Social and Spiritual Development Strand
Social Science

Unit 1: Natural and Cultural Environments

Module 1.3 Environmental Issues

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Cover diagram

The Hump-backed dolphin (top) and the Irawaddy dolphin (bottom) are now confirmed residents of Papua New Guinea waters.
## Unit outline

(Based on the National Curriculum Guidelines)

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## Icons

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Module 1.3 – Environmental Issues

Rationale

Environmental issues are a major concern in the world today. All members of society need to be aware of and knowledgeable about the environment in its totality - natural and built, technological and social (economic political, technological, cultural historical, moral, aesthetic). Teachers can play an important role in promoting the value and necessity of local, national and international cooperation in the prevention and solution of environmental problems.

This module has links with all other modules in Unit 1 – Natural and Cultural Environments.

Objectives

By the end of this module you will be able to:

1. Demonstrate an understanding of the role of various physical and human factors in saving the environment
2. Explain the main elements that influence the physical, social and economic development of the environment
3. Consider the environmental impact of development on individuals
4. Describe the inter relationships between people and environments
5. Explain how and why environments are changing
6. Apply a range of skills such as observing, measuring and recording data, using data to explain, draw conclusions, and make predictions
7. Recognise and discuss cause, effect and consequences
8. Analyse the impact of different perspectives on environmental issues at local, national and global levels
Topic 1 – Introduction

What is environment?

Our environment is our world. If we are to care for each part of it, we must have some understanding of the environment in its totality. The state of the environment ultimately determines the quality and survival of life. The environment comprises:

- the natural environment -which includes sun, air, water, earth, the physical cycles that support life (oxygen, nitrogen, carbon and water) and biological and ecological systems (living things and their interrelationships)

- The built environment-which includes human-altered landscapes

- The social/cultural environment-which includes individuals and groups, technology, religion, institutions, governments, economics, aesthetics, demographics and other human activities.

These parts are interacting and interdependent; they should not be seen as separate or competing. The quality of the interrelationships defines the health and well being of the total environment.

![Diagram of environmental issue impacts](from NSW Department of Education: Environmental Education Curriculum Statement)

People have occupied the Papua New Guinean environment for more than 40,000 years and contributions from many cultures have shaped and will continue to shape its unique natural, historical and cultural heritage. While indigenous inhabitants traditionally embraced a close
relationship with the land, many early European settlers failed to appreciate the interdependence which exists between people and the environment.

1.3 Activity 1

Describe examples of traditional interaction with the natural environment.

Today we recognise that we need to be aware of the impact of our actions on the environment and that we must take positive action to preserve and manage the environment for the future. Changes to the world's natural systems are occurring rapidly. These changes are complex. Human survival will depend on improved understanding and appropriate action. Ultimately the behaviour of all people towards the environment must be based on a global environmental ethic which is sympathetic to the diversity and stability of life on earth.

The natural environment consists of physical environment and biological environment. The physical environment is comprised of three interlocking systems: the atmosphere, the hydrosphere and the lithosphere. The biological environment includes all living organisms of the biosphere, which merges imperceptibly into the lithosphere, the hydrosphere and the atmosphere. Plants, animals and micro-organisms living within a defined zone together with the physical factors (e.g. air, water and soil) of that area, form an ecosystem. Living organisms and their physical environment within an ecosystem have dynamic interrelationships. These relationships may be expressed as natural cycles. In the unpolluted natural environment, the cycles mainly operate in a balanced state and the ecosystem is more or less stable.
Weeds threaten mighty Sepik

AUCKLAND: One of the world's few great river systems to remain in a near pristine state, Papua New Guinea's Sepik River, is under threat from introduced weeds, according to a new report. "The Sepik River: A Natural History" was published last week by the South Pacific program of the World Wide Fund (WWF) for Nature. The report calls the Sepik, with more than 1,500 lakes and dozens of major tributaries and landforms, one of the world's most significant river systems. Its catchment extends for more than 77,700 square kilometres and is navigable for about 500km from its mouth on the northern coast. Biologically, it is among the most diverse and least described ecosystems on earth. "There are no large mining projects, no industrial plants and no large timber extraction projects operating within the region and, compared to other areas of New Guinea, much of the area has a low rate of population growth," it said. "The Sepik has yet to suffer the blows that accompany rapid development." However, water weeds, mostly from South America, are one of its biggest threats. Salvinia molesta, a weed capable of doubling its size every two days, was introduced by a missionary who threw the contents of a fish tank into the river. By August 1977, 32 square kilometres of the river were covered with Salvinia. By 1979 it had spread to 79 square kilometres. A beetle introduced to combat the pest had spectacular results but it did not completely eradicate it and the WWF said the weed will now always be a component of the river. Water hyacinth, a beautiful blue flowering plant from South America notorious for its ability to clog up waterways, is now under control, thanks to a weevil. But a species known as the "Giant Sensitive Plant" is encroaching near the Sepik and poses a major threat as there are no known means of control. "Weeds pose some of the most serious threats to the environment and human inhabitants in the Sepik catchment. Several species that are already in PNG have the potential to invade large areas of the Sepik flood plains where their effect would be catastrophic," the report said.


