

Part 8

Pest management

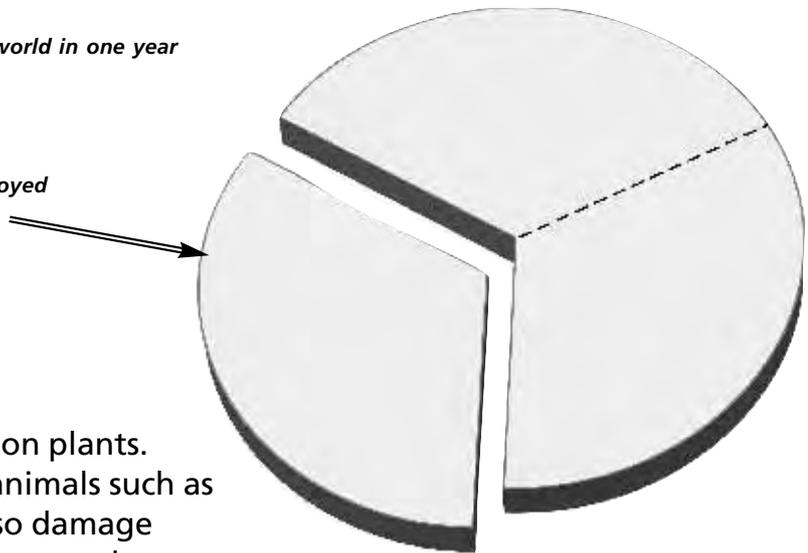
worksheet 8.1:

Controlling pests and diseases

Knowing about pests is important because pests can damage large numbers of your plants. Plants can be damaged at any stage of their growth and when they are being stored. Pests cause the loss of one-third of all the food produced in the world.

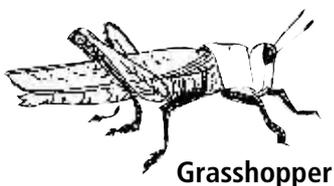
The circle shows all the food produced in the world in one year

This amount of food is destroyed by plant pests



What pests are

Plant pests are animals that feed on plants. Most pests are insects but other animals such as snails, birds, rats and monkeys also damage plants. You can easily see insect pests such as grasshoppers, beetles, aphids and caterpillars. Other pests, such as red spiders, are very small and look like specks of red soil on the back of leaves. Nematodes, which are tiny worms that attack the roots, and some types of mites are so small that you can only see them with a microscope.



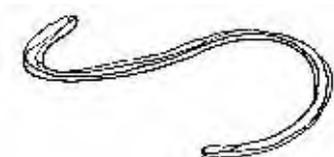
Grasshopper



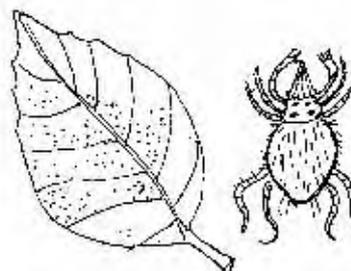
Caterpillar



Beetle



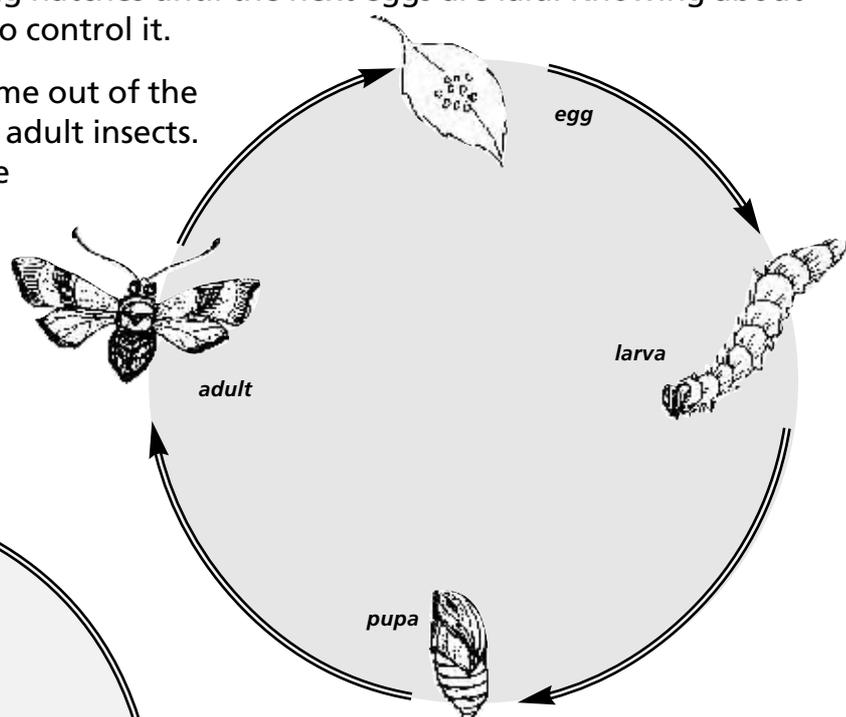
Nematode
(drawn 100 times bigger than its real size)



