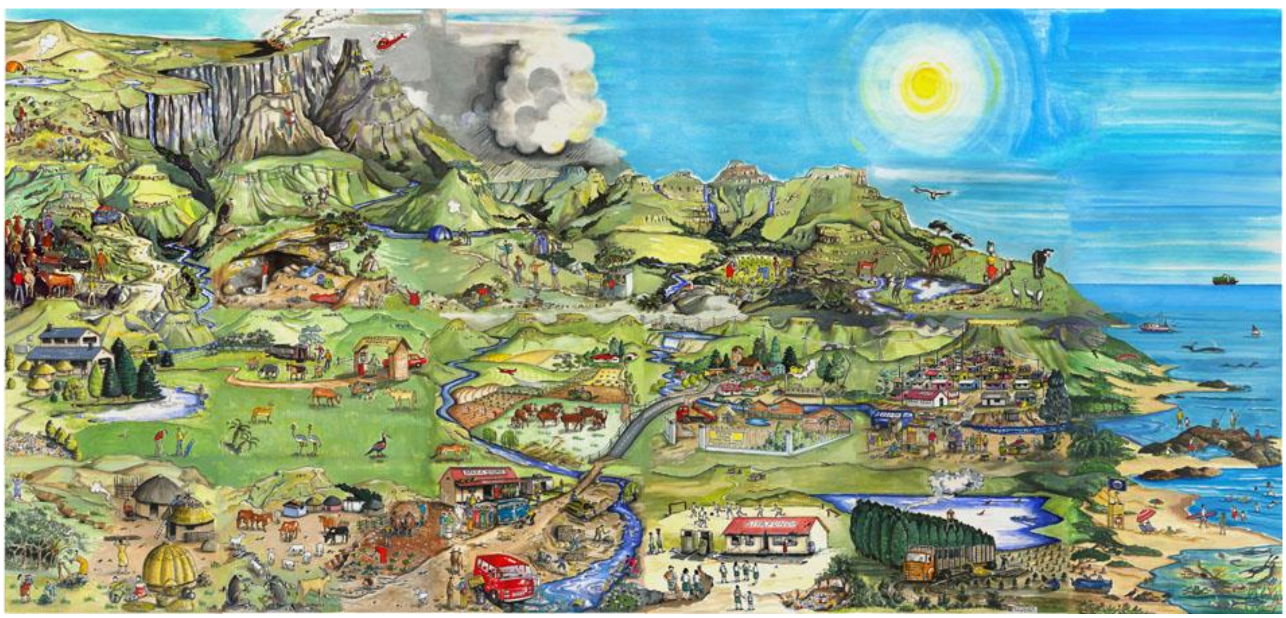
How healthy are our catchments?

Selected citizen science activities to illustrate the links between terrestrial catchment health and broader catchment health



(*Image courtesy of WESSA Share-Net http://www.sharenet.org.za*)

The following activities have been designed to promote an understanding of *how catchments work.* The focus has been to develop activities for communities, school and any other interest groups which will compliment and assist in gaining a broader understanding of *catchment health*, particularly with respect to how catchment activities influence and impact on downstream water quality and quantity. The activities are terrestrially based and have been designed (i) for more dryland parts of the catchment as an indication of the health of the system, but are equally applicable within the wetter areas of the catchment and (ii) as tools to investigate/explain possible reasons for poor aquatic health observed downstream.

The impacts and influences of soil conditions (including ground/grass cover) on catchment processes (water quality and quantity) are examined. This allows learners to appreciate the impacts of livestock and stocking rates on catchments. The broader function of vegetation within a catchment is explored (as it influences soil properties and hydrological processes). Livestock and animal types within the catchment are also considered, as they also influence catchment processes.

The booklet is aimed at teachers/facilitators as a guide to lessons and activities that inspire an understanding of how catchments work and encourage learners to develop a picture of the health of their own catchment. The booklet has been designed to combine, through interactive 'do it yourself' activities, the development of several skills sets:

- Numeracy – counting, capturing data, graphing/presenting data,
- Biological – introduction to new concepts, scientific approach, species identification,
- Language and writing – introduction to new vocabulary, putting observations into words, telling the "story" of what you see in your environment.

Activity sheets are provided at the end of the booklet to assist learners in completing the activities. Examples of completed activity sheets are also provided to assist facilitators/teachers in guiding learners.

No specialised equipment is needed for the activities, but rather leaners and facilitators are encouraged to make their own equipment from recycled materials such as used cool drink bottles. Some basic household tools are required including, scissors, watch/clock, pens and so on. Word clouds introduce new vocabulary and concepts at the beginning of each section and questions close each section. Additional extension activities are provided towards the end of the booklet to extend new skills and concepts.

Complimentary resources

The following resources provide additional information and related materials that support the themes and activities introduced in this booklet. To further develop curriculum links, you should use the syllabi and other documents from the curriculum department in your country.

WESSA Share-Net Resources
http://www.wessa.org.za/ www.sharenet.org.za

WESSA Share-Net is an innovative South African-based, informal networking project that supports environmental education through the provision of resource materials.Share-Net resources are copyright-free for educational purposes. Redevelopment for local use is encouraged. The environmental materials can be used to complement one another and provide a rich, integrated learning experience. The WESSA Share-Net project is supported by WWF-SA, McCarthy Ltd, Old Mutual, the Mazda Wildlife Fund, DUPLO, Mondi and many other institutions and organisations across southern Africa.

Share-Net Resources include **Teachers Guides**designed to provide teachers with a range of learning activities, these guides are related to specific topics such as soil, water, forests, the greenhouse effect and Arbour Week.

United States Geological Survey's (USGS) Water Science School
http://ga.water.usgs.gov/edu/

This site offers information on many aspects of water, along with pictures, data, maps, and an interactive centre where you can give opinions and test your water knowledge.

Ecology Global Network
http://www.ecology.com/2012/05/10/earths-water-single-sphere/

The Ecology Global Network aims to use the modern tools of information and communication to inform, educate and inspire the global community to respect, restore and protect our natural and human world. The site has useful teaching information on water and water related issues.

Our Precious Soil
Enviroteach Desert Research Foundation of Namibia.Adapted for Botswana by University of Botswana Environmental Education Project (1998).ISBN 99912-2-118-2.

What is a catchment?

A catchment is a piece of land that collects water when it rains.Some catchments can be very big and feed huge rivers while others can be small and feed little streams. When it rains the water goes into the soil and some of it filters down into the river or stream andsome of it stays behind in the soil for the plants to use and to feed the river or stream when there is not much rain.

What does a healthy catchment do?

- ✓ Provides clean water for
  - Drinking
  - Farming
  - Industry
- ✓ Provides habitat for wild animals and birds
- ✓ Provides grass for livestock

How can a catchment be unhealthy?

Things that change the way that the soil, water, plants and animals in a catchment interact can make the catchment unhealthy.

- ✗ Decrease in grass cover

  Construction and development in urban areas and overgrazing in agricultural areas decreases grass cover.

  - ➢ Infiltration

    Infiltration is the process where water is absorbed into the soil. When there is no grass or big spaces between the grass tufts the water flows across the soil surface too quickly and is not absorbed into the soil.
  - ➢ Erosion

    When there are big gaps between the grass tufts or the grass is completely gone even a small amount of rain can wash away the soil causing erosion. This soil gets washed into rivers making them muddy and settles on the bottom making them shallower.
- ✗ Alien Plants

  These plants destroy habitat for wild animals and birds, out-compete indigenous plants, and decrease the amount of water in the soil that can feed into the river or stream.

Catchment History

Chatting to local people and listening to their stories can develop a sense of how conditions in a catchment have changed over time. Local information and stories are essential for understanding catchment concerns and how the catchment has over time – sometimes for the better, sometimes for the worse!.

- ✓ History
- ✓ Land cover
- ✓ Land use
- ✓ Indigenous knowledge

Activity (individual)
Interview local people, particularly older folk, who have lived in the area for many years. Work out a set of questions to ask them that will help you understand how things have changed in the catchment area over time.

Aspects you could consider…

- Past and present land cover and condition
- Historical and present activities in the catchment area (how was/is the catchment used?)
- Historical/indigenous use of plants and animals
- People, how they lived and how they live now!

Record what you find out about your catchment and how it has changed.

- Do you think there is a relationship between how the land is used by people and how healthy the catchment is?

Soil

Soil is made up of 5 things – can you think of what they are?

They are mineral (inorganic) particles, organic matter, air, water and living organisms! However, these things are not found in the same amounts, or proportions, in soil.

- ✓ Inorganic
- ✓ Organic
- ✓ Texture
- ✓ Proportion
- ✓ Diameter

Collect samples of soil from different places. Run your fingers through the soil, feel the different textures. How would you describe the soils?