1.3 Activity 2

Study the article above and explain how the Sepik River ecosystem might become unbalanced

The social/cultural environment refers to the environment made by humans through various activities. People interact with the natural environment and convert it into a human habitat by arranging and changing their surroundings as best as they can to suit wants. Today, with a rapidly advancing technology, humans have started influencing the biosphere by changing some of the rules of nature and organizing the world of plants and animals in their own way but they have failed to realize the consequences of these actions.
**Topic 2 - Environmental issues**

The nature of environmental problems are different in various parts of the world. In developed countries, environmental problems mainly relate to pollution, fast depletion of several natural resources and overall damage to the ecosystems. In developing countries, energy and resource consumption is not high and pollution problems - if any, are mostly localized. But here are the problems of poverty, diseases, lack of adequate housing, clean drinking water and safe disposal of human body wastes. High population levels and growth rates are the causes of many such problems. The search for fresh agricultural and grazing land, the depletion of forests for timber and fuel and the intensified use of chemicals for pest control, pasture improvement and crop productivity, all combine to degrade the environment.

Many problems have been caused by the human activities in the process of using the environment for various needs. The use of the environment is a necessary and acceptable concept but instead of the old pattern of use and discard, we must now practice renewal and re-use.

**Resource deterioration**

Resource deterioration is a twofold process involving reduction in the quality as well as quantity of resources. The entire earth, including the ocean and atmosphere, has raw materials that can be made useful. Some of these resources such as timber, air, water and food are renewable, whereas others such as oil, gas and minerals are non-renewable. However, renewable resources are renewable only as long as environmental conditions are favourable for their natural or induced reproduction. Careless use of renewable resources may destroy them to an extent that they may not be available to us in the near future. The problem is much more with the finite resources, whose over-exploitation may cause deprivation of such resources in the future. Problems of resource deterioration include soil, plant, wildlife, minerals, energy and water.

**Soil**

Slow removal of soil through denudation and erosion is a natural process, which is both inevitable and universal. Under stable natural conditions, this process is as slow as that of soil formation. As a result, there is a balance between the two processes and the soil is able to maintain itself. However, human activities or rare natural events may accelerate the rate of soil loss. Deforestation, overgrazing, over-cultivation, mining activities, construction of buildings, transport and communication lines and irrigation projects affect the soil layer in different ways causing soil loss.

Destruction of vegetation cover and overgrazing causes widespread soil erosion. In the absence of plant roots which hold soil together, soil is left loose and is washed away easily by the wind and water. This causes major losses in productivity. Washed away soil is transported through wind and water and is deposited finally at the bottom of the sea. This is called sedimentation.

Unrestricted overgrazing has destroyed vegetation cover and productive soils in many parts of the world, for example, the nomadic herders on the fringes of the Sahara desert are causing the desert to spread southwards towards the tropical grasslands.
Excessive use of fertilizers and pesticides have badly affected the natural cycles. Pesticides are toxic chemicals which stay poisonous for long periods of time. Soil, once impregnated with them can remain seriously toxic for many years. Certain chemicals used as pesticides are harmful to people as well. They find their way into our food and water from the soil and the rivers.

<table>
<thead>
<tr>
<th>Cultural control methods</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use clean planting materials.</td>
<td>No pests and diseases on seeds, tubers and cuttings.</td>
</tr>
<tr>
<td>Plant at the correct time, such as in the wet or dry season.</td>
<td>Plants grow before pests and diseases can attack them</td>
</tr>
<tr>
<td>Put compost, manure and fertiliser on plants</td>
<td>Well-fed plants keep growing, even if attacked by pests and diseases</td>
</tr>
<tr>
<td>Make other crop remains into compost or dig into the ground.</td>
<td>Rotting plants return nutrients to the soil</td>
</tr>
<tr>
<td>Rotate crops</td>
<td>Pests and diseases grow more when the same crops are grown year after year in the same piece of ground</td>
</tr>
<tr>
<td>Control weeds</td>
<td>Pests living on weeds do not have the chance to move on to crops. Air circulates through crops. If air does not circulate, the atmosphere around the crops will be hot and moist, so crops become a breeding ground for fungi and bacteria</td>
</tr>
<tr>
<td>Burn diseased plants.</td>
<td>Diseases do not spread to next crops planted</td>
</tr>
<tr>
<td>Pick off pests by hand and squash them</td>
<td>They cannot spread to other plants</td>
</tr>
<tr>
<td>Use physical barriers, such as a fence to keep pigs out. Wrap bananas to protect them from flying foxes</td>
<td>Stops pests getting to crops</td>
</tr>
<tr>
<td>Plant marigolds</td>
<td>These flowers send out a chemical from their roots, which some worms do not like</td>
</tr>
<tr>
<td>Crush chilli in water and spray on the leaves</td>
<td>Stops pests eating the leaves</td>
</tr>
</tbody>
</table>

