FIRE IS EVERYONE'S FIGHT: WILDFIRE AWARENESS TOOLKIT

Educators' Manual
to be used in conjunction with the flipchart

INTRODUCTION

For many areas in the Western Cape, it is not a matter of "if" wildfire is going to occur, but "when".

Faced with the growing potential for loss of human life and property due to wildfire, the Western Cape Disaster Management, Fire & Rescue Services, CapeNature, SANParks, Fire Protection Associations and various firefighting agencies, have come together to help communities prevent and protect themselves from wildfire.

The wildfire risk in the Western Cape

Fire is a natural part of our environment. The Western Cape has large fynbos areas which are dependent on fire for its survival (for example, seeds are released after a fire). Fynbos has been around for millennia and it has been burning long before we settled here. On average, most fynbos plant communities burn every 12 to 15 years. As many suburbs lie close to the fynbos areas, wildfires caused by nature and accidental fires have become part of our lives. Unfortunately, for many living in fire prone areas, their homes are not equipped to survive wildfire.

Climate change/Global warming

Wildfires may seem like a fixed and unchanging force of nature. They're not. Research shows that both climate and humans have a great effect on wildfire activity. Climate change research predicts large increases in fire activity in India, Australia, central Asia and Siberia, Southern Europe, and Southern Africa. The predicted hot, dry conditions contribute to the increased likelihood of more wildfires.

Factors that influence wildfires and the consequences								
Fire is a natural part of our environment. Our renosterbos and fynbos were burning long before humans settled in the Western Cape.	+	Many homes are built close to fire environment areas without regard for wildfires.	+	With more people accessing our natural areas (e.g. national parks), there is a greater chance of a fire started by carelessness.	+	Today's wildfires can burn intensly and be difficult to control due to the results of climate change/ global warming.	=	This could result in: • Greater loss of life • Increased property losses • More damage to natural resources • More money needed for firefighting

The rising cost of wildfire response

Wildfires are getting larger and causing more damage. The worst fire seasons have occurred recently (e.g. 2000, 2015). Bigger wildfires are generally the result of several factors. Firstly, due to historic management practices, invasive fuels have increased. Secondly, changing climatic conditions have resulted in higher temperatures and widespread drought.

Not surprisingly, wildfire prevention costs have risen substantially and millions of rands have been spent by the Western Cape Government, CapeNature, SANParks, Department of Environmental Affairs and Development Planning, Working on Fire, Fire Protection Associations, and district and local municipalities.

The limitations of wildfire firefighting

A lot of people assume that when a wildfire starts, it will be quickly controlled and extinguished. In the Western Cape, this is an accurate assumption 97% of the time. Firefighters have the ability, equipment, and technology to effectively suppress most wildfires. But 3% of the time, wildfires burn so intensely that there is little firefighters can do.

The Toolkit

There are proven steps that communities, landowners and homeowners can take to improve the odds of human life and home survival during wildfire. The purpose of the *Fire is Everyone's Fight: Wildfire Awareness Toolkit* is to assist public educators, teachers, disaster management officers and fire-fighters promote and teach these steps.

Help Bokkie spread the wildfire prevention message!

Bokkie is the symbol of wildfire prevention in the Western Cape. Bokkie has appeared on posters, billboards, and other materials to spread the wildfire prevention message. The main goal of Bokkie's fire education campaign is to reduce the number of human-caused wildfires by promoting safe behaviour when using fire. The campaign also encourages a sense of personal responsibility for fynbos, forests, mountains and other wild spaces.

Tips on using the lesson plans

This book contains a number of lesson plans aimed at primary school learners in the Intermediate Phase. However, we have included information and ideas that can be used at high school level and also with adults in the field.

Some of the lessons and activities are more suitable for the younger learners (grades 4 and 5) and some for older learners (grades 6 and 7). Other lessons can be used with high school leaners to kick-start various topics that can then be taken further. As the educator, you know your audience and can decide which parts of the lessons are appropriate to your particular group of learners and their environment. In other words, adapt the lessons where necessary.

The lessons are not cast in stone and may be altered to suit the particular circumstances or level of the group. Try to use the information supplied, even if you do it in a way that is different to the original lesson plans. Some of the lessons can be turned into large group projects.

In many lessons we have included a number of activities related to the lesson. You do not need to do all of them, select the ones that are most appropriate to your group. Some could be used as group or individual projects with some research being done at home or at the local library. Decide on the activity that you are going to use and get the materials needed for it.

This book is used in conjunction with the flipchart and plant photos supplied.

CONTENTS

1. What is Fire?

LEARNING OBJECTIVES

Knowledge

Learners will:

- be able to tell the difference between a USEFUL and a HARMFUL (dangerous) fire.

Behaviour

Learners will:

- be able to tell an adult immediately if they see any signs of a HARMFUL (dangerous) fire.
- not leave a USEFUL fire unattended.

BACKGROUND INFORMATION

- There are two kinds of fire – USEFUL and HARMFUL (dangerous).
- Words associated with USEFUL fire: warm, cooking, comforting, braai, bonfire, romantic, gives light, etc.
- Words and phrases associated with HARMFUL (dangerous) fire: deadly, fast, scary, hot, things get burnt, homes get burnt, uncontrolled, life of its own, dangerous, kills, possessions get destroyed, people get hurt and even die, smoke, destroys environments, veld, animals' homes, wild.
- An 'innocent' fire, such as burning garden rubble or cooking on a fire, can easily get out of hand if the wind picks up, turning it into a harmful or dangerous fire.

LESSON PREPARATION

Materials

- Flipchart pages 1 and 2.
- 30 x A6 (A4 paper folded twice to postcard size) pieces of blank paper
- Thick crayon or koki pen
- Prestick, or if you have a metal chalk board, small magnets
- Candle, glass jar, sand and matches (matches to be used only by the educator)

PRESENTATION AND ACTIVITY

Set-up the flipchart in the classroom so that all learners are able to see the flipchart page 1. For this lesson you will be using both **pages 1 and 2**.

Ask: What words describe what you see in the pictures?

As they give you descriptive words or phrases, write them on the A6 pieces of paper – one word or phrase per piece of paper. Alternatively, give each learner a piece of paper and as a word is given by a classmate for a particular picture, nominate a learner to write it down. In this way each learner will have a chance to write down a word/phrase – even if it is not a word that they suggested.

When they have exhausted words related to the pictures on the flipchart, ask them to think of other words related to fire.

Write these down as well – using the same method as before.

If you wrote the words down, hand out your pieces of paper with the words on them to the learners in the class. If the learners wrote down the words, they keep the word or phrase that they wrote down.

Draw a line down the middle of the board. On the one side write: USEFUL and on the other side of the line, write: HARMFUL (dangerous).

Ask each learner to come forward and put their piece of paper in the correct column (using prestick or magnets). Ask each learner to explain their choice.

Discuss with the learners how each of the USEFUL fires could turn into a HARMFUL (dangerous) fire.

Demonstration: Keep your candle safe

Demonstrate to the learners how the candle in the jar is a safe option. (The glass around the flame also helps to give extra light.)

- Fill one third of the jar with sand. Put a candle in the sand in the jar so that it stands upright. The candle should not extend above the rim of the jar. Light the candle. Push over the jar and see what happens to the candle and the flame. The sand will smother the flame.

2. Causes of Wildfire

Note to educator: There is a lot of information in this section. It is up to each educator to decide how much is relevant to his or her group of learners. All the information need not be covered in a single lesson, more time can be taken to cover it thoroughly.

LEARNING OBJECTIVES

Knowledge

Learners will:

- understand how easily a wildfire can start and get out of control.
- know about safe fire practices when camping.
- know about the consequences of uncontrolled fires.

Behaviour

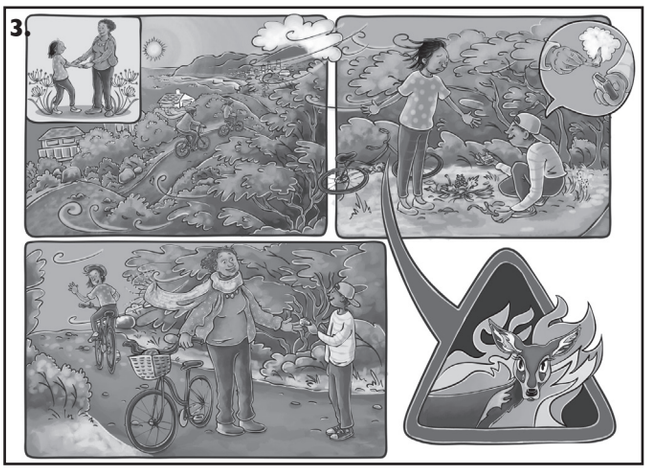
Learners will:

- be able to discuss the risks of playing with fire.
- call for help immediately/report it to the authorities that a fire that is getting out of control and is becoming a wildfire.
- call for help immediately/report it to the authorities if a learner sees any signs of wildfire.
- report any suspicious fire play activity to the authorities immediately.
- will know the emergency number – 10177.

BACKGROUND INFORMATION

WILDFIRE: *An unplanned and uncontrolled fire spreading through vegetation, at times involving buildings.*

- More people are building their homes in what is called the wildland-urban interface. This is where development meets the natural environment. The danger of wildfire is very real in these areas, especially when surrounded by mountains.
- As the number of homes and other structures increases, so does the threat of wildfire to people and property.
- Every wildfire requires some spark or fire to start it.
- More than 90% of wildfires in the Western Cape are started by people.
- The main causes of wildfires are:
    - **Heavy equipment** or machinery being used in rural areas: harvesters, tractors, grinders, etc.
    - **Lightning:** Lightning is a cause of both wildfires and structural/house fires. In the Western Cape lightning is usually accompanied by rain. However, this is not always the case. Sometimes there is lightning on hot days or nights often accompanied by strong berg (warm) winds. This can easily ignite dry vegetation and rubbish. If a person has a house with a thatch roof, there should be lightning deflecting rods on the roof that will stop the lightning from hitting the thatch and igniting it.
    - **Cooking fires:** Open fires for cooking and discarded hot ashes can cause wildfires, particularly in natural areas or on farms.



    - **Smoking:** Discarded cigarette butts can cause wildfires, be these from people working in the veld, passing pedestrians or motorists.
    - **Burning of debris:** Permitted and unpermitted burning of debris if badly managed, or if weather conditions change suddenly, can cause wildfires.
    - **Intentional:** Riots and unrest are also common causes of wildfires. Fires are sometimes set on purpose – this is called MALICIOUS INTENT.
- **Human ignition:** In large fynbos areas that are located close to major population centres, wildfires are largely due to human ignition. A careless match, cigatette butt, an unattended campfire, the use of fireworks, the uncontrolled burning of debris or the sparks from equipment – these unplanned but deadly occurrences destroy lives, the environment and property. With forethought and care, many wildfires can be prevented.
- **Youth/juvenile** fire setting behaviour: Some studies show that youth between the ages of 11 and 14, particularly boys, are at the greatest risk for setting fires. The vandalism category is most closely associated with juvenile and adolescent fire setting. The fires are "set when the opportunity arises, often after school or on weekends. Boredom and frustration among youths, sometimes lead to peer-group challenge to create some excitement".
- **Prescribed burns** are conducted under very controlled conditions to promote growth and prevent uncontrolled wildfires.

- **When camping:**
    - Children must never be allowed to make a fire without adult supervision.
    - Fires should ONLY be made in designated fire areas – not anywhere else. In the Western Cape, campsites have allocated areas for campfires.
    - Never leave a burning or smouldering outdoor fire unattended.
    - Before leaving the site or going to sleep, soak the fire with water and stir sand into the ashes or coals until

every spark is out. Be careful of the hot steam and splashes when the water comes into contact with the hot coals.

- Never use candles, matches or gas stoves in a tent; it can burn within minutes trapping its occupants inside.
- Place tent upwind and well away from a campfire.
- Build the fireplace downwind, away from the tent, clear away all dry vegetation, dig a pit and surround it with rocks/stones.

LESSON PREPARATION

Materials

- Flipchart page 3.
- Decide which activity you would like to do with your learners and get the materials together for that.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 3**.

Ask: What is WILDFIRE?

- We used to call it a veldfire as it is the burning of a natural area. It is not a house or building fire in an urban area.

Break the word into two parts and discuss the word WILD.

Ask: What other words can we put together with WILD?

- Wild animal, wild party, wilderness, wild garden, wild behaviour, wild learners – what does wild in each case mean?

Ask: How can this describe a wildfire?

Link their answers to the definition of a wildfire: *An unplanned and uncontrolled fire spreading through vegetation, at times involving buildings*.

Turn to the comic strip page on the **flipchart page 3**.

Read the following scenario to the learners – they can look at the pictures while the story is being read to them.

> **Scenario:**
> Sarah and her mom enjoy doing things together. One day they decide to go for a ride on their bikes. After riding for a while, they stop in the woods. There they see a boy with a pile of sticks and dead leaves. He has a box of matches in his hand. When Sarah asks what he is doing, he says he is making a campfire because it will be fun. Sarah says she does not think it is fun and that it can be very dangerous. She tells the boy that matches and fire are not toys and asks him to give the matches to her mom, who is standing behind her. Eventually, Sarah manages to persuade the boy to give the matches to her mom. He then goes home and Sarah and her mom continue with their bike ride.

Ask: Did Sarah do the correct thing? Why do you think so?

Ask: What was the boy doing that was not safe?

- Playing with matches.
- Making a campfire without an adult in an unallocated fire area.

Ask: What can we learn from this story?

- Matches and lighters are TOOLS, not toys.
- Children must not have matches with them.
- Children should not make fires.
- Only adults should teach children how to use matches and lighters, not other children.

Tell the learners that bad things can happen if they play with fire. Learners should never play with fire, never burn debris, paper, etc., never set any type of fire, even a useful fire.
Encourage the learners to discourage other learners from doing these things.

Tell them that if they see a child playing with fire, they must tell an adult.

Ask: How else can a fire start?

- Lightning;
- Cooking fires;
- Smoking; and
- Burning of debris.

Ask: How can a person keep safe when using a fire for warmth and cooking?

See background information notes on making a fire when camping.

Intentional fire setting and the law

Ask: What is MALICIOUS INTENT?

- A wildfire that is set on purpose.
- If you know anyone who sets fires on purpose, you need to tell an adult. Tell the learners that if someone gets caught setting a fire they can get a large fine or even go to jail.

Ask: Why would someone start a fire on purpose?

Guide a discussion on peer pressure and juvenile fire setting. Some points to consider are:

- Sometimes young people start fires because they are sad, angry, or not feeling good about themselves. However, most young people start fires out of curiosity or peer pressure. When people our own age try to get us to do certain things or act or look a certain way, this is peer pressure.
- Even when you want to do what your friends do to fit in and be liked, it is important to watch out for others putting pressure on you to do something you know is wrong.
- Methods for dealing with peer pressure include the following:
- If you feel pressured to play with fire, remember that fire setting is dangerous. Just say "no", walk away, and tell an adult.

- Playing with fire is not playing at all, and fire can hurt you and others. If a friend asks you to play with fire, tell him or her of the dangers, and then suggest another activity.
- Find a buddy, agree to help each other if either of you is being pressured to play with fire. Talk your friends out of playing with fire and do not let them talk you into it.

ACTIVITIES

1. Learners can dramatise a new story in groups of 4 to 6 people. In this story they find someone playing with fire and explain why they should stop doing so. These learners are our heroes.

2. As a class decide on a strategy to help prevent juvenile fire setting in your community. Implement the learners' ideas as a class project. Possible class projects can be bulletin boards, electronic slide shows, skits, brochures, editorial letters, and posters. Make sure that the message gets to as many parents and young people as possible.

3. Learners can describe what a WILDFIRE is using their own words. Refer back to the beginning of this lesson for the definition of wildfire and the ideas associated with the word – ***wild.***

3. The Fire Triangle

LEARNING OBJECTIVES

Knowledge

Learners will know that:

- fire needs three elements to exist.
- if one element is not present then the fire cannot start.
- if one element is removed the fire will be extinguished.

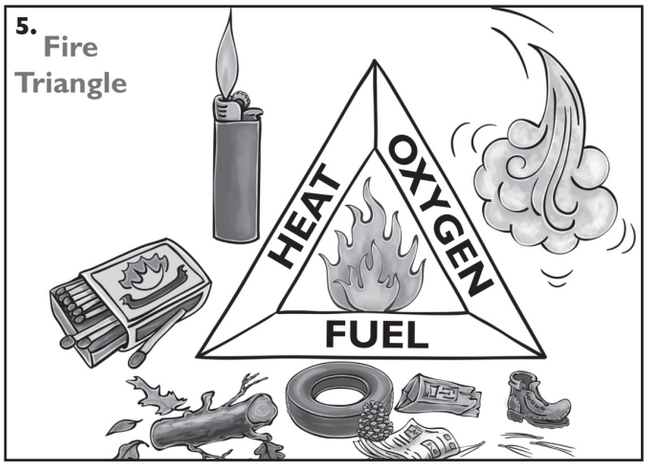
Behaviour

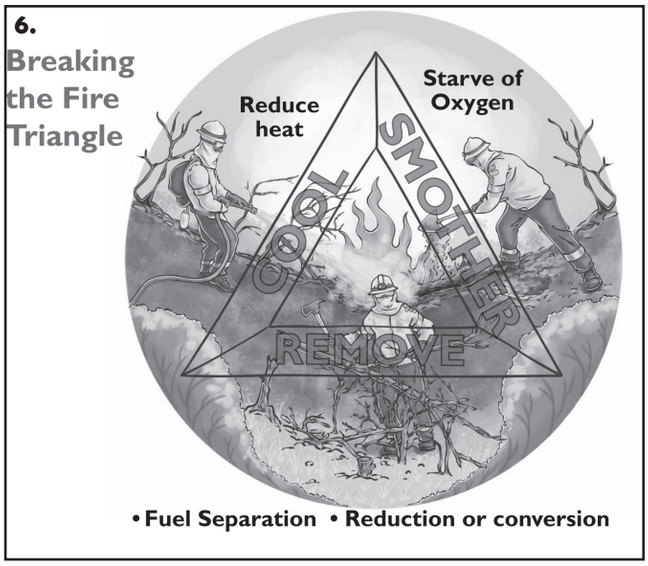
Learners will:

- be able to identify ways of preventing a fire from starting.

BACKGROUND INFORMATION

- Fire requires three elements to survive (written on the stool legs – refer to the fire triangle):
    - **Oxygen** is essential to sustain combustion (burning). Air is made up of 21% oxygen and the rest is a mixture of other gases – predominately nitrogen (78%). The last 1% is made up of water vapour, carbon dioxide and other gases. If the level of oxygen drops to 15% or less, neither people nor a fire will survive. An effective way to remove oxygen from a fire is to starve it by smothering or covering it, usually with sand or soil.
    - **Heat source**. A fire needs a spark or flame to start. Fuel needs to be brought to ignition temperature in order for it to ignite. If the fuel drops below ignition temperature, the fire will go out. The most effective way to reduce this temperature is by cooling the fire with water.
    - **Fuel or combustible material** – dry vegetation, dry wood (furniture/house structure), paper, plastics, rubbish, etc. The most effective way of preventing a fire is by removing or reducing the fuel.
- Take one of these elements away and the fire will die/be extinguished/not start.
- Every year, weather conditions (prolonged high temperatures, wind and dryness) combine to produce an optimal environment for wildfires. Dry debris on the ground (fuel) is ignited by lightning or careless humans (heat), and the resultant fire is supported by the surrounding air (oxygen).
- Use the analogy of a 3-legged stool – take a leg away and the stool no longer stands.
- **Remove air/oxygen:**
    - smother with a blanket/clothes/sand/water/fire extinguisher/foam.
- **Remove heat/ignition source:**
    - add water/use fire extinguisher (water cools the heat, drops the fuel temperature to below ignition temperature and it adds moisture to potential fuel, thus stopping it from catching alight).





- **Remove fuel:**
  - take anything flammable out of the fire-path;
  - remove invasive alien vegetation;
  - create a fire break/prescribed burning.

LESSON PREPARATION

Materials

- Flipchart pages 4, 5 and 6.
- Candle in a glass jar with a lid.
- Matches.
- Decide which activity you would like to do with your learners and get the materials together for that.
- If you do the word game on page 9, photocopy enough copies so that each learner has one to work on.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 4**.

Ask: What is happening in the picture?

- The boy is falling off the stool because one leg has broken.

Explain how a fire is like a 3-legged stool as it needs 3 parts to survive. If we take away one part, the fire will die.

Turn to flipchart page 5. The picture shows the triangle and the 3 elements that are needed to stop it from 'falling over'.

Oxygen: The air we breathe. Humans need oxygen to keep us alive. In the same way, without oxygen, fire cannot breathe and it dies. Explain that oxygen makes up 21% of the air that we breathe. The rest of the air is made up of other gases, mainly nitrogen (78%).

Candle demonstration (educator to do this): Light a small candle on the jar's lid (secure the candle to the lid before the lesson). Show the learners the candle.

Ask: What do we need to breathe?

- Oxygen.

Place the jar over the candle and screw it onto the lid (no need to screw it on completely).

The learners will observe the candle going out because of the lack of oxygen.

Ask: What can you conclude from this?

- Fire needs oxygen.

Heat: Fire needs a spark or flame to start. Fire needs heat in order to burn too. Fires in the shade burn less quickly than those in the sun. Fire won't burn in the snow or in water, because it cannot maintain enough heat to keep burning. Humans need heat too; otherwise, our life processes stop.

Ask: What happens when you pour water on fire?

- It goes out because you have removed the heat.

A Spark or flame can come from a candle, cigarettes, glass reflecting in the sun, matches, lighter, unattended campfire or braai-fire. The temperature of fuel also plays a part in how quickly or slowly fuel reaches its ignition point and burns. Fires in the shade burn less quickly than those in the sun.

Fuel/combustible material. Fire needs fuel like humans need food.

Ask: What happens if we don't eat?

- We starve and die.

Fire needs fuel, which is anything that will burn. Grass burns, trees burn, paper burns, etc. Your clothes will even burn!

Ask: What won't burn?

- Rocks, dirt, cement, etc.

Explain that if one of these 3 elements (oxygen, fuel and heat) is not there, the fire will not start.

Turn to flipchart page 6. The picture shows the triangle and the firefighters.

Ask: What is happening in the picture?

