

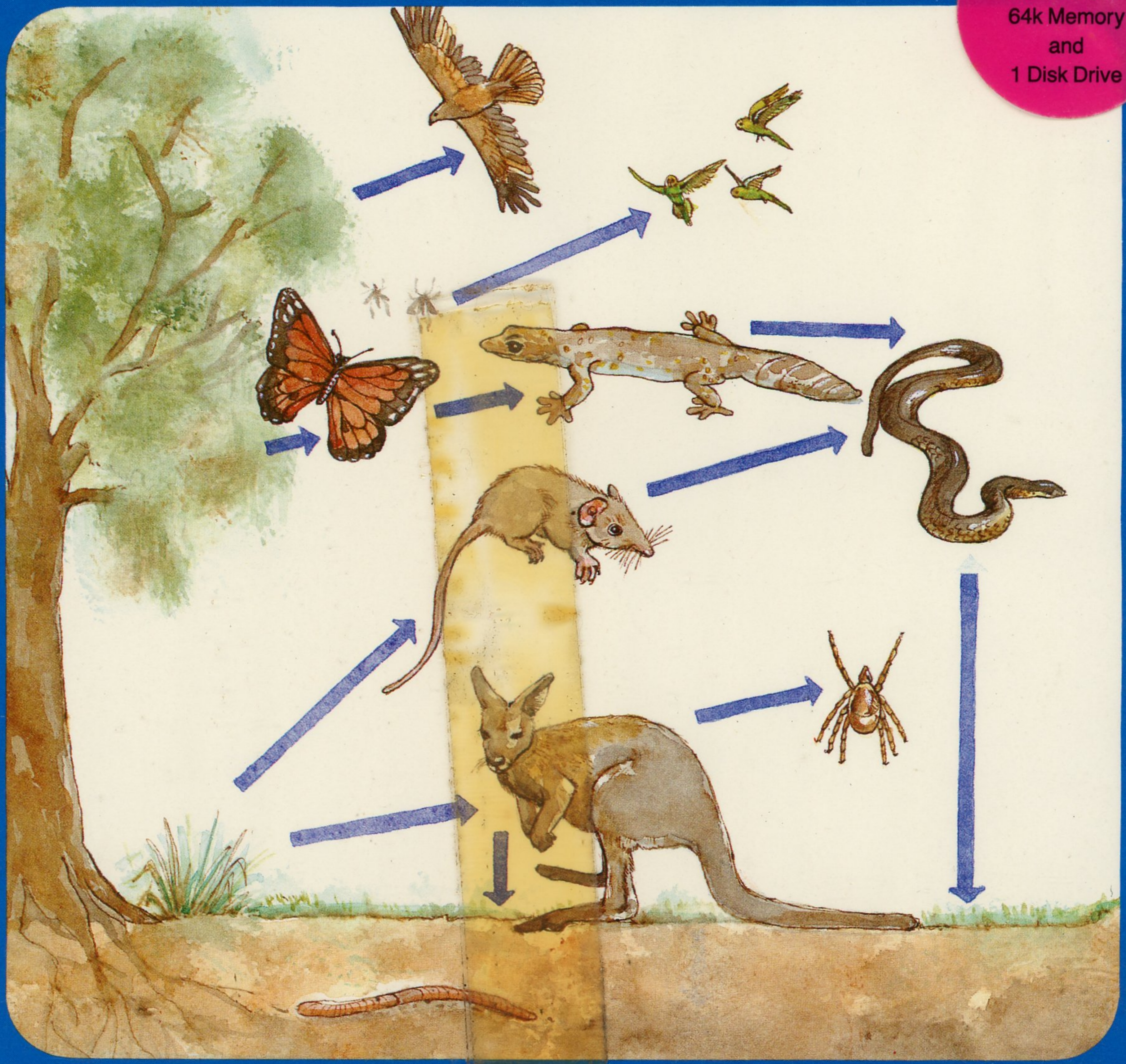
Recommended
for use in schools by
the Education Department
of Victoria

PRÖLOGIC.

Woodland Foodwebs

An investigation into Australian
animal interactions

Apple //e //c
Version requires
64k Memory
and
1 Disk Drive



Woodland Foodwebs

An investigation into Australian animal interactions

This program allows the student to construct a foodweb using Australian animals, and to investigate their interaction over a fifteen-year period.

The student can also simulate the introduction of foreign species, as well as noting the effects of drought on the ecosystem. The changing nature of ecosystems and the impact of exotic animals are highlighted.

The accompanying guide book includes worksheets which provide a variety of exercises.

Used in Science, Biology and Environmental Studies.

This program is available for Apple II+, IIc and IIe computers.

Age 12—17

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ISBN 0 949159 72 7

Woodland Foodwebs

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WOODLAND FOODWEBS

Version 1.01

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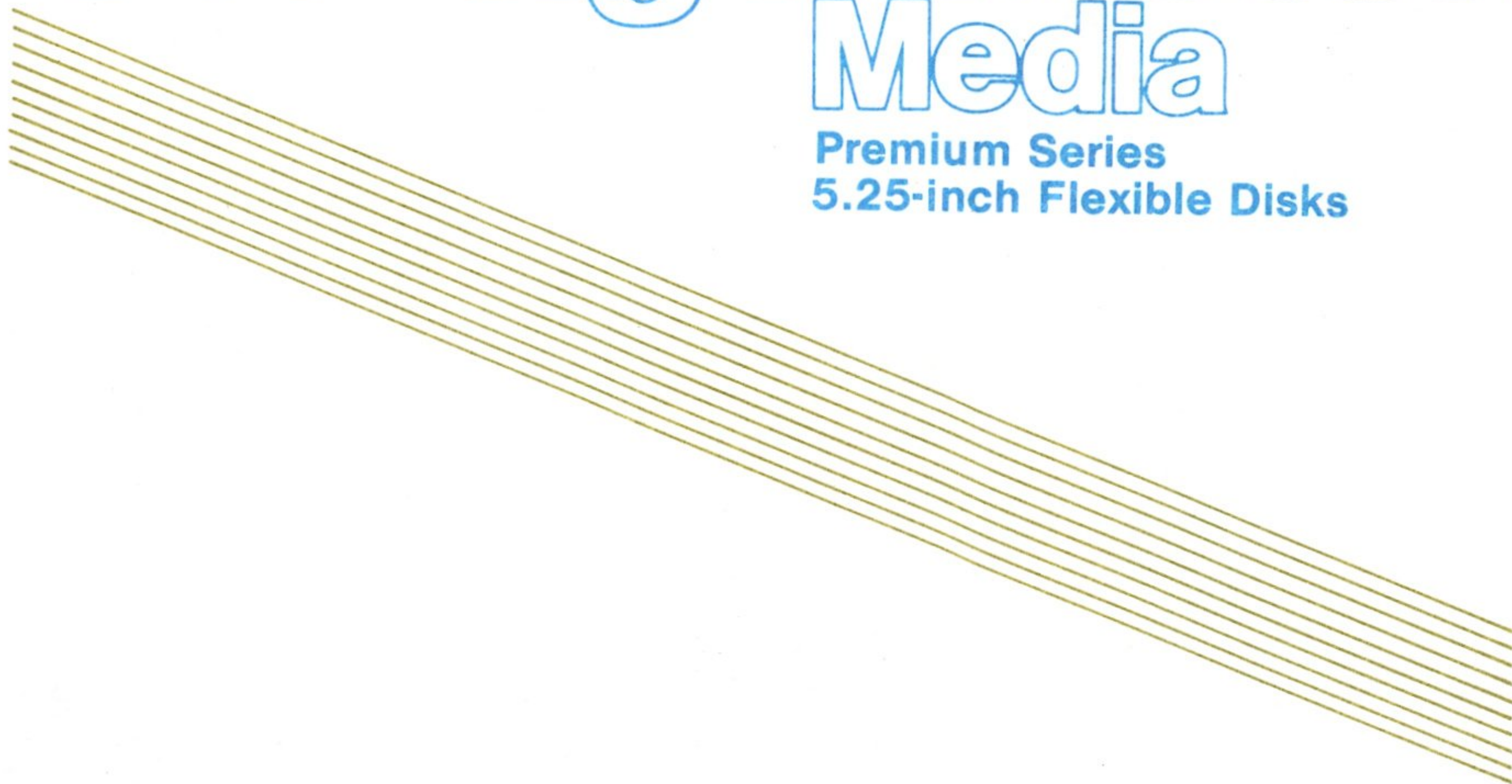
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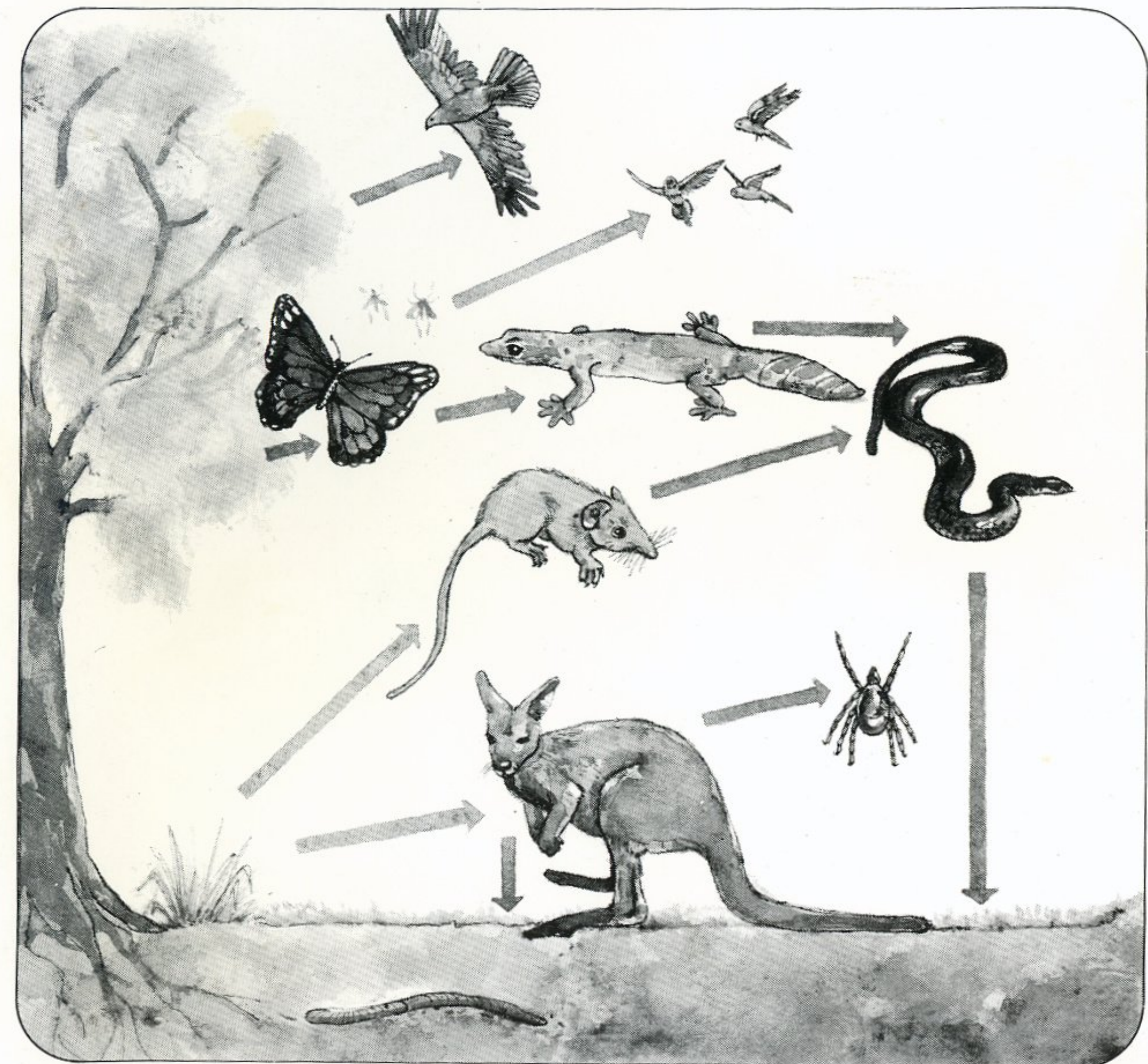
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Woodland Foodwebs

