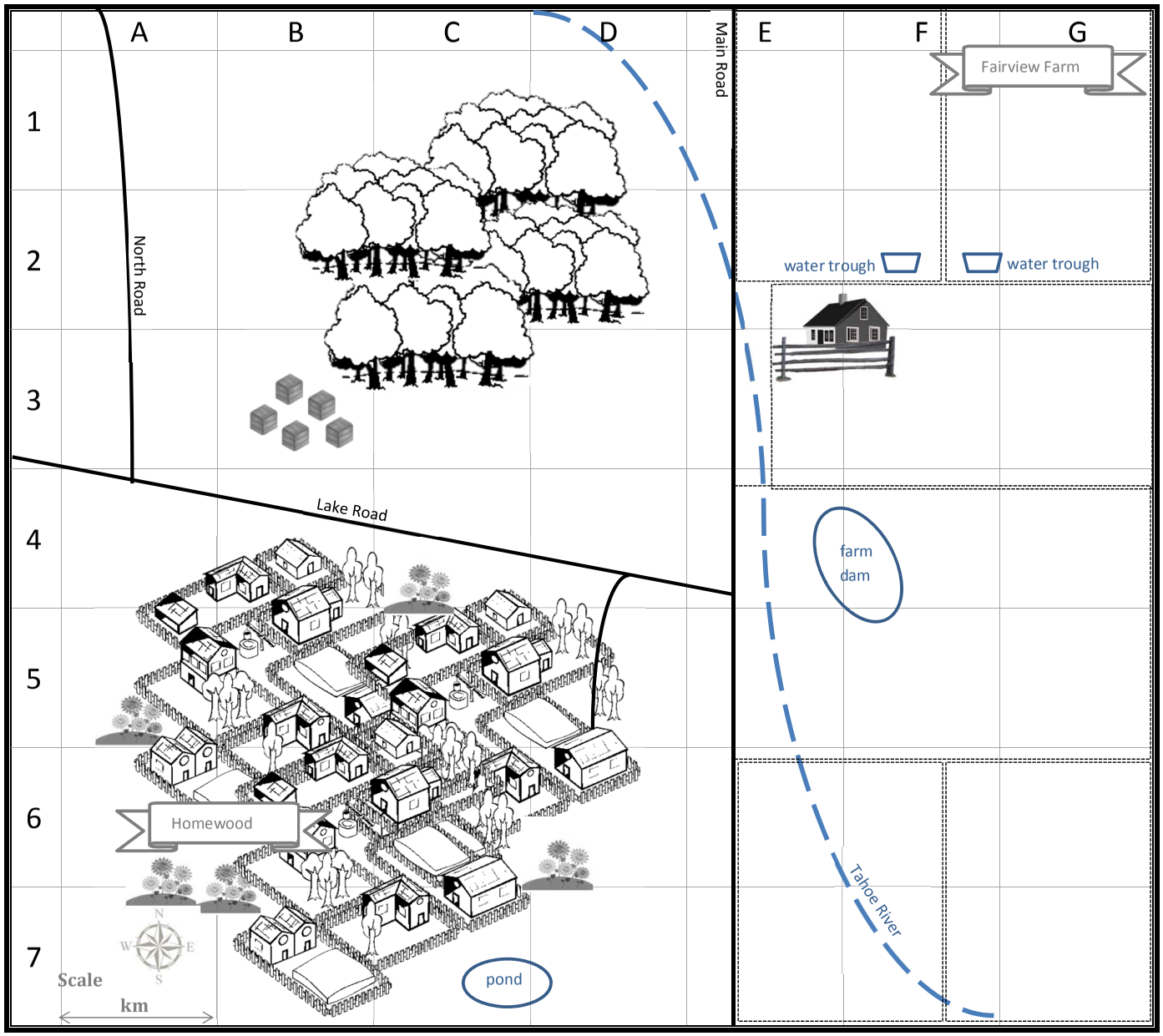
View: some videos from http://beeaware.org.au/videos/bee-biosecurity-video-series/. This series of videos will help students to appreciate the careers in the bee industry.

And this short video from ABC Splash looks at a research project attaching tracking chips to bees to study their behaviour!

http://splash.abc.net.au/home#!/media/2156097/Discovering-the-secret-life-of-bees



The Honey Game board



Week	Production	Total
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

The Honey Game

This game is designed to give students an insight into the role of beekeepers and biosecurity in the bee industry. The 'events' in the game are based on authentic issues in beekeeping however the effects on production - and the production rate of 5kg/week - are simplified. In reality beekeeping is a far more complex industry.