- Firefighters are fighting the fire.

Ask: Can we control air? How would you remove the air?

- If there is no fire yet, you cannot remove the air. If there is a small fire, smother or cover it with a blanket/clothes/sand or use a fire extinguisher. But when the fire is big and if there is wind, it is sometimes impossible to smother.

Ask: Can we control heat? How would you remove heat?

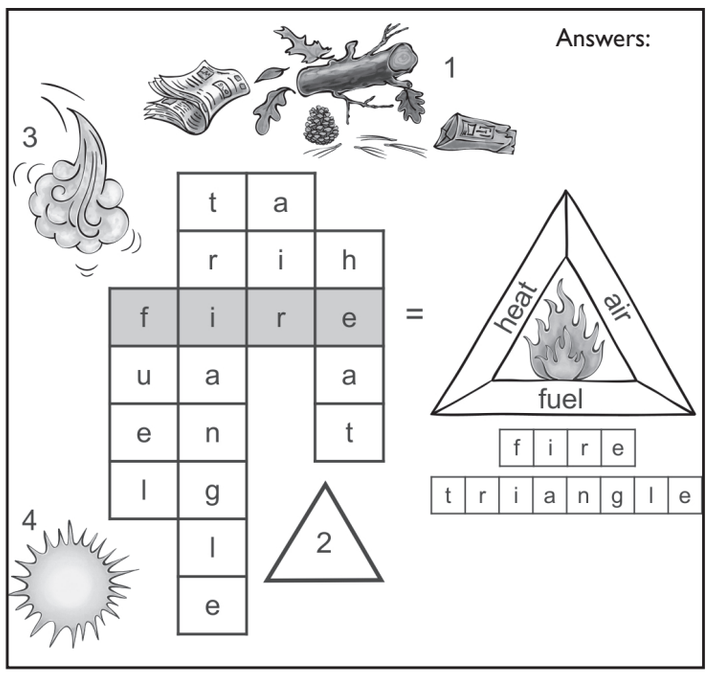
- We can add water to reduce the heat. This also depends on the climate and weather elements. It's hard to control the heat of the sun that enhances the fire's heat.

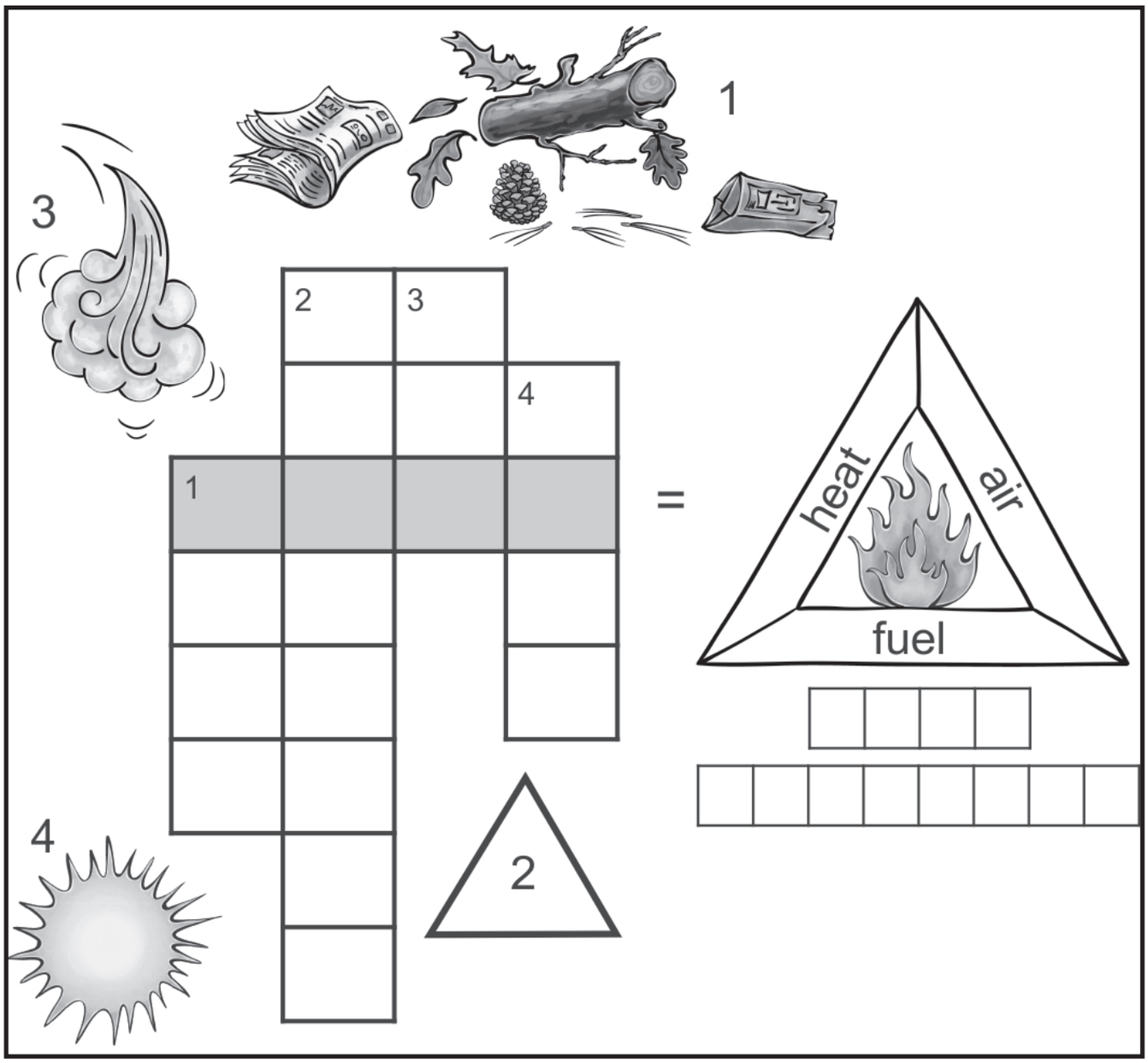
Ask: How would you remove fuel?

- Take anything flammable out of the fire-path.
- Remove invasive alien vegetation from the area.

ACTIVITIES

1. You will need space for this activity. Get learners to spread out around the room or go outside.
2. Learners to make a triangle out of their own bodies by balancing on 2 arms and a leg, or 2 legs and an arm. What happens if you lift one of the balancing limbs – the triangle collapses.
3. Put learners in groups of 7 for this dramatisation. Three learners lie on the ground forming a triangle with their bodies – head to toe. Each learner represents one of the following: air, fuel or heat/ignition source. One learner stands in the middle of the triangle – this learner is the fire and can dance around in the triangle. The remaining three learners need to figure out how to break the triangle – cover the body of 'air' learner; remove the 'heat/ignition source' learner with water; remove the fuel – roll the learner away from the rest of the triangle. Once the triangle is broken – the 'fire' learner must stop dancing – like a fire that is no longer burning. This is dramatised – no props needed (no water, blankets etc.).
4. Draw a fire triangle on paper and label it. Using a different colour, write next to the appropriate element, how to 'remove' it.
5. Make a tetrahedron (4-sided triangle, the base being the 4th side). Label the 3 sides and draw in the appropriate side the element it represents. You could provide a template or ask them to create their own. This can be used in a maths lesson to work out the angles of the triangle.
6. For the young ones: fill in the words in the puzzle. Educator to photocopy puzzle for the learners.




1
3
2
3
4
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=
heat
air
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4. The Fire Behaviour Triangle

LEARNING OBJECTIVES

Knowledge

Learners will:

- understand how the weather, topography and fuel can influence the behaviour of a fire.

Behaviour

Learners will:

- be able to identify when the fire risk is higher than normal;.
- learn that when living near the edge of a suburb/township, a 10m clean and clear space must be kept between the house and bush/veld/vegetation.
- learn to keep flammable material away from the house.
- understand that ladder fuels must be removed where possible e.g. smaller bushes to keep fire from spreading into canopy or roof structures.

BACKGROUND INFORMATION

Environment can influence the behaviour of a fire:

- **Fuel**: what is burning? – indigenous plants, invasive alien plants, dry wood/leaves/man-made fuels such as rubbish.
- **Weather**: heat, wind, rain and humidity.
- **Topography**: slope, aspect, relief, position on a mountain/ hill, on a plain, in a gully/valley.

Fuel – old and dying plants are dry and contain less water and burn more easily than lush, green, moisture-filled plants. If you live near a bushy area, keep a clear area of 10m between your house and the bush. Ladder fuel – smaller bushes that act as stepping stones or ladders for the fire to move from the ground surface to the top of the trees and surrounding canopy.

- Fuel varies in its:
  - type;
  - size and quantity;
  - arrangement; and
  - moisture content.
- Fuel is normally classified as fine or heavy (coarse). Fine fuels such as leaves, twigs and grasses burn readily and cause spotting as the burning embers are carried through the air by the wind, starting new fires ahead of the main fire. Coarse or heavy fuels (greater than 6mm in diameter) such as sticks, branches and logs tend to ignite less readily and burn more slowly.
- It is mainly fine fuels that drive the forward spread of a fire, while the heavy fuels are consumed in the smouldering zone behind the main fire front. The fine fuel is ignited first, this heats the heavy fuel enabling it to catch alight and burn. The proportion of fine fuel verses heavy fuel affects the rate of spread and intensity of the fire. The volume/ amount of fuel affects fire behaviour.
- Generally, the more fine fuel there is, the greater the rate of spread, and the greater the intensity of the fire.

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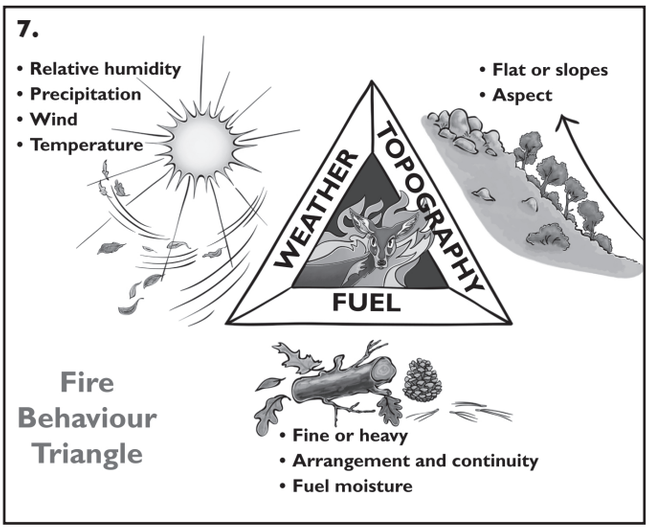

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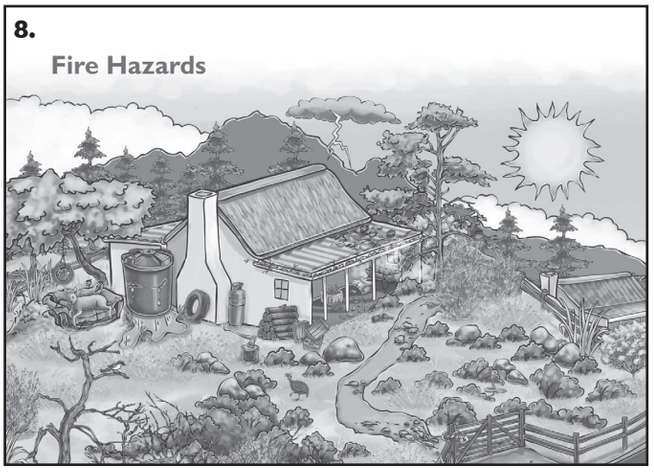


- Fuels that are tightly packed together smoulder slowly because of the lack of oxygen and generally higher moisture content.
- Fine, loosely stacked materials burn quickly and fiercely.
- Fire behaviour is affected by how damp fuels are. The fuel moisture content will vary depending on factors such as weather conditions, vegetation type, the moisture content of the soil and whether the fuel pieces are dead or living vegetation. Fuel that is dry and fine will burn better than heavy fuels that are wet.

Weather – the four key elements of weather are:

- air temperature;
- relative humidity;
- wind (speed and direction) at the flaming zone of the fire; and
- atmospheric stability.

- Higher temperatures normally mean fuel pieces that are warmer, drier and more easily ignited.
- Air contains a certain amount of water vapour. Relative humidity is the measure of the water vapour content in the air as a percentage of its water vapour holding capacity at the same temperature. In the absence of rain,

the amount of moisture in dead finer fuels, for example leaves, litter and grass, varies according to the relative humidity of the air.

- On humid days (high relative humidity), fine dead fuels absorb moisture from the air and burn more slowly or may not burn at all. On dry days with low humidity levels, the air will draw moisture out of these fuels and they will ignite more easily, and burn faster and more fiercely.
- Wind speed is important in determining the intensity of a fire. Wind supplies oxygen for the burning process, removes ash and smoke from the area and increases the rate of burning. The stronger the wind, the more oxygen is supplied to the fire and the more smoke is removed.
- The wind may also lift burning materials, such as bark and other embers, and carry them ahead of the main fire to start new fires.
- Wind direction refers to the direction from which the wind is coming. A north wind comes from the north of where you are standing and travelling in a southerly direction. Sudden changes in wind direction can cause shifts in the fire front. These shifts can be particularly dangerous if they occur unexpectedly.
- Each area has its characteristic winds. Some of these bring the hot, dry conditions that cause further problems. Other local winds may be relied upon to bring cooler, moist conditions. Generally, winds that blow from inland are hotter and drier than those which blow from the sea.

Topography describes the lay of the land and affects the direction in which and speed at which a fire will travel.

- If a fire is travelling up a slope, there will be a shorter distance for radiant heat to travel from the flames to unburnt fuel. Upslope fuels are heated by the fire coming up the slope, reaching their ignition temperature more quickly.
- Fire tends to burn faster uphill than downhill.
- Aspect is the direction that a slope faces. Northerly and westerly aspects will be warmer and drier than southerly and easterly aspects as they get more direct sunlight. This also influences the vegetation growing on different aspects. Northern and western aspects will generally have drier and more flammable vegetation than southern and eastern aspects where vegetation will tend to be lush and less flammable.
- Fires on northern and western aspects will generally burn more fiercely than fires on southern and eastern aspects.

LESSON PREPARATION

Materials

- Flipchart pages 7 and 8.
- Paper and drwaing equipment for the activity.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 7.**

Do a quick recap of the fire triangle and 3-legged stool.

Explain that fire also has a behaviour triangle with **weather**, **topography** and **fuel**.

This behaviour triangle relates to wildfires.

You can briefly discuss wildfire with the children.

One side is fuel, the second side is weather, and the third is topography (terrain/lie of the land).

Weather (wind, temperature and humidity) greatly affect wildfires.

Ask: How do you think wind affects a wildfire?
You can get the children to give some answers and you can give the others. The older learners will come up with more answers. Judge how many and which answers are relevant to your class.

- Strong winds may push the flames toward new fuel sources.
- Wind can transfer embers, sparks or ash to start spot fires.
- Wind can also dry fuel in moist areas, allowing fires to burn more easily.
- Wildfires can even generate their own winds. As the air above the flames is heated, it rises, and the movement supplies fresh air (oxygen) to the fire. As warm air rises during the day, air currents travel up slopes; as night falls and the ground cools, air currents flow down slopes.

Ask: How do you think temperature affects a wildfire?

- The temperature of fuel also plays a part in how quickly or slowly fuel reaches its ignition point and burns. Fires in the shade burn less quickly than those in the sun.

Humidity (moisture levels)
Ask: How does moisture/wetness/humidity affect a wildfire?
It is up to the teacher to decide how much information the learners will find beneficial.

- Moisture or humidity dampens fuel and slows the spread of flames. Humidity is greater at night, so fires often burn more slowly in the evening.

Topography also has a major effect on the spread of wildfire. Explain that the contours, elevation and slope of an area influence temperature and wind conditions. Barriers within the landscape, such as boulders, rocks, cliffs and bodies of water, help determine how a wildfire may spread. Elevation affects the wind and moisture in an area. The steepness of a slope is directly related to the speed with which a fire spreads. If a fire begins at the bottom of a steep slope, the fuel above the fire is preheated by the flames below. Therefore, when the flames reach the higher areas, the fuel catches fire more quickly.

Turn to flipchart page 8.
Ask the learners to look at the picture of the house surrounded by vegetation (fuel) on the flipchart.

Ask: What in the picture is unsafe? Why do you think so?

- Tree close to the house – if it catches alight the house might also burn.
- Wooden fence – this could burn and surround the house with fire.
- Old couch – could easily burn.
- Old tyre and wood pile up against the house wall – could easily burn.
- Narrow, bumpy, unkept driveway – difficult for a fire truck to enter.
- Water tank leaking – making it difficult to use water to extinguish the fire.
- Lots of vegetation behind/surrounding the house – this can easily burn and the fire could spread to the house.
- Thatch houses can catch fire very easily.
- The full gutters could help a fire to spread.
- The braai on the stoep as well as the boxes, logs and sticks lying close to the house are all fire hazards.

Ask: What would you change to make it safe?
This can be discussed in groups. Tell them it is important to keep a 10m free zone between the house and the veld/bush. This area is free from fuel that could catch fire and cause the home to burn down.

ACTIVITY

1. Learners draw a bird's eye view of their house and immediate surrounding area. They are to include all trees, bushes, wood piles, rubbish, rubbish bins, cars, driveways, toys, dams, ponds, gates, etc. Once they have drawn this, they tear away all the things near to the house that could cause or create a ladder/stepping stone for a fire. Then put the remaining drawing on a new piece of paper and draw in an ideal garden/yard. They can also re-draw their home with the ideal fire-safe environment. Remember to include the 10m free zone. The older learners' drawings will be more detailed than the younger ones.

5. Fire Weather

LEARNING OBJECTIVES

Knowledge
Learners will:

- understand the influence of weather and seasons on fire.

Behaviour
Learners will:

- be aware of the influence of the weather/seasons when we have wildfires.
- know how the weather affects the spread of wildfire.

BACKGROUND INFORMATION

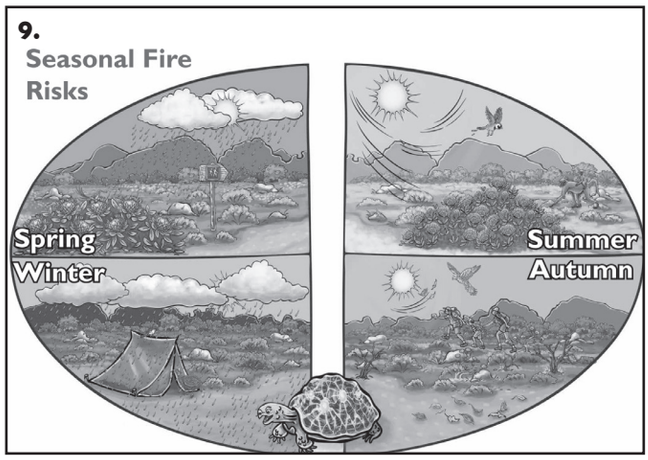
The educator will have to adapt this lesson to the weather patterns of the area where they are. For example, in certain parts of Cape Town the South-Easter wind blows in summer, in other parts it does not. Each area has prevailing winds, these need to taken in account when looking at fire weather.

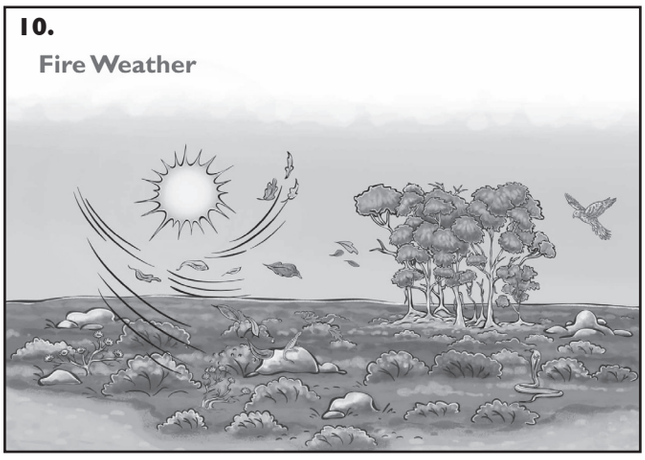
- Both climate and weather affect the risk of wildfires.

Climate: the general weather patterns that occur in an area at a particular time of the year. The Westen Cape experiences a Mediteranian climate. This includes hot dry summers and cool, wet winters. Most countries around the Mediteranian Sea in Europe experience similar weather patterns in summer and winter. The inland areas of South Africa generally have dry winters and wet summers – the bulk of their rain falls in summer.

- Climate has seasons – autumn, winter, spring and summer. Each season has particular weather patterns that generally last for 3 to 4 months every year.
- The climate of a place is dependent on:
  - were on the globe a place is situated (how far from the equator);
  - the distance from the sea/ocean;
  - the temperature of the prevailing ocean currents (this influences the strength, temperature and humidity of wind); and
  - the mountain ranges present.
- Each of the 4 seasons has a different general risk of wildfire. This is particular to each area and the daily weather experienced.
- In the Western Cape:
  - The South-Easter blows in summer, drying out vegetation.
  - The North-Wester blows in winter and brings the rain.

- **Weather**: we experience this on a day-to-day basis.
  - In summer we generally have hot days and no rain.
  - The wind often blows.
  - The wind (South-Easter) drys out the vegetation.
  - One needs to take heat, wind, rain and humidity into account as these all influence the spread of wildfires.





- The weather in Simonstown differs from that in the city bowl and what is experienced in Worcester and Paarl.

Fire weather refers to the weather experienced that is condusive to the spread of wildfire.

- Fire weather includes high temperatures, high winds, rain and low humidity (hot, dry and windy conditions increase the fire risk).
- On hot days, there is a greater risk of wildfire than on a cool day.
- When the wind is blowing, the risk of the spread of wildfires increases.
- When we have rainly weather, the risk of wildfires decreases.
- In spring, after a wet winter, the vegetation is green and moist and the ground is moist. This decreases the risk of wildfires.

LESSON PREPARATION

Materials

- Flipchart pages 9 and 10.
- Paper and drawing equipment for the activity.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 5.**

Ask the learners to remind you about the fire triangles.

Refer to the fire behaviour triangle (page 7) and ask learners how the weather can influence the fuel and spread of the fire (recap the influences of weather, topography and fuel).