An investigation into Australian animal interactions



Woodland Foodwebs

An investigation into Australian
animal interaction

A Simulation Program by
Brian Sharpley

Programmed by
Geoff Illing

For Apple II, IIe and IIc computers

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First published in 1985
Designed by Lauren Statham and Stanley Wong
Set in 10/12 Helvetica
Printed by

National Library of Australia
Cataloguing-in-Publication data

Sharpley, Brian.
Woodland foodwebs.

ISBN 0 949159 72 7.

1. Animal ecology — Australia — Computer programs — Juvenile literature. I. Illing, Geoff. II. Title.

591.52'4'0285425

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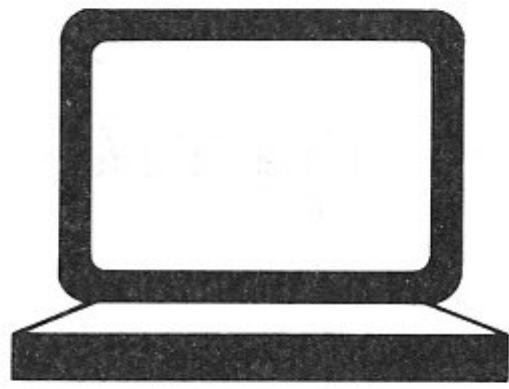
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Teacher's guide



Introduction

Description

This program has been designed for use by teachers as one source of activities in teaching about animals and ecology. It is not a tutorial. Students are expected to know how to draw foodwebs and to have some knowledge of the following concepts:

predator/prey;
ecosystem;
competition;
introduced or exotic species;
food chain/web;
carnivore/herbivore;
producers/consumers.

References are found at the end of this document.

The program simulates an Australian animal community. It demonstrates the dynamic nature of ecosystems and the dramatic effect of introduced species on indigenous species.

Information is provided on a number of Australian animals found in a woodland habitat in south-east Australia. Students may select any of these animals to form a community.

They are able to draw up a foodweb on the screen and by doing so to indicate the relationships that exist between the animals. These relationships are then modelled and the student has a dynamic ecosystem to study.

The population of each species in the ecosystem is calculated for each season and students can investigate the population changes over a fifteen-year period.

The ecosystem can be put through drought conditions and exotic species can be introduced. Changes to the native animal populations can be investigated.

Level

The program is designed for junior and intermediate science classes. However, it was also successfully trialled at senior levels.

Objectives

This computer program will encourage students to:

- read about Australian native animals;
- practise constructing foodwebs;
- investigate a simulated ecosystem and the relationships which exist between the animals that make up the ecosystem;
- recognise the changing nature of ecosystems throughout the year and during stressful periods such as droughts;
- recognise and analyse the changes that occur in a natural ecosystem with the introduction of exotic species.

Hardware requirements

An Apple computer with a minimum 64K RAM, disk drive and a monitor.

A printer is optional.




About the program

The program consists of six major parts.

- 1 The introduction is a reading exercise and gives some background to the program.
- 2 A graphic medium to draw foodwebs.
- 3 The simulation, which models the community formed by the foodweb construction.
- 4 A table of animal populations, showing seasonal changes.
- 5 A graphical output of animal populations over time.
- 6 A reading section on introduced animals.

Students are able to move about in the program by selecting options on four menus.

This program has been designed to give maximum flexibility to the user with a minimum number of controls. As a consequence, the program will allow students to model a null foodweb.

The program is self-contained and the user can work through it without referring to the documentation. When drawing the foodweb, a help file may be called up by pressing the  key.



Teaching ideas

Preplanning

A discussion of the animals found in the woodland habitat would be beneficial, as would slides and/or films showing what they look like and some of their habits.

Excursions to the Zoo or to a wildlife sanctuary would give the students a good understanding of the animals in the community.

The construction of the foodwebs requires some knowledge of using the cursor control keys and it would be useful to demonstrate them beforehand, especially with junior groups.

Classroom strategies

This program has been developed in such a way as to give maximum flexibility to the user.

The dynamic nature of the simulation and the structure of the program allows students to work through the program as a single experiment into foodwebs and ecosystems. This approach would be suitable for junior or intermediate classes. Alternatively, the students can use the program to investigate various aspects of ecology such as carrying capacity, population growth, predator-prey relations, competition, niches and the introduction of exotic species. Thus the program can be used as an assignment on an Australian animal community or for experiments in ecology.

The program generates data that can be investigated and analysed by the student under experimental conditions. The teacher may direct the research by suggesting certain combinations of animal or may leave it as open-ended investigation. The included worksheets may be used as experiments or as a guide to investigation.

As a final exercise, it would be useful to discuss the role of models in helping to explain the world around us. The foodweb simulation and its ability to reflect reality could be analysed and its limitations discussed.

Classroom management

This depends on the number of computers available. If only one or a few computers are available it would be best to use the program as part of a wider range of activities for students. Those lucky enough to have a computer centre can permit a more open-ended approach.



The simulation model

How does it work?