Setting up the game

Print the game board on A3 sheets and give one to each student or group.

Students will be asked to place their hives (they can be drawn on the map as they will not be moved during the game) in a suitable location and throughout the game the bees and hives will encounter 'events' that will affect their honey production.

Read each 'event' to students who are to calculate their honey production for that week and add it to the table and tally their production for the season. We have provided a math helper for students struggling with the calculation – the main aim for the game is to get an idea about the role of bee keepers and the impact of biosecurity threats so if you have students who will have trouble with the math give them a copy of the helper.

At the end of the season students will be able to compare production success and reflect on the events that had the greatest impact on production. A sample form is provided to help students complete this section.

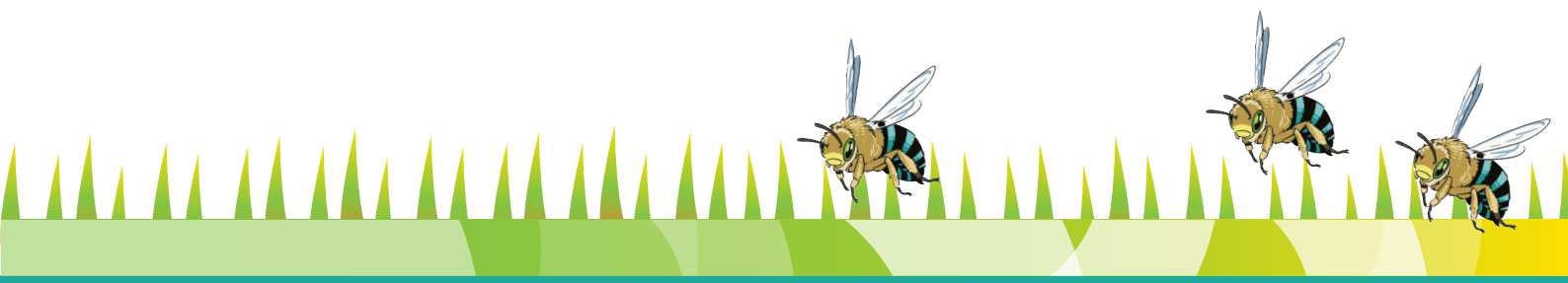
Game Play

Read this section to students to start the game.

You have recently purchased 10 hives - each consisting of a brood box (where bees are bred) and a super (where honey is stored). Your job as the beekeeper is to decide where on the map the hives will be located - they don't all have to be placed together. When deciding where to place the hives think about the needs of bees that you have learnt about in earlier activities - ensure that they have access to food, water and shelter. Try to choose a location where they are not at risk from disease, overspray or other pests.

For each week that the hives are healthy they will produce an average of 5kg of honey (or 0.5kg per healthy hive) - if hives are not affected by the event described then students add 5kg each week. If the hives are affected add the resulting honey, for example if production in all hives are reduced by 20% the honey produced that week is 4kg.

The season for the purposes of this game is 12 weeks.

