Western Cape Government

DISASTER MANAGEMENT

FIRE RESCUE SERVICES

CapeNature

South African NATIONAL PARKS

Fire is Everyone's Fight

Wildfire Awareness Toolkit

Western Cape Umbrella Fire Protection Association

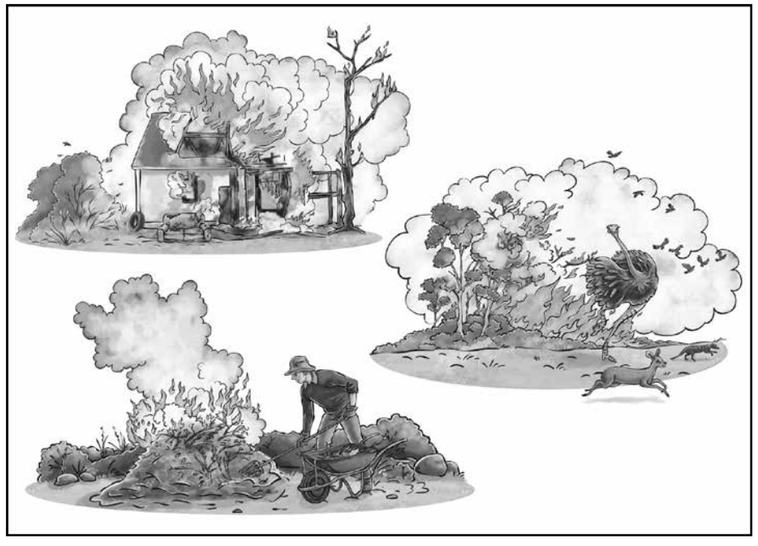
Southern Cape Fire Protection Association

Greater Cederberg Fire Protection Association

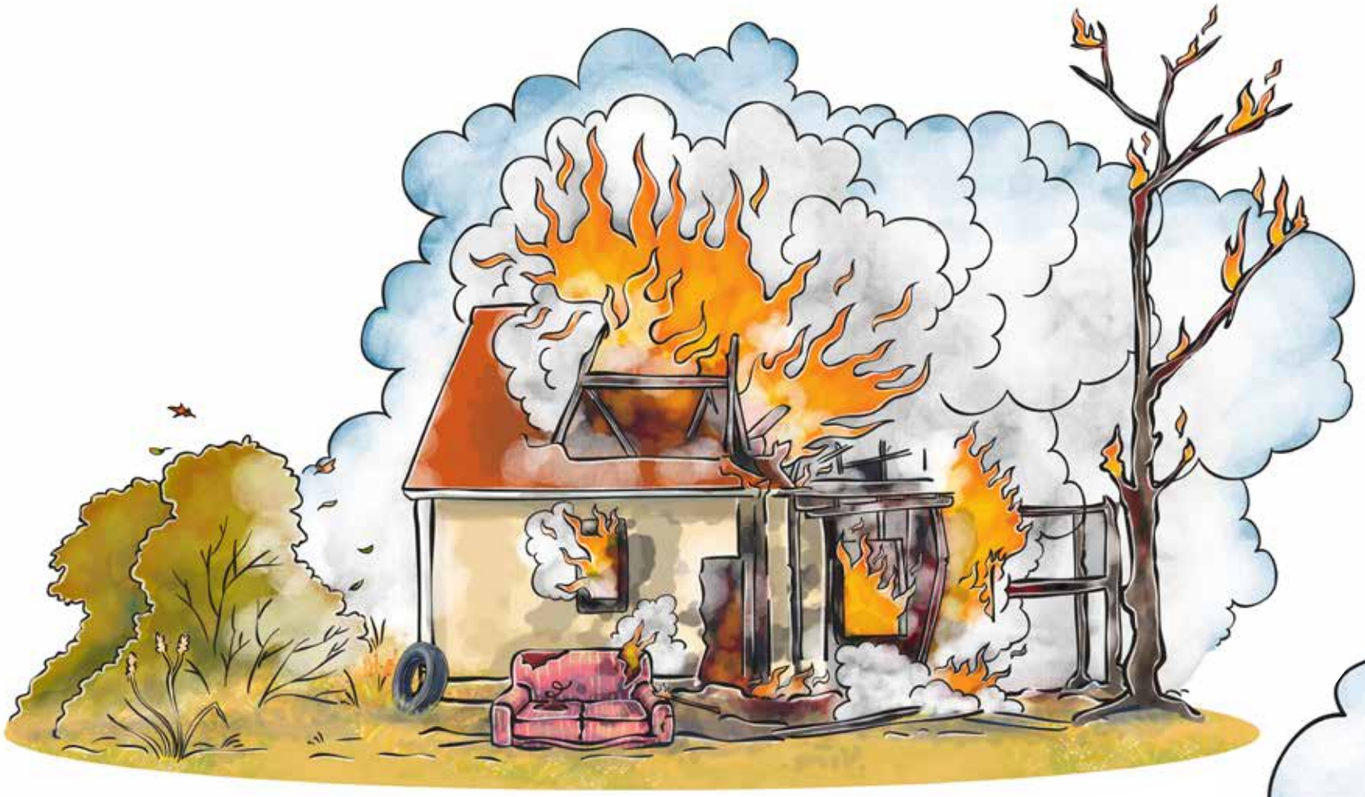
What is Fire?

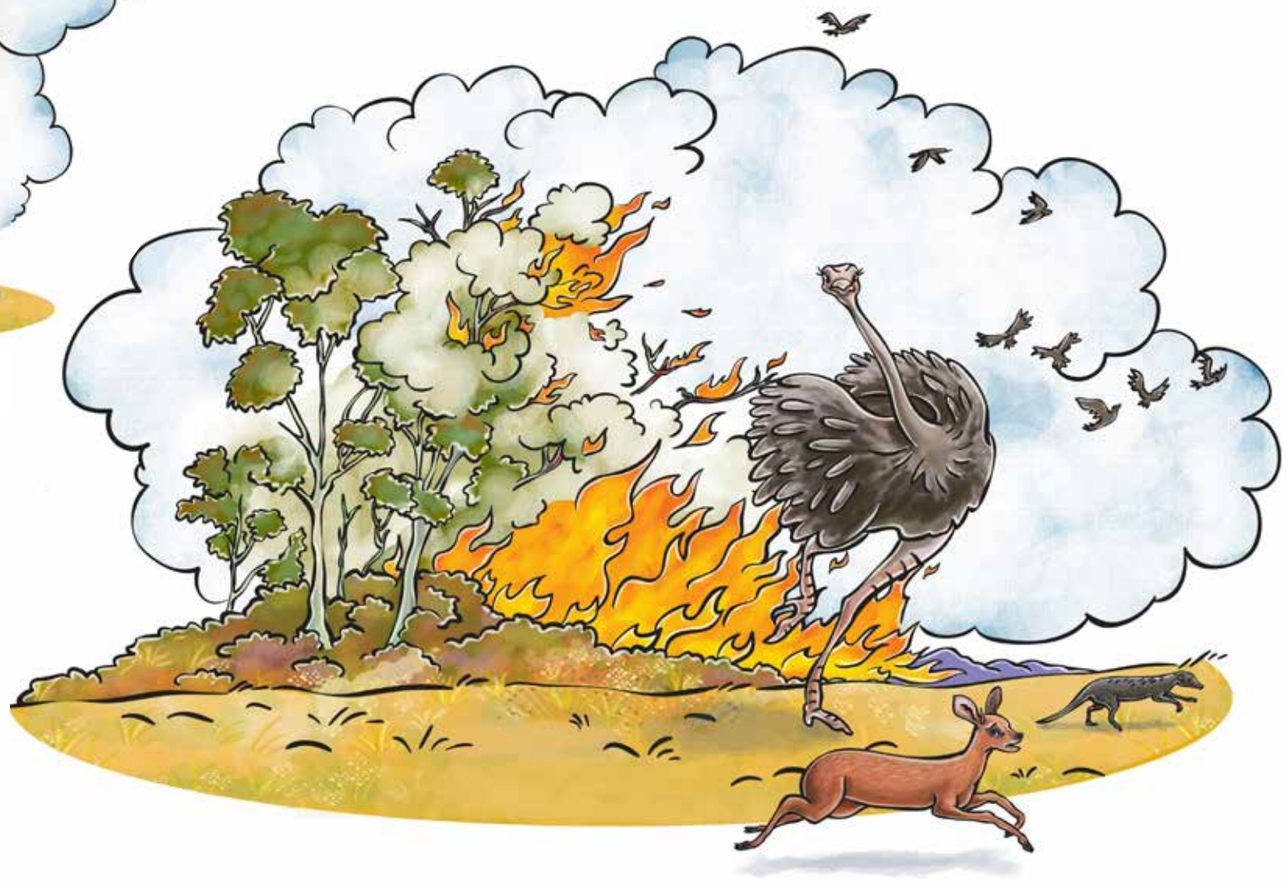
Introduction lesson

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.





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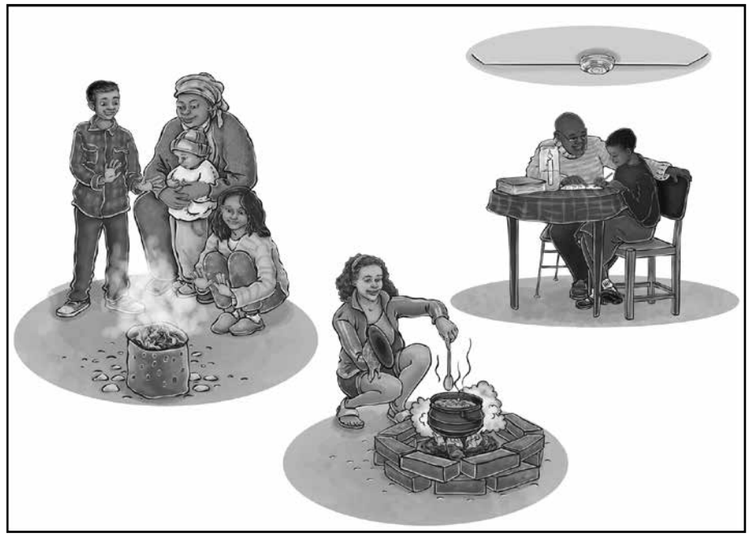


childsafe
KEEP KIDS FREE FROM HARM

A campaign by the Child Accident Prevention Foundation of Southern Africa (CAPFSA) and Safekids Worldwide

KEEP YOUR CANDLE SAFE

1. Place dry sand and candle in a jar
2. Light candle with another candle
3. Candle flame should not burn higher than the jar
4. Place jar on a stable surface away from the edge

SAFE USE OF CANDLES IN A GLASS JAR

- Never leave a burning candle unattended
- Always supervise children near fire, flames or candles
- Place your candle jar on a sturdy, uncluttered surface away from the edge or any place where it could be knocked over, especially by children
- The DRY sand acts to smother the flame if the jar is knocked over
- Light the candle carefully, ensuring that you do not burn yourself - use the other half candle
- Extinguish all candles when you leave the house or go to sleep
- Never leave young children alone in a room with a candle or any flame
- Always keep candles away from anything that can burn like curtains, newspaper, clothing & hanging decorations
- Place lit candles away from windows or near door-ways where drafts could bring combustibles in contact with the flame

GENERAL CARE OF CANDLE IN A GLASS JAR

- Reuse a glass jar without the lid – save the Earth's resources
- Always remove the wax from the sand / soil every time your candle is finished or burnt down
- Ensure that you refill the glass jar with DRY sand / soil with every change of candle to the level of at least 1/3 of the jar
- Should the glass start to get smoky, clean it when you remove the wax
- The glass jar makes the candlelight brighter
- Use only half a candle so the flame is lower than the top of the jar

BROKEN GLASS

- Do take care of the glass if the jar is cracked or broken
- Collect any pieces of broken glass & dispose of them safely by wrapping them in thick newspaper.
- Ensure that all the glass pieces are swept up to avoid cuts.

www.childsafe.org.za

CAPFSA

A Member Of Safe Kids Worldwide

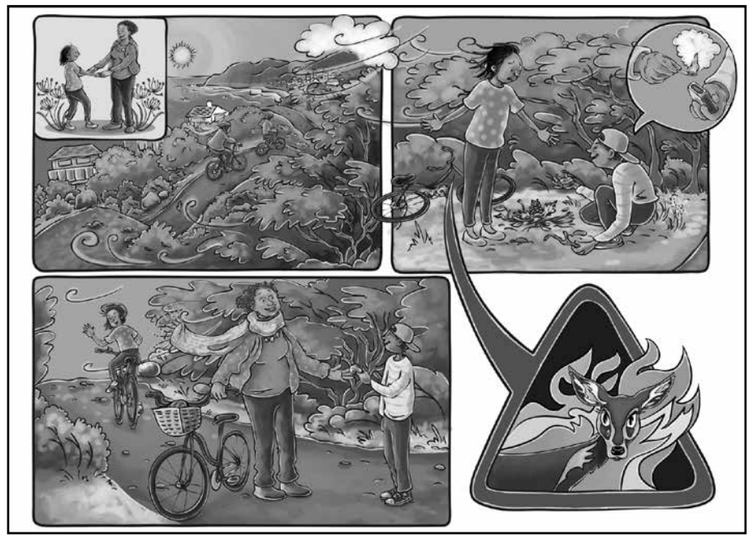
Layout: Sascha & Chantelle

Causes of Wildfire

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.

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.

The Fire Triangle

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.


AIR
FUEL
HEAT

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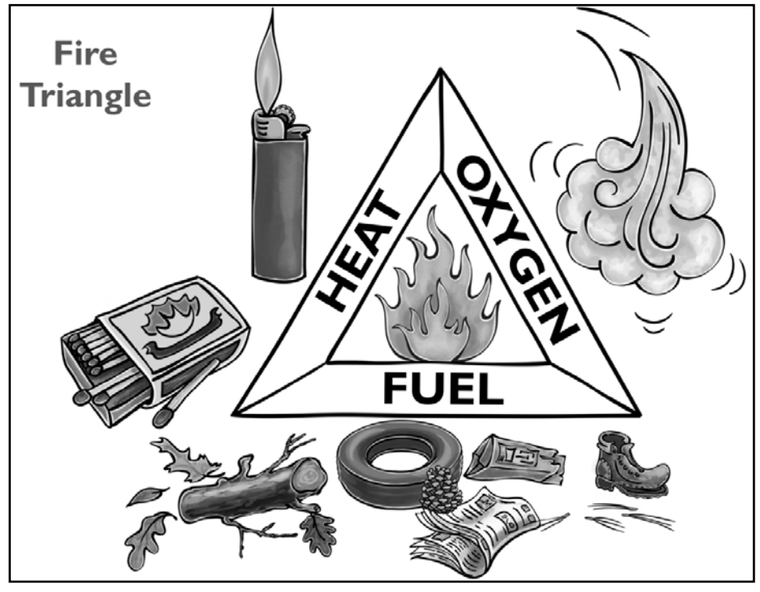

- **Remove air/oxygen:**
  - smother with a blanket/clothes/sand/water/fire extinguisher/foam.
- **Remove heat/ignition source:**
  - add water/use fire extinguisher (water cools the heat, drops the fuel temperature to below ignition temperature and it adds moisture to potential fuel, thus stopping it from catching alight).
- **Remove fuel:**
  - take anything flammable out of the fire-path;
  - remove invasive alien vegetation;
  - create a fire break/prescribed burning.