Turn to **flipchart page 9.**

Look at the pictures of the 4 seasons of the Western Cape.

Ask: Is the weather the same in all seasons?

- No.

Ask: Is the weather we experience the same as in other areas of the Western Cape?

- Answers will be dependent on where you are (Camps Bay, Muizenberg, Paarl or possibly Saldanha Bay).

Ask: Do we have the same weather as shown on the picture?

Ask: How does it differ?

Discuss with the learners in which season they get rain, when it is dry and when does the wind blow where they live.

Ask: When is it most likely that we will experience a wildfire in our area. Why?

- Summer – it is hot, vegetation is dry and the wind blows.

Ask: Why is it called the fire season?

Ask: How does fire weather and the topography affect the firefighters' lives?

- On really hot days it is very uncomfortable to wear all the fire gear as it makes the firefighters even hotter.
- When the wind is blowing, the smoke can blow in the faces of the firefighters, making it difficult for them to breathe.
- When the wind is blowing, the fire can even go around the firefighters and come up behind them trapping them in the middle.
- If a helicopter is being used, the pilot needs to be careful that the wind does not blow the chopper around making it too dangerous to fly.
- If the wind is blowing, the pilot needs to be careful where he drops the water so that the wind does not blow it away from where he is aiming.
- If the fire is in the mountains, sometimes the firefighters cannot get to it.
- If the fire is far from a road, the firefighters sometimes have to walk a long way to get to the fire before they can start extinguishing it.
- Hot, dry and windy conditions increase the fire risk and the risk to firefighters.

Turn to **flipchart page 10.**

Ask: Does this picture show fire weather? Why?

- Yes, sun, wind, dry vegetation and brown, lizard and snake basking in the warmth of the sun. All of these are condusive to wildfire. Alien invasive vegetation would burn well if there was a fire.

ACTIVITY

1. Learners can draw the weather/seasons in their area. Divide the page into 4, one section per season and draw something in each section that is specific to that season.

6. Fire Danger Index

LEARNING OBJECTIVES

Knowledge

Learners will:

- know what factors influence the possibility of a wildfire in an area.

Behaviour

Learners will:

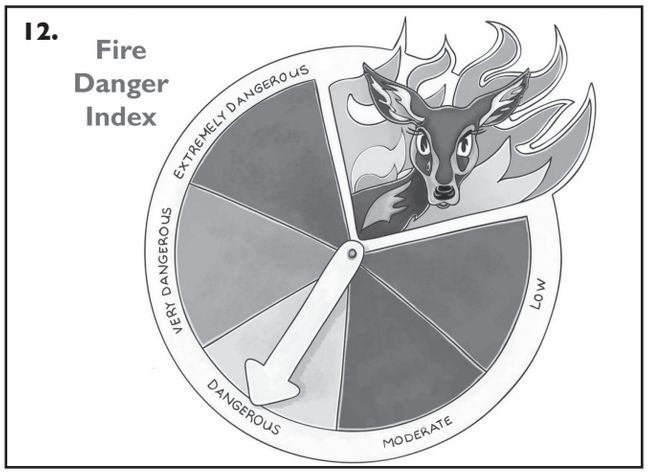
- learn what elements are taken into account when the fire danger index is calculated.
- know three different ways of obtaining the fire danger index on a given day.

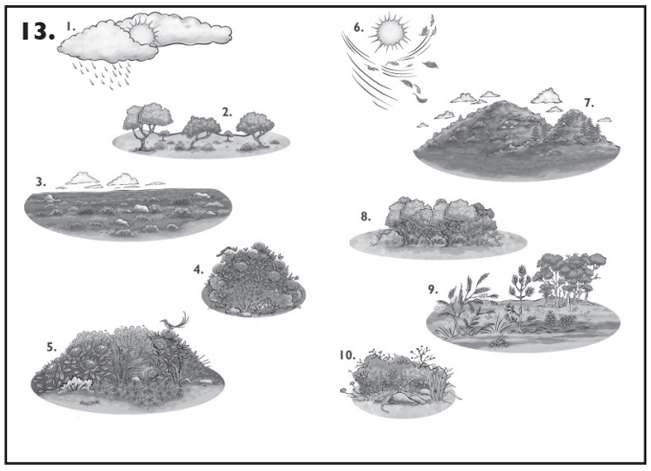
BACKGROUND INFORMATION:

- The fire danger index is a scale that indicates the risk of a possible fire and the rate of its spread on a specific day.
- There are 5 measurements – low (blue), moderate (green), dangerous (yellow), very dangerous (orange), extremely dangerous (red).
- The risk is worked out by taking into account relative humidity, temperature and wind speed. Some days are more risky than others (mid-summer vs. mid-winter in the Western Cape).
- Fire weather is closely related to the fire danger index. When the weather is such that it is conducive to the spread of wildfire, the fire danger index will read dangerous (yellow), very dangerous (orange) or extremely dangerous (red).
- The strength and direction of the wind plays a role in the spread of wildfires.
- Watch this index in the media and be aware of what is happening around you.
- http://www.afis.co.za/mobile/
- http://www.afis.co.za/

Materials

- Flipchart pages 11, 12 and 13. Coloured paper flags x 5 colours – green, blue, yellow, orange and red. The learners will have to make these as the flags are not supplied with the toolkit.
- Decide which activity you would like to do with your learners and get the materials together for that
  - Coloured paper A4 x 10 sheets of each x 5 colours – green, blue, yellow, orange and red
  - Prestick
  - Scissors
  - Paper plates and split-pins
  - Wax crayons, pencil crayons or kokis for colouring in
  - Cardboard
  - Compass for drawing circles/circle template





PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 11.**

Recap information on the fire triangle and the fire behaviour triangle.

Show picture of the map of South Africa with the Fire Danger Index.

Ask: What does the map show us?

- The red areas on the map show the high risk areas for a wildfire.

Ask: Where can we get information about the fire index?

- Radio, phone, TV, Internet.

- The older learners can look for an app on their phones that will give fire danger risk areas.

Turn to **flipchart page 12** which shows the CapeNature Fire Danger Index.

Explain that the fire danger index is a scale that indicates the risk of a possible fire and the rate of its spread on a specific day. It has 5 measurements – low (blue), moderate (green), dangerous (yellow), very dangerous (orange), extremely dangerous (red).
This is worked out by calculating the relative humidity, temperature and wind speed. Some days are more risky than others (mid-summer vs mid-winter in the Western Cape).
The strength and direction of the wind plays a role in the Fire Danger Index.

Turn to **flipchart page 13.**
Ask: Drawing on your knowledge of the fire triangles, weather seasons and fire danger index, to which colour on the fire index would the arrow point for each of these illustrations and why?

1.	Rainy, cool weather.	Blue – low
2.	Vegetation sparse and far apart from each other. Relatively dry.	Green – moderate
3.	Flat topography, small bushes, cool weather, vegetation not very dry. Possibly mid-winter.	Blue/green – low to moderate
4.	Dense, moist (green) fynbos. Relatively small plants (see bird size)	Blue/green – low to moderate
5.	Dense, moist (green) fynbos. Relatively small plants (see bird size)	Blue/green – low to moderate
6.	Hot and windy weather.	Red – extremely dangerous
7.	Dense vegetation, cool weather, (clouds) topography with hills or mountains (slopes), some alien invasive plants.	Yellow/green – moderate to dangerous
8.	Dense vegetation, dry	Yellow/orange – dangerous to very dangerous
9.	Alien vegetation, dry	Orange – dangerous
10.	Fynbos, very dry, possibly the end of summer of during a drought. hot day (basking lizard)	Red – extremely dangerous

ACTIVITIES

1. Take the learners outside. Divide the school ground/field into 5 sections – blue, green, yellow, orange and red. Put a coloured paper flag in each section. Read out a danger level word and learners are to run to that section's colour.
   - moderate – green
   - very dangerous – orange
   - extremely dangerous – red
   - low – blue
   - dangerous – yellow

2. Make a Fire Danger Index for the class. Each morning the learners need to decide where the arrow should point for that day.

3. Learners can also make their own index with a movable arrow.

   For the younger learners, have a circular index similar to the one shown on the flipchart. Learners can use a paper plate and a split pin to attach the arrow.

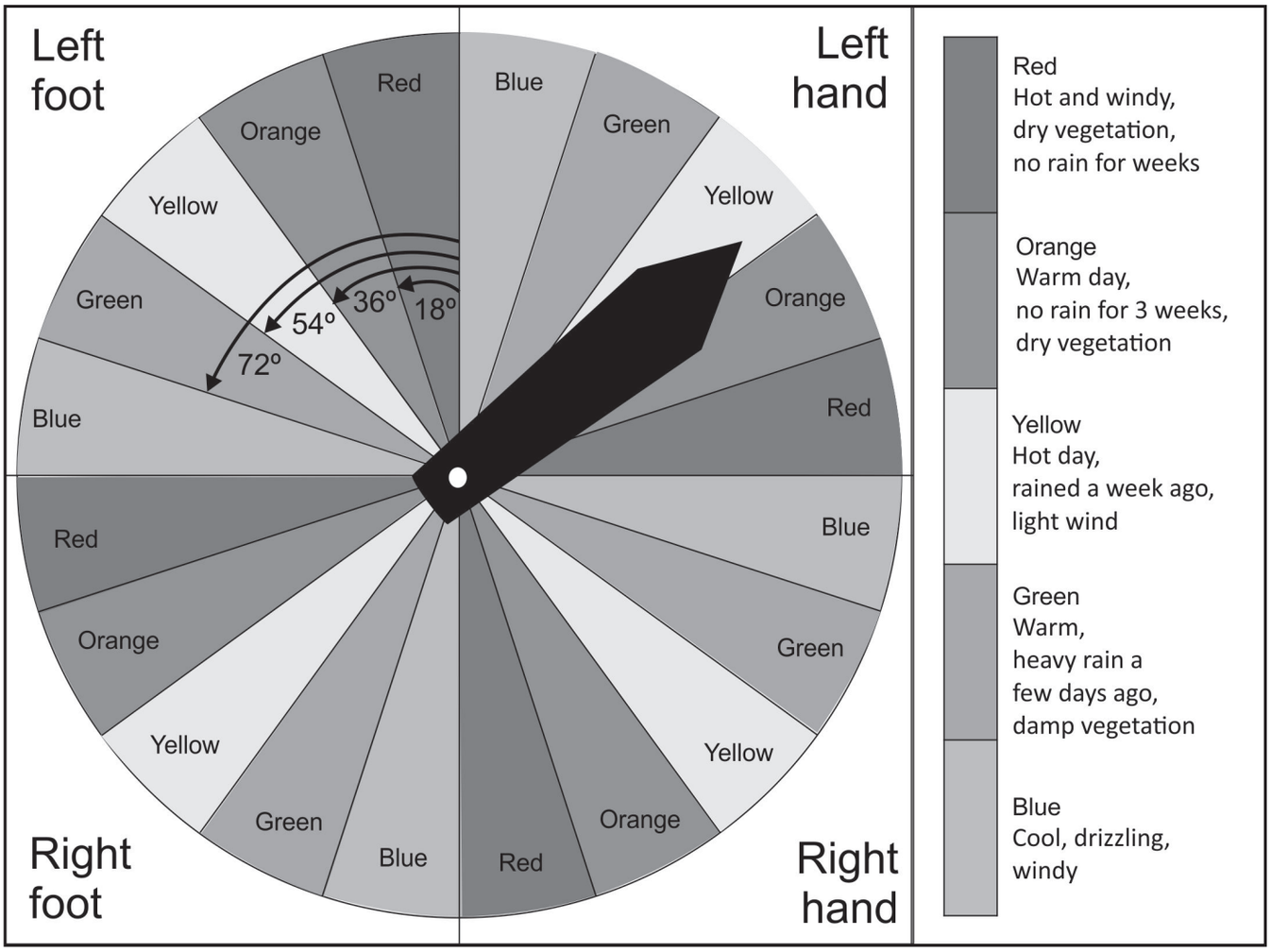
   For the older learners, this could be circular, semi-circular or linear. A linear scale could have an arrow or a sliding scale. They can use a protractor and ruler to make accurate measurements. Encourage each of the learners to come up with their own scale and not just copy the CapeNature one. However, keep to the same colours. There are many ideas on the internet under: Fire Danger Index (click on the 'images' option).

4. In groups, make up a 'Twister board and spinner'.

- For the dots: each group needs 5 sheets of coloured paper of each of the Fire Danger Index colours – 25 sheets of paper in total. Using a compass, draw a circle, 21cm in diameter (radius = 10.5cm) on each sheet of paper. Cut these out and stick them to the floor using prestick. These are traditionally kept in lines, but it could be fun to mix-up the colours and not use lines.

- Make spin scale as follows: Make a cardboard square of about 30 x 45cm. Divide it into 4 sections radiating from the centre. Each section to be marked with one of the following: left foot, right foot, left hand or right hand. Each of these sections to be further divided into 5 equal parts – each with a colour as per the Fire Danger Index. Key:
  - Hot day, rained a week ago, light wind (dangerous – yellow)
  - Warm day, no rain for 3 weeks, dry vegetation (very dangerous – orange)
  - Hot and windy, dry vegetation, no rain for weeks (extremely dangerous – red)
  - Cool, drizzling, windy (low – blue)
  - Warm, heavy rain a few days ago, damp vegetation (moderate – green).
  - Learners can make up scenarios that are appropriate.

- Put an arrow in the middle – this arrow must be able to spin (use a split pin or a rivet).
- Twister with the Fire Danger Index:
  6 to 8 learners to stand on the twister 'board'. The educator spins the arrow and calls out the scenario found in the key that corresponds with the colour that the arrow has landed on. Learners on the 'board' to put appropriate hand or foot on the correct coloured dot. If a learner falls over or gets the wrong colour, he/she is out and another takes his/her place.



7. Indigenous and Alien Invasive Vegetation

Note to educator: This could be presented over two lessons. The first presentation covers indigenous vegetation and the second looks at alien invasive vegetation.

LEARNING OBJECTIVES

Knowledge:

Learners will:

- understand the difference between indigenous and alien invasive vegetation.

Behaviour:

Learners will:

- recognise the difference between indigenous and alien invasive vegetation.
- conserve fynbos and get rid of invasive alien vegetation.
- pull out small invasive alien plants.
- tell their parents/families about these plants and request that fynbos is grown in the garden (water-wise garden) rather than alien invasive vegetation.

Note to educator: Please keep discussions about 'aliens' away from references to human refugees/foreigners being referred to as alien. This could re-inforce a negative perception about people who move from place to place. We do not want to encourage xenophobia in any way at all!

In terms of this discussion it is relevant that invasive alien plants/animals do not have their natural predators or controls in a new space/area, and thus (if the climate and circumstances are in place) can grow or populate without interference and get out of control.

BACKGROUND INFORMATION:

Indigenous: originating in and characteristic of a particular region or country; native or original.

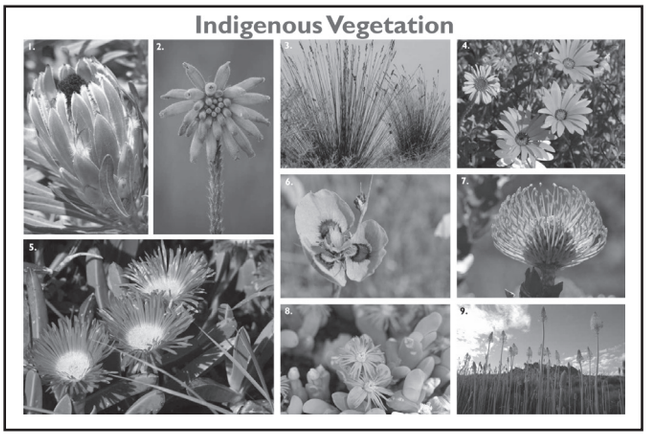
- Fynbos, renosterveld and strandveld are the main types of indigenous vegetation naturally found in the Western Cape.

Endemic: species found nowhere else in the world.

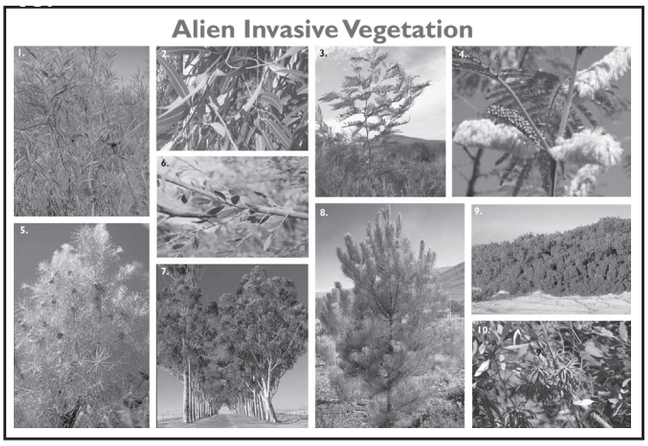
- Most fynbos, renosterveld and strandveld are endemic to the Western Cape and found nowhere else in the world.

Fynbos vegetation

- Fyn = fine;
- bos = bush.
- Defined by fine/small-leaved bushes.
- Fynbos is adapted to coping with hot dry summers and wet winters.
- They have strategies to survive and re-grow after fire.
- They need fire to survive.
- Ideally, they do not need additional water other than rain.



	Plant name	Family	Photographer
1.	Queen Protea	Proteaceae	Joan Ward
2.	Erica	Erica	Scott Ramsay
3.	Restio	Restio	CapeNature
4.	Daisies	Asteraceae	Joan Ward
5.	Suur vygies	Aizoaceae	Joan Ward
6.	Moraea villosa	Iridaceae	Rupert Koopman
7.	Pin Cushion (Leucospermum)	Proteaceae	Joan Ward
8.	Vygie	Aizoaceae	Joan Ward
9.	Bulbinella (Katstert)	Asphodalaceae	Rupert Koopman



	Plant name	Family	Photographer
1.	Long-leaved wattle	Acacia	CapeNature
2.	Port Jackson	Acacia	CPFPA
3.	Black Wattle	Acacia	Donovan Kirkwood
4.	Stink bean	Acacia/wattle	CapeNature
5.	Hakea	Hakea	CapeNature
6.	Myrtle	Myrtaceae	CapeNature
7.	Blue-gum	Eucalyptus	CapeNature
8.	Pinetree	Pinus	CapeNature
9.	Rooikrans	Acacia	CapeNature
10.	Spider gum	Eucalyptus	CapeNature

- The leaves are fine, sometimes even needle-like.
- They are small plants and do not grow very tall. They do not give much shade.
- The leaves may be glossy/waxy or hairy.
- The bark is woody.
- The characteristic plants of the fynbos are proteas (1 and 7), colourful ericas (2), hardy Cape reeds/restios (3) and plants known as geophytes that survive harsh conditions underground as bulbs (9). All of these are seen in the photos for this lesson.

Alien invasive vegetation

- Alien invasive vegetation are plants that were brought to the Western Cape from other places (mainly Australia). They were brought here to give shade and to stabilise the loose sand dunes at beaches and along roads.
- This vegetation grows much more quickly than fynbos and uses a lot of water.
- It gets very large, dense and burns easily.
- When these plants burn, the heat generated (much more than when fynbos burns) can change the structure of the topsoil and harm the microbes and destroy the fynbos seeds in the soil. Fynbos needs the microbes to remain healthy.
- We refer to them as 'alien invasive' as they take over whole areas and the fynbos disappears.
- Alien invasive vegetation in the Western Cape includes: Pine trees, Gum/Eucalyptus, Port Jackson, Black Wattle, Rooikrans, Myrtle.

LESSON PREPARATION

Materials

- Flipchart pages 14 and 15.
- Photos of indigenous vegetation and alien invasive vegetation – 16 x A4 pictures supplied with the toolkit.
- Prestick or magnets or drawing pins for pin-board.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Optional: Computers with internet connectivity and printer. Camera/cell phone camera.
- If taking the learners on the outing, organise it with the relevant authority, the school and parents. Remember to get parental consent.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the flipchart page 14.

Indigenous vegetation

Ask: What does the word 'indigenous' mean?

- Has its home in a particular area; e.g. South Africans are indigenous to South Africa, Chinese are indigenous to China.
- Definition: naturally existing in a place or country rather than arriving there from another place.

Ask: Which plants in our area are indigenous?

- Proteas, Restios, Ericas and Succulents. (The learners might be unfamiliar with these plants – they would have seen them but might not know their names. If so, instead of asking about the plants, tell the learners about them).

Ask: What does 'endemic' mean?

- Found only at a certain place and nowhere else in the world – people and some animals can move from place to place, but most plants stay in the place where they originated.

Ask: What is fynbos, renosterveld and strandveld?

- Vegetation types found in the Western Cape.

Ask: What does 'indigenous endemic fynbos' mean?

- Plants found and adapted to conditions only in the Western Cape and nowhere else in the world.

Ask: Do you think this makes those plants special? Why?

- They are only found here – nowhere else.

Fynbos vegetation:

Write the word 'fynbos' on the board. This is made up of 2 words: fyn = fine; bos = bush. Meaning that these are 'fine plants'.

Turn to **flipchart page14.**

There are 4 main groups of fynbos. Point out the 4 main groups. Divide the board in 2 equal parts, in the left side stick up the following 4 photos: Restios, Proteas, Succulents and Ericas. Write 'indigenous' above these photos.

Make a list under these photos of the main characteristics: small leaves, waxy shiny leaves, hairy leaves, woody bark, not very big, fine leaves and branches, small flowers, hairy flowers, dry flowers, leaves lie close to the stem.

Alien invasive vegetation

Turn to **flipchart page15.**

On the right side of the board, put up 4 photos of invasive alien plant photos and write the words 'invasive alien vegetation' above them.

Ask: What does 'invasive' mean?

- It comes from the word invasion which refers to a country taking over another country in wartime (Germany invaded France during the 2nd World War).
- Something that takes over a place that is not its natural home.

Ask: What does 'alien' mean?

- Something from somewhere else. We often refer to science fiction creatures from outer-space being aliens.

Ask: What does the term 'invasive alien vegetation' mean?

- Plants that take over a place that is not its natural home.

Most of these plants come from Australia – they were imported to provide shade (indigenous plants being too small to provide shade) and to stabilise loose sand.

Make a list under these photos of the main characteristics: large plants, leaves generally bigger than fynbos. These are trees, not shrubs or bushes.

Invasive alien vegetation grows much more quickly than fynbos, uses a lot of water and burns at high temperatures.