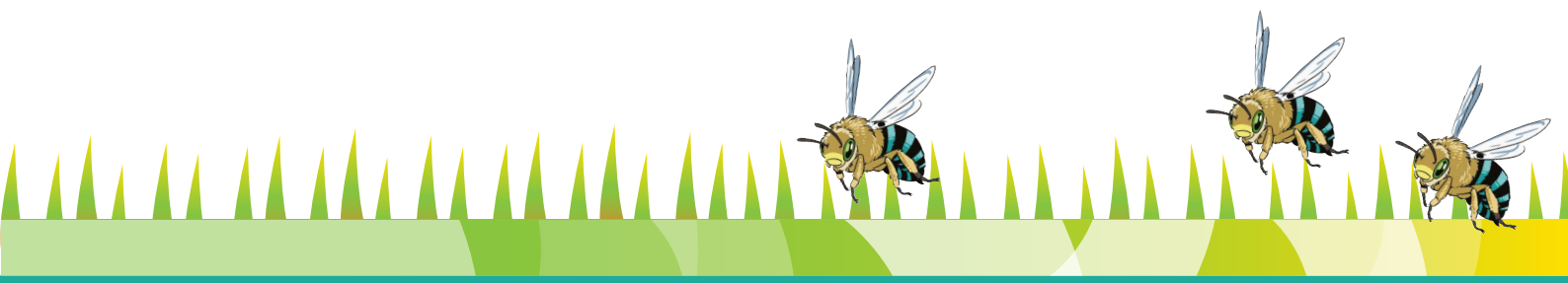


Events

1. For the first week at the new location bees will spend some time reorienting themselves and finding resources - production will be reduced by 25% for this week.
2. The gum trees at C2 are flowering and there is abundant pollen and nectar - bees within 2km of this area increase their honey production by 100% for two weeks. There is a scale marker at the bottom left of the map – each square is 1km.
3. The homeowner at B5 has used a neonicotinoid pesticide on their garden - unfortunately this has affected bees located within 1km of the garden. If your hives are within that area half of your foraging bees were killed and honey production is reduced by half for this two weeks.
4. There has not been much rain lately- bees within 2km of the water sources on the map maintain their honey production for three weeks until there is more rain. Outside these locations honey production is reduced by 30%.
5. The hives located at B3 are inspected by biosecurity officers and are suspected of being infected with American Foulbrood(AFB). They have sent samples away for testing. If your hives are located within 5km of those hives yours will also be inspected by biosecurity officers. If AFB is confirmed in your hives they will need to be destroyed. Do not collect any honey from the hives with 5km of these hives until the AFB test results are known.
6. The results of the AFB test are negative - no hives need to be destroyed.
7. The gum trees have finished flowering and the best source of pollen and nectar is in gardens in the residential area - hives within 3km of residential area increase production by 30%.
8. A local homeowner called you to collect a swarm in their garden, luckily you have a spare hive box and you can add this to your honey production.
9. Unfortunately while you were busy with the AFB testing and other management issues high demand for resources weakened hives that were placed with more than 10 hives. These weakened hives could not keep out small hive beetle and one out of five hives in that group need to be destroyed - these hives will not produce any honey for the rest of the game.
10. Normal production

Math Helper

Production	/10 hives (kg)	/ hive (kg)
Normal	5	.5
↓25%	4	.4
↑100%	10	1
↓50% / half	2.5	.25
↓30%	3.5	.35
↑30%	6.5	.65



Honey game reflection

Which event had the greatest impact on your honey production? _____

_____

_____

_____

_____

_____

What would you do differently to minimise or maximise that impact if you played the game again? _____

_____

_____

_____

_____

_____

Identify one of the events that beekeepers cannot influence _____

_____

_____

_____

How can they manage the impacts of that event on their bees and honey production? _____

_____

_____

_____

_____

_____

What did you learn about the role of beekeepers from playing the Honey Game? _____

_____

_____

_____

_____

_____

_____

_____

How can we encourage others in the community to support bees?

You have developed a plan for ways to make your gardens more diverse and bee friendly … insect habitats, garden diversity, management … now how can we encourage the local community to support bees and pollinating insects?

Some things you might consider:

- Contact your local council and ask them to include bee hotels in parks and reserves.
- Is there somewhere you could place a hive in your school? Somewhere students/visitors and bees won't get in each other's way? Consider contacting an urban beekeeper - who will manage a hive for you while you host it in your school grounds.
- Include tips for supporting bees in your school communication eg newsletters or facebook posts
- Make and sell bee hotels to be used in the community.

Portfolio inclusion: Describe how you have encouraged your community to support bees and what their response was.

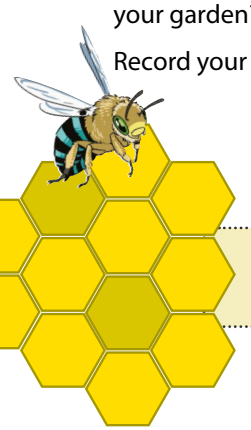
Evaluate

How will we know if it worked?

