SOUTHERN QUEENSLAND

FLYING-FOX EDUCATION KIT

Year 9: Flying-fox ecosystems

www.allaboutbats.org.au

SEQ Catchments
Healthy Land – Healthy Water

Burnett Mary
REGIONAL GROUP
Practical Solutions for Natural Resource Management

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SOUTHERN QUEENSLAND

Flying-fox education kit

About the education kit

The *Southern Queensland Flying-fox Education Kit* was developed as part of the ***Improving Landscape Resilience to Climate Change in SEQ: the flying-fox roost & forage conservation pilot project***. This two-year project, coordinated by SEQ Catchments, aimed to improve the long-term sustainability of flying-fox camp sites in the southern Queensland region and increasing community awareness of the intrinsic value of flying-foxes and the critical ecosystem services they provide.

The project was funded through the Australian Government's Caring for our Country program and supported by Brisbane, Logan and Redland City Councils, Moreton Bay Regional Council, Noah's Ark Wildlife Coalition, Bat Conservation and Rescue Queensland, The Hut Environment and Community Association, the Queensland Department of Environment and Resource Management and Burnett Mary Regional Group.

The education kit introduces teachers and students to Gracie the grey-headed flying-fox. Gracie's mission is to help save my flying-foxes and get the message out about how important they are in pollinating native trees and dispersing native seed - essential things in keeping our environment healthy!

The All About Bats website is a key component to this education kit - www.allaboutbats.org.au.

Year 9: Flying-fox ecosystems

The *Southern Queensland Flying-fox Education Kit* provides schools of southern Queensland with an opportunity to study flying-foxes in the classroom while achieving outcomes (particularly Biological Sciences) under the Australian Curriculum.

The year 9 unit consists of three lessons that contain a variety of activities. Teachers may choose to complete more than the suggested lessons e.g. a teacher may choose to recap some of the year 8 activities.

These activities use a range of different learning media to provide an all-round learning experience for their students. This includes printed materials, PowerPoint presentations, YouTube videos and sound files that are all found on the All About Bats website.

The year 9 unit "Flying-foxes ecosystems", introduces students to the ecosystem of the flying-fox and the abiotic and biotic factors that can influence the health of the ecosystem. The unit asks students to choose from a series of challenges about flying-foxes that will test their scientific knowledge and comprehension.

UNIT OVERVIEW

Year 9 Flying-fox ecosystems

Rationale

In this unit, year 9 students will explore the ecosystem of the flying-fox and the abiotic and biotic factors that can influence the health of the ecosystem.

They will have the opportunity to explore the flying-fox food web and factors and events that influence their population sizes.

The unit asks students to choose from a series of challenges about flying-foxes that will test their scientific knowledge and comprehension.

Lesson 9.1 Flying-foxes and their environment

Students are introduced to the ecosystem and habitat requirements of flying-foxes. They learn about the natural and man-made threats that influence survival rates and methods for reducing the stressors on flying-fox populations. This lesson provides a theoretical background that prepares students for the following ecosystem challenge activities.

Lesson 9.2 Ecosystem challenge activities

Students complete challenges that allow them to investigate ecosystems and the impacts of natural events on population dynamics. Teachers can pick what challenges are completed or allow students to choose. The five challenges provided are:

- Making a poster of a forest food web.
- Writing a report on the effect of climate change on flying-foxes.
- Analysing the effects of Cyclone Larry on flying-foxes.
- Graphing and analysing the fluctuations in population sizes of a fictional roost site.
- Designing an artificial habitat to support a fictional roost site.

Year 9 Flying-fox ecosystems

National Curriculum

Lesson	9.1	9.2	
Science understanding (Biological sciences)	✓	✓	Ecosystems consist of communities of interdependent organisms and abiotic components of the environment; matter and energy flow through these systems (ACSSU176)
Science as a human endeavour	✓	✓	Scientific understanding, including models and theories, are contestable and are refined over time through a process of review by the scientific community (ACSHE157) People can use scientific knowledge to evaluate whether they should accept claims, explanations or predictions (ACSHE160) The values and needs of contemporary society can influence the focus of scientific research (ACSHE228)
Science inquiry skills		✓	Analyse patterns and trends in data, including describing relationships between variables and identifying inconsistencies (ACSIS169) Use knowledge of scientific concepts to draw conclusions that are consistent with evidence (ACSIS170) Communicate scientific ideas and information for a particular purpose, including constructing evidence-based arguments and using appropriate scientific language, conventions and representations (ACSIS174)
General Capabilities: Literacy	✓	✓	As they become literate students learn to: • interpret, analyse, evaluate, respond to and construct increasingly complex texts (Comprehension and composition) • make appropriate word selections and decode and comprehend new (basic, specialised and technical) vocabulary (Vocabulary) • use and produce a range of visual materials to learn and demonstrate learning (Visual information)
General Capabilities: Numeracy		✓	As they become numerate, students develop and use mathematical skills related to: • Calculation and number • Patterns and relationships • Statistical literacy • Measurement
General capabilities: Critical and creative thinking	✓	✓	As they develop critical and creative thinking students learn to: • apply logic and strategies to uncover meaning and make reasoned judgments • reflect on thinking, actions and processes • generate and develop ideas and possibilities • analyse information logically and make reasoned judgments • evaluate ideas and create solutions and draw conclusions • assess the feasibility, possible risks and benefits in the implementation of their ideas
Cross-curriculum priority: Sustainability	✓	✓	The biosphere is a dynamic system providing conditions that sustain life on Earth. (OI.1) All life forms, including human life, are connected through ecosystems on which they depend for their wellbeing. (OI.2)

LESSON 9.1

Flying-foxes and their environment

Objectives

Students will develop an in-depth understanding into the flying-fox habitat, their requirements for survival and the interactions between abiotic and biotic environments.

National Curriculum

Activity	9.1A
Science understanding (Biological sciences)	✓
Science as a human endeavour	✓
General capabilities: Literacy	✓
General capabilities: Critical and creative thinking	✓
Cross-curriculum priority: Sustainability	✓

For outcome codes and descriptions of outcomes, see unit overview.

Background information

Flying-foxes play a vital role in the regeneration of native forests due to their nocturnal feeding habits and extensive feeding ranges. Flying-foxes are able to pollinate tree species that produce most of their nectar at night and are less likely to be pollinated by day-feeding birds and bees.

Climatic changes, such as drought and floods, can disrupt usual flowering or fruiting and affect movements of flying-foxes around the landscape. This is why camps might swell beyond usual numbers at different times.