When these plants burn, the heat generated (much more than when fynbos burns) can change the structure of the topsoil and harm the nutrients in the soil. Thus harming the fynbos that needs the microbes to remain healthy. The fynbos seeds in the soil are often also destroyed by the excessive heat.

Invasive alien vegetation: Pine trees, Gum/Eucalyptus, Port Jackson, Black Wattle, Rooikrans.

ACTIVITIES

1. Hand out the remaining 4 photos of fynbos and the remaining 4 photos of alien invasive plants. Learners to attach the fynbos photos on the fynbos side of the board and explain why they have attached them there. Do the same with the alien invasive plants.

   Ask: How do you know this is indigenous or alien invasive vegetation?

   Transfer the photos from the lesson to a board that can stay up in the classroom for a few weeks. Have 2 columns on the board. One labelled: indigenous, and the other labelled: alien invasive.

   Place the photos of the fynbos under the indigenous vegetation column and the photos of alien invasive vegetation under the other column.

2. Learners can do an internet research and bring other photos from home to add to the collection.
3. Learners can do internet research for specific vegetation such as 'renosterveld' and tell the class something about these plants.
4. Give learners some time to walk around the school grounds in groups and take photos (using their phones) of the various plants found there. Ask learners to find www.iSpotnature.org on the internet. Get the learners to use the website to find out what plants they have photographed. Sometimes this website takes a while to find the answer, but it will give a list of plants and photos that fit that description. Look at the photos supplied and see if you can find them in iSpotnature.
5. Use the following website to get the learners to search for pictures of the alien invasive plants in your area: www.invasives.org.za. Ask the learners to find other websites that will help in this task.
6. Write a rap/poem/song about indigenous vs. invasive alien plants. Perform for the class. This can be done in groups or individually.
7. Organise an excursion to Kirstenbosch, Green Point Park, your municipal park or a CapeNature reserve in your area. Arrange with the reserve manager that a guide/community conservation officer gives the class some direction or a guided tour with special reference to indigenous vs. invasive alien plants.
8. Join a local invasive alien plant hack/elimination drive.

8. Fire Dependent Species

LEARNING OBJECTIVES

Knowledge

Learners will:

- understand that not all fires are bad. Some plant species like the Protea are dependent on fire for their existence.

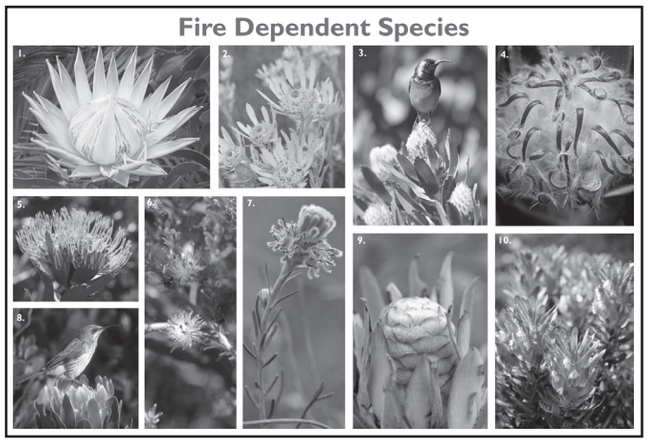
Behaviour

Learners will:

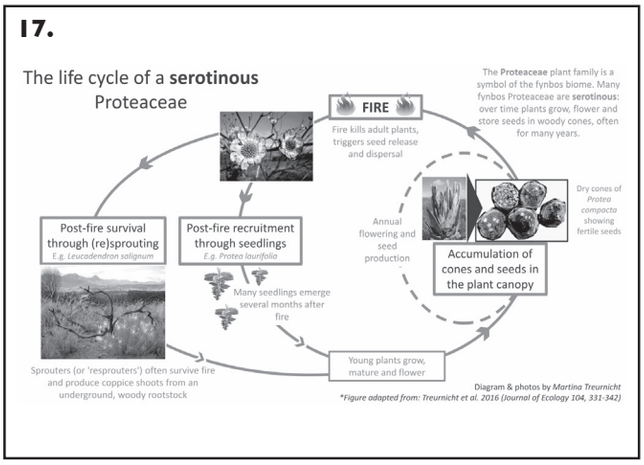
- recognise how to protect the natural life-cycle of the Protea species.

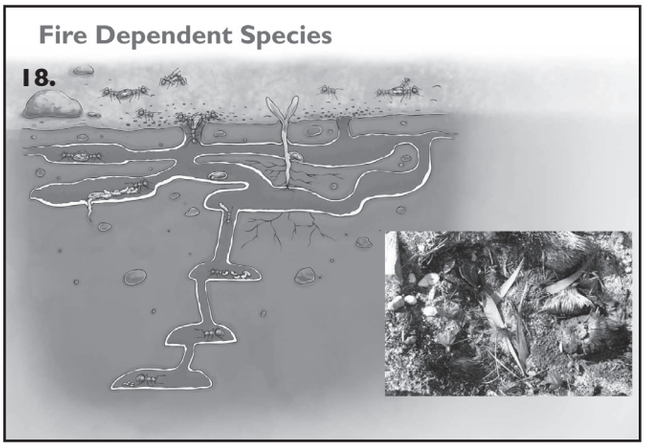
BACKGROUND INFORMATION:

- Many plants in our region are adapted to survive in environments with fire. Some plants even depend on fire to help them grow and disperse.
- The tallest shrubs in fynbos are the proteoids, all of which belong to the family Proteaceae. They are mostly one to three metres in height and have large, leathery leaves. Sometimes the leaves are fury/hairy.
- There are two main types of Protea with regards to their survival when it comes to fire; the resprouters and the non-resprouters.
- All protea produce seeds that germinate and grow into new plants, however, some are able to send up new life from a seemingly dead plant that has been burnt in a fire. These are the re-sprouters as they survive fire by resprouting. A new plant will grow out of the bark of the old burnt bush. There are buds in the stem that are protected by the thick bark. After a fire, these buds grow and a new bush develops in the same place as the old.
- Non-resprouters, also called re-seeders, have a single main stem at ground level. Re-seeders are killed by fire, but fire triggers the release of their seed banks. These are generally the Protea with the big flowers.
- The flowers are pollinated by nectar-loving birds – mainly sunbirds and sugarbirds. When these birds dig their long beaks into the flower to get to the nectar that is deep inside each flower, they get pollen on their heads. As they move to the next flower and do the same thing, the pollen from their heads then sticks to the flower of the next plant and thus pollinates the flower. 'Cones' of seeds then form at the base of these flowers. Bees and various bugs also pollinate the flowers by transferring the pollen from one flower to the next.
- Following a fire, the burnt old flower head that formed a cone after pollination, opens and releases these seeds. Most of these are dispersed by the wind and are only exposed at the onset of wet winter conditions, which are favourable for germination and seedling establishment.
- It takes 5 to 11 years for a seedling to mature into an adult plant and produce its own seeds.
- The interval between fires should not be too long, as



	Plant name	Family	Photographer
1.	King Protea	Proteaceae	Joan Ward
2.	Witzenberg Conebush	Proteaceae	CapeNature
3.	Leucospermum, Sunbird	Proteaceae	Joan Ward
4.	Pincushion	Proteaceae	Scott Ramsay
5.	Potberg Pincushion	Proteaceae	Joan Ward
6.	Flats Silky puff	Proteaceae	Anton Wolfaard
7.	Needle-leaf Spiderhead	Proteaceae	Anton Wolfaard
8.	Protea, Cape Sugarbird	Proteaceae	CapeNature
9.	Luecadendron	Proteaceae	Scott Ramsay
10.	Common Pegoda	Proteaceae	Scott Ransay





fynbos plants like the Protea become old in the absence of fire. If Protea live too long, they stop flowering and die, releasing their canopy-stored seeds. These seeds will either be eaten by rodents or be killed in a subsequent fire.

- Fire intervals should not be too short either as the seeds need time to mature before they are ready to be released after a fire. If the Protea has not matured enough to build up sufficient seed resources, it is also too young to sustain a fire.
- Other seeds are taken by the Pugnacious ant and buried in their ant colonies. There is a very nutritious oil in the seed and the ants are particularly fond of this substance. They eat off the 'fruit' part of the seed and the rest of the seed is left buried under the ground where it is safe from rodents that would normally eat the seeds. During a fire, the ground heats up and the seed shell splits, water from the winter rains germinate the seed.
- *Throw four or five fresh seeds onto a patch of open sand mid-morning or mid-afternoon, sit back and set your eyes for some fine focussing. After a minute or two you will probably see some aimlessly wandering ants. By random lurches, what statisticians sometimes call `drunkard's walks', the ants at last make contact. Shock!; amazement!; thrill! – who knows what goes on in their tiny minds! Then a sprint for the nearest nest, tap on the portals and out flow the heavies, the mean looking major ants that hover near the entrance, straight to the seeds. Within minutes the scene is a mass of crawling, struggling, frenzied ants pulling and tugging at the seeds from every direction. Astonishingly, order eventually prevails and the seeds are slowly, painfully dragged to ant nests, via numerous detours on the way, until at last they vanish neatly into the entrance hole of the nest. From: www.Proteaatlas.org.za/watch.htm*

LESSON PREPARATION

Materials:

- Flipchart pages 16 – 18.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing equipment.
- Computers/cell phones with internet connection.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 16.**

Ask: What type of flowers are shown on the flipchart?

- All Protea

Tell the learners that there are a great many different species of Protea. They are all indigenous and most are endemic to the Western Cape.

Ask: What do the terms indigenous and endemic mean?

- Indigenous – grows in that area naturally.
- Endemic – found there and nowhere else in the world.

Tell the learners that the one thing that all Protea have in common is that they need fire to survive. Without fire, the species will die. But like with all things, not too little and not too much. The Protea needs fire – just the right amount.

Turn to **flipchart page 16**

This section of the flipchart shows part of the lifecycle of a Protea. Explain that there are 2 main types of Protea with regard to survival when it comes to fire; resprouters and non-resprouters.

Resprouters: these survive fire by resprouting. A new plant will grow out of the bark of the old burnt bush. Buds in the stem are protected by the thick bark. After a fire, these buds grow and a new bush develops in the same place as the old.

Non-resprouters, also called re-seeders, have a single main stem at ground level. Re-seeders are killed by fire, but fire also triggers the release of their seed banks. These are generally the Protea with the big flowers.

Explain that the flowers are pollinated by nectar-loving birds – mainly sunbirds and sugarbirds. When these birds dig their long beaks into the flower to get to the nectar that is deep inside each flower, they get pollen on their heads. As they move to the next flower and do the same thing, the pollen from their heads then sticks to the flower of the next plant and thus pollinates the flower. 'Cones' of seeds then form at the base of these flowers. Bees and various bugs also pollenate the flowers by transferring the pollen from one flower to the next. This is how the seeds are made.

Following the fire, the 'cone' opens and releases the seeds. Most of these are dispersed by the wind.

Some are eaten by rodents.

Turn to **flipchart page 18.**

Other seeds are taken by the Pugnacious ant and buried in their ant colonies. There is a very nutritious oil in the skin surrounding the seed and the ants are particularly fond of this substance. The ants eat the skin and leave the seed buried until the next rains fall when germination occurs. These seeds are safe underground from the rodents that would normally eat the seeds.

Only when exposed to our wet winter conditions, do the seeds germinate.

It takes 5 to 11 years for a seedling to mature into an adult plant and produce its own seeds.

The interval between fires should not be too long, as fynbos plants, like the Protea, become too old in the absence of fire. If these live too long, they stop flowering and die, releasing their canopy-stored seeds. These seeds will either be eaten by rodents or be killed in a subsequent fire.

Fire intervals should not be too short as the seeds need time to mature before they are ready to be released after a fire. If the Protea has not matured enough to build up sufficient seed resources, it is too young to sustain a fire.

ACTIVITIES

1. Get learners to draw a Pugnacious ant burrow with the seeds being taken into the nest. Remind them that there are different sizes of sand grains, pebbles and even rocks underground. They should also include in the drawing the roots of various different plants in the soil around their ant burrow.

2. Argentinean ant
   Leaners can do some research on this ant and the effect this alien species has on our fynbos. They can look up the Pugnacious ant as well and see the relationship between the two ants.
   - **http://www.Proteaatlas.org.za/watch.htm**
   - **http://www.Proteaatlas.org.za/antarg.htm**

9. The Cape Floral Kingdom

Note to educator: This could be presented over two lessons. The first presentation covers the various indigenous plants and the second covers the destruction of an indigenous area by alien invasive vegetation.

LEARNING OBJECTIVES

Knowledge

Learners will:

- be able to identify the Cape Floral Kingdom as a biodiversity hotspot.
- have an awareness of the huge diversity within the floral kingdom and hopefully be able to identify some of the plants in the veld.
- understand the importance of having pristine fynbos areas without any invasive alien vegetation.

Behaviour

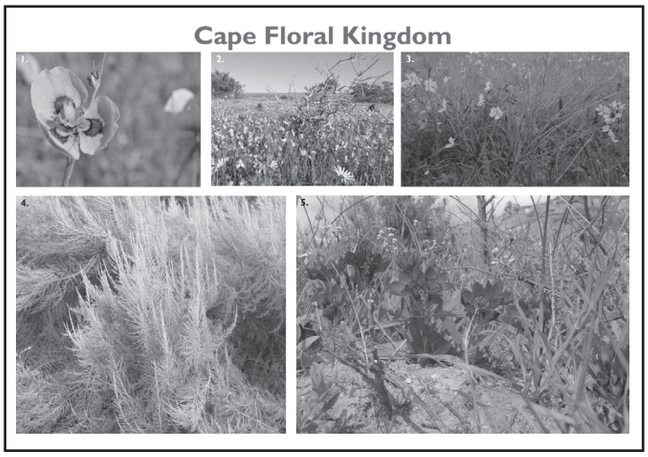
Learners will:

- learn how to protect our fynbos.
- persuade their parents to grow fynbos in their gardens rather than alien invasive plants.
- get rid of plants that threaten it.

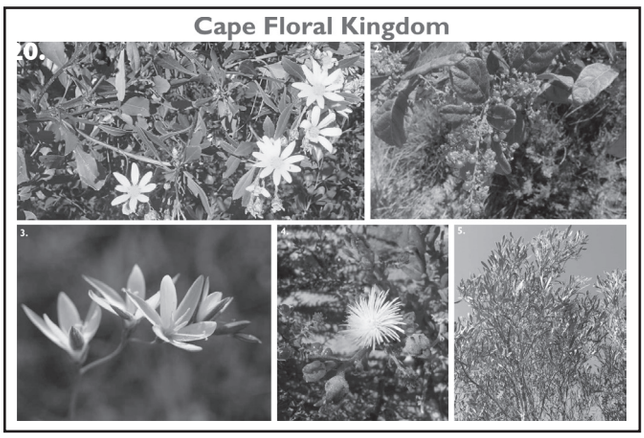
BACKGROUND INFORMATION

- The Cape Floral Kingdom, also known as the Cape Floristic Region World Heritage site, is one of the six floral kingdoms in the world. The earth is divided up into six botanical regions, with each one of them being referred to as a "floral kingdom".
- The other floral kingdoms are:
  - Holarctic Kingdom: (North American west coast and Central Asia);
  - Paleotropical Kingdom (Central Africa);
  - Neotropical Kingdom (South America);
  - Australian Kingdom;
  - Holantarctic Kingdom (Tip of South America); and
  - Capensis Kingdom (Western Cape, South Africa).
- The Cape Floral Kingdom stretches from Nieuwoudtville in the west to Port Elizabeth in the east.
- It is a hotspot of biodiversity, with many more species per unit area than anywhere else in the world.
- Fynbos covers 80% of the region.
- Fynbos, grey renosterveld and coastal strandveld make up the Fynbos Biome.
- There are also patches of wetland, thicket, forest and succulent karoo vegetation.
- Fynbos – the characteristic plants of the fynbos are proteas, colourful ericas, hardy Cape reeds (restios) and plants known as geophytes that survive harsh conditions underground as bulbs.

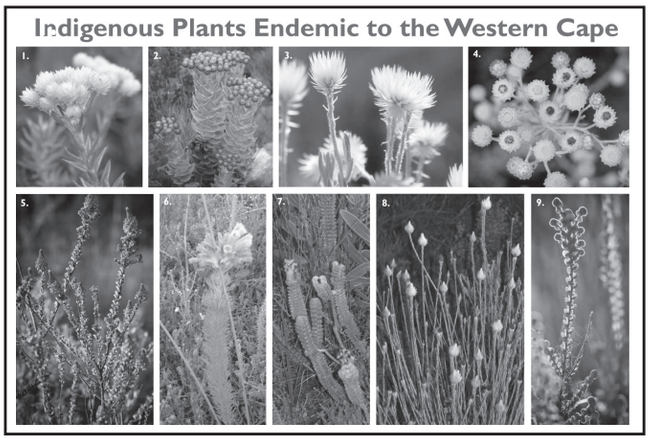
	Plant name	Group	Photographer
1.	Peacock Moraea (Morea Vilosa)	Renosterveld	Rupert Koopman
2.	General renosterveld	Renosterveld	Rupert Koopman
3.	General renosterveld	Renosterveld	Rupert Koopman
4.	Elytropappus rhinocerotis	Renosterveld	unknown
5.	Babiana	Renosterveld	Rupert Koopman



	Plant name	Group	Photographer
1.	Chrysanthemoides monilifera	Strandveld	iSpot
2.	Dune Olive Olea exasperata	Strandveld	iSpot
3.	Hesperantha falcata	Strandveld	Donovan Kirkwood
4.	Mesembryanthemum	Strandveld	iSpot
5.	Searsia laevigat	Strandveld	iSpot

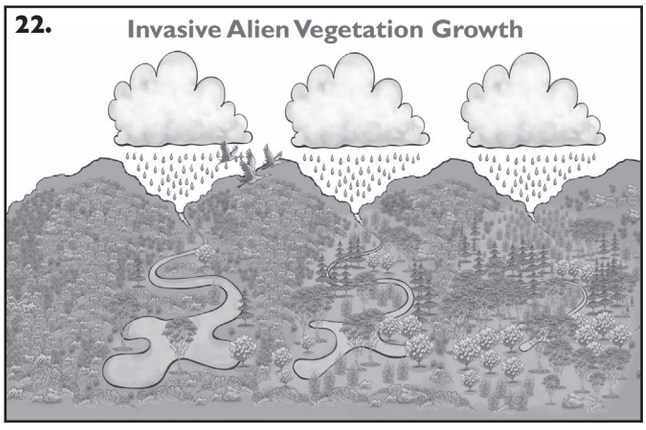


- Renosterveld (chinoceros veld) – is largely characterised by low-growing grey bushes known as renosterbos and a high number and diversity of geophytes.
- Strandveld (beach vegetation) – Strandveld grows on dune and limestone cliffs along the seashore. The sand contains old seashells, is rich in calcium and phosphorus and is alkaline. Many of the plants are low shrubs with broad, fleshy leaves. Succulents are common on the drier west coast.
- Succulent karoo – Sparse, low-growing succulent karoo vegetation is found in dry areas with less than 250 mm of mainly winter rain and where the soil is rich in nutrients. It has the highest number of plant species for a semi-arid area anywhere in the world. The most common of its fleshy-leafed plants are the vygies, with over 1000 species.
- Subtropical thickets – Dense thickets of bush or low forest occur along rivers, dunes and on termite mounds. Thickets thrive in nutrient-rich soils with a rainfall of between 300 – 800 mm and where there is little danger of fire.
- When a floral kingdom has endemic plants that are threatened by human activities, they are known as biodiversity hotspots. (Biodiversity is the variety of all living things in a particular habitat.) The Western Cape is one such hotspot.
- This biodiversity hotspot in the Western Cape, known as "the hottest hotspot", has the highest concentration of different plant species in the world.
- Fynbos, renosterveld and strandveld: vegetation groups naturally found/endemic to the Western Cape. 2/3 of these are found only in the Western Cape (endemic) – nowhere else in the world.
- Fynbos and renosterveld are both fire driven and strandveld burns very infrequently.
- Plant biodiversity at the species level in fynbos vegetation is the highest in the world.
- These plants live in course soil with not many nutrients.
- Some have fat, succulent leaves (vygies) adapted to water storage.
- Fynbos is a fire-adapted vegetation type and needs fire to sustain itself - without fire there would be no fynbos.
- Fire is part of the fynbos-cycle of destruction, regeneration, maturation and destruction again, it is an integral part of its biology.
- This vegetation is flammable.
- After a fire, they thrive on the nutrients that the fire puts back into the soil after burning the old vegetation.
- Most fynbos needs a fire every 10 to 25 years to survive. This differs slightly between species. If other invasive alien plants grow around them, consume too much water and make too much shade, they will die off. As the non-fynbos plants tend to burn at a higher temperature, a fire not only destroys them but can also destroy the fynbos and its seeds at the same time.
- Some fynbos plants have seeds that germinate/start to



	Photographer
1.	CapeNature
2.	CapeNature
3.	CapeNature
4.	Scott Ramsay
5.	CapeNature
6.	Mandy Lomberg
7.	Mandy Lomberg
8.	Mandy Lomberg
9.	Scott Ramsay

The photos here show some of the pretty and interesting indigenous plants that are endemic to the Western Cape.



grow after the heat of the fire. The fire is like an alarm clock that wakes them up.

- Others have bulbs that are hidden underground and they grow quickly after a fire (the fire lily and watsonias). The spread of flowers after a fire can result in magnificent carpets of colour.
- Some plants have a thick bark that protects the plant. New growth comes from the bark.
- Fires that are too frequent (ignited by people) or too intense/hot can be detrimental to fynbos diversity.
- For fynbos, it is in the shape and size of its flowers in which its great diversity lies.
- One of the most valuable functions of fynbos is the delivery of high, sustained yields of clean water.
- Fynbos does not use huge amounts of water resulting in the run-off in these areas being sufficient to sustain rivers and the water table.
- Several of the flora jewels in the fynbos region have, over the years, due to their horticultural potential, found their way to gardens in other parts of the world.

LESSON PREPARATION

Materials

- Flipchart pages 19 – 22
- Decide which activity you would like to do with your learners and get the materials together for that.
- Paper and pens.
- If you do the wordsearch (page 27) or the crossword (page 28), remember to photocopy enough copies for the learners to have one each to work on. Answers on are pages 26 and 29.

