Social Studies

A Curriculum Companion for Teaching Environmental Education in Eritrean Elementary Schools

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Contents

1 Introduction

This book has been produced as part of the Elementary Schools Environmental Education Initiative in Eritrea (ESEE Initiative). The purpose of the initiative is building the capacity of elementary students to understand and respond to the environmental issues which confront Eritrea, so that they can appropriately contribute to a more sustainable future.

The goal of the project is to ensure that Eritrean children have equitable access to quality educational experiences, which address relevant environmental, health and hygiene education issues. Towards this goal, a range of materials has been produced for use in Eritrean classrooms and by other stakeholders in the schools' community.

Specifically, these materials have been designed to:

1. Improve the knowledge, attitude and skills of elementary school children on environmental issues. To promote health and good hygiene behaviour, thereby ensuring that the children can demonstrate capacity to prepare for and manage the country's environmental issues.
2. Train teachers so that they can appropriately use the materials. In particular, the teachers will be supported to apply child-centred inquiry learning approaches that improve quality of teaching and decrease student drop outs.
3. Strengthen the capacity of PTA and community members to play key roles in preparing for and managing the environmental conditions.

2 Using the Environmental Education Curriculum Companion for Social Studies

This book has been designed to help Social Studies teachers in Eritrean Elementary Schools deliver their curriculum and meet their teaching objectives. At the same time, it introduces students to Environmental Education.

These materials are not intended to be additional to the requirements of the textbooks and teacher guides. Instead, they offer alternative ways of teaching parts of the curriculum that teachers may choose to use.

The alternative lessons offered here all include interactive child-centred activities that also contain environmental messages which help strengthen students' understanding of the environment and environmental issues.

Overview

The Environmental Education Curriculum Companion for Social Studies has four main parts.

1. Activities for you to use in your classroom together with background information so that you know more about the topic you are teaching.
2. Strategies to improve your teaching so that it is more effective and more child-centered.
3. Toolbox contents and maintenance.
4. More information about Environmental Education.

Getting Started

- Read through the activities, looking particularly at those for the grades you are teaching.
- If you are not used to working in groups it is a good idea to read the section on Working in Groups (page 57) before you start any activities.
- When you are next teaching a topic in the curriculum which relates to the environment, try out one or two of the activities. Make sure you read the background information before you do the activities.
- Either before or after the activities, read more about the philosophy of Environmental Education and what the activities have been designed to achieve. See pages 65-75.
- Reflect on how the activities went in your class and plan for how you will incorporate more of them into your teaching. Read more about how to make your teaching more effective. See pages 57-62.

Integrating the activities into your teaching

These activities can be used instead of some of the activities in your text book, or in addition to the activities in your text book.

They are designed to help students meet the learning outcomes set out in the Social Studies Curriculum They provide additional options for you to draw on when you are planning your classes. You don't have to do every activity in the book but you will probably find that the students like this approach to learning and will want to use many of them.

Assessment

Environmental Education is already part of the Social Studies Curriculum and does not need to be assessed separately for exam results.

Each of the activities includes ideas for formative assessment. There is more information about monitoring student progress on page 62.

The Toolbox

The Toolbox provides some practical resources to use in teaching Environmental Education. These resources can be used in all your teaching, not just on environmental topics. Use them wherever they are useful and relevant. For information on what is in the Toolbox see page 54.

See page 53 for information on how to use and maintain the Toolbox.

Overview of Environmental Education

Environmental Education is designed to engage students with issues and ideas connected to their environment. It encourages students to consider all aspects of the environment in an interrelated way and leads towards their being able to act in an environmentally sustainable manner. A more detailed description of Environmental Education is on page 74.

Student-centred learning is crucial to education for sustainability with a strong focus on encouraging higher-order thinking and self-direction by engaging students in authentic experiences related to sustainability issues.

The inquiry model is often used in education for sustainability, as it is student-centred and promotes investigation, action and reflection about issues of concern. Students are motivated to develop and apply knowledge by engaging with local issues of concern. They research to gather information including data, communicate findings and their ideas to others and use higher-order thinking skills by explaining and elaborating on the issues before evaluating and reflecting on them.

Activities 3

Environmental Education within Social Studies

Grade 4

Activities

Deforestation

The importance of forests

Background information

Trees naturally grow in a forest or woodland. There is much we can learn about our environment from the forests.

Forests and woodlands are rich in bio-diversity. They have many different types of trees, shrubs, small plants and grasses. They also contain many animals such as insects and birds. In an old forest the soil is usually quite rich. This is because over years, organic matter builds up in a forest and the soil remains covered and protected by plants like grasses and mulch. While there are many different insects and animals in a forest it is rare to see one species or insect, animal or plant take over. Widespread pest and disease problems are rare. This is because the ecosystem is in balance.

Eritrea had many types of forest and woodland in the past. These included:

- highland forest
- mixed woodlands
- bush or shrub vegetation
- grasslands to wooded grasslands
- riverine forest and
- mangroves
-

Within these forests are many different kinds of trees. Many of these trees are useful to people. All of these trees have important roles in the environment and in their ecosystems. It's important to replant these indigenous trees of Eritrea. They are well adapted to our environment. **Our indigenous trees are a great resource for Eritrea.**

What is desertification?

Desertification happens when land which has been able to support people gradually turns into desert. It is a process that occurs in dry and fragile ecosystems. It affects topsoil, earth, groundwater reserves, surface runoff, animals, plants and humans too. Desertification causes soils to erode and disappear. There is less water. The number of plants and animals which can live on the land is reduced. This makes it harder for farmers to make a living and results in increased poverty.

Combating desertification in Eritrea

Eritrea, as part of the sub Saharan world, is directly effected by desertification and it is because of many natural and human causes. These include climatic conditions, deforestation, over-grazing, over-cultivation, soil erosion, and decline of soil fertility. The cultivated cropland of Eritrea is approximately 23% and it is the key resource which needs to be protected

Photo courtesy of Ministry of Agriculture

Soil erosion in Eritrea

from desertification or land degradation. According to the country assessment report on sustainable development, the annual net rate of soil loss from the croplands of Eritrea is estimated at 12 tons/ha and crop yields are declining at an average rate of about 0.5% /annum owing to soil loss alone.

Much of the country's land is composed of hilly and mountainous terrains with steep slopes. These features make the land very vulnerable to excessive land degradation. Records show that about 30% of the country's land mass was covered by forest a century ago. This percentage is now dramatically lowered to less than 1%. The main causes for this catastrophe include the long struggle for independence, the impact of human settlements, which led to overuse of trees for different purposes, and clearing of forests for agriculture. A contributing factor has also been unfavourable climatic conditions.

What can be done about desertification?

There are a number of steps which can be taken to reduce desertification:

- ***Improve soil fertility*** – the fragile soil needs to be built up with organic material. The cheapest and most effective way to do this is with compost. The *Green Clubs Manual* contains information on making compost. Land can also be left unused for one season or more and allowed to rest.
- ***Reduce the effect of wind*** – wind blows away fragile soil. You can reduce the effect of the wind by terracing and by planting trees which act as a wind break.
- ***Reduce water erosion*** – although Eritrea is a dry country, the rains when they come are often very heavy. Because the topsoil is loose, the sudden rush of water can cause erosion. Your *Green Club Manual* gives practical activities for reducing erosion.
- ***Plant trees*** – planting trees, or reforestation, is one of the best things you can do to reduce desertification. Planting indigenous trees is recommended.
- ***Eliminate over-grazing*** – reducing the number of animals grazing in an area will help plants to establish. This helps in reducing erosion.

Activity 1: Defining Deforestation

Time: 30 minutes

Purpose:

- To define the term '*Deforestation*'
- To ensure all students have the same understanding of the term *Deforestation*

What you need:

- Paper for students to write on

What to do:

Steps:

1. Divide the class into groups.
2. Write the term '*Deforestation*' on the board.
3. Give each group a piece of paper to write on.
4. Tell the students they are going to write a definition for the term '*Deforestation*'. They must answer the question- '*What is Deforestation*?'
5. The paper is passed from one student to the next in the group. As the paper is passed each student writes a word or sentence about what deforestation means. (Students do have the right to pass if they cannot think of anything).
6. Set a time limit for this activity. Ten minutes should be enough.
7. When the time is up or all the groups have finished, the groups share their ideas with the class. Ask each group in turn to read out 1 idea and the teacher lists these on the board. As ideas are listed if other groups have the same ideas they cross them off their list. Keep asking groups in turn for their ideas until all ideas are listed on the board.
8. The class discusses the ideas and organises them into a short 2 or 3 sentence definition.
9. This is written onto a large sheet of paper and displayed in the room for future reference.

Activity 2: Deforestation - Cause and Effect

Time: 40 minutes

Purpose:

- To identify the causes of deforestation
- To identify the effects of deforestation

What you need:

- A large sheet of paper for each group

What to do:

Steps:

1. Divide the class into groups.
2. Ask each group to copy the following *Cause & Effect* diagram onto their paper. Groups will have more than one cause and effect written on their paper.

Deforestation

Cause	Effect
Why did it happen?	What is the consequence?

3 Students write the ***Causes*** of 'Deforestation' and the ***Effect*** it had. This can be positive or negative. Students can have as many '*Causes*' and '*Effects*' as they can think of.

4. The reporter from each group presents the groups ideas to the class.
5. When the groups have finished the *Cause & Effects* charts are displayed in the room.

Extension:

Teacher could collate all ideas onto one sheet of paper, the main causes and effects identified by the students.

Assessment ideas:

- Note how students work as a group (See the section on *Working in Groups* on page 59).

Activity 3: Deforestation- PMS (Plus Minus Solutions)

Time: 40 minutes

Purpose:

- To consider why trees are cut down
- To consider the negative / impact of deforestation
- To think about ideas to deal with or other ways to think about deforestation

What you need:

- A sheet of paper for each group
- 3 large sheets of paper to record class ideas- *'Plus', 'Minus' & 'Solutions'*

What to do:

Steps:

1. Divide the class into groups.
2. The teacher gives each group a sheet of paper and asks them to draw the following table on their paper.

Plus Why are trees cut down?	**M**inus What is the downside to deforestation?	**S**olutions What can be done to reduce deforestation?

3. Students look at the *'Cause & Effect'* information they presented in the last lesson.
4. Students list the ideas under either *'Plus'* or *'Minus'*.
5. Once this is completed the students then look at the '*Solutions*' column. In this column they can think creatively about things that can be done to help the situation. They may list ideas that have been already done in their area but it is also good to encourage students to come up with their own new ideas and thoughts on deforestation.
6. Each group shares their solutions for class discussion. Teacher could prompt the discussion with the following questions: Who could you approach to suggest this solution? What would they do? Which of these solutions could you do?
7. Conclusion: Reflection time (Think Time) Teacher asks the questions: *'What did you learn?' 'Why is it important to know about this?'*
    - The teacher gives the students 1 or 2 minutes to think quietly about what they learnt.

- Students share what they learnt. Not all students have to share but make sure a range of students do share. Good students and weaker students.

Assessment ideas:

- Note how students work as a group (see the section on *Working in Groups* on page 59).
- Note students who show particularly creative ideas.

Activity 4: Where Do You Stand?

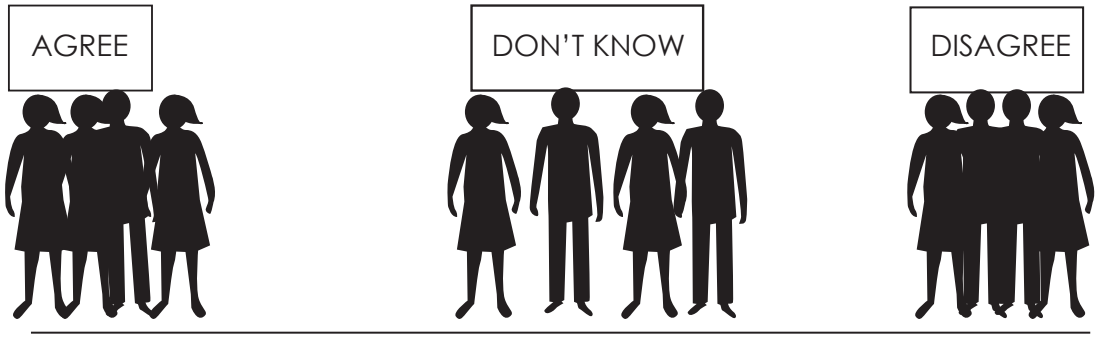
Time: 20 minutes

Purpose:

- To develop individual ideas and thinking
- To think critically about deforestation
- To encourage students to express their opinions

What you need:

- 3 pieces of cardboard to be used as signs: 'Agree', *'Disagree'*, and '*Don't Know'*
- Space (move desks or go outside)



What to do:

Steps:

1. Place the signs- '*Agree', 'Disagree'* & *'Don't Know'* in different corners of the room.
2. The teacher asks the students to stand in the middle of the room.

   Read out some statements and ask the students to move to which ever area they choose. If they *'agree'* move to that sign, if they *'disagree'* they move to that sign and if they '*don't know'* they move to that sign.

Some possible statements to ask students:

- *Deforestation does not involve me.*
- *Logging is bad for the environment.*
- *I am eager to help plant more trees.*
- *Deforestation is not really a problem in Eritrea.*
- *Looking after people is more important than looking after trees.*
- *The problem of deforestation is too big and we cannot do anything about it.*
- *It is important to save the trees for the animals.*
- *Trees can help protect our environment.*

3. This is not meant to find out how many people *agree* or *disagree* but for students to clarify their own opinion.
4. When students have positioned themselves and decided where to stand, ask a few student s to say why they decided to stand where they are. Students might have different reasons for their choice so it is important to get a range of ideas from the students.

Assessment ideas:

- Note students who are able to justify their opinions.
- Note students who are able to justify their opinions with clear thinking and clearly articulated ideas.

Activity 5: The investigator

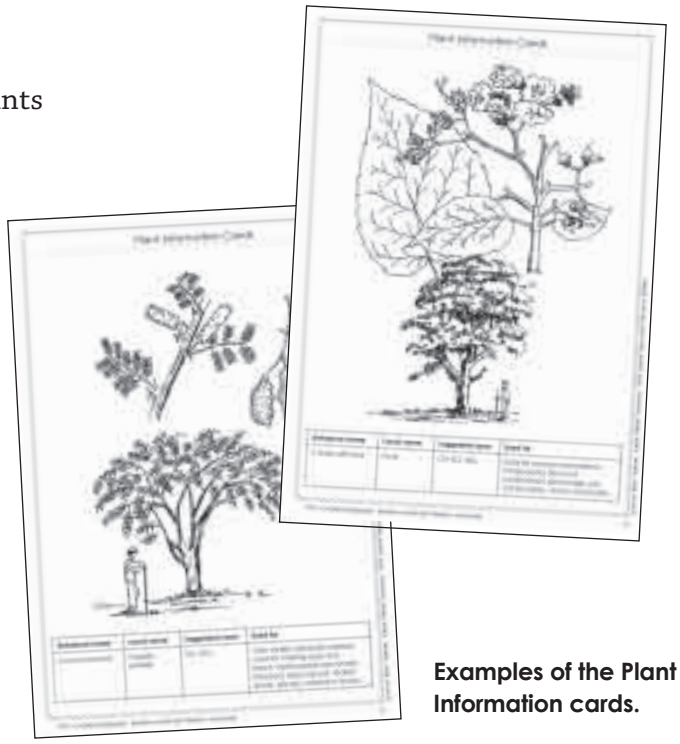
Time: 40 minutes

Purpose:

- To investigate traditional uses of plants

What you need:

- Paper
- Pencils
- **Toolbox:** Plant Information Cards
- **Toolbox:** Book - *Medicinal Plants*



Examples of the Plant Information cards.

What to do:

Steps:

1. Brainstorm some plant types that may be found in the school compound or in the area around the school.
2. Student read the Plant Information Cards or use local knowledge to research uses of the different plants.
3. Discuss the value of the different plants.
4. Students record the plants and their uses on a table. For example:

Name of plant	**Uses of the plant**						
	Firewood	Construction	Fodder	Tools	Food	Medical	Charcoal
Albizia amara	x		x	x		x	x
Anogeissus Leiocarpus	x					x	x

5. Examine the uses of each plant from the table. Students can make a priority list of the trees and their usefulness to their community.
6. See if students can locate any of these trees in the school and/or in their community.

Ideas for Extension:

- Students can work with the Ministry of Agriculture to plant some of these trees in the school compound or in a regeneration area in the community.
- Students can also work with the Ministry of Agriculture to grow the trees from seed and sell them, or give each student a tree to plant at their home.