Activity (groups)

Equipment list

- Small clear plastic/glass bottles/jars
- Soil (at least two samples from different places)
- Stirring stick
- Clear water
- Activity sheets/paper and pencil

SAFETY FIRST

Remember these things when you are doing experiments outside

- ✓ Closed shoes
- ✓ Long pants
- ✓ Hat &Sunscreen
- ✓ Soap to wash hands
- ✓ Lots of water to drink!!

Method

Getting Ready

1. Rinse out the empty bottles
2. Fill one with clear water
3. Crush the soil and fill the other bottle a third of the way up with soil
4. Measure and record the height of the soil (you can use a ruler!)

You can use the Soil Activity Sheets to help you record your observations!

The Experiment

1. Add the clear water to the jar of soil until it is almost full.
2. First watch the mixture for a while – do you see air bubbles rising?
3. Stir the mixture with the stick.
4. Leave the bottle for 2 or 3 hours (or overnight) for the contents to settle.

Repeat the experiment for soil samples taken from different places. Look carefully at the plants (vegetation) in the areas you take soil from. Record you observations.

Questions

The substances that make up the soil will settle in layers; the heaviest particles on the bottom and the lightest on top. **Sand, silt,** and **clay** make up the mineral material found in soils. Organic matter floats to the water's surface.

- Observe the bottles(s). Do you see different layers? Describe them.
- Can you tell which layer is sand and which is silt?

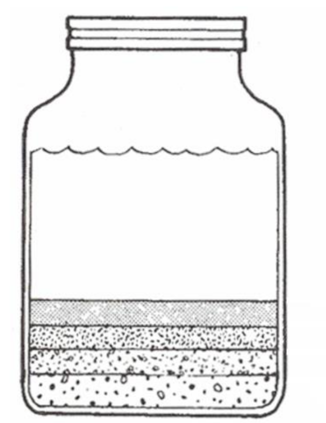
SAND – has the biggest particles. Sand is rough and scratchy; particles are round and blocky and look like tiny rocks. Water moves quickly through sand.

SILT – has smaller particles than sand, but bigger particles than clay. Silt is soft, a little clumpy, individual particles are hard to see. Particles are still round. Water moves slowly through silt.

CLAY – has the smallest particles. It is soft, powdery and clumpy. Particles areflat and sticktogetherbecause they areelectricallycharged. Water moves very slowly through clay.

- Label the different layers on a drawing of your bottle.

(Example drawing of a bottle showing the various layers of soil)



Calculating Proportion

Proportion - A quantity of something that is a part or share of the whole.

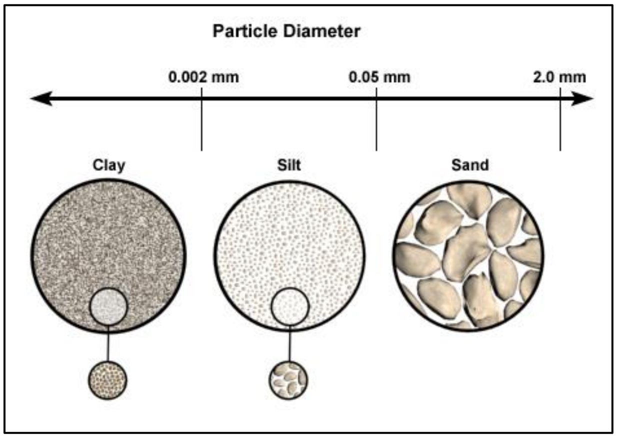
Measure the thickness of each of the layers (you can use a ruler!).The percentage proportion of each layer (particle size) is given by:

% = [Layer thickness / Total height of soil (H)] * 100

- Compare the results with soil samples taken from other areas.
- Were the layers in the different samples the same thickness?
- How did the proportion of each layer in the various samples differ?

Infiltration

Infiltration is the process by which water on the ground surface enters the soil.Soil type affects the way water is absorbed by the soil. Different types of soil have different size particles and so different size spaces between the particles.



(Image courtesy of The Comet Program http://www.comet.ucar.edu/)

Lesson 1 – Infiltration rate

Infiltration rate is the length of time it takes for a known volume of water to be absorbed into the soil. The two processes causing infiltration to take place are gravity and capillary action. Gravity causes water to move quickly into the large and medium sized air spaces in the soil, but the small spaces are filled more slowly using capillary action.

Activity(individual/groups)

Equipment list

- 2 empty plastic 2L cool drink bottles
- 2 empty 500ml cool drink bottles
- Permanent marker
- Craft knife or scissors
- Ruler
- Measuring jug
- Stopwatch/clock with a second hand
- Sandy soil
- Non-sandy soil (loam or clay)
- Kitchen scale (that can weigh 1kg)
- Activity sheets/paper and pencil

Capillary action

Take 2 tubes, one thinner than the other and put them both into a glass of water. Do you see how the water in the thinner one is pulled higher up the tube than the water in the thicker one? This is capillary action. The forces that hold the water molecules together (cohesion) and cause water to stick to other surfaces (adhesion) interact to pull the water up the tube, the thinner the tube, the stronger the pull on the water. This is how the small gaps in the soil pull water into them.

Method

Getting Ready

1. Rinse out the empty cool drink bottles
2. Take the 2 empty 2L cool drink bottles and cut the tops off
3. Weigh 1kg of each soil
4. Put the sandy soil into one 2L bottle and the non-sandy soil into the other
5. Squash the soil down in the bottle to make sure that there are no very big air spaces
6. Draw a line on the 2L bottle with permanent marker where the top of the soil is
7. Using the ruler make marks on the 2L bottle 1cm apart starting at the soil surface and going towards the top of the bottle
8. Number the marks you have made on the bottle starting from 0 at the soil surface
9. Do the same with the other bottle
10. Take the 2 empty 500ml cool drink bottles and pour 300ml of water into each one using the measuring jug.

The Experiment

1. First take the 2L bottle with the sand in it. One person is in charge of timing (the timer); one of writing down data (the scribe) and one of pouring the water into the 2L bottle (the pourer)
2. When the timer is ready he/she tells the pourer to start pouring the 300 ml of water from one of the 500ml bottles into the 2L bottle on top of the soil
3. As soon as the 500ml bottle is empty the scribe must record the water level in cm using the marks on the 2L bottle and the timer must start timing
4. When the water has all been absorbed into the soil the timer stops timing and the scribe writes down the number of seconds it took for all the water to be absorbed
5. Do the same with the 2L bottle of non-sandy soil.

Calculating Infiltration Rate

To calculate the infiltration rate in cm per second divide the volume of water used (so 300 for 300ml of water used) by the number of seconds it took for all the water to be absorbed into the soil (so if it took 1 ½ minutes it would be 90 seconds).

Infiltration rate = volume of water (ml)/time taken to fully absorb (seconds)

This will give you the infiltration rate in ml per second (ml/s). You know that you used 1 kg of soil for the experiment so you can say the infiltration rate is ***x***ml/s/kg.

Questions

- How long did each soil type take to absorb the water?
- Which soil type do you think has bigger air spaces?
- Can you think of any other soil types that would be different?
- What is the importance of soil being able to absorb water?

Lesson 2 – Grass and Infiltration

Grass and other plants slow rain water down as it moves across the soil surface. This gives the water a chance to be absorbed into the soil before it is lost as run-off. **Run-off**is water that does not seep into the groundand flows downhill, carrying with it topsoil and nutrients. Increased run-off reduces infiltration and therefor groundwater recharge.

- ✓ Run-off
- ✓ Erosion
- ✓ Topsoil
- ✓ Nutrients
- ✓ Groundwater recharge

Groundwater rechargeis a hydrologic process where water moves downward from surface water to groundwater and is particularly important in dry-land areas.

The roots of the grass and other plants also help to hold the soil together and prevent erosion.

Activity(individual/groups)

Equipment list

- 2empty ice-cream tubs or similar containers
- Baking tray with a lip (larger than an ice-cream tub)
- 2 clear 1 L plastic bottles
- Soil
- Small stones
- Grass seed (*Eragrostisteff* – is readily accessible from most nurseries but any grass or other seed will do – even if you collect some from your local grasses!)
- A plank or small block of wood (about 4 cm high)
- Watering can with a sprinkler head (or a plastic bottle with holes in it!)
- Funnel
- Measuring jug
- Stopwatch or clock
- Permanent marker
- Activity sheets/paper and pencil

Erosion

Erosion is a natural process that forms valleys and mountains. It takes place when soil and rocks are removed and transported somewhere else. Erosion can be caused by wind, water and human activity.

If it is natural then why is it bad?
Natural erosion takes place very slowly, but human activities such as bad farming practices, deforestation and too many roads and pathways (especially dirt roads and tracks) has made erosion speed up. This means that large areas of the earth are losing valuable topsoil (the soil which is full of nutrients for plant growth).

Tip: plastic containers and bottles can be collected from a nearby recycling depot!

Method

Getting Ready (about 2 weeks before the experiment!)