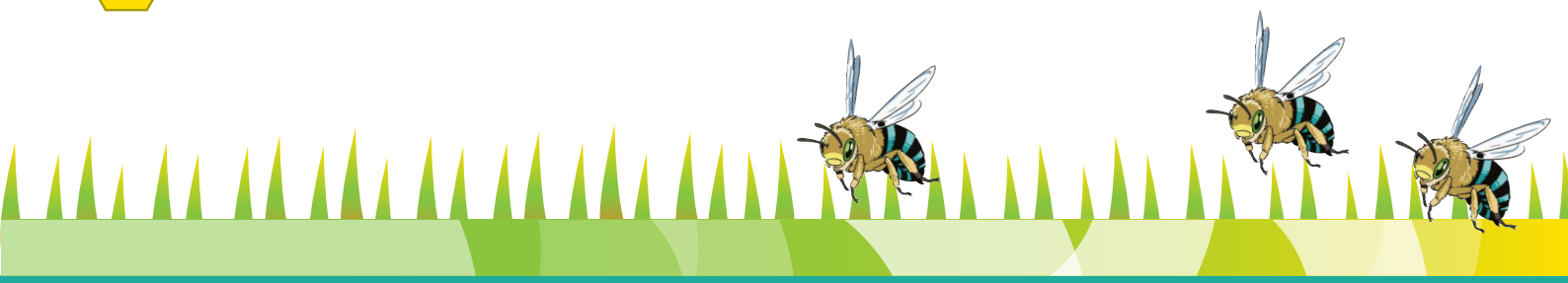
Discuss: how long before you expect to see the results of your efforts?

How can you evaluate the success of your plans to encourage bees and other pollinators in your garden?

Record your plan for evaluating the effectiveness of your investigation.



Portfolio inclusion: Plan for reviewing the project.



INVESTIGATE: bees

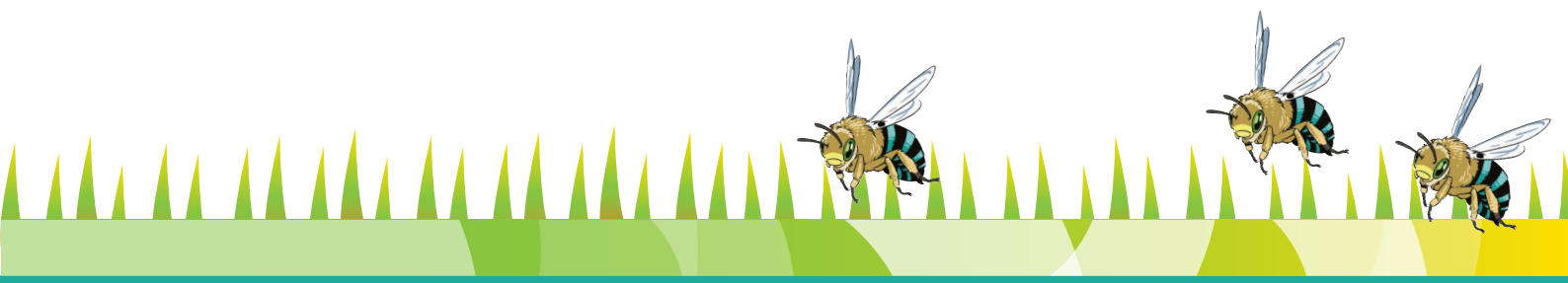
Encourage community support

How can we encourage others in the community to support bees?

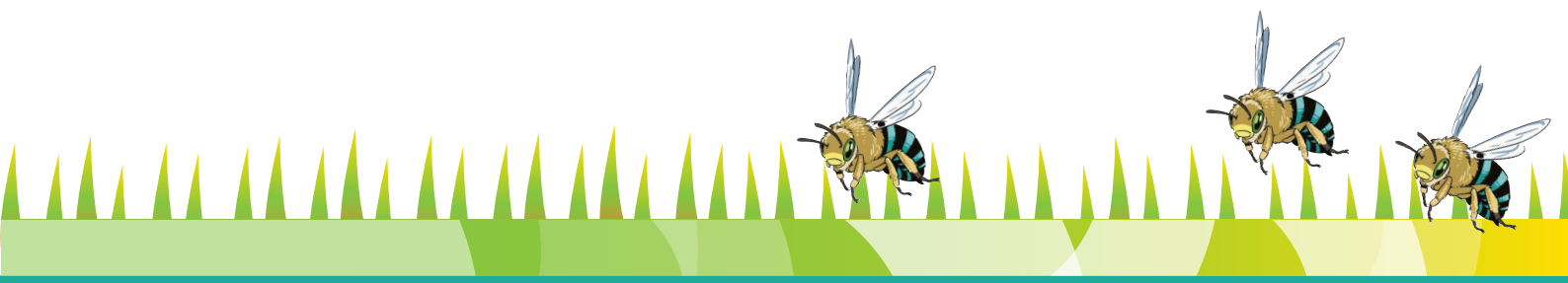
How will we know if it worked?