Activity 6: Deforestation- Report

Time: 40 minutes

Purpose:

- To define the term '*Deforestation*'
- To ensure all students have the same understanding of the term '*Deforestation*'
- To understand the causes and effects of '*Deforestation*'

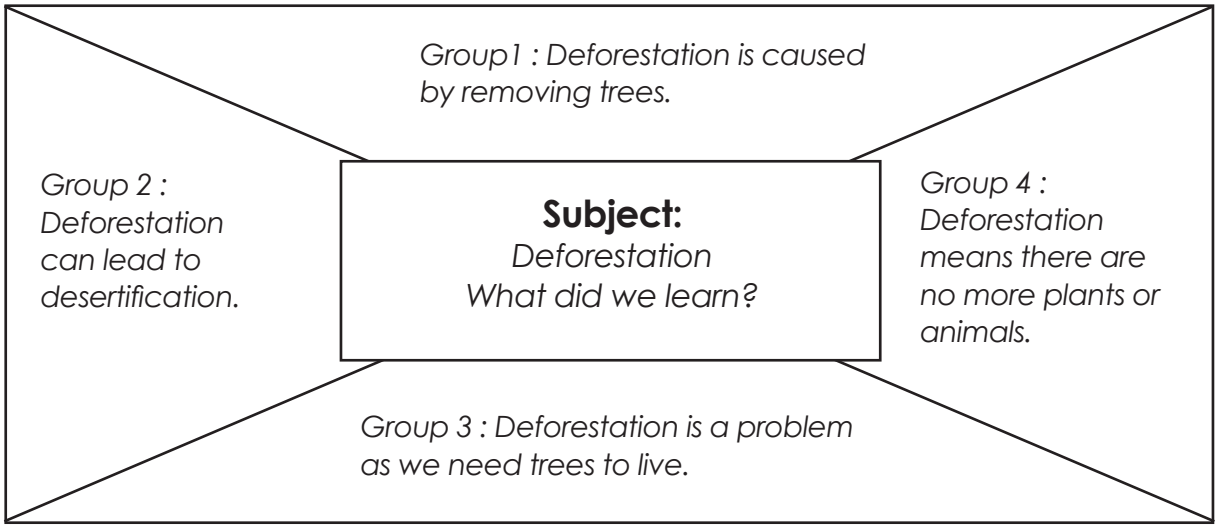
What you need:

- Paper for students to write on
- **Toolbox:** 10 copies of the Deforestation Information cards. See example on page 20.

What to do:

Steps:

1. Divide the class into groups.
2. Give each group a copy of the Deforestation Information card.
3. Students read the information.
4. Each group then draws up a '*Place Mat*' to record the information they have learnt about deforestation. Students should do this without looking at their notes from previous lessons. See how much they remember before giving them any help.
5. Once students have done the group '*Place Mat*' ask them to decide the information they want to put on the class '*Place Mat*'. Each group should decide on one or two points to go on the class '*Place Mat*' .



Example of how students could fill in the class Place Mat.

6. Using the information from the group '*Place Mat*' students organise the information into a report*.

   - Which information goes together to make paragraphs?
   - What order should the paragraphs go in?
   - What is the topic about? What should go in the introduction?
   - What do we need to say at the end? How do we summarise?

Teaching note:

Place Mat

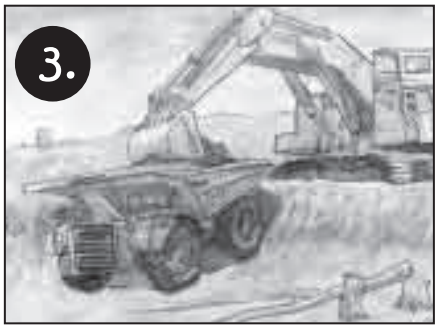
- The Place Mat is drawn on a large sheet of paper. The page is divided so that each group member has a section to write in. Put a square or circle in the middle to record the title.
- Students are given an issue, topic or question to consider and they begin the process by considering their responses and ideas.
- Responses are recorded in their section of the Place Mat. Students share their ideas.

*Report Format: Reports often have three main parts:

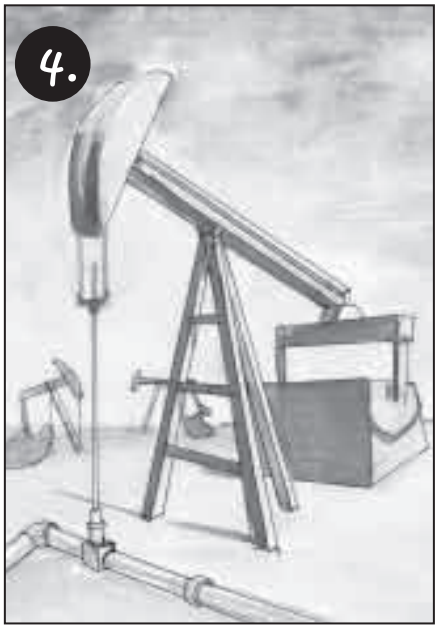
- **Introduction:** to tell readers the topic and describe what the report will focus on about with regard to the topic.
- **Detailed facts:** organised under headings and in paragraphs. It can also have diagrams, photographs, maps and charts with labels and captions.
- **Conclusion:** is a summary of what the facts say about the topic.

Deforestation

Deforestation is the cutting down, clearing, burning and removing of trees from the land. There are many reasons that trees are cleared from the land.



1. Sometimes the trees are cut down because people want wood to build houses or they need wood for cooking.
2. People cut down the trees so they can build villages and towns.
3. Trees are sometimes cut down so that people can mine for gold or tin, iron ore and some other things.



4. People sometimes want to look for gas and oil so they cut down trees.

5. People need food so they cut down trees to make farms for cows or to plant crops.

What are the consequences of deforestation?

Environmental:

1. Extinctions: plants, insects and many animals disappear forever.
2. Animals lose their homes.
3. When trees and plants are removed, the rainwater washes the soil away. This is called 'erosion'.
4. Places can turn into deserts. They become hot and dry. This is called 'Desertification'.
5. The climate can change and animals can die.
6. Trees are important for absorbing carbon dioxide. Increasing levels of carbon dioxide are creating a change in our climate.

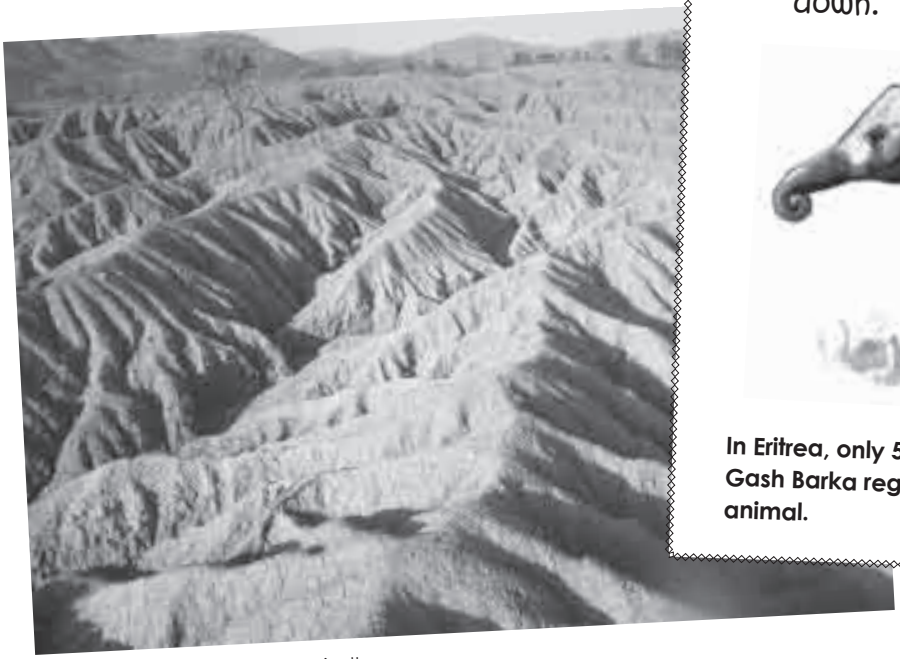


Photo courtesy of Ministry of Agriculture

Social impacts:

1. Loss of culture. People who live in forest areas depend on the natural environment for food, shelter, materials for cooking, clothing, etc. If the forest is cut down or if their environment becomes polluted from oil extraction and mining, they are forced to move or risk starvation and sickness.
2. Displacement of people (loss of farmland, forest resources, etc).
3. Social conflicts and struggles over land and natural resources.

Did you know?

- Tropical forests cover only 6-7% of the earth. They contain over half the world's plants and animals.
- Every second 1 hectare of forest is being cut down.
- This means that every minute 60 hectares of forest is being cut down.

In Eritrea, only 50-100 elephants are left in the Gash Barka region. They are an endangered animal.

Grade 4

Activities

Water

Water cycle theory

Water is one of the most basic of human needs. Without water, life could not exist. It is the most valuable resource on Earth. Earth's water is always in movement, and the water cycle, also known as the hydrologic cycle, describes the continuous movement of water on, above, and below the surface of the Earth. Since the water cycle is truly a 'cycle,' there is no beginning or end. Water can change state among liquid, vapor, and ice at various places in the water cycle, with these processes happening in the blink of an eye and over millions of years.

Rainwater soaks into the ground, runs off the land and flows into streams, rivers, lakes, ponds or into the sea. The sea, oceans lakes or other surface waters are heated by the sun and water (vapour) rises up into the atmosphere to form clouds. When it rains again the process starts all over again. As shown in the illustration, the water cycle consists of the following:

1. Transpiration

Plants draw water in at the roots where it moves up to the leaves and then evaporates. This process is called **transpiration** and is responsible for much of the water that enters the atmosphere. If plants are removed, particularly trees, then this part of the water cycle is disrupted, there is less transpiration and therefore less rain.

Water Facts

- Water covers 75% of the Earths surface, so we really are a water planet.
- Over 97% of Earth's water is salt water.
- 2% is stored in glaciers and icecaps.
- 1% of the Earth's water is freshwater stored in groundwater or surface water.

2. Evaporation

Energy supplied by the sun helps water to rise up (**evaporate**) from water surfaces such as lakes, seas and oceans, into the atmosphere. (Note that rainwater is always fresh and not salty).

3. Condensation and rain

These drops of water in the atmosphere form (**condense**) into clouds. The sun also provides the energy which drives the weather systems to move the water vapor (clouds) inland (otherwise, it would only rain over the oceans). Once water condenses, it gets heavier, gravity takes over and the water is pulled to the ground as rainwater.

4. Runoff and infiltration

Rainwater runs off the land and flows into oceans, lakes and rivers. Rainwater can also

soak into the soil, subsoil and rock to become groundwater. The water moves down into the ground because of gravity, passing between particles of soil, sand, gravel, or rock until it reaches impervious rock. This area becomes filled, or saturated with water. This groundwater may be very near the ground's surface or it may be hundreds of feet below. Wells that are sunk in the ground tap into this groundwater, or sometimes groundwater makes its way to the surface and forms a spring.

5. Groundwater

Most groundwater is clean, but it can become polluted, or contaminated. It can become polluted from sewage, or when people apply too much fertilizer or pesticides to their fields. When pollutants leak, spill, or are carelessly dumped on the ground they can move through the soil to contaminate the water. Because groundwater is deep in the ground, groundwater pollution is generally difficult and expensive to clean up. Sometimes people have to find new places to dig a well because their own becomes contaminated.

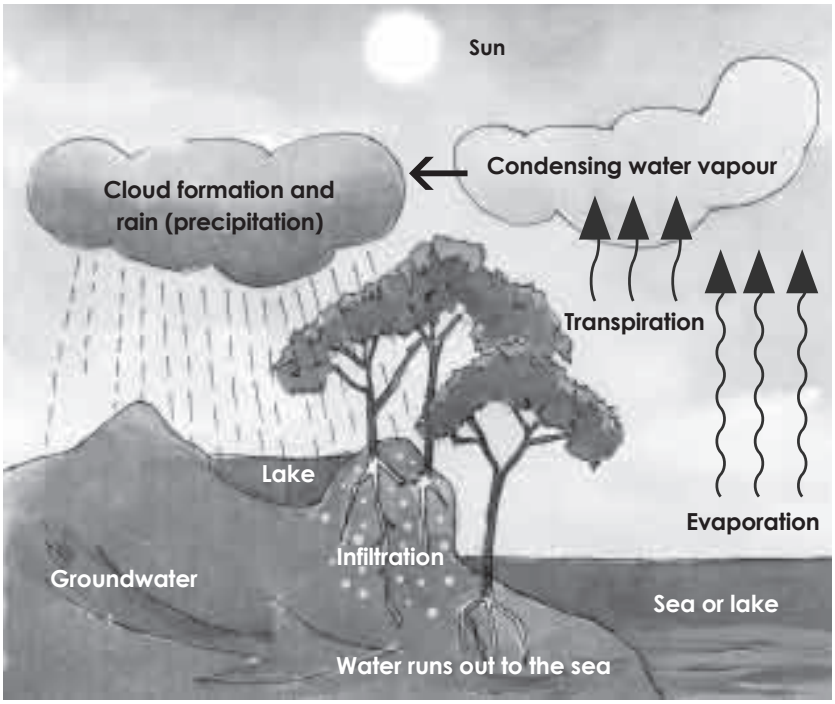
6. Storage

Huge quantities of water are stored in rivers, oceans, lakes and glaciers.

The Amazing Water Cycle

Did you know that the water in your glass could have been in a puddle that a dinosaur stepped in 65 million years ago? How is that? It's because of the water cycle, the process that describes water's constant movement from the Earth to the sky. Another name for the process is the hydrologic cycle. 'Hydro' means water.

The amount of water on Earth remains about the same, and it's been here since the planet formed billions of years ago. Water constantly changes form. Sometimes it's the liquid we drink and swim in. Sometimes its frozen solid like snow and ice. Other times it's a gas called water vapour. You've seen water vapour in the steam from a kettle. Water's ever-changing states allow it to move from the ground to the clouds and back to Earth as rain. The Sun drives the process, recycling the same water over and over. That's how *a dinosaur's* puddle could end up in your glass.



Activity 1: A Drop in a Bucket

Time: 40 minutes

Purpose:

- To calculate the amount of fresh water on the Earth.
- To understand that there is a limited amount of fresh clean water on the Earth and that we must look after it.

What you need:

- 1000ml, 100ml & 10ml containers, a metal container e.g. a metal bucket, eye dropper.
- Map or world globe.

What to do:

Steps:

1. Ask the students were water can be found on the Earth. Write the answers on the board.
2. Tell the students they are going to calculate the amount of fresh water on the Earth and compare it to the rest of the water on the planet.
3. Prepare the 1000ml, 100ml & 10ml containers, a metal container, eye dropper. Fill the 1000ml container with water. (use bottles or jars if you don't have proper containers and mark the measurements on them).
4. Show the students the 1000ml container of water then tell them that this represents all the water on Earth.
5. Refer back to the students list of where water is found and ask where most of the water is located. Pour 30ml of water from the 1000ml into the 100ml container. Tell the students that this represents earth's fresh water. About 3% of the total amount of water on Earth.
6. Put salt in the remaining 970ml. This is water found in the oceans. Humans cannot drink it.
7. The teacher asks students, what is at the earth's poles (use the map or globe). Almost 80% of the fresh water on Earth is frozen.
8. Pour 6ml of fresh water (from the 30 ml) into the 10ml container. The remaining 24ml represents fresh water frozen in ice caps and glaciers.
9. The 6ml of water represents non-frozen fresh water. Only 1.5ml of this water is surface water; the rest is undergroundwater.
10. Use the eye dropper and remove one drop of water, 0.003ml, from the 6ml. Drop this on drop into a metal container. Make sure the students are very quiet so they can hear

the sound of the drop hitting the bottom of the container. This drop represents clean, available fresh water on the Earth! This precious drop must be managed properly.

Activity 2: Water Cycle

Time: 40 minutes

Purpose:

- To develop an understanding of the water cycle.

What you need:

- **Toolbox:** water cycle picture cards
- **Toolbox:** large flip chart paper with a *Before* and *After* chart on it or the blackboard
- Paper for groups to write on

What to do:

Steps:

1. Divide the students in to groups.
2. Give each group some paper and ask them to draw a *'Before & After'* chart.

Before	After

3. Each group fills out the '*Before*' section of the chart by writing what they already know about the 'water cycle'.
4. The teacher puts the water cycle picture cards on the board for the students to see.
5. A reporter from each group reports to the class what their group knows about the water cycle.
6. The teacher records what the students say and asks what stage of the water cycle the students think their information is about. The information is recorded beside the appropriate picture card.
7. This information is displayed in the room for future reference.