1. Clean the ice-cream tubs/containers and jars or plastic bottles
2. Punch some holes in the bottom of each tub
3. Line each tub with a layer of small stones
4. Fill each tub with soil and press it down lightly
5. Sprinkle the soil in one of the tubs with grass seed, but leave the other as soil only
6. Place the 2 tubs in a warm sunny place
7. Water both tubs of soil with 200ml of water, use a watering can or make holes in a plastic bottle and allow the water to fall gently as ‘rain’

8. Water the tubs every 3 days until the grass in the ‘grass and soil’ container is about 1.5cm tall.

The Experiment

1. Take the two tubs outside where you can make a mess
2. Take the soil and grass tub and put the block of wood under the one end of the tub
3. Put the other end of the tub into the baking tray
4. Measure 300 ml of water and pour it into the watering can
5. Gently pour the water over the soil and grass (mostly from the highest edge of the tub)
6. When the watering can is empty wait for 3 minutes
7. Take the baking tray and pour the water in it into the measuring jug
8. Write down how much water was in the baking tray in millilitres (ml)
9. Now pour the water from the measuring jug into one of the clear 1L bottles using the funnel
10. Write ‘soil and grass’ on the bottle in permanent marker
11. Rinse the baking tray, the funnel and the measuring jug and repeat the steps above for the tub with soil only.

Calculating Run-off Percentage

We know that we used 300 ml of water to pour onto each ice-cream tub for the experiment. Divide the volume of water in the baking tray (in ml) by the amount of water used for the experiment (300ml) and multiply this by 100.

Run-off percentage = [run-off water volume (ml) / volume of water used (ml)] * 100

Do this for both the soil and grass and the soil only measurements. This will give you the run-off percentage for each one.

Example of results (to be illustrated)

Questions

- Look at the colour of the water in the two bottles. Which one looks dirtier?
- Which bottle has more water in it?
- Which one do you think would lose more soil to erosion?
- What other things can you think of that would affect run-off?

Changes in the way we use land can result in changes in our catchments; water may flow in a different direction or water may flow more quickly reducing infiltration and carrying away soil. When vegetation is removed from our catchments (through clearing for buildings or over-grazing) less rain (or even no rain) can soak into the soil causing flooding and erosion.

Do the same experiment with other types of soil cover, such as loose leaves, mulch or stones and compare how land cover affects water run-off!

Example of different land covers (to be illustrated)

Vegetation

Not only is grass an important supply of food for livestock and wildlife, but it is also 'anti-erosion cover' for hillsides. Its leaves stop the rain from hitting the ground too hard and forming a soil crust and slow down water run-off from storms, while its roots help to hold the soil together preventing it from being washed away. When there are too many animals in an area they eat more leaves then the grass can re-grow and grass tufts start to die and bare patches form. In these patches soil crusting and erosion can start.

- ✓ Basal cover
- ✓ Soil crust
- ✓ Data
- ✓ Overgrazing

Lesson 1 – Grass basal cover

Basal cover is the amount of ground that the grass plant is attached to. This is important to prevent erosion from storm water run-off.

The 'Toe to Tuft' activity can be used to evaluate the grass basal cover in your area.

Activity(groups)

Equipment list

- Blindfold (kitchen towel/cloth)
- Ruler
- Activity sheets/paper and pencil

Method

Getting Ready

Find an area of grassland in one of your local catchments.

- Blindfold one person from each group!

The Experiment

1. Choose one person to be blindfolded, one to be the measurer (and scribe) and one to be the leader
2. The leader takes the blindfolded person by the hand and leads them across the ground for a few paces and then stops (this is the starting point)
3. The scribe notes if the blindfolded person's right foot is touching soil or grass

What is a soil crust?

A soil crust is a hard layer on the surface of the soil similar to the crust on the outside of a loaf of bread. A soil crust makes it difficult for water to be absorbed into the soil and for seeds in the soil to germinate and push through the crust to get to the light.

A soil crust is caused by rain falling on bare soil and then the soil drying out in the sun.

Have you ever been in rain that hits so hard it stings? Because rain falls from so high up it hits the soil very hard when it eventually reaches it. When this happens over and over again the top of the soil hardens and forms a crust. The leaves of plants help to slow the raindrops down and so they don't hit the soil so hard.

4. The measurer then measures the distance from the blindfolded person’s right toe to the nearest grass tuft. You can use a ruler or tape measure
5. The measurer/scribe then records the distance (cm). If the person’s foot is on grass the distance to the nearest tuft is 0 cm
6. The measurer then measures the diameter of this grass tuft and records the result
7. The leader then leads the blindfolded person onwards and again stops
8. The scribe notes if the blindfolded person’s foot is touching soil or grass and the group repeats the two measurements as before
9. Do this 30 times!

(Illustrated examples)

Measuring from toe to grass tuft

Measuring tuft diameter

Calculating…..

- *Proportion grass*
  Count the number of times the ‘toe’ landed on grass then divide this by the total number of times you recorded data (30 in this exercise) and multiply by 100

  Proportion grass(%) = (no of hits on grass / total number of hits) * 100

- *Average distance to tuft*
  Add up all the distance to nearest tuft measurements you collected and divide them by the total number of measurements (30 in this exercise)

- *Average tuft size*
  Add up all the tuft diameter measurements you collected and divide them by the total number of measurements (30 in this exercise)

Questions

- Do you think the basal cover is high or low?
- Are the patches between the grass tufts generally big or small?
- Are the grass tufts generally big or small?
- Which do you think is better, lots of small grass tufts or fewer big ones?
- Do you think that this catchment looks like it is overgrazed?
- Do you think this catchment will lose a lot of soil when it rains?
- If you owned this piece of land, what could you do to reduce run-off and erosion?

Lesson2 – Grass aerial cover

Grass aerial cover is the amount of ground that is covered by the leaves of the grass. This would be equal to the area of ground shadowed by the grass leaves when the sun is directly overhead. Aerial cover is important to prevent a soil crust forming. The rain hits the grass leaves before hitting the soil and slows down so that it doesn't hit the soil so hard and make a crust. Aerial cover also helps to decrease evaporation from the soil and keep the soil moist.

Activity(groups)

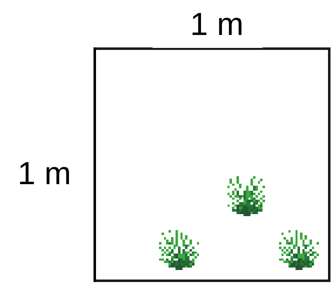
<u>Equipment list</u>

- Quadrat
- Activity sheets/paper and pencil

Make your own quadrat

Take four sticks of equal length (1 m) and join them (using heavy tape) to form a square. Make sure that all four sides are the same length.

Take a brightly coloured plastic packet and cut off four strips. Tie these to the four corners of the quadrat so that you can find it in the grass.



<u>Method</u>

Getting Ready

1. Make a quadrat

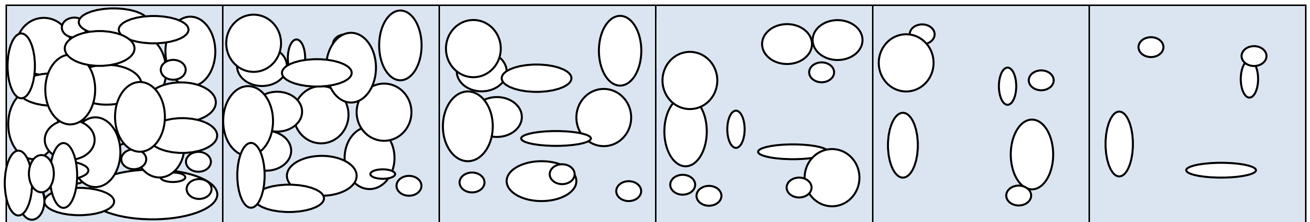
The Experiment

Find an area of grassland in one of your local catchments.

1. Choose one person to be the scribe and one to throw the quadrat
2. Take the quadrat and throw it. Not too far because you need to be able to find it again
3. Find the quadrat and estimate how much grass there is in the square (if you are having trouble look at the percentage picture key to help)
4. Write this down on your data sheet
5. Repeat this 30 times!

Aerial Cover Percentage Picture Key

To record how much grass there is in the quadrat, look down on the quadrat from above and estimate the percentage of the quadrat covered by grass. You can use the key below to help you make the estimations. The circles represent the extent of grass cover (%).



100 to 80	**80 to 60**	**60 to 40**	**40 to 20**	**20 to 10**	**<10**

Calculating…..

Add up all of your aerial cover percentage estimates and divide them by the number of times you threw your quadrat (30 in this exercise).

This will give you the average aerial cover for the catchment you are looking at.

Questions

- Sketch a diagram of a quadrat showing the average aerial cover for your catchment.
- Do you think the aerial cover is high or low?
- Can you think of anything other than grass that would….
    - Prevent soil crusting?
    - Decrease evaporation from the soil?
- How would grazing affect grass aerial cover?