To survive in any ecosystem species must sustain a viable population. To do this, they need to have sufficient food, to avoid predators and to reproduce in sufficient numbers.

The program simulates this by assigning to each animal in the ecosystem values for reproduction, appetite, food value, optimum population and ferocity.

The foodweb is based upon four food sources which also have a population and a reproduction rate. The computer has a knowledge of the animals' preferences and computes accordingly. Thus competition for food resources occurs.

At the start of a foodweb, each species is assigned a population and for each season the new populations are assessed as follows.

The food sources at each level of the foodweb, and the requirements of each species are calculated (population \times appetite). If the food supply is scarce, each species receives an amount of food proportional to its food requirement and ferocity. The population of each species is then adjusted.

The populations of the species for that season are shown on the screen. It should be noted that the simulation would be more accurate if the above process was repeated a number of times for each season, however this would involve an unacceptable time delay between seasons.

How realistic is the simulation?

The relative abundance of animals, birth rates, food requirements, predator–prey relationships and the relative competitiveness of animals is documented to some extent, as is the introduction and impact of exotic animals. However, research into Australian communities is limited and there are few comparative studies into animal populations on which to base the simulation development. The simulation should not be seen as a perfect model of reality; rather, it reflects a few aspects, which enable students to gain some insight into the dynamic nature of animal communities and the changes brought about by the introduction of non-native animals into Australia.

The relative abundance of the higher-order animals, compared to the lower-order animals, has been increased in the simulation. This was necessary to give the simulation enough stability and to avoid high animal population levels, which complicate the recording process.

Theoretical situations can be created, such as a predator–prey food-web that clearly could not exist in nature. The simulation uses a closed-system approach and ignores the complex relationships which actually exist between the biotic and abiotic aspects of the environment.

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Student's activities and notes



Tutorial

This tutorial will help you understand how to use this program. It tells you how to use the menus to move about the program and the graphics to draw the foodwebs.

The boxed instructions tell you what to do.

PLACE THE DISK INTO THE DRIVE AND TURN ON THE COMPUTER.

The program will start automatically.

The flow of the program is controlled by four 'menus'. Each menu gives you several options, and you select the one you want by keying in the number of your choice. This gives you a great deal of control over the program.

After the introduction frames, Menu 1 appears, as follows:

Do you want to:

- 1 Read the introduction?
- 2 Construct a foodweb?

Use the space bar or type the number of your selection, then press <RETURN>

How to select from Menu 1

PRESS THE KEYS **1** AND **2** AND THE **SPACE BAR**

This moves the selector through the menu and allows you to highlight your choice. The choice is registered by pressing the **RETURN** key.

TYPE IN **1** AND PRESS THE **RETURN** KEY.

READ THE INTRODUCTION. USE THE **RETURN** KEY TO MOVE TO THE NEXT FRAME.

The foodweb construction

The graphics for drawing the foodweb are automatically loaded after the introduction is completed.

The screen appears as follows.

INSECTS

LEAVES


SEEDS/ROOTS


GRASSES



<?> - help <return> - menu

lines: <1> start <2> end <3> delete

<delete> or <-> remove animal



If you need help in drawing a foodweb press the  key.

PRESS THE  KEY AND READ THE HELP FILE

The white square on the screen is called the cursor. It can be moved around the screen by pressing the arrow keys or  and  keys.




PRESS THE KEYS AND MOVE THE CURSOR AROUND THE SCREEN.

Drawing a foodweb



PLACE THE CURSOR ABOVE THE GRASSES.
TYPE IN THE FIRST FEW LETTERS OF WALLABY.
PRESS  KEY. THIS HIGHLIGHTS THE WALLABY. MOVE TO THE GRASSES AND PRESS .

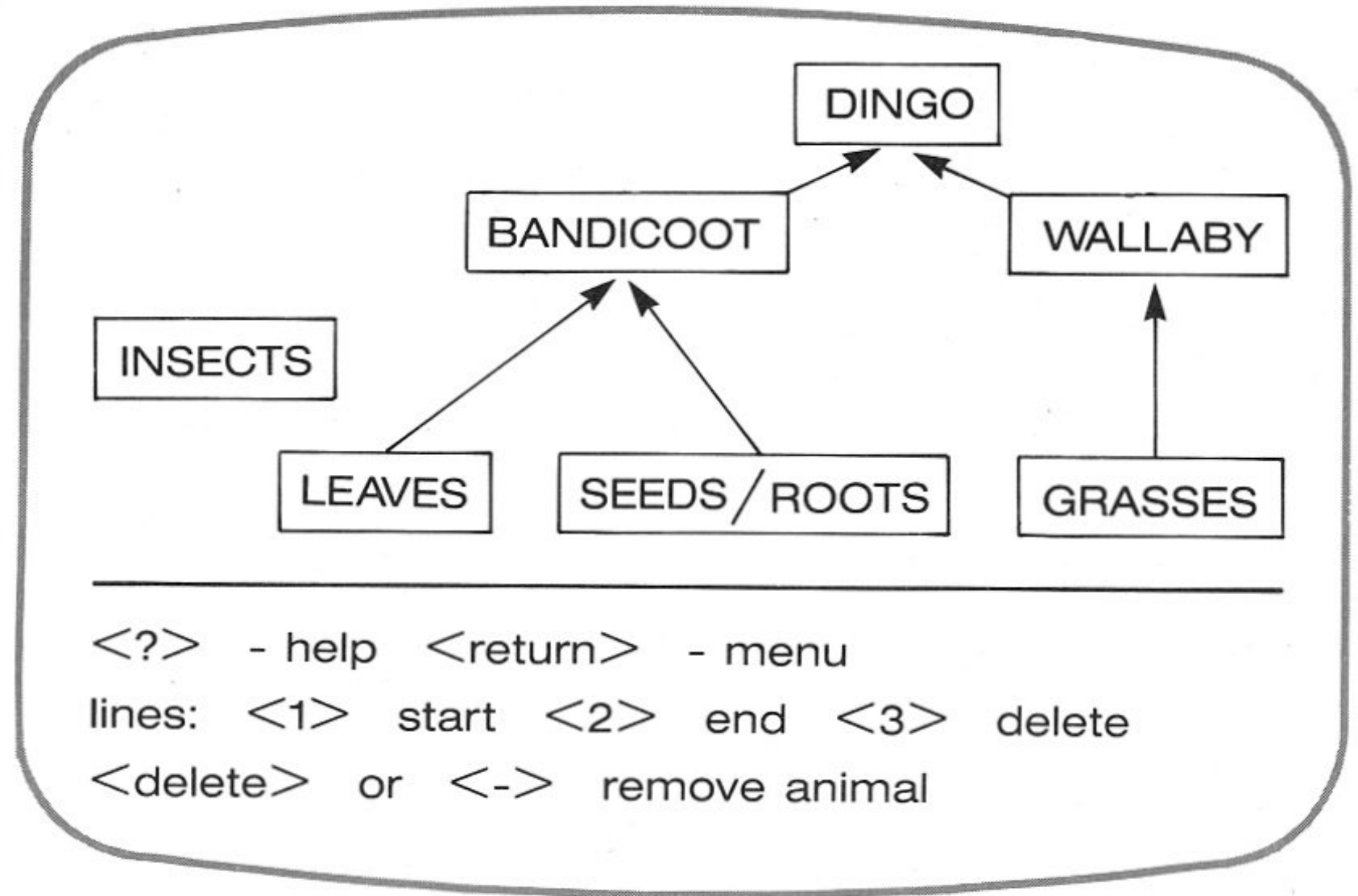
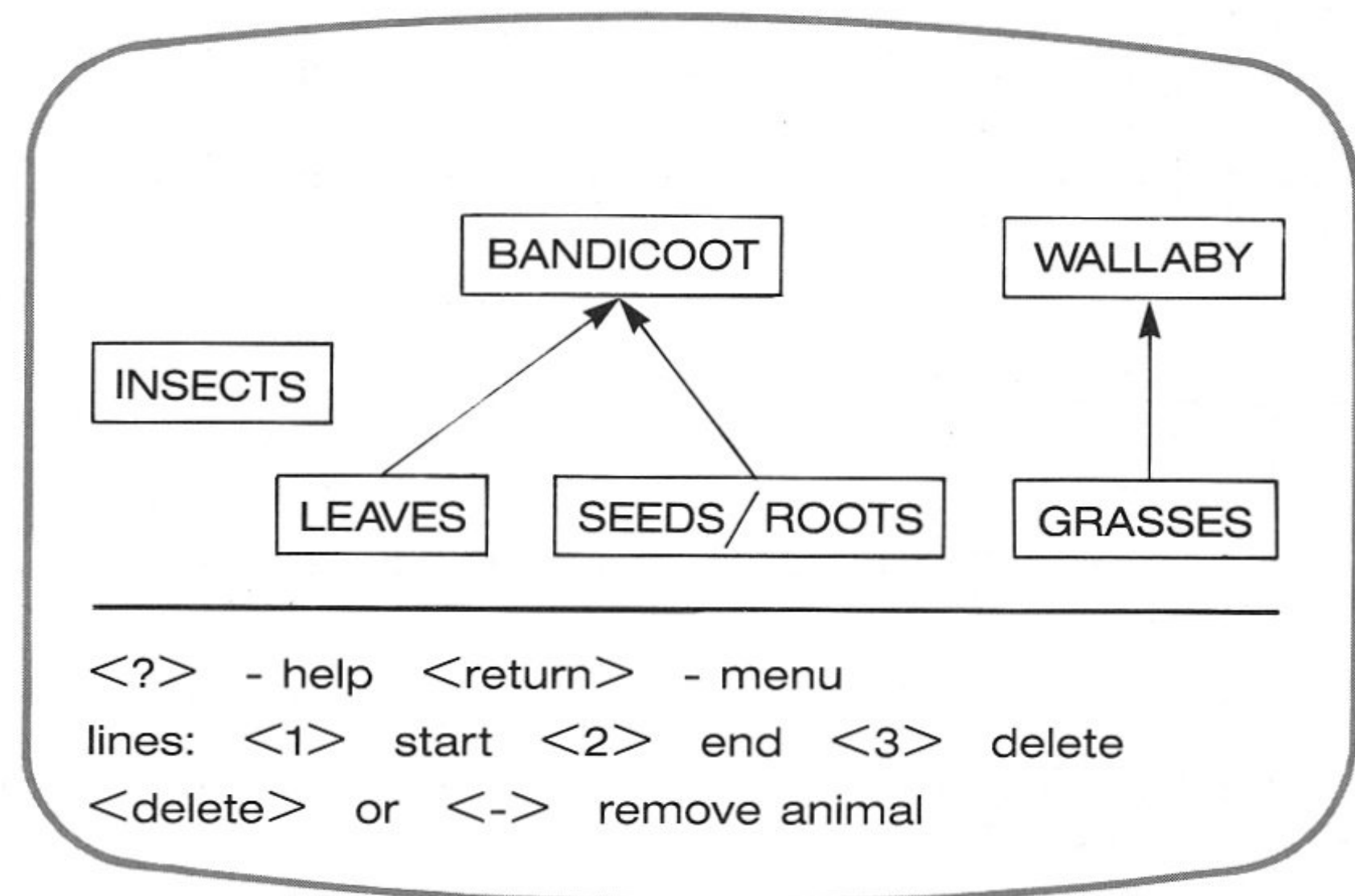
MOVE THE CURSOR TO THE RIGHT AND REPEAT USING THE BANDICOOT AND THE LEAVES, SEEDS AND ROOTS FOOD SOURCE.

