SPLASH!

A water resource for curious kids

WATER RESEARCH COMMISSION

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WATER WORDS

Aquifer: A geological formation or structure that stores and/or transmits water, such as wells and springs.
Capillary action: The ability of a liquid (such as water) to flow in narrow spaces without the assistance of, or even in opposition to, external forces like gravity.
Climate: Day-to-day weather over a long period of time. Climatology is the study of climate.
Cloud: A large collection of very tiny droplets of water or ice crystals. The droplets are so small and light that they can float in the air.
Condensation: The process of water vapour in the air turning into liquid water. Water drops on the outside of a cold glass of water are condensed water.
Delta: The flat, low-lying plain that sometimes forms at the mouth of a river from deposits of sediments.
Dissolved oxygen: The amount of oxygen dissolved in the water.
Drought: A deficiency of rainfall over a period of time resulting in a water shortage for some activity, group or environmental sector.
Endemic: Native or restricted to a certain place. Found nowhere else.
Evaporation: The opposite of condensation. It is the process of liquid water becoming vapour.
Freshwater: Water that contains less than 1 000 milligrams per litre of dissolved solids.
Glacier: Huge mass of ice, formed on land by the compaction and recrystallisation of snow.
Groundwater: Water stored underground in rock crevices and in the pores of geologic material that make up the earth's crust.
Headwaters: The beginning of a river.
Hydrogeology: The study of groundwater.
Hydropower: Power derived from the energy of falling water or fast running water, which may be harnessed for useful purposes.
Irrigation: The supply of water to land or crops to help growth, typically by means of channels.
Precipitation: The water that falls to earth in the form of rain, snow, hail or sleet.
River: A large, natural stream of flowing water.
River mouth: The place where a river flows into a larger body of water, such as another river, a lake or the ocean.
Suspended solids: Suspended solids refers to small solid particles which 'hang' or are suspended in water due to the motion of the water. It is used as one indicator of water quality.
Transpiration: The process by which water is absorbed by plants, usually through the roots, is evaporated into the atmosphere from the plant surface, such as leaf pores.
Tributary: A smaller stream or river that joins a larger or main river.
Turbidity: Turbidity is the cloudiness or haziness of a fluid caused by large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. The measurement of turbidity is a key test of water quality.
Vapour: Water in a gas form.
Water cycle: The cyclic transfer of water vapour from the Earth's surface via evapotranspiration into the atmosphere, from the atmosphere via precipitation back to earth, and through runoff into streams, rivers and lakes and ultimately into the oceans.
Water table: The top of the water surface in the saturated part of the aquifer.
Weather: The condition of the earth's atmosphere of a brief period of time, like a day or a week.

THE WONDERFUL WORLD OF WATER

Water can be found all around us – in fact, about 70% of the Earth's surface is covered with water. Water is essential to life and greatly influences weather and climate.

Water is the most common substance on the planet yet it has some very unusual characteristics. Pure water is odourless and tasteless. A drop of water is made up of millions of tiny particles.

Water has a very simple atomic structure. Water is composed of two elements, Hydrogen and Oxygen, making it is a compound. Pure water has a neutral pH of 7. This means that it is neither acidic nor basic.

2 Hydrogen + 1 Oxygen = H_20

One of the most remarkable things about water is that it can be found in all three states of matter: solid ice, liquid water and gaseous water vapour (or steam). When water is cooled down to about 0°C (zero degrees Celsius) it will freeze. When water is heated up to about 100°C it boils, changing from a liquid to a gas or vapour. Earth's water is constantly interacting, changing and in movement. This perhaps, makes water one of the greatest examples of recycling.

Did you know that water expands (gets less dense) by 9% when it freezes? This is very unusual for liquids. Think of the ice blocks in your glass of water on a hot summer's day. They float on top rather than sinking to the bottom. This is one of the wonderfully unusual characteristics of water. This characteristic is very helpful in nature. When a lake freezes, for example, ice forms on the surface and the water underneath stays liquid. This helps living things in the water survive cold winters.

A UNIVERSAL SOLVENT

Another remarkable characteristic of water is that it has the capability to dissolve many things. This means that wherever water flows, either through the ground or through our bodies, it takes along valuable chemicals, minerals and nutrients. This is why pure water is so rare to find in nature. Even rainwater, the purest natural water, contains chemicals dissolved from the air.

Have you ever tasted how salty seawater is? That is because of the dissolved salts in the water. Take a cup of water and add a teaspoon of sugar. Now sir. See how the sugar is dissolved in the water? Now take a cup of warm water and stir in a teaspoon of sugar. Which cup of water dissolved the sugar the fastest?

Minerals dissolved in water help nourish living things. Harmful substances, such as decaying animal and vegetable matter and poisonous chemicals, may also be dissolved, and for this reason it is important that sources of drinking water be tested (and why water has to be treated before we can safely drink it). It is also because water is such a good solvent, and therefore dissolves dirt, that it is good for washing.

EXTRAORDINARY PROPERTIES

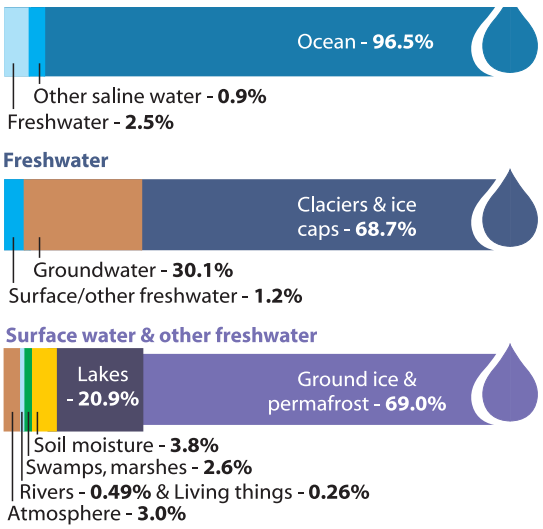
Water has a high specific heat index. This means that water can absorb a lot of heat before it begins to get hot. This is why water is valuable to industries and in your dad's car radiator as a coolant. The high specific heat index of water also helps regulate the rate at which

air changes temperature, which is why the temperature change between seasons is gradual rather than sudden, especially near the oceans.

Another interesting characteristic of water is that it has a high surface tension. This means that water is sticky and elastic, and tends to clump together in drops rather than spread out in a thin film. This is why water drops are, in fact, drops. This surface tension is responsible for capillary action, which allows water (and its dissolved substances) to move through the roots of plants and through the tiny blood vessels in our bodies.

You can test the capillary action of water. Place a straw into a glass of water. See how the water 'climbs' up the straw? What is happening is that the water molecules are attracted to the straw molecules. When one water molecule moves closer to a straw molecule the other water molecules (which are cohesively attracted to that water molecule) also move up into the straw. Capillary action is limited by gravity and the size of the straw. The thinner the straw or tube the higher up capillary action will pull the water.

HOW MUCH WATER DO WE HAVE?



So how much water do we have? In simplest terms, water makes up about 70% of the Earth's surface, while the other 30% comprises continents and islands. To break the numbers down, 97% of all the earth's water is contained within the oceans as salt water, while the remaining 3.5% is freshwater lakes and frozen water locked up in glaciers and the polar ice caps.

Of that freshwater, almost all of it takes the form of ice: 69% of it, to be exact. If you could melt all that ice, and the earth's surface was perfectly smooth, the sea levels would rise to an altitude of 2.7 kilometres.

Aside from the water that exists in ice form, there is also the staggering amount of water that exists beneath the earth's surface. If you were to gather all the Earth's freshwater together as a single mass (as shown in the image above) it is estimated that it would measure some 1,386 million cubic kilometres (km^3) in volume).

Meanwhile, the amount of water that exists as

groundwater, rivers, lakes and streams would constitute just over 10.6 million km^3, which works out to a little over 0.7%. When we realise how little of the world's water is truly fresh, the limited and precious nature of this resource becomes very clear.

Did you know?

Less than 1% of the world's water can be found in groundwater, rivers, lakes and streams.

It is not just humans who need water to survive. Freshwater ecosystems are actually home to an incredibly large proportion of the world's wildlife. About 12% of all animals and 40% of fish species can be found in freshwater. Because these ecosystems host such a wide variety of fish, amphibians, crabs and insects, they are excellent habitats for large numbers of birds, otters and other animals as well. Freshwater ecosystems are also home to a wide variety of plants.

A HEALTHY BODY NEEDS WATER

All living things need water to survive, even humans! More than half of our bodies are made up of water – it is what makes up the majority of our blood, digestive juices and sweat, and is found in our organs and muscle cells.

It is very important that we take care of our bodies by drinking water regularly. Apart from keeping us alive, water is very good for our bodies. For instances, our blood, which contains a lot of water, carries oxygen to all the cells of our bodies. Without oxygen, those tiny cells would die and our bodies would stop working.

Water is also in lymph, a fluid that is part of our immune systems. This helps us fight off illness. We need water to digest our food and get rid of waste as well. Water is needed for digestive juices, urine and poop. Water is also the main ingredient in our perspiration. Besides being an important part of the fluids in our bodies, water is needed by each cell to function normally.