Stress in a population of flying-foxes can be caused by both natural events and human influenced events and activities. This stress can show itself in the death of flying-foxes, especially young, long-term decline in populations and outbreaks of diseases.

We can all play our part to reduce these stressors by conserving existing forest, being more sustainable to help reduce our contribution to climate change, and learning more about the importance of species like flying-foxes to our environment.

Activity

9.1A Flying-foxes and their environment

This activity takes students through a PowerPoint presentation that has been divided into four sections. It is intended that students complete their worksheets at the end of each section. It will require students to research further information (using the internet or text books) and discuss ideas with others in the class.

This activity will provide students with the background knowledge that they will require to complete the Ecosystem Challenge Activities (Lesson 9.2). It is recommended as a self-directed learning lesson in a computer lab or it can be completed as an entire class.

ACTIVITY 9.1A

Flying-foxes and their environment

SECTION 1 Our local flying-foxes

Find definitions for the following words and provide an example of one animal that could fit this definition. Use a dictionary or website like wikipedia.com to find a definition.

1. Frugivore .....

   .....

2. Nectarivore .....

   .....

3. Insectivore .....

   .....

4. Carnivore .....

   .....

5. Herbivore .....

   .....

Flying-foxes are a type of mega-bat. Mega-bats also include blossom and tube-nosed bats. There are three flying-foxes that can be found in southern Queensland. Identify two other mega-bats and record both their common name and their scientific name.

All About Bats > Mega-bats web page can help
www.allaboutbats.org.au/11/Mega-Bats/10/Mega-Bats

6. Common name 1

   .....

   Scientific name 1

   .....

7. Common name 2

   .....

   Scientific name 2

   .....

Create your own distribution maps for the three flying-foxes. Write a short description that you can use to identify them in the future.

Black flying-fox (*Pteropus alecto*)

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Grey-headed flying-fox (*Pteropus poliocephalus*)

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Little red flying-fox (*Pteropus scapulatus*)

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ACTIVITY 9.1A

Flying-foxes and their environment

SECTION 2 Forests rely on foxes that fly

"Flying-foxes are responsible for maintaining genetic diversity amongst remnant patches of rainforest."

Discuss what this statement means to you with your classmates. Here are some questions to get you started.

1. What does genetic diversity mean?
   www.biology-online.org

   .....

   .....

2. What is a remnant patch of rainforest?
   www.derm.qld.gov.au/wildlife-ecosystems/plants/remnant_vegetation_in_queensland/

   .....

   .....

3. What other animals which live in a rainforest, or other type of forest, perform a similar role to the flying-fox?

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   .....

4. Name two ways that flying-foxes use to help grow our native forests?

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Flying-foxes feed on over 100 different types of native trees and shrubs.

The following page provides a list of trees frequently visited by flying-foxes in the Brisbane region. This excerpt is from the Brisbane City Council's Wildlife Conservation Action Statement that can be downloaded from www.brisbane.qld.gov.au/environment-waste/wildlife/threatened-species/index.htm

5. Do you have any flying-fox food trees at your school or home? What might they be? (e.g. eucalypt/gum tree or other)

   .....

   .....

6. Do you think there is a problem with planting more flying-fox food trees around your home or school? Why?

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Flying-foxes will travel 20 km away from their home to find food. Their nightly travels can clock up to 400 km in flight.

Discuss with your classmates the following.

7. How far are you willing to travel for your dinner?

   If you travelled as far as a flying-fox for your meals, how would you feel if you:

   - found out the food was gone?
   - would have to move your house?
   - had to leave behind friends & family?

4 Ecology continued...

Diet

The diet of flying-foxes consists mainly of fruit and nectar. Most of the nectar sources utilised by the three species of flying-fox come from the Myrtaceae family, in particular the *Eucalyptus, Corymbia, Melaleuca* and *Angophora* genera. Other blossom food sources are members of the Proteaceae, Fabaceae, Arecaceae, Elaeocarpaceae, and Xanthorrhoeaceae families. A sample species list of flying-fox nectar sources that occur in Brisbane is provided in Table 2 below. A wide variety of native and exotic fleshy fruits are eaten. Native figs such as Moreton Bay fig *(Ficus macrophylla)* and weeping fig *(Ficus benjamina)* are considered to be particularly important.

Table 2: Sample list of flying-fox food nectar sources in Brisbane

Family	Species	Common name	Grey-headed flying-fox	Black flying-fox	Little red flying-fox	Notes	Time of usual flowering
Myrta-ceae	*Angophora floribunda*	Rough-barked apple	XX	XX	XX	Medium honey source. Best nectar producer of the Angophoras, best in dry years.	Dec-Jan
	Corymbia gummifera	Red bloodwood	XX	XX	XX	Medium honey source.	Dec-April
	C. intermedia	Pink bloodwood	XX	XX	XX	Minor to medium honey source. The most important of the bloodwoods for beekeepers	Jan-Mar
	Eucalyptus acmenoides	White mahogany	XX	XX	XX	Medium honey source.	Oct-Dec
	E. moluccana	Gum-topped Box	XX	XX	XX	Medium honey source.	Feb-April
	E. siderophloia	Grey ironbark	XX	XX	X	Major honey source. One of most valuable honey sources. Some blossom every year, good yields about every 3 years.	Jul-Dec
	E. tereticornis	Forest red gum	XX	XX	X	Minor-medium honey source. Common and regularly planted, regular blossom, heavy every 3-4 years.	Jul-Nov
	Melaleuca quinquenervia	Broad-leaved paperbark	XX	XX	X	Common and commonly planted, good nectar.	Mar-Jul
Pro-teaceae	*Banksia integrifolia*	Coast banksia	XX	XX	X	Medium honey source. Ample nectar source.	April-May
	Grevillea robusta	Silky oak	XX	XX	X	Not common as native, but abundantly planted	Sep-Nov

X indicates that the food is eaten by that particular flying-fox species in Brisbane.

XX indicates that the food is likely to be an important or abundant food source for flying-foxes in Brisbane. These judgements have been derived through the assessment by researchers that the nectar production is considered good or the species is abundant.

ACTIVITY 9.1A

Flying-foxes and their environment

SECTION 3 Natural threats

1. What are the signs of stress in a flying-fox camp?

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Recently Queensland has experienced the impact of a changing climate with cyclones, droughts and floods. Discuss with your classmates the following questions.

How were you affected by the 2010-11 summer weather events? How did this make you feel?