*Figure 2: Environmentally friendly pest control. (Source: Dellasta Encyclopedia – PNG)*
Trobiand Forest 'Dying,' Conservation Director Says

PORT MORESBY: The fast depletion of forest on the Trobriand Islands in Milne Bay province will be an environmental problem in the next 20 years unless it is stopped, Environment and Conservation Director Dr Wari Iamo said. Dr Iamo said the danger is erosion if the rate of intensive gardening is not closely monitored or reforestation is not done quickly. Mr Iamo, who visited the Trobriand Islands at the weekend with Environment and Conservation and Rural Development Minister William Ebenosi, said most part of Kiriwina is now covered in grassland as a result of intensive gardening in the past. Mr Iamo said yam gardening was common and because people could not live without yams which are their staple food and a pride of their culture, they have to make new gardens consequently cutting down more trees. “When all the trees are cut, the danger is soil erosion and even strong winds can sweep the islands bare if there are no trees left,” he said. He said what needed to be done now was reforestation in order to save the Islands. Losuia is almost covered in grass except for the few trees left along the coastlines of Kaibola and Waowela beaches. He said yam festivals are part of the people’s culture and livelihood and because of such pressure people turn to doing more gardening. Trees are being cut quite often because people do not let a particular bush to rest for at least ten years to recover until a new garden could be made, he said. Dr Iamo said this practice of over using the land could also reduce the fertility of the soil.

The National, August 25, 1999

Plant

Forests represent the natural vegetation. These cover less than 7 per cent of the earth's land surface but contain 30-50 per cent of all living species. It was estimated that by the mid-twentieth century, people had reduced the world's original forested area by at least 33 per cent. Tree felling and forest clearance has caused soil erosion and silting. Destruction of vegetation results in simplification of the ecosystem structure through elimination of plants which play an important role in the ecological food chain. Removal of forest cover may also lead to increase in certain insect populations which might pose health hazards e.g. tse-tse fly increase in the bush that takes over from forests. The safeguarding of the flora and fauna is essential for maintaining ecological balance. Even insects, notorious as pests and carriers of disease, can be of value in controlling their own kind.

For farming, timber and fire-wood, people have deforested vast areas without replacing these areas with similar vegetation cover or a system of farming which would help in maintaining the fertility of the soil. This has, therefore, led to serious soil erosion, and loss of valuable flora and fauna.

1.3 Activity 3

Observe the local area close to your college. What environmental changes can you identify?
Mineral

Mining directly disturbs the land in many ways such as surface disturbance and disposal of water. Mineral extraction and processing have a wide range of environmental impacts which can be divided into four categories - impacts on land, atmosphere and water-and socio-economic environment of people. Mining activity defaces the land with great sears and pits, destroys ecosystems, and brings on many undesirable side effects such as water pollution and the disturbance of hydrologic systems.

*Figure 3: Impact of Panguna mine on the landscape (from Bougainville Copper brochure)*

Environmental pollution

The existence of pollution in the environment, as a national and a world problem was not generally recognized until the 1960s. Today it is increasingly being appreciated that the general effects of pollution produce a deterioration of the quality of the environment which may be summarized as the following:

- Damage to human health caused by specific chemical substances present in air, water and food
- Damage to the natural environment which affects vegetation, animals, crops, soil and water
- Damage to the aesthetic quality of the environment caused by smoke, noise, dumping of rubbish and waste
- Damage caused by long-term pollution effects which are not immediately apparent, for example, effects of radioactivity

*Figure 4: Sources of environmental pollution (from Dolan (1998) Hazard Geography, Longman)*
The problem of pollution has increased in recent years because of many interrelated factors such as increased world population, increased food, energy and natural resources consumption, developing technology and economies.

Industrial activities have their impact on the natural environment in two ways. Wastes from the industries are released into the atmosphere (gaseous) or dumped on land (solids), or discharged into streams, rivers, lakes or seas (liquids).

![Figure 5: Contamination of the food chain by toxic wastes](from Dolan (1998) Hazard Geography, Longman)

**Land pollution**

Solid wastes dumped on land pose a serious environmental problem. These wastes come from different sources such as residential areas, commercial properties, and industrial sites. The quantity, the treatment and disposal methods of waste are very important. A wide range of so-called 'disposable' goods made of paper and various kinds of plastic are very convenient for consumers but they aggravate the disposal problem. Plastics are not easily affected by bacteria or affected by weather.

### 1.3 Activity 4

*Discuss the steps taken in different parts of PNG to combat pollution from 'disposable wastes'.*
**Water pollution**

Water pollution like other forms of pollution is caused basically by people's inability to dispose of waste in ways that do not change the natural balance of the environment.