What happens when you drink water regularly? Firstly, you immediately feel refreshed. Quenching your thirst happens rather quickly, usually within the first sip or two of water. This is because when you drink water, your taste buds signal to your brain that water is coming to feed the parched cells, and signal feeling full when you have had enough to drink.

Water can make you have more energy. Many times, people feel tired because they haven't had enough water to drink. Instead of reaching for a caffeinated drink, like coffee, try a big glass of water instead. Water keeps your bodily systems functioning at their best and perks you up to get over that afternoon slump.

By hydrating your insides, you can look better on the outside. If you do not have enough water, your skin becomes dry, your wrinkles are deeper and your overall complexion looks duller. Although drinking water isn't a cure-all for all of your skin woes (sorry teenagers), it will definitely brighten your face and help fight inflamed skin. Water also helps our brains to focus. Since your brain is made up of 80% water, it is no wonder proper hydration keeps your brain functioning at its best.

Even our bones need water. Water keeps the cartilage (the rubbery material that coats our bones) around our joints hydrated and supple, ensuring that our joints stay lubricated. It also protects our spinal cord and tissues, keeping us healthy from the inside out.

Water further helps to flush toxins from our bodies. Since your kidney's job is to filter out waste from your blood, the more efficient they are, the more toxins are being eliminated. To keep your valuable kidneys in tip-top shape, keep that water glass nearby.

How much water does your body need? The amount of water a child needs depends on how active they are, the weather temperature, and their overall diet and health. As a general guide, children up to eight years should have a minimum of four to five cups of water a day. Children above eight-years-old require at least six to eight cups of water a day.

We don't just get water from the tap. Any fluid we drink will contain water, but water and milk are the best choices. Lots of foods contain water too. Fruit contains quite a bit of water (think about a juicy peach) – watermelons are about 90% water. Vegetables also contain water.

One of the easiest ways to tell if you are getting enough water is to check your urine when you go to the bathroom – the darker the colour, the more dehydrated you are. On the contrary, if your stream is regularly a light yellow, almost clear colour, that means you are drinking plenty of fluids.

If you are not sure whether your water supply is safe to drink you should boil the water before you drink it or clean your teeth with it. We are lucky in South Africa that most of our tap water is safe to drink. So, drink up!

Did you know?

a mere 2% drop in our body's water supply can trigger signs of dehydration like fuzzy short-term memory, trouble with basic mathematics and difficulty focusing on smaller print.

children younger than eight years need to drink at least four cups of water a day.

We don't just need water on the insides of our body to stay healthy. The simple act of washing hands with soap and water is one of the best ways to keep ourselves and our families healthy. Research has shown that hand washing can significantly reduce the two leading causes of child deaths in the world – diarrhoeal disease and acute respiratory infection (such as pneumonia).

Bacteria and viruses can spread to the hands by sneezing, coughing or rubbing the eyes and can then be transferred to other people. Simply washing your hands can help prevent such illnesses as the common cold and eye infections.

Unfortunately, many people do not wash their hands regularly. An international hygiene survey conducted among a number of countries, including South Africa, found that nearly 70% of the country's people are at risk of transmitting dangerous infections because they do not wash their hands regularly. Gross! Almost half of the 1 000 people surveyed in the country believed that disinfecting surfaces, avoiding close contact with others and not letting animals in the house were more effective in preventing disease than hand washing. This is not true – hand washing remains the best way of preventing the spread of disease.

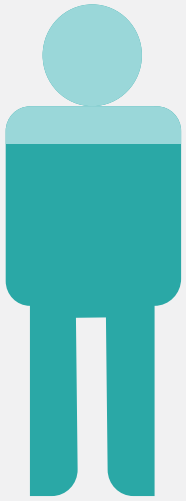
You need to wash your hands before eating and cooking; after using the toilet; after cleaning around the house; after touching your pets; before and after visiting or taking care of sick relatives or friends; after blowing your nose, coughing or sneezing; and after changing the baby's nappy.

What is dehydration?

Our bodies need water to work properly. When you lose too much water by being very active, when it is hot, or when you are sick you can become dehydrated. When you are dehydrated it means that your body doesn't have enough water to keep it working the way it should. You take in water by eating or drinking, and lose this water again when you urinate, sweat, have diarrhoea or throw up. You even lose a little water when you breathe. What are the signs of dehydration? Being thirsty is the first clue. You may also be dehydrated when you feel lightheaded, dizzy or tired, have a rapid heartbeat or have a dry mouth and lips. Another sign of dehydration is not peeing as much or having dark or strong-smelling urine. The best ways of preventing dehydration is by drinking water often, especially if you are very active, and when it is hot. If you are sick, keep taking small sips of drinks like water and juice. Foods such as fruits and vegetables, contain water as well.

BODY & WATER

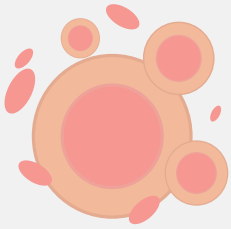
infographic



70%
Body
Water

Brain
75%
Water

8 Cups of water Per day

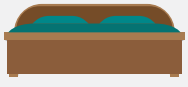


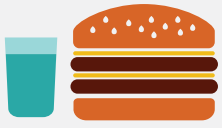
60%
in Cell

2  
in Morning

30% Outside Cell

10%
Blood

1 Before Bed 

1  Before Meal

Drink
More
Water
For Good Health

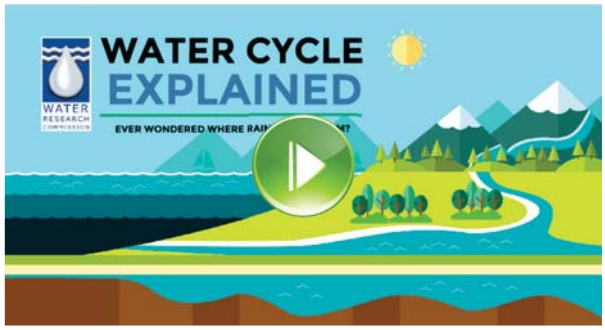
How do you wash your hands properly?

step 1: wash your hands in warm water.
step 2: use soap (it does not need to be anti-bacterial soap) and lather up for 10 to 15 seconds (about as long as it takes for you to sing happy birthday). make sure you get in-between the fingers and under the nails. do not forget to wash your wrists!
step 3: rinse and dry well with a clean towel.

To watch a video on the importance of hand washing, **click here**

always wash your hands before preparing food and after playing outside or with your pets.

THE WATER CYCLE



Click to view the video on the water cycle.

There is water all around us. There is water in the air, under the ground and in ice caps and glaciers in the very cold parts of our planet.

The Earth never gets new water, and water never disappears. This means that the same water you brush your teeth with in the morning was used millions of years ago by a mother dinosaur to give her baby a bath. This is because water never stands still and is constantly recycled. We call this the hydrological or water cycle.

The water cycle is made up of different parts. The water cycle starts with evaporation. That is when the sun heats up water in rivers or lakes or the ocean and turns it into vapour or steam. This vapour the leaves the river or lake or ocean and moves up into the air. We also get transpiration which is when plants lose water out of their leaves.

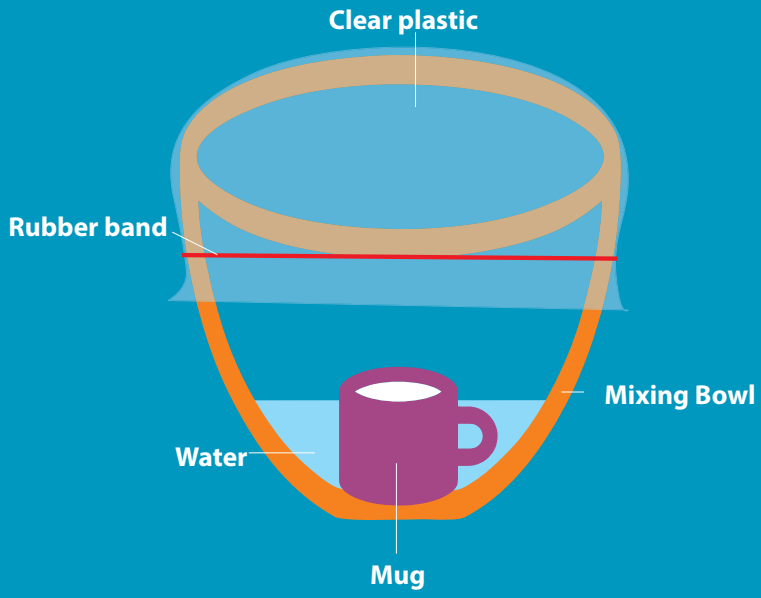
When the water vapour or steam is up in the air it gets cold and changes back into liquid form. This forms clouds, and the process is called condensation. Take a cold glass of water and hold it against the mouth of a boiling kettle. Do you see the water droplets forming on the outside of the glass? That is condensation.

The last step in the water cycle is precipitation. This is when water falls back to the earth (for example, when it snows, rains or hails). As more water falls to the ground we get surface runoff, which is when some of the rain runs into streams and rivers and returns to the oceans.

Some of the water infiltrates the soil, some of it moves through the roots of plants and is transpired by the leaves. Other water percolates or seeps deeper into the ground into layers or rocks or soil underground that hold the water (these are called aquifers).