Activity 3: Water Cycle- Definitions

Time: 40 minutes

Purpose:

- To develop an understanding of the water cycle.

What you need:

- **Toolbox:** Water cycle cards.
- **Toolbox:** 10 sets of definitions card of the stages of the water cycle.

What to do:

Steps:

1. Divide the students into groups.
2. Give each group a set of picture cards and definition cards.
3. The groups have to match the pictures with the definitions.
4. A reporter from each group reports to the class which definitions they matched with each picture.
5. As each group presents, the class can discuss if the definition is correct or not.
6. Conclusion:

   Reflection Time: (Think Time) Teacher asks the question: '*What did you learn?*'

   - The teacher gives the students 1 or 2 minutes to think quietly about what they learnt.
   - Students share what they learnt. Not all students have to share but make sure a range of students share. Good students and weaker students.
   - Students make up a poem, a song or a performance of the different stages of the water cycle.

Activity 4: Water Cycle- Drama

Time: 40 minutes

Purpose:

- To develop an understanding of the water cycle.

What you need:

- **Toolbox:** 10 sets of Water cycle picture cards.

What to do:

Steps:

1. Do a quick review of the water cycle with the class.
2. Give each student a water cycle card. They should not show their card to anyone.
3. Ask the students to imagine they are a water molecule at the different stages of the water cycle. They must imagine what they would be experiencing at their stage of the water cycle (what is on their card) as a water molecule.
4. Start: encourage the water molecules (students) to move around the classroom doing actions for their stage of the cycle and try to find other students at the same stage, i.e. students doing similar actions. Students cannot speak.
5. When all the water molecules have found each other the class then arranges themselves in order according to the different stages. Where does the water cycle start? What comes next?
6. Discussion: possible questions:
    - *How did the water molecules find each other?*
    - *Ask students to explain why they acted the way they did.*
    - *How do human actions affect the water cycle?*
7. In their groups ask the students to record what they learned in the *'after'* section of the *'Before and After'* chart.
8. Students share what they have learnt and the teacher writes this on the class '*Before and After'* chart

Assessment ideas:

- Note how each student participates in the drama. This will show their level of understanding.
- Note the students' explanations of the way they acted the way they did. This will also show their level of understanding.
- Have the students draw a water cycle diagram.

Activity 5: Aqua Bodies

Time: 40 minutes

Purpose:

- To appreciate that water is the main ingredient in living things.

What you need:

- Paper.
- Pencils.

What to do:

Steps:

1. Present the students with the following two scenarios; 2 people are stranded in the desert:
   - Person 1 has a basket of food including; dried meat, cake, bread, injera etc- enough for one month.
   - Person 2 has only water; enough to last one month.
2. Ask the students, *'Which one of the two will survive?'* Compare how long we can go without food (about 1 month) to how long we can go without water (about 3 days).
3. Explain to the students that the bodies of most living things are made up of at least 50% water. Display samples of fruits and vegetables and compare the water content in each.

Water content in selected foods	
Food	Percentage water
Pizza	49
Gelati (ice cream	61
Beef Liver	70
Bananas	74
Grapes	81
Oranges	87
Carrots	88
Tomatoes	94
Lettuce	96

4. Show the percentage of the vegetable that is water by cutting off a representative piece. E.g. carrots are 88% water, note the water did not spill out when the carrot was cut.
5. The teacher asks the students, '*Do you think humans have water in their bodies?*' Ask them to guess what percentage of their body is water.
6. The students are divided into pairs. Each pair is given a piece of paper. The students draw the outline of a human body. (The teacher might draw an example on the board).

7. The teacher explains to the students that about 65 – 70% of their body is water. For this activity make it 70%. (about ¾). The teacher can show this by cutting a square or circle into 4 pieces and taking away 1 piece.

8. The students are asked to show how much of the body is water by colouring 70% of the body they have drawn.

Teacher Note:

The best way is for the students to divide their bodies into 10 equal parts and colour 7 of the parts. E.g. Draw a line down the middle head to toe. Then divide the body into 5 parts horizontally.

9. These drawings could be displayed in the classroom with a few sentences from each pair about what they learned.

Assessment idea:

- Note what the students write about and what they have learned.

Activity 6: Water Conservation

Time: 40 minutes

Purpose:

- To identify where water in the area comes from.
- To identify how water is managed in the area.
- To identify potential water wastage / problems in the area.

What you need:

- Large flip chart paper or blackboard.
- Paper for students to write on.

What to do:

Steps:

1. Write the following 3 questions on the flip chart paper or blackboard, in 3 columns.

Where does our water come from?	How is water managed in our area?	How is water wasted in our area?

2. Divide the students into groups. Each group should discuss the questions and list their ideas under each question.

3. Each group shares their answers and the teacher writes them on the chart or board under the questions.

4. As a class discuss the information.

5. As a class discuss what extra information they want to find out and how/where they can find this information. (The ideas here is to get students thinking about using local resources/people to gather information).

6. Questions generation- each group then discusses and writes down the questions they have generated for research. Providing question stems for the students may help with question generation. For example:

   - What is / are ..... ?
   - Who is / are ..... ?
   - Why is /are ..... ?
   - What would ..... ?
   - How would ..... ?
   - How can ..... ?
   - Who can ..... ?
   - What will ..... ?

Teaching Note:

- The teacher may provide a *'Question Matrix'* to help students generate questions.
- The teacher makes sure that each group has different questions to ask.
- For the next lesson the teacher can organise local people to come and speak to the students about water management the area. This may be local people in the village, people from a local land management unit, the Ministry of Agriculture, or a local water management representative.

Drum under roof runoff downpipe for rainwater storage within schools

Collecting 'grey water' from hand washing and washing of dishes for use on a garden area

Students carrying water from home in plastic containers

What is?

How can?

	Event	Situation	Choice	Person	Reason	Explain
Present	What is/ are?	Where/ when?	Which is / are?	Who is/are?	Why is/are?	How is/are?
Past	What did?	Where/ When/ did?	Which did?	Who did?	Why did?	How did?
Possibility	What can?	Where/ when can?	Which can?	Who can?	Why can?	How can?
Probability	What would?	Where/ When would?	Which would?	Who would?	Why would?	How would?
Prediction	What will?	Where/ when will?	Which will?	Who will?	Why will?	How will?
imagination	What might?	Where/ when might?	Which might?	Who might?	Why might?	How might?

The question matrix can be used to help generate simple questions at different levels. Teacher generated or student generated. The grid can be cut into individual sections, strips at each stage or cut into 4 sections.

For example, for present – how much water is there currently in Eritrea?

Activity 7: Water Conservation Guest Speaker

The teacher should have organised for a guest speaker to come into the class to speak with the children and answer their questions about water management in the area.

Time: 40 minutes

Purpose:

- To gather information about water management in the area.

What you need:

- Student questions: each group should have a list of their questions generated in the last lesson.

What to do:

Steps:

1. The guest speaker can give a short talk on water management in the area.
2. Students can take notes on the information given.
3. Students can ask the guest speaker the questions they have prepared. They record the answers given.

Activity 8: Water Conservation / Water Management in the area – Taking this further

Time: 40 minutes

Purpose:

- To identify specific problems / issues in the area that the students can take action on.

What you need:

- Paper for each group to record problems.

What to do:

Steps:

1. As a class, from the information obtained from the guest speaker, brainstorm to identify specific local problems / issues with water. For example, is the water in our community

good quality water? If not, what can we do to improve the quality of water? The teacher records the ideas on the blackboard.

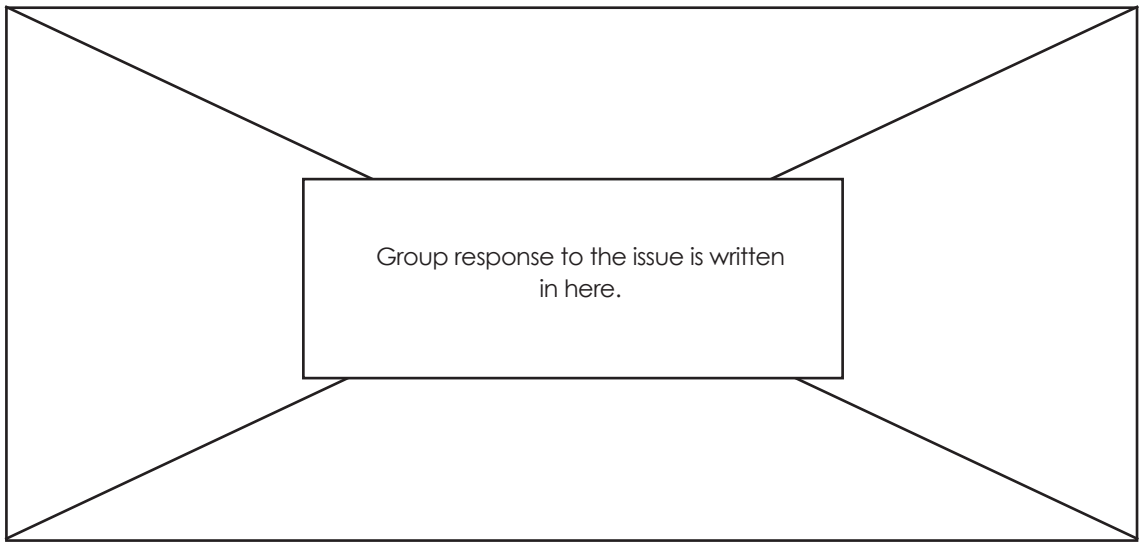
2. Once the problems have been listed classify these into 2 groups:
   - Things the students can do something about.
   - Things the students can't do anything about.
3. The teacher divides the class into groups and gives each group a problem / issue to deal with.
4. Each group then uses the 'Place Mat' activity to come up with some ways they can have a specific impact on the problem / issue. Refer to the information in the WASH Activites Manual for ideas of what different actions the students can take around the school.
5. Students then take responsibility for putting into action their ideas.

Teaching Note:

- The problem / issue can be the same one for the whole class or different ones depending on what is identified by the class.

Place Mat

- The place mat is drawn on a large sheet of paper. The page is divided so that each group member has a section to write in with a square or circle in the middle to record the group response.
- Students are given an issue, topic or question to consider and they begin the process by considering their responses and ideas.
- Responses are recorded in their section of the place mat. Students share their perspectives and a team response is recorded in the middle of the sheet.



GRADE 4

Activities

Soil

What is soil?

Soil is the supporting structure of all living creatures. It anchors plants and supplies them with the nutrients, oxygen and water, which are essential for growth. Soil can easily be eroded by wind or water, or damaged by compaction.

Additional ideas for lessons on soil are included in the *Science Curriculum Companion* and the *Green Club Manual*.

How soil is formed?

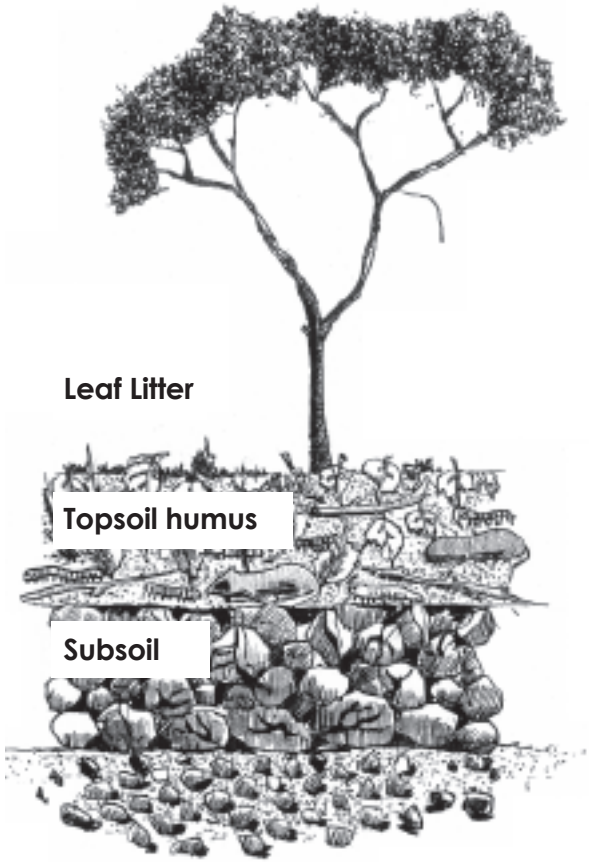
Soil consists of:

- **Leaf Litter** – remnants of dead plants and animals.
- **Topsoil humus** – leaf litter broken down by micro-organisms.
- **Subsoil** – broken down rock.

Subsoil

Nature produces soil from many different kinds of rock. It happens by:

1. **Changes in temperature** – During the day the rock is heated and at night it cools down. Tension occurs and the rock cracks into smaller pieces. This is called thermal weathering.
2. **Streams and rivers** – stones in running water rub against each other.



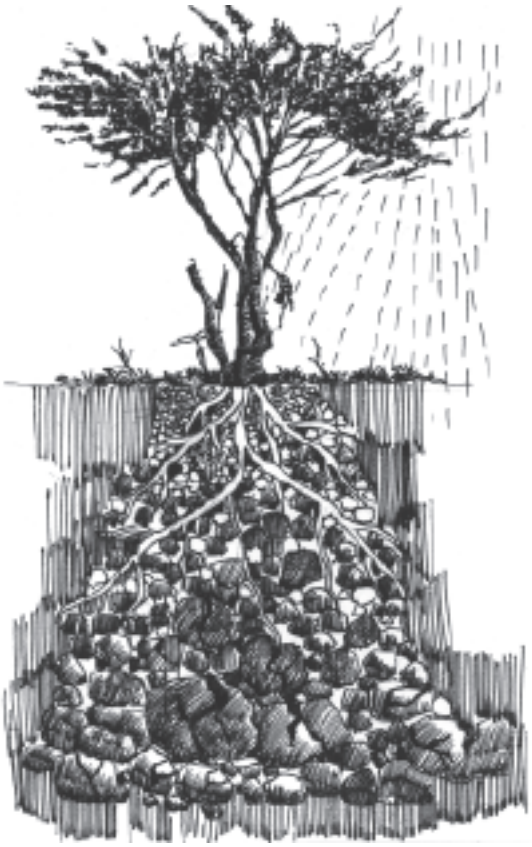
Three layers showing soil formation.

The fragments are carried away by the water and settle when the strength of the current decreases. New soil is thus formed.

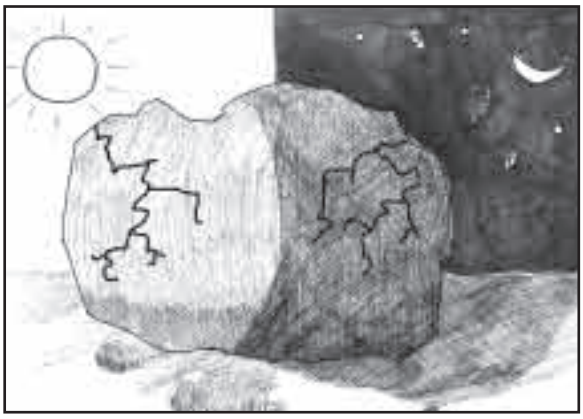
3. **Plant roots** – Roots absorb oxygen from the air and from water in the ground and give off carbon dioxide. The gas combines with the moisture of the soil

and forms carbonic acid. Carbonic acid helps break down rock particles. This is called chemical weathering.

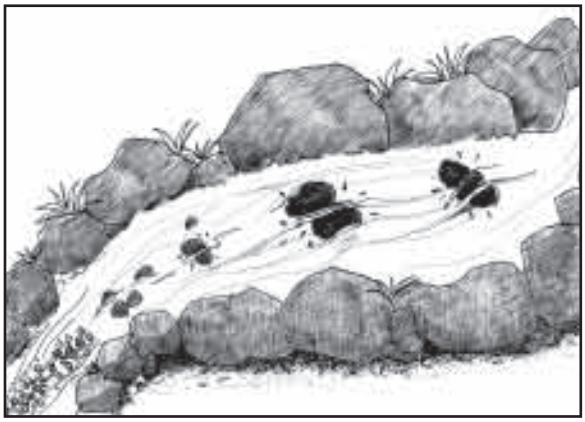
4. **Glaciers** – Heavily compressed ice and snow slowly slide downwards and create friction with the ground and breaking down rock. This debris collects at the end of the glacier and is washed away by stream and rivers and is eventually deposited as new soil.