The screen appears as opposite (top).

MOVE THE CURSOR ABOVE THE WALLABY AND BANDICOOT AND TYPE IN THE FIRST FEW LETTERS OF DINGO.
PRESS  KEY, MOVE TO THE WALLABY AND PRESS  KEY, MOVE TO THE BANDICOOT AND PRESS THE  KEY.

The screen appears as opposite (bottom).

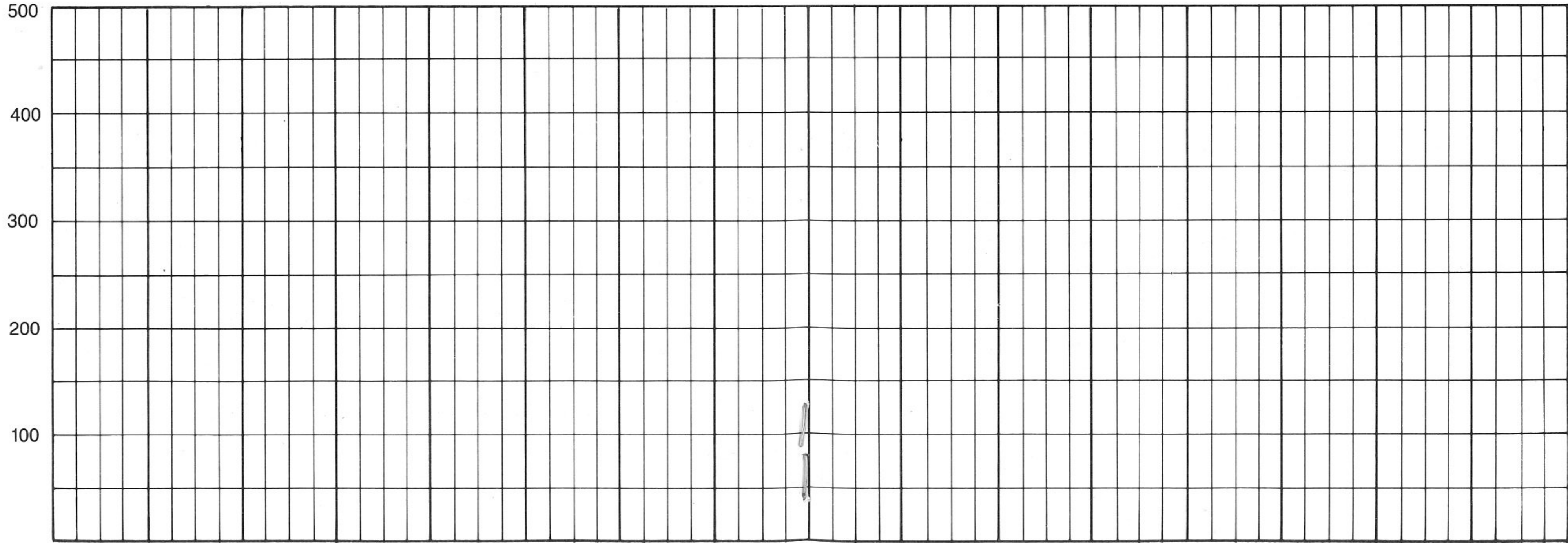
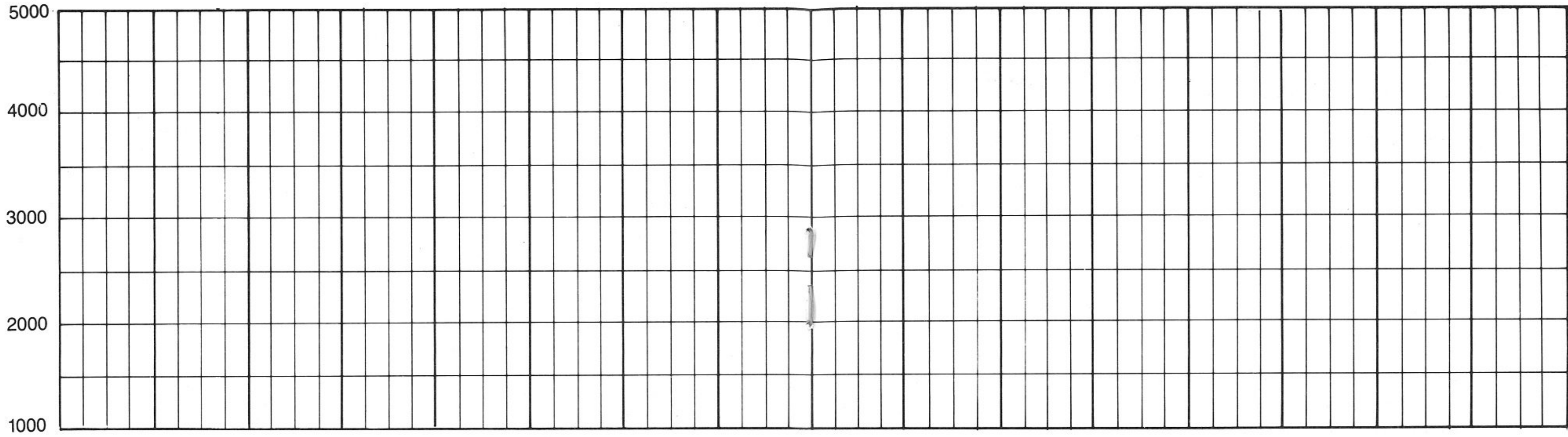
To delete an animal, move the cursor to that animal and press the  or  keys.



Continued on p.14.

Student Name(s) _____

Population



S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W S S A W

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Years (divided into four seasons)

TO MODEL YOUR COMMUNITY, PRESS  KEY.
THIS WILL MOVE YOU INTO MENU 2.