We will now look at some of the individual parts of the water cycle.

Build your own water cycle



you will need:

a large metal or plastic bowl
a pitcher or bucket
a sheet of clear plastic wrap
a dry ceramic mug (like a coffee mug)
a long piece of string or large rubber band
water

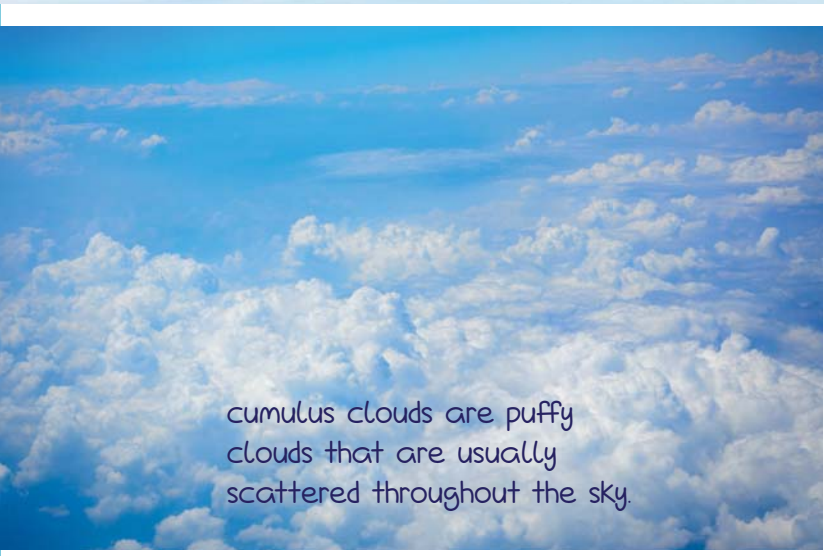
put the bowl in a sunny place outside. using the pitcher or bucket, pour water into the bowl until it is about 1/4 full. place the mug in the centre of the bowl. be careful not to splash any water into it.

cover the top of the bowl tightly with the plastic wrap. tie the string around the bowl to hold the plastic wrap in place. watch the bowl to see what happens.

the 'mist' that forms on the plastic wrap will change into larger drops of water that will begin to drip. (you can speed up the dripping by carefully moving the bowl don't splash! into the shade.) when this happens, continue watching for a few minutes, then carefully peel back the plastic. is the coffee mug still empty? water from the 'ocean' of water in the bowl evaporated. it condensed to form misty 'clouds' on the plastic wrap. when the clouds became saturated it 'rained' into the mug!

source: www.thewaterproject.org

CLOUDS



While they look like fluffy tufts of candyfloss or marshmallows, clouds are actually suspended masses of water or ice crystals floating above us. When warm air rises, swells and cools, it forms clouds.

There are 27 different sub-types of cloud – from the wispy to the ominous. Clouds are named according to their height and form. ***Cirrus*** clouds typically form high in the sky (above 6 000 m) when strong winds sweep ice crystals into shapes that remind of wisps of fleece. Cirrus clouds are thin because they are made of ice crystals instead of water droplets. A blue sky and a few cirrus clouds high in the sky usually means it is going to be a nice day.

Impenetrable grey sheets, ***stratus*** clouds create the rainy-day look typical of Cape winters. Altostratus forms in the middle of the cloud-forming layer of the atmosphere (2 00 to 6 000 metres) and may contain ice and water. Rain-bearing sheets of cloud are called nimbostratus.

Those cauliflower-shaped clouds are called ***cumulus***. These clouds begin in the lower level of the sky and may tower up to 16 kilometres high. This type of cloud is formed when warm air rises carrying water vapour with it by evaporation. Cumulus clouds can be white or grey. White fluffy clouds mean no rain, but when they form into dark or grey clouds, it is probably going to rain.

Clouds play an important part in trapping and reflecting heat back to earth – this is called the 'greenhouse effect' that allows us to survive on earth. Low, white, lumpy cumulus clouds reflect sunlight away from earth, while thin, wispy, high-altitude clouds transit light and trap heat, warming the earth.

Why do clouds float? When the water evaporates into the air, it is warmer than the air in the sky. The water cools down enough to clump together to make the clouds, but it doesn't cool down to the same temperature as the air around it. Because the cold air is heavier, the warmer air of the cloud holds it up above the colder air. In other words, it floats. When we see the

clouds moving across the sky, they are floating, but they are also being blown around by the wind.

Clouds are created in five ways:

1. as air is heated by the ground rises in thermal currents into cold air.
2. as air is forced upward by a topographic feature such as a mountain (called an orographic cloud).
3. as two fronts meet and the warmer front is forced to rise.
4. as turbulent air currents sweet across the earth's lumpy surface.
5. as cold air meets the warm ocean surface.

Storm clouds start small and grow as warm, humid air rises in an unstable atmosphere. Here, cool and warm air mixing creates strong updraughts that support large amounts of water. Eventually the updrafts weaken, or the amount of water becomes so great that the updraft can no longer support it aloft, and it falls to the ground as rain. Severe storms usually hit in the afternoon when the earth's surface is hottest, but can be difficult to predict.

How do raindrops form?

The clouds overhead contain water vapour and cloud droplets, which are small drops of condensed water. These droplets are too small to fall as precipitation, but they are large enough to form visible clouds. Water is continually evaporating and condensing in the sky. If you look closely at a cloud you can see some parts disappearing (evaporating) while other parts are growing (condensing). Most of the condensed water drops in clouds do not fall as precipitation because their fall speed is not large enough to overcome updrafts which support the clouds. For precipitation to happen, first tiny droplets may grow as a result of additional condensation of water vapour when the particles collide. If enough collisions occur to produce a droplet with a fall velocity which exceeds the cloud updraft speed, then it will fall out of the cloud as precipitation. This is not a trivial task since millions of cloud droplets are required to produce a single raindrop.

Source: USGS

Hailstorms are the bane of car insurance companies and crop farmers, dangerous to anyone caught unawares. Hailstorms form as small particles of ice circulate in the updraughts of storm clouds, and can increase their size by accumulating layers and colliding with other ice fragments.

Lightning is formed by water and ice moving around inside the cloud; forced up by warm air currents, down by gravity, and compressed in the cloud. Just as rubbing a balloon can create static electricity, the particles in the cloud become charged. It's not clear how it happens, but charges separate in the cloud. Positive charges move up, and negatives move down.

Once a significant charge separation has built up, the positive and negative charges seek to reach each other and neutralise. 'Streamers' come up from the ground to form a pathway. Once a pathway is completed a spark forms, neutralising the charge. As the negative charge races down, the air surrounding it heats up. The spark is very hot at almost 20 000 °C, and it rapidly heats the air to create a shock wave.

Considering light travels very fast – about 300 million metres per second, and that sound only travels at 300 metres per second; light is a million times faster than the sound produced. To find out how far away the storm is, you can count how long you hear the sound after the lightning. For every 4 seconds between the flash and the rumble, the thunderstorm is two kilometres away.

What to do in a thunderstorm

1. stay away from open spaces. but do not stand under a tree. the best place is inside a building.
2. if there is no building nearby, get as close to the ground as you can.
3. if you are swimming, get out of the water. get out as soon as you see a storm coming.
4. during a thunderstorm, shut off or unplug all electrical items.
5. never walk in a thunderstorm carrying a metal pole. don't even carry an umbrella!
6. how will you know if a lightning strike is near you? you will feel the hair on your head or body start to stand up. if this happens, get to safety quickly!

RIVERS

A river is a large, natural stream of flowing water. Rivers and their tributaries are the veins of the earth, providing much needed freshwater across the landscape as they flow from the mountain to the sea. Rivers carry water and nutrients to areas all around the earth. They play a very important role in the water cycle, acting as drainage channels for surface water. Rivers drain nearly 75% of the earth's land surface.

River sustain some of the richest biodiversity on earth, sustaining thousands of species from colourful dragonflies to giant hippos. Many plants and trees grow by rivers.

Rivers are also the lifeblood of human civilisations. They supply water to cities, farms, and factories. Rivers carve shipping routes around the globe, and provide us with food, recreation, and energy. Rivers are found on every continent and on nearly every kind of land.

No two rivers are exactly the same, but all rivers have features in common and go through similar stages. The beginning of a river is called its source or headwaters. Rivers have different sources, varying from mountain water, to groundwater springs and lakes.

From its source, a river flows downhill as a small stream. The river becomes bigger the further it flows. Headwaters often have small waterfalls and rapids. Precipitation and groundwater add to the river's flow. The river is also fed by other, smaller streams, called tributaries. The Amazon River, for example, receives water from more than 1 000 tributaries. The point where two rivers join is called a confluence.

The area from which a river receives its water is called

a catchment or watershed. The middle part of a river is called a mature river. It might be very deep and run fast. It is much wider than the headwater streams. The end of the river is its mouth. Here, the river empties into another body of water – usually the ocean.

The land next to the river is called the riverbank and the streamside trees and other vegetation is sometimes called the riparian zone. This is an important, nutrient-rich area for wildlife, replenished by the river when it floods.