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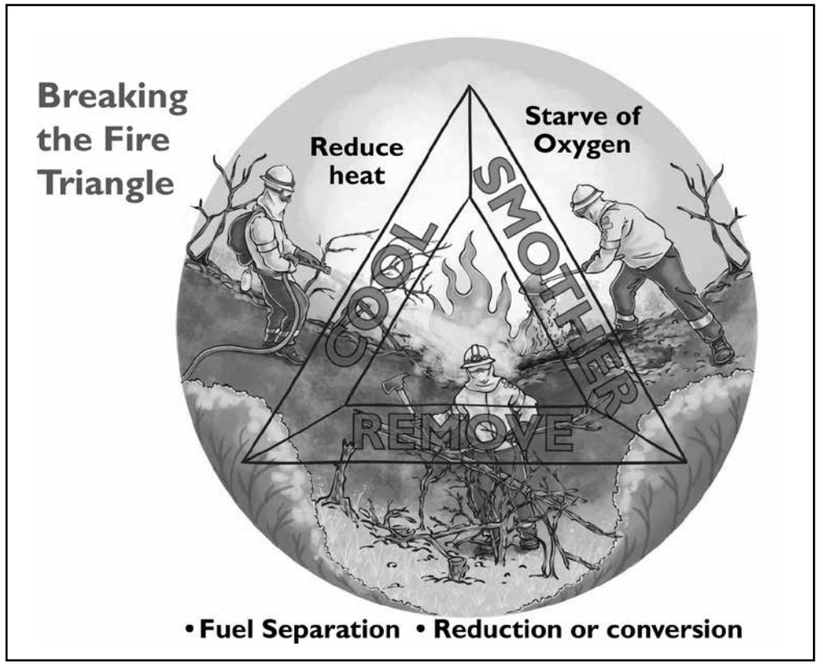

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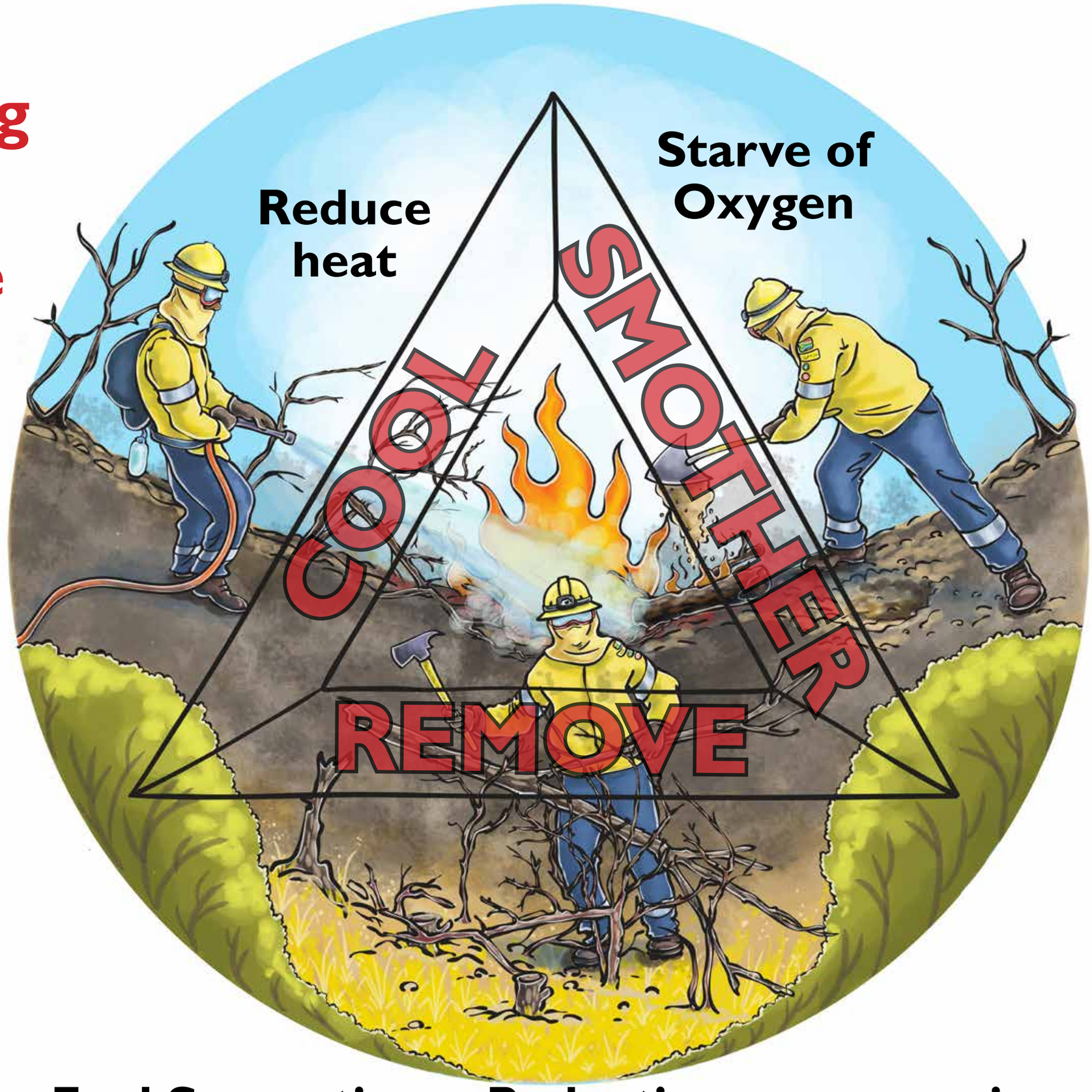
Breaking the Fire Triangle



- **Fuel Separation**
- **Reduction or conversion**

The Fire Behaviour Triangle

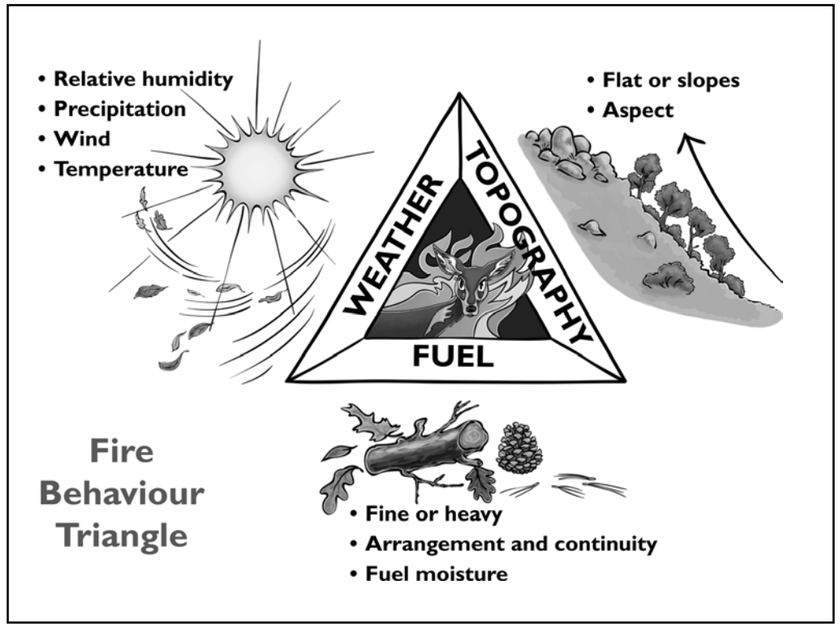
Background information:

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.

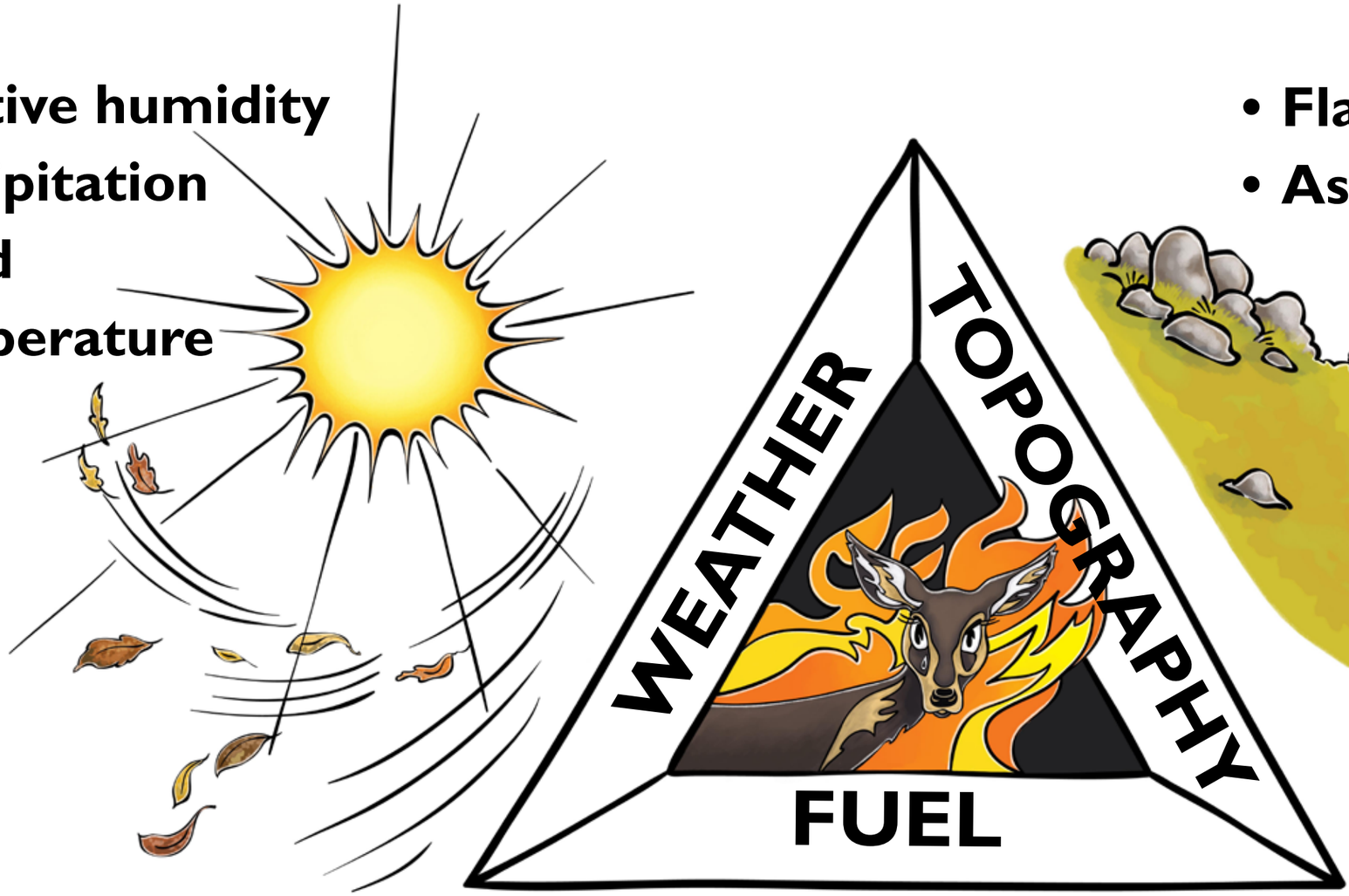
Fuel – old and dying plants are dry and contain less water and burn more easily than lush, green, moisture-filled plants. If you live near a bushy area, keep a clear area of 10m between your house and the bush. Ladder fuel – smaller bushes that act as stepping stones or ladders for the fire to move from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

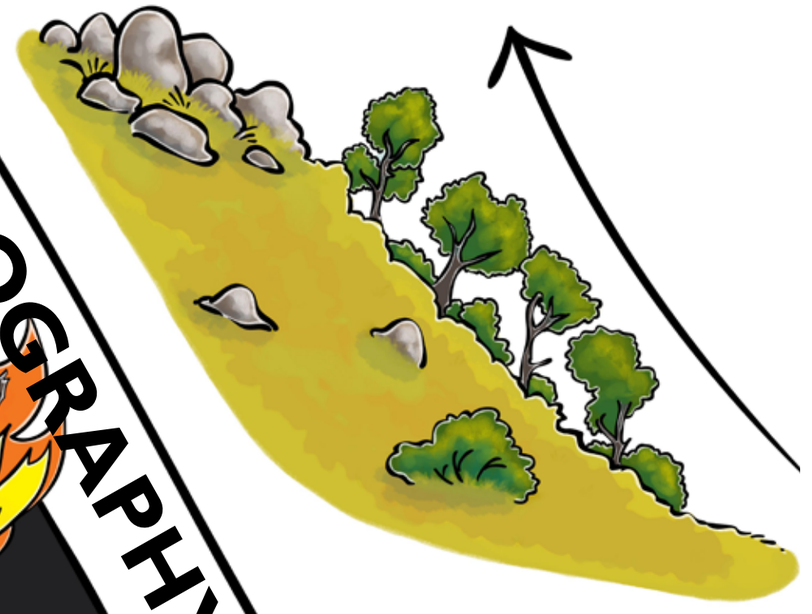


- It is mainly fine fuels that drive the forward spread of a fire, while the heavy fuels are consumed in the smouldering zone behind the main fire front. The fine fuel is ignited first, this heats the heavy fuel enabling it to catch alight and burn. The proportion of fine fuel verses heavy fuel affects 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.
- 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.

- Relative humidity
- Precipitation
- Wind
- Temperature



- Flat or slopes
- Aspect



Fire Behaviour Triangle

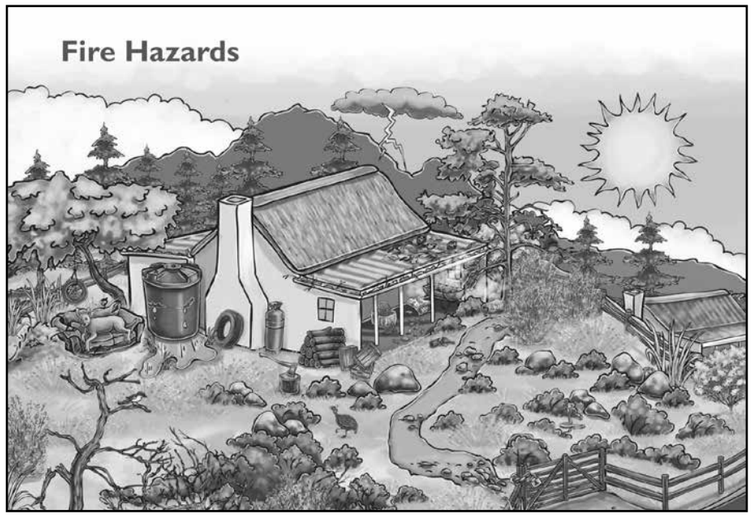
- Fine or heavy
- Arrangement and continuity
- Fuel moisture

The Fire Behaviour Triangle (continued)

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.