Growth of urban settlements has greatly affected our natural environment. It has been estimated that a million acres of living soil are taken over annually for erecting buildings. The contents of urban sewers and industrial effluents are discharged into streams and rivers polluting the water. Tremendous quantities of water are needed by human settlements for domestic as well as industrial uses. Waste chemical substances enter and accumulate in ecosystems and food chains affecting biological life and human health.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Source</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sewage</td>
<td>Industries, household waste dumping at sea</td>
<td>Kills water life, causes a range of gastrointestinal diseases</td>
</tr>
<tr>
<td>Heavy metals (e.g. arsenic, mercury)</td>
<td>Chemical and metal industries, mining urban run-off</td>
<td>Contaminates fish, passes through food chain to humans causing lung, heart and nervous disorders</td>
</tr>
<tr>
<td>Polychlorinated biphenyls (PC13s)</td>
<td>Industry (e.g. chemical, plastics, pulp paper)</td>
<td>Contaminates and causes disease in fish and shellfish. Damages human organs</td>
</tr>
<tr>
<td>Radioactive waste</td>
<td>Nuclear power stations, dumping at sea</td>
<td>Contaminates water, increases risk of cancer</td>
</tr>
<tr>
<td>Oil</td>
<td>Oil refineries, flushing of tankers, accidental spills</td>
<td>Kills bird and marine life, po</td>
</tr>
<tr>
<td>Herbicides and pesticides (e.g. DIDT, dieldrin)</td>
<td>Run-off from farmland</td>
<td>Persistent, passes through food chain to humans, May cause birth defects, cancer and other illnesses</td>
</tr>
<tr>
<td>Nutrients</td>
<td>Fertilisers in run-off from farmland, sewage, animal waste</td>
<td>Increased algae in water. Causes lack of oxygen. Destroys water life</td>
</tr>
<tr>
<td>Sediment</td>
<td>Soil erosion from cleared land</td>
<td>Blocks light needed for water life. Pipes and drains become blocked, waterways become too shallow for boats and ships</td>
</tr>
<tr>
<td>Plastics</td>
<td>Household waste, litter, dumping</td>
<td>Destroys natural habitats, strangles and mutilates wildlife</td>
</tr>
<tr>
<td>Hot water</td>
<td>Power stations, various industries</td>
<td>Harms water life, destroys natural habitats</td>
</tr>
<tr>
<td>Salt (in freshwater)</td>
<td>Saline groundwater or run-off, coastal flooding</td>
<td>Kills trees, crops and pasture. Rusts machines and appliances more quickly</td>
</tr>
<tr>
<td>Acid rain</td>
<td>Power stations, various industries motor vehicles</td>
<td>Kills water life, corrodes pipes, causes illness in humans</td>
</tr>
</tbody>
</table>

*Figure 6: Major water pollutants (from Dolan (1998) Hazard Geography, Longman)*
Air pollution

Atmospheric pollution impacts on the biosphere in many ways. It affects buildings and materials, the soil, vegetation crops and animals, human beings. The fabric of buildings surrounded by heavily polluted air for years may undergo chemical changes. Metal surfaces are corroded. The most widespread effects of air pollution on human beings are caused by smoke and S02 which cause bronchitis, pneumonia and associated respiratory complaints.

Various means of transport do not only consume vast stretches of land but they also consume different sources of energy such as coal, diesel and petroleum in large quantities. Besides, these means of transport pollute the environment in different ways. Motor vehicles alone are responsible for 60 per cent of air pollution. The carbon-monoxide and lead emitted from motor vehicles are extremely dangerous to human health. Aircrafts, like other forms of transport, are users of fuel oil. They pour huge quantities of polluting fume into the air.

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Source</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon monoxide</td>
<td>Motor vehicles, fuel combustion, industrial and farm burning</td>
<td>Oxygen deficiency in blood leading to angina, impaired vision, poor coordination</td>
</tr>
<tr>
<td>Sulphur dioxide</td>
<td>Power generation, chemical factories, smelting of sulphur bearing ores</td>
<td>Produces acid rain, obstructs breathing, irritates eyes, reduces visibility</td>
</tr>
<tr>
<td>Ozone</td>
<td>The exposure to sunlight of nitrogen oxides and hydrocarbons from vehicle exhausts and factories</td>
<td>Restricts airways, reduces lung capacity, and causes bronchitis and eye irritation</td>
</tr>
<tr>
<td>Benzene</td>
<td>Motor-vehicle emissions, petrol refining</td>
<td>Poisonous, colourless gas, which has been linked to many cases of leukaemia</td>
</tr>
<tr>
<td>Nitrogen dioxide</td>
<td>Industry, power generation and motor-vehicle combustion processes</td>
<td>Causes asthma and bronchitis, lowers resistance to colds and influenza</td>
</tr>
<tr>
<td>Lead</td>
<td>Leaded-petrol emissions from motor vehicles exposure to lead paints</td>
<td>Brain damage (especially in children), nervous disorders, kidney disease, impaired growth</td>
</tr>
<tr>
<td>Particulates (fine particles of suspended material)</td>
<td>Natural- and human-made smoke and dust industry, domestic heating, diesel engines</td>
<td>Reduced visibility, eye and lung damage respiratory problems, soiling of materials</td>
</tr>
<tr>
<td>Pesticides</td>
<td>Sprayed on agricultural land</td>
<td>Spray often remains in air causing health problems for wildlife and humans</td>
</tr>
<tr>
<td>Radioactive particles</td>
<td>Nuclear-power generation</td>
<td>Possible cause of leukaemia in children</td>
</tr>
</tbody>
</table>