As the river flows towards its mouth, the countryside around the river often changes from hilly to flat. As it flows over the flat land the river becomes wider and slower. The shape of the mouth depends on the conditions of the sea where it flows. The fresh water of the river mixes slowly with the salt water, becoming brackish water. Many kinds of fish, clams, molluscs and other sea life in this water, known as estuaries. Many of the world's largest cities and harbours are at estuaries.

Where a river flows out to sea, it sometimes flows very slowly through sandy or muddy land, making lots of little islands as it flows. The main stream of the river gets broken into many parts that spread out into a triangle shape. When this happens, it is called the delta of the river.

Deltas are often places that are not good for towns or farms but are very good for birds and other wildlife. Deltas are often made into wildlife reserves. Not all rivers have deltas. There are famous deltas on the Nile River, Amazon River, the Mekong River, the Mississippi River and the Danube River.

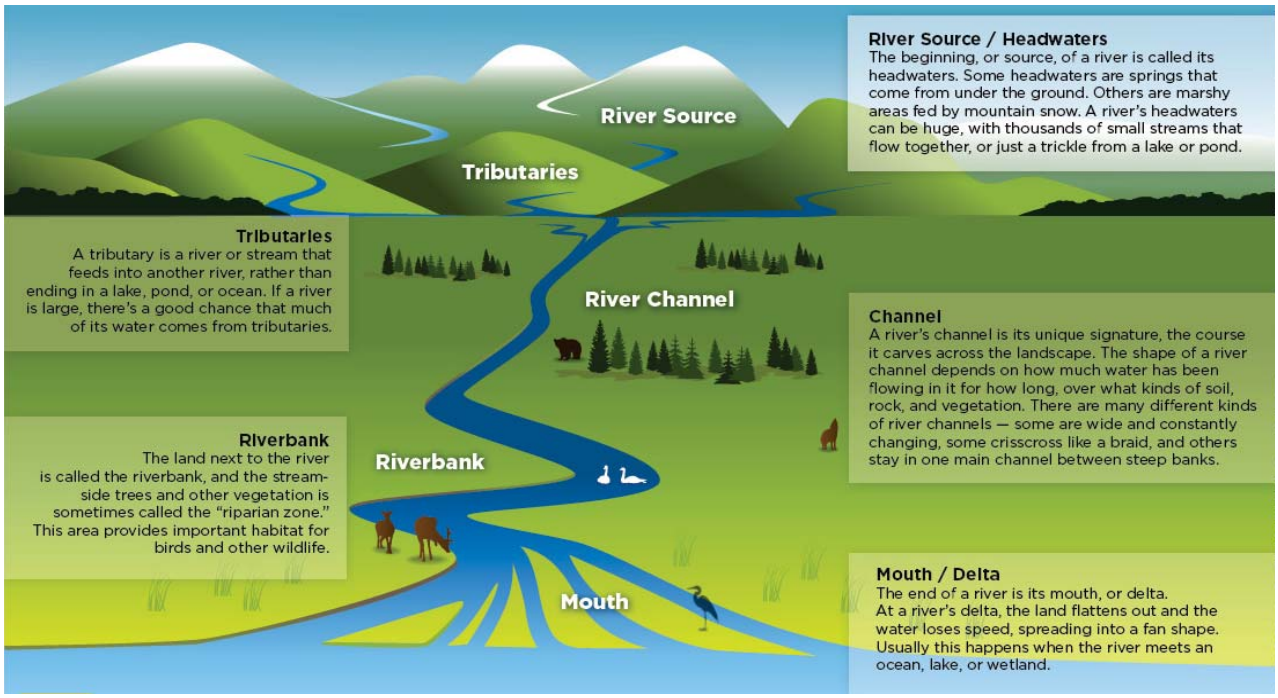
How do rivers flow? Think of a huge torrent of water flowing under the power of gravity, for thousands of years. Like the water from a pressure washer, it has enough energy to cut sediment from the hills of its upper reaches and carry it down to the middle and lower reaches. Rivers gradually slow down because the water has to overcome friction as it flows – friction as the moving water rubs against the banks and bottom of the river channel itself and friction as layers of water flow past one another.

Ten cool facts about rivers

Source: www.huffingtonpost.com

1. rivers are some of the most diverse ecosystems on the planet. rivers and lakes sustain more fish species than the sea even though they contain 600 times less water.
2. rivers feed us. freshwater fishes currently sustain about 550 million people on a fish-based diet.
3. rivers are the cradle of our civilisations. our most ancient cultures sprang up along rivers, such as the tigris and euphrates, the nile, the indus and the yellow.
4. rivers shape our planet and have created some of its most beautiful landscapes. think of the grand canyon, the fish river canyon and the victoria falls.
5. by depositing nutritious silts on floodplains and deltas, rivers have created our most fertile agricultural lands.
6. rivers inspire us and give religious meaning. in india and other countries, rivers are revered are gods.
7. with a depth of more than 220 metres the congo river is the world's deepest river.
8. rivers create identity. at least 17 countries – from india to nigeria – are named after rivers. another 17 – from saudi arabia to the bahamas – have no rivers at all!
9. freshwater species have lost 76% of their populations since 1970 – twice the loss of marine and terrestrial ecosystems have suffered.
10. rivers contain only 0.003% of the water on earth – but sustain much of her life. they deserve our protection!

The life journey of a river



Source: https://www.americanrivers.org/rivers/discover-your-river/river-anatomy/

the longest river in the world is the nile river, which is 6 650 kilometres long.

the amazon, in south america, has more than a thousand tributaries.

The rate at which a river flows is also affected by the climate and the seasons. Some rivers receive a lot of rain all year round and therefore flow permanently (these are called perennial rivers), while others may only flow after heavy rain and dry up during the winter season (ephemeral rivers). The Nile is arguably the longest river in the world. One tributary of the Nile, the White Nile, flows from tiny streams in the mountains of Burundi through Lake Victoria, Africa's largest lake. The other tributary, the Blue Nile, begins in Lake Tana, Ethiopia. The two rivers join at Khartoum, Sudan. The Nile then flows through the Sahara Desert in Sudan and Egypt, and empties into the Mediterranean Sea.

Another large river in Africa is the Congo River, which flows across the middle of Africa through a huge equatorial rain forest before emptying into the Atlantic Ocean. The Congo is the deepest river in the world, measuring more than 230 metres deep in some places. Towns and cities such as Brazzaville and Kinshasa have developed along the banks of the Congo River.

Zambezi – Home to the world's largest waterfall

the zambezi river is the fourth-longest river in africa, and the largest flowing into the indian ocean. the river is more than 2 500 kilometres long, and starts in zambia before flowing through angola, along the borders of namibia, botswana, zambia and zimbabwe to mozambique before reaching the indian ocean.
the zambezi's most spectacular feature is the victoria falls, the world's largest waterfall based on its combined width of 1 708 metres and height of 108 metres. victoria falls is roughly twice the height of north america's niagara falls.
the zambezi river supports large populations of many animals, including many hundreds species of fish, some of which are endemic to the river. important species include cichlids which are fished for food, as well as catfish, tigerfish, yellowfish and other species.

RIVER POLLUTION

Our rivers and streams are the lifeblood of our country. Without them we have no water to drink, no water for our factories and power plants, no water to grow our food and no water for our environment. Yet we are slowly killing our rivers by polluting them. Water pollution is any substance introduced into a river, stream, lake or ocean that harms the natural resources found in those environments (such as plants and animals).

Water pollution is all about quantities: how much of a polluting substance is released and how big a volume it is released into. A small quantity of a toxic chemical may have little impact if it is spilled into the ocean from a ship. But the same amount of the same chemical can have a much bigger impact if it is pumped into a lake or river, where there is less water to disperse it.

There are two different ways in which pollution can occur. If pollution comes from a single location, such as a discharge pipe attached to a factory, it is known as point-source pollution. Unfortunately, a great deal of water pollution happens not from one single source but from many different scattered sources. This is called non-point source pollution.

It must be remembered that water is part of a deeply interconnected system. This means that what we pour on the ground can end up in our water, and what we spew into the sky can end up in our water. By depleting (i.e. using up) and polluting rivers, lakes and wetlands we are destroying ecosystems that play an essential role in filtering and assuring freshwater resources.

Water pollution has many different causes and this is one of the reasons it is such a difficult problem to solve. Disposing of sewage is a major problem. Human waste is landing up in river systems because of communities lacking toilet facilities, leaking and faulty sewerage pipelines and overflowing sewage treatment works can lead to water-related diseases such as cholera and diarrhoea.

Wastewater for industries and mines is another source of pollution. Factories and mines are point sources of water pollution, but quite a lot of water is polluted by ordinary people from non-point sources. Virtually everyone pours chemicals of one sort or another down their drains and toilets. Even detergents used in washing machines and dishwashers eventually end up in our rivers. So do the pesticides we use in our gardens.

Some people believe pollution is an inescapable result of human activity: they argue that if we want to have cities, mines, factories and cars some degree of pollution is almost certain to result. Fortunately, not everyone agrees with this view.

One reason people have woken up to the problem of pollution is that it brings costs of its own that undermine the economic benefits that come about by polluting. It affects our health, destroys our environment, and makes the water so much more expensive to treat for drinking purposes.

We need to make a choice: either we live with smelly rivers, and poisoned fish that we cannot eat, or we do our part of keep the environment clean so that animals, plants and people who depend on them can remain healthy.