Did you notice any changes in local wildlife after these or similar events?

If you were a flying-fox, how would you have felt? Where would you find food and water for yourself or your young?

How would these events affect other animals that rely on the native forests for survival?

Hendra virus has recently become an issue for horse owners. Research how hendra virus is transmitted and write up your findings. Use the following website as a guide.

Biosecurity Queensland: www.dpi.qld.gov.au/4790_2900.htm

2. What are the signs and symptoms in horses?

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3. How is hendra virus transmitted to horses?

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4. Who do you contact?

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ACTIVITY 9.1A

Flying-foxes and their environment

SECTION 4 Man-made threats

Netting trees is one way that people can protect their fruit trees from flying-foxes and birds and potentially protecting against insect pests and hail damage. However, every year thousands of animals are injured in inappropriate netting of fruit trees, or discarded netting.

1. What types of netting should not be used?

   The Wildlife Friendly Fencing website can help you. www.wildlifefriendlyfencing.com

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2. What animals, other than flying-foxes, get frequently entangled in badly netted fruit trees.

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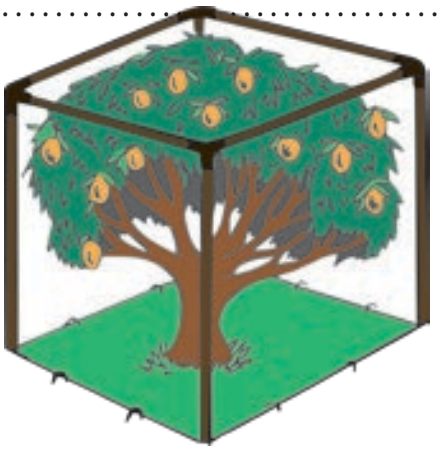

The costs of netting can often be offset by improvements in fruit quality and yield and shorter sorting and packaging times. Fruit growers that want to install exclusion netting for the control of flying-foxes can apply to the Queensland Rural Adjustment Authority for a low interest loan.

Cocos palms (now called queen palms) have been a common sight in Queensland gardens for decades.

3. How have cocos/queen palms become such a successful bushland pest species?

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4. What happened to the flying-fox in the PowerPoint slide on pest trees?

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5. Write down three things that you are now going to do to:

   a. Reduce the stress that is placed on flying-fox habitat.

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   b. Reduce the stress that humans place on flying-foxes.

      .....

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LESSON 9.2

Ecosystem challenge activities

Objectives

Students explore the interactions between species in a forest food web. Students look at how abiotic factors (e.g. weather) play an important role on the health and wellbeing of biotic ecosystems. Students also look at the population dynamics of a flying-fox camp and what can influence changes in numbers.

Teachers can choose which challenges students are going to complete or let them choose themselves.

National Curriculum

Activity	9.2A	9.2B	9.2C	9.2D	9.2E
Science understanding (Biological sciences)	✓	✓	✓	✓	✓
Science as a human endeavour		✓	✓	✓	✓
Science inquiry skills			✓	✓	✓
General capabilities: Literacy	✓	✓	✓	✓	✓
General capabilities: Numeracy			✓	✓	✓
General capabilities: Critical and creative thinking	✓	✓	✓	✓	✓
Cross-curriculum priority: Sustainability	✓	✓	✓	✓	✓

For outcome codes and descriptions of outcomes, see unit overview.

Activity choices

9.2A Who's on the menu?

Students sort a list of forest species into their roles within a food web - producers, primary consumers, secondary consumers and decomposers. This information is used to make a poster showing the food web of the flying-fox.

9.2B Weather effects on flying-foxes

Students will read three media articles that describe the impacts that extreme changes in weather can have on flying-foxes. They will write a discussion piece based on a series of questions regarding the species' adaptations.

9.2C Lost in the cyclone

Cyclone Larry had a big impact on our natural environment back in 2006. Students read an article about the impact that the cyclone had on local flying-foxes and conduct a mapping activity. This looks at the number of camp sites that were affected and predict the implications on the camp sites of southern Queensland.

9.2D Graphing populations

Students will investigate the changes in population of a fictional camp site over a four-year period. This involves them preparing a line graph (using either paper or ICT) and analysing the results. They will explore the possible causes of rapid increases and decreases and how this impacts the entire colony.

9.2E Designing an artificial habitat

Students learn about the habitat requirements of flying-foxes. They are provided with two examples that highlight the difficulty in designing an artificial habitat. Students will use their knowledge to design an artificial habitat roost for a fictional camp and write a report about their chosen design.

ACTIVITY 9.2A

Who's on the menu?

Energy flow through ecosystems

All living things need energy to survive. Each organism in an ecosystem feeds on and obtains energy from other organisms, and in turn is eaten by and provides energy for the others (e.g. plant to herbivore to carnivore). A food web is a diagrammatic representation of how energy flows through an ecosystem.

Almost all food webs begin with plants, which transform and store the sun's energy. Plants are called **producers** because they produce their own food.

Organisms that feed on plants are called **primary consumers** as they obtain their energy directly from the producers.

These plant eaters are eaten by other animals, carnivores, which are called **secondary consumers**.

In every ecosystem there are several levels of producers, primary consumers and secondary consumers that sustain the energy flow through the system.

In the end every living thing will die and **decomposers** will break them down to once again provide nutrients to the producers (plants). In a food web the energy is recycled continually throughout the system.

Part A

The list below contains some of the species that could be found in a forest food web. Sort them into producers, primary consumers, secondary consumers and decomposers.

Ants
Bottlebrush
Carpet python
Cocos / Queen palm
Eucalyptus tree
Flying-fox
Frog
Fungi
Goanna
Kangaroo
Kookaburra
Lilly Pilly
Lorikeet
Mango tree
Micro-bat
Mosquito
Moth
Native grasses
Possum
Sea eagle
Sun
Wedge-tailed eagle

Producers	Primary Consumers	Secondary Consumers	Decomposers

Who's on the menu?

Energy flow through ecosystems

Part B

In this challenge, you will make a poster about the food web of the flying-fox and its forest ecosystem.

To complete this challenge, do the following:

1. Using the list of species in Part A, draw a rough sketch of the food web for the forest ecosystem of the flying-fox.

   Check with your teacher that you are on the right track. Remember to draw the arrows in the direction of the energy flow (e.g. from the plant to the flying-fox).