You could either turn to the pages on the flipchart; or you could CAREFULLY open the ring-binders (do not force them or they will break) and take out the pages and put them up in the classroom side by side.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see it. **Flipchart pages 19 – 21.**

Presentation 1:

Ask: Who has heard of the Cape Floral Kingdom? Do any of you know what it refers to?

- This is the area of the Western Cape where we find fynbos, renosterveld and strandveld growing naturally.
- Almost 2/3rds of plants found here are found nowhere else in the world.
- There are 5 other floral kingdoms in the world and the Cape Floral Kingdom has the most number of plant species of all the kingdoms in the world.
    - Holarctic Kingdom: (North American west coast and Central Asia);
    - Paleotropical Kingdom (Central Africa);
    - Neotropical Kingdom (South America);
    - Australian Kingdom;
    - Holantarctic Kingdom (Tip of South America);
    - Capensis Kingdom (Western Cape, South Africa).

Ask: Who remembers what 'endemic' means?

- Found only in that particular area/place

Ask: What are the main characteristics of fynbos?

- small plants, small leaves, waxy shiny leaves, hairy leaves
- woody bark, need fire to survive, adapted to hot dry summers

Mention that fynbos has more characteristics that help it survive in the dry hot summers where it is found.

- The leaves have a small surface area to reduce evaporation from the leaves.
- Leaves often appear to cling to the stems. This reduces evaporation from the leaves.

- The hairiness helps trap moisture/dew and stop it from evaporating.
- The shiny, waxy leaves also prevent evaporation.
- The woody bark also protects against evaporation.
- These plants do not grow to be big trees.

Turn to **flipchart pages 19 – 21** and look at the pictures of fynbos, renosterveld and strandveld.

Look at each picture and discuss how each plant displays one or more of the above characteristics.

Ask: Where do you think the name 'renosterveld' might have come from?

- It is thought to come from the early settlers who named these plants after the rhino that were seen in the area. These plants are generally greyish in colour – like the rhino. Alternatively, it might be that there were rhinos in the area where the renosterveld was first seen.

Ask: What could be the differences between fynbos and renosterveld? (Most learners will not know this, so the educator can explain – see 2 answers below)

- The areas where they are found are different.
- Renosterveld needs a richer soil than fynbos.

Ask: Where do you think the name 'strandveld' might have come from?

- It comes from the word 'strand' which is Afrikaans for 'beach'.
- These plants are found very close to our beaches.

Look at the picture of the suurvygie (page 22, pic: 2 and 8; page 14 pic 5).

Ask: Why do you think the leaves are so odd looking?

- They store water in the leaves to help them survive the dry summers.
- These water-filled leaves also help ensure that they do not burn very easily in a wildfire.

Tell the learners that fynbos is designed to survive and regrow after fire. They need fire to survive.

Explain that these plants live in poor soil not very rich in nutrients/food and need to burn every 10 to 25 years to survive. The ash from the fire forms the correct nutrients/food that these plants need to survive.

If other invasive alien plants grow around them, consume too much water and make too much shade, they will die off. Fire removes these other plants, sometimes it also stimulates growth of invasive plants that are also fire-adapted.

Some fynbos plants have seeds that germinate and start to grow after the heat of the fire.

Others have bulbs that are hidden underground and they grow quickly after a fire (fire lily and watsonias). The spread of flowers after a fire can be magnificent carpets of colour.

Some plants have a thick bark that protects the plant and new growth comes from the bark.

Fynbos, renosterveld and strandveld do not use much water, whereas the alien invasive vegetation requires a lot of water.

ACTIVITIES:

1. Divide the class in groups of 4 or 5 and get them to make a list of some of the things that make fynbos so special.

2. Divide class in pairs. Pairs think of and write down 2 questions to ask the rest of the class in a quiz about fynbos, renosterveld and strandveld. Then divide the class into 2 teams. Each pair from each group has a chance to ask the other team a question. If the opposing team gets the question correct, they get a point. Once all questions have been asked, the quiz ends. If one team runs out of questions, the educator may ask a question on their behalf.

Presentation 2:

Ask: What does 'biodiversity' mean when talking about the Cape Floral Kingdom?

- The word 'diverse' means 'different'.
- Biodiversity means that there are many different plants species/types growing in an area.
- They all look different and all have different ways of surviving and helping animals and insects to survive.
- They are all important links in the chains of our eco-system of the Western Cape.

Ask: What do you think a 'hotspot' is?

- This could be an area of danger – where there is gang warfare.
- It could be an infected sore that is red and infected and hot to touch.

Ask: If we talk about a 'biodiversity hotspot' what do you think we mean?

- This is an area where lots of different plants are found together, but that are threatened by either invasive alien plants (gang warfare) or human development in these areas. The Western Cape is a 'biodiversity hotspot'.
- This is an area where the ecosystem is sick/not working properly and infected by invasive plant species.

Turn to **flipchart page 22.**

Ask: What do you think is happening in the picture?

- The illustration here shows the damage done to a water system when invasive alien vegetation is allowed to get out of control.
- Working from left to right. The veld is covered with fynbos. The catchment area in the mountains feeds a river that then forms a vlei area at the base of the mountain. This is the only water required by the fynbos. There are a few alien invasive plants seen here.
- Middle section: the alien invasive vegetation is speading, the fynbos is less prevelant and the vlei is begining to dry up. Invasive alien plants are taking over the landscape and destroying the water sources. The smaller indigenous plants are disappearing.

- Right section: The alien invasive vegetation has taken over. There are very few fynbos plants to be seen. The vlei area has almost disappeared. The water is disappearing as the alien invasive plants drink much more water than the indigenous plants. The underground water is being sucked up by the trees.

Ask: What do you think will happen when there is a wildfire here?

- The invasive alien vegetation will burn easily and at a high temperature.
- The remaining fynbos will be destroyed by the high temperatures of the fire and might not recover.
- It will be difficult to put this fire out as the water resources are now very limited.
- After the fire, the area will look like a moonscape. It will take a long time for the area to recover and the plants to regrow.
- The indigenous plants might have been destroyed in this area and might not come back.

Ask: What will happen when the winter rains come?

- Because the indigenous vegetation has been destroyed, there will be flooding. The fertile top soil will be washed away. Dongas (gullies) may form. There may be mudslides into the low lying areas.

Explain that if the alien invasive plants are removed before they take over, there will be no floods, no mud-slides and no resultant dongas.

Explain why this area is now a biodiversity hotspot.

Ask: What can we do about this?

- Whenever you see a baby alien plant – pull it out!

ACTIVITIES

1. Write a song/rap/poem about a fynbos, renosterveld or strandveld plant that they have researched using the internet. Use cell phone lingo and 'spelling'.

2. What is a biodiversity hotspot?

3. Wordsearch – below, answers page 30

4. Crossword – page 29, answers page 30

Find 26 words in the WORDSEARCH. Circle words as you find them.

Rain, Protea, vygies, strandveld, kingdom, seeds, hot, hotspot, flower, watertable, fire, fynbos, bark, veld, floral, biodiversity, shade, stores, summer, renosterveld, planted, leaves, soil, waxy, leaf, dry.

Wordsearch answers

S	P	S	H	A	D	E	A	B	C	S	H	F
U	L	S	T	O	R	E	S	I	F	E	O	Y
M	A	T	K	I	N	G	D	O	M	E	T	N
M	N	R	P	R	A	I	N	D	X	D	G	B
E	T	A	R	U	V	Y	G	I	E	S	H	O
R	E	N	O	S	T	E	R	V	E	L	D	S
L	D	D	T	F	L	O	W	E	R	V	R	B
E	D	V	E	L	L	P	I	R	T	A	Y	A
A	S	E	A	O	H	O	T	S	P	O	T	R
V	E	L	D	R	A	B	F	I	R	E	J	K
E	H	D	W	A	T	E	R	T	A	B	L	E
S	O	I	L	L	W	A	X	Y	L	E	A	F

S	P	S	H	A	D	E	A	B	C	S	H	F
U	L	S	T	O	R	E	S	I	F	E	O	Y
M	A	T	K	I	N	G	D	O	M	E	T	N
M	N	R	P	R	A	I	N	D	X	D	G	B
E	T	A	R	U	V	Y	G	I	E	S	H	O
R	E	N	O	S	T	E	R	V	E	L	D	S
L	D	D	T	F	L	O	W	E	R	V	R	B
E	D	V	E	L	L	P	I	R	T	A	Y	A
A	S	E	A	O	H	O	T	S	P	O	T	R
V	E	L	D	R	A	B	F	I	R	E	J	K
E	H	D	W	A	T	E	R	T	A	B	L	E
S	O	I	L	L	W	A	X	Y	L	E	A	F

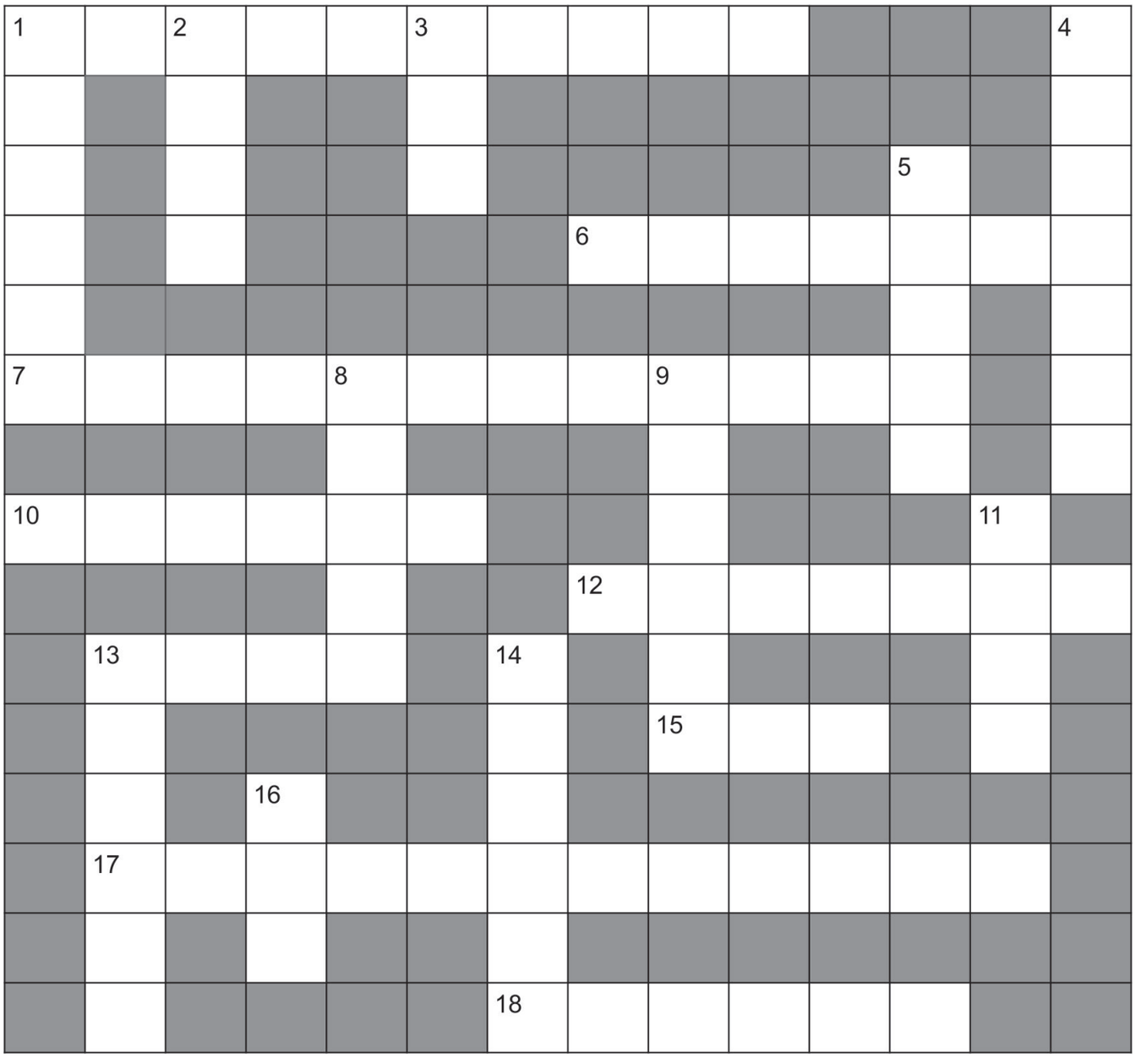
CROSSWORD

Across:

1. S--------- is a type of vegetation found near the beach. (10)
6. P------ are part of the fynbos family and our national flower. (7)
7. R---------- is named after one of the big five. (12)
10. The design on the fabric was very f----- as it had many pictures of flowers. (6)
12. The Cape Floral K------ is also known as the Cape Floristic Region or fynbos biome. (7)
13. Some fynbos plants need f--- to survive. (4)
15. The s-- gives our planet light, heat and life. (3)
17. This b---------- hotspot in the Western Cape has the highest concentration of different plant species in the world. (12)
18. A succulent plant s----- water in its leaves. (6)

Down:

1. S----- is our hot and dry season. (6)
2. In the Western Cape we get r--- in winter. (4)
3. Our summers are hot and d--. (3)
4. A place where endemic plants are threatened is called a h-------. (7)
5. S---- germinate and grow into young plants. (5)
8. Most fynbos do not grow well in s----, but prefer full sun. (5)
9. F----- are succulent plants often found near the beach. (6)
11. The s--- in the Western Cape is not rich in nutrients. (4)
13. F----- is endemic to the Western Cape. (6)
14. The l----- of most plants are green. (6)
16. Summers are h-- and dry. (3)



Crossword answers

s	t	r	a	n	d	v	e	l	d				h
u		a			r								o
m		i			y						s		t
m		n					p	r	o	t	e	a	s
e											e		p
r	e	n	o	s	t	e	r	v	e	l	d		o
				h				y			s		t
f	l	o	r	a	l			g				s	
				d			k	i	n	g	d	o	m
	f	i	r	e		l		e				i	
	y					e		s	u	n		l	
	n		h			a							
	b	i	o	d	i	v	e	r	s	i	t	y	
	o		t			e							
	s					s	t	o	r	e	s		

10. Useful Fires and Harmful Fires

LEARNING OBJECTIVES

Knowledge

Learners will:

- understand the benefits and problems associated with fire.
- recognise the difference between natural and human-caused fire.

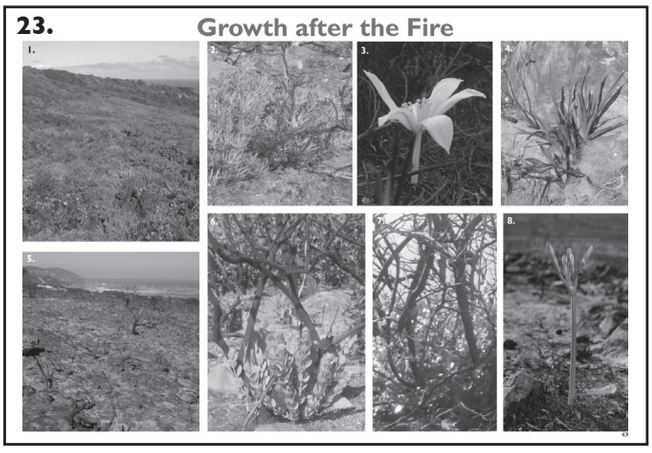
Behaviour

Learners will:

- understand the dangers of wildfire and not get involved in any fire-making activities that could be harmful or without an adult present.

BACKGROUND INFORMATION

- Fires are a natural part of the ecosystem. They have always burned regularly in the wild, cleaning out extra vegetation, insects and diseases, and generating a rebirth of the plants of the area. Without fire, plants and animals requiring nutrients and vegetation from other parts of the ecological cycle disappear. Some areas depend on fire to promote vegetative and wildlife diversity, to help keep the veld healthy and to stop the build-up of dead plant material that can lead to catastrophic wildfires.
- Many plants have adapted in ways that protect them as a species from the effects of wildfire, some plants are even strengthened by fire.
- People are encroaching more and more on areas where wildfires occur (wildland-urban interface). This mix of humans and fuel-filled wildlands has led to major wildfires.
- If an area does not have regular fires, there is a build-up of fuel (often invasive alien vegetation). So, when a fire does start, it burns so hot that the beneficial effects are lost. As a result, such ecosystems are less diverse; are laden with overgrowth and dead plants; and have given rise to species that do not adapt to fire.
- "Controlled fire" or "prescribed burns", help restore the natural balance of an ecosystem. These are fires that are set by the authorities in an area that needs to be burned. Firefighters will be on site to make sure that the fire does not get out of control. Prescribed fires are used only in circumstances under which the flames and heat can be controlled; these include specific weather conditions, certain locations and available firefighting personnel.
- Definition: Prescribed burning is the process of planning and applying fire to a predetermined area, under specific environmental conditions, to achieve a desired outcome.
- Wildfire is any unplanned fire burning in a wildland area. The most common type of wildfire, a surface fire, burns along the veld floor.
- Ground fire burns along and/or below the veld floor along the dense root systems of trees.
- After fire, some fynbos plants will send up new green leaves from the seemingly dead stems.



- There are also the bulbs that appear after a fire. The red flower (3) is known as the 'fire lily' as it appears out of the black earth in a flash of colour.
- The white lily (8) has also grown from a bulb. These bulbs are protected by the soil. Soil and sand are not good conductors of heat so the heat of the fire does not travel very deep into the earth.

Useful fires (good)

- Fires that burn in fynbos areas are generally not very intense and help with the new growth of the fynbos in that area.
- Fynbos that is mature (after about 15 to 25 years) needs to burn to reproduce new young strong plants.

Harmful fires (bad)

- Some fires have more value than others: If there is too much alien vegetation, the fire will burn too hot and too often and will destroy fynbos and the seeds.
- A hot fire also damages the soil and the organisms that live in it and animals and insects cannot burrow deep enough to survive.
- If an area has a fire more often than every 10 years, the fynbos will be damaged. or even be destroyed. Some plants are not able to mature and produce seeds in such a short time.
- Many plants and animals that are adapted to living with fynbos, will also disappear (e.g. the geometric tortoise).

LESSON PREPARATION

Materials:

- Flipcharts pages 1, 2 and 23.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing equipment and paper.
- Camera or camera phones and printer connected to a computer.
- Equipment for making finger puppets.
- If getting involved in an alien hack, remember to organise it very carefully. Get permission from the landowner/ manager where you are planning to go. Get parents and other educators to accompany you.
- If you choose the board game as your activity, you will need blank cards (about credit card size), pens, markers, dice and the board will have to be copied and stuck onto card for each group. Colouring-in crayons to make the board game more colourful. Use the fire danger index colours.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see it.

Divide the blackboard in 2, Write USEFUL on the left side and HARMFUL on the right.

Turn to **flipchart pages 1 and 2** and revise what is a USEFUL fire and what is a HARMFUL fire.

Write these in the correct column.

Once the pictures have been allocated to their column, ask the learners for more USEFUL and HARMFUL fire examples.

Tell the learners that sometimes what appears to be a HARMFUL /BAD fire is actually a USEFUL/GOOD fire.

Turn to **flipchart page 23.** The first photos and the one below it were taken at the same place at the Robberg Nature Reserve – one before a fire and the other after a fire.

Explain that depending on conditions, fires burn differently.

Ask: What conditions make fires burn differently?
Refer to the lessons on the fire triangles and the conditions discussed there (heat, oxygen and fuel).

Ask: What do you think a surface fire is?

- A surface fire is one that burns along the ground burning undergrowth and leaf/veld litter.

Ask: What is veld litter?

- Old dead leaves and plant material that is lying around.

Explain that by burning veld litter, fires release nutrients present in veld litter that would otherwise decompose very slowly.

Explain that surface fires can also spur the germination of plants, especially the Protea. These plants need to be exposed to extreme heat before the seed can be released from the seed bank in the flower/cone and germinate.

Such fires help reduce the number of pathogens (germs) and insects.

Surface fires create or help to maintain habitat for animals by burning back or thinning sections of the veld.

Explain that surface fires often occur naturally but park officials have begun setting fires called "controlled" or "prescribed" fire or burns to imitate these natural fires.

Ecosystems need occasional fires to maintain themselves. Otherwise, these ecosystems would be taken over by trees.

Definition of an ecosystem: *An ecosystem is all the living things, from plants and animals to microscopic organisms, that share an environment. Everything in an ecosystem has an important role. The term ecosystem was coined in 1935. Eco is a spin-off from the word ecology and describes anything having to do with the environment and our relation to it. And system comes from the Greek word systema or "organised body, whole".*

Look at **flipchart page 23.**

Point out how new plants are popping up in this 'moonscape'.

Most of the plants here have new growth growing from the stems. Some fynbos plants will sprout from the seemingly dead stems.

There are also the bulbs that appear. The red flower is known as the 'fire lily' as it appears out of the black earth in a flash of colour.

The white lily has also grown from a bulb. These bulbs are protected by the soil. Soil and sand are not good conductors of heat so the heat of the fire does not travel very deep into the earth.

The plants whose seeds are released by fire, will take longer to regrow after a fire.

Ask: Which of the following are GOOD (useful) or BAD (harmful) fires:

- Fires that burn in fynbos areas are generally not very intense and help with the new growth of the fynbos in that area. – GOOD
- Fynbos that is mature (after about 15 years) needs to burn to reproduce new young strong plants. – GOOD
- If there is too much alien vegetation, the fire will burn too hot as well as too often and will destroy fynbos. – BAD
- A hot fire also damages the soil and the organisms that live in it. – BAD
- If the fire is too hot, animals and insects cannot burrow deep enough to survive. – BAD
- If an area has a fire more often than every 10 years, the fynbos will be damaged. Some plants are not able to mature and produce seeds in such a short time. – BAD
- Many plants and animals that are adapted to living with fynbos, will also disappear (geometric tortoise). – BAD

ACTIVITIES

1. Review the invasive alien vegetation from the lesson on invasive alien vegetation. Get pics of alien vegetation found in your area – learners can even go out and photograph plants using their cell phones. Leaners to do research on other alien vegetation in the area.