Figure 7: Some major air pollutants from Dolan (1998) Hazard Geography, Longman
Wars and the threat of war have always been a part of the history of human civilization. But in recent years, the advancements made in the field of science and technology has increased the destructive power of modern weapons. War activities involve vast human and natural resources. Some raw materials including bauxite, copper, lead and zinc were especially in demand for military uses. Besides, military activities have their impact on ecosystems in several ways. Despite widespread condemnation of nuclear weapons, 469 nuclear explosions mostly to test weapons have been reported between 1970 and 1980.

### 1.3 Activity 5

*In small groups identify the sources and types of land, air and water pollution which are evident at your college.*

**Habitat loss**

Thousands of animals and plants are endangered (dying out or becoming extinct) because people cut down the forests and drain the swamps to garden or build on the land. People change the environment so much that animals and plants cannot survive. This is habitat loss. People compete against wildlife for support from the natural environment because they need food, clothes and houses. Many areas of PNG are covered with grasslands instead of natural forests now.

The most serious threat to the environment, especially in PNG, is the clearance of forests for timber, particularly lowland tropical rainforests, which support the greatest variety of living things. Loss of trees means less wildlife.

There seems to be a growing awareness of the necessity to conserve forests and wildlife. But traditional landowners are often torn between the rich rewards offered by foreign logging and mining companies and the destruction of their environment. Village leaders also have limited experience from which to draw when making decisions regarding large-scale commercial logging. The problem is further exacerbated by the limited capacity of PNG authorities to police the activities of the logging companies which often over-log and operate outside the scope of their agreements.
Climate change

Global mean surface temperatures have increased 0.6-1.2°F since the late 19th century. The 10 warmest years in this century all have occurred in the last 15 years. Of these, 1998 was the warmest year on record. The snow cover in the Northern Hemisphere and floating ice in the Arctic Ocean has decreased. Globally, sea level has risen 4-10 inches over the past century. Worldwide precipitation over land has increased by about one percent. The frequency of extreme rainfall events has also increased.

Increasing concentrations of greenhouse gases are likely to accelerate the rate of climate change. Scientists expect that the average global surface temperature could rise 1.6-6.3°F by 2100, with significant regional variation. Evaporation will increase as the climate warms, which will increase average global precipitation. Soil moisture is likely to decline in many regions, and intense rainstorms are likely to become more frequent. Sea level is likely to rise half a metre along most of the U.S. coast.

1.3 Activity 6

Study Figure 8 and list the main components of our climate system. Find out how one of the techniques listed below can assist scientists studying climate change.
**Studying climate change**

Scientists study the climate record to learn about climate and its changes. One way is to study standardized measurements by weather instruments. The reliable instrument-based record dates back only about 125 years and is too short to reveal all possible variations in climate. Climatologists have lengthened the record by studying:

- Historical documents
- Tree growth rings
- Fossil plants and animals
- Deposits of pollen
- Cores drilled out of glacial ice
- Seafloor sediments

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**Success for team studying climate**

AUCKLAND: A six nation effort to drill through the Antarctic sea-ice to record climate changes millions of years ago reached a record depth of 939 metres below the sea floor, project leader New Zealand announced yesterday.

‘This is crucial cutting edge science and helps us piece together the formation of the Antarctic Continent and gives us hard data by which to evaluate current phenomena like climate change,’ Associate Foreign Minister Simon Upton said in a statement.

The $US4.3 million ($A6.6 million) project began several years ago at Cape Roberts, 125km north-west of New Zealand's Scott Base at McMurdo Sound. It also included Australia, Germany, Italy, the United Kingdom and the United States.

*(Post Courier, 23-11-99)*

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**Causes of climate change – natural**

About 18,000 years ago, a sheet of glacial ice up to 3,000 metres thick covered much of what is now Greenland, Canada, and the northern United States. A warming trend gradually melted almost all the glaciers, except in Greenland. The warming trend ended after a mild period from 7,000 to 5,000 years ago, when the global average temperature was higher than it is today. Within the past 1,200 years, the period between about A.D. 950 and 1250 was mild. The years from about 1400 to 1850 were cool. Since then, global average temperatures generally have risen.