2. Now make a poster of the food web including a title and illustrations.
3. Label a producer, first consumer, second consumer and decomposer.
4. Label a predator, its prey, two competitors and a pollinator.
5. Circle the species that are not native to Australia and label them as introduced.

A food chain is made up of a single connecting line of a food web.

Sun ⇨ Lilly Pilly ⇨ Flying-fox ⇨ Carpet python ⇨ Wedge-tailed eagle

How many food chains can you make from your food web?

Photo: Kelly Coleman

www.carpetpython.com.au

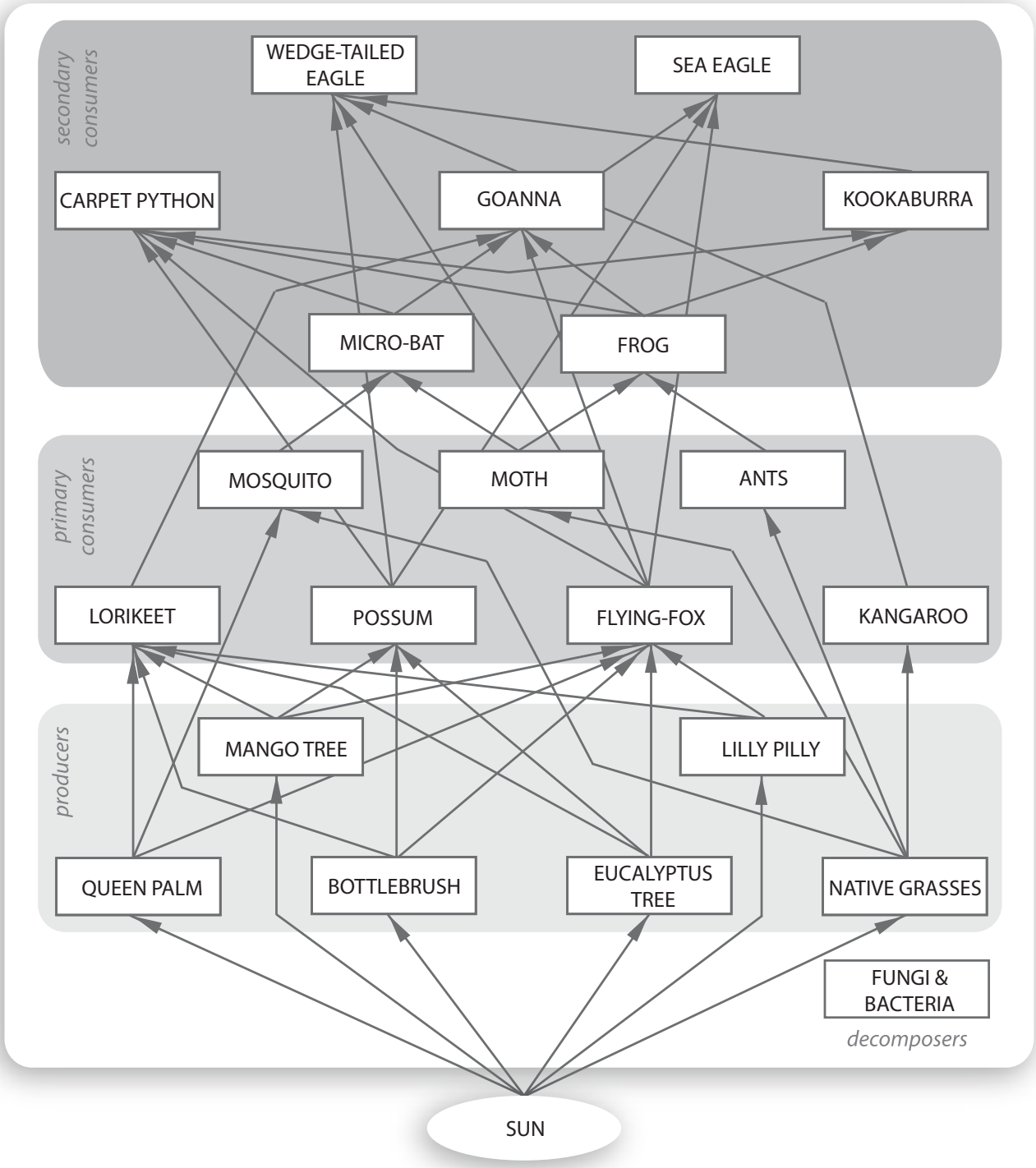
Photo: Julian Robinson

ACTIVITY 9.2A

Who's on the menu?

Teacher's answers

Forest Food Web



ACTIVITY 9.2B

Weather effects on flying-foxes

Reviewing the media

One of the most common things that people talk about is the weather and how it affects our lives.

"It is too hot." "It is too cold." "This is a bad drought." "The floods are terrible." "Climate change is causing…"

What we sometimes forget is how the extremes and changing weather events affect the wildlife we share the planet with. These creatures can be very sensitive to weather events and can be an indicator to the changing climates in their area.

Read through the three articles about weather and flying-foxes and write a discussion piece including the following:

Do you think flying-foxes are affected by severe weather conditions?

What weather events can affect flying-foxes?

What are some of the impacts to flying-foxes caused by severe weather?

Where are some of these problems occurring?

What can we do to the help flying-foxes?

Going in to bat for tiny orphans

Torrential rain has brought chaos to parts of Australia, and not just to the humans who live there.

Australian Bat Clinic and Wildlife Trauma Centre director Trish Wimberley and her carers have helped save 130 orphaned bats on the Gold Coast in past weeks. They saved 350 young bats during the 2008 storm season but this year think there's more going on than just wild weather.

Carers have visited several bat "camps" on the coast in recent weeks to find four-week-old babies on the ground covered in maggots and fly eggs. Trish said: "They're coming down to feed on the ground. That makes them vulnerable. It's not a natural occurrence and shows there is trouble in the environment. Bats are a barometer to what is going on in the environment. They're our canaries down the coal mine."

The babies will be bottle fed and kept hanging on clothes lines or in intensive care units until they are ready to fly again in about four weeks.

www.adelaidenow.com.au/rescuers-go-in-to-bat-for-tiny-orphans/story-e6frea6u-1225984280508

(Sunday Mail - SA, 9 January 2011)

Flying-foxes doing it tough

The prolonged wet weather is taking its toll on local wildlife and no species is doing it tougher than the flying-fox, whose main diet of pollen and nectar has been destroyed by the bad weather.

Northern Rivers Wildlife Carers' flying-fox coordinator Cheryl Cochran said larger-than-usual numbers of bats have been coming into care due to the food shortage.