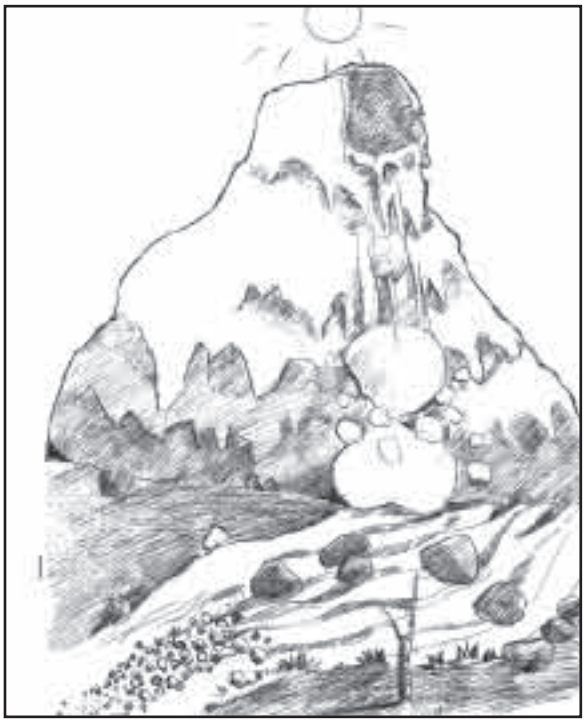
The roots of plants grow down through topsoil into subsoil.



Changes in temperature can cause rock to crack.



Stones and rocks rub together in a river and can form new soil.



Glaciers move slowly down mountains, creating friction and breaking down rock to form soil.

Activity 1 – How subsoil is formed

Purpose:

To show how rock is broken down through friction and temperature changes.

Time: 40 minutes

What you need:

- Rocks.
- White paper.

What to do:

1. The teacher introduces the lesson and explains how subsoil is formed.
2. The teacher organises students to work in groups to simulate rock breaking down into subsoil.
3. Each group rubs two rocks, preferably sandstone together. Collecting the dust formed onto a piece of paper so it is easier to see the fine particles.
4. Students write up a report of what they observed.
5. As a class discuss the observations.

Teacher information:

Leaves from trees, branches and other plants fall to the ground as do the bodies of dead animals. They are immediately broken down by micro-organisms in the soil into what is called topsoil or humus. Topsoil is the 'home' of living organisms which produce nutrients necessary for plant life. Topsoil has a grainy consistency. This improves air circulation and makes the soil easier to cultivate. Topsoil enables the ground to retain water during dry periods and prevents erosion.

Under natural conditions for health growth of vegetation. Nature takes 100 to 400 years to create 10 millimetres of Topsoil. Between 2000 and 8500 years are needed to create a 2 cm layer of soil.

Activity 2: A decomposition experiment

Time: 40 minutes (revisit over two weeks)

Purpose:

- To demonstrate the decomposition of leaf and vegetable matter.
- To demonstrate the role of worms in decomposition.

What you need:

- Soil, sand, old leaves and a few potatoes.
- Two plastic bottles per group.
- Earthworms.

What to do:

1. Students are organised into groups.
2. Into each plastic bottle they place the same amount of soil, sand, old leaves and a few potatoes.
3. The students place a few earthworms in one plastic bottle and not the other. So one plastic bottle is without worms.
4. Keep the contents moist but not wet and leave for a few weeks.
5. Students study the contents of the plastic bottles for a few weeks.
6. At the end of a few weeks students draw conclusions about the role of earth worms in the process of decomposition – the forming of new topsoil.

Activity 3 – Topsoil retaining water

Time: 40 minutes

Purpose:

- To demonstrate the water retaining capacities of topsoil and show how important it is to protect topsoil.

What you need:

- Two tin cans with even number of holes in the bottom of each. (Can use a hammer and nail to make holes in the base of each tin).
- Plate to collect water.
- String.
- Water.

- Soil – sub soil and topsoil.
- A pole to suspend the tins.

What to do:

Before the class

Organise students to bring empty, clean tin cans to school.

Class time

1. Students are organised into groups and organise who can bring tins from home.
2. Students prepare the tins. They can make holes in the bottom using a hammer and nail. Caution the children to take care and not hurt themselves. Add holes in the side at the top near the rim, to tie string.
3. Even amount of soil is placed in each tin. One tin has dry, hard sub soil the other has dry crumbly Topsoil. Label each tin.
4. Suspend the tins and place a plate or bowl underneath to catch the water.
5. The students pour the same amount of water into each can and observe which of the two types of soil retains the most water.
6. The water collected is measured to determine which soil retained the most water.
7. Class discusses the results.

Activity 4: Make a Catchment

Time: 40 minutes (1-2 lessons if required)

Purpose:

- To build a model catchment.
- To examine how running water can cause erosion in a catchment.
- To examine how mulch and steepness of slope can affect erosion.
- To examine what happens to toxic spillage.
- To examine the affects of land development on wetlands.

> **Teacher Note:**
>
> This lesson could be conducted outside or on the veranda as it involves water and soil.

What you need:

- 2 plastic bottles or cartons (2 litre size) per group of students.
- **Toolbox:** scissors.
- Mulch materials (leaves, bark, sawdust, twigs, grass clippings).
- Small plastic containers or bowl.
- Watering can (plastic bottle with small holes in the base).

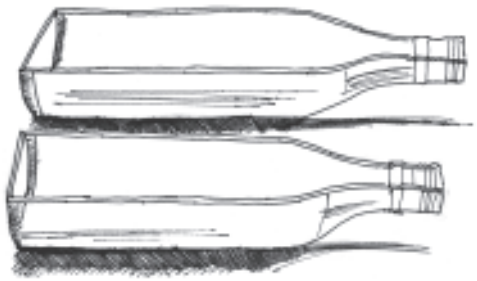
- Clock with second's hand.
- Science measuring equipment could be used for quantifying the water. Or else class containers with quantities marked on them.

What to do:

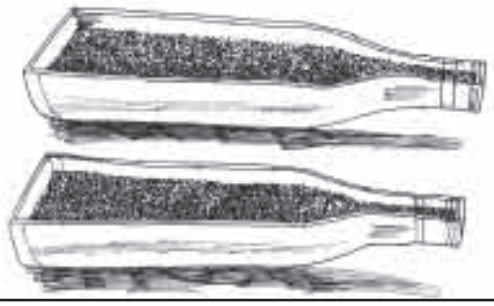
Steps:

1. Beforehand the teacher requests the students bring a 2 litre plastic bottle or drink carton from home and a small plastic container. Organise enough scissors for each group.
2. The teacher introduces the lesson explaining that this experiment is designed to demonstrate what happens *with* and *without* mulch and plant matter on the surface of the ground.
3. The students prepare the drink bottles or cartons. With the pouring side of the drink carton or drink bottle face up, with scissors cut the bottle in half.
4. The students fill each bottle with soil. Make sure there is the same amount of soil in each bottle.
5. The students then place a layer of mulch over the soil in one of the bottles.
6. The students incline the two bottles equally to represent the same slope. Place a plastic container at the end to collect run off from the experiment.
7. The students sprinkle the same amount of water over each catchment and measure the time it takes for the water to flow into the container base.
8. Measure the amount of water in the containers. Record:
   - the quantity of water
   - the appearance of water
   - content
   - quality of water

Step 3.



Step 4.



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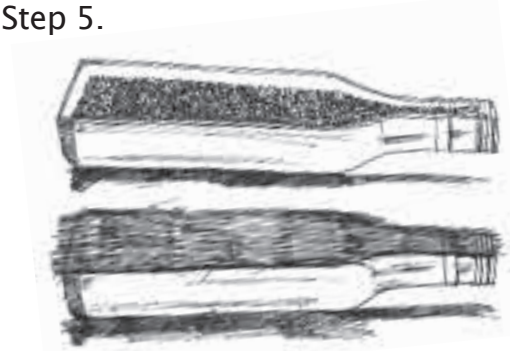
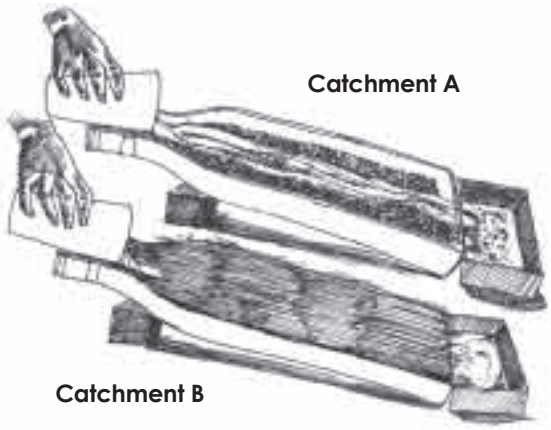


Step 6.



	Catchment A	Catchment B
Water at Start		
Water at Finish		
Time taken		

9. Record results in the chart in their exercise books.

10. The class discusses their findings. Which catchment is more likely to have soil erosion problems? Brainstorm some ways we can improve the catchment to reduce soil erosion, such as planting trees.

Ideas for extension:

Students could experiment by varying the angles of the slope and observing the effect of the angle on run off in terms of quantity and quality of water in the runoff.

Simulate a toxic waste spill with a drop of food colouring nearer the start of the water source. Observe what happens to the red dye. Compare this to oil or toxic chemicals being dumped near a waterway and the rain washing the toxic chemical into the waterway.

Pretend that someone has built a house very close to the waterway and leaves a pile of loose soil. What happens to the pile of soil? This will create sediment, soil collecting on the bottom of the river. Ask what effect a large amount of sediment might have on a river and the plants and animals living in those waters?

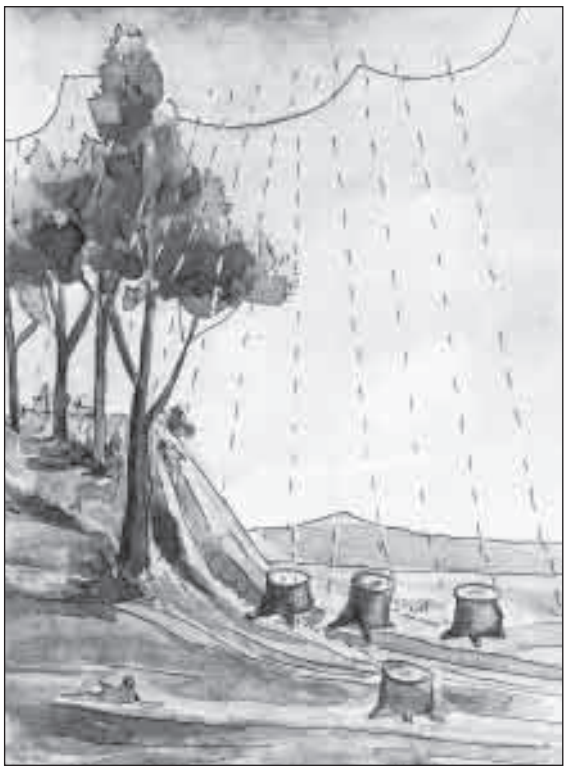
Teacher information:

When rain falls on ground covered with vegetation, the raindrops are cushioned by the plants. The rainwater can then penetrate slowly into the soil.

If the vegetation is removed and the ground is turned into farmland, the rain falls directly onto the soil at certain times of the year. Erosion begins.

With little or no protection by plants, the soil may be washed away during heavy rainfall. The once fertile land is then transformed into grazing land. Sheep and goats feed off the protective plant cover and the land becomes bare. Erosion continues.

Land covered once by forest can absorb four times more water than bare land. When it rains heavily water that is not absorbed by vegetation descends in torrents and floods the valleys.



A cover of vegetation assists water absorption into the ground. Where trees are removed, erosion can occur.

Soil salinity

Salty water contained in soil pores is referred to as soil salinity. High salinity can make it difficult for plants to absorb water from the soil. It can result in a drought effect where plant growth can be stunted. The roots of plants have difficulty absorbing this water, because the water cannot be transferred across the membrane surrounding the roots to the fresh water environment within. Salt also causes damage and destruction to cells in the plant. This appears evident in the outer tips of the leaves, which darken and die. Salinity problems are heightened in clay soils because the salt cannot easily pass through.

Activity 5: A dose of Salt

Time: 40 minutes (will continue over several weeks as seeds grow)

Purpose:

Students to observe the effect of salty water on seeds.

What you need:

- Grass seeds or other plant seeds.
- 2 containers with drainage holes for each group.
- Soil.
- Water.
- Salty water.

What to do:

1. The teacher organises students into groups.
2. Each group gathers the materials they need for the group from the front of the class.
3. The containers are filled with soil and the seeds planted in each container.
4. Once the plant is well established, the students try an experiment which involves watering the seedlings in one container with a small amount of salt dissolved in water. The second container with seedlings is watered with fresh water.

Teacher Note:

Make sure there are several plants in each container so that the changes can be attributed to the salty water.

5. Record the observations in a chart similar to the following,

	Record of seed growth			
	Day 1	Day 2	Day 3	Day 4
Seedlings given water				
Seedlings given salty water				
	Day 5	Day 6	Day 7	Day 8
Seedlings given water				
Seedlings given salty water				

6. Class shares the findings.

7. Class writes up a report, with the following headings:
   - Purpose
   - Materials
   - Procedure
   - Findings
   - Conclusions

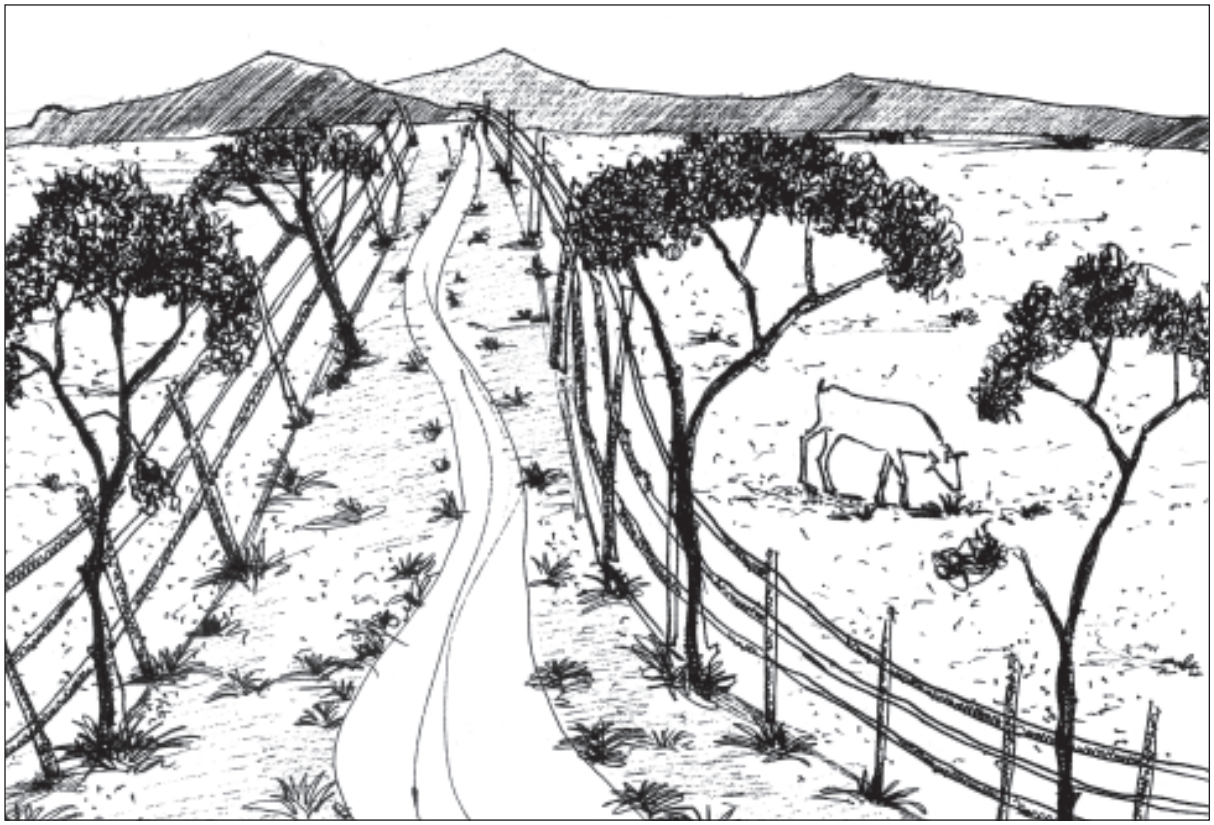
Assessment ideas:

- Assess how well students were able to get organised.
- Assess how well students were able to maintain experiment over the period of time.
- Assess how well students prepared a report on the experiment.

Teacher information

Things students can do to help conserve soil:

- Plant trees.
- Maintain a worm farm at school to turn organic waste into soil.
- Create posters for school and the community on the importance of protecting soil.
- Give talks to other year levels and the community on issues and actions that can be achieved at school and in the local community.
- Organise a fundraising project to raise money for revegetating school ground or local community.