The screen appears as follows:

Do you want to:

- 1 Read comments about your foodweb;
- 2 Start modelling your foodweb;
- 3 Return to foodweb construction;
- 4 Start a new foodweb;
- 5 Restart the program.

Make your selection, then press <RETURN>

CHOOSE OPTION 1 AND READ COMMENTS ABOUT YOUR
FOODWEB AND THEN OPTION 2 AND START MODELLING
YOUR FOODWEB.

You are now on your own.

EXPLORE THE PROGRAM FULLY BY MOVING THROUGH
THE MENUS.



Student information sheet

Australian animals

The animals that can be included in your foodweb are all found in the woodlands of south-east Australia. This habitat is the transition stage between the open plains of the interior and the wetter coastal forests.

The woodlands are dominated by eucalypts and contain many of Australia's best-known animals.

Antechinus

The antechinus at first sight looks similar to a house mouse, however it is carnivorous and can be distinguished by its sharp tearing teeth.

It builds nests in tree hollows and wood piles and eats insects and other small animals.

Its major predators include tiger cats, feral cats, foxes, owls, dingoes, eagles, goannas and the brown tree snake.



Bandicoot

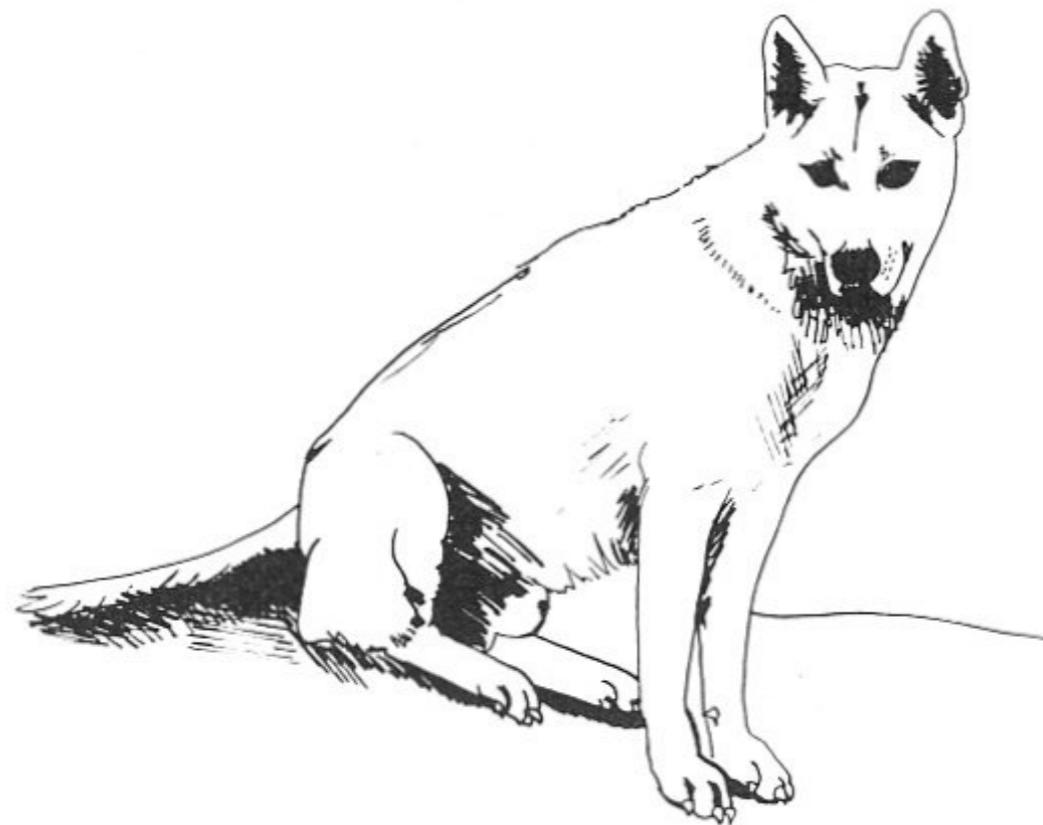
There are about twenty species of bandicoot, ranging in size from a rat to a rabbit. The bandicoot is quick moving, has a sensitive pointed nose and alert bright eyes.

The bandicoot is nocturnal and sleeps in grass nests and tunnels. Its diet consists of insects, grubs, roots and other vegetation. Its major predators are foxes, snakes, feral cats, eagles, owls and dingoes.



Dingoes

The dingo is believed to have been brought to Australia by Aboriginals between 7000 and 10 000 years ago.



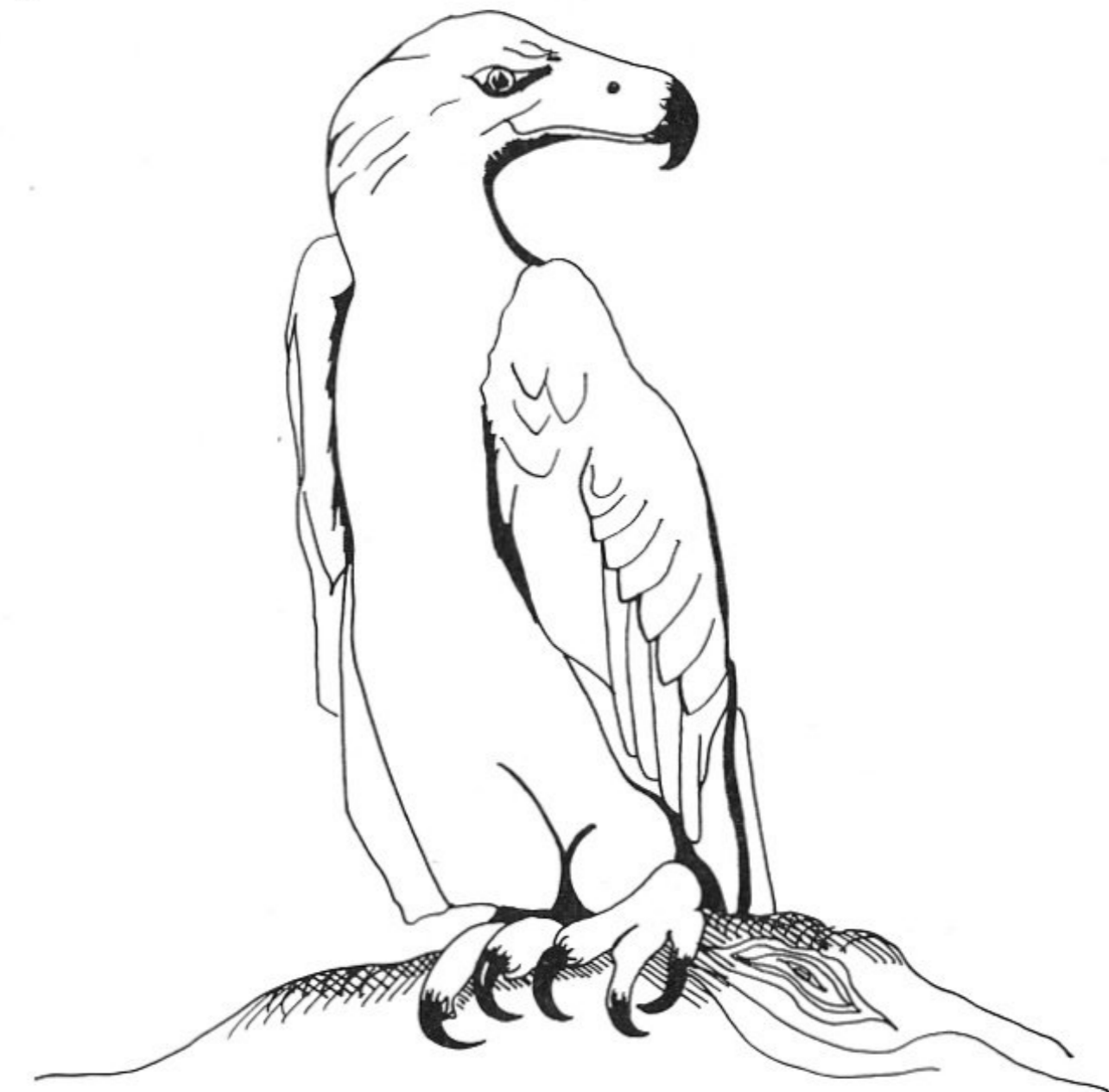
The dingo is the same species as the domestic dog and they can interbreed. The dingo, however, has a larger skull and larger teeth. It also breeds only once a year, as against the domestic dog, which breeds twice a year.

The dingo's standard prey consists of the middle-sized animals such as possums, bandicoots, rabbits, rodents, tiger cats, feral cats, lizards and antechinuses, supplemented, if necessary, by the larger animals such as kangaroos, wombats and wallabies.