How does pollution affect freshwater? You can watch the video here.

Did you know?

according to guinness world records, the worst river pollution in the world occurred in november 1986 when firefighters tackling a blaze at the sandoz chemical works in basel, switzerland, flushed 30 tons of agricultural chemicals into the rhine river, western europe's most important waterway, killing about 500 000 fish.

Water quality parameters

Water specialists used various ways to measure the water quality of a river or other water body.

Dissolved oxygen: Aquatic organisms require sufficient levels of dissolved oxygen to survive. The amount of dissolved oxygen in the water is a factor in determining the species and abundance of organisms that can live in a river, stream or estuary. Dissolved oxygen refers to the amount of oxygen dissolved in the water. Oxygen enters the water by direct absorption from the atmosphere, by rapid movement, or as a waste product of plant photosynthesis. Water temperature and the volume of moving water can affect dissolved oxygen levels.
Temperature: Temperature is a critical factor in determining whether aquatic organisms live and how well they thrive in their water

environment. Growth rates of aquatic plants and cold-blooded animals generally increase with temperature, up to a point known as the thermal optimum. Temperature also affects the solubility of oxygen in the water, which is critical for the survival of aquatic organisms.

Acidity (pH): Solutions with a pH less than 7 are acidic, and those with a pH greater than 7 are alkaline. Knowledge of pH is important because most aquatic organisms are adapted to live in pHs between 5.0 and 9.0.

Turbidity: Turbidity is a measure of the ability for light to transmit down through the water. As suspended solids increase in the water, the amount of light travelling through the water is reduced. This can influence the populations of organisms that are directly dependent on light (phytoplankton and aquatic plants) and those, in turn, that are dependent on them as a food source. Suspended solids include particles of algae, sediment (i.e. small particles of sand and rock), debris or solid waste.

MiniSASS – An easy way for citizens to monitoring water quality

Have you ever wondered about the condition of your local stream or river? Insects are very sensitive to different types of water pollution and whether we find them or not can be very important in helping scientists decide if water is safe or not safe for people to use. The Mini Stream Assessment Scoring System (miniSASS) is a simple biomonitoring tool for measuring river health is empowering communities by allowing ordinary citizens to monitor the health of their local rivers, thereby contributing towards local water quality data and the conservation of their water resources. Nets are used to catch insects and other aquatic water life from a section of a river or stream under rocks and against vegetation in the water. Animals are identified using a magnifying glass. Based on the type of animals you find the health of the river is established. You can download the easy-to-use miniSASS app here, http://www.minisass.mobi/. To learn more about miniSASS watch the video.

Stop river pollution – how you can help

1. do no litter.
2. take part in local river clean-up and river monitoring campaigns.
3. always throw unwanted fishing line, hooks etc. in a trash can, not in the water.
4. do not use toilets and stormwater drains to dispose of trash of any kind.
5. notify your parents or the authorities if you see someone dumping trash in a river or stream.

WETLANDS

Wetlands, as the name implies, refers to any land surface area that spends at least part of its existence submerged or predominantly wet. Wetlands are not connected to the ocean, and can be found along the boundaries of streams, lakes, ponds or even in large shallow holes that fill up with rainwater.

Known by many names, such as swamps, marshes, vleis, bogs, mires, fens and sponges, wetlands may stay wet all year or the water may evaporate during the dry season. Wetlands are highly diverse and unique habitats that are amazingly rich in the diversity of species that they support and the services they provide to the planet. Many wetlands support endangered species that are seen nowhere else.

Not only are wetlands important habitats for a range of plants and animals, they provide important functions to humans as well. Wetlands improve water quality by screening pollutants from the water that flows through.

They also house plants that are used for medicinal or cultural purposes. In addition, wetlands provide benefits to people through provision of grazing, direct water abstraction, and the production of fibre and animal protein.

In many rural areas in South Africa, people make use of wetlands to grow traditional crops such as amadumbe to feed their families. For some people, wetlands have spiritual and aesthetic value, while others use them for recreational purposes.

Unfortunately, we have not been as good to our wetlands as they have been to us. In many countries around the world, including South Africa, up to half of wetlands have been lost due to urban development, mining, and bad agricultural practices.

What are the benefits of wetlands? Click to find out.

ESTUARIES


SA Tourism

Estuaries and the lands surrounding them are places of transition from land to sea, and from freshwater to saltwater. Although influenced by the tides, estuaries are protected from the full force of the ocean waves, winds and storms by the reefs, barrier islands, or fingers of land, mud or sand that surround them.

Each estuary is unique, though all of them have fundamental properties in common. South Africa has around 290 estuaries.

There are several different types of estuaries:

- **Permanently open estuaries**: usually quite large systems with a perennial river and/or strong tidal exchange with the sea. For example, the Breede and Swartkops estuaries.
- **Temporarily closed/open estuaries**: These estuaries are often closed for many months of the year and sometimes for more than a year at a time. For example, the Van Stadens and Mhlanga estuaries.
- **River mouths**: All rivers flowing into the sea have a river mouth. However, estuaries under this category are usually permanently open to the sea. For example, the Orange and Thukela estuaries.
- **Estuarine lakes**: These estuaries occur where a coastal lake is connected to the sea by a channel of varying length and width. For example, St Lucia and Kosi Bay.
- **Estuarine bays**: These estuaries have wide mouths with strong tidal exchange resulting in a continuously open mouth, and the regular replacement of sea water in the lower and middle reaches. For example, Durban Bay and Knysna.

Did you know?

estuaries are among the most productive natural systems on earth due to the mixing of nutrients from land and sea.

Estuaries are focal points for community and business activities along the coast as they provide us with a range of opportunities and benefits. They are an important location for cultural and recreational activities for coastal residents and visiting tourists.

Not only do estuaries enhance the quality of life of households, but they also provide numerous opportunities for jobs and income generation. Many businesses rely on estuaries to perform functions which have economic value, such as providing a nursery for marine fish and crustaceans (animals like crabs and prawns), for transport or for a place to provide facilities for tourists. In turn, this helps to support businesses and jobs in the coastal region (think of places such as Durban, Knysna and Kosi).

Estuaries are often called the nurseries of the sea. More than 100 species of fishes, prawns and crabs in South Africa use estuaries as nurseries and/or feeding ground. The lifecycle of most of these species involves egg production at sea, often close inshore and near an estuary mouth. Eggs and larvae develop at sea, but the larvae and juveniles migrate to estuaries in great numbers. In fish, this migration takes place mainly during late winter, spring and early summer when millions of juveniles swim into estuaries. Should these habitats be degraded or destroyed, a drastic reduction in the number of these water species would occur.

Because estuaries are so beautiful and useful to us, many people live around them and make use of them. Unfortunately, as more people flock to the shore, they are upsetting the natural balance of estuaries and threatening their health.

We endanger our estuaries by polluting the water and building on the lands surrounding them. These activities can contribute to unsafe drinking water, beach closings, declines in fisheries, loss of habitat, fish kills and a host of other human health and natural resource problems.

Example of an eStuary – St Lucia

iSimangaliso Wetland Park on the KwaZulu-Natal coast is a United Nations World Heritage Site. Like many tidal estuaries, iSimangaliso has diverse wildlife reflecting the concentration of diverse ecosystems. Among the animals to be found there are the white-backed and pink-backed pelican, flamingos, fish eagles and some 530 other bird species. Two sea turtle species use the beaches for laying eggs. It is also home to the largest population of hippopotamus in South African parks. The estuary is the largest in Africa and boasts among other attractions the world's largest forested sand dunes. It is the only park on the continent where you can find hippopotamus, crocodiles and sharks in the same area. Swamps along the border of the lake and sponge areas are fed by water seeping through the dunes. These provide critical refuge to freshwater life when the lake salinity (salt content) is particularly high. For centuries, people have come to iSimangaliso for the food, materials and beauty that it and the surrounding wetlands offer.

GLACIERS

Glaciers require very specific climatic conditions. Most glaciers are found in regions of high snowfall in winter and cool temperatures in summer. While most of the world's glaciers are found near the Poles, they exist on all of the world's continents. The glaciers of Africa are limited to three specific geographic locations; two volcanoes (Mount Kenya and Kilimanjaro) and one mountain group (the Ruwenzori).

Glaciers begin to form when snow remains in the same area year-round, where enough snow accumulate to transform into ice. Each year, new layers of snow bury and compress the various layers. This compression forces the snow to re-crystallise, forming grains similar in size and shape to grains of sugar. Gradually, the grains grow larger and the air pockets between the grains get smaller, causing the snow to slowly compact and increase in density.

Over time, larger ice crystals become so compressed that any air pockets between them are very tiny. In very cold glacier ice, crystals can reach several hundred millimetres in length. For more glaciers, this process takes over a hundred years.

Glaciers are special because they store about 75% of the world's freshwater. Currently, glaciers cover about ten percent of the earth, but climate change and the consequent heating of the planet is making them melt. Glacial ice can be hundreds of thousands of years old, which makes it a valuable resource for assessing climate change. By extracting and analysing the ice, scientists can learn about what the climate was like on Earth thousands of years ago!