Catchments and Animals

Catchments are not just important because they absorb rain water and filter it into the rivers for us. They are important to the animals too because they provide food and homes for them.

- ✓ Diversity
- ✓ Domestic animals
- ✓ Wild animals
- ✓ Species
- ✓ Spoor
- ✓ Bar graph

Lesson 1 – Animal Diversity

How many different animals live in or visit your catchment?

Based on your knowledge of the catchment area, design a data sheet of the animals that could be in your catchment area.

Talk to people who have lived in the area for a long time, look at books (field guides) and use the internet if you can. Think about which animals are wild and which ones are domestic. Think about big animals and small ones too, ones that walk or fly or crawl!

Activity(individual)

Equipment list

- Pencil
- Your data sheet

Method

The Experiment

1. Walk around the catchment looking for animals and signs of animals

Look in the trees and on the ground. Are there animal droppings or footprints (spoor)? What animals could these be from? Stop and listen, what can you hear? Do you recognize the call of birds or frogs or beetles? Try and walk around in the early morning and/or the late afternoon. Animals often rest during the day and may be harder to see or hear at midday, especially if it is hot!

2. When you see an animal decide which group it fits into on the data sheet
3. Make a mark (a tick or a cross) next to that group on the datasheet
   E.g. If it is a brown lizard then put a mark in the row for lizards
4. Now carry on looking for animals

5. If you see another animal the same as the one before don't write it down again, but if it is different then make another mark on your datasheet in the correct row E.g. If you saw a brown lizard before and then you saw a green lizard put another mark next to lizards because you saw a different lizard OR if you saw a lizard before and then you saw a butterfly put a mark next to butterflies
6. Remember to make notes about each animal you mark down on your datasheet so that you remember which kinds you have counted
7. Do this for 30 minutes (more time could be allowed) and see how many animals you can find!

Calculating….

Count how many different animals you saw in each group. Write the total for each group on your data sheet. Draw a **bar graph**of your results so that you can compare the differences.

See the activity sheet for Catchments and Animals for information on how to draw a bar graph!

Questions

- Which animals did you see the most of?
- Which animals did you see the least of?
- Why do you think this is?
- Choose one of the animals you saw and go to your nearest library or use the internet to look up information about it, how it lives and what it eats. Write a short story about that animal. Imagine you are the animal and you are facing the environmental problems that many animals to day have to deal with, habitat loss, pollution etc. How would this affect your life and what would you do about it?

Lesson 2 – Animals and the Environment

The animals you have seen in the catchment were grouped with animals that looked similar to them (all the lizards together) but animals can also be grouped using other characteristics. One characteristic is what they eat.

Activity (Individual)
Using the list of animals and the notes you made in lesson 1 group the animals you saw according to which feeding category you think they fall into.

Remember that animals that were in the same group in lesson 1 might not be in the same group in lesson 2. E.g. not all birds eat the same thing.

Animal feeding groups

Herbivores – Eat mainly plants (both trees and grass)

Carnivores – Eat mainly meat

Omnivores – Eat plants and meat

Insectivores – Eat mainly insects

Frugivores – Eat mainly fruit

Calculating….

Count how many different animals you saw in each category. Now draw a bar graph so that you can compare the differences. Compare this bar graph to the one you drew for the previous activity.

Questions

- Are there more wild or domestic animals in your catchment area?
- What would happen to the catchment if there were too many of one kind of animal there?
- What would happen to the animals if people came and mowed the grass in the catchment?
- What would happen to the animals if people built houses in the catchment?
- Which feeding group do you think people fit into?

Catchment Health

How healthy is YOUR catchment?

Activity(group)

Method

In your groups, discuss the new things you have learnt and the activities you did. What are some of the challenges you experienced? What did you really enjoy? Ask other people in your group any questions you have about the new concepts and ideas introduced in this booklet.

How healthy is your catchment? Tell the other groups your answer and why you think so. Show them your experiments and explain your findings.

Activity(individual)

Equipment list

- Paper
- Coloured pens
- Craft materials of your choice

Method

Using your new understanding of catchments and their health, create a picture collage of your catchment area that

- Tells a story about the health of YOUR catchment
- Reflects your new understanding of catchment processes/ how you came to know more about the catchment area
- Suggests ways of improving the health of your catchment!

Be creative! You could draw, colour in, stick bits and pieces onto your picture, use old magazine/newspaper pictures and many more.

Activity Sheets

These activity sheets have been designed to assist learners in recording and capturing the results and data generated during the catchment activities. These sheets can be modified by teachers/facilitators as needed.

- The sheets can be printed off or photocopied and distributed to learners for each of the activities.
- Answers to the questions can be written on the back of activity sheets!
- A set of completed activity sheets is provided with this booklet as an example for teachers/facilitators and learners.

Name: Date:

Soil Activity Sheet

You can use the two activity sheets below to complete the Soil Activities!

Using the results of the Soil Activity, draw a diagram of your sample bottles and label the different layers. Remember that the substances that make up the soil will settle in layers; the heaviest particles on the bottom and the lightest on top.

Give your drawings a title and don't forget to label the layers!

Labelled drawings

Name: Date:

Calculating Proportion

Measure the thickness of each of the layers (you can use a ruler!) in each of your sample bottles and calculate the proportion of each layer.

Remember:

Proportion - A quantity of something that is a part or share of the whole.

The percentage proportion of each layer (particle size) is given by:

% = [Layer thickness / Total height of soil (H)] * 100

Datasheets

Sample 1	*(Describe the area the sample was collected from, record vegetation observations)*			
Layer	**Description**	**Type** *(sand/silt/clay)*	**Thickness (cm)**	**Proportion (%)**
1				
2				
3				
4				
Total height				

Sample 2	*(Describe the area the sample was collected from, record vegetation observations)*			
Layer	**Description**	**Type** *(sand/silt/clay)*	**Thickness (cm)**	**Proportion (%)**
1				
2				
3				
4				
Total height				

Name: Date:

Infiltration Activity Sheet

You can use thetables below to record your results and calculate the infiltration rate for the Infiltration Activities!

Calculating Infiltration Rate

To calculate the infiltration rate in cm per second divide the volume of water used (so 300 for 300 ml of water used) by the number of seconds it took for all the water to be absorbed into the soil (so if it took 1 ½ minutes it would be 90 seconds).

Remember:

Infiltration rate is given by:

Infiltration rate = volume of water (ml) / time taken to fully absorb (seconds)

Lesson 1 – Infiltration

	Water level (cm)	**Time (s)**	**Volume water added (ml)**	**Infiltration rate (ml/s)**
(Experiment)	(step 3)	(step 4)	(Getting ready step 10)	
Sandy soil				
Non-sandy soil				
(for 1 kg of soil)				

Name: Date:

Calculating Run-off Percentage

Use your measurements from the Grass and Infiltration Activity to calculate the run-off percentage for both the soil and grass and the soil only experiments.

Divide the volume of water in the baking tray (in ml) by the amount of water used for the experiment (300 ml) and multiply this by 100.

Remember:

Run-off percentage is given by:

% = [run-off water volume (ml) / volume of water used (ml)] * 100

Lesson 2 – Grass and infiltration

	Volume of water added (ml)	**Volume of water in tray (ml)**	**Run-off percentage (%)**
(Experiment)	(step 4)	(step 8)	
Soil & grass			
Soil only			

Draw a diagram showing the different types of soil covers you used in your experiments!

Name: Date:

Vegetation Activity Sheet

Use the datasheets on the next two pages to record your measurements from the Vegetation Activities!

Lesson 1 – Grass basal cover

Calculate the proportion of grass compared to soil, the average distance to tuft and the average tuft size.

Remember:

To calculate

- *Proportion grass*
  Count the number of times the 'toe' landed on grass then divide this by the total number of times you recorded data (30 in this exercise) and multiply by 100

  Proportion grass (%) = (no of hits on grass / total number of hits) * 100

- *Average distance to tuft*
  Add up all the distance to nearest tuft measurements you collected and divide them by the total number of measurements (30 in this exercise)

- *Average tuft size*
  Add up all the tuft diameter measurements you collected and divide them by the total number of measurements (30 in this exercise).

Lesson 2 – Grass aerial cover

Calculate the average aerial cover for the catchment you are looking at.

Remember:

To calculate average aerial cover:

Add up all of your aerial cover percentage estimates and divide them by the number of times you threw your quadrat (30 in this exercise).

Name: Date:

Vegetation Activity Sheet

Lesson 1 – Grass basal cover

Measurement	Grass (yes/no)	Distance to nearest tuft (cm)	Tuft diameter (cm)
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
Total			
Proportion grass (%)			
Average distance to tuft (cm)			
Average tuft size (cm)			

Name: Date:

Vegetation Activity Sheet

Lesson 2 – Grass aerial cover

Quadrat	Grass cover (%)
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	
25	
26	
27	
28	
29	
30	
Total	
Average aerial cover (%)	

Name: Date:

Catchments and Animals Activity Sheet – Animal Diversity

You could use the sheet below to help you design your data sheet and record your observations from the Catchment and Animals Animal Diversity activity!