Eagles

The wedge-tailed eagle is a huge bird with an average wing span of 2.5 m and a beak-to-tail measurement of about 1 m.

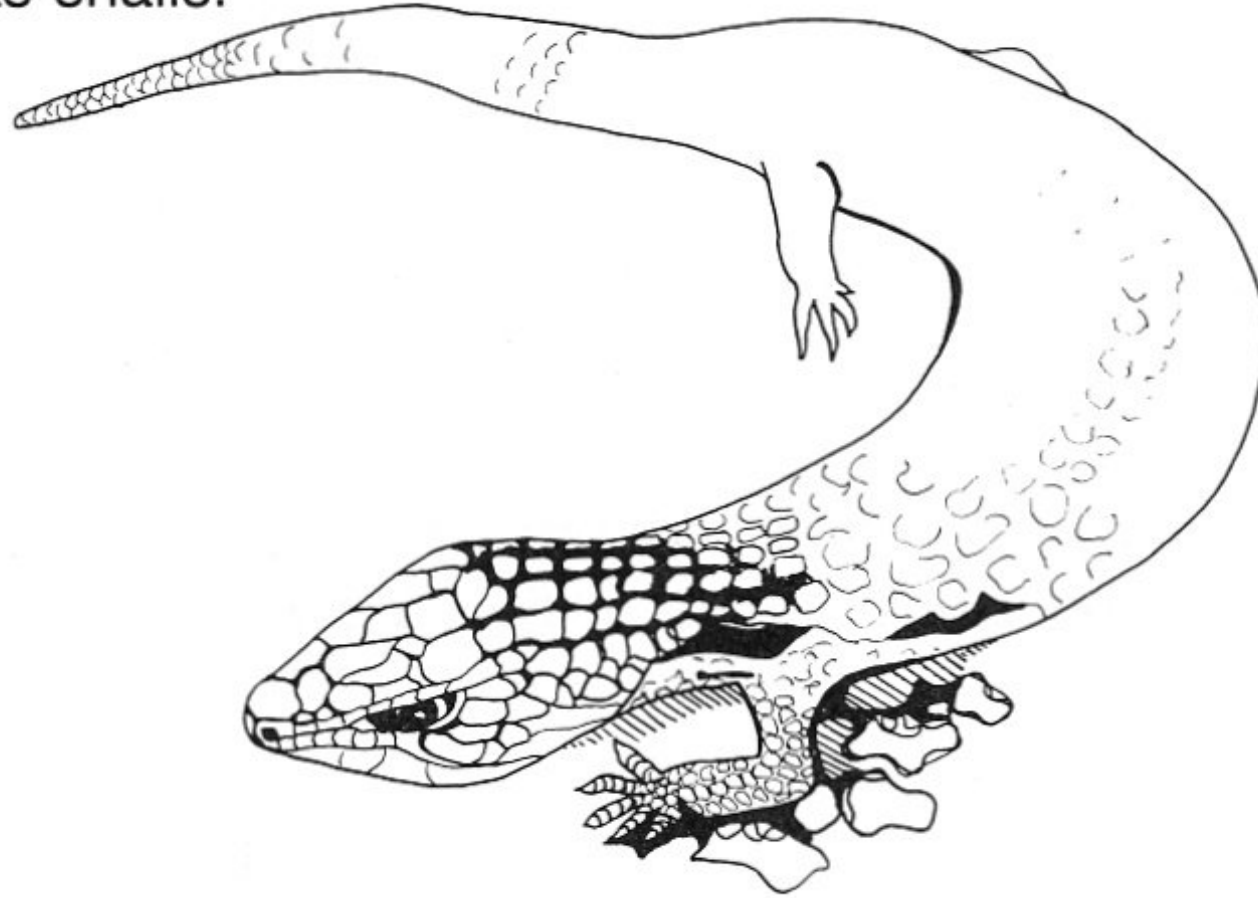
The eagle's nest is usually high in a tree, often on ridges or rocky slopes. It eats bandicoots, wallabies, kangaroos, possums, reptiles, birds, rabbits, foxes, goats and cats. As it is at the top of the foodweb, it is susceptible to the accumulation of pesticides in its prey.



Lizard, bluetongue

The bluetongue lizard belongs to the skink family of lizards and can reach 60 cm in length. It is powerfully built, but its legs and feet are small compared with its thick body, large head, and flat tail.

The bluetongue will eat almost any type of vegetable matter, including fruit and berries, as well as insects and other small animals such as snails.



Possum



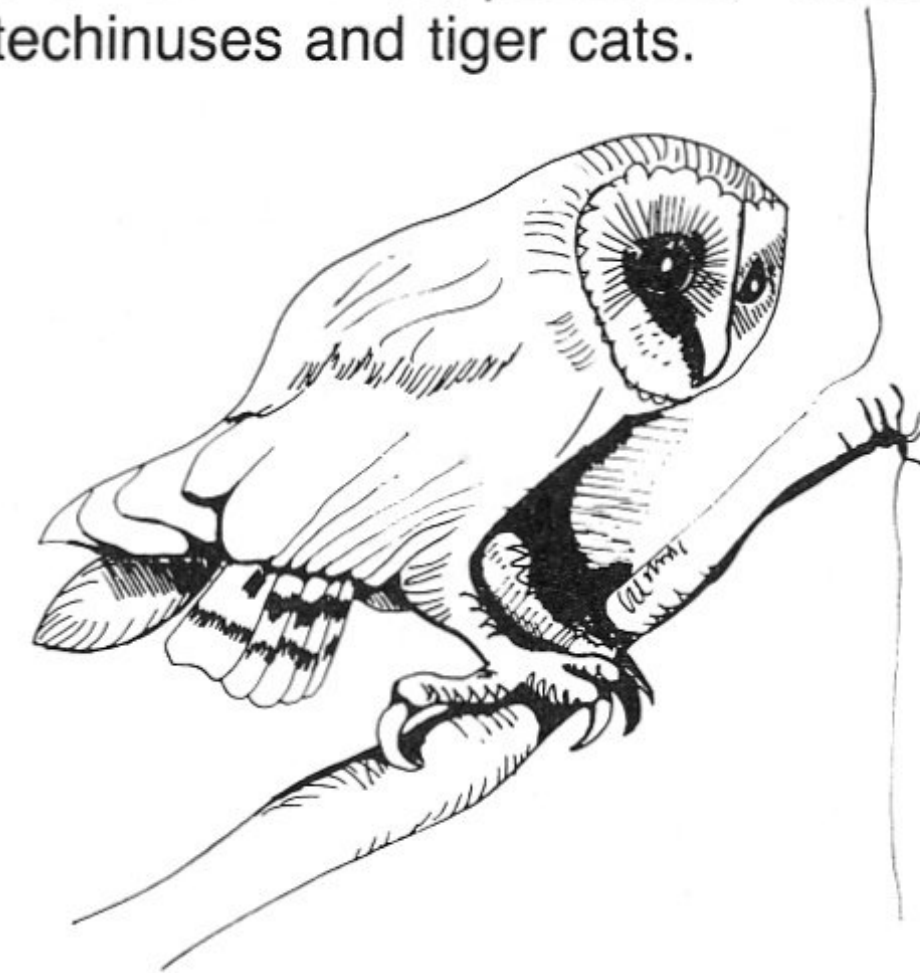
The possum is the most successful of the Australian marsupials in number. It can be found in both city and country areas. The ring-tail and the brush-tail are the most common types of possum.

It eats leaves, shoots, berries and also insects. Its major predators include the powerful owl, feral cats, goannas and dingoes.

Owl

The owl is well adapted for night hunting in forests. Its feather and wing structure deadens any flight sound, its feet are adapted for seizing prey and its eyes are large and adapted for binocular vision. Its ears are not symmetrically placed and can immediately pinpoint its prey.