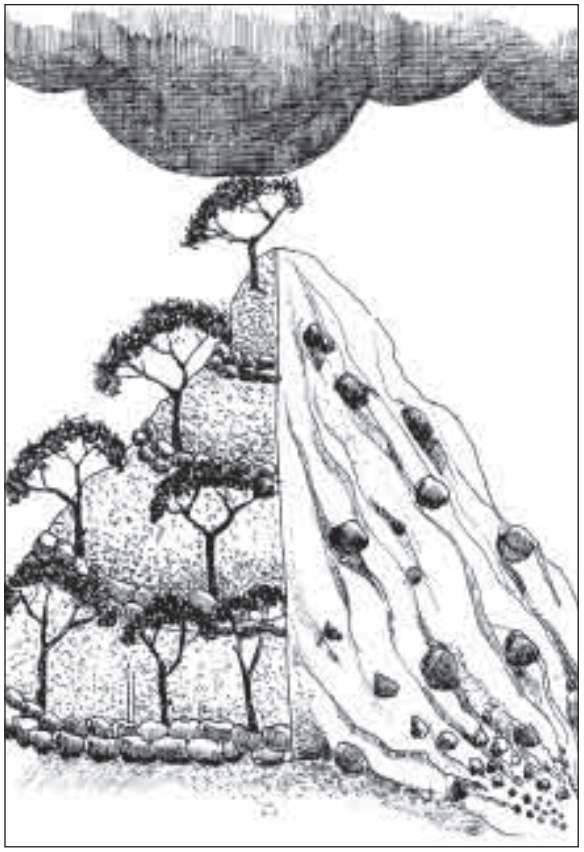
Heal a Gully

Fence-off gullies by erecting a fence away from the edges. The distance from the fence to the edge of the gully should be twice the depth of the gully. This will stop people and animals from further eroding the fragile topsoil and allow plant growth. After building the fence, let nature heal the gully. Plant grass to aid the process.

Erosion Dams

To stop erosion on steep slopes build small dams out of logs and brush starting at the top of the hill. The dams catch the soil as it washes down the hillside. Several dams may be needed depending on how much erosion has taken place.

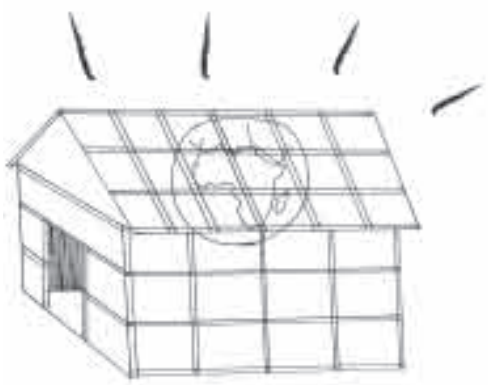
This diagram shows how you can prevent sloping roads, tracks and paths from becoming gullied by fast rushing water. Build broad, shallow humps at appropriate intervals and angle the humps so as to firstly, slow down the water and secondly, disperse the water gently into the grassy areas.



Trees and terracing help slow down the flow of water and therefore increase water absorption.

GRADE 5

Activities



Climate and Weather

Background information

The climate across the world is changing. In Eritrea it is becoming drier. This worldwide change is called '*climate change*'.

What is climate change?

Climate change is the change that is occurring because of the increase in the average temperature across the earth. This increase in temperature is known as '*global warming*'.

Does it matter if the temperature goes up a few degrees?

Even a small change in average temperature across the world can make a big difference. Some of the effects could be:

- Rising sea levels caused by melting of ice on the polar ice caps
- Increasing number of storms
- More unpredictable weather
- More droughts
- Stress on animals and plants which need predictable weather to survive
- Stress on fragile ecosystems such as coral reefs

Do all scientists agree about global warming?

All scientists agree that the earth is getting warmer. There is now a great deal of evidence to support this view. For example:

- 1995 to 2006 saw eleven of the twelve warmest years on record (since 1850).
- The Earth's average surface temperature has risen 0.74 degrees Celsius since 1900.
- Heat waves and extreme rainfall have become more common in many regions.
- The sea level has risen 1.8 mm per year since 1961 and the rate is accelerating.
- There have been fewer frosts and the ice sheets of Antarctica and Greenland are shrinking.
- The distribution of plants and animals is changing.

(Information from the New South Wales Government Department of Environment and Climate Change)

Most scientists agree that the main cause of these changes is human activity contributing to an increase in greenhouse gasses. A small number of scientists believe that the changes are caused by the natural climate cycles of the Earth which take place over hundreds of year.

What are greenhouse gases?

The sun beams down on the earth and warms it up. This warmth releases gases which are called greenhouse gases. They form a shield around the earth which acts like a barrier to hold in warmth. If this barrier formed of greenhouse gases did not exist, the warmth

from the sun would be lost and the planet would cool down. So greenhouse gases are natural and they help the earth.

What do most scientists think is causing global warming?

Most scientists think that the problem is that humans have caused a lot of extra greenhouse gases to be produced. This has made the shield thicker and denser and so more warmth is being trapped inside. The result is that the temperature of the earth is increasing.

Some of the human activities which cause greenhouse gases are:

- Driving cars, planes and trains which produce carbon dioxide and nitrous oxide.
- Burning wood and fossil fuels such as oil, coal or gas.
- Creating large amounts of garbage which give off methane when they decay.

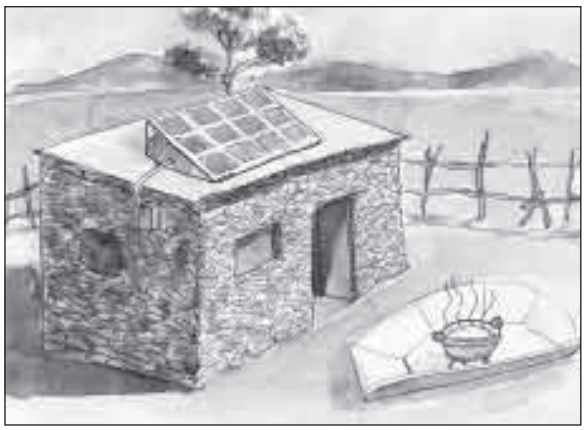
Ecological Footprints

If we walk on sand we leave an impression of our foot, a footprint. Similarly, everything that we do leaves a small impression on the Earth – each thing that we buy or grow or discard or consume has an effect. Scientists have worked out a way to measure these effects, called The '*ecological footprint*'. Each person has an ecological footprint and so does a school, a village, a business and even a country.

The ecological footprint for a country measures the total area of land required to produce the food, fibre and timber that a country uses and the area needed to absorb its waste and house its infrastructure such as cities, villages, roads, and bridges.

If we added together all the footprints for all the people living in the world, we would find that the human world's ecological footprint is 23% larger than what the planet can support. This is the same as spending 23% more money than you have.

Driving cars and heavy industry contribute to greenhouse gases.



Alternative energy sources such as solar energy can be used to power our homes and solar cookers can cook our food.

So what can we do about global warming and climate change?

Each person on earth can contribute to solving the problem of climate change. We can each work to reduce our ecological footprint. Each of us can make better choices about what we consume, how we reduce the garbage we produce and how we re-use and recycle things. Even small things like using a solar cooker or using an energy efficient stove can make a big difference.

Activity 1: Climate- Finding out

Time: 40 minutes

Purpose:

- To identify what '*climate*' is.
- To understand how the climate affects the world.

What you need:

- **Toolbox:** 10 copies of the story *'What is Climate?'* An example of this story is on page 47.

What to do:

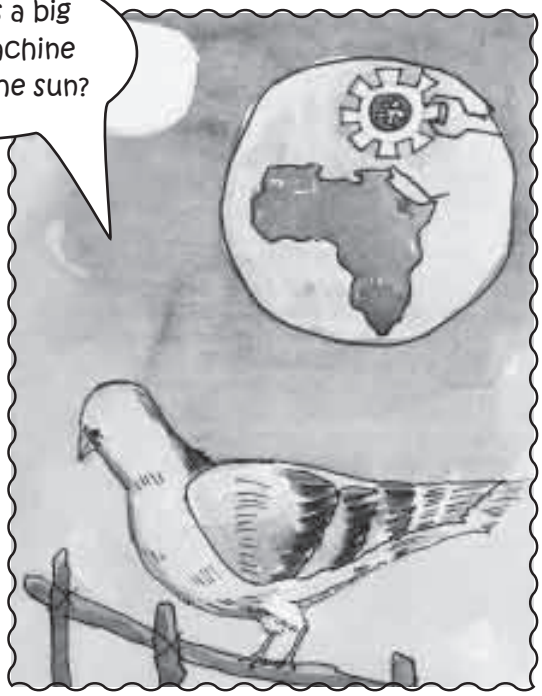
Steps:

1. Students read the story. While reading they can note any words or phrases that they don't understand.
2. After reading students share anything that needs clarifying with the class.
3. Question time: give groups time to re-read the story and write questions they would like to discuss.
4. Discuss the students' questions as a class.
5. Summary: each group writes a summary of the story.
6. Ask one group to share their summary. Then ask if any other group would like to add to the summary.
7. Conclusion:

   Reflection time (Think Time) Teacher asks the questions: *'What did you learn?' 'What would you like to know more about?' 'Is Climate Change affecting Eritrea?' 'If so what are the repercussions for the people of Eritrea?'*

   - Give the students 1 or 2 minutes to think quietly about what they learnt.
   - Students share what they learnt. Not all students have to share but make sure a range of students share. Good students and weaker students.
8. List the things students want to know more about. They may be able to find some information in the library.
9. They can share this information with the class in another lesson.

What is Climate?



Climate is a sort of huge 'machine'. What's called 'weather' is just a small bit of this machine which you and I notice: you know a storm, a drought, very hot weather or very cold weather. And I bet you know what drives this machine, don't you? Yes, it's the sun. Without the sun, there would be no climate, no weather, no people, no trees, and no life.

The climate 'machine'

The sun warms the air and hot air rises bringing with it moisture from the sea. As the moist air rises, it expands. This makes it cooler and so any moisture in the air condenses to make clouds.

And, as you know, clouds mean rain.

The sun warms the air.

Hot air rises to form clouds.

Clouds mean rain.

Rain helps plants to grow.

The sun also warms the seas and oceans which makes huge currents of water -- a little like winds, but inside the ocean. These currents move large amounts of water around the globe. They can bring warm weather to cold areas and they can bring cold water to warm areas. This can change the climate of an area.

All these things, the oceans, the atmosphere, the hot and the cold parts of the planet, deserts, and forests, all depend upon climate and upon the sun.

Activity 2: Climate - Greenhouse Effect

Time: This will take 2 x 40 minute lessons

Purpose:

- To define *'The Greenhouse effect'*.
- To identify how this affects the Earth.

What you need:

- **Toolbox:** copies of the 'Greenhouse information Cards'

What to do:

***Think, Pair, Share:** This strategy encourages students to think first and then discuss their opinions with a small group of people.

Set a time for each section of the *'think pair share'*

1. Students begin by reflecting on their opinions and ideas on the topic and record them.
2. Next the students are required to come together in pairs and share their ideas and collate a group response.
3. A member from each pair shares their ideas with the class.

Steps:

1. Do a **Think, Pair, Share**- *'What do you know about Global Warming?'* List the students' ideas on the board.
2. Divide the class into 7 groups.
3. Give out the 'Greenhouse' information cards. One per group.
4. Explain to the students that they are going to read the information and list some key words that they think people need to know. Make sure each group has a recorder and a reporter.
5. The groups read the information noting key words and meanings to put in a glossary.
6. The reporter shares the key terms with the class.
7. Explain to the students that they will make a presentation to the class to share the information they have read. It is up to each group to decide how they will present their information. It can be done: as a drama, story, poem, pictures, diagrams etc. Each member of the group must have an active part in the presentation.
8. Students present their information.
9. Conclusion:

   Reflection Time (Think Time) Teacher asks the question: *'What is the most important thing you need to tell people about global warming?'*

Give the students 1 or 2 minutes to think quietly about what they learnt.

Students share what they learnt. Not all students have to share but make sure a range of students share. Good students and weaker students.

Activity 2: Climate - Greenhouse Effect in a Jar

Background:

This simple experiment is an introduction to the greenhouse effect. Students can see for themselves the effects of a greenhouse, and relate this understanding to what occurs in our atmosphere.

The air over the exposed thermometer is constantly changing, and as it gets warm it is replaced by cooler air. Because the air in the jar cannot circulate, this air stays in the sunlight and gets warmer and warmer. A similar trapping of heat happens in the Earth's atmosphere. Sunlight passes through the atmosphere and warms the Earth's surface. The heat radiating from the surface is trapped by greenhouse gasses. This warming due to heat-trapping gasses is called the '*Greenhouse Effect*.' Both the atmosphere and the jar allow light to enter, but then trap that energy when it is converted to heat. They work differently, however, because the jar keeps in the heated air, while the greenhouse gasses absorb radiative heat. Without an atmosphere, the Earth's temperature would average about zero degrees (freezing point).

Time: 40 minutes

Purpose:

- To help students understand the greenhouse effect as a physical phenomenon.

What you need: For every group of students:

- **Toolbox:** 2 small thermometers for each group.
- **Toolbox:** 1 clock.
- A sunny area to perform the experiment.
- 1 jar, plastic bottle or other clear container.

What to do:

Steps:

1. Group the students and distribute the materials. Each group should place their thermometers a few centimetres apart under in direct sunlight.
2. Wait about three minutes so the thermometers will be giving accurate readings, and then have the students record the temperature readings on both thermometers as well as the time.

3. Each group should now place their jar (or cut the plastic bottle in half) over one of their thermometers, taking care that the jar does not cast a shadow over the uncovered one. If the thermometers are too large to remain horizontal inside the jars, it is fine to stand them against an inner side. Every minute, for ten minutes, the students should record the readings of both thermometers.

4. Students should copy the work sheet below, into their books.

Work Sheet

Instructions:

1. Place the two thermometers in the sunlight for a few minutes to let them get warm.
2. Record the readings of both thermometers at the top of the columns.
3. Record the time next to the starting temperatures and place the jar over thermometer.
4. Every minute, record the readings of both thermometers without disturbing them.

Time Start:

Observation Number	Thermometer #1	Thermometer #2
1		
2		
3		
4		
5		
6		
7		
8		

5. Students graph the results.

6. Each group writes a summary of their data.

7. Conclusion:

   Reflection time (Think Time) Teacher asks the questions: *'What did you learn?' 'Why is it important to know about this?'*

   - The teacher gives the students 1 or 2 minutes to think quietly about what they learnt.
   - Students share what they learnt. Not all students have to share but make sure a range of students share. Good students and weaker students.

Activity 4: Greenhouse Effect Poster

Time: 40 minute

Purpose:

- To present key information about *'Global Warming'*.

What you need:

- Paper.
- Pencils.

What to do:

Steps:

1. Revise the key points from the previous lessons. List these on the board.
2. Ask the students: *'What is the most important thing people need to know about Climate Change / Global Warming?'*
3. Students then make a poster to share this information.
4. The posters can be displayed in the classroom or around the school.

Glossary

Biosphere: the realm occupied by living things.

Biodiversity: the number and variety of organisms that are found in a specified geographic area.

Carnivores: meat eaters.

Consumers: the animals that eat plants and other animals.

Cross pollination: the transfer of pollen from one plant to another to create fertilised seeds.

Decomposers: organisms that help other things rot. For example, fungi and mould.

Deforestation: the cutting down, clearing, burning and removing of trees from the land.

Domestic animals: these are animals that live with people, for example, goats and sheep.

Ecosystem: a system in which living organisms interact with each other and with the non-living parts of the environment.

Endangered animals: these are animals which are in danger of becoming extinct.

Extinct animals: these are groups of animals who have all died out and there is no representative of their species left alive anywhere.

Food chain: a series of organisms that depend on one another in turn for food.

Food web: a complex of interrelated food chains in an ecological community.

Germination: the process whereby a seed starts to grow.

Habitat: the place that an organism such as a plant or animal is usually found.

Herbivores: animals that are plant eaters.

Indigenous animals: these are animals which occur naturally in an area.

Introduced animals: these are animals which have been brought into an area from somewhere else. Introduced animals are sometimes called exotic animals.

Native animals: this means the animal is native to the country but may have come from another part of Eritrea.

Non-renewable energy: comes from sources that, when they are used up, cannot be replenished in a short time.

Omnivores: meat and plant eaters

Photosynthesis: the process by which leaves make food for the plant by capturing sunlight.

Pollination: the process of sexual reproduction in plants when male and female cells combine.

Pollution: contamination of the environment.

Pollutants: the substances that cause pollution.