"The colonies have broken up and set up small camps in places they've never roosted before," Cheryl said." We think it's because if they have found food sources they are staying close to it, so they don't have to expend energy."

Cheryl said one of the starving bats that recently came into care is a little red flying-fox rescued in Lennox Head.

"It was getting close to dark and the poor little fellow was so weak he could barely climb up a tree," Cheryl said. "While he is doing well, his colony has moved on, probably into Queensland where he would have been transported to if there was no flooding."

Rescues due to injury from entanglement in netting and on barbed wire have also increased.

Weather effects

Reviewing the media

Cheryl said that the bats, desperate for food, are landing on incorrectly-netted fruit trees and native trees planted along barbed wire fences, where they become entangled.

"I got a mother last week off barbed wire and she was lactating but I couldn't let her go because apart from the hole in her wing, she was over 200 grams underweight," she said.

Cheryl said the heartbreaking decision was made to take the grey-headed flying-fox into care, saving her life but dooming her baby to starve, as all flying-foxes leave their babies in the colony at night while they fly out to feed.

"It was horrible," Cheryl said. "But she couldn't have kept the baby alive at that weight. She is doing well now."

Cheryl said that the bats are aware the carers are helping them.

"They are very grateful for the food, I can tell you. They eat all day and night for the first few days, only stopping for a nap."

The large increase in the number of bats in care, there are currently 31 orphans, as well as the extended period of care needed for feeding them is putting a strain on Northern Rivers Wildlife Carers' coffers.

If you would like to make a donation or report orphaned or injured wildlife phone Northern Rivers Wildlife Carers' 24-hour hotline on 6628 1866, or visit www.wildlifefriendlyfencing.com and www.wildlifecarers.com for more information.

www.echonews.com.au/story/2011/01/20/flying-foxes-doing-it-tough/

(The Northern Rivers Echo - NSW, 20 January 2011)

Flying-foxes to wilt with climate change

Some of Australia's flying-foxes face a grave threat from extreme temperatures expected to become more frequent with climate change, new research shows.

Flying-foxes, among the largest species of fruit bats, are a cornerstone species in native forests, says co-author Dr Nicola Markus, an Australian expert in their ecology.

"The role they play in pollination and seed dispersal is unique."

But in early 2002, she and an international team of researchers led by Dr Justin Welbergen from the University of Cambridge witnessed an event that brought home how vulnerable these bats are to very high temperatures.

On 12 January of that year, a record heatwave struck a colony of grey-headed flying-foxes and black flying-foxes at Dallis Park in northern New South Wales.

"On that day, what we saw was, very simply, that the flying-foxes died of heat stress," says Markus, who was with WWF Australia when she conducted the research.

The temperatures, which exceeded 42°C, killed more than 1300 of the animals, most of them females and their dependent young, the researchers report in the journal Proceedings of the Royal Society B[1].

1 Proceedings B is the Royal Society's flagship biological research journal, dedicated to the rapid publication and broad dissemination of high-quality research papers, reviews and comment and reply papers. The scope of the journal is diverse and is especially strong in organismal biology.

rspb.royalsocietypublishing.org

Weather effects

Reviewing the media

State-wide, more than 3500 flying-foxes fell to the soaring temperatures in that single heatwave, they write.

Black flying-foxes, which are less able to adapt to temperature fluctuations, were worst hit.

Their deaths should serve as a warning of what could happen as global warming makes such scorchers more common, Markus says.

"We know that we're going to get more heat events and more extreme heat events," she says.

"It bodes extremely badly for the black flying-foxes."

Any climate changes that harm flying-foxes will have knock-on effects throughout all coastal forest ecosystems, she says.

Certain species of eucalypt, for example, rely heavily on the bats for pollination.

"They are a keystone species for forest environments," Markus says. "There are lots of other species whose fate may also be in serious doubt."

www.abc.net.au/science/articles/2007/11/29/2105307.htm
(David Pincock, ABC News in Science, 29 November 2007)

ACTIVITY 9.2C

Lost in the cyclone

Where have the bats gone?

Read the following article about the flying-foxes and go through the questions at the end.

Flying-foxes vanish after Cyclone Larry

Cyclone Larry, which hit Australia's northeast in March, has scattered 10,000 flying-foxes far and wide, says a zoologist.

And CSIRO's Dr Louise Shilton needs to find this local species of crow-sized, fruit-eating bat quickly.

The event is both good and bad for her ongoing project to monitor the usually poorly distributed animals. It's bad news because it's rather difficult to study animals you can't find. "We need to be providing the best possible population data and we can't monitor them without knowing where they roost," says Shilton.

Among her questions are what they are eating and where they have chosen to roost. The good news is that when she finds them, she'll probably be able to learn what these animals regard as good habitat, a matter of debate at the moment, she says.

Do they really depend solely on undisturbed forest or do they like urban areas where fruit trees are irrigated and predators are few? It's the sort of thing people who love, and those who loathe, flying-foxes want to know. "There's this kind of love-hate relationship with fruit bats in Australia," says Shilton.

Some people adore them and point to evidence that flying-foxes play a critical role in pollinating and spreading the seeds of native plants. Others are less enthusiastic. "They do come into contact with fruit growers," says Shilton. "But they also come into conflict with people in urban environments." That's because the bats congregate in large noisy crowds and produce foul-smelling guano.

The animosity was bad enough that it was once common for people to shoot flying-foxes. Now, however, the local northern Queensland species is protected and a permit is required to kill them. "This particular species is the one with the smallest distribution and it is believed to have the smallest population," Shilton says.

Scattered or killed?

Shilton is pretty certain the bats were scattered rather than killed by the cyclone, because she visited known roosting sites and found few dead animals, "just a handful compared to the 10,000 that had been around before the storm".

And some people reported seeing the bats hurrying away en masse before the storm arrived, probably a natural response to quickly dropping air pressure.

"I would agree that Queensland probably does offer more places for the flying-foxes to escape the storm," says Dr Kim McConkey, a wildlife researcher who studied the effects of another cyclone on another species of flying-foxes in Tonga.

"We recorded an 80% decline in flying-fox abundance in Tonga after the cyclone, and this was almost certainly due to mortality, either directly during the storm or afterwards due to a lack of food and human hunting," she adds. McConkey's colleagues also reported seeing bat carcasses in the lagoon after the island cyclone, she says.