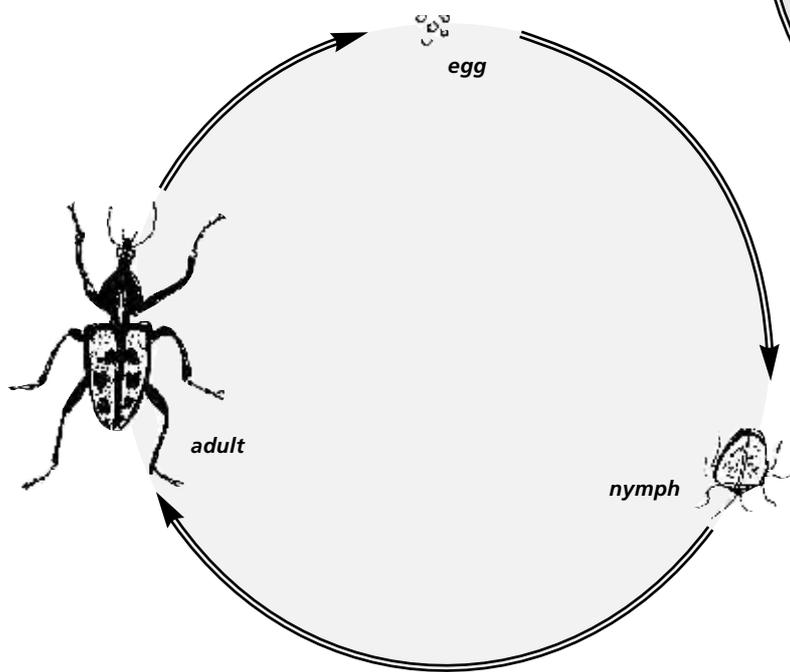
Red spider mite
(on the back of a leaf and 10 times bigger than its real size)

Insects multiply by laying eggs. They can have three or four stages in their life-cycles. A lifecycle is the time from when an egg hatches until the next eggs are laid. Knowing about the life-cycle of a pest can help you to control it.

In the four-stage life-cycle, larvae come out of the eggs. The larvae do not look like the adult insects. Once fully grown, the larvae produce pupae in which they change into adults. Examples of insects with four-stage life-cycles are moths, butterflies, flies, beetles and bees. It is usually the larvae, not the adults, that damage crops.



The four-stage life-cycle of a moth



The three-stage life-cycle of a bug

In the three-stage life-cycle, nymphs come out of the eggs. The nymphs are the same form as the adults but are smaller and softer and may be a different colour. Examples of insects with three-stage life-cycles are grasshoppers, termites, scales and bugs. By knowing the life-cycle of pests you can find out how to control them.

The damage pests cause to plants

Insects damage plants when they feed. Some pests feed on only one type of plant. For example, the larvae or caterpillars of the citrus swallowtail butterfly feed only on citrus such as oranges, lemons and naartjies. Other pests feed on many different types of plants. For example, the larvae of the mediterranean fruitfly feed on citrus, mangoes, coffee, litchis, guavas, peaches, grapes, granadillas and many other types of fruit. When you see small worms in a fruit, they are usually fruitfly larvae.

The damage that plant pests do to plants depends on the way that they feed. Insects feed in one of two ways – either they chew or they suck.

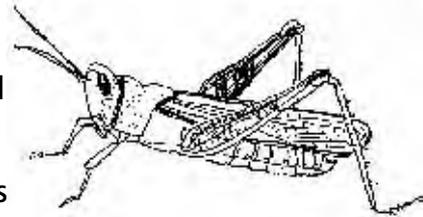
The types of damage that chewing and sucking insects cause are given below. Reading this will help you to know about the types of damage that pests cause. You can use this information when you see that damage has been done to some of your plants, and you want to find out what is causing the damage.