Producers: green plants that make food through photosynthesis

Renewable energy: comes from natural sources that can be replaced and used over and over again without harming the environment. For example solar energy from the sun.

Seed Dispersal: the process whereby mature seed is scattered. This allows plants to spread to new places.

Scavengers: clean up the kill from other animals

Self pollination: the transfer of pollen from the male to the female parts of the plant to create fertilised seed.

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Curriculum Links

The following table shows where environmental topics are covered in the current Social Studies curriculum. These resources will provide additional exercises to support your teaching of these topics.

Themes/Grades	Grade 4	Grade 5
Deforestation		
Water		
Soil		
Climate and Weather		

Toolbox 4

Contents of the Toolboxes

The Toolboxes provides some of the physical material needed to conduct the activities. Where materials are needed from the Toolbox for an activity, this is noted under '*What you need*'. If items in the Toolbox run-out, or need replacing, the PTA could assist in raising money to replenish these items. Other items such as seeds or aluminum foil could be bought from home by students.

Using a Toolbox to integrate Environmental Studies

Operation and maintenance of Toolboxes:

- ***Toolbox log.*** Each time someone takes any equipment from the toolbox, they should sign for the pieces they are using and sign again when they return them. An equipment log should be kept in each Toolbox.
- ***Paper materials.*** It is important that books, posters, student resource materials and pictures be kept in a dry place that is well aerated and free from insects. If these materials do get wet, it is important to dry them immediately and not to put wet items back with the dry items.
- ***Outdoor equipment.*** If any equipment is used outdoors, it is very important to ensure that it is clean and dry before it is put away. It is important to store this equipment in a dry, well-aerated area free from insect or animal damage.
- ***Specialist equipment.*** Some items don't just need care in storage, they need skill in setting them up for correct use. For example, instructions for the H_2S water testing kits need to be followed carefully to maximise the accuracy of results.

Toolbox contents

The materials are supported by a Toolbox of items to use with activities.

Item (Alphabetical order)	QTY
• 1 Metal box for storage of the items. • 2 padlocks. The box can be locked if your school does not have a safe storage room, but if you choose to lock the box, please ensure all teachers can have access.	
Aluminium foil –large rolls (to make solar cooker) 150m x 44cm, or 150x 30cm.	5 rolls
Animal pictures, series 1: A4 size, 20 cards in each set (cat, dog, bird, camel, goat, cow, horse, hen, fish, lion, monkey, rabbit, snake, leopard, ostrich, tortoise, zebra, elephant, hyena, fox).	10 sets
Animal pictures - ENDANGERED AND VULNERABLE, series 2: A4 size, 7 cards in each set, (African wild ass, nubian ibex, African elephant, greater kudu, Soemmerring's gazelle, ostrich, leopard).	1 set
Animal pictures – African Animals, series 3: A4 size, 16 cards in each set, (rhinoceros, chameleon, lizard, aardvark, buffalo, eland, impala, crocodile, Arabian bustard, hedgehog, hippopotamus, giant golden mole, green turtle, Egyptian goose, gorilla, dolphin).	1 set
Animal Food Pictures: A5 size, 13 cards in each set, (meat, seeds, mice, bananas, hay, hen, insects, lizard, tree, fruit, bird, water, milk - with words).	1 set
Ball of nylon string (for web of life game) about 50 metres long	2 balls
Bird Identifier: Picture Card	10 sets
Brightly coloured twine (for hanging up artwork) roughly 80 metres	2 balls
Chalk, assorted colours, calcium carbonate, in box of 100	13 boxes of 100
Clear plastic bags –Polythene (plain) (for tree transpiration activity) - approx A3 size (297*420mm). 60/kit *(please re-use for each class).*	60
Clear plastic bags - Heat resistant (for solar cooking). A4 size (210 × 297 mm) 50 / kit. *(please re-use for each class).*	50
Clock with a second hand for a classroom. Analogue display. 350mm diameter. - Battery for clock. 1xAA. 1 Pack of 4	1
Clothes pegs (for hanging up artwork in classroom) 40/kit	40
Colouring pencils, Set of 12 assorted colours. Metal box.	12 packs
Composting poster: Simple Steps to Making compost	1 poster
Crayons, wax, 8 colours per pack/box of 10 packs.	6 boxes of 10 packs.
Deforestation Information Cards	10 sets
Drawing pad white, A3, 50 sheets. pack of 10	2 packs of 10
Ecosystems of Eritrea: Map	1 poster
Elastic bands: packet of 100 *(please re-use for each class).*	2 packets
Eye dropper (Pippet) 155 mm. Plastic. graduation 1 mm	2
Marker, flip chart, assorted colours (tip-4.5mm)/pack of 4	6 packs
Glue, classroom use, bottle, approx. 170 ml.	10 bottles

Greenhouse information cards	10 sets
Hand washing poster: Steps to wash your hands	1 poster
Hand washing poster: Don't spread germs	1 poster
Hygiene, sanitation, water, health Information Cards	10 sets
Inflatable globe, (diameter of 42cm), without stand	1
Insect identifier: Picture Cards	10 sets
Plastic binoculars for kids. Magnification 3 x.	10
Magnifying glass: Magnification x 4, or x 5, plastic handle	8
Masking tape (for making a solar cooker) 50mm x 50m. auto grade	4 rolls
Measuring containers (PP beaker) measurement 10ml . 1 of each/set Capacity 1000 ml (1), 100ml (1) and 25ml (1).	1 set
Measuring spoons (for waste activity and soil activity) 1 of each/set • tablespoon approx. 15 mil (1) • 1/2 tablespoon approx. 7-8 mil (1) • teaspoon (1/3 tablespoon) apprx. 4-5 mil (1)	1 set
Measuring tape – length 5 metre, retractable	10 pieces
Paint, black, for blackboards. 500 ml per tin NB: The inside lid of the metal box can be painted with blackboard paint and used as a blackboard. The blackboard paint can also be used on a smooth surface e.g. wood or on a wall.	4 tins
Paint brushes for blackboards 50-60mm	2 brushes
Paper, white, A4, 1 ream – 500 sheets	3 reams
Paper, black, A4, 1 ream – 500 sheets *(please re-use for each class)*.	1 ream
Pencil, black, HB grade. Box of 10	13 boxes of 10
Plant information cards	10 sets
Red food dye – small bottle 100ml	1 bottle
Red Sea Zoo	10 copies
RRR - Reduce, Reuse, Recycle Poster	1 poster
Plastic wrap (for experiment to understand the water cycle and condensation) 300 mm X 300 m. catering size. *(please re-use for each class)*.	1 roll
Ruler, plastic, 30cm. Pack of 10	5 packs of 10
Scissors, blunt, safe for school use. 135mm. Box of 10	7 boxes of 10
Seeds: packets of corn and beans	1 set
Seed Poem	10 copies
Gardening equipment: 5 of each • Hand trowel (Green club), 285*87mm, carbon steel (5) • Weeding fork (green Club), 285*80mm, carobon steel (5) • Spade (Green club). Wooden shaft and plastic handle 940mm Blade (235*140mm) (5)	1 set
Soap: toilet bar, approx 110g. Wrapped.	50 bars
Soil Texture Chart	10 copies
Solar cooker kit	1 kit
Stapler: metal base half strip accepts 26/6 staples.	5
Staples: 26/6. 5000 per box	2 boxes
Sticky Tape: transparent 1,5cm x 10m/box of 20	2 boxes

Thermometers: spirit filled - 10 degree C + 100 degree C. Child safe easy to read (for measuring temp of weather and water)	3
Water cycle definition cards	10 sets
Water cycle picture cards	10 sets
Water testing kit: Bacteriological H_2S field testing kit	40 kits
Web of life cards: A5 size, 19 cards in each set. (hyena, vulture, cheetah, hunting dog, lion, baboon, giraffe, impala, seeds, wildebeest, tree, grass, bacteria, dung beetle, fungi, sun, water, bird, insects).	1 set
What is climate story	10 sets
Weather picture cards: A5 in size, 7 cards in each set, (rain, windy, cloudy, sunny, hot, cold, storm).	1 set
Zoo Pictures	10 sets

Books

These books can be stored in your school library to allow all students access.

Title/ISBN	Quantity
Book of Eritrean medicinal plants ISBN 99948-53-00-7	1
Jaws Discovery series- 8 books *Deserts : The driest places in the world* ISBN:9780435898564 *Disaster! Natural disasters of the world around us* ISBN: 9780435898939 *In Danger! Endangered species of the world* ISBN 9780435898595 *It Works! Jaws Discovery* ISBN 9780435898908 *Patterns in Nature* ISBN 9780435898588 *Sensation JAWS Discovery* ISBN 9780435898526 *Shapes in the world around us* ISBN 9780435898557 *Water: Nature's liquid miracle* ISBN 9780435898571	1 of each
Africa's most amazing animals ISBN: 1410930920	1
The oceans most amazing animals ISBN: 1410930971	1
My First Book of Southern African Insects ISBN: 9781770072138	1
Let's Go Picture Dictionary, Monolingual English Edition, Paperback ISBN 9780194358651 **Using the Picture Dictionary** Pictures are a great help when you are teaching new vocabulary. Use the Picture Dictionary to show students a picture of what you are talking about, rather than always translating from Mother Tongue. The Picture Dictionary is based on high frequency words so you should find all the vocabulary you need at the grades 1 to 5. The Picture Dictionary is based around topics, for example family, and weather. The illustrations, vocabulary and exercises all focus on the topic. There is also an alphabetical index so that you can look up individual words to check the page on which they are illustrated.	1

Effective Teaching Methods for Environmental Education in Social Studies 4

The following section has suggestions to support teachers with a learner-centred approach to teaching Social Studies that integrates the teaching of Environmental Education.

Social Studies as a cross-curricular activity

Social Studies is an important cross-curricular activity. You also need to be aware of what other teachers are doing in their subjects. This helps you to connect Social Studies learning with the content in other subjects.

If possible, try to plan activities with other teachers which go across the curriculum. You might agree, for example, to follow up a Science activity about animals by doing some research on their distribution in Eritrea. You can help the students to make the connections between subjects by referring to what they have already learned in other subjects.

Working in groups

Why is group work important?

Large classes are a big challenge for Social Studies teachers. You know that in order to make progress, students need plenty of opportunity to develop their idea through discussion. If each student in a large class takes a turn to say something, it takes a lot of time and students get bored. The best solution is group work. Environmental Education activities work best when all students are involved, so group work is ideal for teaching environmental topics in Social Studies.

What if my students are not used to group work?

Both students and teachers need time and practice to get used to working in groups. Here are a few tips for getting started.

Start simple – the first time you do a group activity, pick a short simple task. Just do one group activity with your class.

Give all the instructions for the activity first before you move the students into groups. Make sure students are clear about their task first, and then give them instructions on how to form groups.

Choose the simplest way of forming groups when you first start using group work. This will be to form groups of four or six – two or three students turn around to face the two or three students in the desk behind them. Check the classroom before you start. If some students need to move to make up numbers for groups, be ready with instructions for them.

Make sure the students quickly get any materials they need for the activity. You can use a couple of students to hand things out if necessary.

Keep the activity short and make sure there is something for each student to do in the group.

Move around the classroom while the students are doing the activity. Help students who are not sure what to do, but don't spend too much time with any single group.

Stop the activity when most students have completed the tasks. Students will get bored and restless once they have finished so stop the activity even if not every student has finished. As students get used to group work, you can be more flexible about when you stop an activity.

Pick an activity to start with that you are sure students will enjoy. Once students decide that group work is fun, they will want to do group work more often.

What size of group works best?

You can use different size groups for different activities. For example if you are doing a quiz you might just divide the class into two groups – the two halves of the room, or boys and girls, for example. Students can also work in pairs.

Many of the activities in the Environmental Education Curriculum Companion are designed for groups of six. This is a good number to allow individual participation. It also suits groups working at desks. The Toolbox has material sets based on a class of 60 – 10 sets for groups of 6 students. If your classes have a bigger or smaller number of students, make sure you adapt the group numbers.

Don't forget about working in pairs

Working in pairs is the easiest and quickest way to get your students to work together in Social Studies. Students can work with their neighbour without moving the whole class around, or you can try other ways of forming pairs.

Asking questions to the whole class is fine but some students don't participate when you do this. So encourage practice in pairs to make sure that all students are actively discussing their work You will need to move around the room during pair practice so that you can monitor student progress.

Are there other ways of organizing groups?

There are many ways to organize groups. Here are a few ideas:

- ***Organise by numbers*** - Count from one to 10 around the room. It is good practice and can be done quickly. All the 'ones' form a group; all the 'twos' form another group, and so on.
- ***Organise by birthdays*** – get the students to line up in order of their birthdays. You can then divide into groups of six by counting one to six, or form a group for each month, depending on the activity.
- ***Organise by animal cards*** – give out cards of animals (see Toolbox) and ask

Students can turn around and form a group with the students at the desk behind them.

students to find the others with the same animal.

- ***Select the group members yourself*** – for some activities you might want to put the students into particular groups. You might want to put the more advanced students together so they can do some more challenging practice. You might want to put weaker students together so you can give them a bit more help. You might want to split up noisy students. Whatever your reason, make sure you have done the student lists in advance.

Remember, however if you choose to put students into groups, it needs to be done fairly quickly and without too much fuss. If students are moving from their usual desk make sure you give clear instructions about where each group will be sitting. When students first start working in groups, it is best to keep it simple.

Are students really learning when they work in groups?

There is a lot of research which shows that group work is a very effective learning strategy.

How do I get shy students to participate?

Sometimes students are shy about speaking in class especially when they are learning a language. They are afraid they will make a mistake and look foolish. Often the same good students will answer all the questions in class.

Group work is especially helpful for shy students. It is much easier to speak in a small group than it is to speak in front of a large class. So make sure that you regularly use pair and small group work so that shy students will have more chances to speak.

If you want to have a whole class discussion or activity it is a good idea to start out with small group work. Get students to discuss the topic in pairs or small groups first. This way they have a chance to try out their ideas before speaking in front of the whole class. You can do this at two levels if necessary. Start first with pair work or groups of three, then move to groups of about six and then move to a whole class discussion.

When working together, children can achieve great things!

How do I cater for the diverse learning needs of students?

In a class of students, there is enormous diversity in learning styles, learning ability and levels of motivation. *Multiple Intelligences* framed by Howard Gardener, Project Zero at Harvard University, refers to the different abilities and talents that students may have:

- ***Verbal linguistic*** is about working with language. It involves reading, writing and speaking. It is used when conversing in one's mother tongue or a foreign language.
- ***Logical-mathematical*** is about number skills, recognising patterns and relationships, timelessness and order and the ability to solve different kinds of problems through logic.
- ***Visual-spatial*** is about everything that we see: shapes, patterns, designs, images, colour and texture. It also includes images we can visualise in our minds. The spatial side is about the relationship and placement of these objects in space and time.
- ***Bodily–kinaesthetic*** is about learning or expressing oneself through physical activities. It involves physical coordination, using one's motor skills such as facial expressions, posture and 'body language'.
- ***Musical*** is about sound, rhythm and vibration.
- ***Interpersonal*** is about human relationships. It involves communicating with and understanding people.
- ***Intrapersonal*** *i*s about self awareness and self reflection.
- ***Natural*** is about being able to recognise, appreciate and understand the natural world of plants and animals, noticing their characteristics and observing them closely. It involves such capacities as identification of species of plants and animals.

It is important that as a teacher, you recognise and value the different abilities and talents that students have. Your teaching should actively encourage students to develop as many talents and abilities as possible.

How do you get students to work well together in a group?

You need to make sure that the group activity is well structured. Every student should have a role in the activity and the success of the group should depend on each student making a contribution. The students need to clearly understand their academic task. You should also be clear about what social behaviours you expect. Tell students what the behaviour will look like, for example if you want students to work together on a drawing, explain that each person will do part of the drawing and that the group needs first to agree on who will do what.

Make sure you give students positive feedback for working well together as well as

for completing their tasks successfully.

Teachers need to make sure students with special needs are catered for in their groups. Those students with visual impairments need to be seated closer to the blackboard, poster, flashcards, etc. In an activity where the students go outside to the school compound, students can be encouraged to support peers with moving difficulties as well as to take actions to remove pebbles, and make their path more accessible.

In the assessment ideas, you can suggest teachers to take note about those are not performing well as other students, assess what difficulties those individuals are facing, and take necessary actions.

How do I know if a group is working well?