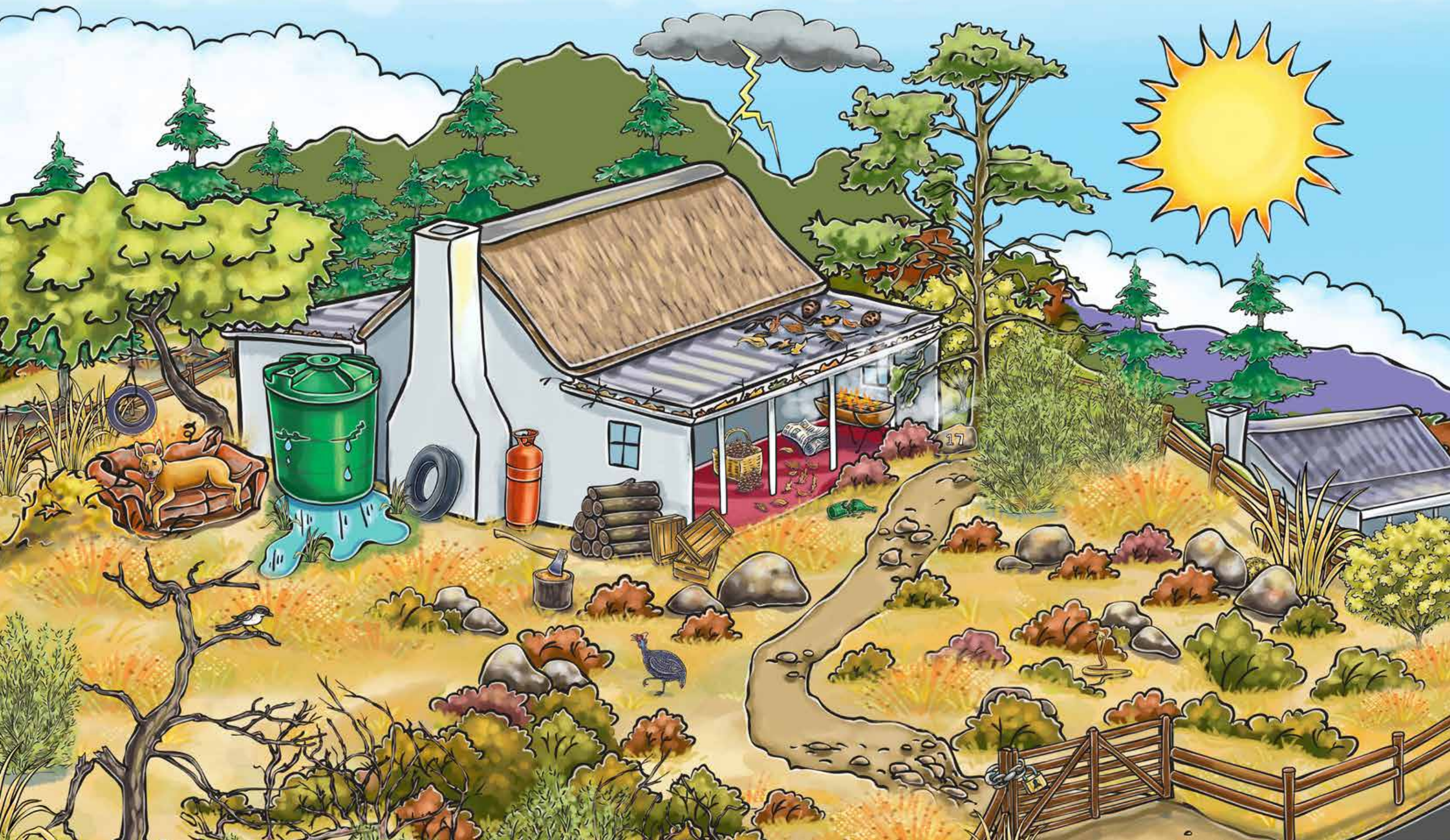


- Each area has its characteristic winds. Some of these bring the hot, dry conditions that cause further problems. Other local winds may be relied upon to bring cooler, moist conditions. Generally, winds that blow from inland are hotter and drier than those which blow from the sea.

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.

Fire Hazards



Fire Weather

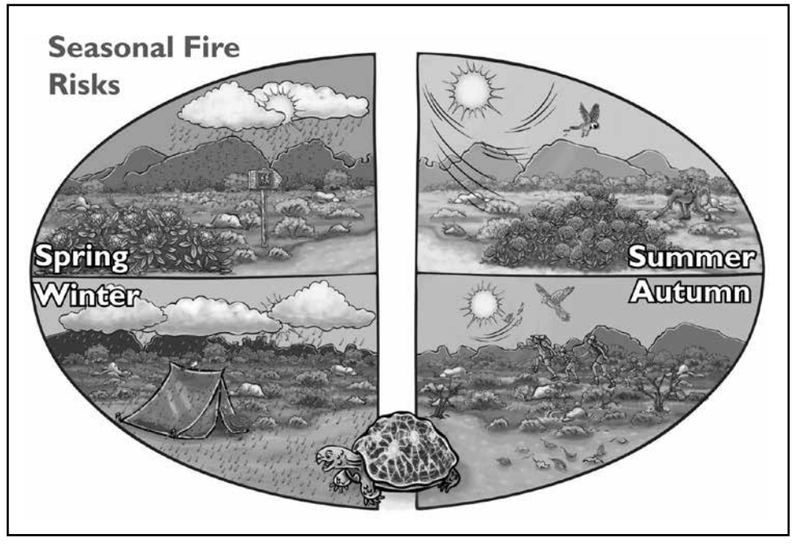
Background information:

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.



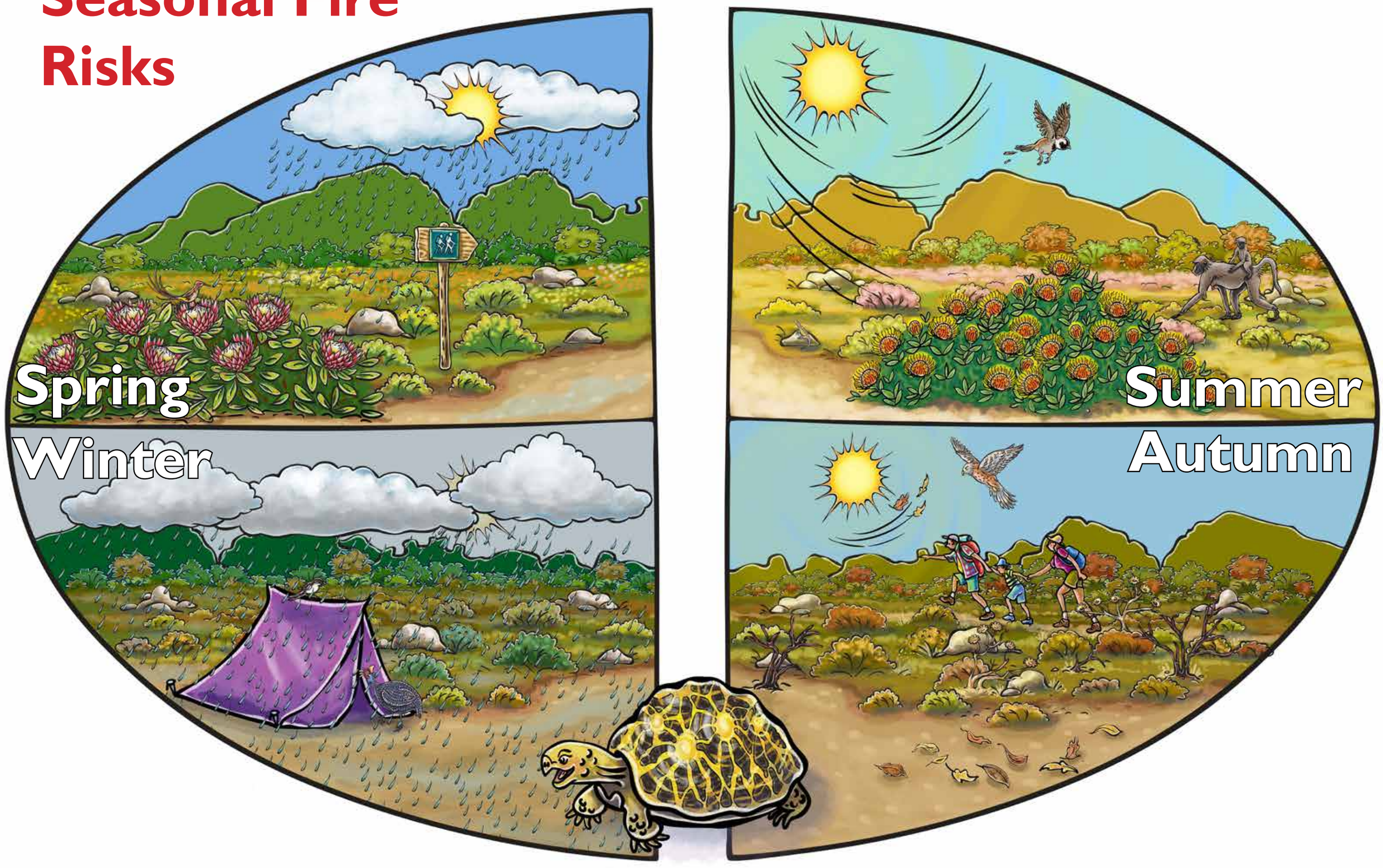
Weather: we experience this on a day-to-day basis.

- 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.

Seasonal Fire Risks



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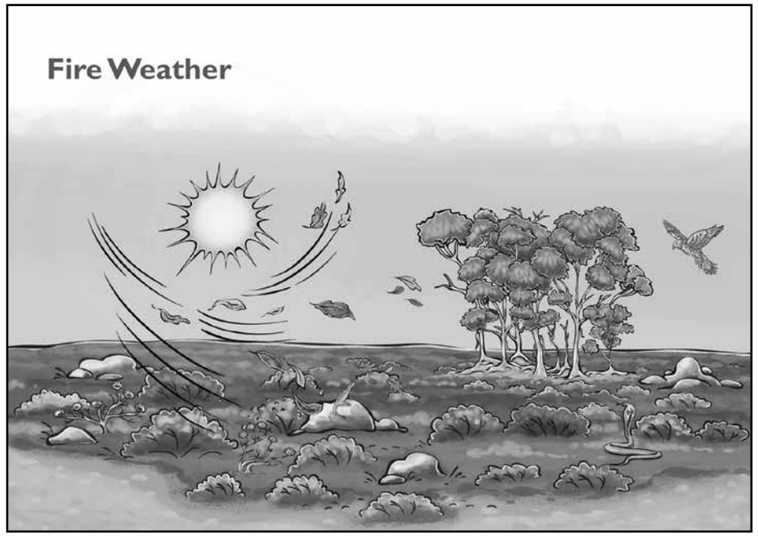

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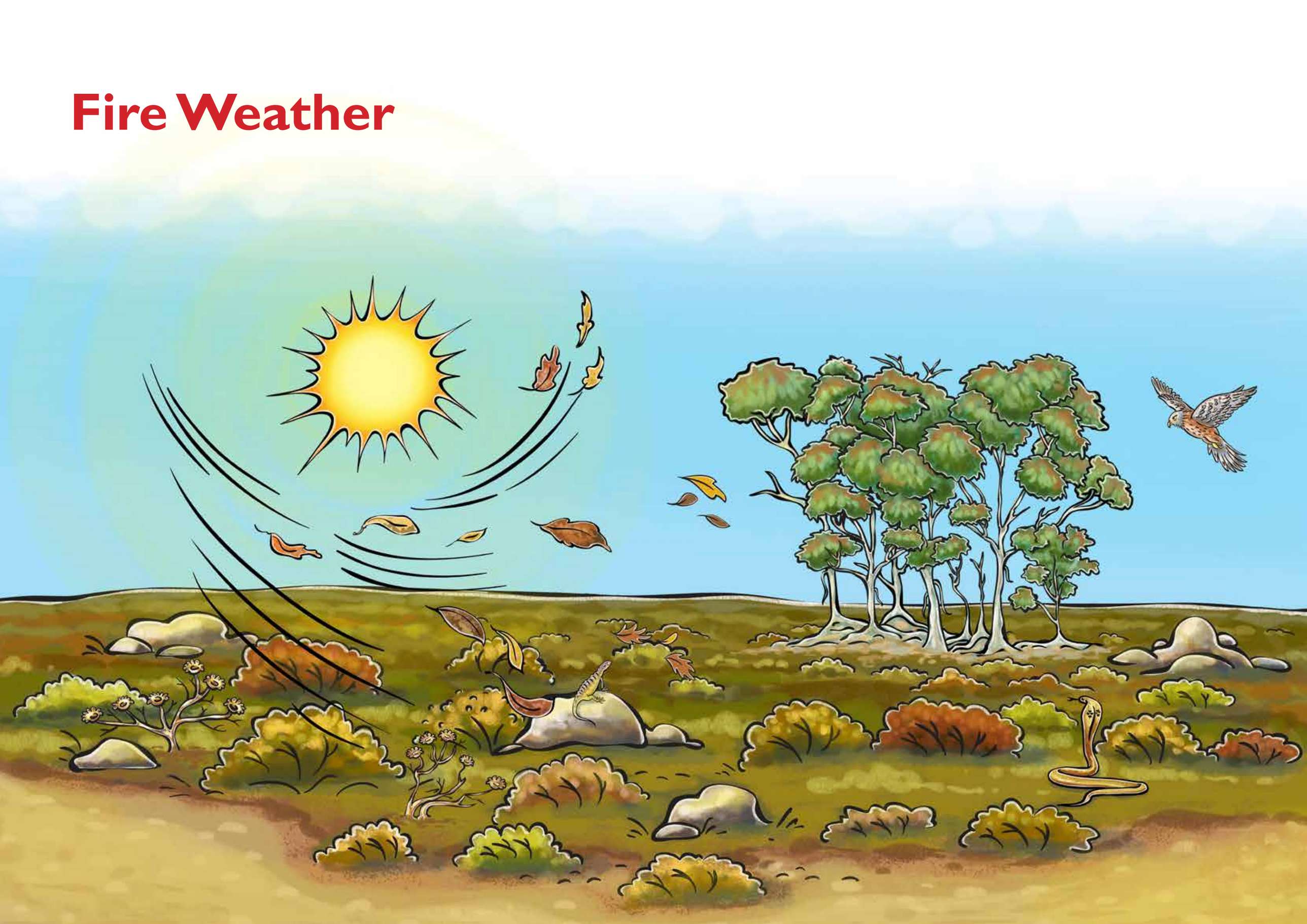


Fire Danger Index

Background information:

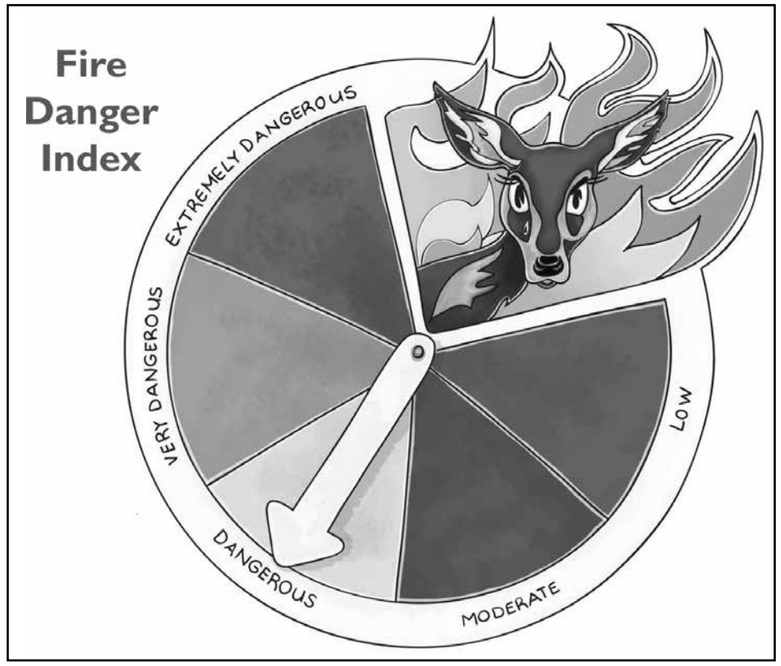
- The fire danger index is a scale that indicates the risk of a possible fire and the rate of its spread on a specific day.
- There are 5 measurements – low (blue), moderate (green), dangerous (yellow), very dangerous (orange), extremely dangerous (red).
- The risk is worked out by taking into account 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/