2. Do a pamphlet that will go to a community where you are planning an 'ALIEN HACK' this is where people go out into the veld and remove invasive alien vegetation. The adults will use choppers and saws and the learners will help to pull out baby plants and help move the cut vegetation to where it can be removed from the area. Explain in the brochure what an ALIEN HACK is and put together a list of plants with pictures that you will be looking for to remove – invasive alien vegetation found in that area. Explain in the brochure why this ALIEN HACK is important for the environment.

3. Divide the class into two groups. Within the groups, have learners work in smaller groups of two or three and create a television spot or a puppet show on the dangers of uncontrolled wildfires. This can be in the form of an interview. The learners need to decide on the questions and answers on their topic.

   In the other group, have learners work in groups of two or three to create a television spot or a puppet show on the benefits of prescribed burns. This can be in the form of an interview. The learners need to decide on the questions and answers on their topic.

   If the learners decide to do a puppet show, they can make their own finger puppets using paper, scissors and glue.

4. Write a rap on GOOD and BAD fires and perform it.

5. Board game

- The learners need to develop 30 question cards relating to GOOD and BAD fires. The answer to each question needs to be either USEFUL or HARMFUL. The answer must apear below the question on the card. Each card can be about bank card size.
- Each game will need a dice.
- Each learner will need a marker – this could be a button, eraser, shapener etc.
- Each learner will put their marker on the START block.
- Each learner will have a turn to roll a dice and move forward according to the number rolled. When they land on a block that has the beginning or end of a tunnel on it, they will need to take a question card and answer the question. The learner will take a card from the pile, not look at it, and give it to the learner sitting on the right hand side. This learner will then read the question. If they get it correct, they move up the tunnel towards the finish point. If they get the answer incorrect, they move down the tunnel back towards the start. If there is a dispute about the question, the group must discuss it can come up with an answer.
- It the learner lands on a block with a tunnel that will take them backwards (i.e, back to the begining), they still need to answer a question. If they get it correct they stay where they are and if they get it incorrect, the move down the tunnel towards the begining of the game.
- The winner gets to the END first.

Teacher: Photocopy one board per group. Enlarge to A3 size

1 **START**	2	3 Go back 1 block	4	5	6	7 Go back 2 blocks	8
16	15	14	13	12	11	10	9
17 Go back 3 blocks	18	19	20	21	22 Go forward 3 blocks	23	24
32	31	30 Go forward 2 blocks	29	28	27	26	25 Go forward 3 blocks
33 Go forward 2 blocks	34	35	36	37 Go back 2 blocks	38	39	40
48	47	46	45	44	43	42 Go back 2 blocks	41
49	50	51 Go back 3 blocks	52	53	54	55	56
64 **END**	63 Go back 1 block	62	61	60	59 Go forward 1 block	58	57

- You must each put your marker on the START block.
- You must each roll the dice and the person with the highest number will start the game.
- Going in a clockwise direction, you will have a turn to roll a dice and move forward according to the number rolled.
- If you land on a block that has the beginning or end of a tunnel on it, take a question card from the top of pile, do not look at it and give it to the learner sitting on your right hand side. This learner will then read the question. Answer the question. If you are at the beginning of a tunnel and get the answer correct, move up the tunnel towards the finish point. If you get it wrong, stay where you are – do not move your marker. If you are at the end of a tunnel and get the answer correct, stay where you are. If you get the answer wrong, move down the tunnel back towards the start. If there is a dispute about the question, the group must discuss it can come up with an answer.
- The winner gets to the END first.

11. Greenhouse Effect, Climate Change and Global Warming

LEARNING OBJECTIVES

Knowledge

Learners will:

- understand what climate change is.

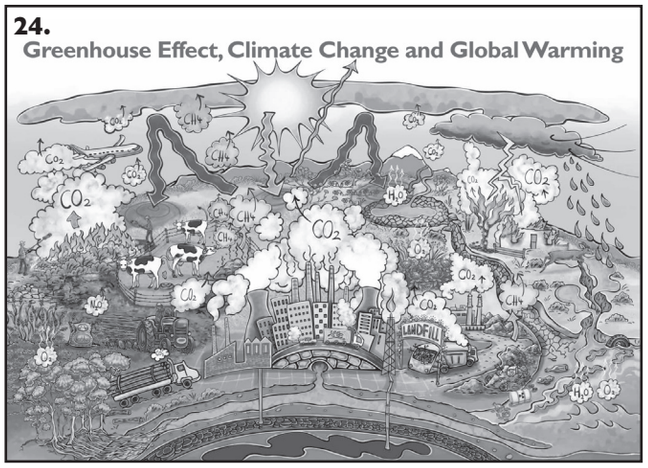
Behaviour

Learners will:

- recognise how to reduce the risk from climate change.
- show how they can Reduce, Reuse and Recycle.
- be able to demonstrate ways to conserve water.

BACKGROUND INFORMATION

- **Greenhouse effect:** A greenhouse is a shedlike structure made of glass. It has glass walls and a glass roof. People grow tomatoes and flowers and other plants in them. A greenhouse stays warm inside, even during winter. Sunlight shines in and warms the plants and air inside. The heat is trapped by the glass and can't escape. During the daylight hours, it gets warmer and warmer inside a greenhouse, and stays pretty warm at night too.
- The earth's atmosphere does the same thing as the greenhouse. Gases in the atmosphere, such as carbon dioxide, do what the roof of a greenhouse does. During the day, the sun shines through the atmosphere. The earth's surface warms up. At night, the earth's surface cools, releasing the heat back into the air. Some of the heat is trapped by the greenhouse gases in the atmosphere. That's what keeps our earth warm and cozy.
- **Global warming:** a gradual increase in the overall temperature of the earth's surface, water/oceans and the atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, CFCs (harmful gases), and other pollutants.
- **Climate change:** a change in global or regional climate and weather patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.
- If we look at the 3 definitions above, we see that carbon dioxide is responsible for all of these. In order to lessen these effects and even reverse them, we need to control the emission of carbon dioxide and other carbon-based gases into the atmosphere.
- The greenhouse effect, global warming and climate change are closely related.
- Climate change is caused by humans' need for food, energy, space, wood, money and the disposal of waste.
- This is resulting in an increase in the amount of carbon dioxide in the atmosphere, which in turn is resulting in:
    - Seasons slowly changing – summers hotter, winters warmer;
    - Drought/floods;



    - Storms;
    - Melting of ice caps;
    - Rise of sea level;
    - Dry, hot summers in the Western Cape;
    - More fires in the Western Cape;
    - Climate change predictions show the Western Cape becoming hotter and drier; and
    - Change in rain patterns.

LESSON PREPARATION

Materials:

- Flipchart page 24.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Empty 2-litre cooldrink bottles, koki pens, scissors/NT cutter, soil, newspaper, plants (spekboom), water.
- For vertical garden, same as above, cable ties and trellis.
- Computer/cell phones/tablets with internet access.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 24.**

There is a lot of information here so adapt it to your group.

Ask: What is happening in the picture?

- It is a picture of the earth with the sun shining.
- The rays of the sun are getting in through the atmosphere.
- A grey layer of pollutants is keeping all the gases trapped in our atmosphere – this is commonly called the greenhouse effect.
- We can see a city giving off carbon dioxide (CO_2) into the atmosphere. This is from people breathing as well as cars and other gaseous pollutants.
- There is a factory giving off smoke (CO_2) and a landfill giving off methane gas (CH_4).
- There is a farmer ploughing his field – the tractor is giving off CO_2.
- The cows in the field are giving off CH_4 as part of their

digestive process.

- There is a mountain with some snow that is melting and running into a lake. Evaporation is taking place from the lake.
- There is a tree and house on fire giving off CO_2. This looks like it could be a fire caused by lightning.
- There is rain falling and causing a donga (gully) to develop. This is because there is not enough vegetation to hold the soil together due to the fire or over-grazing.
- We can see a river coming from the city, putting sewage into the sea. Another river is full of pollution.
- The groundwater is contaminated. Possibly caused by the chemicals used by the farmer and the pollution from the city.
- Plants are giving off oxygen (O_2). Explain that we need oxygen to survive and only plants give off oxygen. So we need to protect our plants. Introduce the dilemma about needing wood for building and heat and the need to conserve our source of oxygen. Hopefully they will come up with the idea that we conserve the indigenous vegetation and use the invasive alien vegetation for building and heat.
- There is a truck transporting logs from cut down trees. The truck is polluting the air. Behind the truck is wildfire with firefighters trying to beat out the fire. The fire is giving off CO_2.

Ask: Is this how we would like our earth to look?

- No.

Explain that these are all man-made problems as man needs food, energy/electricity, wood for building, coal for electricity, refuse and places to live.

Ask: What do you notice about the harmful gases that are given off?

- The main gas given off is carbon dioxide (CO_2) and methane (CH_4).

Explain that one of the major environmental issues facing us today is the strong possibility that our climate is warming due to the excess carbon dioxide being released into the atmosphere by the burning of fossil fuels and forests. It is known as a greenhouse gas as it traps warmth and other gases – forming a blanket over an area.

Explain how all of these things shown in the picture are making the earth heat up as the extra gases are not escaping into the atmosphere. We call this the greenhouse effect which in turn causes global warming.

Ask: Why do you think it is called the greenhouse effect?

- A greenhouse is an enclosed area where plants are grown. It is usually warm and moist inside and often plants that are out of season or from another area are grown here. The warm gases cannot escape and the area warms up. Similarly, the gases created on the earth cannot always escape and they warm up the earth like inside a greenhouse.

Explain that as global warming takes place it results in climate change.

Ask: What does climate change result in?

- Seasons are slowly changing, summers hotter, winters warmer;
- More drought/floods;
- More very bad storms;
- Melting of ice caps;
- Rise of sea level;
- Dry, hot summers in the Western Cape;
- More fires in the Western Cape; and
- Climate change predictions show the Western Cape becoming hotter and drier; and
- The biggest thing that is affected by climate change is the amount of water available.

Ask: What can you do to help put a stop to global warming and climate change?

- Decrease the amount of carbon dioxide in the atmosphere.
- Limit your use of electricity (thus a decrease demand).
- Use public transport, a bicycle or walk when possible.
- Do not cut down trees or bushes that are indigenous.

The learners might come up with some interesting ideas around helping to stop climate change. These ideas could be used in an activity as a dramatisation, art lesson, poetry or music.

ACTIVITIES

1. Make a garden of spekboom in recycled bottles:

   Each learner must have a 2-litre cool drink bottle with the lid attached.

   Using a koki pen the learner must draw a line all around the middle of the bottle (circumference).

   Using a pair of scissors the learner pierces the bottle and cuts along the line. There will be 2 equal parts of the bottle – the top and the bottom.

   CAUTION: The learner will need to pierce a few holes in the lid using a hammer and a nail. If you feel confident that the learners can safely do this, then let them go ahead, if not – prepare the plastic bottles beforehand.

   Put the lid back on the bottle, turn the top half of the bottle upside down and place it in the bottom half.

   Get a piece of newspaper – about 40cm x 40cm in size. Fold it in half and in half again making it 40cm x 10cm in size. Line the inside of your bottle. This is to keep the roots of the plant cool. It will also help with water retention in the bottle. Try to use sheets of newspaper that do not have too much ink on them (lots of pictures) as some inks could damage the plants.

   Put a little gravel/stones in the neck of the upturned bottle.

Mix up some potting soil/ garden soil and a bit of compost if available. Fill the top of the bottle with this mixture. Plant your plant in this mixture and add water. The excess water will run out of the holes in the lid and into the bottom half of the bottle. The water can be re-used.

We suggest you get spekboom plants. These grow easily and they gobble the most CO_2 of all plants. If you do not have spekboom growing around or near the school, go to your local nursery and buy a few plants. Cut off as many cuttings and you have learners in your class and they can each plant a cutting. These root very easily. Spekboom like sun, and need to be watered occasionally, especially while waiting for the root system to develop.

After a year or so the spekboom will need to be planted into a bigger pot or even into the garden/school grounds.

If you have a problem with storage of these plants at school, google 'vertical garden with recycled bottles'. There are many ideas available.

2. Make a vertical garden
   Search the internet for 'SuzelleDIY – on how to make a vertical garden'.

   For other ideas on a vertical garden search the internet for: 'The Green Wall – Educational Vertical Garden Bottle System Project'.

3. Encourage a discussion: If we look at how man influences climate change can you give suggestions how we can help stop it?
   - Need for water – catchments/wetlands;
   - Need for food – more natural vegetation destroyed so that farmers can grow food;
   - Energy – man needs electricity – creates pollution, inversion layers, uses a lot of water to create electricity, pumps too much CO_2 into the atmosphere;
   - Space – people need homes – natural areas destroyed to make space for houses and roads;
   - Wood – people use wood for building, burning for heat – destroying forests in other parts of the world – oxygen levels are affected. Try to use only invasive alien vegetation;
   - Money – people want to make money and they destroy sensitive areas in the process of developing areas and making money; and
   - Rubbish dumps – create greenhouse gases, take up space – natural vegetation destroyed.

4. Organise a debate amongst the older learners. Those in favour of development and those in favour of conserving our environment.

5. Older learners can search the internet for bio-gas digesters. How can this affect our lives as well as climate change? If you live in the Cape Town area, organise a trip to Intaka Island EcoCentre, Century City and see how their bio-gas convertor works.

6. Advanced Fire Information System:

   Do an internet search for "advanced fire information system" (www.afis.co.za).

   Click on AFIS viewer and show the learners where the active wildfires are in South Africa.

   Indicate how the increase in fires has been impacted by climate change and in turn impacts on climate change.

12. Carbon Footprint

LEARNING OBJECTIVES

Knowledge

Learners will:

- be able to identify the major ways that carbon dioxide escapes into the environment.

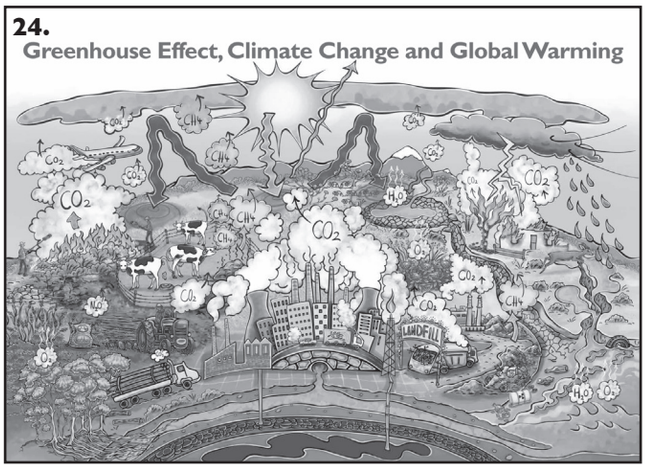
Behaviour

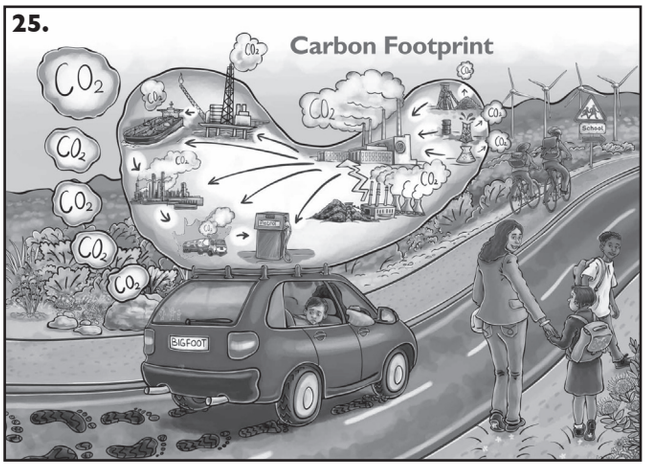
Learners will:

- be able to identify activities that increase their carbon footprint.
- be able to demonstrate how to decrease their carbon footprint.
- choose a lower carbon footprint in their own lives.

BACKGROUND INFORMATION

- Carbon footprint: *the measure of the environmental impact of a particular individual or organisation's lifestyle or operation, measured in units of carbon dioxide.*
- A carbon footprint is composed of two parts, a primary and secondary footprint. The primary footprint is the sum of the direct carbon dioxide emissions of burning of fossil fuels, like domestic energy consumption by water heaters/geysers, and transportation, like motor vehicles and aeroplane travel. The secondary footprint is the sum of indirect emissions associated with the manufacture and breakdown of all products, services and food an individual or business consumes.
- Everything we use and do has a carbon footprint, even the most basic of things like getting up and getting dressed in the morning:
- Turning on the light – uses electricity which has been made from coal and makes use of an elaborate infrastructure to get to us. The electric light bulb is made from glass and metal – both had to be 'harvested', processed, transported, packaged and sold to us.
- Taking a shower – water is collected in a dam, purified and delivered to our homes through a very intricate series of metal or plastic pipes. To heat the water, we use electricity or maybe gas. Some of us might have solar systems which take out a small part of the carbon footprint.
- Our clothes have a carbon footprint. If the fabric is synthetic, it is probably a petroleum bi-product, so many processes have happened to get the fabric to the factory that actually makes the clothes. If the fabric is natural, it still involves planting, growing (watering) and harvesting. What machinery does the factory use? How did the factory get the machinery? Once the garment has been made, it is packaged (in either plastic of paper), delivered to a shop and sold to us. How did we get to the shop to buy our clothes – did we walk or drive in a car? Most of these things form part of our secondary carbon footprint, but it is a carbon footprint, even if we were not directly responsible for the manufacture of the goods used.





- Reducing, recycling and re-using of goods will lower our carbon footprint, e.g. saving energy and water.

LESSON PREPARATION

Materials:

- Flipchart pages 24 and 25.
- Decide which activity you would like to do with your learners and get the materials together for that. There are quite a number of activities listed, different age groups will find some more appealing than others.
- Writing and drawing equipment, paper.
- Computer/ cell phones/ tablets with internet access.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 24.**

Do a quick recap of the previous lesson about the greenhouse effect, climate change and global warming.

Ask: What gases are given off in this picture?

- Mainly carbon dioxide (CO_2) and methane (CH_4) are given off. These are both carbon based gases. Too many of these gases in the atmosphere cause global warming and climate change. A carbon footprint is the measurement of how much carbon gas is given off by an activity.

Turn to the **flipchart page 25.**

Ask: What is happening in this picture?

- People are going to school. Some are walking – stars under their shoes. Some are riding bicycles.
- A car is being used to take a child to school.
- Car tracks – footprints.
- There is a footprint on-top of the car.
- The toes are CO_2 (carbon dioxide).
- In the footprint we see an oil rig (getting crude oil from under the sea bed), an oil tanker (transporting the crude oil to the oil refinery where it is refined into petro, diesel and paraffin), a tanker transporting the petrol to the filling station were we can buy it for the car. We also see a mine (iron), an oil well, chemicals being mixed, another mine (coal), a power station and a factory (where the car is manufactured).
- All of these things in the picture are giving off CO_2.

Explain that we call this a *carbon footprint*.

Use the example of driving to school – cars/taxis/buses use petrol which is a fossil fuel. Fossil fuels are formed by natural processes such as decomposition of buried organic materials like decayed plants and animals that have been converted to combustible geologic deposits and fuels such as crude oil, coal and natural gas, by exposure to heat and pressure over hundreds of millions of years.

Pollution is created during the process of extracting the fuel/oil from the earth. The oil is then put onto an oil tanker and brought to South Africa. Fuel is burned creating CO_2 to make the oil tanker sail. Oil is then pumped ashore, processed into petrol and stored until it is ready to be transported around South Africa to filling stations. Again CO_2 is given-off in all these processes. Pollution of many sorts is made when manufacturing the oil tanker, the fuel pumps, the oil refinery that converts the crude oil to petrol, the storage facilities and the vehicles that bring it to your filling station. So, the act of driving to school in a car/taxi/bus has layers of carbon being emitted and creating greenhouse gases – this is known as having a large carbon footprint. However, if you walk to school you are creating almost no carbon in the process and you have a very low carbon footprint.

Explain that there are two carbon footprints. The first is called the **primary** (meaning first) and it refers to something that you do (for example going to school in a car/taxi/bus as they give off CO_2).

The second one is called the **secondary** (meaning second) and it refers to things that other people have done to allow you to do what you just did. To go to school in a car/taxi/bus, you need a car/taxi/bus which is manufactured in a factory. The steel needs to be mined and transported to the factory. The car/taxi/bus needs petrol. The petrol has to be produced and transported to filling stations. The tanker in which it is transported, gives off gases. The manufacturing of the tanker gave off gases as well. And so on.

Ask: What are the primary and secondary sources of carbon pollution in the carbon footprint picture?

- Primary – the car is giving off CO_2 exhaust fumes (toes).
- Secondary – all the activities associated with the pictures inside the footprint on-top of the car.

Ask: What other examples of high and low carbon footprints can you think of?

- Low: Planting your own vegetable garden, using your bicycle or walking to get to places, using solar power geyser.
- High: Eating imported foods, using a gas-guzzler car when going places, using an electric geyser.

Ask: What is the carbon footprint of an object made in South Africa and one made in Japan but used here? For example, a TV?

- There is a carbon cost of getting it here (the carbon cost of the transport of getting that product to us).

Ask: Why is it important to eat fruit and vegetables that are in season, rather than fruit and vegetables that come from far away?

- Transport costs – primary and secondary footprints.

Ask: Which is a better option, buying honey made in the Western Cape or honey that comes from Argentina?

- Western Cape honey – transport carbon costs (and possible diseases).

Ask: So now that you know this information, how do we stop/slow global warming? Discuss in the class.

- Do not waste resources: reduce, reuse and recycle.

ACTIVITIES

1. Take any object in the classroom and discuss its carbon footprint. This object could be a shoe, a plastic ruler, a lightbulb, a lunchbox.
   Ask the learners to think of other uses for those same items. Some will be more difficult than others. The idea is to get them to understand that by re-using products for different purposes we reduce our carbon footprint.

2. Divide the class into groups of 4. Give each group 2 objects found in the classroom. The learners need to think about more uses for these items and report back to the class. Encourage creative and even silly suggestions.

3. Learners can draw a picture of a foot and on the foot, list up to 10 of their own carbon footprint activities. They can then rate the activity as having a high or low carbon footprint.

4. Do a recycle project in the class. Divide the class into groups and give each group something to collect for recycling (glass, tin, paper, plastic bottles, yogurt and margarine tubs, plastic bags, cardboard boxes, etc.). This could be done over a week or even a month. Keep in mind

that you will need storage space for the goods collected. Once done, organise collection or delivery to a recycling depot. Ideally, find some way of using these items again at school before sending them to recycling.