For most group work, you will be moving around the classroom keeping an eye on what is happening and helping where necessary. There are a number of things you should watch for:

- Are all the students actively engaged in the task? All the students should be busy. They should not be looking bored, or be doing something other than the set task.
- Are all the students participating in the group interaction? You can tell this by their eye contact with each other, and the flow of their conversation. Students usually enjoy group work and there should be a happy hum of conversation and activity.
- Is one student dominating the group? If the same student is talking each time you glance at a group, it is worth moving closer to monitor what is happening. If necessary you may intervene to remind students of their task and of the need for everyone to have their say. If you find one student often dominates a group then you need to think carefully about the group in which you place this student.

Is group work too noisy?

Experienced teachers who use group work are well organised. Their classes are busy and productive. There is certainly more talking from students than in a teacher-led class, but this is a healthy sign.

Encourage students to develop their own set of rules for group work. You can do this in mother tongue so that students understand the process and can participate. Agree on some simple rules, such as talking one at a time, allowing each student to have a say, and moving quietly if they shift from one place to another. If the classroom is getting noisy, remind the students of their rules.

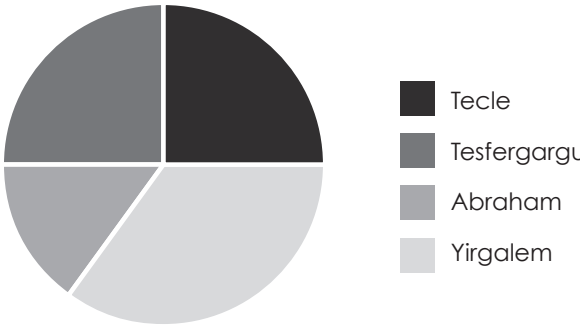
Activities

The Environmental Education Curriculum Companion for Social Studies has lots of suggestions for group work. Once you have tried some of these, start designing your own group-work activities. Your students will be more motivated, make better progress and both you and they will enjoy classes more.

Activity: Reflection on group work

Students could respond to the following questions.

1. How well did you group share the responsibilities for completing the task? As a group, fill in a pie chart to show the contributions of individuals in the group. You must all agree on the final chart.



2. Now think about the way you worked as a group and give yourself a score out of ten for each of the following areas:

Taking turns	/10
Listening to others	/10
Giving each other feedback	/10
Keeping to time	/10
Sharing the responsibility	/10
Solving problems	/10

Monitoring student progress

One of the most important tasks of a teacher is to monitor student progress. For example, when you are teaching Environmental Education in the English Language classroom, you will want to know several things:

- How well are students progressing with English in the four skill areas of speaking, listening, reading and writing?
- Do students understand the Environmental Education concepts you are teaching?
- Are students developing environmentally sustainable attitudes and behaviours?
- How are student progressing in relation to the *Expected Learning Outcomes* for the grade they are in?

Formal assessment of learning

You will be formally assessing student learning in relation to *Expected Learning Outcomes* when you conduct exams each semester. This assessment process provides formal feedback to parents, students and the school Director about student progress. Exam results will identify both individual and class problems in understanding. They will also help you to monitor your own success as a teacher.

Environmental Education in Social Studies is assessed as an overall part of the curriculum. When you examine students on the topics in the curriculum you will be covering the environmental content as well as Social Studies content. You will not need to make any separate formal assessment of Environmental Education.

Using assessment to guide learning

In order to know how well students are learning, teachers are constantly monitoring their students. In order to plan your classes you need to know how individual students are progressing and also how the class overall is progressing. Monitoring student progress on the Environmental Education topics in the curriculum is no different. You can do this by observing students' participation in class, marking written work including homework and by giving regular quizzes and exercises in class.

Using assessment as a form of learning

Assessment activities can actually help students learn. Giving students feedback on their work is an important part of their learning. You do this when you correct student work, for example, marking their homework. You also give students immediate feedback when you praise them for something they have done well or when you correct their mistakes in class.

One of the most difficult challenges for students is learning the amount of vocabulary they need to master at each grade. Frequent assessment of vocabulary helps students to learn. You can easily prepare a variety of oral and written vocabulary quizzes about environmental topics. These can be activities that students enjoy, such as team competitions, or there can be more formal written quizzes or exercises. Students have word lists in their text books. This is the core vocabulary they need to know by the time they complete a grade. Encourage students to check the words they get wrong in their word lists rather than simply correcting them yourself. You want your students to be independent learners and helping them to use the word lists is an important strategy for independent learning.

Assessing Environmental attitudes and behaviours

It is not possible to directly assess attitudes, but we can work out what students' attitudes are by the way they behave. To take an example: if students throw their rubbish on the ground in the schoolyard, then you can work out that they do not have an environmentally sustainable attitude to waste. Changing behaviour is a difficult process. Students first need to be informed about an issue such as waste. Then they need to understand why it is important for them to behave in a certain way. Then they need to take the step of acting differently.

In the case of students who throw away rubbish in the school grounds, they may not have enough information on the consequences of their action, or they may not be acting on the information they have.

Some of the things that encourage students to change behaviours are:

- ***Good role models.*** It is important that teachers demonstrate environmentally sustainable attitudes themselves.
- ***Peer groups.*** Students are more likely to change their behaviour if other students are also changing their behaviour.
- ***Participating in practical activities with an environmental theme.*** Activities which students enjoy and learn from will have more success than just talking to students. Life Skills Education also focuses on behaviour change. Make sure you talk to the teachers trained in Life Skills Education to see what strategies they are using to develop positive behaviours in students.

Example of Assessment Tools

Student Assessment of Group Work		
Student Name:	Date:	
Group Work	Yes	No
1. Helps members participate equally to complete the task together as a team.		
2. Listens quietly to the other group members.		
3. Waits for the speaker to finish before speaking.		
4. Makes comments and submits ideas that are on topic.		
5. Disagrees with others opinions without getting angry.		
6. Tries to meld her/his ideas with other ideas.		
7. Asks questions when he/she doesn't understand another group member.		
8. Takes part in the problem solving process, when the group has a problem		
9. Stays on task, when a specific group role is assigned		
10. Keeps the group on track with the time allotted for the activity.		

Refer to the Schools Environmental Audit in the *WASH Activities Manual.* By using an audit on the school every year you can measure the difference in behaviour towards the environment in your school.

Activity: Self-reflection

Students could record their responses to the following questions.

1. Three things I have learned about _____ are:
   *
   *
   *
2. The most important thing I have learned about _____ is:
3. During the unit I felt _____ because _____ .
4. Something I have learned about myself as a learner is:

   _____

   _____

   _____

5. The best activity we did was _____ because _____ .
6. Something I need to improve on is _____ .
7. I would like to find out more about _____ .

Organisational Framework for Environmental Education

Environmental Education is not only ***what*** we learn but ***how*** we learn and ***how we know*** it is learnt. A popular framework for organising learning experiences in Environmental Education is ***'about'***, ***'in'*** and ***'for'*** the environment':

- Education ***about*** the environment refers to the important understandings of facts, concepts and theories developed by students.
- Education ***in*** the environment refers to students' direct contact with the natural environment such as a beach, a mangrove, a forest, grassland, or even the schoolyard. This helps students to develop an awareness about and concern for the environment.
- Education ***for*** the environment is directed towards action, and aims to motivate behaviour change towards lifestyles that involve more compatible and sustainable use of environmental resources.

Students as learners for a sustainable future should be encouraged to be:

- Reflective and deep thinkers who have the capacity to understand the complexity of environmental issues.
- Interested, enthusiastic and capable of learning about the world around them.
- Autonomous learners who are self motivated with a real interest in learning about the environment.
- Ethical and responsible citizens who have the capacity to make ethical decisions and who consider the views of others when making decisions, imbued with the skills necessary to work with others towards collaborative goals.

Student knowledge and understanding should include the three pillars of sustainability 1. environment, 2. economy and 3. society, supported by the skills and capabilities of critical thinking and reflection, systems thinking, future thinking, participation skills and the capacity to plan and manage change.

Education *about* the Environment

- Provides understanding of how natural environments work.
- Provides understanding of the impact of human activities.
- Develops environmental investigation and thinking skills.

Integrating Environmental Education across the curriculum

Environmental Education is an important cross-curricular activity. If a subject teacher is aware of what other teachers are doing in their subjects, this helps them to connect Environmental Education learning with the content in other subjects.

A school garden is a good example of how you can work across the curriculum. Students can be involved with the garden in a variety of ways. They may be in the Green Club or Agriculture Club. The Science teacher might involve students in some experiments related to the growth of plants. The Social Studies teacher might work with students on soil quality in the garden and might also consider the social, cultural and historical significance of plant selections. The Maths teacher might involve students in measuring out an area to be planted. English can give students a way to bring all these things together in the form of simple stories or dramas. If teachers are individually aware of what other teachers are doing in the garden at each grade level, they can follow up some of the activities in their own classes and thereby provide a richer learning context.

If possible, it is desirable to plan activities with other teachers to create learning that

goes across the curriculum. A Social Studies teacher might agree, for example, to follow up a Science activity about animals by doing some research on their distribution in Eritrea. Students can be helped to make the connections between subjects by reference to what they have already learned in other subjects.

Critical thinking

Critical thinking is an important approach to be introduced in the teaching/learning process in the elementary schools. Critical thinking is about asking questions, challenging prior knowledge and learning, and challenging assumptions (what you believe/think is real or true) and what is already known. Critical thinking is about not taking anything at face value. It is about uncovering assumptions and finding the underlying meanings and causes. Critical thinking can question external issues in society such as water-use practices and resource management. Critical thinking is also about students looking inward to challenge their own assumptions, beliefs, values and attitudes.

Why should we be doing this?

As the world changes and we are exposed to new experiences, new learning, new ways of acting and working, we need to engage in critical thinking as we try to understand what these changes mean for us. Questions to ask when experiencing social change (for example in a township an example could be the introduction of a new industrial plant in your community) may include:

- How will this change affect my life? My family? My community? The environment?
- Are my values changing as a result of this new aspect of life?
- How has it affected my life? Is this what I want? Is this what is best for the environment in which we live?

Critical questions that could be asked about litter could include:

- Where is this pollution coming from? What must occur so that the local environment is not polluted?
- Who or what is polluting the community? Why are they polluting the community? What would make them change?
- What is the best way to address this issue? What would happen if the local environment continued to be polluted?

These are the sort of questions – challenging, uncovering, discovering – that are asked when using critical thinking. This is so that we can uncover and discover what is occurring in our world, how we feel and what we are going to do about it.

Students must make choices, evaluations and judgments every day regarding:

- Information to obtain, use and believe.
- Plans to make.
- Actions to take.

Findings from research indicate that:

- There needs to be a shift in many classes from a teacher-centred classroom to a student-centred classroom, in which students can be involved in collecting and analysing information, paired

problem solving, cooperative learning settings, simulations, debates and critical reporting sessions.

- Providing experiences in real-life situations or situations that simulate real-life situations increases the probability that skills will be used.
- Providing modelling of the skills, ample opportunities for practice and feedback on the effectiveness of the student's thinking are also important considerations.

Selection of experiences should be based on the developmental levels of the students.

Environmental Education *in* the environment

Education **IN** the environment – Environmental interpretation:

- Direct contact with the environment provides reality, relevance and practical learning to the student.
- Develops aesthetic appreciation.
- Develops skills for data gathering and analysis.
- Fosters environmental awareness and concern.

Teaching Outside in the Environment

Learning outside the classroom will be an important part of Environmental Studies. Providing students with high-quality learning activities in relevant situations beyond the walls of the classroom is extremely beneficial for helping students appreciate their first-hand experiences from a variety of different perspectives. An experience outside the classroom also enhances learning by providing students with opportunities to practice skills of inquiry, values analysis and clarification and problem solving in everyday situations.

Local area investigations are useful, not only because they can be linked to meet student

Education research over 30 years has developed to strongly suggest that teachers should take advantage of these 'live' examples and not limit their teaching to textbooks and in-class examples.

outcomes of subject areas, but also because they can be most enjoyable. They can provide the thrill and satisfaction that stems from discovery and recognition. They can be extremely motivational with school children of all ages. A range of very useful skills can be developed and practiced in the course of a local-area investigation. Local-area studies or investigations are sometimes referred to as excursions or field trips.

The great thing about any excursion is that it provides FIRST HAND EXPERIENCE that is a REAL, AUTHENTIC EXPERIENCE.

Such experiences can be used as a base upon which to build. Students invariably experience excursions as a relaxed, enjoyable approach to learning and as a result are more engaged. The chief skill associated with an excursion is OBSERVATION, although most teachers emphasise inquiry, an approach based on data collection and interpretation. Furthermore, any excursion does not restrict learning to observation at a specific site but can provide a wealth of information en route

to the particular site. Hence, excursions can be very meaningful and, although sometimes awkward and time consuming to prepare and manage, invariably they have a great impact on the children.

Education research over 30 years has developed to strongly suggest that Teachers should take advantage of these 'live' examples and not limit their teaching to textbooks and in-class examples.

Points to remember:

1. You are responsible for the safety of the children.
2. Seek to have well-prepared parent helpers to accompany the children on excursions and consider a number of competent adult helpers for any excursion.
3. Always check numbers regularly BEFORE and AFTER segments of the excursion.
4. Use the 'buddy system': get children paired.
5. Ensure all Ministry of Education and school regulations are met.
6. You can never be TOO CAREFUL when in charge of children.

Reference: Live & Learn Environmental Education, Best Practice Guidelines for Environment Education, Maldives, 2008.

Environmental Education *For* the environment

Education **FOR** the environment – a sustainable environment:

- Links knowledge to change.
- Develops concern and responsibility for the environment.
- Develops environmental ethics.
- Develops the motivation and skills to participate in environmental improvement.
- Promotes a willingness and ability to make lifestyle choices compatible with the wise use of environmental resources.

Values education

Values are an internalised set of beliefs or principles of behaviour held by individuals or groups. Clarifying student values is an important aspect of Environmental Education, as it helps students to self-reflect and increase their awareness of their own values.

Children involved in values education are encouraged to:

- Identify their own value positions and/or attitudes of the groups they belong to.
- Talk about what they believe in and why.
- Take the opportunity to hear opposing points of view and to defend their own.
- Respect the value position of others.
- Feel free to change, modify or reject their own value position.
- Realise that people's value positions change as a result of reflection, new experience, maturity, or other factors.
- Make choices and make them freely.
- Discover and examine available alternatives.
- Take action to affirm their values.
- Act, behave and live in accordance with their values.

Values education can be incorporated in daily activities across the curriculum through role-plays, storytelling and indigenous knowledge. Here are some examples of activities to engage students in the exploration, identification and clarification of values:

1. ***Surveys and opinion polls.*** Lifestyle surveys can be carried out and analysed. Students can design their own lifestyle surveys and to gather data from others.

Analysis of poll or survey results helps students to develop the understanding that people view issues in different ways and that decisions made for a community of people need to take into account the various values and beliefs they hold.

2. ***Significant moments.*** Ask students to recall a particular moment in their lives that involved making an environment-related decision. Once they have identified a 'significant moment', they must brainstorm the factors that influenced their thinking about the issue at the time. Students might write a reflective piece to read to one another, re-enact the decision through drama, or represent the decision-making process in a comic-strip form. Share the significant moments and isolate the various values that played a role in the decision-making process.

3. ***Physical continuum.*** Place signs around the room (for example, 'strongly agree', 'partially agree', 'partially disagree', 'strongly disagree') in four corners or spread across a line. Read out controversial statements to students who must place themselves in the area that reflects most closely 'where' they stand on a particular issue. For example, 'city life is better than country life'. Once students move to their preferred position on the statements, conduct some roving interviews asking them to justify their reason for choosing a particular viewpoint. After the activity, talk about the influences that affected the decisions made.

4. ***Directed reading and thinking activity.*** Select a piece of writing that deals with a contentious environmental issue, such as a newspaper report. Read the first part of the piece and then ask students to predict what they think the author might say next – in keeping with

the point of view already evident in the writing so far. Read the next section, stop, predict and confirm. Consider the values held by the writer and the way those values influence choice of language used to report or describe the situation.

5. ***Moral dilemmas.*** Moral dilemmas involve the presentation of a hypothetical situation in which a central character is faced with two choices, both of which are feasible and produce a mental conflict or dilemma. Dilemmas may be very simple at first and then become more complicated as additional factors are presented. The technique is a way of showing that there are usually a range of reasonable and feasible views about any one issue. Once the dilemmas have been explored, it is vital to assist students in the analysis of the discussion that has taken place. What values underpinned the various arguments in the discussion? How would this dilemma be resolved if conservation of the environment was the dominant value? What decision would be made?