Chewing insects

Insects which chew damage plants in the following ways:

Chew large holes in the leaves.

For example, many different types of beetles, grasshoppers and caterpillars



grasshopper (different sizes)



beetle (different sizes)

Chew along the surface or into the fruit.

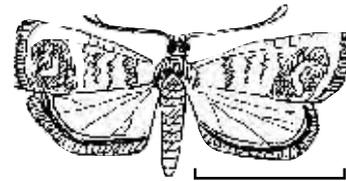
For example, bollworms and leaf roller caterpillars



caterpillar (different sizes)

Some types of insects lay their eggs into fruit. The larvae which come out of the eggs then chew on the fruit.

For example, fruitflies and codling moths



codling moth



fruitfly

Chew or bore into the wood of stems or roots.

For example, termites and woodborers

Chew through the stems of seedlings.

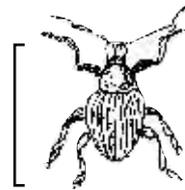
For example, cutworms



cutworm

Chew holes in seeds.

For example, weevils



woodborer - adult



weevil

Chew the flowers so that few fruit form.

For example, CMR beetles



CMR beetle

Sucking insects

Some insects suck the liquid out of leaves, buds, fruit, shoots, roots or branches.

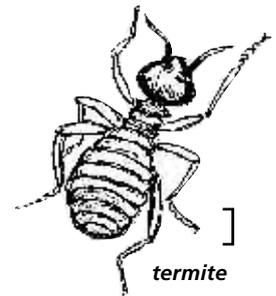
This liquid is called sap. Removing sap damages plants in the following ways:

Leaves curl.

Caused by, for example, aphids



aphid



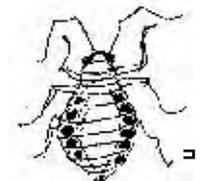
termite

Leaves or fruit are malformed or have strange shapes. This is often caused by sucking insects feeding on the leaf or flower buds.

For example, mites and stinkbugs



stinkbug



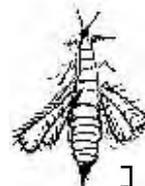
red spider mite

Leaves are mottled or covered in small yellow marks.

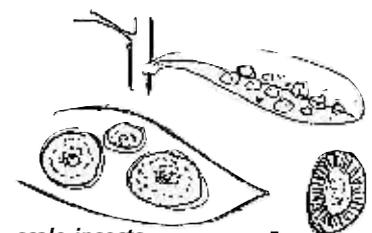
Caused by, for example, thrips and red spider mites

Shoots and branches die back.

Caused by, for example, scale insects



thrip



scale insects

Brown, soft areas on fruit.

Caused by, for example, fruit-piercing moths

Marks on the skins of fruit.

Caused by, for example, scale insects, red spider mites and thrips

The line next to the insect shows the real size of the insect

Controlling pests

Pests are living things which reproduce themselves so farmers and gardeners need to control them at all times, from before they plant the seeds until after they harvest the crop. The best way to do this control is to understand how the pest lives, behaves and reproduces. By understanding this, we can do things to stop pests from increasing in number and becoming a problem. The methods that come from this understanding are called organic control methods or integrated pest management.

Many farmers control pests by using chemical poisons called pesticides. Different pesticides kill different types of living things. There are many dangers in using pesticides for control, for the people applying them, for the environment and for the people eating the food treated with pesticides.

Activity 8.1



Group work

Think about ways to protect plants

1. In Activity 4.2 you worked in pairs to research a food chain in your home or school garden. Discuss the different food chains found by your group members.
2. Now go out into a particular area of your school garden. Your teacher will tell you which area your group should go to.
3. Look for animals. Record what you see.
4. Back in the classroom, try to work out the food chain/s these animals belong to. You may need to first do some research on diet and habitat. Write down the likely food chain.
5. Do you think that any of the animals you saw are plant pests?
6. Give a reason for your answer to Question 5.
7. Discuss this question:
How can we use food chains to control plant pests that damage our plants?
8. Write down your conclusions.
9. Do you know of any methods to protect plants from pests? List your ideas. Also write down which pests your methods could control.
10. Do you know of any methods to control weeds?
11. Choose one person to explain your group's ideas to the other learners in your class.



It looks to me like there is a link between food chains and pest control!

Integrated pest management

These methods help to prevent pest problems as well as getting rid of pests that are already there.