Daily Fire Danger

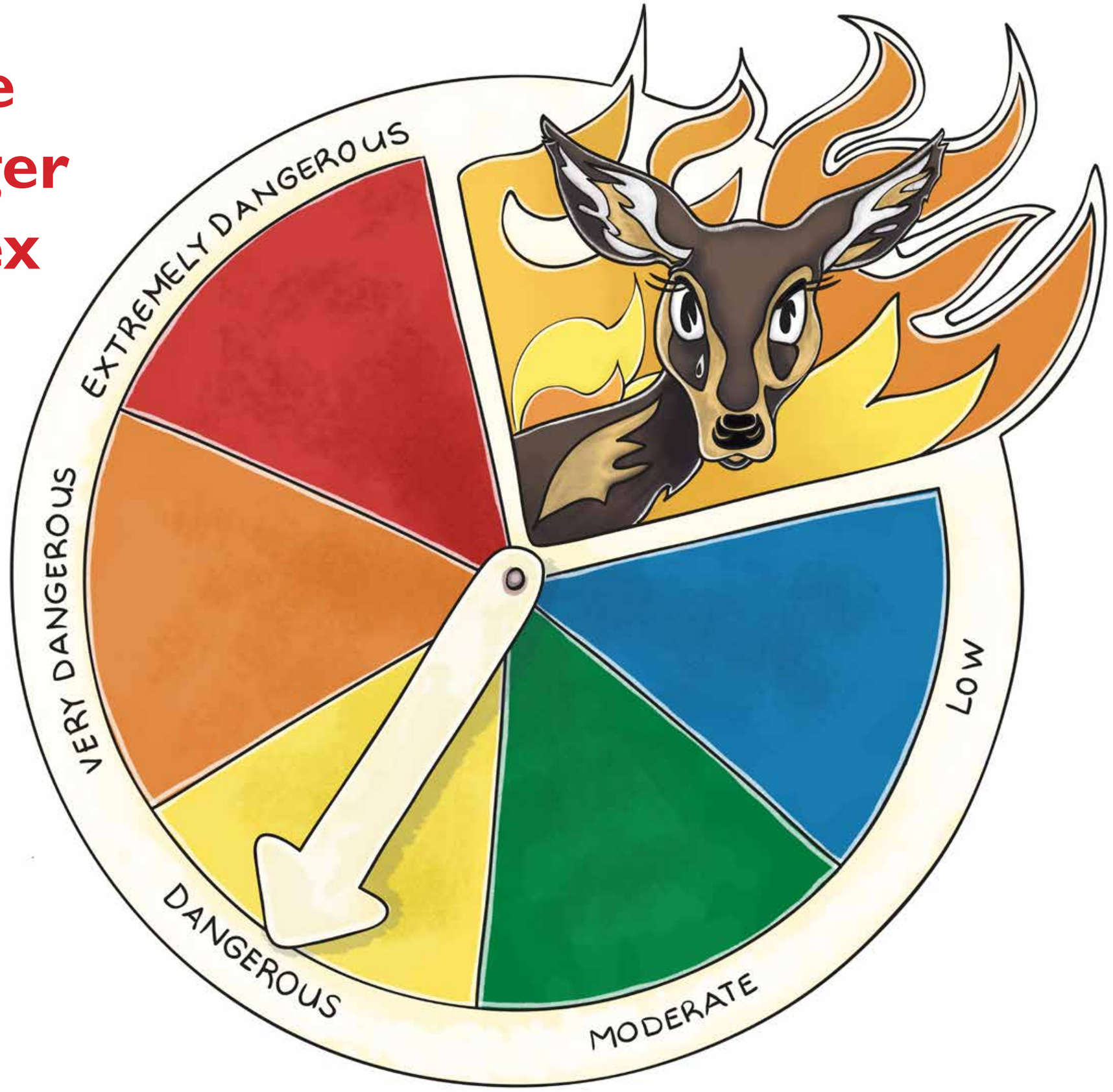
Fire Danger Index

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/

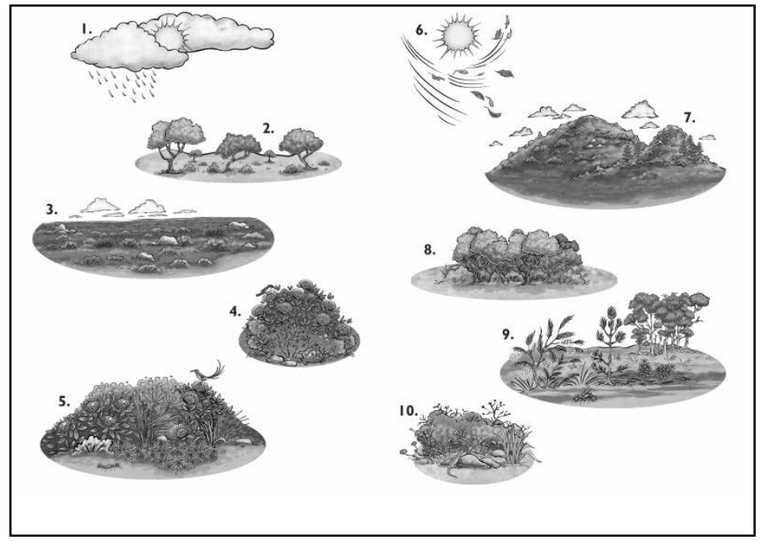


Fire Danger Index



Fire Danger Index and Fire Weather

The pictures here show different fire weather. They can be used to create discussion and to re-inforce previous lessons on fire weather, and the different aspects of the fire triangles (fuel, topography and weather).



		Fire Danger index
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

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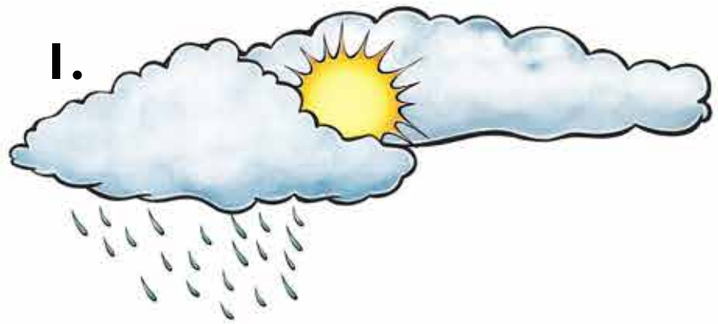

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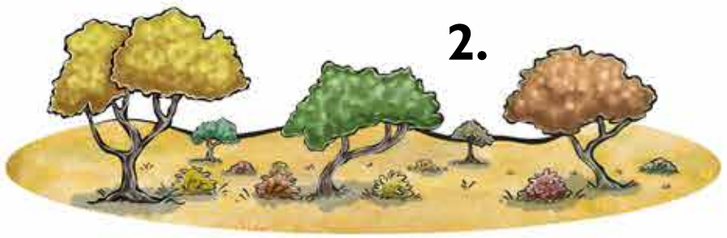

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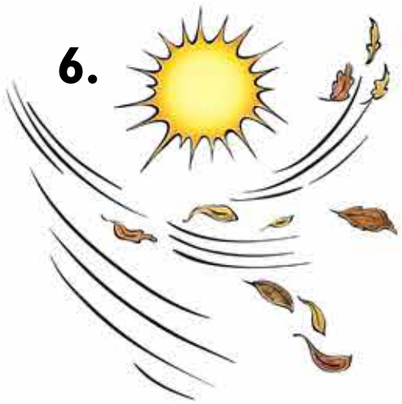

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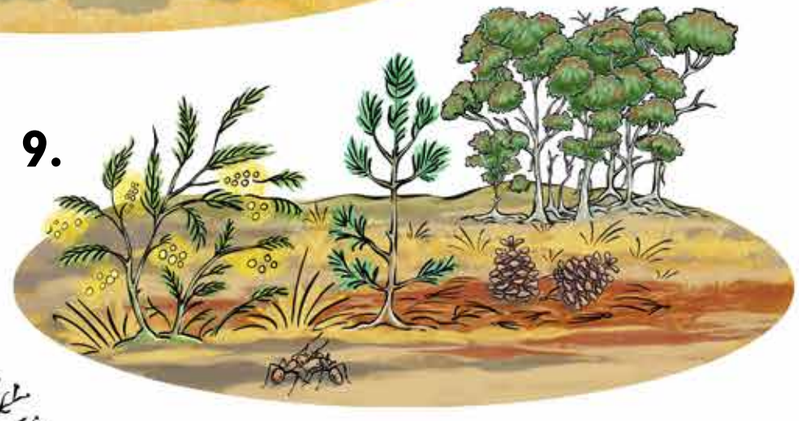

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Indigenous and Alien Invasive Vegetation

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.

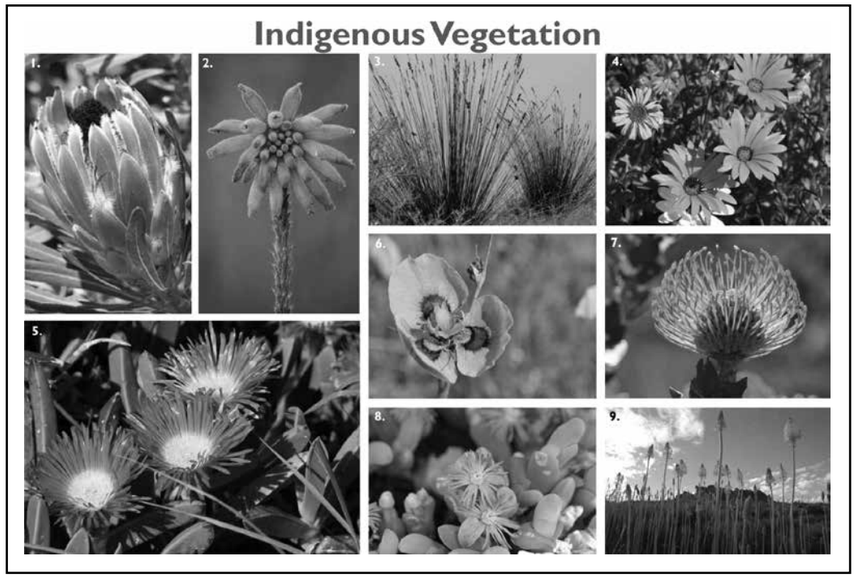
Endemic: species found nowhere else in the world.

- 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.
- 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.

	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



Indigenous Vegetation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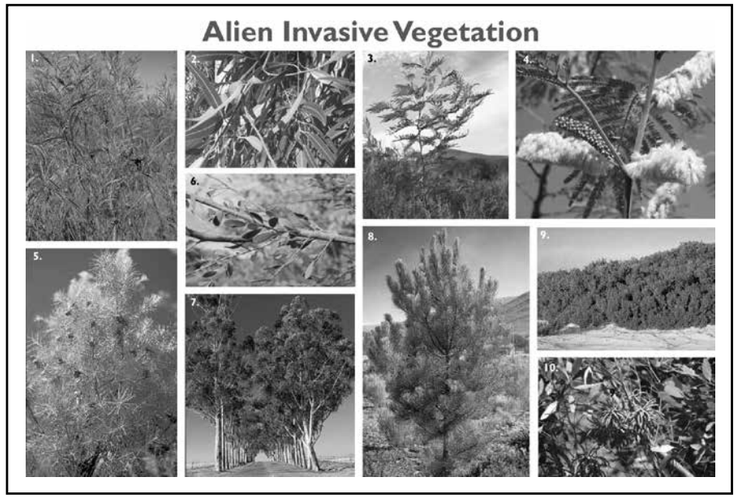
Indigenous and Alien Invasive Vegetation (continued)

Background information:

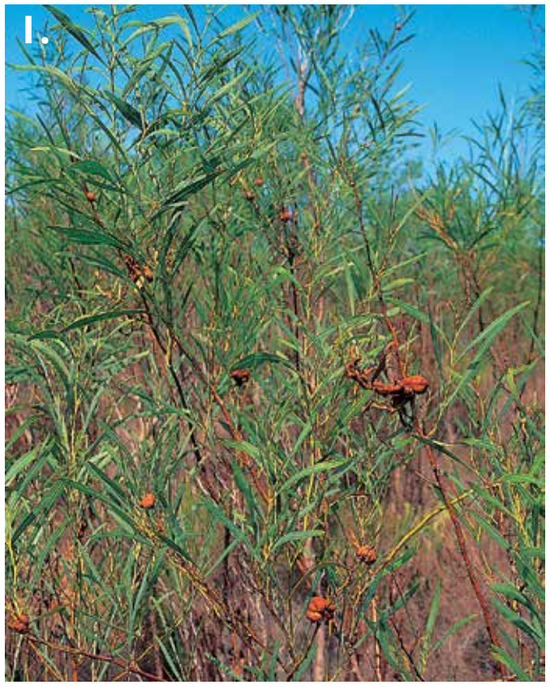
Alien invasive vegetation

- 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.

	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



Alien Invasive Vegetation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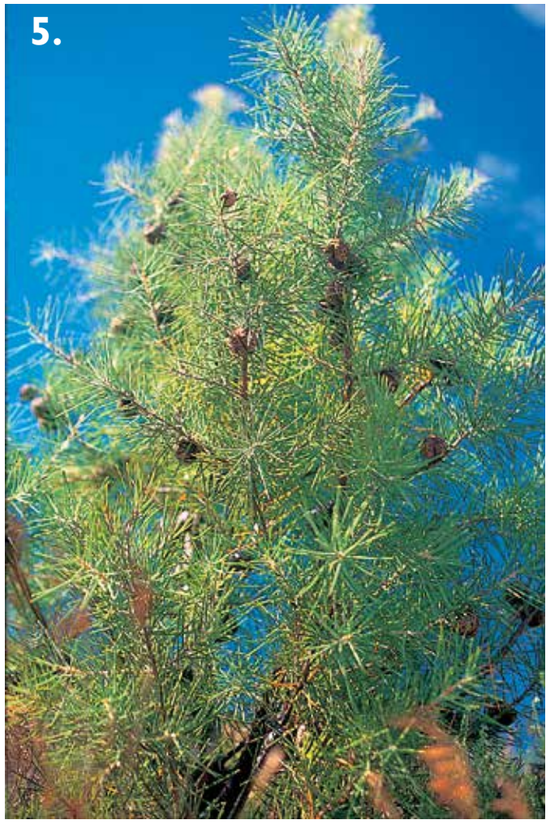
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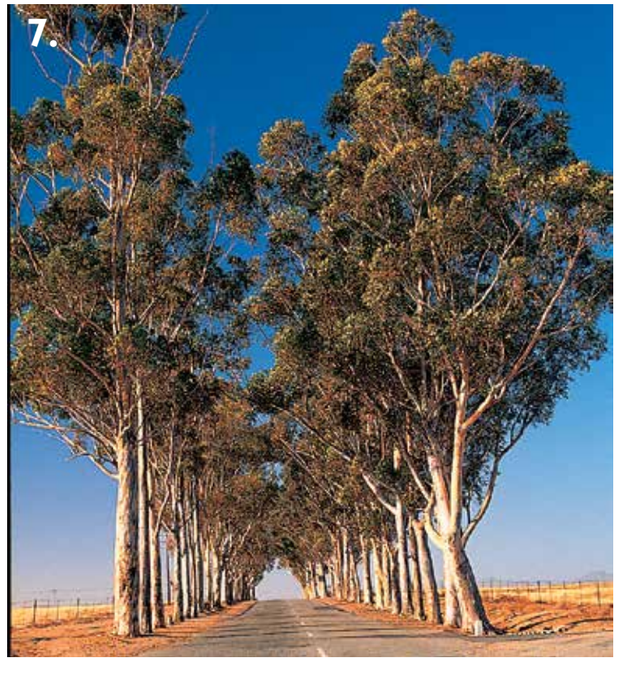
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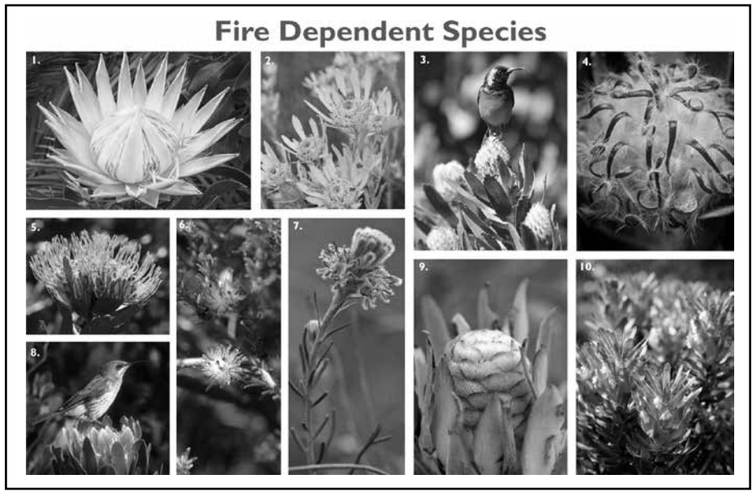
Fire Dependent Species

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.
- Resprouters: these 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.