Marking rubric

Category	3	2	1	0	Score
Love Food? Love Bees reflection	Have conveyed thorough understanding of the relationship between bees and plants and used all of the words supplied	Have conveyed an understanding of the relationship between bees and plants and have used some of the words supplied	Have conveyed a limited understanding of the relationship between bees and plants.	No reflection included	**/3**
Research forms	5+ species researched	3 species researched	2 species researched	No research forms submitted	**/3**
	>3 sources cited, including local bee group/ beekeeper	2 sources cited	1 source cited	No research forms submitted	**/3**
Observation records	Observations have been recorded on more than 3 occasions	Observations have been recorded on 3 occasions	Observations have been recorded on 2 occasions	Observations have been recorded on occasion	**/3**
	All sections of the observation forms have been completed in detail	Most sections of the observation form have been completed with good information	Some sections of the observation form have been completed	Limited information is recorded on the observation forms	**/3**
	Insects observed are described, photographed or drawn in detail with labels	Insects observed are described, photographed or drawn without labels	Insects observed are described, photographed or drawn	Insects observed are noted	**/3**
Discussion of results	Students have considered the results of their observation in detail, including each of the questions supplied	Students have considered the results of their observations in detail	Students have considered the results of the observations in limited detail	Students have not considered the results of their observations	**/3**
Plan for school garden/grounds	>5 improvements identified	3 improvements identified	2 improvements identified	No improvements identified	**/3**
The Honey Game reflection	Students provided a thoughtful and thorough reflection on the events in the game and considered the role of beekeepers	Students reflected on the events in the game and have shown an understanding of the role of beekeepers	Limited reflection on the Honey Game and the role of beekeepers is included	No reflection is included	**/3**
Community action	A simple and effective method of encouraging community action was identified and carried out.	A simple and effective method of encouraging community action was identified	A method of encouraging community action was identified	There was no plan made to encourage community action	**/3**



Category	3	2	1	0	Score
Evaluation	A robust plan for evaluation was made.	A plan for evaluation was made.	Little or no plan for evaluation was made.	No plan for evaluation was made.	**/2**
	2	**1**	**0**	**0**	
Entry / Exit surveys	Both surveys completed by >85% of students as well as teachers	Both surveys completed by >50% of students as well as teachers	Both surveys completed by >25% of students as well as teachers	Teacher surveys not completed or entry or exit surveys completed by less than 25%	**/3**
	3	**2**	**1**	**0**	
Quality and Effort	Superior effort has been put into the portfolio	Average effort has been put into the portfolio	Some effort has been put into the portfolio	Little effort has been put into the portfolio	**/5**
	5	**3**	**1**	**0**	
Total marks and comments					**/40**



INVESTIGATE: bees

Assessment

Assessment guide

The Investigate: bees learning sequence provides a variety of opportunities for teachers to assess students' knowledge and skills development, as shown below. Level of achievement may be completed as per your local assessment or reporting system.

Student name: _____

Class / Year: _____

Activity	Assessment activity	Syllabus outcome/s	Date of assessment	Level of achievement	Notes
Beeing Curious	Students engage with a topic of local and national importance; view, comprehend and respond to digital media and discuss features and interactions between places and people and identify factors affecting the growth and survival of living things in their environment.	ST3-1VA ST3-11LW EN3-1A EN3-3A GE3-1 GE3-2			
Should we worry about bees?	Students view, comprehend and respond to digital media; discuss features and interactions between places and people and identify factors affecting the growth and survival of living things in their environment. They use mathematics to explore and understand real world concepts and compose a text to communicate their findings.	EN3-1A EN3-2A EN3-3A GE3-1 GE3-2 MA3-2WM			
Honey bees or Australian native bees?	Students view and interrogate a range of texts to investigate the Australian environment and the world of bees. The results of their research are communicated in written and spoken to texts to a range of audiences.	EN3-3A ST3-11LW ST3-4WS ST3-2VA EN3-1A GE3-1 GE3-2 GE3-4			