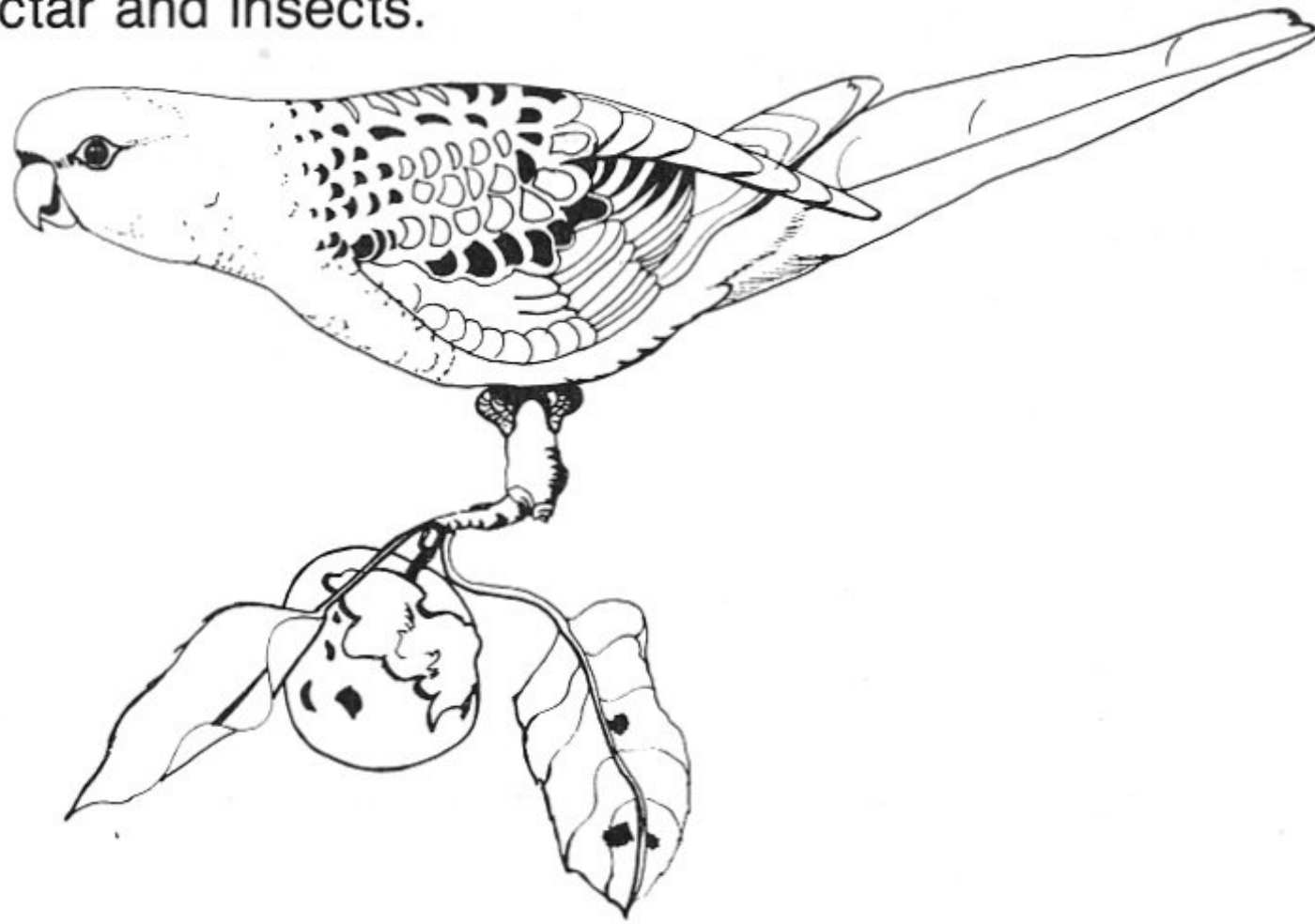
The owl feeds on small birds, possums, rabbits, bandicoots, feral cats, antechinuses and tiger cats.



Rosella

The crimson rosella is one of the best-known Australian parrots. The name comes from the fact that the adult birds are mainly reddish in colour with blue on the wings and the tail, and have ear patches of bright blue.

The crimson rosella eats fruits and seeds of many kinds, as well as nectar and insects.



Tiger cat

Named by the first white settlers, this animal only superficially resembles the domestic cat.

The tiger cat is a marsupial and is related to the antechinus and the Tasmanian tiger. It grows to 1 m in length and weighs between 4 and 5 kg.

It lives in caves and hollow trees and kills small wallabies, large birds, rabbits, rodents, insects and antechinuses. Its enemies include feral cats, dingoes and foxes.



Wallaby

The major difference between the kangaroo and the wallaby is in size. The data for this program was based upon the red-necked wallaby.

The male can reach a weight of 22 kg and the female 13 kg. It is a grass and leaf-eater and has a well-developed pouch in which the young, called a joey, is carried.

Its major enemies are wedge-tailed eagles, dingoes and foxes.



Wombat



The common wombat is a lumbering, bear-like creature which feeds on herbs, roots and the inner bark of trees.

It is very compact, weighing up to 35 kg, although rarely 1 m long. The wombat is a solitary animal and has few enemies, apart from man.

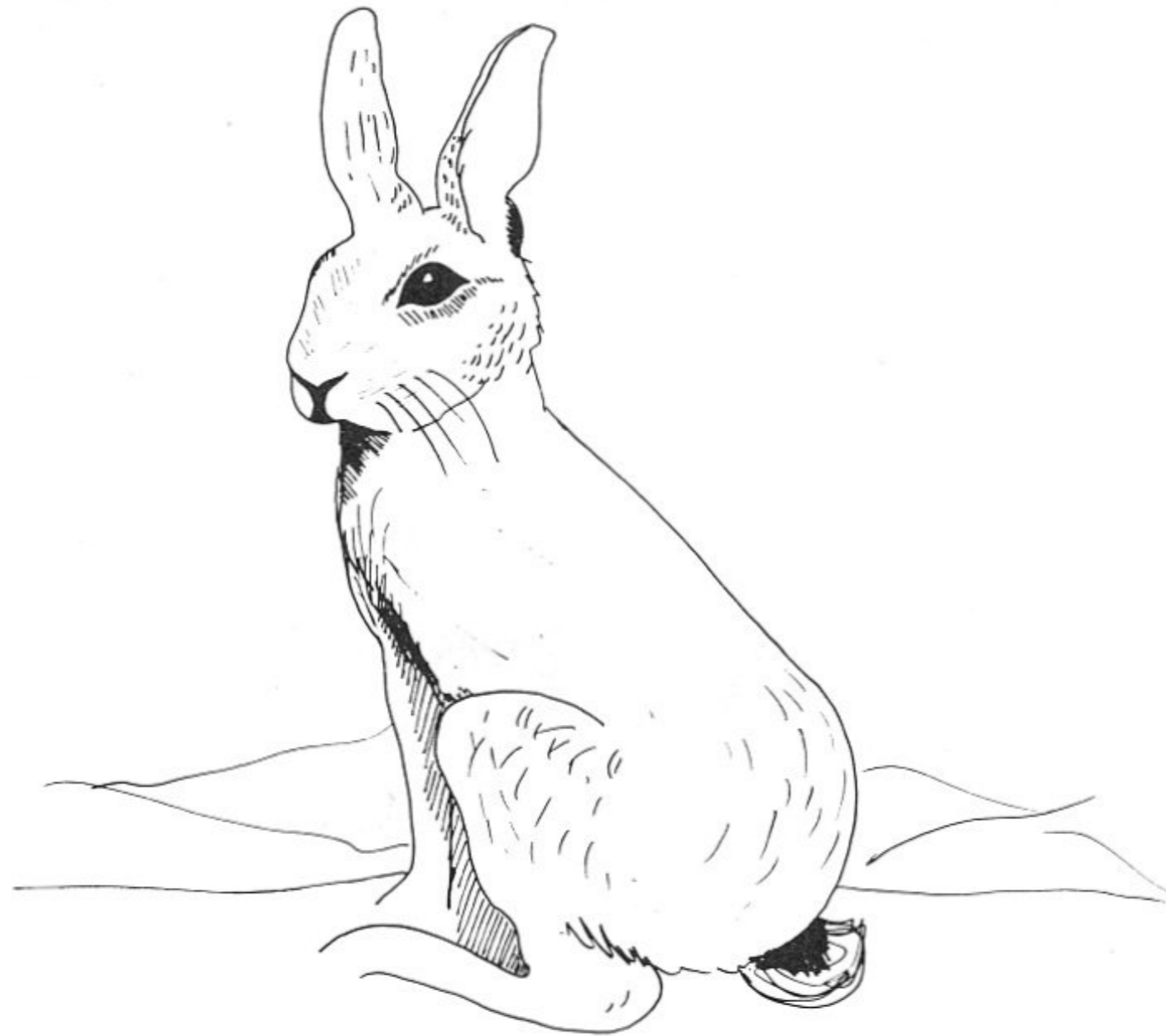
Introduced animals

Rabbit

Attempts were made to establish the rabbit in Australia soon after European settlement. Five domestic rabbits were listed amongst the livestock brought by the First Fleet in 1788.

In 1859 about twenty-four rabbits were brought into Victoria and released at Barwon Park near Geelong. These rabbits became well established.