	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



Fire Dependent Species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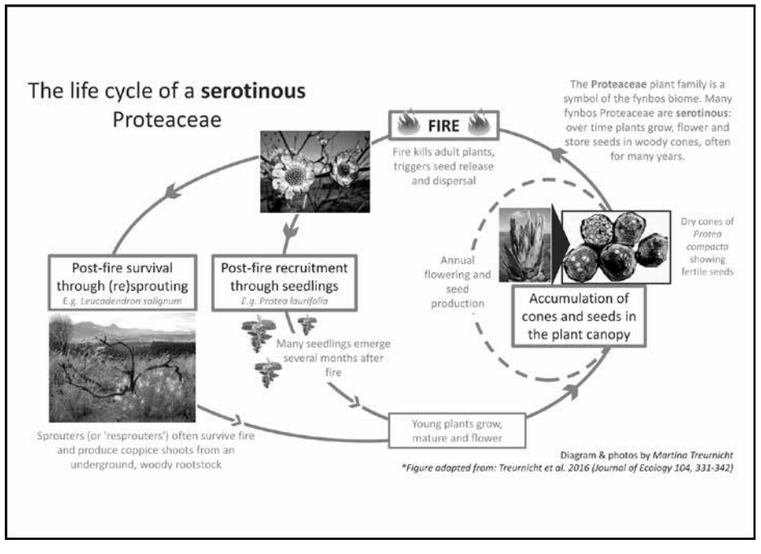
Fire Dependent Species (continued)

- 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 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.



The life cycle of a **serotinous** Proteaceae

The **Proteaceae** plant family is a symbol of the fynbos biome. Many fynbos Proteaceae are **serotinous**: over time plants grow, flower and store seeds in woody cones, often for many years.

FIRE

Fire kills adult plants, triggers seed release and dispersal

Dry cones of *Protea compacta* showing fertile seeds

Annual flowering and seed production

Accumulation of cones and seeds in the plant canopy

Post-fire survival through (re)sprouting

E.g. *Leucadendron salignum*

Sprouters (or 'resprouters') often survive fire and produce coppice shoots from an underground, woody rootstock

Post-fire recruitment through seedlings

E.g. Protea laurifolia

Many seedlings emerge several months after fire

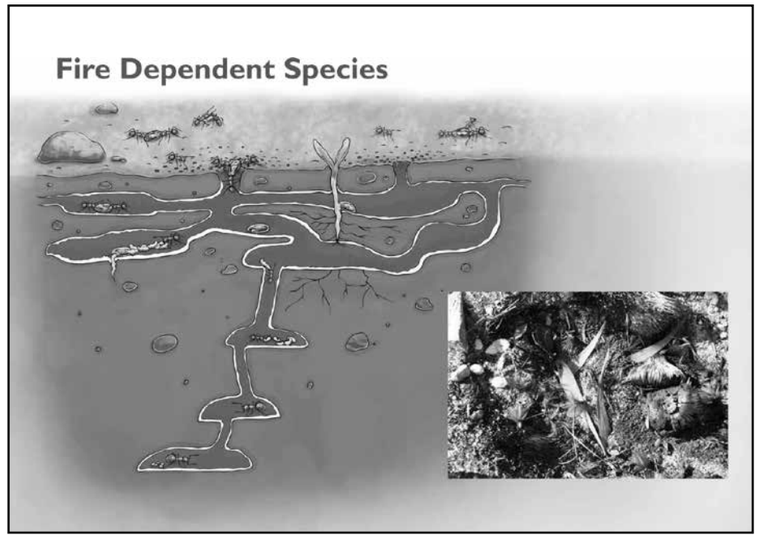
Young plants grow, mature and flower

Diagram & photos by *Martina Treurnicht*

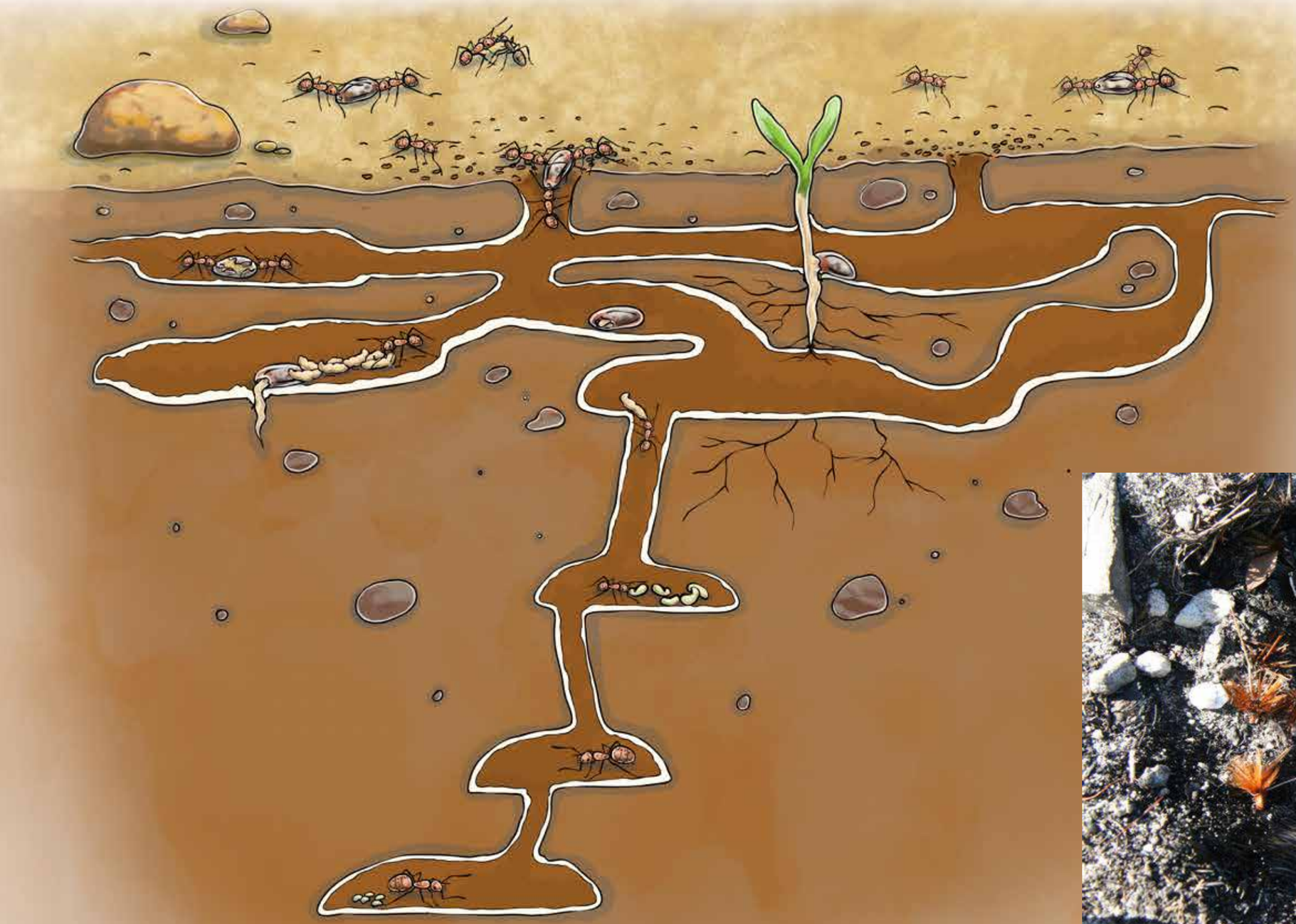
**Figure adapted from: Treurnicht et al. 2016 (Journal of Ecology 104, 331-342)*

Fire Dependent Species (continued)

- 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.



Fire Dependent Species



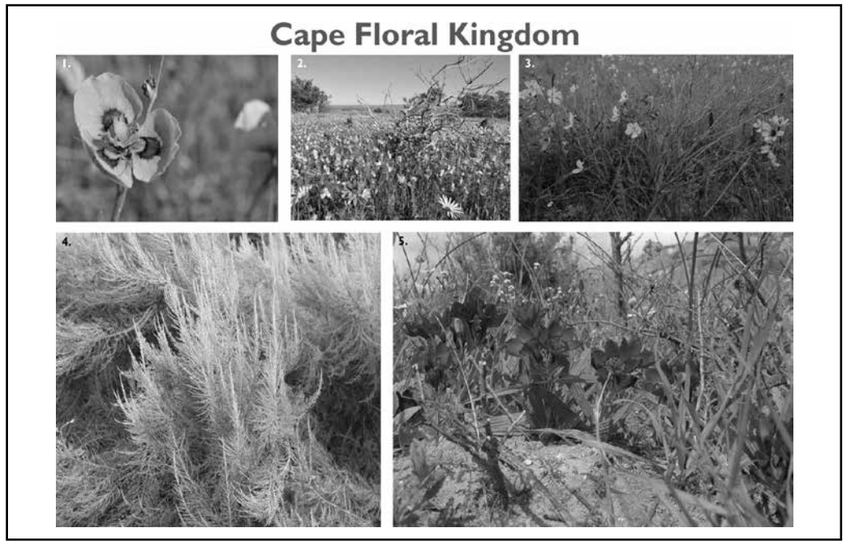
Cape Floral Kingdom

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);
  - 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.
- A heath-like vegetation known as 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.
- **Renosterveld** (chinoceros veld) – Renosterveld is largely characterised by low-growing grey bushes known as renosterbos and a high number and diversity of geophytes.

	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 no copyright
5.	Babiana	Renosterveld	Rupert Koopman



- **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.

Cape Floral Kingdom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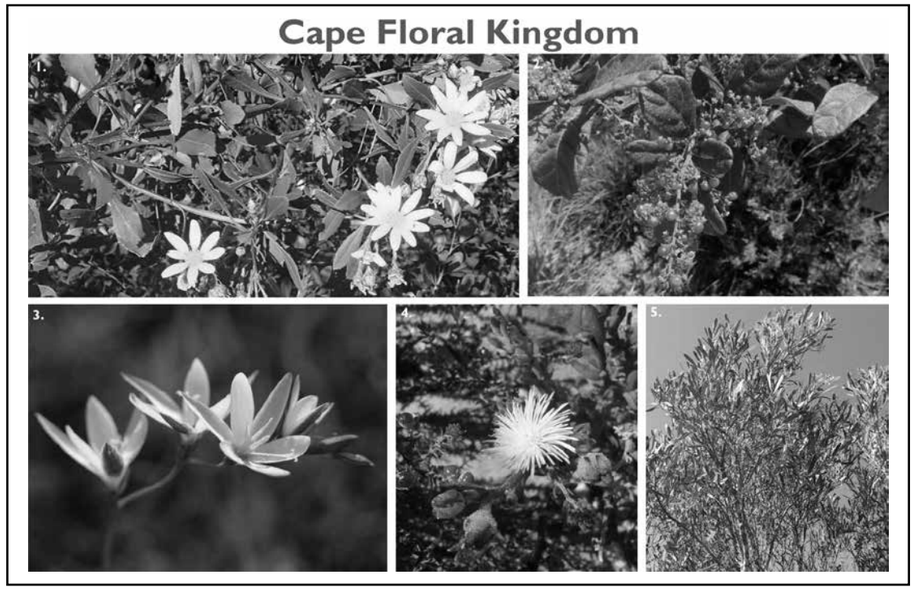
Cape Floral Kingdom (continued)

- 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.

	Plant common 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



- Some fynbos plants have seeds that germinate/start to 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.

Cape Floral Kingdom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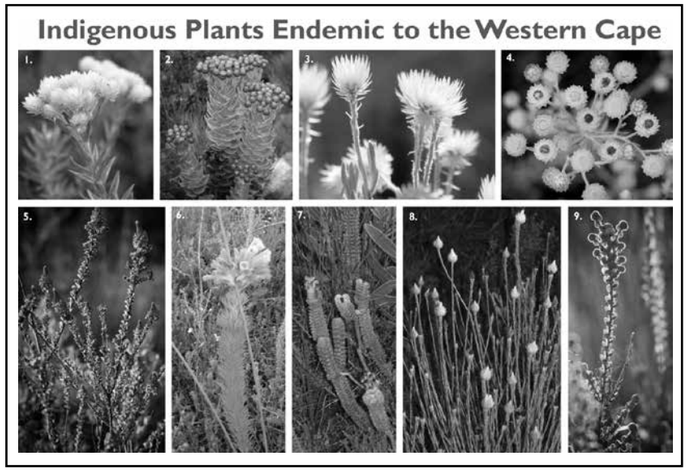
Cape Floral Kingdom (continued)

- 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.



	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.

Indigenous Plants Endemic to the Western Cape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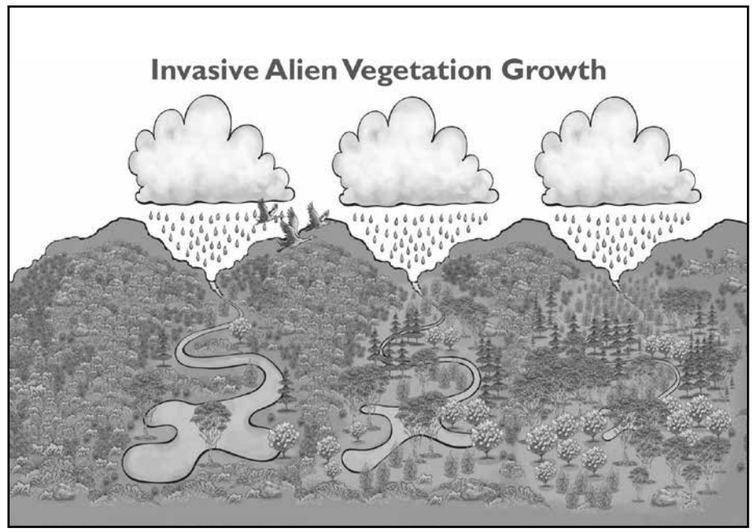
Invasive Alien Vegetation Growth

The illustration here shows the damage done to a water system when invasive alien vegetation is allowed to get out of control.



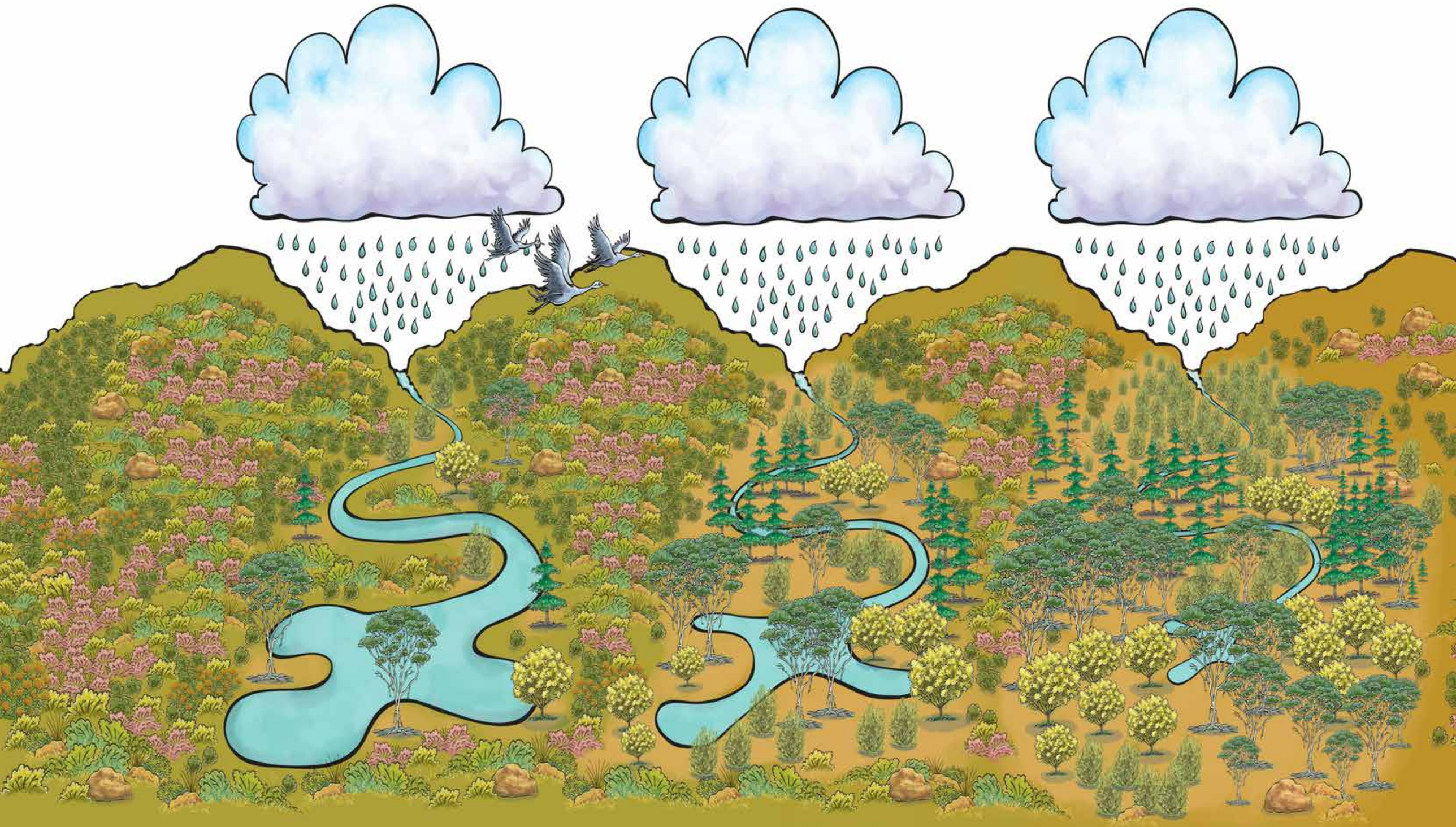
Working from left to right.
Far left: The veld is covered with fynbos. The catchment area in the mountains feeds a river that then forms a vlei area at the base of the mountain. This is the only water required by the fynbos. There are a few alien invasive plants seen here.
Middle section: the alien invasive vegetation is speading, the fynbos is less prevelant adn te vlei is begining to dry up.
Right section: The alien invasive vegetation has taken over. There are very few fynbos plants to be seen. The vlei area has almost disappeared.