Many natural processes influence a region's climate. Some of these processes, such as volcanic eruptions, are short-lived and cause short-term changes. In 1991, the eruption of Mount Pinatubo in the Philippines threw large amounts of sulphur gases high into the atmosphere. This eruption likely caused a drop of more than half a degree Celsius in the global average temperature during the following few years. Other processes, such as mountain building, occur over long periods and cause long-term changes in climate.
El Niño

El Niño is a severe atmospheric and oceanic disturbance in the Pacific Ocean that occurs every four to fourteen years. It is called El Niño, meaning “the Child”, because it usually appears near the Christmas season. Changes in ocean currents that occur during El Nino can affect the climate for a year or two. Changes in the air pressure over the tropical Pacific Ocean cause the trade winds there to weaken or even reverse direction. This change enables the warm waters of the ocean surface to drift from the western tropical Pacific to the eastern tropical Pacific. This flow makes sea-surface temperatures lower than usual over the western tropical Pacific and higher than usual over the eastern tropical Pacific. The influence of these currents brings torrential rain, flooding, and mudslides to the usually dry coastal areas of Peru and Ecuador. Another result is the collapse of the monsoons in Asia, which can bring severe drought to Indonesia, Papua New Guinea and northern Australia. The phenomenon also causes severe weather disturbances in other parts of the world, such as droughts in areas of Africa and central North America.

1.3 Activity 7

What impact has El Nino had on PNG - Think of examples of extreme climatic conditions experienced in the past five years.

Causes of climate change - human

Human activity also affects the climate. The building of cities, the clearing of forests, and the burning of oil, coal, and natural gas can all cause climatic changes.

The construction of cities creates areas that are warmer and drier than the surrounding countryside. Cities are drier because they have storm sewer systems that quickly carry off rainwater and snowmelt. Cities are warmer because brick, asphalt, and concrete surfaces readily radiate the heat they absorb and so raise urban air temperatures even more. In addition, cities themselves generate heat from a number of sources, including motor vehicles and heating and air conditioning systems.

The burning of fossil fuels has contributed to recent increases in the amount of carbon dioxide in the atmosphere. Since the mid-1800's, the level of atmospheric carbon dioxide has risen about 25 per cent, mainly because of an increased use of fossil fuels for transportation, space heating, and generation of electric energy. The clearing of forests also contributes to the build up of atmospheric carbon dioxide by reducing the rate at which the gas is removed from the air.

Global warming

Global warming is an increase in the average temperature of the earth's surface. Since the late 1800's, the average temperature has increased about 0.3 to 0.8 degree Celsius. Many scientists believe that human activities have caused the trend by enhancing the earth's natural greenhouse effect. This effect warms the lower atmosphere and surface of the earth through a complex process involving sunlight, gases, and particles in the atmosphere.
Since the mid-1800's, human activities—chiefly the burning of fossil fuels (coal, oil, and natural gas) and the clearing of land—have increased the amounts of heat-trapping atmospheric gases, called greenhouse gases. The burning of fossil fuels produces the greenhouse gas carbon dioxide. Most of this burning takes place in cars, electric power plants, and industrial facilities. The clearing of land reduces the amount of carbon dioxide that trees and other plants remove from the atmosphere in a process called photosynthesis.

![Figure 9: Possible advantages and disadvantages on agriculture.](image)

Continued global warming could have a beneficial impact in some areas and a harmful impact in others. For example, people could begin to farm in regions where it is currently too cold. At the same time, global warming could cause sea levels to rise and thereby increase the threat of flooding in low-lying coastal areas, many of which are densely populated. The increase in surface temperature could alter the ecology of many parts of the earth. For example, global warming could change rainfall patterns, melt enough polar ice to raise the sea level, increase the severity of tropical storms, and lead to shifts in plant and animal populations.
Keep global warming vow, WWF warns

GENEVA: Global warming could flood major cities, including New York and Tokyo, cause widespread drought in Latin America and destroy Australia's Great Barrier Reef, the World Wide Fund for Nature warned yesterday. The environmental group urged governments meeting in Germany next week to honour earlier pledges to cut emissions of carbon dioxide one of the main greenhouse gases by implementing tough energy saving policies.

"Evidence for the warming of our planet over the last 200 years is now overwhelming," a WWF statement said. "With no action to curb emissions, the climate on earth over the next century could become warmer than any the human species has lived through," it said. "The rate of this change may be so great that many ecosystems and wildlife species will not be able to adapt." It said China's Giant Panda and the Arctic polar bear were among the species at risk.

WWF commissioned the Climatic Research Unit at Britain's University of East Anglia to conduct research into various climate change scenarios over the next few decades. It projected that sea levels would rise between two to 10 centimetres a decade. This would threaten low-lying US coastal cities such as New York, Boston, Baltimore and Miami with flooding. The Japanese cities of Tokyo and Osaka - among others would also be at risk, it said. Large areas of the Amazon would become more susceptible to forest fires. Drought would also likely affect the mid-west of Argentina, southern Mexico and Central America. Rising sea temperatures by 2010 threatened the very survival of the Australian Great Barrier Reef, it warned.