INVESTIGATE: bees

Activity	Assessment activity	Syllabus outcome/s	Date of assessment	Level of achievement	Notes
There is a buzz in the air and	Students plan and carry out an investigation into the school environment considering how it meets the needs of bees, they plan how to record and present their findings.	ST3-4WS ST3-5WT ST3-11LW ST3-2VA ST3-14BE GE3-1 GE3-2 EN3-1A			
Beeing Helpful	They discuss the results and write a considered response to the investigation.				
What could we do better?	Students analyse data collected during the investigation in order to develop a plan that supports bees and bee habitat while considering the needs of other users.	GE3-1 GE3-2 ST3-5WT ST3-11LW ST3-2VA			
What is the role of a bee-keeper?	Students complete a mathematical challenge using appropriate addition, subtraction, multiplication and division strategies, use of percentages while considering time and position as variables. Students compose a reflection on the processes described in the game taking into account the needs of bees and the role of the beekeeper.	MA3-5NA MA3-6NA MA3-7NA MA3-13MG MA3-17MG			
How can we encourage others in the community to support bees?	Students undertake to communicate their findings and resulting plan with a variety of audiences in an appropriate format encouraging engagement of the broader community with local and national issues.	GE3-4 EN3-1A EN3-2A			
How will we know if it works?	Students plan for an evaluation of their investigation assessing the effectiveness of their strategies.	ST3-4WS ST3-5WT			

Glossary

Apiculture - the name given to the branch of agriculture that involves honey bees and beekeeping. The honey bee is a member of the 'Apis ' genus which is Latin for Bee.

Social bees - a term given to bees that live in a social group or have a hierarchy. Honey bees are considered to be a social bee.

Solitary bees - a term given to bees that live on their own and are not part of a social group or hierarchy.

Queen Bee - the only reproductive female in the colony and is the mother of all the worker bees and drones.

Drones - are male bees who reproduce with the queen bee.

Workers - are non-reproductive female bees. They collect nectar, pollen and water. They also carry out all the duties within the hive.

Brood - is the eggs, larvae and pupae of the colony which will develop into adult bees.

Nectar - is a liquid that is secreted by the flowers of plants. It is a solution of sugars and other compounds. It is a food source for the bees and later becomes honey.

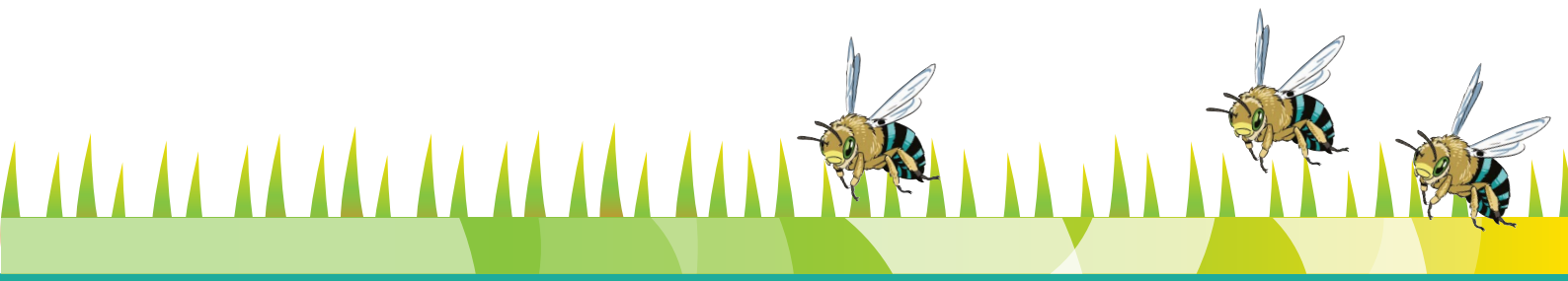
Pollen - is the male gametes of a flower which is found on/within the anthers. Pollen grains or gametes are a food source for bees, providing them with protein. It is collected by bees on their hind legs while they collect nectar. It is stored in cells within the hive.

Hive - a hive is an artificial structure or container where a colony of bees establishes itself.

Colony - is the name given to the entire group of bees that lives within a hive. It includes the queen, drones, worker and brood.

Biosecurity - is the act of protecting living things such as plants and animals from other living threats such as pests and diseases. It involves both preventing, managing and treating pest and disease outbreaks.

Neonicotinoid - is a type of insecticide (group of chemicals that kills insects) commonly used in agriculture worldwide. Its use is considered to be a major threat to honey bee populations worldwide.

American Foul Brood (AFB) - is a disease of the honey bee. It is a bacterial disease that destroys bee brood. The spores can be carried to other hives destroying them as well. The bacteria can survive for many years and is resistant to freezing and high temperatures. If detected, the colony must be destroyed. The physical parts of the hive must also be irradiated or destroyed to prevent spread.

Small hive beetle - is a pest of the honey bee that originated from Africa. It lays its eggs in hives which hatch and the larvae consume the brood, pollen and honey stores.