Keep your plants healthy

Healthy plants are attacked by fewer pests and diseases than plants that have a shortage of minerals and water. Give your plants plenty of organic matter and mulch to keep the soil wet.

Check plants for pests

Regularly check for pests on your plants. Control any pests as soon as you notice them.

Pick large pests off the plants

Pick large pests such as grasshoppers, snails and beetles off plants. If there are small numbers, stand on them. If there are large numbers of the pests, carry a bucket of water to throw them into. Feed the pests to chickens or other birds.

Wash small pests off the plants

Small pests such as aphids and mealybugs can be washed off leaves with a strong spray from a hose-pipe. These insects are seldom a problem if you use sprinkler irrigation because the spray washes the pests off the leaves.

Use crop rotation

Crop rotation means changing the plants you grow on the same piece of land. If you grow the same plant in the same place over many seasons, the pests and diseases that attack that plant will increase. If you grow different plants every season then the pests and diseases of the previous season's plants will have nothing to live on and so will die out.

Bury fallen fruit

Fruit in which eggs have been laid or in which larvae are feeding often fall off the plant. Bury this fruit or allow pigs and chickens to feed under fruit trees to stop the life-cycle of the pests.

Use home-made pesticides

You can make sprays to control certain pests. These sprays do not cause the problems that chemical pesticides cause. These sprays are still poisons and so you must use them with care. Do not make the spray too strong or to put too much on the plants as you could damage or kill the plants. There are many different types of home-made pesticides. Some of these are given below.

Buttermilk spray: 1 tablespoon buttermilk mixed with ½ cup of flour in 2 litres of water. This spray destroys adult spider mites and their eggs which are covered in the sticky mixture.

Epsom salts: Dissolve 50g Epsom salts in 4 litres of water. Spray on plants whose leaves are yellowing as if they have a virus. Such plants are suffering a magnesium deficiency. This is caused in soils where too much lime, wood ash or phosphorus has been used.

Fruit fly spray: Dissolve 1 kg of sugar in 15 litres of water. Add 1 litre of real seawater. Also add 1 litre of molasses and enough diatomaceous earth to make the mixture creamy. Spray several times when fruit fly is bad on fruit. Spray when trees are budding and flowering too. If you leave out the diatomaceous earth, this spray is good against aphids, curly leaf and codling moth.

Garlic spray: Chop 85g of garlic bulbs and add 2 tablespoons of paraffin to the garlic. Soak together for 48 hrs, and then add 800ml of water, and grate 7g of hard Sunlight soap into this mixture. Strain the mixture through gauze and store in a glass or plastic container. When you want to use it, you must dilute it 100 times. If you need 5 litres of spray: mix 50ml of the original with 5 litres of water. This is a spray that kills aphids, cabbage white butterfly, caterpillars, mosquitoes, snails and wireworms. It can also kill other beneficial insects, so use carefully! It also helps to halt downy mildew and leaf spot in cucumbers and bean rust and blight.

General spray: Chop 1 onion, 1 chilli and 1 garlic bulb. Steep overnight in enough water to cover it.

Dilute 5 times before you use it. This spray repels most pests and also kills funguses. Spray for heavy infestations.

Milk spray: Milk from the bottle or cow, or sour milk is diluted 9 times. Use for tomato mosaic virus, and it kills red spider mites, caterpillars and tomato worms.

Onion spray: Grind onions (you can add chives, garlic, onion tops) in a blender, or chop by hand. Add twice as much water as vegetables. Use the spray often against blight on potatoes and tomatoes. It works for apple scab, curly leaf of peach, trees, powdery mildew, aphids and red spider mites.

Cabbage grub dust: Mix 2 handfuls each of wood ash, and flour with ½ cup of salt. Dust plants to kill all kinds of cabbage worms.

Pyrethrum spray: Make a tea by pouring 1 litre of boiling water over a few flower heads of pyrethrum, or feverfew. Let it draw for 15 minutes. Add a little soap. Spray in the evenings against aphids, caterpillars, leafhoppers, mites and thrips, mildew and scab. Pyrethrum is toxic to humans.

Marigold spray: This is made in the same way as pyrethrum spray, and is good against bean beetles.