Animal group	Animal (drawing)	Number	Notes

Name: Date:

Catchments and Animals Activity Sheet – Animal Diversity

Bar graphs

A **Bar Graph** (also called a Bar Chart) is a graphical display of data using bars of different heights. Bar Graphs are good to use when data is in **categories** (such as animal groups!) and allows us to compare groups of data andto make generalizations about the data quickly.

Use the data you collected in the Catchments and Animals Section, Lesson 1 Activity, to draw a bar graph of the animals you observed!

Give your graph a title and don't forget to label the axes!

Name: Date:

Catchments and Animals Activity Sheet - Animals and the Environment

Using the list of animals and the notes you made in Animal Diversity activity, group the animals you saw according to which feeding category you think they fall into. Count how many different animals you saw in each category.

Remember:

Herbivores – Eat mainly plants (both trees and grass)

Carnivores – Eat mainly meat

Omnivores – Eat plants and meat

Insectivores – Eat mainly insects

Frugivores – Eat mainly fruit

Draw a bar graph to show the number of animals in the different groups. Compare this bar graph to the one you drew for the previous activity.

Give your graph a title and don't forget to label the axes!

Activity Sheets – completed examples

Example

A set of completed activity sheets is provided with this booklet as an example for teachers/facilitators and learners!

Name: Carey Ndlovu Date: 12 March 2013

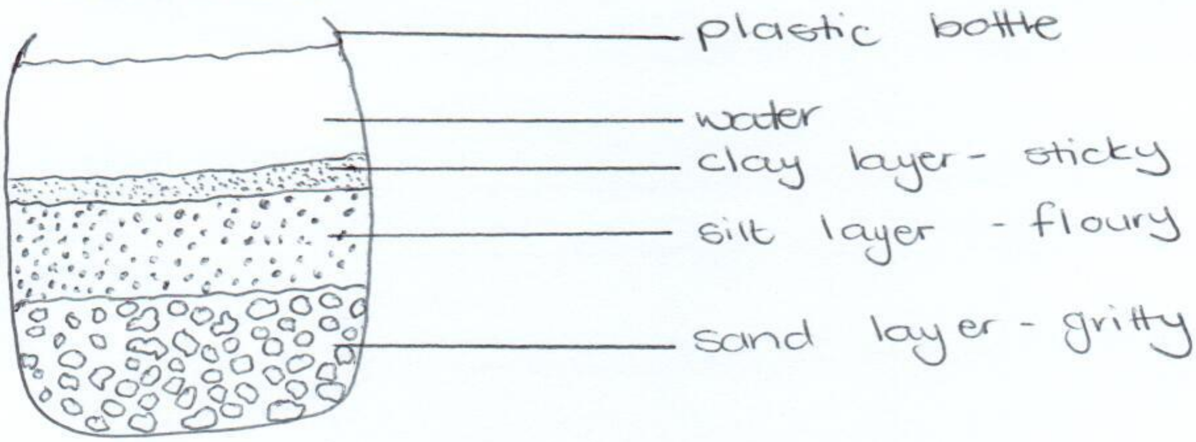
Soil Activity Sheet

You can use the two activity sheets below to complete the Soil Activities!

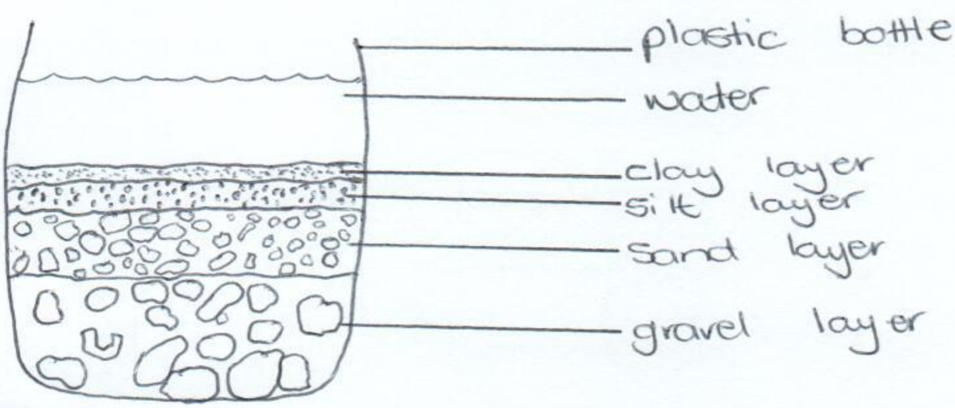
Using the results of the Soil Activity, draw a diagram of your sample bottles and label the different layers. Remember that the substances that make up the soil will settle in layers; the heaviest particles on the bottom and the lightest on top.

Give your drawings a title and don't forget to label the layers!

Labelled drawings



A diagram showing the settled layers in Sample 1



A diagram showing the settled layers in Sample 2

Name: Carey Ndlovu Date: 12 March 2013

Calculating Proportion

Measure the thickness of each of the layers (you can use a ruler!) in each of your sample bottles and calculate the proportion of each layer.

Remember:

Proportion - A quantity of something that is a part or share of the whole.

The percentage proportion of each layer (particle size) is given by:

% = [Layer thickness / Total height of soil (H)] * 100

Datasheets

Sample 1	*(Describe the area the sample was collected from, record vegetation observations)* School Vegetable garden, by the spinach. Soil was moist, fine, clumpy and soft to the touch			
Layer	**Description**	**Type** *(sand/silt/clay)*	**Thickness (cm)**	**Proportion (%)**
1	Grainy and Gritty	Sand	4.5	52.3
2	Powdery	Silt	3.4	39.5
3	Sticky	Clay	0.7	8.1
4				
Total height			8.6	

Sample 2	*(Describe the area the sample was collected from, record vegetation observations)* School Soccer field, no grass on the field. Soil was hard, dry and rough to the touch			
Layer	**Description**	**Type** *(sand/silt/clay)*	**Thickness (cm)**	**Proportion (%)**
1	Large Particles	Gravel	6.2	48.4
2	Gritty	Sand	4.3	33.6
3	Floury & Smooth	Silt	1.8	14.1
4	Sticky	Clay	0.5	3.9
Total height			12.8	

Name: Kelly Stuart Date: 9 April 2013

Infiltration Activity Sheet

You can use the tables below to record your results and calculate the infiltration rate for the Infiltration Activities!

Calculating Infiltration Rate

To calculate the infiltration rate in cm per second divide the volume of water used (so 300 for 300 ml of water used) by the number of seconds it took for all the water to be absorbed into the soil (so if it took 1 ½ minutes it would be 90 seconds).

> Remember:
>
> Infiltration rate is given by:
>
> Infiltration rate = volume of water (ml) / time taken to fully absorb (seconds)

Lesson 1 – Infiltration

	Water level (cm)	Time (s)	Volume water added (ml)	Infiltration rate (ml/s)
(Experiment)	(step 3)	(step 4)	(Getting ready step 10)	
Sandy soil	7	50	300	6
Non-sandy soil	7	85	300	3.5
(for 1 kg of soil)				

Name: Kelly Stuart Date: 9 April 2013

Calculating Run-off Percentage

Use your measurements from the Grass and Infiltration Activity to calculate the run-off percentage for both the soil and grass and the soil only experiments.

Divide the volume of water in the baking tray (in ml) by the amount of water used for the experiment (300 ml) and multiply this by 100.

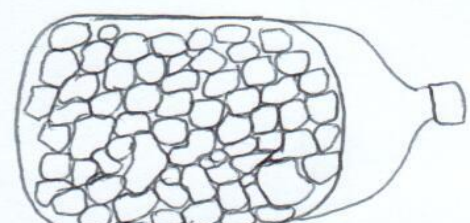
> Remember:
>
> Run-off percentage is given by:
>
> % = [run-off water volume (ml) / volume of water used (ml)] * 100

Lesson 2 – Grass and infiltration

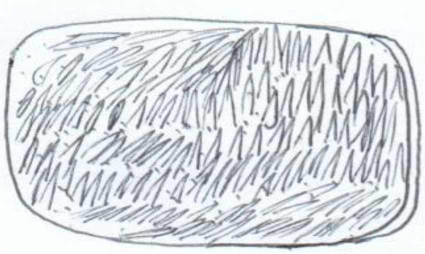
	Volume of water added (ml)	Volume of water in tray (ml)	Run-off percentage (%)
(Experiment)	(step 4)	(step 8)	
Soil & grass	300	69	23
Soil only	300	168	56
Soil & Rocks	300	125	42
Soil & Leaves	300	100	33

Draw a diagram showing the different types of soil covers you used in your experiments!

Soil Only



Soil and Rocks



Soil and Grass

Soil and Leaves

Name: Asanda Zondi Date: 8 May 2013

Vegetation Activity Sheet

Use the datasheets on the next two pages to record your measurements from the Vegetation Activities!