5. Internet search: Heath Nash – click on the images link and see what has been done with plastic bottles. Maybe some of the learners could come up with their own creations.

6. Internet search: reusing plastic bottles – click on the images link and get some ideas from there. Get the learners to collect waste materials then make a useful product or create a diorama (a model representing a scene with three-dimensional figures, either in miniature or as a large-scale museum exhibit).

7. Internet search: Haybox cooking – see how this is done to save energy. Possibly make one at school or use one of the various commercial ones that are available. Look for an easy recipe that all the learners will enjoy. The learners could make a meal in such a box at home (introducing their parents to the concept) and bring it to school the next day.

8. Get the learners to put together a business plan and business model for the reuse of old bricks/old car tyres/ building rubble. Present their ideas to the class.

9. Look at the two definitions below. Re-write into simple understandable English that could be used with the younger learners:
    - Definition: *A carbon footprint is the measure of the environmental impact of a particular individual or organisation's lifestyle or operation, measured in units of carbon dioxide.*
    - Definition: *A carbon footprint is composed of two parts, a primary and secondary footprint. The primary footprint is the sum of the direct carbon dioxide emissions of burning of fossil fuels, like domestic energy consumption by furnaces and waters heaters, and transportation, like vehicles and aeroplane travel. The secondary footprint is the sum of indirect emissions associated with the manufacture and breakdown of all products, services and food an individual or business consumes.*

13. Healthy Ecosystems

Knowledge

Learners will:

- understand the influence that ecosystem services can have on natural disasters such as floods and drought.
- be able to correctly define and use basic terms associated with the water-cycle (collection, evaporation, condensation, precipitation, etc.).

Behaviour

Learners will:

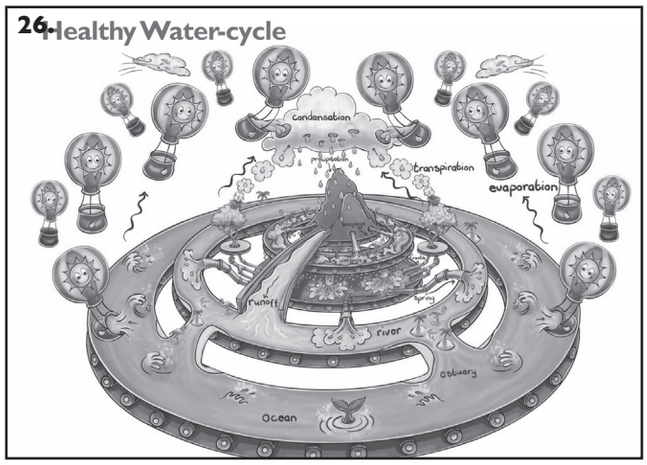
- modify their behaviour to use less water at home and at school.

BACKGROUND INFORMATION

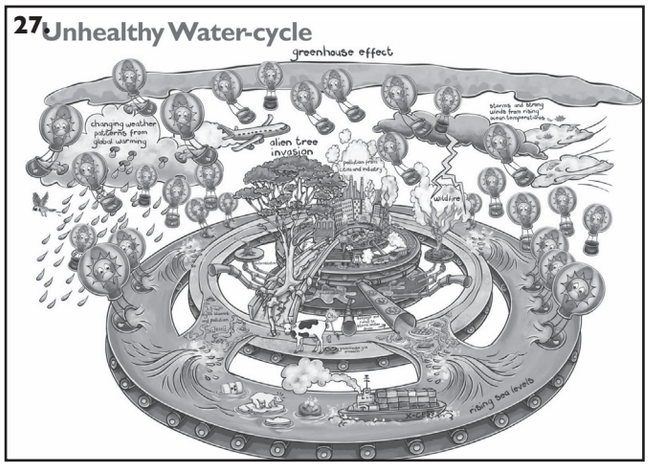
NOTE: Teachers are advised to spend an extra few moments studying the pictures of our water-cycle on the flipchart before commencing this lesson.

- Ecosystems are fine balanced systems that keep life on our planet working well together.
- *An ecosystem is a community of living organisms in conjunction with the non-living components of their environment (things like air, water and mineral soil), interacting as a system.*
- Water is one of the cornerstones in all ecosystems. The correct balance of water in any area is vital to life on our planet.
- The water-cycle is the journey that water takes through various phases. Water from the sea, rivers and dams evaporates. This water vapour rises, condenses and forms clouds. The wind moves the clouds. They release the water vapour in the form of precipitation (rain, hail, sleet and snow). Water vapour condenses into water droplets when it reaches dew-point temperature. Rain falls onto the earth, becomes run-off and enters the many rivers and streams. These, in turn, flow into larger rivers, lakes, dams and ultimately reach the sea where it evaporates and forms part of the cycle again. Some water sinks into the earth and forms ground water.
- Along this journey, the water is consumed by humans, animals and plants. People store and use the water for many things.
- If we take something out of the eco-chain, we break the cycle. This can cause all sorts of problems that will always affect us negatively.
- If we cut down too many trees, we influence the production of oxygen (O_2). We need oxygen to breathe – without it, we die. Evaporation increases with fewer indigenous trees, taking water out of the water-cycle. The earth becomes dry, making it difficult for the trees to grow and in turn, the levels of oxygen are seriously depleted. If the soil becomes very dry, it becomes aqua-phobic and does not absorb water, which then forms run-off and causes erosion. It also results in plants not getting enough water from the soil.

26. Healthy Water-cycle



27. Unhealthy Water-cycle



- If we clear too many natural woody areas for growing crops, we disturb the natural flow of water in the area. The animals and plants of the area are affected and sometimes wiped out. This influences the health of the soil and its ability to sustain the crops grown there. The use of chemical fertilisers kills natural living elements (earthworms and other bugs) in the soil that keep plants healthy. Insecticides are used to kill the unwanted bugs that are no longer kept under control naturally. The people get sick from the poisons on the food. Everything we do is part of a chain reaction and damaged ecosystems will take many years to recover.
- Invasive alien plants use more water than indigenous plants.
- There will be more dead trees from beetle infestations – beetles like the warmer weather. Drought and warmer temperatures weaken trees allowing bark beetles to eat them.
- Using too much water and wasting water has huge impact on ecosystems.
- Deserts are expanding, rain forests are shrinking as pressure is put on the underground water supplies.
- Rivers, streams and dams do not have enough water, ecosystems reliant on underground water in aquifers become endangered or even die. An aquifer is an underground water-bearing layer from which groundwater can be extracted using a well/borehole.
- When the water in an area is compromised, the vegetation is dry. This results in too many wildfires which, in turn, destroy more vegetation.
- The two natural disasters most linked to water are drought (expanding deserts) and floods.
- With global warming, the sea temperature is rising. Warmer water warms air above it and more evaporation takes place. The warmer air above the sea results in stronger thermals/winds that carry the clouds towards the land. This, in turn, has resulted in massive storms and floods in areas that did not have these in the past. Very heavy clouds are not always able to rise above the mountain ranges resulting in inland areas and catchment areas not receiving the rain they need. In the news we are constantly seeing pictures of floods and droughts across the world. Parts of the United States of America on the eastern side have been experiencing very big storms over the past 15 years, e.g. Hurricane Katrina. The Pacific islands and parts of the Asian continent are also experiencing unprecedented storms. Rain is not reaching the catchment areas, resulting in drought and expanding deserts in other regions. Here in the Western Cape, large parts of the Western Cape are suffering a crippling drought (2016), particularly the Oudtshoorn area. The West Coast is also suffering from a lack of water. This is partly due to agricultural practices that deplete underground water supplies (aquifers) or rivers. We should all use water responsibly at home and on the farm.
- The water-cycle presented here is not the conventional one. We have used a more 'Charlie and the Chocolate Factory' approach with the hope that the learners will be more engaged and excited about the concept of the water-cycle. It will encourage more creative thinking. It is a bit of a mind shift from the conventional illustrations of the cycle.
- We have presented a perfectly working water-cycle and then one that has been compromised. The results seen in the 2nd cycle are alarming. We need to get the message across to the learners about the vital importance of a working water-cycle.

Page 1 of Ecosystem Services

- We have the earth represented on concentric discs on conveyor belts (like in a factory).
- The hot air balloons, with smiley sun faces, represent evaporation as they collect the water vapour from the sea, lakes rives and even plants. The wind blows these balloons around until they come together at a certain height and temperature (dew point) or when they reach an obstacle like a mountain. This vapour is 'poured' into to the atmosphere where it condenses and forms a cloud. The wind blows these clouds to the areas where precipitation is needed and expected – often up against the side of a mountain and to the catchment areas where rain traditionally falls. The condensed water vapour forms precipitation (rain, hail, sleet and snow).

- The highest middle disc with the mountain is the water catchment area. Run-off goes across a bridge into the rivers. Water seeps through the ground into pipes and the next level, which is wetlands. Evaporation also happens from this level. Here we have puddles and reeds. The puddles are draining into an underground aquifer. There are trees that appear to be floating and have pipes going down to the groundwater/aquifer. The next level is the river. The run-off water on the bridge feeds into it. The groundwater/aquifer has anti-gravity pumps that pump the water into springs/pipes that join the river. The river feeds up into the next level – the ocean via estuary outlets.
- 'Hot air balloons' then pick up the water from the ocean and rise up to where wind-blown clouds carry small drops/water vapour to the big cloud above the mountain and they condense and form precipitation (rain, sleet, hail and snow). The trees are sending up little puffs of water vapour clouds to join the big cloud. Most water vapour comes from the oceans, but evaporation also takes place from dams, lakes, rivers, even the soil and plants.

Page 2 of Ecosystem Services

- This picture illustrates what is happening to the water-cycle with the advent of global warming and irresponsible usage and management of water resources.
- This picture also needs to be studied carefully by the educator before starting the lesson.
- Again we have our factory theme with the conveyor belts of concentric discs at different levels.
- You will also notice the grey layer above the earth – this represents the greenhouse effect that is responsible for global warming.
- The most notable difference between this and the previous picture is the unhappy 'hot air balloons'. There are many more of them than before. This is because, with global warming, the sea temperature is rising and the temperature of the air above the sea is rising resulting in more evaporation taking place. With the warmer sea and air, there are stronger winds developing and the balloons are being buffeted about.
- The 'hot air balloons' are not always forming clouds above the catchment area.
- Now look at what is happening on the earth discs. The centre disc – previously the main catchment area – is now a city giving off many pollutants, especially air pollution in the form of carbon dioxide (CO_2). An aeroplane is also giving off CO_2. These gasses are warming the atmosphere and contributing to the greenhouse effect. The 'hot air balloons' are now rising higher and higher to find dew point before they can condense and form clouds/water vapour.
- Simply put, the rain clouds are not reaching the traditional catchment areas where they can discharge their load.
- The groundwater disc has a few puddles and not the constant stream of water as in the previous picture.
- The natural vegetation is battling to get enough water to survive and is getting very dry, making it susceptible to wildfire.
- A huge invasive alien tree is sucking up all the available water that is attempting to cross the bridge to the river.
- Now look at the sea disc. There is a polar bear on a shrinking iceberg. This indicates the shrinking of the icecaps and the rise in sea level.
- The sea is now moving into the estuaries which are polluted. This is causing a bacterial/fungal/algae surge/bloom in the estuaries. The estuaries are no longer working as filters of water into the oceans. Their own ecosystems are damaged.
- This, together with the increasing ocean temperatures, in turn is affecting the production of plankton – the very bottom of the ocean world food chain.
- There will be more dead trees from beetle infestations - beetles like the warmer weather. Drought and warmer temperatures weaken trees allowing bark beetles to eat them.

LESSON PREPARATION

Note to teacher: The water-cycles presented here are aimed at children. Some adults may have difficulty with this 'factory' concept. If you, the presenter, are dealing with an adult group, be very sure that you fully understand the illustration BEFORE embarking on a lesson.

Materials:

- Flipchart pages 26 and 27.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing and writing equipment. Paper.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 26.** This is a new look at the water-cycle.

Ask: Look carefully at the picture and explain what you think is happening?

- This will take a while for them to work it out. They will get quite excited as they see it all unfold.
- Refer to the section on background information to help you fill in the gaps and answer their questions.

Turn to **flipchart page 27.** This is a look at how people are damaging the water-cycle.

As before, ask the learners to look carefully at the picture and explain what they think is happening. This will take a while for them to work it out. Again, they will get quite excited as they see it all unfold.

- Refer to the section on background information (above) to help you fill in the gaps and answer their questions.

This is a good time to introduce the concept of how everyone has the responsibility towards preserving ecosystems and how they play a role in ensuring that their generation and future generations don't suffer.

ACTIVITIES

1. Discuss how they can save water at home.

2. Discuss in groups (different levels of discussion depending on the age-group), how we can protect our water resources as a community.

3. Discuss the water factory (water-cycle) and how we can keep it going. Ask what do people and governments need to do to protect our water resources and in turn, the water-cycle. If part of the water factory is destroyed, the system dies.

4. Ask learners to create their own diagrammatic water-cycle of an area that they know well where there is either a river, dam, pond or the sea to illustrate how evaporation takes place.

14. Wildland Urban Interface

LEARNING OBJECTIVES

Knowledge

The learners will:

- understand what areas are considered to be the Wildland Urban Interface.

Behaviour

Learners will:

- be able to recognise the Wildland Urban Interface.

BACKGROUND INFORMATION:

- Wildland Urban Interface is the area where the suburbs/ residential areas of a city meet the natural environment (wildland) that has been untouched by development.
- It includes the areas between wildland/reserves and industrial areas.
- It also includes larger properties/homesteads/small holdings or farms surrounded by wildland/the natural environment.
- These are areas of high risk of fire as they are close to wildland.
- If, however, the Wildland Urban Interface is alien-free, the risk of fire is much less than if the wildland has alien vegetation on it.

LESSON PREPARATION

Materials:

- Flipchart page 28.
- Drawing equipment and paper.

PRESENTATION

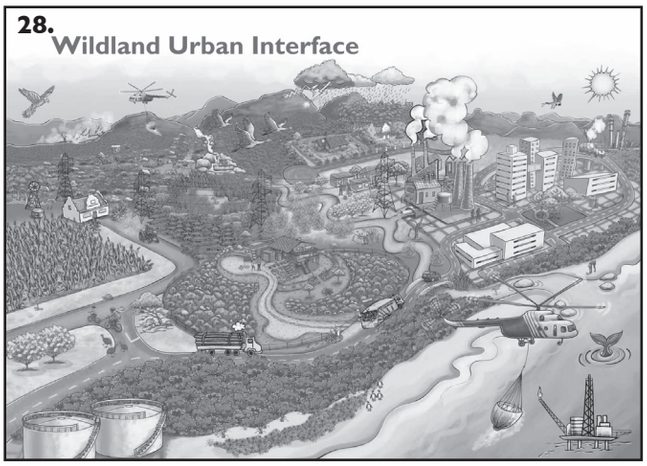
Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 28.**

Ask the learners to look at the picture and tell you what they see.

- A house near a city or town;
- Quite a number of trees around;
- A farm growing crops;
- A river with a bridge;
- A beach;
- Sewage outlet into the sea;
- Lightning striking the mountain causing a possible fire;
- Campsite with lots of bush; and
- A tent.

Ask: How safe would you feel if there was a fire and you were in any of these houses? Point to the various houses. Include the tent as well.

- They would probably say that they would prefer to be where there is less bush around them.



Ask them to explain why.

- They would be less likely to be caught in an uncontrolled fire.

Ask: Where in the picture would be the safest place for you to be and why would you say so? Encourage them to look at the road infrastructure for escaping a fire.

Ask: what in the picture could start a fire?

- Children on bicycles
- Cooking fire at campsite
- Warming fire at houses
- Spark from tractor
- Lightning
- Spark from electric cables

ACTIVITIES

1. Ask each learner to draw an aerial picture of the area around their home and assess the risk of how close it is to the Wildland Urban Interface. This will differ from learner to learner. Some may live in a totally suburban place, others on the outskirts. The idea is for the learner to figure out how much risk his/her home is in a wildfire situation. Even in suburban areas there are areas of bush that could be potentially dangerous in a wildfire situation.

2. Show the flipchart of the fire danger index (page 14 pic 12) and ask the learners to draw in where the arrow would point to (i.e. the risk at that property).

15. Defensible Space

LEARNING OBJECTIVES

Knowledge

Learners will:

- know what defensible spaces are.

Behaviour

Learners will:

- tell their parents that open space between the home and the wildland is your best protection against wildfire and suggest that they clear some of the vegetation that is close to the house.
- identify that dead vegetation (including invasive alien vegetation) and household refuse close to their home that needs to be removed and help with removing it.

BACKGROUND INFORMATION:

- The term "defensible space" describes vegetation management practices aimed at reducing wildfire threats to homes.
- Defensible space: The area between a house and an on-coming wildfire where the vegetation has been modified to reduce the wildfire threat and to provide an opportunity for firefighters to effectively protect the house.
- Sometimes, a defensible space is simply a homeowner's properly maintained backyard.
- What is the relationship between vegetation and wildfire threat?
- Many people do not view the plants growing on their property as a threat. In terms of wildfire, the vegetation adjacent to their homes can have considerable influence upon the survivability of their houses. All vegetation, including plants native to the area, as well as ornamental plants, is potential wildfire fuel. If vegetation is properly modified and maintained, a wildfire can be slowed, the length of flames shortened, and the amount of heat reduced, all of which assist firefighters to protect the home against an on-coming wildfire.
- Ladder fuel – smaller bushes that act as stepping stones or ladders for the fire to move from the ground surface to the top of the trees and surrounding canopy or from garden plants to a house.

LESSON PREPARATION

Materials:

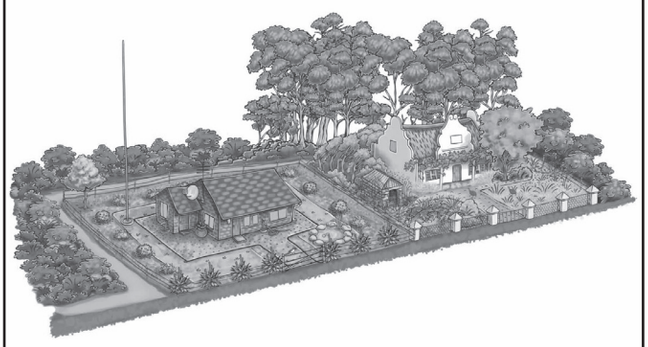
- Flipchart page 29.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing equipment and paper.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the f**lipchart page 29.**

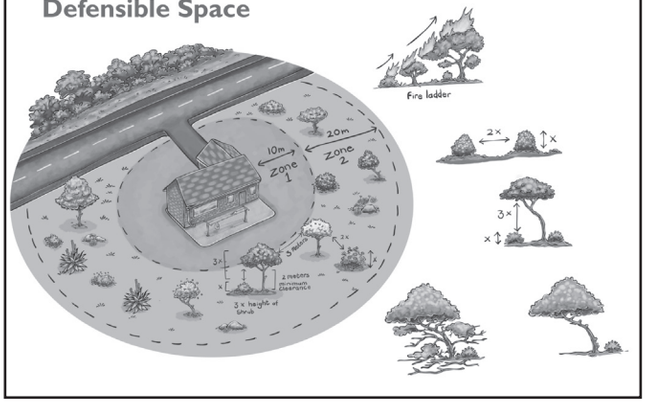
29.

Defensible Space (keeping your home safe)



30.

Defensible Space



Ask the learners to look at the picture.

Ask: If the trees behind the two houses caught fire which house would you prefer to live in? Why do you think so?

- The small house on the left – less vegetation around it to burn.

Ask: What is dangerous about the Cape-Dutch house on the right?

- Thatch roof;
- Overgrown garden;
- Small wooden wendy-house/shed close to the main house;
- Vegetation right up against the walls of the house;
- Tree branches touching the roof; and
- The trees behind the house are very high and close.

Ask: Why is the smaller house on the left safer?

- There is an open space between the house and the plants on the outside of the yard;
- There is a flagpole that would act as a lightning deflecting stick;
- There are taps and hoses clearly visible and ready to be used in an emergency; and
- The bush behind the house is relatively low.

Turn to **flipchart page 30.** This is a picture of what is recommended.

It is a good idea to have space between the house and the garden vegetation. Having short grass is also a good idea. In addition, there is even larger space between the house and the wildland surrounding the house.

Ask: How long is 10m?

- Pace this out in the classroom if you have space (one large stride is about 1m).

Ask: How long is 20m ?

- Double 10m.

Ask the children to look carefully at the picture and give their comments about what they see.

Ask: Is this way of having a garden going to prevent your house from burning down if there is a wildfire?

- It will make it much more difficult for the fire to reach the house.

ACTIVITY

1. Ask the learners to draw a map/bird's eye view of their house and the space around it and see what plants or buildings are close to their home.
   Which ones can be moved?

   Ask what they can do about it – tell parents.

16. Protecting your Property

LEARNING OBJECTIVES

Knowledge

The learners will:

- understand the importance of preparing properties before the fire season.

Behaviour

Learners will:

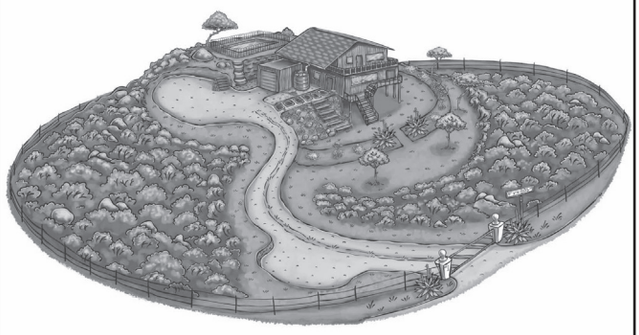
- be able to prepare properties before the fire season.