In the case of a wildfire, the following will happen:

1. The alein 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.
2. When the rain comes, there will be no vegetation to hold the soil and there will be floods and mud-slides.
3. Dongas will develop.

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

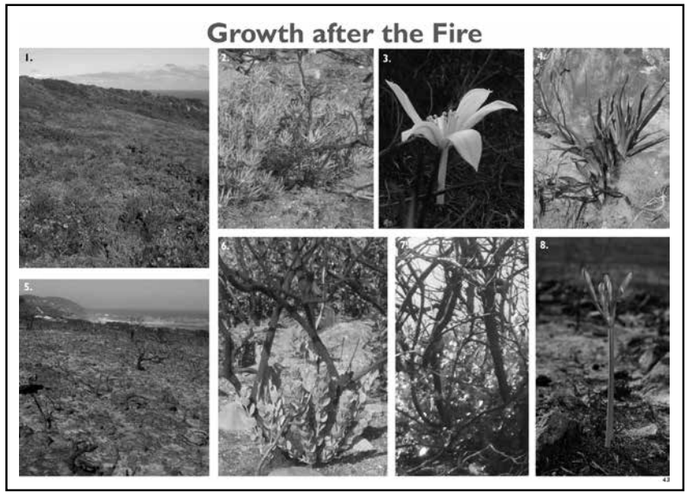
Invasive Alien Vegetation Growth



Useful Fires and Harmful Fires

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.
- Photo 1 shows fynbos, a fire dependent species and 5 shows the 'burn scar' after the fire, before regrowth occurs.
- After fire, some fynbos plants will send up new green leaves from the seemingly dead stems.
- There are also the bulbs (4) 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.
- Some plants send out new leaves from the burnt stems (2, 6, 7)



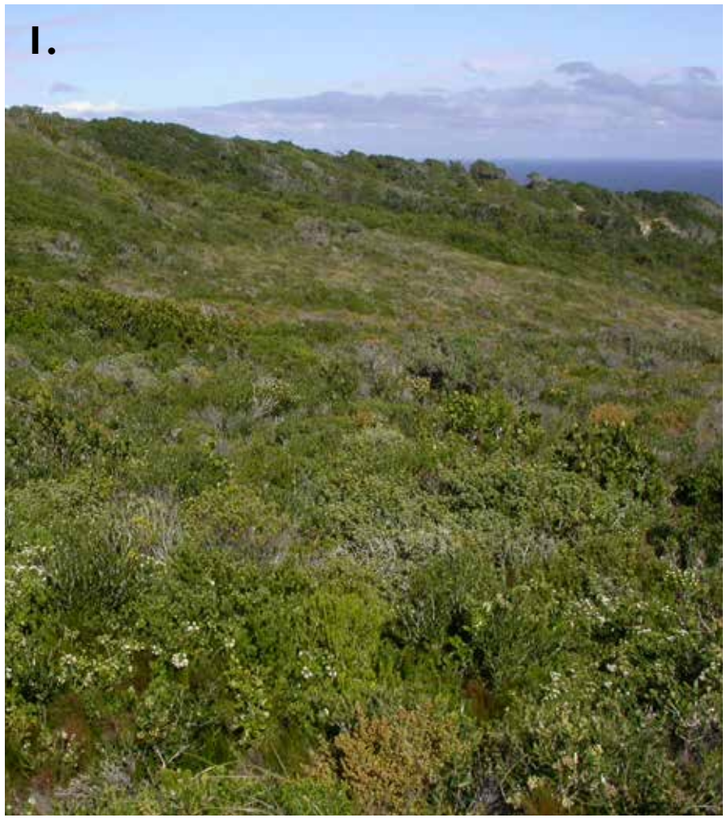
Useful fires (good)

- 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).

Growth after the Fire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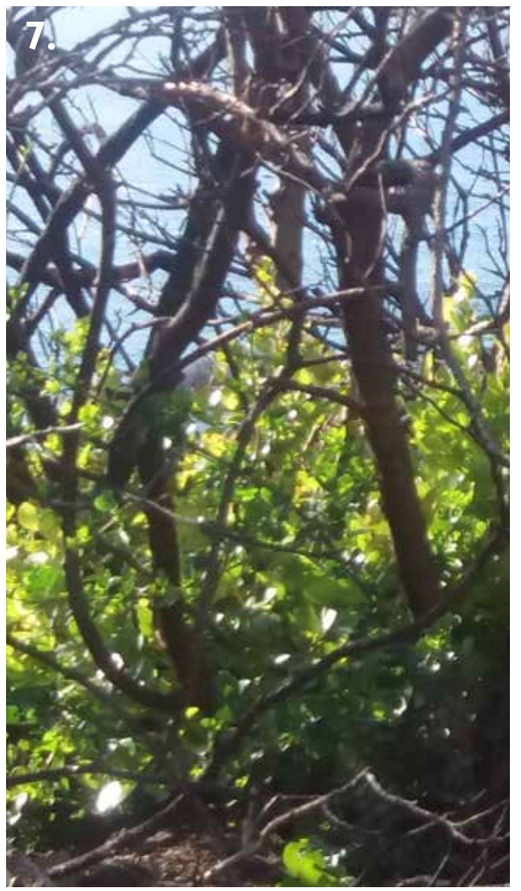
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8.

Greenhouse Effect, Climate Change and Global Warming

Background information:

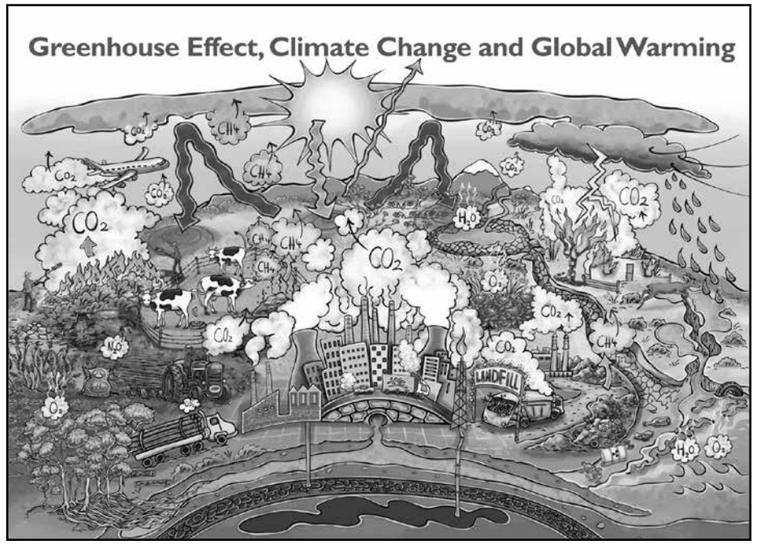
Greenhouse effect: A greenhouse is a shedlike structure made of glass. It has glass walls and a glass roof. People grow tomatoes and flowers and other plants in them. A greenhouse stays warm inside, even during winter. Sunlight shines in and warms the plants and air inside. The heat is trapped by the 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.

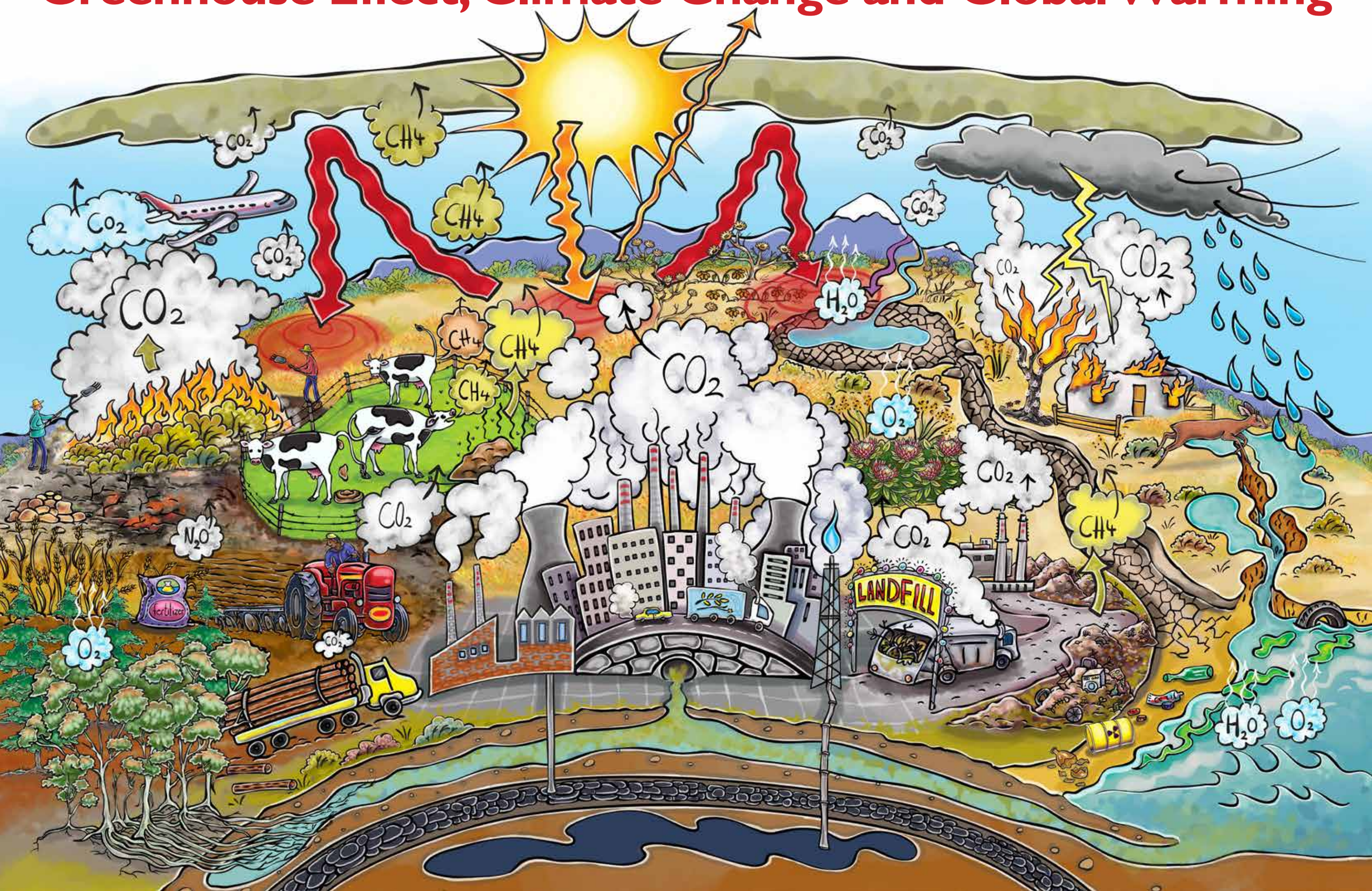
Climate change: a change in global or regional climate and weather patterns, in particular a change apparent from the mid to late 20th century onwards and attributed largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

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.

Greenhouse Effect, Climate Change and Global Warming

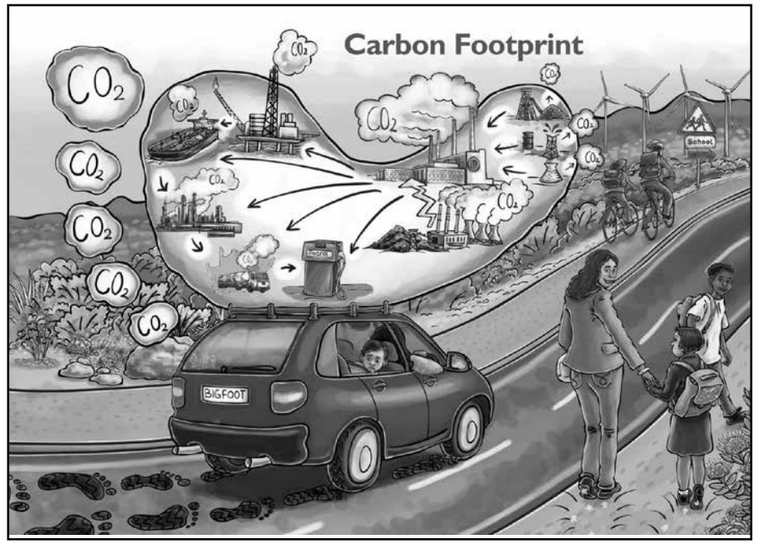


Carbon Footprint

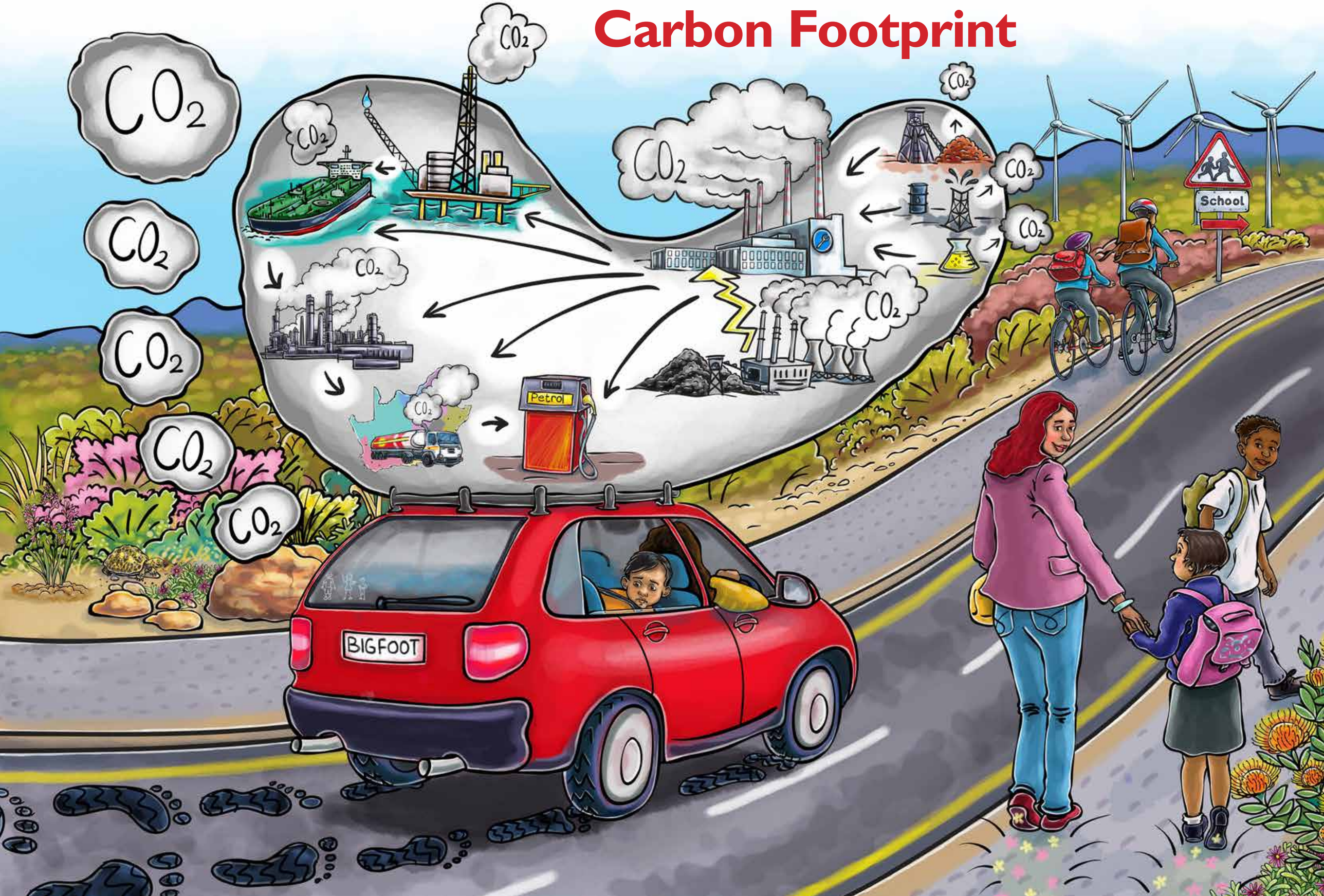
Background information:

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.