Lesson 1 – Grass basal cover

Calculate the proportion of grass compared to soil, the average distance to tuft and the average tuft size.

> Remember:
>
> To calculate
>
> - *Proportion grass*
>   Count the number of times the 'toe' landed on grass then divide this by the total number of times you recorded data (30 in this exercise) and multiply by 100
>
>   Proportion grass (%) = (no of hits on grass / total number of hits) * 100
>
> - *Average distance to tuft*
>   Add up all the distance to nearest tuft measurements you collected and divide them by the total number of measurements (30 in this exercise)
>
> - *Average tuft size*
>   Add up all the tuft diameter measurements you collected and divide them by the total number of measurements (30 in this exercise).

Lesson 2 – Grass aerial cover

Calculate the average aerial cover for the catchment you are looking at.

> Remember:
>
> To calculate average aerial cover:
>
> Add up all of your aerial cover percentage estimates and divide them by the number of times you threw your quadrat (30 in this exercise).

Name: Asanda Zondi Date: 8 May 2013

Vegetation Activity Sheet

Lesson 1 – Grass basal cover

Measurement	Grass (yes/no)	Distance to nearest tuft (cm)	Tuft diameter (cm)
1	NO	10	0.5
2	NO	4	0.4
3	NO	6	0.1
4	NO	30	1
5	NO	1	0.5
6	No	4	0.4
7	No	19	0.2
8	No	16	0.4
9	No	18	3
10	No	9	1
11	No	6	0.1
12	No	4	0.4
13	No	7	0.9
14	No	16	0.4
15	No	18	0.3
16	No	7	0.1
17	No	9	0.1
18	Yes	0	3
19	No	8	0.9
20	Yes	1	0.3
21	No	26	1
22	Yes	0	0.5
23	No	10	0.3
24	No	15	0.5
25	Yes	0	0.3
26	Yes	0	0.6
27	No	8	0.2
28	No	34	0.2
29	Yes	0	0.5
30	No	11	0.1
Total		297	18.2
Proportion grass (%)	Yes = 6 ∴ 6 ÷ 30 = 0.2 × 100 = 20%		
Average distance to tuft (cm)	Total Distance = 297 ∴ 297 ÷ 30 = 9.9 cm		
Average tuft size (cm)	Total Diameter = 18.2 ∴ 18.2 ÷ 30 = 0.6 cm		

Name: Asanda Zondi Date: 8 May 2013

Vegetation Activity Sheet

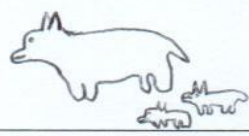
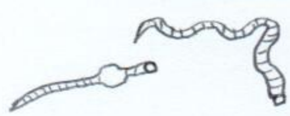
Lesson 2 – Grass aerial cover

Quadrat	Grass cover (%)
1	100
2	100
3	80
4	20
5	60
6	50
7	10
8	25
9	33
10	50
11	62
12	100
13	63
14	75
15	43
16	27
17	18
18	52
19	10
20	2
21	0
22	17
23	58
24	10
25	90
26	95
27	100
28	50
29	22
30	67
Total	1 509
Average aerial cover (%)	$\frac{1509}{30} = 50.3$

Name: Andrew Bester Date: 28 May 2013

Catchments and Animals Activity Sheet - Animal Diversity

You could use the sheet below to help you design your data sheet and record your observations from the Catchment and Animals Animal Diversity activity!

Animal group	Animal (drawing)	Number	Notes
Birds		9	· Swallow · Robin · Chicken
Frogs		3	· One frog dead on the road
Insects		24	· Bee · Lady Bug · Butterflies
Lizzards		11	· Brown lizzards on tree bark · Blue Headed
Dogs		4	· Mom Dog with puppies
Worms		16	· Earthworms on vegetable garden
Snails		2	· Snails on the wall
Goats		19	· Goats grazing outside school fense
Cats		2	· Orange cat · Brown cat

Name: Andrew Bester Date: 28 May 2013

Catchments and Animals Activity Sheet - Animal Diversity

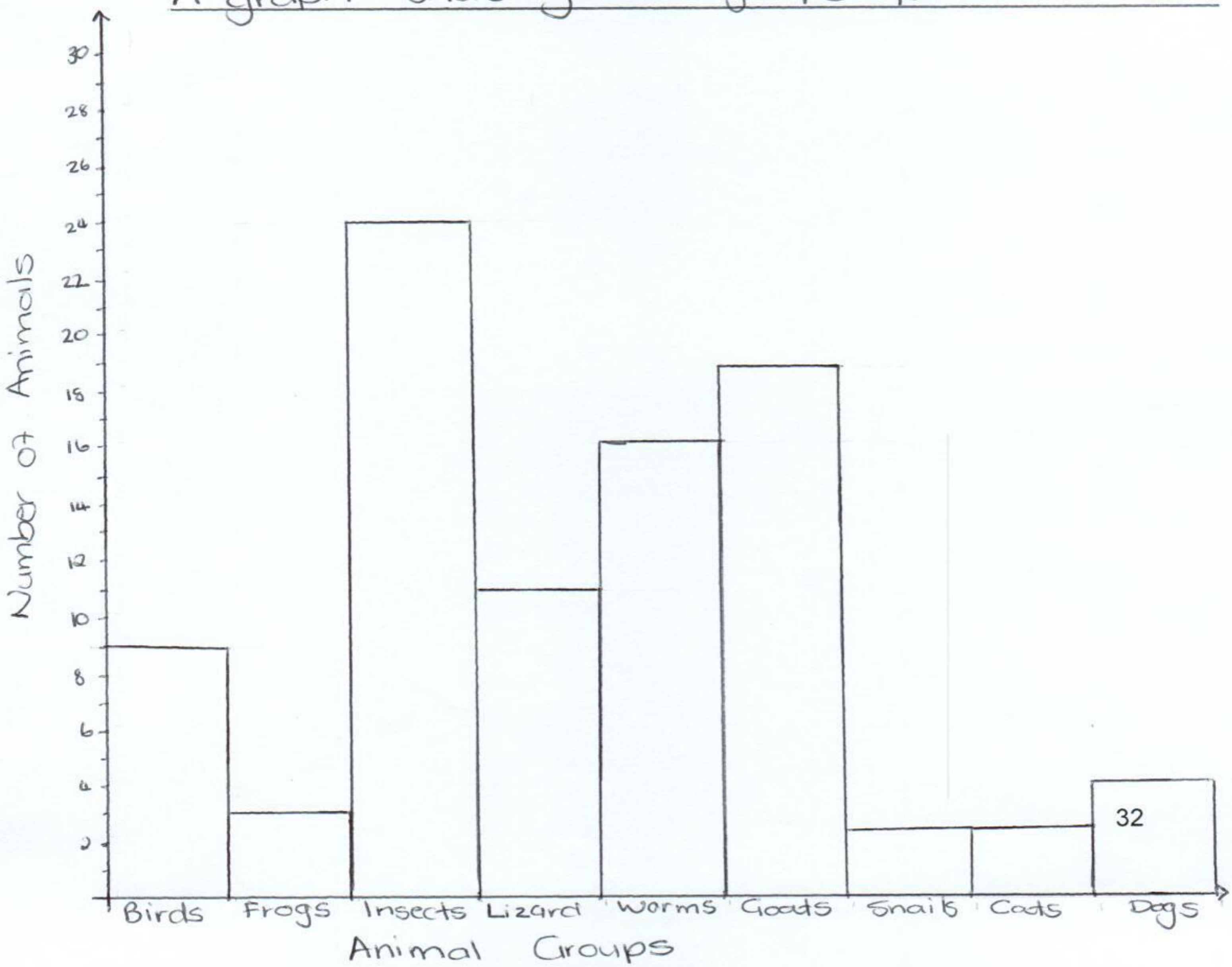
Bar graphs

A **Bar Graph** (also called a Bar Chart) is a graphical display of data using bars of different heights. Bar Graphs are good to use when data is in **categories** (such as animal groups!) and allows us to compare groups of data and to make generalizations about the data quickly.

Use the data you collected in the Catchments and Animals Section, Lesson 1 Activity, to draw a bar graph of the animals you observed!

Give your graph a title and don't forget to label the axes!