BACKGROUND INFORMATION

- Firefighters are usually the people that get killed in wildfires.
- The cause of a wildfire may include malicious intent, smokers, campfires, lightning or mischievous behaviour.
- Prescribed burns are conducted under very controlled conditions to promote growth and prevent uncontrolled fires.
- To protect property from a wildfire:
  - Report uncontrolled wildfire and smoke immediately.
  - Maintain a firebreak around your home by clearing all flammable vegetation to a minimum of 10m around the structures (this creates a protection perimeter which keeps your home safe as well as providing fire-fighters with a safety zone to fight the fire).
  - Cut grass as needed, especially when grasses dry out.
  - Clear all dead leaves and branches.
  - Clear ladder fuels – smaller bushes that act as stepping stones or ladders for the fire to move from the ground surface to the top of the trees and surrounding canopy or from surrounding plants to the house.
  - Stack woodpiles or store LPG cylinders at least 10m from buildings, fences and other combustible materials. Clear any flammable vegetation 5m away from these woodpiles or any LPG cylinders.
  - Clean all leaves, branches and any vegetation from the roof.
  - Trim tree limbs within 3m of a chimney, as well as any dead branches hanging over your home.
  - Cover chimney outlets with a spark arresting mesh screen.
  - Keep a spade, rake, buckets and fire beater available in the garage for use in a small wildfire.
- In wildfire hazard areas select landscape vegetation based on fire resistance and easy maintenance. In general, fire resistant plants:
  - grow close to the ground;
  - have a low sap or resin content;
  - grow without accumulating dead branches, needles or leaves;
  - are easily maintained and pruned;
  - have a high moisture content; and
  - are drought tolerant in some cases.
- Find out from your local nursery which fire resistant plants are adapted to the climate in your area.
- Vary the height of your landscape plants and space them at least 3m apart. The taller the plants, the wider apart they should be.
- For trees smaller than 5m, prune lower branches within 1.5m off the ground.
- On steep slopes remove flammable vegetation to 30m or more.
- Work with neighbours in your community to clear common areas between houses and property, prune areas of heavy vegetation that is a threat to both.
- Avoid planting trees under electrical power lines where they may grow into or contact the lines in windy conditions and cause a fire.
- If you have a heavily wooded area on your property, remove some of the trees to decrease the fire hazard and improve growing conditions. Remove dead, weak or diseased trees and trees with an obvious lean, leaving a mixture of older and younger trees.
- Never throw a used match or cigarette butt in or near grass or vegetation, especially if it is dry. Hold all matches until they are cool. Crush all cigarettes.
- Keep above ground fuel storage tanks at least 30 metres from any buildings.
- Keep areas around fuel storage tanks clear of any vegetation and do not screen tanks with shrubs or trees.
- Wildfires will find the weakest links in the defence measures you have taken on your property!

31.

Fire Resistant Landscaping



Gaining access to homes in an emergency

- House addresses must be clearly visible and easy to find. Street names should be printed in letters and numbers that are at least 10cm high, on a contrasting colour background. The sign should be visible from all directions of travel for at least 50m. Ideally, the sign should be made from fire resistant materials.

- Roads should be clearly marked and easily accessible.
- In a rural/farming area, if more than one home is accessed off a single pathway, all addresses should be displayed at the road and at each appropriate intersection along the way.
- Single lane access routes should have turnouts with enough space to allow a fire engine and car to pass (approx. 3m wide).
- Bridges should be able to carry at least 20 000kg, the average weight of a fire engine.
- Every dead-end road or long driveway should have an area large enough to allow fire engines to safely turn around (either a "T" or large enough circle).

Making your home safe

- Clear at least 3m of vegetation from either side of the roads as well as any overhanging tree branches (this will increase chances of escape and assist with firefighting efforts).
- Make sure your home is near a fire hydrant or that you have water storage of at least 10 000 litres for use in an emergency situation.
- Water tanks and streams are important emergency water sources that must be accessible for firefighting equipment.
- Electrical fences should be kept clear from any dry vegetation.
- Overhead electrical cables must be clear from any branches that could fall and break the lines.
- Rubbish piles should be at least 10m away from any building to reduce the chance of a fire.
- The most vulnerable part of a house is the roof. The single most important fire safe construction step is to create a fire resistive roof with non-combustible materials.
- Have all structures signed to aid firefighters (flammable liquid store etc.).

LESSON PREPARATION

Materials:

- Flipchart page 31.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing equipment and paper.
- If creating a 3-D model, you will need a variety of things. Get the children to plan carefully and bring what they need from home.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 31.**

Ask the learners to look at the picture and tell you what they think of the design of the property.

- There are few large trees, mainly bush and shrubs (indigenous fynbos).
- The wide driveway and the wide gate ensures that a fire truck can easily gain access to the property.
- There is a sign outside with the name/number of the house.

Ask: Why is there so much space for cars near the house?

- Large turning circle for large vehicles like a fire engine.

Draw attention to the swimming pool that could be used as a water source.

Ask: Can you see another water source?

- Water storage tank.

Ask: What other things are necessary in an emergency situation?

- Roads leading to homes need to be wide enough for a fire truck to get through – this also applies to homes in suburban/township areas;
- Roads need to be in good condition so that help can get to you;
- Roads need to be clear of high vegetation that encroach on them;
- Gates that the fire-truck would use need to be wide enough;
- Gates need to be kept unlocked; and
- Road-signs need to be clear so that the fire department can find your home.

Ask: What materials should houses be made of to prevent burning?

- Brick, stone, iron, mud and clay.

Ask: What is unsafe in this picture?

- Wooden deck/veranda/stoep.
- Wooden fence around the swimming pool.

ACTIVITIES

1. Draw the ideal fire-wise property and indicate what building materials should be used.

2. Draw their surroundings and see what needs to be done to prepare for the fire season e.g. get parents to trim branches, move things blocking the gate, etc.

3. In groups design a fire-wise community – a whole village. Half the class can do a risky village situation and the other half can make an ideal and safe village. This can be presented as a picture, a collage, or as a model made from recycled material.

   If doing a model, it will take a while to complete, so as a group they need to do the planning and then each learner can be responsible for a section of the model – they will need to keep the scale of the model the same throughout. In the report back, they need to stipulate materials to be used when building the real thing.

   Remind them what buildings there are in a village – school, houses, shops, filling station, hotel, church/mosque, police station, library, fire station, playground, etc.

17. Be Safe in Nature

LEARNING OBJECTIVES

Knowledge

Learners will:

- know how to keep safe when in nature (walking and camping).

Behaviour

Learners will:

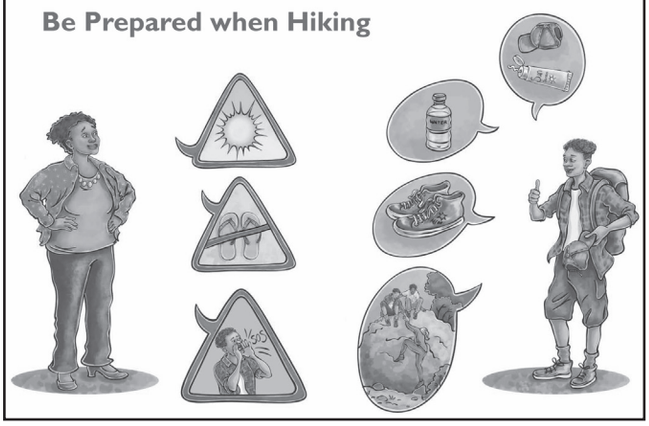
- be able to use the information learnt should they go walking.

BACKGROUND INFORMATION

- When in nature, always be aware of the possibility of fire.
- Check on the fire danger index before you go walking in nature.
- Tell someone where you are going and when you will return.
- Don't forget to check in with them when you get back.
- Wear closed shoes.
- Wear sun protection.
- Take a cell phone with you and check the signal availability of where you are going. Don't count on cell phones working in the wilderness. Also, don't rely on a GPS to prevent you from getting lost. Batteries can die or the equipment can become damaged or lost.
- Carry plenty of drinking water and never assume stream water is safe to drink.
- Do not use open flame/fire unless in a designated area.
- If going into a reserve, sign-in before entering.
- Always hike in groups of no fewer than 3 people.
- Avoid hiking alone because the "buddy system" is safer during any type of activity. If travelling with a group, never stray from the group. Remember that the slowest hiker sets the pace.
- Stay on marked trails. Making shortcuts and "bushwhacking" causes erosion and greatly increases your chance of becoming lost. As you hike, pay attention to trail signs and landmarks.
- Never climb on waterfalls.
- Always carry quality rain gear and turn back in bad weather. If you become wet or cold, it is important to get dry and warm as quickly as possible, avoiding hypothermia.
- Dress in layers and avoid cotton (if wet, it takes a long time to dry). Today's hikers can choose from numerous fabrics that wick moisture, dry quickly or conserve heat.
- Wear bright colours.
- All hikers should carry a whistle, which can be heard far away and takes less energy than yelling. Three short blasts is a sign of distress.

32.

Be Prepared when Hiking



Fire danger (reference to fire triangle):

- Weather
  - If it is hot and dry, a wildfire could start and spread quickly.
  - If it is windy, the fire can move very quickly.
  - If it is rainy, the chances of a fire are minimal, but they could get cold and wet and any walking on rocks could be potentially dangerous as the rocks will be wet and slippery.
- Dryness of vegetation
  - If a fire starts, the vegetation will burn quickly if it is very dry. The group could get caught or surrounded by fire.
  - Greener vegetation will burn more slowly giving them more time to get away from the fire.
  - The dryness of the vegetation is related to the season, age of the vegetation and when it last rained.
- Density of vegetation
  - The thicker or more dense the vegetation, the more difficult it could be to get away from a fire.
  - The less dense the vegetation, the easier it is to get away from a fire, but at the same time a fire moves faster in less dense vegetation.
  - An area where there are paths is ideal.
- Fynbos or invasive alien vegetation
  - If there is a fire in a fynbos area, it will burn at a lower temperature to an area that is covered in invasive alien vegetation.
  - Fynbos is way more interesting to look at when walking.
- Topography
  - If you will be walking up and down hills, keep in mind that a fire burns more quickly up a hill than down it and should there be a fire, try to get below it.

LESSON PREPARATION

Materials:

- Flipchart page 32.
- Decide which activity you would like to do with your

learners and get the materials together for that.

- Drawing equipment and paper/cardboard.
- If organising a walk, get the go-ahead from the relevant authorities and parents. Get the learners to make a list of what they need.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the flipchart page 33.

Ask: What is happening in the picture?

- Mom is warning the boy:
  - to check the weather before he goes and to dress appropriately;
  - to be careful of where he walks and wear closed shoes;
  - that he may need help and not to go alone.
- The boy tells his mom:
  - he has a water bottle, sunscreen and a hat;
  - he has good shoes; and
  - he will be going in a group.

Ask: If you are going on a hike, what else do you need to remember? (Use the background information to expand on some of the things mentioned e.g. a cell phone can be taken but there may not be reception, etc.)

- Check the fire danger index;
- Food;
- Water;
- Cell phone;
- Plan your route and do not deviate from it;
- Tell an adult where you are going and when you will be back – do not change your plan later;
- Do not make a fire in the veld; and
- Take warm clothes.

Remind the learners that they may NOT make a fire without an adult present and then only in a designated area. Make sure there are stones around the fire and that there is no vegetation overhanging the fireplace. Extinguish the fire correctly (water and sand) when you are ready to leave.

Remind the children of the fire triange and the fire danger index.

Ask: what do you need to be aware of when out in the veld, with regards to a wildfire?

- Weather
  - If it is hot and dry, a wildfire could start and spread quickly.
  - If it is windy, the fire can move very quickly.
  - If it is rainy, the chances of a fire are minimal, but they could get cold and wet and any walking on rocks could be potentially dangerous as the rocks will be wet and slippery.
- Dryness of vegetation
  - If a fire starts, the vegetation will burn quickly if it is very dry. The group could get caught or surrounded by fire.
  - Greener vegetation will burn more slowly giving them more time to get away from the fire.
  - The dryness of the vegetation is related to the season, age of the vegetation and when it last rained.
- Density of vegetation
  - The thicker or more dense the vegetation, the more difficult it could be to get away from a fire.
  - The less dense the vegetation, the easier it is to get away from a fire, but at the same time a fire moves faster in less dense vegetation.
  - An area where there are paths is ideal.
- Fynbos or invasive alien vegetation
  - If there is a fire in a fynbos area, it will burn at a lower temperature to an area that is covered in invasive alien vegetation.
  - Fynbos is way more interesting to look at when walking.

ACTIVITIES

1. Tell learners that they are organising a group of people to go on a full day walk in the veld or on the mountain. They need to advertise this outing. They must make a brochure with a checklist of everything the group needs to take with them. They also need to do a checklist of what the group must do before going on the walk and what type of behaviour is allowed on the walk.

2. Draw a picture of a person who is prepared with all the things they need and then label the drawing.

3. Take the class on a short circular hike at a botanical garden, municipal park or a nature reserve.

4. In groups, make a quiz for your fellow learners about the fire hazards in an area.
   Conduct the quiz within the classroom environment.

5. Design a poster that will tell people what to look out for when planning a walk in the mountains/veld and also give a checklist of what they must remember to take with them. Remind them that a poster needs to be eye-catching and not have too much written information. The person looking at the poster cannot take it home like a brochure, so they need to be able to understand and remember the information in just a minute or two. Inform the person looking at the poster where they can get information about the daily fire danger index.

18. Fire Adaptation

LEARNING OBJECTIVES

Knowledge

Learners will know that:

- animals and plants in the veld have survival techniques in the event of a wildfire.
- plants have adapted to survive fire.
- many, but not all animals can escape from a fire.

Behaviour

Learners will:

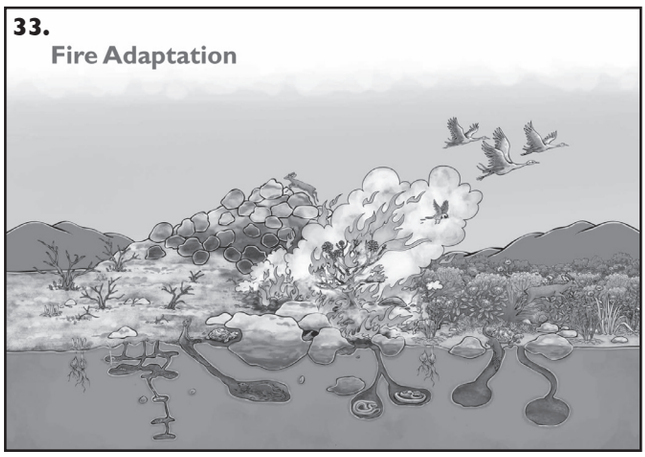
- be able to protect the environment accordingly as they would be aware of the dangers and survival techniques of certain animals and plants.

BACKGROUND INFORMATION

- Fires can benefit ecosystems. Certain plants and animals have adapted to wildfires.
- Adaptation – a characteristic that increases an organism's ability to survive and reproduce in its environment.
- Behavioural Adaptation – are things animals do to survive, usually in response to some type of external stimulus. Over generations, animals have adapted to know what to do when there is a change in their environment.
- The specific pattern of fire, including how frequently it burns, how hot it burns, and during which season it burns, helps dictate the types of plants and animals found in a given area and the adaptations they need to survive. The landscape and structures in an area can often help to contain fires and limit their potentially negative impacts.

Plant adaptations:

- Many plants are adapted to survive in environments with fire. Some plants even depend on fire to help them grow and disperse.
- Some plants have sturdy, fire resistant root stock – after a fire, new sprouts appear from the roots.
- Some fynbos have very thick bark which protects the buds in the stem.
- Some plants have underground bulbs or tubers that are protected from the fire as they are under the ground.
- Some plants have fire resistant cones that protect the seeds. During a fire the cones dry out and after the fire the seeds fall out of the cones to germinate in the next wet winter. Cones also protect them from predators – mice and some birds.
- Some cones release their seeds every autumn, ants take the seeds into their nests underground. The ants eat off the 'fruit' part of the seed and the seed remains under the ground. During a fire, the ground heats up and the seed shell splits, water from the winter rains germinate the seed.



- If fires are too frequent there may not be enough seeds accumulated under the soil and a plant species can die out.

Animal adaptations:

- Some of the larger animals can run from the fire. Some buck scale the rocks and get above the fire where vegetation is sparse.
- Smaller animals – mice, shrews, dassie, mongoose, porcupines, reptiles and insects burrow down into the soil.
- Some animals shelter amongst rocks.
- Animals like tortoises often do not escape a wildfire.
- Birds fly away, but often their chicks will not survive.
- Snakes go underground. If someone wants to clear a field where snakes are found, fire will not kill them as they will just burrow into the soil and survive the fire.
- Ants often thrive after a fire. Their nests are deep underground.
- Food and water is scarce after a fire making it difficult for the animals that have escaped the fire to survive.

LESSON PREPARATION

Materials:

- Flipchart page 33.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing equipment and paper.
- If doing the role-play, the learners may want to bring their own props.

PRESENTATION

Set-up flipchart in the classroom so that all learners are able to see it. Turn to **flipchart page 33.**

Explain that in the picture a fire is approaching and ask the learners to look at the picture and tell you about the different animal escape routes that they see.

- A buck is running away from the fire;
- Another buck is going up the hill to the rocks on the top where the vegetation is sparse;
- A bird is flying away;
- A snake is in a burrow below ground;
- A mongoose is also underground;

- A tortoise is hiding amongst the rocks;
- A lizard is hiding amongst the rocks; and
- Ants and other insects have lots of burrows beneath the soil.

Point out that the plants cannot flee, so they will burn.

Explain that most plants have a way to make sure that their species survives:

- Some plants have sturdy, fire resistant root stock – after a fire new sprouts appear from the roots.
- Some fynbos have very thick bark which protects the buds in the stem.
- Some plants have underground bulbs or tubers that are protected from the fire as they are under the ground.
- Some plants have fire resistant cones that protect the seeds. During a fire the cones dry out and after the fire the seeds fall out of the cones to germinate in the next wet winter. Cones also protect them from predators – mice and some birds.
- Some cones release their seeds every autumn, ants take the seeds into their nests underground. The ants eat off the 'fruit' part of the seed and the seed remains under the ground. During a fire, the ground heats up and the seed shell splits, water from the winter rains germinate the seed.
- If fires are too frequent there may be not enough seeds accumulated under the soil and a plant species can die out.

ACTIVITIES

1. Draw an ant burrow with seeds to show how they are able to escape the heat. Or draw an underground scene of all the animals that might be sheltering below the ground.

2. Do a roleplay in which a fire burns through an area. Hand each learner a piece of paper with a character written on it. A few learners can be the fire – using strips of red fabric that they use to create red waves. Some learners will be plants and others will be various animals – those that run, fly and burrow. Not all characters will survive the fire. This can be done in groups.

   After this experience get each learner to write a short paragraph about how they felt being their character in the roleplay. Ask them if this has changed their view of a wildfire.

19. Report Fire and Smoke

LEARNING OBJECTIVES

Knowledge

Learners will:

- know their address/location and telephone number in an emergency.
- know the correct emergency number to use when reporting an emergency.

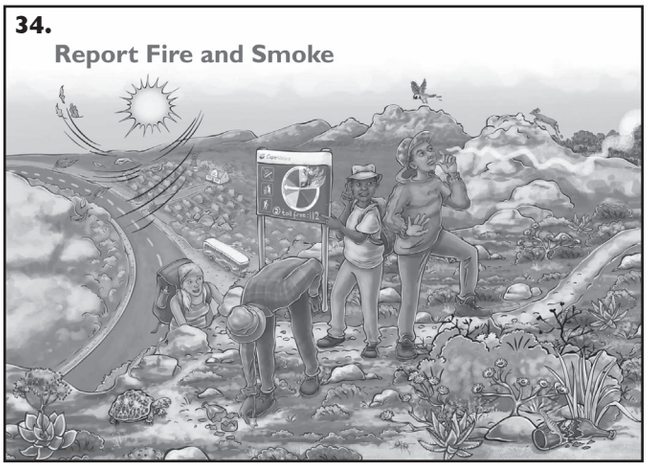
Behaviour

Learners will:

- demonstrate an understanding of correct procedure for reporting fire and smoke.
- show that they know the correct emergency number to use when reporting an emergency.

BACKGROUND INFORMATION

- In an emergency, the ability to call for help quickly and effectively can mean the difference between minor property damage and total devastation, or even between life and death. Each year, thousands of emergency calls are made to 1-1-2. Many more calls are made to other local emergency numbers. Calling for help is a critical life skill.
- Everyone should know how to report a fire or another emergency in the work, home or school environment. Important numbers should be visible on or near the phone.
- Calling the fire department:
  - The fire department is a community helper. The firefighters will help if there is a fire or a medical emergency. Everyone in the home should know the emergency phone number to call to get help from the fire department. Most communities have access to cell phones and can call 1-1-2 toll free. Some communities have to use another telephone number to call. Check with your local fire department to find out the best emergency number to use for your area.
  - Calling the fire department when there is no emergency can hurt someone else who might need help from the firefighters. If the emergency is a house fire, get out first, then call the fire department from outside. After you are safely outside, you can use a neighbour's phone or a cell phone to call for help.
  - Be very clear and specific about where the fire is located. For example: "I want to report a house fire at 109 James Street near the corner of First Avenue." When you call the emergency number, stay on the telephone until the fire department says it is okay to hang up.
- Information the fire department will need when calling:
  - Type of emergency;
  - Your name;
  - Your address; and



- Telephone number from where you are calling.
- Stay on the line and do not hang up until the fire department tells you, you can do so.

LESSON PREPARATION

Materials:

- Flipchart page 34.
- Decide which activity you would like to do with your learners and get the materials together for that.
- Drawing equipment and paper.
- Computer, cell phone or tablet with internet access.

PRESENTATION

Set-up the flipchart in the classroom so that all learners are able to see the **flipchart page 34.**

Ask: What three things in the picture could indicate a possible fire?

- One person is sniffing the air – is it smoke?
- A bird is flying away – could this be a fire?
- A buck is on the run – could this be a fire?

Report fire and smoke immediately.

Ask: One person is pointing to the sign – what is she pointing at?

- Phone number in case of emergency.
- 112 on a cell phone for every area.

Ask: Why one guy is picking up broken glass?

- Someone could get hurt on the glass.
- Many people believe that the reflection of the sun on the glass could start a fire.

ACTIVITIES

1. Make up a list of contact numbers of emergency services. Include the general telephone numbers of the police station and hospital in your area. This could be credit card size so that it is easy to carry. Look at https://www.westerncape.gov.za/general-publication/emergency-contact-numbers and select which numbers are relevant.
2. Do an internet search for the emergency numbers of your area. This could also be made into a poster for the classroom or a small poster that could go home with each learner and be placed on the fridge or next to the phone.