6. ***Role-play/simulations.*** Role-plays encourage students to understand the

range of values that are held by people involved in the decision making. One strategy is to provide students with a scenario and then to allocate role cards to individuals who must argue out their case at a group meeting. Allocate roles to students and then allow them time researching, organising and thinking about their arguments. After the meeting, discuss the following:

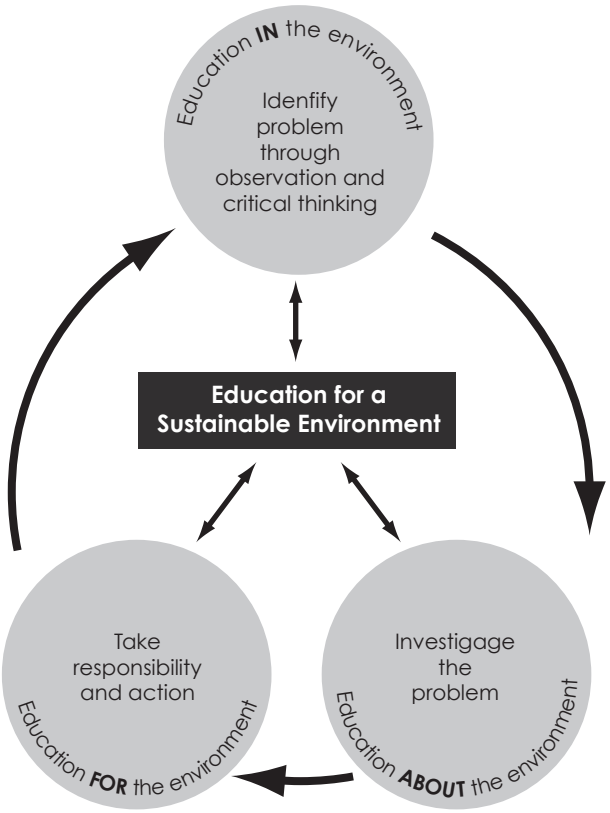
- How did you feel when you had to play a role that you didn't agree with?
- Which arguments were the most convincing and why?
- Who felt like they didn't get a fair say? Why?
- What could you do next?

A Problem Solving Model: An inquiry approach to teaching and learning Environmental Education

Only education **FOR** the environment offers teachers the theory and practice that can link knowledge to environmental improvement and this therefore remains an essential component of Environmental Education.

To incorporate environmental issues in the schools, we need to recognise some basic characteristics of these issues:

- Environmental issues are often complex as they involve economic, social, cultural and political circumstances.
- There are always two sides to an issue and multiple perspectives.
- It takes more than knowledge and facts to understand environmental issues. It requires seeing the problem from different angles and awareness of values and beliefs.
- Taking action and solving environmental problems in Eritrea, as in all countries, is an ongoing process. As positive changes are made, new challenges and access to new information will emerge so that continual reassessment and revision of



Problem Solving Model in Practice

strategies is required.

It is important that teachers allow students to claim ownership of environmental problems and to develop their own responses and ideas about solutions without imposing their own views. The *Problem Solving Model* aims to protect this process.

Component 1: Identifying a problem

Students are asked to identify problems associated with their local school environment.

The task could include an Environmental Audit of the school environment using practical processes of learning. During the environmental audit of the school, environment issues will present themselves to the students.

Important points!

- It is important that the teacher does not select the issues for the students as this

often causes students to lose interest.

- The students will often jump straight to the 'Take responsibility and action component'. It is important that the teacher protects the process and encourages the students to fully understand the problem.

Teachers will know a problem is well-defined and understood when the students can:

- Identify the people and organisations with an interest in it.
- Explain how those people/organisations perceive the problem and what assumptions they have made about it.
- Identify their own interests and concerns about the problem.
- Understand the issue well enough to be able to frame it in several ways based on the different assumptions and perspectives.

Component 2: Search for solutions

Searching for solutions involves understanding alternative views and the range of alternative solutions. It requires time to understand the scope of a problem and to experiment with several solutions. It means encouraging great creativity and then going back to the identification stage to learn more about what the solution might entail. This often happens by giving examples and changing ideas.

The teacher may want to consider the following:

- Decide exactly what you want students to learn. (student learning outcomes and levels).
- Locate or develop a suitable problem/question or a series of problems/questions that can be used to help students achieve the desired learning outcomes.
- Normally, these problems/questions will be built around an important concept or principle (for example, the concept of water conservation). The problems/questions should also be built around some realistic situation that the students think important, such as the need to conserve water in the home.
- Identify what prior knowledge the students will need in order to try to solve the problems or find answers to the questions. If necessary, teach the needed prior knowledge.
- Decide how you will motivate the students to engage in the inquiry (i.e., how will you make the problem/question one that they will want to resolve).
- If necessary, teach the students the inquiry skills that they will need, or structure the problem-solving or question-answering process so that these skills will be learned as students work through the process.
- Do not forget that thinking skills are very important.
- Identify parts of the problem and questions that are likely to cause the most difficulty for the students.
- Decide why this might be the case. Help the less able students through those parts.
- Try to identify a number of strategies that will help students learn as they attempt to solve this problem/question.
- Use this information above to plan your lesson or series of lessons. (Often, problems/questions that will help students to gain real insights into the subject matter have to be investigated over an extended period of time.) Make sure that your plans give the students the freedom they need to think, explore ideas and experiment. If you are using inquiry for the first time, do not be too ambitious – try it with one class and refine your approach until you feel comfortable that it is working successfully, then try it with other classes.

The teacher's main roles in inquiry learning are to:

- Frame the inquiry situation so that students understand what they have to do.
- Guide students to resources that will help them to solve the problem.
- Facilitate group processes as the students work on the problem.
- Encourage student participation.
- Help to keep students on track.
- Challenge students' logic and beliefs.
- Provide constructive feedback to correct erroneous student reasoning.
- Assume the role of fellow learner.

Throughout this manual, the different components of the *Problem Solving Model 'about'* – *'in'* and *'for'* – are identified to support teachers with inquiry teaching.

Futures thinking

Educating for a sustainable future includes a futures perspective: presenting the role of Environmental Education in working towards ecological sustainability. Some possible strategies that teachers can use with students to encourage them to consider their own future includes:

1. ***From here to there.*** This activity requires a large area or floor space and a set of blank cards:
    - One card depicts a current problem, event or situation for example, polluted waterway. This is placed at the left hand end of the space
    - Another card depicts a resolution to the problem for example, clean waterway. This is placed in the far right corner end of the space.
    - The space in between the cards is regarded as the pathway. Each blank card becomes a stepping stones in the pathway.
    - On one of the pavers, students write or draw events, actions that would help move the problem closer to the solution.
2. ***Possible futures.*** Students are given a timeline. Along the timeline they plot significant events that have occurred in relation to the topic being studied. On each arm of the timeline, students plot, first probable, then preferable, outcomes for the future. The timelines are compared between groups or individuals. At the end, the class discusses what could be done to make the probable more preferable?
3. ***Future wheels.*** An event/problem or situation is placed in a circle in the middle of a page. Students must then identify the key consequences (positive or negative) of that event and the consequences. Additional lines used as consequences become more remote. Sample starting points could be:
    - More trees planted in the school grounds;
    - Reduction in water availability.
4. ***Diamond ranking.*** Students are given a set of different viewpoints about a particular issue. Their task is to organise the viewpoints according to, for example, the extent to which they agree with them. The views are organised into a diamond shape indicating the priority given to them by the student. Criteria for ranking can be varied. Discuss the ramifications of each view for the 'future' in relation to a particular topic.

More about Environmental Education 5

Environmental Education — What is it?

'Environmental Education' is broadly defined as encompassing the raising of awareness about environmental issues *and* the development of new perspectives, values, knowledge and skills with regard to managing those issues. Environmental Education includes both formal and informal processes that lead to *changed behaviour* in support of a sustainable environment.

1. Environmental Education must involve everyone.

Media, educational institutions and community groups — as well as individuals – can contribute to the environmental well-being of the planet.

2. Environmental Education must be lifelong.

New environmental issues and new solutions are continually evolving. To move closer to achieving ecologically sustainable development involves continually refreshing the knowledge and skills, which are being applied to the environmental challenges faced.

3. Environmental Education must be holistic and about connections.

Environmental challenges are complex and involve multiple systems, connections, patterns and causes, all of which have social, scientific, cultural, economic, political and ethical aspects. All of these factors must be considered for effective management of environmental challenges. Thus a multi-disciplined approach, as well as specialist knowledge, is essential for the solution of environmental issues.

4. Environmental Education must be practical.

   Better Environmental Education outcomes are achieved through action, and action-based approaches are fundamental to Environmental Education. Such approaches enable effectiveness to be more easily measured.

5. Environmental Education must be in harmony with social and economic goals and accorded equal priority.

One of the objectives of Environmental Education is to develop acceptance in the community that the nation's environmental objectives have the same priority as its social and economic objectives.

The teacher resources have been developed with an emphasis on 'Best Practice' in Environmental Education, which is based on three aspects:

- What and how are teachers teaching?
- What learning outcomes are students gaining?
- Is the environment likely to improve from the learning outcomes?

This manual outlines practices that engage students and enhance learning in ways that result in successful environmental outcomes.

Environmental Education for a Sustainable Future

The ESEE Initiative holds the view that it is important for the design of Environmental Education in Eritrea to be informed by international best practice. Environmental Education has evolved from being a response to the environmental crisis coming from increased contamination of land, air and water, growth of the world's population and the continuing depletion of natural resources. There is now a much stronger emphasis on integrating thinking and action around ecological, social, political and economic systems. It has become critical to acknowledge the complex relationships between these four systems if we are to achieve a sustainable future.

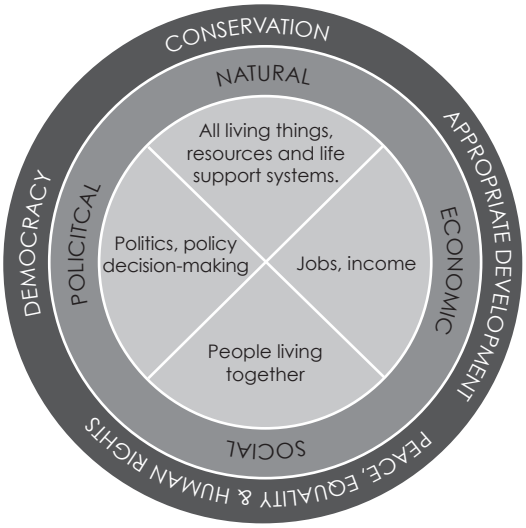


Diagram 1: UNESCO's model of the interlocking dimensions of sustainability

Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. It is also critical for achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development, and for effective public participation in decision-making. (*Agenda 21*, paragraph 36.3)

The United Nations Decade of Education for a Sustainable Future began in 2005 (2005–2015). Fundamental to the framing of this initiative is that a sustainable future requires transformational change of values and behaviour at all levels from the individual to the global.

Whole-School Approach

Effective Environmental Education includes curriculum but also requires the involvement of the whole school. Successful Environmental Education influences all aspects of school operations, curriculum, teaching and learning, physical surroundings and relationships with the local community.

A school with effective Environmental

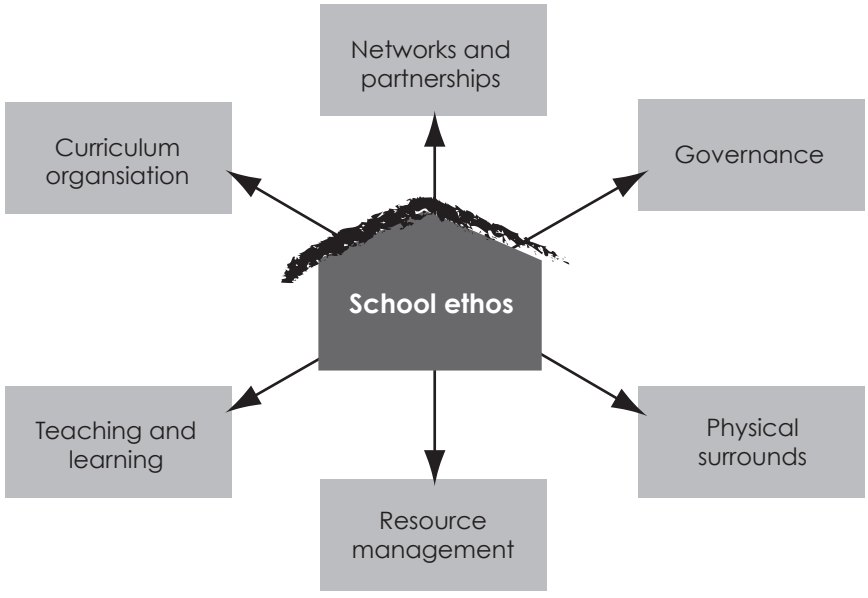
Education practice has a vision and goals for the contribution it can make to Environmental Education that encompasses the following components:

- Inclusion in the curriculum and the teaching and learning.
- Skills, values and actions that support sustainability of people and natural resources.

Education for sustainable development can be taught in all school subjects in such a way that the learning objectives of the subject are achieved whilst keeping students talking about and planning ways of living sustainably as citizens in a local and a global community. This can be done either through infusion into each subject area or through interdisciplinary modules.

The richness of learning activities made available to children is of utmost importance. How students learn is often more important than what they learn. This is because different students have different abilities and learning styles and so a variety of strategies and methods are crucial to ensure that all students have opportunities to learn. Teacher oriented expository approaches such as questioning, explaining and demonstrating are effective for covering a large amount of information and if done well can be very exciting and motivating for students. These approaches can be enhanced when followed by collaborative learning, which provides further opportunities for learning and sharing with and among students in the classroom.

Alternative approaches for structuring classrooms can be utilised to further enhance learning. Such approaches include: small groups, individual, pairs and larger groups. These approaches can maximise opportunities for students to learn from each other, developing mutual respect and cooperation on various tasks and projects. Collaborative learning through learner-centred interactive approaches such as inquiry, problem solving, storytelling involving students, brainstorming, using surveys and work sheets along with learning outside the classroom can help students feel responsible for their own learning, developing thinking skills and fostering independent social and group processes.



School organisation and operation

Schools can undertake environmental audits of resources such as water and energy used and the amount of waste produced in the school. If environmental auditing is done carefully and methodically, reliable information can be gathered about problem areas and the associated costs. Auditing and the consequent saving of resources can save schools money by reducing the cost of resources such as water and electricity. Schools can also save by re-using and recycling resources such as paper.

School design

The design of the infrastructure in the school is essential to harvesting water, storing water and providing fresh water and clean toilets to students so that the school community can maintain healthy water, sanitation and hygiene practices.

In planning for the future, consider installing natural sources of energy that can be utilised through solar panels and wind turbines to replace electricity and other non-renewable fuels.

Development and management of school grounds

School grounds and the local environment can be an important resource for many learning experiences. The school grounds can be used in a number of different ways, including local studies of plant and animal life found in the school grounds. This could lead to local action projects such as:

- A school vegetable garden, mini-forest or recycling project in the school.
- Maximisation of the harvesting of water and management of the use of precious resources such as water, energy and wood, as well as management of waste.

Action projects in the school grounds and local community by a class or club can provide valuable learning experiences. Projects can include: maintaining school compost heap, visiting and accompanying elders, caring for a garden, cooking with elders, making gifts of preserved food and handicrafts for friends and relatives away from home, monitoring local air or water quality and so on. One of the many educational benefits of action projects is the self-esteem that young people feel from being successful in planning and conducting a project that benefits others.

Enhancement of connection with the broader school community and other education institutions

Perspectives developed in school learning materials often do not reflect knowledge that has direct local relevance. The school curriculum can be enriched with local stories, history and community experiences of change and of how people lived in the area in earlier times. The local environment provides students with opportunities to put what they have learnt to immediate use by planting areas where there is high erosion, to shelter the local village from winds, to conserve local waterways, plants and animal life.

Conservation and protection of heritage values in the school and its grounds

Programmes that enable students to interact with local people and to find out about early history and change are essential to successful education processes. Children often have an intuitive capacity to distinguish between fact and fiction when listening to the stories of older people. This critical capacity can be enhanced through teaching with stories in ways that reveal and yet respect local cultural traditions as valuable sources of rich ideas for sustainable living. Teaching processes that include local and traditional knowledge are also useful ways of contextualising the school in the community.

Overview of the Resources

The Environmental Education Curriculum Companions for elementary schools provide practical examples of how Environmental Education can be integrated across the subject areas of:

- English
- Science
- Social Studies

A manual has been developed to provide teachers with practical ideas for extra-curricular activities, including suggested activities for Green Clubs and Health Clubs.

A resource has also been developed to support the School Directors, School Staff and PTA about ways in which they can contribute to ensuring their school operates as a sustainable school environment.

There are additional resources provided in the Toolbox which includes posters, information cards and reference materials.