A graph showing the groups found at school



Name: Andrew Bester Date: 28 May 2013

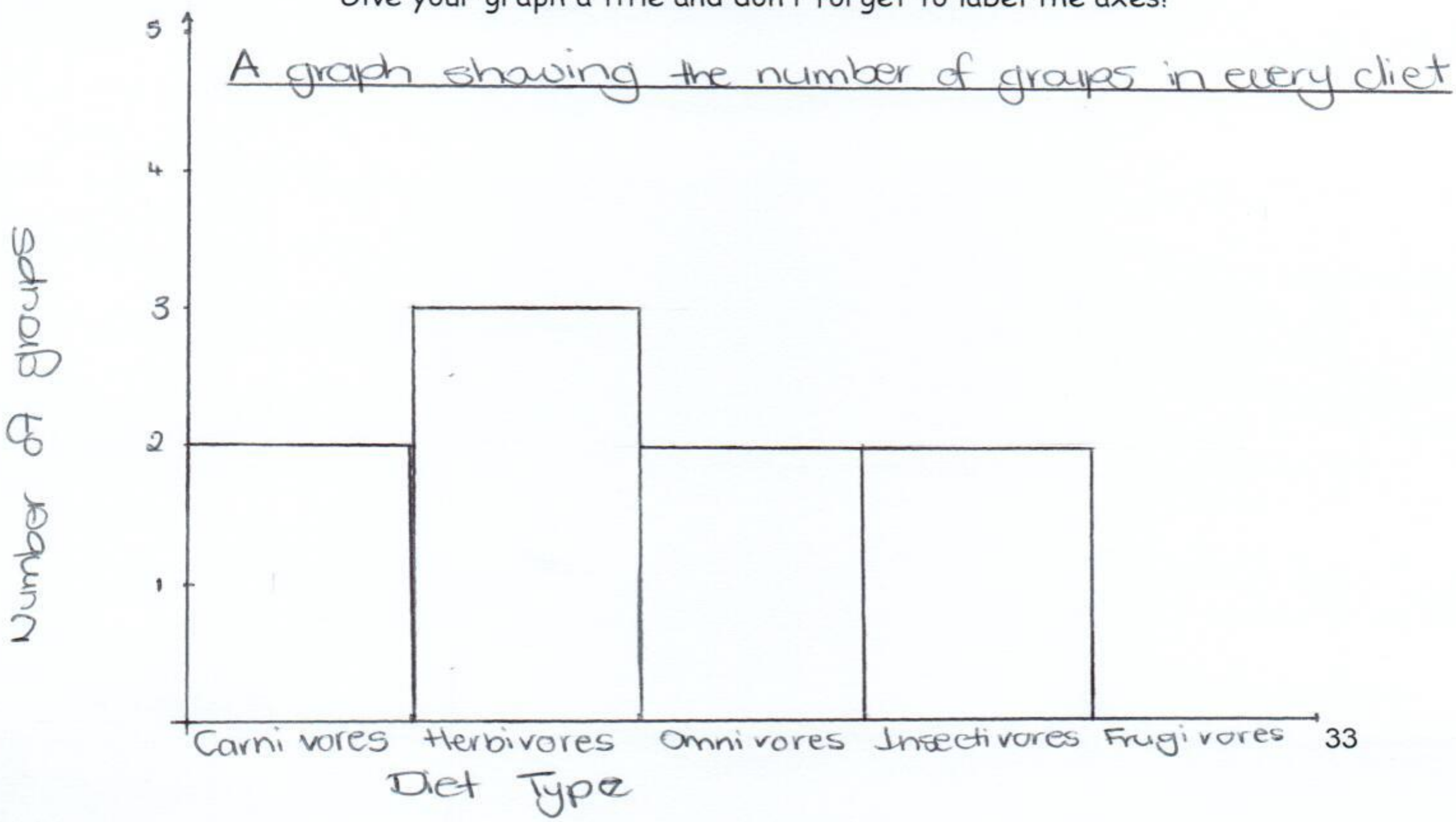
Catchments and Animals Activity Sheet - Animals and the Environment

Using the list of animals and the notes you made in Animal Diversity activity, group the animals you saw according to which feeding category you think they fall into. Count how many different animals you saw in each category.

Remember:
Herbivores – Eat mainly plants (both trees and grass)
Carnivores – Eat mainly meat
Omnivores – Eat plants and meat
Insectivores – Eat mainly insects
Frugivores – Eat mainly fruit

Draw a bar graph to show the number of animals in the different groups. Compare this bar graph to the one you drew for the previous activity.

Give your graph a title and don't forget to label the axes!



Extension Activities

These activities have been designed to extend or further entrench the concepts and skills introduced in this booklet.

A - Drawing graphs

Using the data generated through the Soil Activity - proportions of the different layers in soil - draw two graphs to represent your data.

A **Pie Graph** (also called a Pie Chart) is a circular chart divided into sectors, illustrating numerical proportion.

A **Bar Graph** (also called a Bar Chart) is a graphical display of data using bars of different heights. Bar Graphs are good to use when your data is in **categories** (such as animal groups!) and allows us to compare groups of data andto make generalizations about the data quickly.

PieGraph – show the proportion (%) of the different layers in your first sample.

Bar Graph 2 – Show the proportion (%) of sand in each of the different samples.

- What do the graphs tell you about the soil samples you collected?
- Can you tell if there is a relationship between the proportion of the different layers and the plants growing on the surface?

Give your graphs titles and don't forget to label the axes!

Pie Graph (illustration)	**Bar Graph** (illustration)

B - Soil particle size distribution & Stoke's Law

Sand, silt, and **clay** are the three particle sizes of mineral material found in soils. **Sand** is the **largest** sized particle, **Silt** is **medium** sized, and **Clay** is the **smallest.**

The **amount of each size particle** (sand, silt, or clay) in the soil is called the **particle size distribution**. Knowing the particle-size distribution of soil helps us understand many properties of soil such as how much water, heat, and nutrients the soil will hold, how fast water and heat will move through the soil, and what kind of structure, bulk density and consistency the soil will have.

Soil texture is the way soil feels.

A mixture of dispersed soil particles in water is called a **suspension**. How quickly (or slowly) mineral particles settle out of a suspension is called the **settling rate** and depends on the size of the particle. Large particles settle out of suspension more rapidly than small particles.

Velocity is the speed of something in a given direction and can be used to describe how quickly (or slowly) the particles settle out of solution.Large particles settle out of suspension more quickly than small particles; small particles settle at lower velocities.

Analytical techniques based on the relationship between particle size and settling rate allow quantification of particle size distribution.

The connection between particle size and settling rate is expressed by **Stoke's Law**, which shows that small particles settle more slowly than large particles.

Stoke's Law and sedimentation principles are useful in understanding soil erosion: moving water maintains particles in suspension that would otherwise settle. Fast moving water can transport even very large particles, but as water flow slows, first sand particles and then silt are deposited. These deposits can bury an existing surface,alter subsequent water flow patterns, and reduce reservoir capacity.

Advanced Vocab!
Velocity (V)
Diameter (D)
Gravity (g)
Density (d)
Viscosity (n)

C - Soil is a filter

- What is a filter?
- Can soil be a filter?
- Do all soils work the same?

Filter - A porous device for removing impurities or solid particles from a liquid or gas passed through it (such as a coffee filter or a tea bag).

Hypothesis -A tentative explanation for an observation, phenomenon, or scientific problem that can be tested by further investigation.

Formulate a hypothesis to answer the questions posed above!

Percolation Rate

Soil can filter particles out of water that passes through it. Different types ofsoils have different abilities to filter pollutants out of water. Soil that is fine (small particles) willbe able to trap more sizes of pollutants than soil made of large particles.

Slow flowing water is more likely to go through (penetrate) the surface ofthe ground and pass through the soil. The slower the water passes through the soil, themore particles will be filtered out.As run-off and pollutants in water percolate through soil, particles are trapped within the soil where they are stored, resulting in cleaner water.

The rate at which water passes through soil is called the **percolation rate**.

Activity (groups)

<u>Equipment list</u>

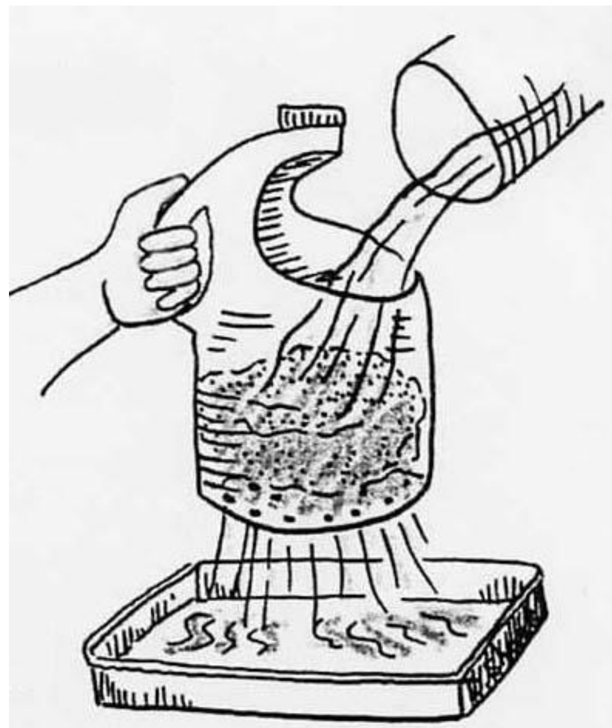
- Bags or containers for collecting soil
- Soil samples (several different types/from different areas)
- A nail
- A large funnel
- Several pans/baking trays
- Scissors
- Water (cloudy or coloured water, you could use food colouring!)