What is the difference between an iceberg and a glacier?

an iceberg is a large piece of freshwater ice that has broken off from a snow-formed glacier or ice shelf and is floating in open water.

GROUNDWATER

Groundwater is an important part of the water cycle. Groundwater is water that is located below the earth's surface. Over time, water from rain and rivers migrates through the ground and is stored in porous soils and rocks. The study of groundwater is known as hydrogeology.

The area that is filled with water is called the saturated zone and the top of this zone is called the water table. The water table may be very near the ground's surface or it may be hundreds of metres below.

Although groundwater exists everywhere under the ground, some parts of the saturated zone contain more water than others. An aquifer is an underground formation of permeable rock or loose material which can produce useful quantities of water when tapped by a well. These aquifers may be small, only a few hectares in area, or very large, underlying thousands of square kilometres of the earth's surface.

Groundwater makes up 98% of the freshwater on the planet. Groundwater presents an important water resource in South Africa. Although irrigation is the largest user of groundwater in South Africa, the supply to more than 300 towns and smaller settlements is also extremely important.

Even if groundwater isn't used by people, it may still play an important role in the local environment and sustain rural livelihoods in that way. In many places, groundwater discharges naturally to the surface, bubbling into natural springs or contributing to rivers and wetlands. Groundwater often plays a crucial role in sustaining rivers and streams, particularly during droughts when it becomes a valuable buffer. Many ecosystems depend on groundwater.

Groundwater is a finite resource, and aquifers can become depleted when extraction rates exceed replenishment, or 'recharge' rates. Like surface water, groundwater can become polluted or contaminated. Pollutants dumped on the ground or in landfills may leach into the soil, and work their way down into aquifers. Pollutants include substances that occur as a liquid (such as oil) or can be dissolved in water (such as nitrate) or are small enough to pass through the pores in soil (such as bacteria).

Movement of water within the aquifer is then likely to spread the pollutant over a wide area, making the groundwater unusable. Typical contamination sources include on-site sanitation (such as unlined latrines), waste disposal sites, burial sites, and animal husbandry.

While groundwater is an abundant resource that does not mean we should waste it. Some groundwater resources take a long time to replenish. If too much groundwater is extracted too fast, it may become depleted. Therefore, it is important to decide how much water can be extracted from an aquifer before it is developed.

WATER IN SOUTH AFRICA

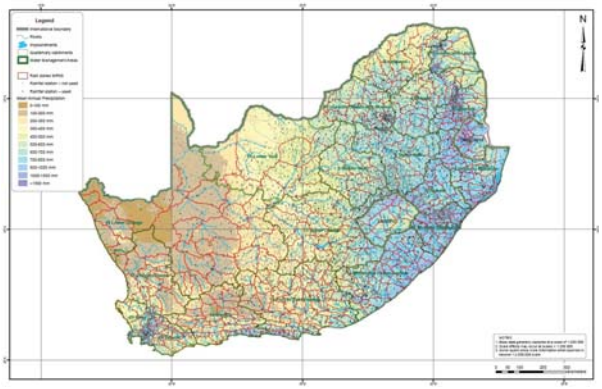
South Africa might be rich in resources such as gold, diamonds and platinum, but South Africa does not have a lot of water. In fact, South Africa is considered a semi-arid country, which means it does not receive a lot of rain. Our water is further limited by factors such as climate change and water pollution.

The average annual rainfall for the entire country is about 450 millimetres – that is less than half the world average of 860 millimetres. South Africa's climate is also quite extreme – we have periods of intense rainfall (think of an afternoon thunderstorm) and then periods where little to no rain falls (think of dry Highveld winters). We also have very wet years (where the annual rainfall is more than average) interspersed with dry years (where annual rainfall is below average). This extreme climate between seasons and between years means we often have droughts and floods in different parts of the country – often at the same time!

Not all the areas in South Africa get an equal amount of rain. In general, South Africa's western areas are much drier than South Africa's eastern areas, and less than two thirds of the country receives more than 500 millimetres of rain a year. Take, for example, the difference in rainfall between Durban on the east coast of South Africa, which has an annual rainfall of about 1 070 millimetres, and Port Nolloth on the west coast of South Africa, which has an annual rainfall of only 60 millimetres. The highest rainfall occurs in the mountain ranges of the southwestern Cape and in the Drakensberg, where the annual rainfall is more than 3 000 millimetres.

While South Africa's rainfall is generally low the country is blessed with abundant sunshine and meagre cloud cover. This means that evaporation levels are high. So high in fact that from all the rain that falls only 9% usually ends up in our river systems, while the rest is evaporated or sucked up by the soil. The fact that South Africa is a water scarce country can also be seen in the state of our rivers. Only about a quarter of the country's rivers are perennial (i.e. flow throughout the year). These rivers are mainly located in the southern and south-western Cape and on the eastern marginal slopes of South Africa.

It has been found that the lower the rainfall in an area, the smaller the proportion of this rainfall that reaches the river systems. It has also been found that the lower the rainfall, the greater its variability from year to year. For example, in the arid north-western Cape, the potential evaporation is 25 times higher than the rainfall.



The distribution of rainfall in South Africa.

The Drakensberg is considered one of South Africa's 'water factories' as it receives the most rain.

Because of the country's low, irregular rainfall, it is important to store water for our daily use. More than two thirds of South Africa's water is stored in dams. The government looks after more than 700 large dams, which store millions of litres of water for people and their water needs.

Water is unevenly distributed across the country and is not always available where it is needed. To overcome this it is necessary to transfer water through sophisticated dams, pipes and canals from areas where there is surplus water to areas of need. An example is the Lesotho Highlands Water Scheme which moves water all the way from Lesotho to Gauteng. South Africa has 28 inter-basin transfer schemes which moves a total of 7 billion cubic metres of water a year.

The Department of Water and Sanitation is the national custodian of water in South Africa. The department manages the country's water resources to:

- Ensure reliable and equitable supply of water for sustainable economic and social development.
- Ensure protection of the resources.
- Ensure and support the development of effective water management institutions.
- Align staff and stakeholders towards a common vision of integrated water resource management.

In South Africa there are some areas that receive summer rainfall, and others that receive winter rainfall. Frequent and violent storms cause most of the rain across the greatest part of the summer rainfall region. Short, occasional thunderstorms are also the main source of rain in the drier areas.

Click to see the different rainfall areas in South Africa.

South Africa's rivers have a total length of 163 533 kilometres. Main rivers make up 47% of this total length while tributaries constitute the remaining 53%. The density of South Africa's river network, as well as the volume of water carried, increases as we move across the country from the arid west to the wetter east.

Unlike the large rivers of Europe and North America, for example, South African rivers are not suited to accommodate large-scale transport. Lowland rivers – large, meandering waterways – make up only 9% of South Africa's total river length. The remaining 91%

comprise mountain stream (4%), upper foothill streams (45%) and lower foothill streams (41%).

Our rivers, along with our wetlands, are the lifeblood that drives our economy. Feeding our dams with precious water, our river ecosystems carry life into our fields, homes and factories.

Rivers don't keep to country boundaries. This means that we share many of our water resources with our neighbours. South Africa shares four major river systems with neighbouring countries:

- The Orange-Senqu system is shared with Lesotho and Namibia.
- The Limpopo River is shared with Botswana, Mozambique and Zimbabwe.
- The Incomati system is shared with Swaziland.
- The Usutu/Pongola-Maputo system is shared with Mozambique and Swaziland.

This means we have to ensure that we leave enough water in our rivers for our neighbours to use. South Africa has signed and ratified the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses, which promotes the principles of equitable and reasonable utilisation and the obligation not to cause significant harm (to downstream users). The country also prescribes to the Southern African Development Community Protocol on Shared River Courses.

The management of internationally shared surface and groundwater resources is considered so important to South Africa that it has been taken up in the country's national law (called the National Water Act). This Act gives international water requirements a priority that is second only to the basic human needs and the Ecological Reserve. This means that no infrastructure may be developed in any transboundary waters without considering the needs (or without the involvement) of the other countries involved.

Drought – the creeping disaster

When we think of drought, most of us immediately think of 'no rainfall'. But drought is much more complicated than that. Basically, drought occurs when there is less rainfall than expected over an extended period of time, usually several months or longer. How bad a drought is usually depends on how little precipitation falls, how long the drought lasts, and the size of the area that is affected.

Unlike other natural disasters, such as hurricanes, earthquakes, fires and floods, droughts do not appear suddenly and, while they might not appear as frightening, droughts can have far-reaching effects. Drought doesn't have a clear beginning or end. It starts slowly, and for that reason it is often called a 'creeping' phenomenon.

The damage caused by drought is not always seen right away. Farmers, who need adequate water to grow crops and raise livestock, usually feel the effects of drought first. In poor, rural areas, people are dependent on rain to grow their food, so a drought can mean hunger and starvation.