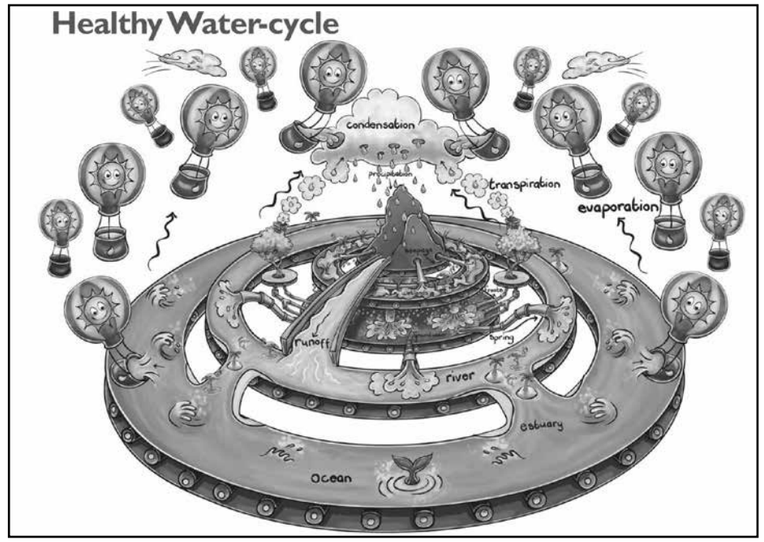
Carbon Footprint



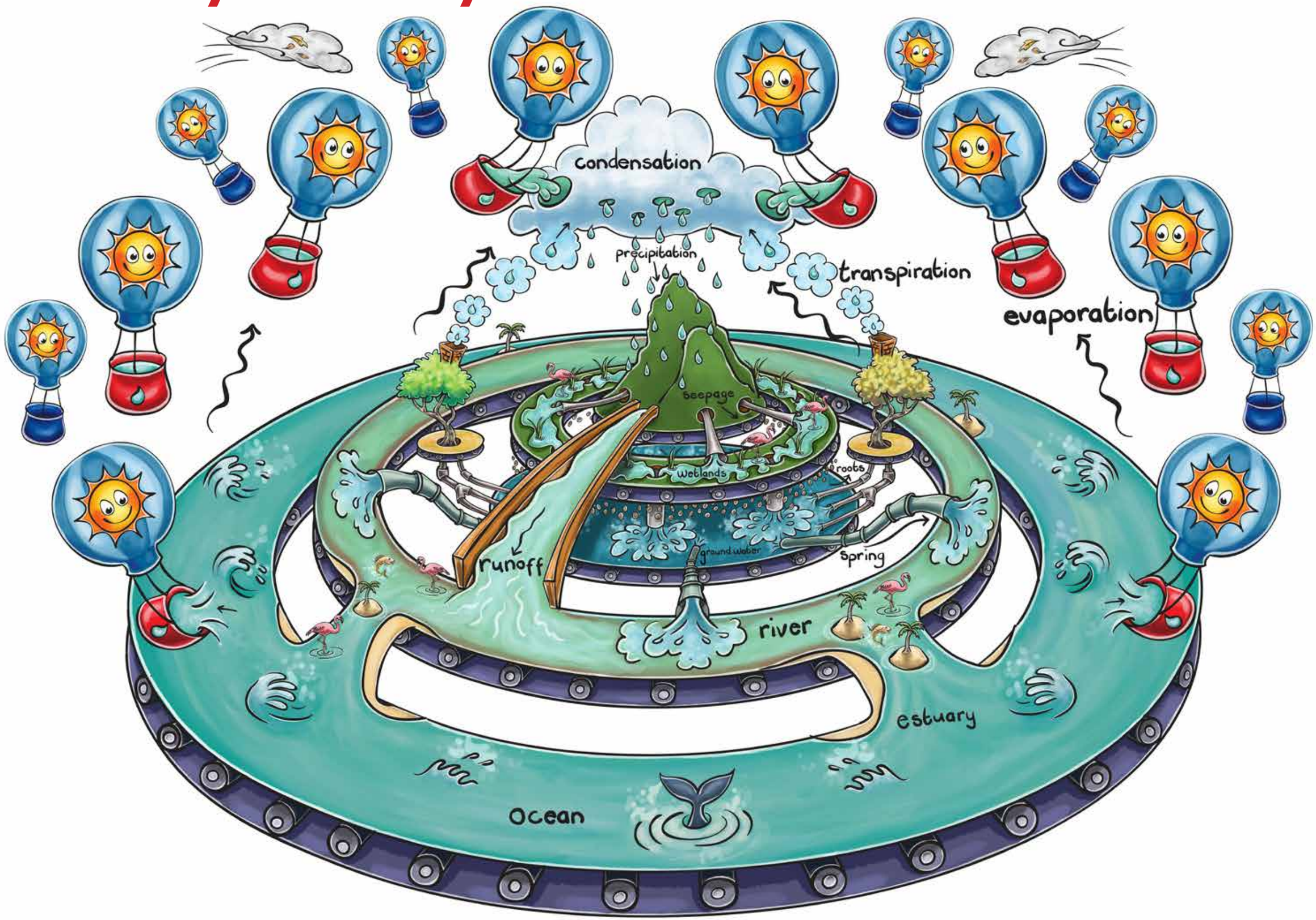
Healthy Ecosystems

Background information:

- 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. 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 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.
- 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.



Healthy Water-cycle



An Unhealthy Ecosystem – Natural Disasters

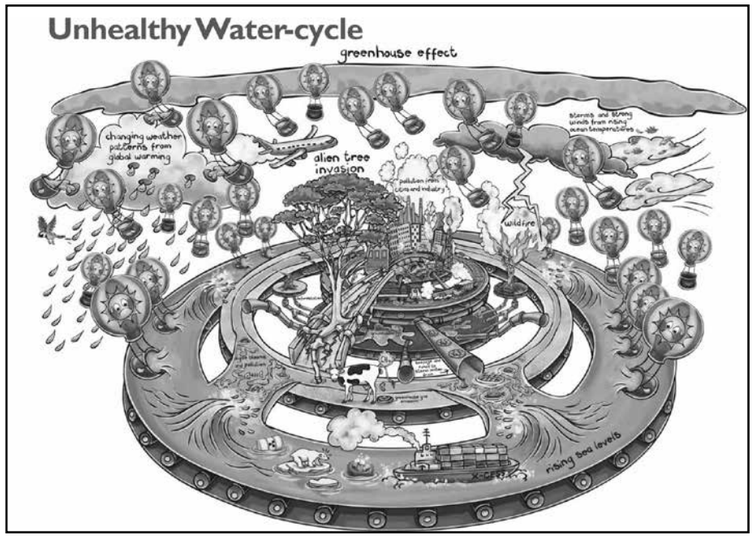
NOTE: Teachers are advised to spend an extra few moments studying the pictures of our water-cycle on the flipchart before commencing this lesson.

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 smily 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 catchments 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.

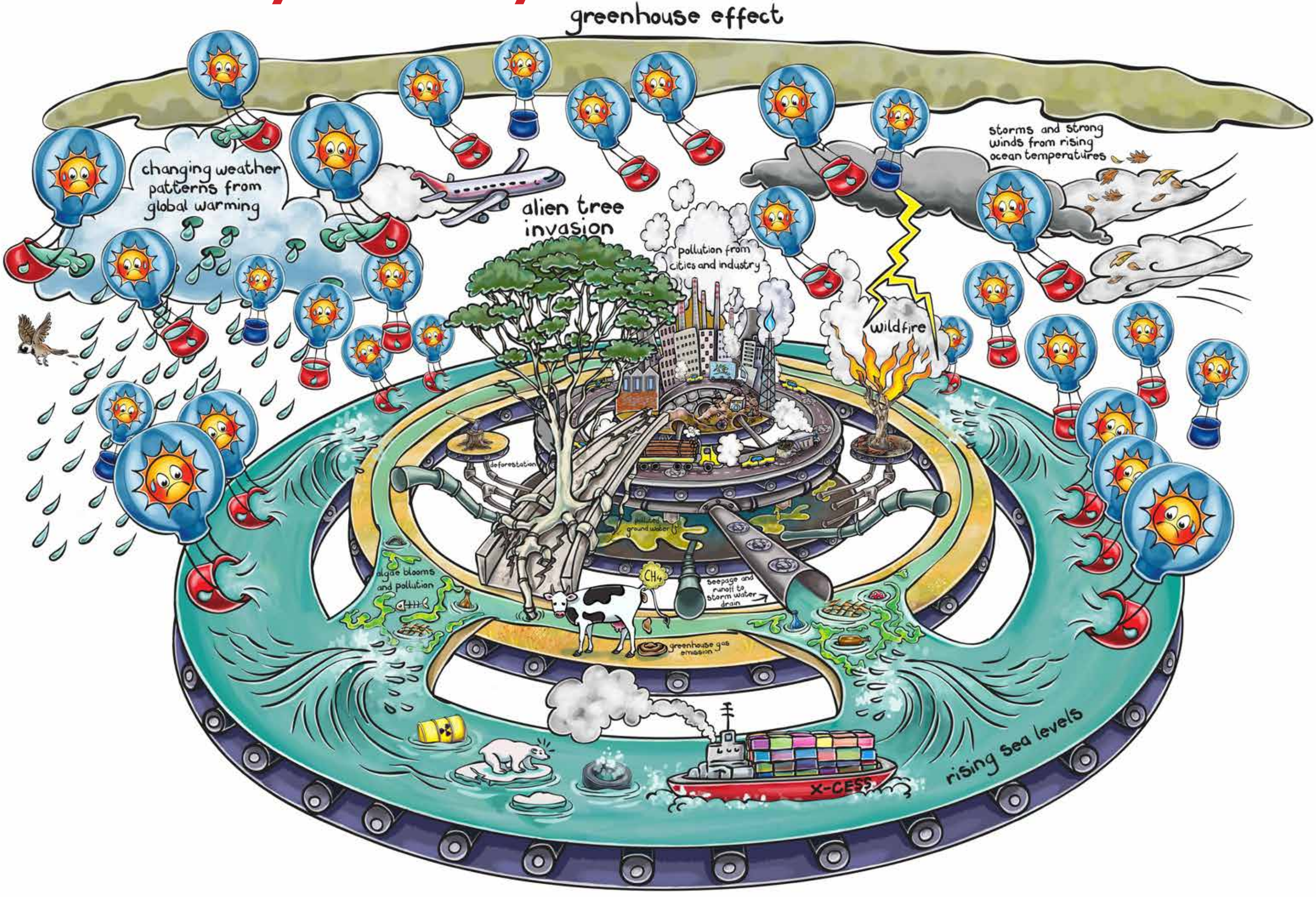
Page 2 of Ecosystem Services

- 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.

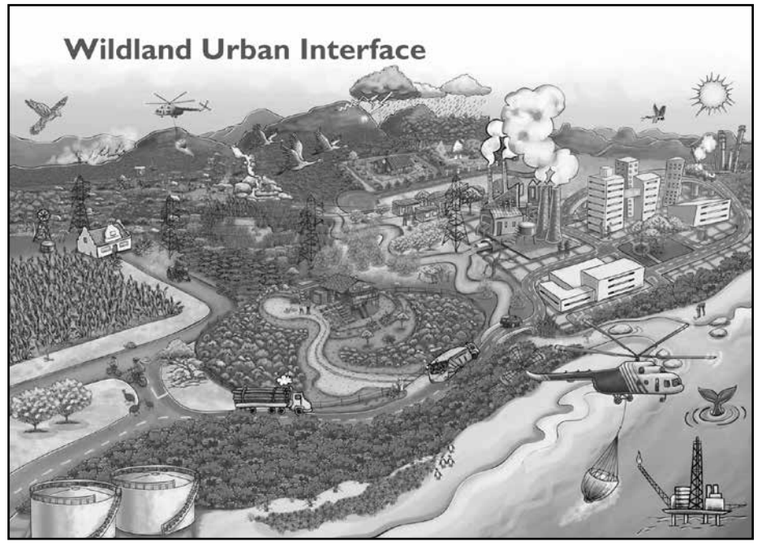
Unhealthy Water-cycle



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.

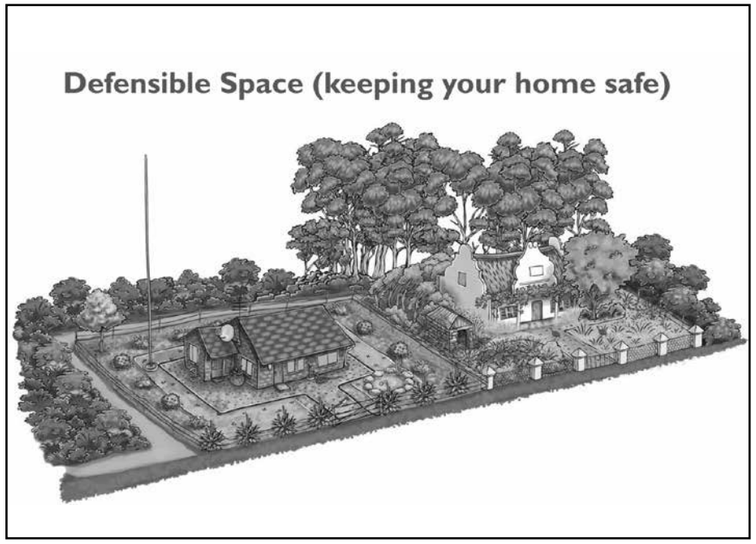


Wildland Urban Interface

Defensible Space

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.