- 1 plastic jug or container for each soil sample collected
- 2 glass/plastic containers for each soil sample collected

Method

Getting Ready

1. Punch many small holes in the bottom of each plastic jug/container (one for each soil sample collected). Cut out a section of the top of each bottle (see illustrations)
2. Rinse out the empty containers
3. Collect soil samples. Try to find different types of soil, such as sandy, clay, humus or loamy soils
4. Fill each plastic container half-full with soil. Label each with the soil type (sand, clay, loam, gravel, humus)



Humus - The organic component of soil, formed by the decomposition of leaves and other plant material by soil microorganisms!

The Experiment

1. Place the soil-filled jug over an aluminium tray/pan and pour a glass container of water on the soil
2. Collect the water that drains through the holes in the bottom of the jug in the tray. Use the funnel to transfer the drainage from the tray to the second glasscontainer. Label the container with the soil type
3. Repeat the experiment for the other soil samples and record your findings.

- Which soil type filtered the waterbest?
- Why do you think some soils filtered better than others did?

A samplewith fine particles that lie close together and one with a tangle of roots in thesoil should be better filters than a loose sample with large particles and lots ofair spaces.

- Pour the dirty water over each of the soil samples again. Record your findings. Does the water eventually become clear?

Water clarity- The depth to which light penetrates water. Rate the clarity of the water before and after it has drained through the soil:

1 = cloudy

5 = clear!

	Sample 1	Sample 2	Sample 3	Sample 4
Soil type				
Water clarity – before pouring				
Water clarity – 1^{st} pour				
Water clarity – 2^{cd} pour				
Water clarity – 3^{rd} pour				
Water clarity – 4^{th} pour				

In nature, rain washes loose soil off construction sites, a bare spot on the lawn orploughed farmland. We call this process **erosion**. Eroded soil eventually ends up as sediment in our waterways; a form of nonpoint source pollution. It clouds thewater,chokes fish and other animals, blocks sunlight that aquatic plants need togrow and makes it harder to clean up our drinking water.

What can we do to prevent soil erosion?

When water runs downhillover the ground surface, it will carry loose soil and pollutants. If there isn't timefor the water to soak or percolate into the soil, erosion and sediment become aproblem. We can reduce the amount of loose soil by controlling erosion and sediment fromnew construction sites and by caring for indigenous groundcover.

Think of and research ways contractors, road builders and homeowners can preventnonpoint source pollution (what is nonpoint solution?). Write your findings in the form of a guide that gives practical ways to reduce erosion and nonpoint source pollution!

D - Make a wheel intercept

A different activityto assess grass basal cover(groups)

Equipment list

- Wheel intercept
- Pencil, activity sheets/paper
- Data sheets
- 3 m tape measure
- Clip board

Make your own Wheel-intercept

You will need 1 old bicycle wheel, short nails, 1 short piece of metal or wood that will fit through the middle of the bicycle wheel, and 2 long pieces (the same length) of wood or metal.

Take an old bicycle wheel and take the tyre off. Get some short nails and get someone who can weld to attach one nail on where each spoke joins the outside of the wheel. Put the short piece of wood/metal through the middle of the bicycle wheel so that the wheel spins on it. Attach the end of one long piece of wood/metal to one end of the short piece and attach the other long piece to the other end. Then join the remaining ends of the two long pieces of wood so that you have an isosceles triangle.

Now choose one of the nails and paint it and the wheel spoke it is connected to red. Find the nail directly opposite it and paint that red also.

Now you are ready!!

Drawing of a wheel intercept

Front view

Drawing of a wheel intercept

Side view

The Experiment

Find an area of grassland in one of your local catchments.

1. Choose one person to be the scribe, one to be the measurer and one to be the wheeler
2. The wheeler takes the wheel point by the handle and rolls it through the grass until one of the red nails is touching the ground. This is the starting point
3. Write down if the nail is touching soil or grass
4. The measurer then measures the distance from the red nail to the closest grass tuft and the scribe writes this down. If the nail is touching grass then the distance to the nearest tuft is 0
5. The measurer then measures the diameter of this grass tuft and the scribe writes this down too
6. The wheeler then pushes the wheel intercept until the next red nail is touching the ground
7. The measurer and the scribe then repeat the two measurements they did before
8. Do this 30 times.

Calculating…..

- *Proportion grass*

  Count the number of times the wheel landed on grass then divide this by the total number of times you recorded data (30 in this exercise) then multiply by 100

  Proportion grass % = (no of hits on grass / total number of hits) * 100

- *Average distance to tuft*

  Add up all the distance to nearest tuft measurements you collected and divide them by the total number of measurements (30 in this exercise)

- *Average tuft size*

  Add up all the tuft diameter measurements you collected and divide them by the total number of measurements (30 in this exercise)

E - Averages and sample size

Both the 'Toe to Tuft' and 'Wheel Intercept' methods of estimating grass basal cover asked you to repeat the method 30 times and then calculate an average 'distance to tuft' and average 'tuft size'.

Why do you think 30 measurements are required?

Using the data from your experiments, calculate the average 'distance to tuft' and 'tuft size' using only the first 3 measurements. Are the average 'distance to tuft' and 'tuft size' very different using only 3 measurements compared to using 30 measurements?

Remember:

Average =sum of all the measurements / total number of measurements

Complete the table below and chart you results on a **line graph** of average 'distance to tuft' versus the number of measurements.

A **line chart** or **line graph** is a type of chart which displays information as a series of data points connected by straight line segments.

Give your graph a title and don't forget to label the axes!

- What happens to the average as the number of measurements increases?
- What do you think would happen if you increased the sample size to 60 measurements?

To be confident that your survey results are representative of the actual (or true) situation, you must have a sufficiently large sample size.

The larger the sample size, the more accurate/representative the estimated average is of the true average!

Number	Distance to nearest tuft (cm)	Average distance to nearest tuft (cm)	Tuft diameter (cm)	Average tuft diameter (cm)
E.g.	*14*	*14/1=14*	*3*	*3/1=3*
E.g.	*5*	*(14+5)/2=9.5*	*7*	*(3+7)/2=5*
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
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21				
22				
23				
24				
25				
26				
27				
28				
29				
30				

F - Plant identification and dichotomous keys

Take a closer look at the grass tufts you found during the 'Toe to tuft' and/or 'Wheel intercept method' and the quadrat activities.

- Did you notice different grasses?
- Do you recognize the different grass species?

See if you can complete the table below using the knowledge you have of your local grasses. Think about what the different grasses are used for in your catchment. Are there animals that eat the grass? Do people use the grass in their own homes? How? Have the types of grasses changed or how grasses are used changed?

Share what you know about the grasses in your catchment!

Grass	Local name	Scientific name	Use
1			
2			
3			
4			
5			
Notes/observations/comments!			

Often it is difficult to tell the difference between different types of grasses, or animals or rocks! Dichotomous keys can be used to help determine the identity of unknown items. A **dichotomous key** is a tool that scientists use to help identify a particular specimen. The specimen could be a chemical that is identified by its physical properties, an insect identified by its markings and traits, or even a rock sample based on its different properties.

The term dichotomous begins with the prefix of "di" which means two. **The dichotomous key** is made up of pairs of descriptions or questions. By continuing to answer simple yes or no questions or descriptions, the user is eventually led to the name of the organism.**A dichotomous key always gives two choices in each step.**

Activity

Look at the drawings on the next page and followthe dichotomous key below to identify the creatures. Choose one picture and answer the questions about that picture only until you find the solution. Always start with number one and follow the instructions until you reach the solution.Then move on to the next picture. Keep a record of what you find.

Dichotomous Key

1.It is a plant...go to number 8
It is an animal...go to number 2

2. It has a hard outer shell...go to number 3
It has an internal skeleton...go to number 4

3. It has three main body parts (head, thorax, abdomen) and six legs.................... *insect*
It has two main body parts (head and abdomen) and eight legs..…………..……...*spider*

4. It lays eggs...go to number 5
It gives birth to live young and has hair..*mammal*

5. Ithas wings ....*bird*
It does not have wings. ....go to number 6

6. It has scaly leathery skin and lives on dry land..*reptile*
It lives in water at least part of its life...go to number 7

7. Ithas scales, fins, and cannot breathe air ....*fish*
It is born in the water and matures to breathe air……………………………...*amphibian*

8.It has a tall woody trunk...*tree*
It has a soft green stem and a showy blossom for making seeds.........................*flower*

Creatures

Drawing	**Answer**
(Lady bug drawing)	1)
(Spider drawing)	2)
(Mammal drawing)	3)
(Bird drawing)	4)

(Fish drawing)	5)
(Flower drawing)	6)
(Lizard/reptile drawing)	7)
(Tree drawing)	8)
(Frog/amphibian drawing)	9)

References and Resources

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