Out in daylight

To find out where the Queensland bats are, Shilton has asked the public to call her with information. Already, she says, there are sightings of flying-foxes heading out for food in daylight, an unusual behaviour for the nocturnal animal. That information alone suggests some bats are finding food scarce and working harder to get a meal.

ACTIVITY 9.2C

Lost in the cyclone

Where have the bats gone?

Meanwhile, says Shilton, anyone cheering at the flying-foxes' disappearance shouldn't assume they have disappeared for good. "I've personally got no doubt that once the native trees come into season the bats will come back," Shilton says.

www.abc.net.au/science/articles/2006/09/22/1746219.htm
ABC Science Discovery News, 22 September 2006

Post Script: Ms Shilton was right, the flying-foxes did come back after they had spent a little time at camps in southern Queensland.

Cyclones are weather events that can bring devastation to large areas throughout the tropics. Such events can seriously disrupt the habitats and lives of the indigenous fauna to the area. Flying-foxes are no exception. Each time a cyclone hits landfall the camps throughout the area are affected.

Cyclone Larry hit the coast of far north Queensland at Innisfail on March 20 2006.

Mapping exercise

Use the Cyclone Larry map as a guide to sketch in the path on your roost map.

Cyclones do not just affect the areas that are directly in their path. Cyclone Larry had extremely destructive winds up to 20 km from its centre and destructive winds up to 120 km.

Extremely destructive winds

Using the scale on the map, shade in an area 20 km on either side of the cyclone path. This area was classed as having extremely destructive winds. How many of the marked camp sites are located in this area?

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Destructive winds

Using the scale on the map, and a different colour, shade in an area 120 km on either side of the cyclone path. This area was classed as having destructive winds. How many of the marked camp sites are located in this area? (include from cyclone path out to 120 km mark)

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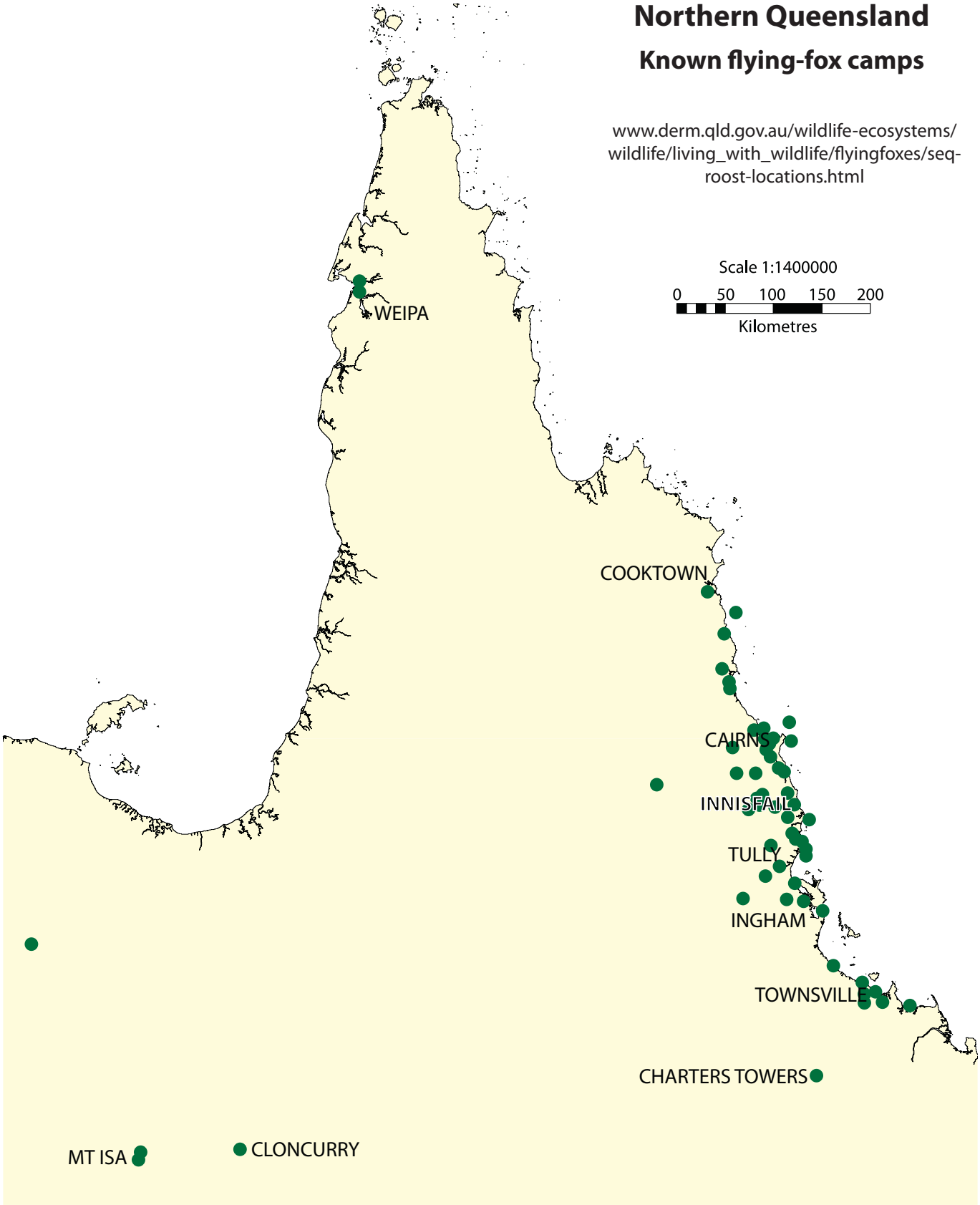
Answer the following:

1. Find out what the cyclone symbols (L, 1, 2, 3 & 4) mean on the cyclone path map above.
2. What damage do you think this cyclone did to the ecosystem of the flying-foxes in the area?
3. If you were Dr Louise Shilton working for the CSIRO, where would you go to look for the missing flying-foxes?
4. This cyclone also had a direct affect on the flying-foxes in southern Queensland. Can you think of what happened to cause this?
5. What problems do you think the influx of flying-foxes into southern Queensland caused for the local camps?

ACTIVITY 9.2C

Lost in the cyclone

Where have the bats gone?



ACTIVITY 9.2D

Graphing populations

The population of flying-foxes at the Fake Creek camp in southern Queensland has been monitored over a number of years. The following data was taken between 2004 and 2007.