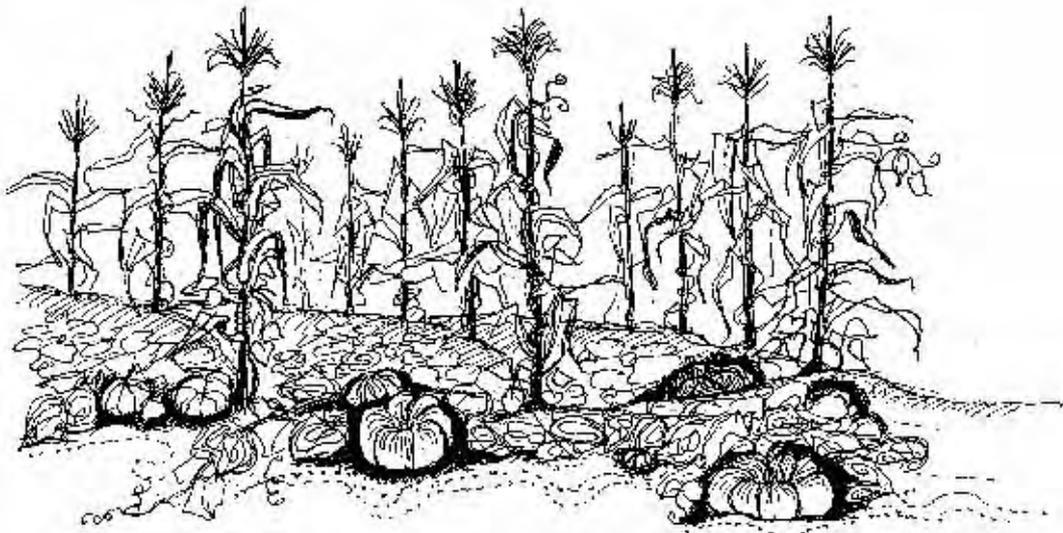
Soapy water: Mix 30g of grated Sunlight soap in 1 litre of water. Stir until soap is dissolved. Strain and use against aphids, maggots, leafcutters, mealybugs, red spider mites and whitefly. If you have a serious pest infestation, add 1 tablespoon of paraffin to the mix. You can also add soap to other sprays to make sure they stick to leaves.

Wormwood tea: Take a handful of English wormwood (Wilde ALS) and pour 1 litre of boiling water over it. Let it draw until it cools. Use the spray undiluted against aphids, black flea beetle, flies, cabbage white butterfly and slugs. You can also bath dogs and cats in this to chase away fleas.

PLEASE NOTE THAT SOME ORGANIC INSECTICIDES ARE POISONOUS. USE THEM WITH CARE.

Inter-crop

Inter-cropping means planting two or more different kinds of plants together. If there is a big area of one kind of plant, the pests of that plant have plenty to feed on and quickly increase in number. Pests can spread easily from one plant to another. If you separate plants of one kind from one another by plants of other kinds, the pests have to look for other plants to feed on. Pests do not spread so easily to healthy plants.



Inter-cropping is the planting together of different kinds of plants

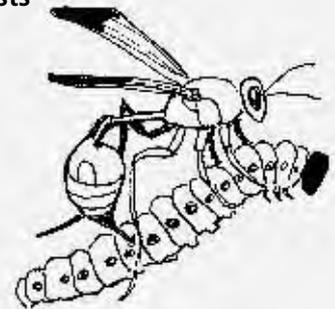
Encourage the natural enemies of pests

Plant pests are all parts of their own food chains and food webs. There are many animals that eat the pest animals which eat crop plants. These pest-eating animals, which we call predators or natural enemies, help to keep pest numbers down. Spraying with chemical pesticides kills the natural enemies as well as the pest insects. Examples of natural enemies of plant pests are lizards, chameleons, insect-eating birds including chickens and ducks, ladybird beetles and larvae, preying mantises, spiders, wasps and some fly larvae. Some wasps lay their eggs into the larvae of pest insects.