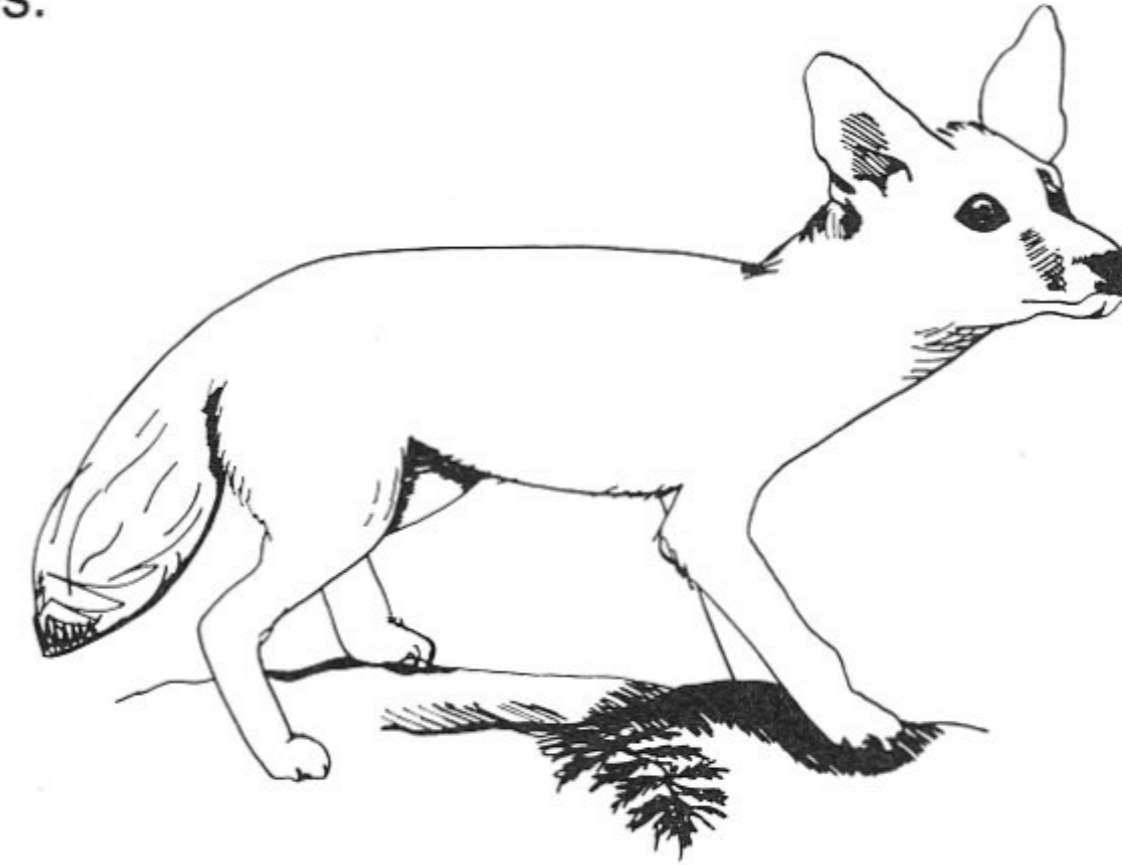
Rabbits are now found throughout Australia, south of the tropic of Capricorn. They feed on soft green grasses and are eaten by foxes, feral cats, dingoes, eagles and goannas.



Fox

The fox was introduced into Australia in the 1860s and 1870s. The majority were released near Melbourne to provide sport for gentlemen. It has now spread over 60 per cent of the continent.

The fox can eat a wide range of foods, including rabbits, wallabies, possums, lizards, bandicoots and antechinuses. During summer the fox will eat large numbers of insects and berries.



Feral cat

Cats were brought to Australia as pets and some were released into the wild.



A feral cat is best described as a cat which obtains its own food by hunting and scavenging. Cats are extremely efficient hunters and excellent climbers, enabling them to reach many animal species.

They prey upon rabbits, possums, bandicoots, tiger cats, antechinuses, birds, mice, lizards and frogs.



Worksheets

Worksheet 1 Studying a community of Australian animals

In this activity you will read about some Australian animals and then construct a foodweb using some of these animals.

The foodweb you draw will define a community, which you can then investigate.

Constructing a foodweb

To construct your foodweb you need to work in groups of five or more.

Read through the notes on Australian animals and then each student in the group should choose one animal.

Draw up a foodweb containing these animals, using the following food sources.

1


INSECTS

LEAVES

SEEDS/ROOTS

GRASSES

Turn on your computer and read the introduction.

Now type your foodweb onto the screen. You will need to read through the notes on how to construct a foodweb or press the  key on the computer for help.

Once you have completed your construction, press the **ESC** key and then read the comments about your foodweb.

Make sure your foodweb is correct.

2 List your animals under the following headings:

| <i>Producers</i> | <i>First-order consumers</i> | <i>Second-order consumers</i> | <i>Third-order consumers</i> |
|------------------|------------------------------|-------------------------------|------------------------------|
| | | | |

- 3 Which animal would you expect to have the greatest population?
- 4 Which animal would you expect to have the smallest population? Now model your foodweb for five years.
- 5 Carefully plot the population of your animal on the graph paper supplied (see centre of book). How does the population of your animal change over one year?
- 6 Compare your answer to question 5 with others in your group. Do they all have the same pattern? Explain any differences.
- 7 What happens to the population of your animal over the five years?
- 8 Is this the same pattern for all animals in your foodweb?
- 9 Can you suggest reasons for the different patterns?
- 10 Return to questions 3 and 4. Were your answers correct?

11 Take the figures of any season in the fifth year and complete the following table.

| | <i>Animal</i> | <i>Population</i> |
|------------------------|---------------|-------------------|
| First-order consumers | | |
| Second-order consumers | | |
| Highest consumers | | |

Can you draw any conclusion from this table?

Worksheet 2 Introducing an exotic animal

In this activity you can add an introduced animal to your foodweb and investigate the changes that take place.

Read through the section on introduced animals, then choose an exotic animal.

1 What animal are you going to introduce?

Include this animal in your foodweb and check the comments.

Model your foodweb for another five years and plot the population of your animal and the introduced animal on your graph.


- 2 Have there been any changes in the population graph of your animal?
- 3 What changes have occurred in your foodweb?
- 4 Explain what has happened.
- 5 Can you suggest why so many introduced species have flourished in Australian conditions?

- 6 Can you suggest methods of reducing the numbers of introduced animals?
- 7 Why do you think exotic animals were brought into Australia?

Worksheet 3 Investigating the dynamics of an Australian animal community

The animals that you may include in your community can all be found in the woodland habitat of south-eastern Australia.

A description of these animals can be found in your notes.

Start up the computer and work through the introduction until you are at the foodweb construction. To work out how to use the foodweb, read the foodweb construction sheet or press the  key on the computer.

Enter the wallaby and the possum into the diagram.

Run the model for four years and plot the population figures on graph paper.

- 1 During which season(s) do these animals reproduce?
- 2 How many offspring do they have per year?
- 3 Carefully describe what has happened to the population during the four years. Can you explain why this might happen?
Return to the foodweb construction and add a dingo to the community. Run the model for another four years and plot the figures.
- 4 Describe what is happening to the dingo and possum populations.
- 5 What factors are influencing the wallaby population?

- 6 Does the system reach equilibrium? Is it a static or dynamic situation?
Read through the section on introduced animals. Add a rabbit to your foodweb and model it for four years.
- 7 Describe what is happening to the population of the four animals.
- 8 Can you explain what is happening?
- 9 What would you expect to happen in an area where rabbits are introduced?
Start a new foodweb. Include the antechinus, bandicoot, tiger cat and eagle. Run the model for five years and plot the population figures.
- 10 Can you form hypotheses concerning:
 - a the position in the foodweb and the stability of the population?
 - b the position in the foodweb and the size of the population?
- 11 Can you think of any other factors which might influence your answer to question 10?
Return to the foodweb construction and include a feral cat.
- 12 Describe any changes that may occur.
- 13 Does the foodweb reach equilibrium?
- 14 Which animal(s) in your foodweb could be endangered by the releasing of cats into the wild?
- 15 Why were exotic animals introduced into Australia?
- 16 Can you suggest reasons why many introduced animals flourish in Australian conditions?
- 17 A hunting club applies to the Federal Government for permission to introduce South African deer into Australia for sporting purposes.

If you were involved in making the decision what information would you require when considering the application?

Would you allow the introduction of this animal? Explain your answer.

- 18** Built up a foodweb of your own design. Check it for accuracy.

Model it for five years and then add exotic animals. Explain as much as you can about what happens in this community.

Ecology is the study of how plants and animals relate to each other and to their environment.

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Press a key to continue



In this exercise you will construct a foodweb using Australian animals. These animals will form a community which you can investigate.

Press a key to continue