Scientists generally agree that temperatures are rising - with 1998 being the warmest on record. But there is no consensus on how much man is to blame. "Although the precise contribution of human activities to global warming cannot yet be stated with confidence, it is clear the planet would not be warming as rapidly if humans were not currently emitting about 6.8 billion tons of carbon into the atmosphere each year."

Under a 1997 agreement reached in the Japanese city of Kyoto, industrialised nations agreed to reduce their carbon dioxide emissions by 5 per cent between 2008 and 2012. Representatives from 150 countries are expected to meet later this month in Bonn to work on ways of implementing the Kyoto deal.

(Post Courier, 24-10-99)

1.3 Activity 8

Summarise the possible effects of global warming in point form.
The greenhouse effect

The greenhouse effect refers to the way in which gases in the Earth’s atmosphere warm the Earth like the glass roof of a greenhouse—by letting sunlight in but keeping the reflected heat energy trapped inside. These naturally occurring gases, notably carbon dioxide and water vapour, are called greenhouse gases. The chief greenhouse gases are made up of atoms of carbon, hydrogen, and oxygen. These gases are water vapour, carbon dioxide, methane, and ozone. The greenhouse particles include cloud droplets, soot, and dust.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Source of increased emissions</th>
<th>Contribution to Greenhouse effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbon Dioxide</td>
<td>Combustion of fossil fuels: coal, oil and gas. Deforestation involving burning Decreasing vegetation</td>
<td>~55%</td>
</tr>
<tr>
<td>Methane</td>
<td>Agricultural activities: releases from farm animals, humans and rotting vegetables in rice paddies. Rubbish tips, landfills and wood burning. Releases from coal mines and natural gas leaks</td>
<td>~ 15%</td>
</tr>
<tr>
<td>Chlorofluorocarbons and halons</td>
<td>CFCs used in refrigeration and air-conditioning, as propellants in aerosol spray cans, and in foam products for packaging and insulation. Halons used in fire extinguishers. These are also the gases which deplete the ozone layer</td>
<td>~ 24%</td>
</tr>
<tr>
<td>Nitrous oxide</td>
<td>Fertiliser use Combustion of fossil fuels Motor vehicle emissions</td>
<td>~ 6%</td>
</tr>
</tbody>
</table>

Figure 10: Greenhouse emissions and their source.

Under normal conditions, the level of carbon dioxide in the atmosphere remains constant, and trees absorb the same amount of carbon dioxide that people produce. However, in recent decades, our planet is supporting more people and fewer trees, leaving an excess of carbon dioxide in the atmosphere. Burning fossil fuels and using products that contain chlorofluorocarbons (CFCs) also increase the level of greenhouse gases, which then enhance the greenhouse effect by reflecting more heat energy back to the Earth. The amounts of heat-trapping atmospheric gases, called greenhouse gases, have greatly increased since the mid-1800's, when modern industry became widespread.

The natural greenhouse effect

The earth’s surface reflects about 15 per cent of the solar energy that reaches it back toward space. The remaining energy heats the lands and seas. The warmed lands and seas then send most of the heat back into the atmosphere, chiefly as infrared rays and in evaporated water. Without the natural greenhouse effect, the average temperature of the earth’s surface would be about 33 °C cooler than it is now.
Efforts to prevent global warming

In 1997, more than 150 nations attending a United Nations conference on global warming in Kyoto, Japan, agreed to limit greenhouse gas emissions. The agreement (the Kyoto Protocol) called for 38 industrial nations to reduce emissions of several greenhouse gases--mostly carbon dioxide--to an average of 5 per cent below 1990 levels by the year 2012.

1.3 Activity 9

Prepare responses for the following discussion questions

- What are some of the techniques which could be used to reduce global warming?
- What was the significance of the Kyoto conference in 1997?

Sea level change

Sea-level rise is one of the projected changes that will accompany global warming. Recent measurements show a sea-level rise of about 1 to 2 millimetres per year or 100 millimetres in the last century. If sea levels are changing due to global warming, the causes would be:

- Thermal expansion of the oceans
- Melting of glaciers and small ice masses in mountainous areas or high latitudes
- Melting of the Greenland ice sheet
- Break-off of the West Antarctic ice sheet
- Change in the mass balance of the Antarctic ice sheet

By the "worst case" scenario, global mean sea-level is expected to rise from 38 to 55 cm by the year 2100. The majority of the people that would be affected under the worst scenario live in China (72 million) and in Bangladesh (71 million). Between 0.3% (Venezuela) and 100% (Kiribati and the Marshall islands) of the population would be affected.