A ladybird beetle eating scale insects



Some types of wasps lay their eggs into the larvae of plant pests



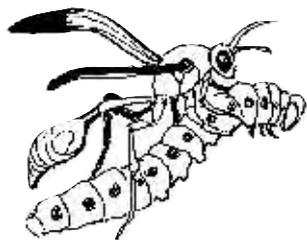
A wasp laying its eggs in a young caterpillar



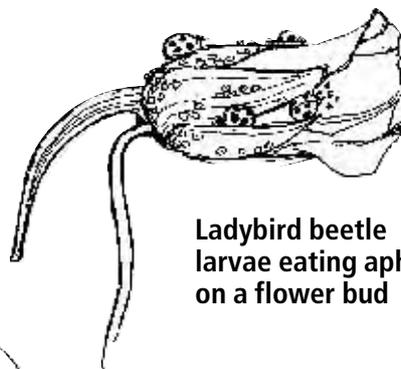
The wasp larvae feed in the caterpillar



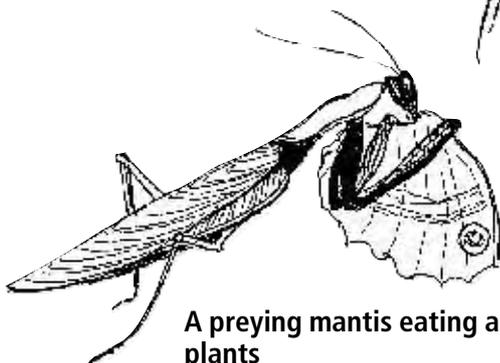
The caterpillar dies. The wasp larvae pupate. After a few weeks, adult wasps come out of the pupae



A wasp carrying a caterpillar to its nest



Ladybird beetle larvae eating aphids on a flower bud



A preying mantis eating a moth whose larvae eat plants

We can encourage the natural enemies by leaving wild areas and by creating wildlife habitats. Natural enemies come to the garden areas from the wild areas and thereby help to control garden pests. By creating habitats for the natural enemies, and encouraging biodiversity, we can further improve our pest control.

In the next activity we are going to create a habitat for lizards. Lizards mainly feed on insects, many of which are plant pests. By building a lizard habitat, we increase the number of lizards in our garden and therefore get better pest control.

Activity 8.2



Group work

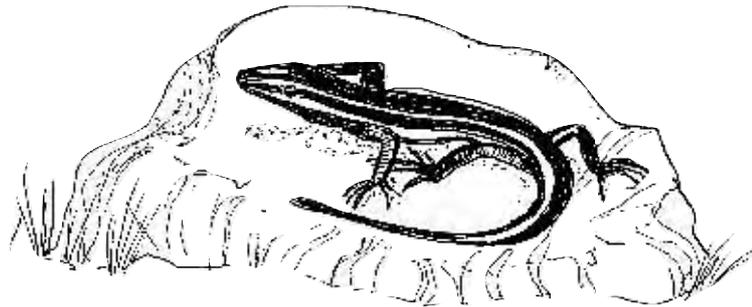
Building habitats for lizards

You will need

stones, rocks, digging tools, plants, logs, mulch

Lizards like stones and rocks on which to lie in the sun. They also like logs to hide under and underground chambers that stay dry in winter where they can shelter from predators. The lizard garden needs to be close to the food garden, so that our predators can be on hand to eat plant pests.

Your teacher will show you where to place the stones and dig the underground chambers. Then plant around the rocks and place the logs in protected places. Mulch the plants so that they survive the transplanting.



Activity 8.3



Individual work

Make a poster about the benefits of lizards.

You will need

Poster paper, paints, crayons, glue, magazines, and examples of adverts for houses.

You are going to make a poster to make the rest of the school aware of the lizard habitat you have built and of the benefits of lizards. Make your poster as if it is an advert for lizard homes so as to get more lizards into the area. Head your posters something like 'LIZARD DREAM HOUSE' or 'CALLING ALL LIZARDS'. Advertise the special features of the lizard home. For example, 'hundreds of sun-bathing rocks and cool, dry underground chambers.'

Start by designing your poster in draft. When you are happy with your design, make the poster.

Present your posters to one another in the class and then together stick them up around the school.

NS LO2: Learners know, interpret and apply scientific knowledge.

NS LO3: Learners understand the impact of technology – learners identify the negative effects of development on the environment.

Assessment

Assess the answers to the questions.

worksheet 7.2 Guilds and food forests

Activity 7.3 Thinking about food forests

Pair work

This activity gets learners to explore the idea of a food forest.

Answers to questions

1. Food from trees includes many fruits (apples, peach, pear, avocado, lemon, orange) and nuts (pecan, almonds, macadamias, cashews) as well as spices like cinnamon and pepper.
2. A food forest is a forest planted with trees and other plants that provide food.

Curriculum Links

see below for Activity 7.4

Activity 7.4 Choose plants for a pit bed guild

Pair work

This activity gives learners practice in selecting plants according to stacking, companion planting and usefulness with the use of the information in Tables 7.1 and 7.2 and Appendix 1.