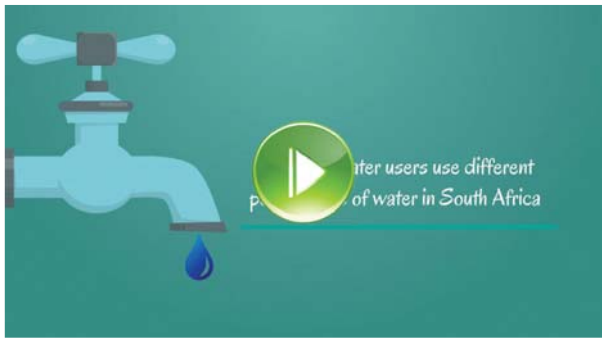
There are four main types of drought:

- **Meteorological** drought is brought about when there is a prolonged period with less than average precipitation.
- **Agricultural** drought is brought about when there is insufficient moisture for crop or range production.
- **Physiological** drought is a condition afflicting plants that have been exposed to too much salt, preventing them from absorbing water from the soil.
- **Hydrological** drought is when water reserves available in sources such as rivers and dams fall below average.

The potential economic impacts of drought includes farmers losing money because of destroyed crops; water companies having to spend money or new or additional water supplies; increased irrigation costs and increased importation of food. There is also environmental impacts, such as the loss of fish and wildlife habitat, loss of wetlands, increased groundwater depletion, more wildfires, lower water levels in dams, and soil erosion.

Who uses water in South Africa? Like most countries, South Africa's water use is dominated by irrigation, accounts for about 62% of all water used in the country, with domestic and urban use accounting for 27% and mining, large industries and power generation accounting for 8%. Commercial forestry plantations account for a little less than 3% of water used by reducing runoff into rivers and streams.

Who are South Africa's main water users? Click here to find out



SOUTH AFRICA'S LARGEST RIVERS

ORANGE RIVER

Augrabies waterfall on the Orange River.

Buchuberg Dam was the first dam to be built on the Orange River.

Known as the 'Gariep' or the 'Great River' by the indigenous Nama people, at 2 000 kilometres long the Orange River is South Africa's largest river. Along with its main tributary, the Vaal River, the Orange conveys nearly 23% of the total surface water of South Africa.

The Orange River catchment varies dramatically both in climate and topography from east to west. To the east, at the source of the Orange River high in the Lesotho Highlands (here the Orange River is known as the 'Senqu'), the precipitation, some of which occurs as snow, can exceed 2 000 millimetres a year in place.

As the river progresses towards the west, the lush pastures of Lesotho are gradually transformed into harsh but impressive desert areas where only the most drought resistant plants can grow. The desert areas of the Lower Orange basin are among the driest in the world, with an average rainfall of less than 50 millimetres a year. The river eventually connects with the Atlantic Ocean at Oranjemund, in Namibia.

Arguably the most dramatic point on the river occurs at the Augrabies Falls where the might Orange River plunges 56 metres in a deafening and breath taking explosion of power. The name of the falls is derived from the Nama meaning 'place of big noise'.

The Orange River is the most developed of all the rivers in southern Africa. The first time the Orange River was dammed was in 1929, when Buchuberg Dam was built. Today, there are at least 29 dams in the basin with a combined storage capacity of more than 12 million cubic metres. The largest of these is the Gariep Dam with a storage capacity of 5 600 million cubic metres

(also South Africa's largest dam) and the Vanderkloof Dam, with a storage capacity of 3 200 million cubic metres.

VAAL RIVER

The Vaal River is often described as the hardest working river in South Africa. The Vaal River (named after its naturally dull brown-grey colour) is the second-largest river in South Africa, into which it flows. The 1 200 kilometre long river crosses a number of provinces, namely Gauteng, the Free State, Mpumalanga and the Northern Cape.

The Vaal River starts in the eastern Highveld plains, in the vicinity of Ermelo, in Mpumalanga. The river then flows westward along a long course, without rapids or waterfalls, broadening into a large river. While it is a major river in South Africa it is still a tributary as it does not reach the sea, but instead joins the Orange River at Douglas, in the Northern Cape.

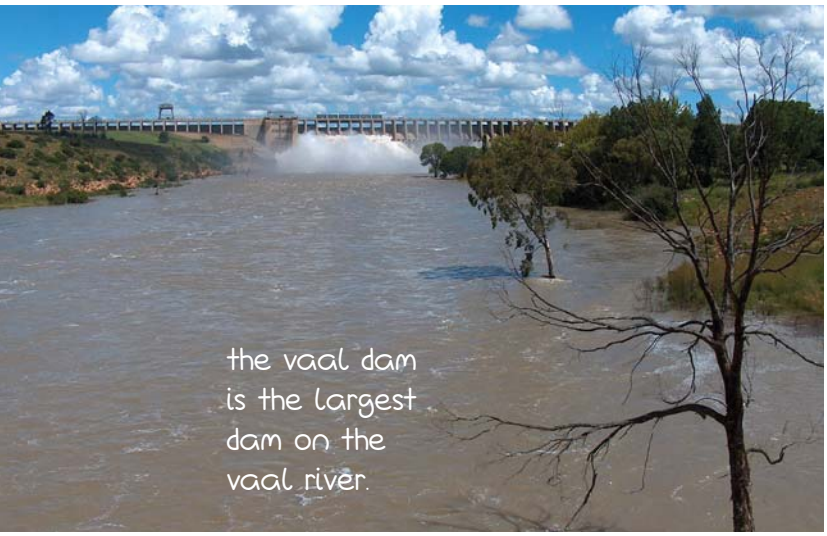
The Vaal River features a number of dams and weirs along its course. One of the first large water schemes to be built on the Vaal River was the Vaal Barrage. This dam, situated about 70 kilometres from Johannesburg was finished in 1923. This dam has a capacity of 63 million litres. The barrage was originally built to supply Rand Water with water supplies, mainly for Johannesburg.

The biggest dam on the Vaal River is the Vaal Dam. This dam was built in 1938. While it was the biggest dam to be built in South Africa at the time, it was constructed almost entirely by hand by hundreds of workers. These workers lived and worked at the dam in special construction villages.

The Vaal Dam has been raised twice, in the 1950s and again in 1985. The dam now has a volume of 2 575 million cubic metres. The dam has a surface area of 321 square kilometres and an average depth of 22.5 metres.

The Vaal Dam is one of the most important dams in the country because of its role as the primary supplier of water to the economic heartland of South Africa. The water from the Vaal River supplies water to all of the most important industries in South Africa. These industrial areas produce more than 50% of South Africa's wealth as well as more than 80% of the country's electricity requirements.

The Vaal River is not only the hardest working river in South Africa because of all the people and industries it supports, it also has to deal with a lot of pollution, like wastewater treatment plants, runoff from mines, industries and agriculture. Organisations like Rand Water and Save the Vaal Environment work to improve conditions in the catchment of the Vaal River and so improve the quality of water that enters the river.



the vaal dam is the largest dam on the vaal river.

LIMPOPO RIVER

Drinie van Rensburg

The Limpopo River travels a distance of over 1 750 kilometres from the confluence of the Marico and Crocodile rivers in South Africa to the Indian Ocean at Xai Xai, in Mozambique. The Limpopo River is the second-largest river in Africa that drains into the Indian Ocean, after the Zambezi River.

The Limpopo River flows in a great arc, first zig-zagging north and then north-east, then turning east and finally south-east. Along its route, the river forms the border between Botswana and South Africa, then the border between Zimbabwe and South Africa, before passing into Mozambique at Pafuri. In the north-eastern corner of South Africa the river borders the Kruger National Park. There are several rapids as the river falls off southern Africa's inland escarpment.

The main tributary of the Limpopo River is the Olifants River, which contributes about 1 233 million cubic metres of water a year. Other large tributaries include the Shashe River, Msingwane River, Crocodile River, Mwenezi River and Luvuvhu River.

Did you know?

a zambezi shark was caught hundreds of kilometres upriver at the confluence of the limpopo and luvuvhu rivers in july 1950. zambezi sharks tolerate freshwater and can travel far up rivers from the sea.

THE ECOLOGICAL RESERVE – KEEPING OUR RIVERS FLOWING

Just like the human body needs water to survive and function, so rivers and other water resources (like wetlands, estuaries and groundwater) need to retain a certain amount of water. People need water for all sorts of things, not only for drinking, but also for washing, cooking, and growing food. We also need water to power our industries and create electricity and mine precious metals and minerals.

But in the process of using water, people can damage rivers, wetlands and other watery places. Damaged ecosystems do not work very well and may fail us when we need them most.

Because South Africa is a semi-arid country we have to take care of the little water that we have. The South African Bill of Rights states that everyone has the right to sufficient food and water and to an environment that is not harmful to our health or well-being. One way of protecting water is through the creation of special laws.

The National Water Act, which was passed in 1998, emphasises that all aspects of water on earth are connected, and that we have to manage water resources within that connected cycle. The Act recognises that water belongs to the whole nation and is administered by the government for the good of the people. This law protects the right of all people to have water for their basic needs, but also takes into account the needs of aquatic ecosystems.

How does the law do this? By ensuring that a little bit of all water resources are reserved for future generations (this is called the Reserve). South Africa was the first country in the world to legislate this concept and provide this Reserve as right of law.

The Reserve consists of two parts – the Basic Human Needs Reserve and the Ecological Reserve:

- The Basic Human Needs Reserve is the water allocated for human consumption before any other water can be assigned. It provides for the essential needs of individuals and includes water for drinking, food preparation and personal hygiene. The Reserve ensures that people are never overlooked in favour of other water uses. At present, this amount is calculated as a minimum of 25 litres per person per day.
- The Ecological Reserve relates to the water required to protect and sustain the aquatic ecosystems in South Africa's water bodies in order to secure ecologically sustainable development and water use.