2004		2005		2006		2007	
Jan	26743	Jan	27893	Jan	28040	Jan	29875
Feb	33455	Feb	32323	Feb	35976	Feb	32467
Mar	38975	Mar	42457	Mar	39755	Mar	39064
Apr	31466	Apr	35200	Apr	45787	Apr	37543
May	21342	May	20349	May	78966	May	25674
Jun	14566	Jun	14780	Jun	76443	Jun	14788
Jul	12457	Jul	12457	Jul	75432	Jul	13453
Aug	12453	Aug	11780	Aug	56433	Aug	13455
Sep	16753	Sep	17700	Sep	43215	Sep	17865
Oct	21954	Oct	22178	Oct	19873	Oct	25964
Nov	26873	Nov	25890	Nov	22334	Nov	27855
Dec	27235	Dec	26380	Dec	21860	Dec	1379

Plot the roost population data on a line graph with the months on the x-axis and the population on the y-axis (using a program like Excel is suggested).

The following are a number of hints that will help you analyse your data.

- The roost site is home to both grey-headed and little red flying-foxes.
- Grey-headed flying-foxes are present at the site all year.
- Little red flying-foxes are very nomadic following the flowering of native plant species.
- Tropical Cyclone Larry hit far north Queensland in late March 2006 causing bats to relocate.
- Silky oak trees (*Grevillea robusta*), a favourite food of little red flying-foxes, flower in the area during late summer and early autumn.
- In December 2007, a severe storm hits southern Queensland causing damage to vegetation.

ACTIVITY 9.2D

Graphing populations

Data anaylsis

When analysing your data, consider the following questions.

1. In what months are there usually the most flying-foxes at Fake Creek camp (not including the 2006 outlier)?

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2. Why do you think the numbers are largest during this period?

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3. During what months is Fake Creek camp usually the quietest?

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4. What species of flying-foxes do you think are not present at the time of year when there are the lowest numbers?

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5. Why do you think there was a massive increase in flying-fox numbers at Fake Creek camp during the middle of 2006?

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6. What pressures do you think this increase would have put on Fake Creek camp?

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7. The last entry in 2007 showed a huge decrease in population. Why do you think this occurred?

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8. What other events could affect the population of flying-foxes at Fake Creek camp each year? Write down a list of your ideas.

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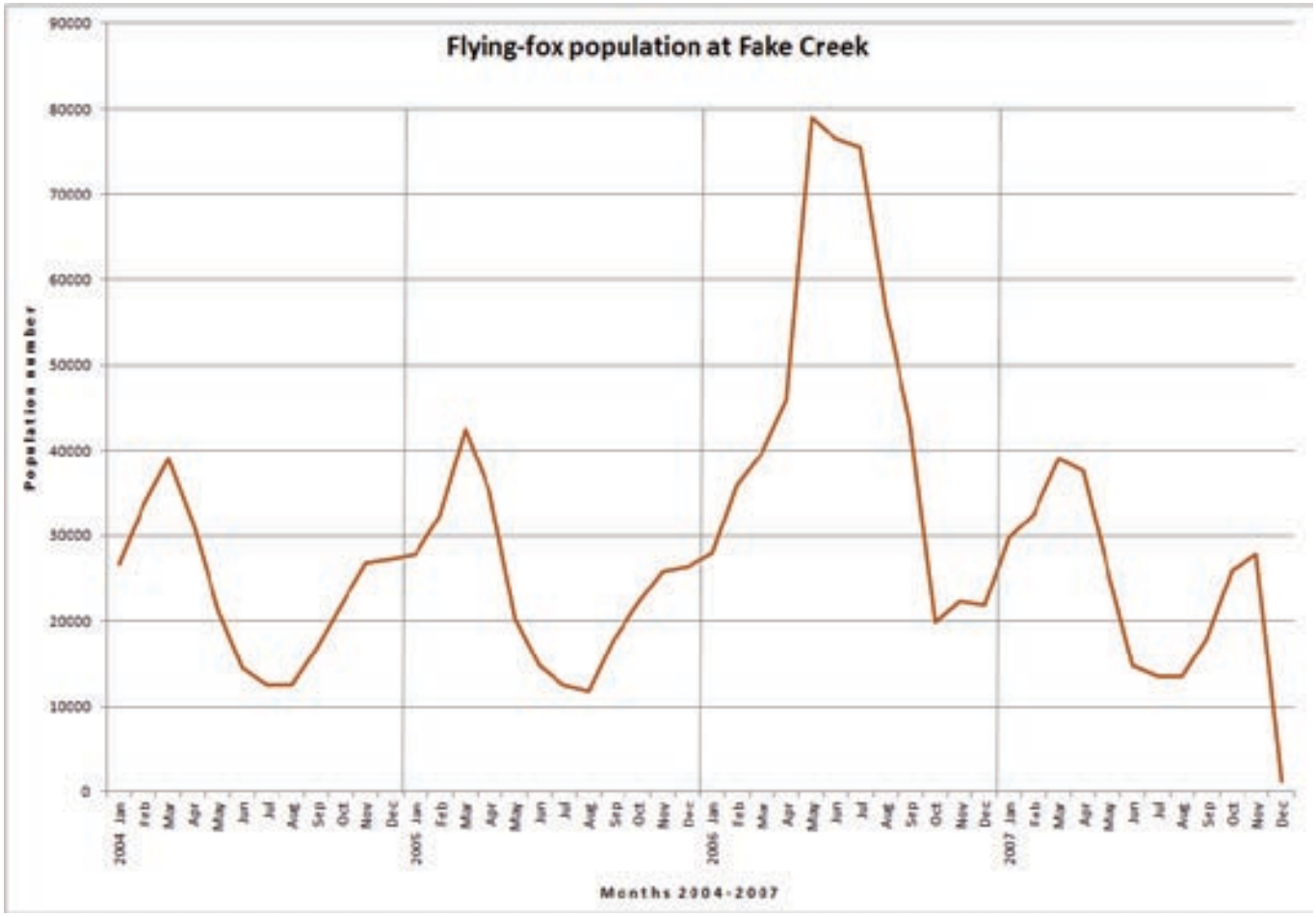
ACTIVITY 9.2D

Graphing populations

Teacher's answers



1. February to April in 2004, 2005 and 2007.
2. The little red flying-foxes have moved to the area to feed on the silky oak trees and possibly other trees that are flowering in the region.
3. June through to August.
4. Nomadic little red flying-foxes have gone elsewhere to follow the flowering of native trees. Due to the winter climates some flying-foxes will migrate north.
5. Cyclone Larry caused a lot of damage to roosting trees and feeding grounds in far north Queensland. Large numbers of flying-foxes migrated south in search of food and safe habitat.
6. Pressure on the camps would include:
   - Food shortages
   - Territorial disputes
   - Expansion of camps into surrounding areas
   - Damage to roosting trees
   - Possible increases in disease
7. A severe storm hit southern Queensland causing damage to roosts and food sources. The semi-permanent flying-foxes had to move to more suitable habitat.
8. Other influences can include mating cycles, birthing and human interference in and around the camp.