Curriculum Links

Outcomes

NS LO2: Learners know, interpret and apply scientific knowledge.

CO2: Identify and solve problems and make decisions using critical and creative thinking.

CO7: Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

Assessment

Assess the completed tables.

Part 8: Pest management

worksheet 8.1 Controlling pests and diseases

Activity 8.1 Think about ways to protect plants

Group work

Learners may not have done Activity 4.2 in which they look for food chains. In this case ignore Step 1 and begin the activity with Step 2. Tell learners that they are now going to see what food chains they can find in their school grounds. Divide learners into groups and assign each group an area in the school. Agree on how much time is needed to carry out this research. Then continue with Step 4 in the classroom.

In Steps 6, 7 and 8 of this activity the learners will explore their own knowledge and ideas about protecting plants from pests, diseases and weeds. There are no right or wrong answers in this activity. Encourage discussion and the sharing of ideas and knowledge. Listening to the discussions can inform you about the nature of the learners' understanding and you to identify and correct misconceptions.

Curriculum Links

Core content and knowledge

NS Life and Living

Ecosystems are self-contained areas where a wide variety of plant and animal species live and reproduce. They depend on each other and on the non-living environment. The life and reproduction of all the organisms in an ecosystem depend on the continuing growth and reproduction of plants.

Outcomes

NS LO1: Learners conduct investigations and collect and evaluate data and communicate their findings.

NS LO2: Learners know, interpret and apply scientific knowledge.

Assessment

Assess the written answers on the worksheet.

Activity 8.2 Building habitats for lizards

Group work

You will need

stones, rocks, digging tools, plants, logs, mulch

In this activity you direct learners to build a lizard habitat. This is a good activity for an afternoon club as it takes some time to do and does not require a full class of learners.

Curriculum Links

Outcomes

CO1: Work effectively with others as members of a team, group, organisation and community

NS LO2: Learners know, interpret and apply scientific knowledge.

Assessment

This is a good opportunity to assess CO1.

Activity 8.3 Advertise the benefits of lizards

Home activity, Individual work

Each learner will need

Poster paper, paints, crayons, glue, magazines, and examples of adverts for houses.

Curriculum Links

Core knowledge and content

NS Life and Living

Animals' habitats are the places where they feed, hide and produce and shelter their young.

Outcomes

NS LO2: Learners know, interpret and apply scientific knowledge – recalls meaningful information and categorises information.

A & C LO3: The learner will be able to demonstrate personal and interpersonal skills through group participation in Arts and Culture projects.

CO4: Collect, analyse, organise and critically evaluate information.

CO5: Communicate effectively using visual, symbolic and/or language skills in various modes.

Assessment

Assess the posters according to:

- neatness
- use of drawings, pictures and other illustrations
- use of colour

- clarity of the main message
- balance of the layout
- lack of clutter
- use of headings and sub-headings.

Part 9: Chickens

worksheet 9.1 Improving the soil with chickens

Activity 9.1 Understanding the role of chickens in a food garden

Work in groups

The aim of this activity is for learners to see the many functions that be fulfilled by a chicken tractor system.

Answers to questions

1. a) Chickens take the place of hoes because they dig the soil while looking for worms to eat.
- b) Chickens take the place of chemical fertilisers by adding their manure to the soil.
- c) Chickens help us to avoid using herbicides by eating seedlings as they germinate.
2. If we did not use chickens in a food garden, we would need to dig, fertilise and weed.

Curriculum Links

Outcomes

CO6: Use science and technology effectively and critically showing responsibility towards the environment and the health of others

CO7: Demonstrate an understanding of the world as a set of related systems by recognising that problem solving contexts do not exist in isolation.

Assessment

Assess the written answers.

worksheet 9.2 Keeping chickens – breeds

Activity 9.2 Explore concepts of animal reproduction

The aim of this activity is to meet a Natural Science core content requirement as given below under Curriculum links.

Answer to questions

The diagram below shows the reproduction cycle of cattle. Learners can draw their own diagrams for the reproduction cycle of any mammal of their choice.

Curriculum Links

Core knowledge and content

NS Life and Living

Sexual reproduction is the process by which two individual plants or animals produce another generation of individuals. The next generation's individuals look like the parents but always have slight differences from their parents and from each other.

Outcomes

NS LO2: Learners know, interpret and apply scientific knowledge.

Assessment

Assess the diagrams for correctness and understanding.