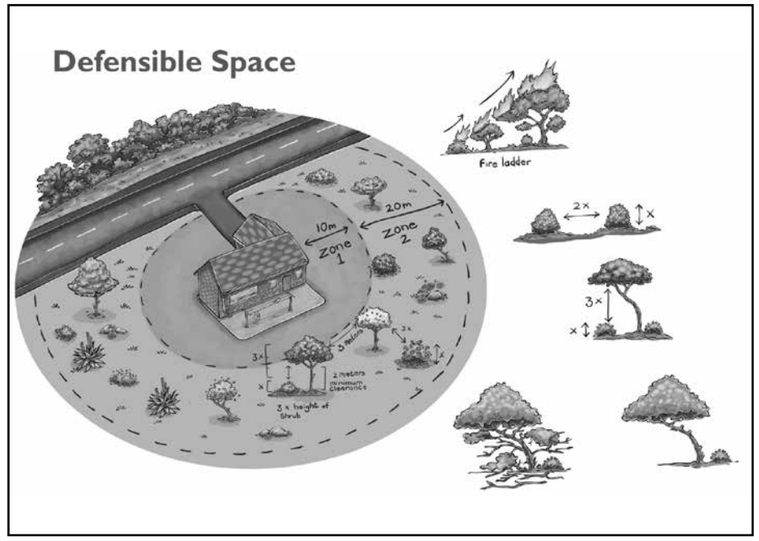
Defensible Space (keeping your home safe)

Defensible space (the picture here is part of the 'Defensible Space' lesson)

Protecting property (next lesson, picture on next page)

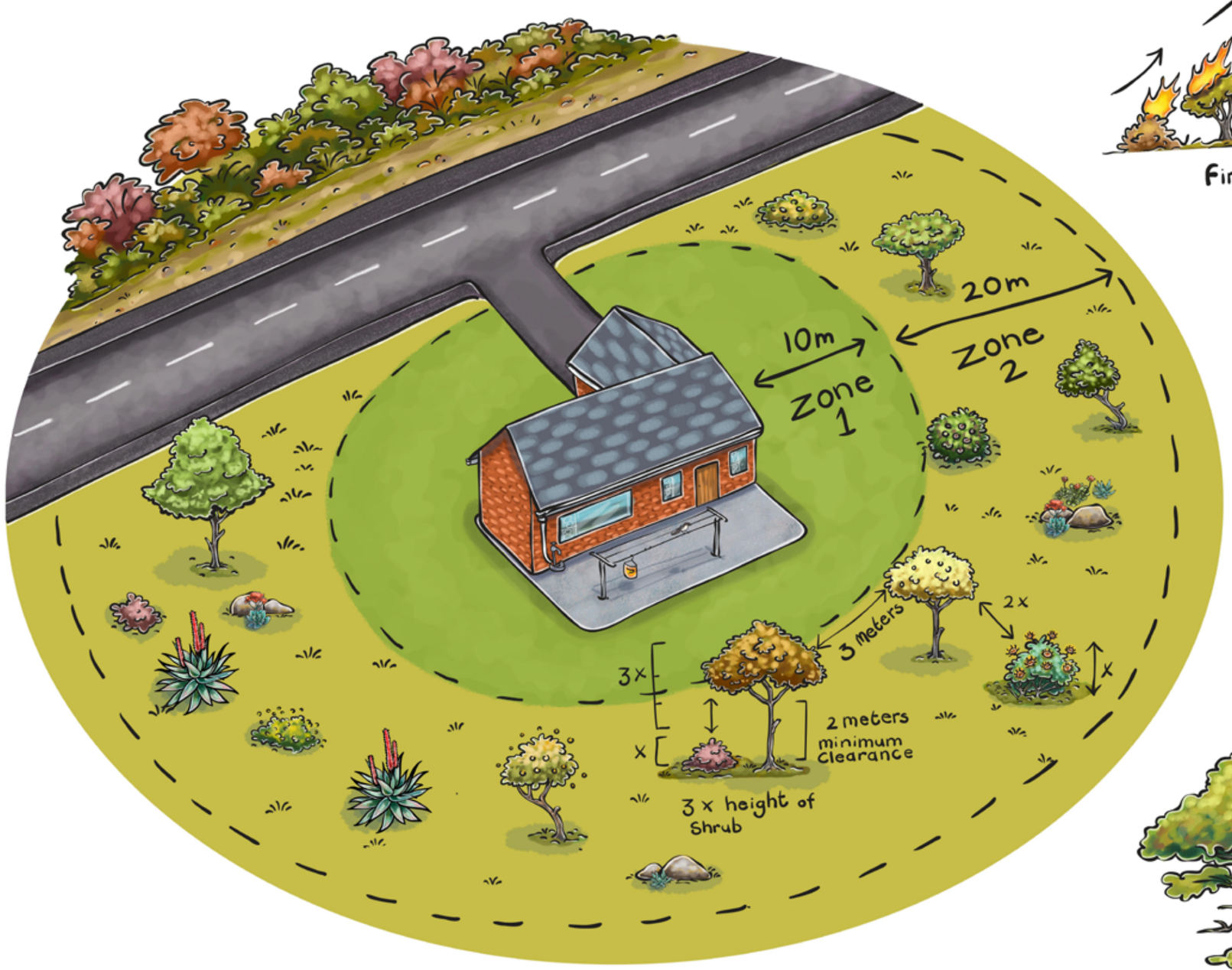
Background information:

- 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 firefighters 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.

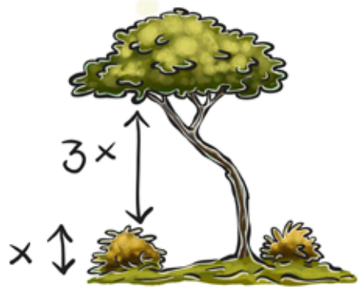


  - Cover chimney outlets with a spark arresting mesh screen.
  - Keep a spade, rake, buckets and fire beater available in the garage for use in a small wildfire.
- In wildfire hazard areas select landscape vegetation based on fire resistance and easy maintenance. In general, fire resistant plants:
  - 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.

Defensible Space




Fire ladder

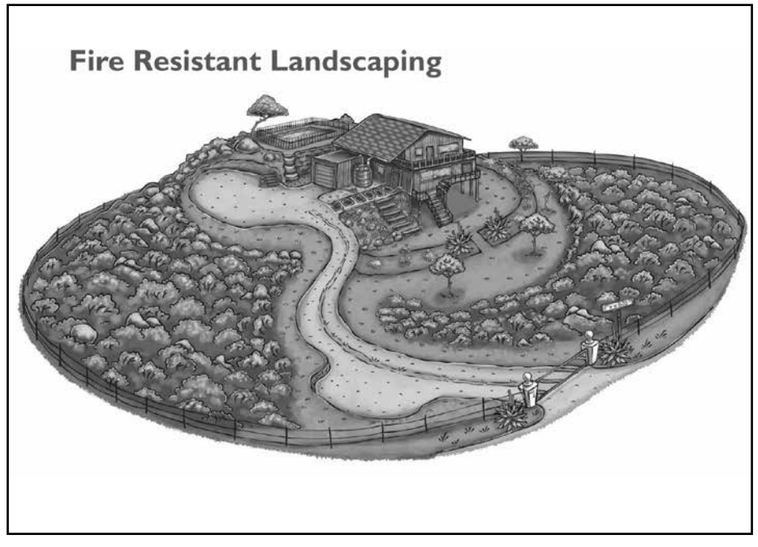


Protecting your property (continued)

- 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!

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 to 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.).

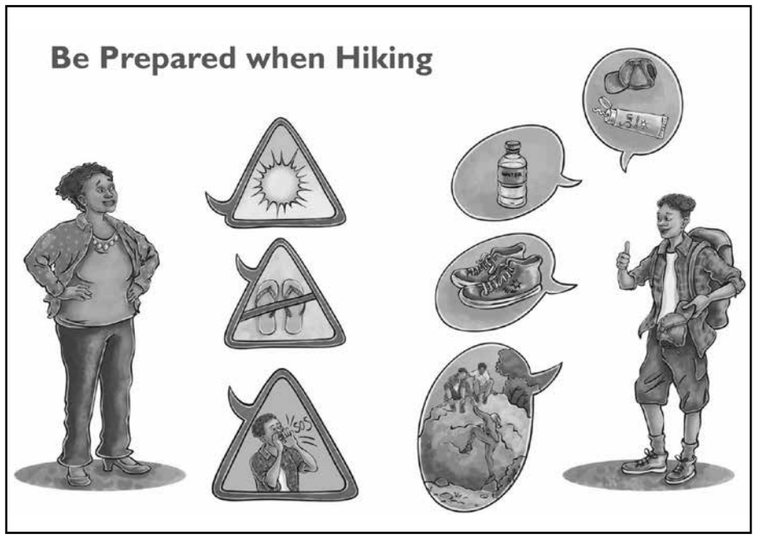
Fire Resistant Landscaping

Be Safe in Nature

Background information:

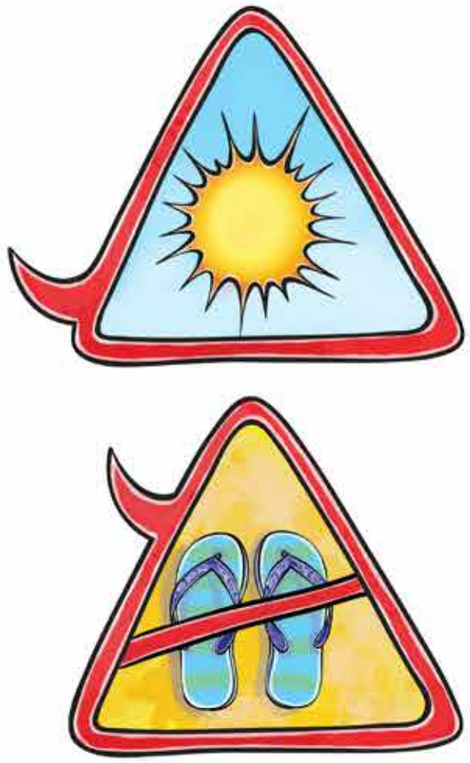
When in nature, always be aware of the possibility of fire.

- 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 is 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.

Be Prepared when Hiking



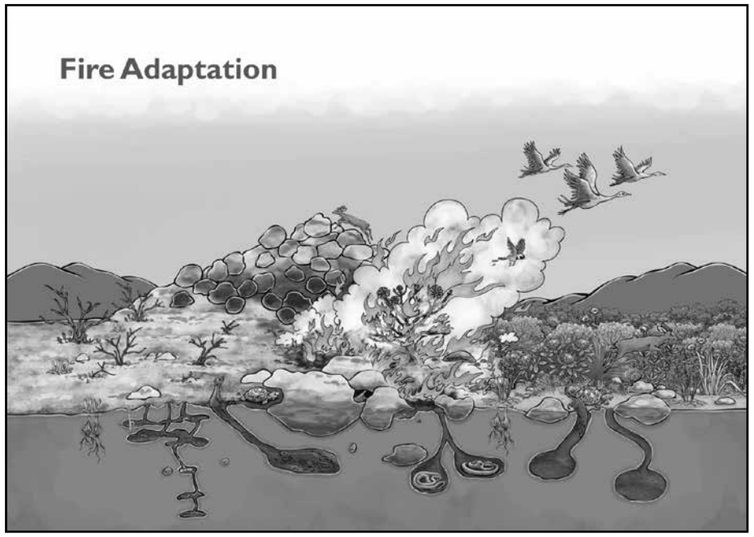
Fire Adaptation

Background information:

Fires can benefit ecosystems. Certain plants and animals have adapted to wildfires.

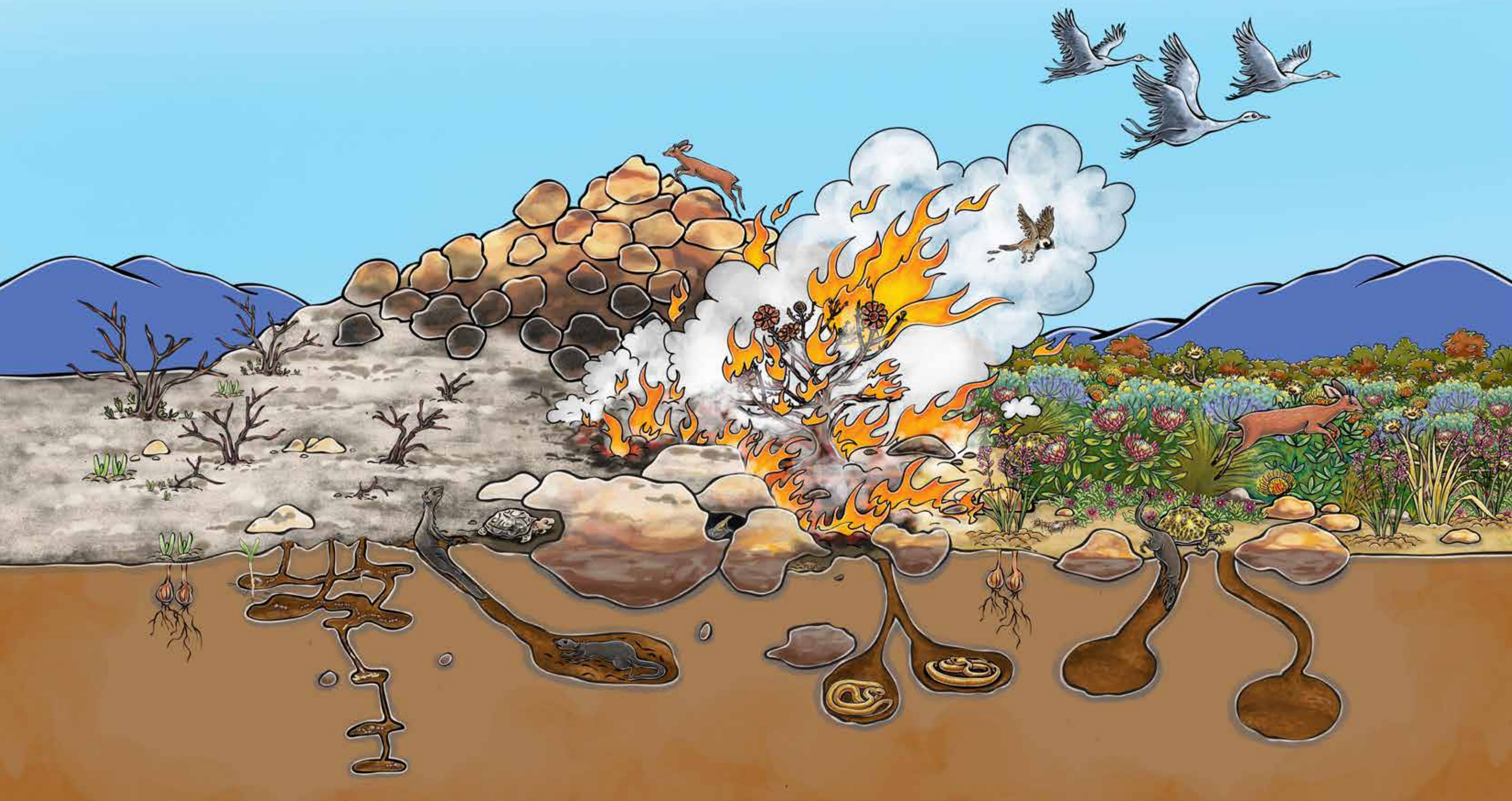
- **Adaptation** – a characteristic that increases an organism's ability to survive and reproduce in its environment.
- **Behavioural Adaptation** – are things animals do to survive, usually in response to some type of external stimulus. Over generations, animals have adapted to know what to do when 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.

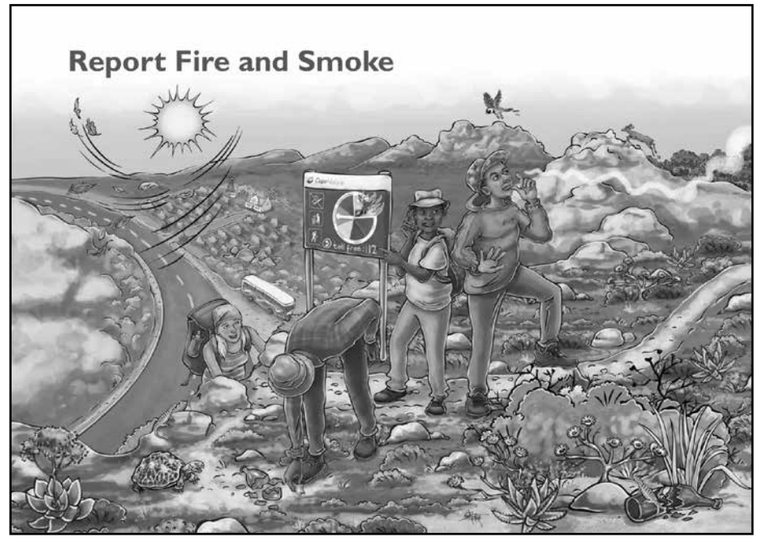
Fire Adaptation



Report Fire and Smoke

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 department tells you, you can do so.

Report Fire and Smoke