ACTIVITY 9.2E

Designing an artificial habitat

Lending a hand in times of need

Fake Creek scenario

After Cyclone Larry hit in 2006, there was a large increase in flying-foxes at the Fake Creek Camp[1] in southern Queensland. The camp grew from having around 10,000 flying-foxes on a semi-permanent basis, to over 70,000. This happened over the span of one week.

This huge influx was not welcomed by the local residents and business owners who live next to the camp. There was a lot of media and pressure on the local authorities to move the camp to a larger site away from the urban environment.

Concern that this may cause more angst if flying-foxes spread into backyards and the local playground, has led to the decision to try and keep the camp where it is and manage it appropriately.

The migrants consisted of 30% black flying-foxes and the rest were little red flying-foxes. The clumping nature of little red flying-foxes on branches added a tremendous weight to the limbs of the old trees found in the camp. Straight away, the smaller limbs dropped off and before long the larger limbs began to drop under the sheer weight of the flying-foxes.

The main roosting trees in the camp were getting old and this influx caused them to die. A local conservation group planted new roost trees in the middle of the camp site, but these trees won't be large enough to hold the weight of flying-foxes for many years.

1 Fake Creek Camp is a fictitious location for the purposes of this activity.

Real life attempts

Hervey Bay, Queensland

In 2005, the Hervey Bay City Council attempted to provide some artificial roosts within the Tooan Tooan Creek camp. The core roosting trees were dead or dying. As the camp site was located within an urban environment, it was better to keep the camp in a location that it could be looked after.

Council staff strung Hemp rope between some of the roosting trees. Hemp was chosen as it is a natural fibre that would break down if the experiment didn't work.

Council staff and volunteers conducted regular counts to see how, or if, flying-foxes used the rope roosts. Results identified that flying-foxes only roosted on the rope less than 1 to 2 metres from the trunk of the tree. It was presumed that they did not like the swinging nature of the rope.

Yarra Bend, Victoria

The trial to relocate Melbourne's flying-fox colony from the Royal Botanic Gardens relied on two approaches: attracting the colony to move themselves to a pre-selected site in Ivanhoe; and, pushing them out of the Gardens using sound.

Efforts to attract the colony to Ivanhoe were unsuccessful. However, attempts to disperse the colony and prevent it from roosting back in the Royal Botanic Gardens were effective.

There are significant limitations in the ability to manoeuvre the colony and there is a risk that, in attempting to further relocate the colony, it could disperse into surrounding residential areas or back into inner-city parks and gardens.

www.dse.vic.gov.au/__data/assets/pdf_file/0003/106932/April04QA.pdf

ACTIVITY 9.2E

Designing an artificial habitat

Lending a hand in times of need

You have been asked by the local Council to design an artificial structure to support the Fake Creek flying-fox camp. The aim is that the man-made structure will provide a place for the flying-foxes to roost and ease pressure on the surrounding environment.

Things to consider when designing your structure:

- Shelter from predators
- Strength to hold many flying-foxes
- Longevity to last for 10-20 years
- Black and grey-headed flying-foxes tend to roost high in a tree (unless it is very hot)
- Little red flying-foxes tend to roost closer to the ground where it is cooler.

You need to submit the following to the council:

- A background explaining the need for the artificial structure, including why the camp should be maintained where it is.
- A technical diagram of the structure/s with a scale.
- A list of materials used for the structure/s. Justify why you chose these materials.
- An explanation of why you think your design will work.

Draw and label your artificial habitat below.

For more information

All About Bats. . . . . www.allaboutbats.org.au
SEQ Catchments . . . . . www.seqcatchments.com.au
Burnett Mary Regional Group . . . . . www.bmrg.org.au
Department of Environment and Resource Management. . . . . www.derm.qld.gov.au

Working with bats

The following organisations can be contacted for more information about bats, or individuals may be willing to speak to your class about what they are doing to help conserve our wildlife.

Bat Conservation & Rescue Inc.
www.bats.org.au
P: 07 0488 228 134
E: info@bats.org.au

The Hut Environmental and Community Association Inc. (THECA)
www.theca.asn.au
P: 07 3878 5088
E: theca@hotkey.net.au

Wildlife Presentation Society Queensland
www.wildlife.org.au
P: 07 3221 0194
E: wpsq@wildlife.org.au

Your local council.

Queensland Parks and Wildlife Services
www.derm.qld.gov.au
South East P: 07 3512 2300
Sunshine Coast and Burnett P: 07 5459 6110

SEQ Catchments
www.seqcatchments.com.au
T: 07 3211 4404
E: admin@seqcatchments.com.au

Burnett Mary Regional Group
www.bmrg.org.au
P: 07 4181 2999
E: admin@bmrg.org.au

Excursion ideas

The following locations can be used to viist a flying-fox camp where there is interpretive information to learn more about the local camp. There are many more sites out there that have not been represented here. To find your nearest camp site go to:

www.derm.qld.gov.au/wildlife-ecosystems/wildlife/living_with_wildlife/flyingfoxes/seq-roost-locations.html

Cascade Gardens
Gold Coast Highway, Broadbeach

Woodend Nature Centre
35 Williams Street, Coalfalls
www.discover-our-ipswich.com/woodendnaturecentre.html

Black Swamp Wetland
Access via Queen Street, Cleveland
www.more2redlands.com.au/Explore/Leisure_Attractions/Nature%20-%20Wildlife/Mainland/Pages/Black%20Swamp%20Wetlands.aspx

Tooan Tooan Creek
Cnr Taylor Street and The Esplanade, Hervey Bay

Batty Boat Cruise (Brisbane River)
www.wildlife.org.au/news/2011/batty.html
P: 07 3221 0194
Although this Batty Boat Cruise is an evening activity with a per person cost, It is recommended for teachers who may like to broaden their knowledge about flying-foxes.

www.allaboutbats.org.au

SEQ Catchments
Healthy Land – Healthy Water

Burnett Mary Regional Group
Practical Solutions for Natural Resource Management