Did you know?

the south african bill of rights (chapter 2 of the constitution) states that: everyone has the right to an environment that is not harmful to their health or well-being; and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

1. prevent pollution and ecological degradation;
2. promote conservation; and
3. secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

In this way, the National Water Act protects the rights of water ecosystems because they provide people with many free services necessary to life – water supply, waste processing and dilution, natural products (like reeds, fish and medicinal plants), nature conservation, flood control, recreation and places for beauty, relaxation and religious rituals.

This does not mean we are not allowed to use these resources. We must use water and water ecosystems to sustain our communities and grow our economies so everyone can have a job and make a living. But we must also leave enough water (of good quality) in an ecosystem so that the ecosystem remains alive and functioning.

Rivers clean themselves naturally. They provide habitats for a wide range of plants, animals and microbes. When a river is used by many people, the number and kinds of plants, animals and habitats change. The structure and function of the river change. The health of the river suffers.

The Reserve provides that all rivers, regardless of their health, need:

- Enough water to maintain their structure and to provide habitats for plants and animals.
- Water in the right season so that plants and animals can complete their life cycles.
- Variability of flow so that the groups of animals that thrive in either wetter or drier conditions can be maintained.
- Enough water in severe droughts so that rivers that usually flow all year continue to do so, and seasonal rivers do not dry up for longer than they would naturally.

Amazing water animals – frogs

Freshwater systems are home to amazing animals, such as frogs. Frogs are part of the family of animals known as amphibians. Amphibians are cold-blooded animals that spend part of their lives in water and part of their lives on land. They are the only vertebrates (i.e. animals with a backbone) that go through metamorphosis, in other words, they change from tadpoles that breathe in water through gills to adults that have lungs which survive out of the water. South African frogs belong to ten families and 50% of the 115 or so species occur nowhere else but here. Besides being really beautiful and interesting, frogs are a very important part of nature. They act as both a predator (of insects) and prey (for birds, fish, reptiles and other animals). Frogs also play an important role in pest control by eating huge numbers of pesky insects such as mosquitoes, flies and ticks. Unfortunately, all is not well with our frogs. As people pollute and destroy their homes, spread alien animal species and overhunt them for food and medicine, frogs are among the most threatened animals on the planet. In South Africa, about 30% of frog species are endangered.

The power of water

Although it is not very common in South Africa, water can be used to generate electricity. This is done in two ways. Conventional hydroelectric stations capture the energy of falling water to generate electricity. A turbine converts the kinetic energy of falling water (usually from a dam) into mechanical energy. Then a generator converts the mechanical energy from the turbine into electrical energy. The electricity generated is fed onto the transmission lines that link up with the national electricity grid. Once the water has run through the turbines it is discharged back into the river below the power station to continue its course.

The second way in which water can create electricity is through pumped storage schemes. These schemes use off-peak energy to pump water into an elevated dam from a lower dam from which it can be released to generate electricity when required. When the electricity is needed, the water is released from the top dam to flow through the power station to the bottom dam.

While hydropower stations are considered more environmentally-friendly than coal-fired stations, there is some debate whether they should really be actively pursued. This is because most hydropower stations involve the construction of a dam, which can be disruptive to the surrounding environment and to communities who might be displaced.

Because of its limited water resources and erratic rainfall, South Africa does not have much potential for large hydropower stations.

WATER USE IN THE HOME

We all need water on a daily basis for drinking, washing, cooking and other household activities. Most of us take for granted the fact that we can open a tap and get clean, safe and reliable supply of water into our homes. However, water is an extremely scarce and special commodity.

How does water get to our homes? Water-supply networks comprise sophisticated engineering components, including pipes and pumps, to transport water from a raw water source (such as a dam, a river or a spring) through the water treatment plant to our homes.

Raw (i.e. untreated) water is collected from the source and transferred to the water treatment plant using pipes, pumps, canals or tunnels. The raw water is transported to a water treatment plant.

Virtually all water needs treatment before it can be safely used for human consumption. Treatment processes at treatment plants vary slightly according to the plant and the type of raw water being treated. In general, the treatment process involves the following steps:

1. **Coagulation and flocculation**: Chemicals, including aluminium sulphate, ferric sulphate and sodium aluminate are added to the water. These substances cause waterborne particles to clump together to form bigger, heavier particles that are easier to remove from the water. The chemicals are removed from the water during the treatment process and do no remain in the final treated water. The high pH (alkalinity) levels of the water at this stage helps to destroy any bacteria and viruses that may be present in the water.
2. **Settlement (sedimentation)**: The particles are allowed to settle at the bottom of settlement tanks and are later removed as sludge. The sludge is then dried and removed to a waste disposal site.
3. **Stabilisation**: Lime and/or carbon dioxide gas is added to water to adjust the water pH levels and softness.
4. **Disinfection**: Chlorine is added to kill any pathogens. It is important that a small amount of residual chlorine remains in the final water, to keep the water safe from the possible introduction of any pathogens while in the water distribution network.

Once the water has been treated, it is known as potable water. After treatment, finished water is distributed to customers through a system of pipes, pumps, valves, and storage reservoirs. The flow of water distribution systems may be controlled either by gravity or by pressure (pumping). While much of this infrastructure is buried and invisible, it is an important system that ensures that water is available when and where we need it.

Since South Africa is a water scarce country we have to be extra careful in the way we use water. If we use water in an irresponsible way the storage, supply and wastewater treatment facilities will have to be enlarged sooner than planned for – increasing the cost of water. Furthermore, during droughts, we could find ourselves with little water for longer periods.

There are various ways to conserve water. The first step to water conservation in the home is to check for leaks.

A dripping tap can waste as much as 60 litres a day or 1 800 litres a month! Leaks are not only wasteful but also expensive. Fortunately, most leaks are relatively easy and inexpensive to repair.

Did you know?

dripping taps and leaking toilets can count for as much as 5% of water used inside the home.

Once you have repaired the leaks you can work on reducing your water consumption. One of the easiest ways to save water (and electricity) in the bathroom is to take a short, quick shower instead of a bath. Reduce the shower flow rate to the minimum necessary for a comfortable shower and cut showering time to a maximum of 5 minutes.

A further saving could be achieved by turning off the shower taps while you soap up, only opening them to rinse off. You could also shower standing in a plastic tub. This would allow you to collect the water for some other purpose (like washing, flushing or watering the plants).

Do you leave the wash basin tap running wastefully when you shave, brush your teeth or wash your hair? Rather run a suitable quantity of water into your wash basin. Two litres of water in the basin is plenty for shaving and rinsing, while a cup full is more than enough for cleaning your teeth.

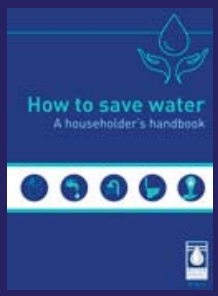
Don't use the washing machine or the dishwasher unless it is full. Do not rinse the dishes, fruit or vegetables under running water. Rather use the sink bowl or a plastic tub. Washing-up water can be used on garden plants.

Do not use a hosepipe to wash your car. A bucket, sponge and car shampoo are adequate. Also, do not hose down driveways, courtyards and swimming pool surrounds.

WHERE DOES WATER GO IN THE HOME?*

* Typical water use for a middle-income household with four persons and a garden

25%	Garden & outdoor
24%	Bath & shower
25%	Toilet
11%	Kitchen
13%	Laundry
2%	Other



Want to learn more about saving water? You can download, How to Save Water – A Householder's Handbook, for free from the Water Research Commission by clicking here.

Grey water is great water!

we have to save water in any way we can. reusing water is a great way to do just that. the water left over in a basin, and from showering, bathing and laundry is known as greywater.

while greywater or slightly used water might seem dirty – it might contain traces of food, dirt, grease or cleaning products – it can still be used for various things such as for lawns and gardens. you don't have to be an engineer or a plumber to reuse greywater. for example, you can easily use your old pet water to give your plants a drink before refreshing the animal's water bowl. the same goes for the old water in your fish tank. and what about reusing that water with which you washed your fruit and vegetables?

greywater is best used on lawns and ornamental plants, but can also be used for vegetable gardens, just as long as it doesn't touch the edible part of the plant.

Reaping the rain

When groundwater and surface water sources are in short supply, rainwater may be a sustainable alternative or supplement to water supply. Rainwater harvesting refers to the collection and storage of rainwater for future use. Catching and storing rainwater from the roof of houses, schools and other buildings is the most common form of rainwater harvesting. Even a small roof can collect a lot of water during light rain.

Water is usually channelled from the roof into a gutter and then channelled into clean drums, large buckets, old baths or any kind of water collection tank. A mesh over the top of the downpipe keeps leaves out. It is best to cover the container to reduce water loss through evaporation. To prevent mosquitoes from breeding in the water, add a few drops of cooking oil.

This water can be used to flush toilets, wash laundry, showering or bathing, irrigation and livestock watering. The water may require treatment before drinking.

SOURCES USED IN THIS BOOK

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- www.dws.gov.za
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