Small islands, low-lying coastal areas and deltas fall into the same category of areas very vulnerable to sea-level rise. However, unlike deltas and other coastal areas, small islands have no hinterland to move to in the case of loss of land. In addition, their land resources are very limited. Other than direct land loss the main difficulties associated with sea-level rise include erosion patterns and damage to coastal infrastructure, salinization of wells, sub-optimal functioning of the sewerage systems of coastal cities with resulting health impacts, loss of littoral ecosystems and loss of biotic resources.
### Module 1.3 Environmental Issues

<table>
<thead>
<tr>
<th>Type of Coast</th>
<th>Sea Level rising</th>
<th>Sea level falling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rocky coast</td>
<td>Steep cliff</td>
<td>Rocky shelf above water</td>
</tr>
<tr>
<td></td>
<td>Deep water</td>
<td>Old shells stuck on rocks above water</td>
</tr>
<tr>
<td>Sandy coast</td>
<td>Sand cliff with vegetation hanging over edge</td>
<td>Shallow slope to water</td>
</tr>
<tr>
<td></td>
<td></td>
<td>New clumps of vegetation on seaward side of sand</td>
</tr>
<tr>
<td>Mudflats</td>
<td>Dead mangroves in sea</td>
<td>Mangroves not in water at high tide</td>
</tr>
<tr>
<td></td>
<td>Drowned ground plants</td>
<td>Mudflats between ground plants and water at high tide</td>
</tr>
<tr>
<td>City coast</td>
<td>Refurbished sea wall</td>
<td>Broad beaches between buildings and the sea</td>
</tr>
<tr>
<td></td>
<td>Buildings undercut</td>
<td>River mouth silting up</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Old harbours now too shallow for ships</td>
</tr>
</tbody>
</table>

*Figure 11: Indicators of sea level changes.*

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### 1.3 Activity 10

*Figure 12: Effects of changing sea levels.*

**Using the diagram above explain in your own words how a rise in sea level could affect low lying islands and coastal regions.**
Topic 3 – Caring for the environment

Environmental decisions

Most of the environmental problems of the present-day world are essentially from human activity. The role of humans is, therefore, crucial because it is their attitude that has shaped the present-day environment. Obviously it is only through a change in attitude that people can take initiatives in influencing the conditions of the environment.

"Think globally, act locally" is a theme of environmental education. It refers to the need for people to develop an understanding of the global context within which their actions towards the environment have meaning. The problems of environmental management at a local level may be examples of problems which also exist at a national or global level.

Figure 13: Components of the environmental decision-making process (from NSW Department of Education – Environmental Education Curriculum Statement)

1.3 Activity 11

Identify examples of environmental pollution beyond the control of the local community.

Select an environmental issue, for example excess logging, and examine the role of governments, individuals and businesses in contributing to the problem.

Decisions affecting the environment may be made by an individual, a family, a society, consumers, industries or the government. In the 20th century, technologically advanced
societies regarded a steadily improving standard of living for their people based upon economic growth and industrial development as their main goal. Environmental considerations had a low priority.

Effective environmental decision-making involves consideration of various issues. Ecological, economic, social and technical aspects must all be carefully analysed and various alternatives in policies, actions and practices examined before taking a decision. Whenever the people have organized in a group to protest and challenge the short-sighted developmental activity, they have compelled the government to act.

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**Planning Needed to Ensure Proper Decommissioning of Mine and Oil Projects**

THERE is no reliable mechanism in place to ensure sufficient funds are put aside for the decommissioning and rehabilitation of mining and petroleum projects in the country, a senior government official said yesterday. James Wanjik, from the Department of Mineral Resources, said project developers pay bonds at the early stage of a project, but many of them would be insufficient to cater for mine rehabilitation or decommissioning. Mr Wanjik, who is the assistant director, mineral project assessment, said this is one issue the committee has to look at. Some of the issues discussed yesterday included planning implications after mine closure, the legal implications, the technical and safety aspects, the environmental and safety aspects and the costs involved. Mr Wanjik said not much consideration had been given to these issues in the past as many host nations, including PNG, and mining companies concentrated their efforts on developing mines as opposed to closing mines. He said the estimated cost for the rehabilitation of the following projects are: Kutubu estimated to be $US50 million; Porgera K15 million; Misima K4.5 million; and Lihir K15 million. Mr Wanjik said all the mining projects have deposited a bond of K40, 000, while the Kutubu project has a bond of K1 million.

Post Courier, August 26, 1999

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**Mine Wastes PNG Rivers, Global Ban Urged**

PORT MORESBY, Papua New Guinea, August 11, 1999 (ENS) - The release by Australian mining company Broken Hill Proprietary of reports confirming severe environmental impacts of mine wastes dumped in Papua New Guinea's Ok Tedi River has sparked calls for a global ban of river and sea dumping of mine tailings. The Ok Tedi open-pit mine produces copper and gold. The president of the Washington D.C. based Mineral Policy Center, Stephen D'Esposito, describes BHP's Ok Tedi mine as an "an environmental catastrophe where an entire river system has been destroyed by mine waste."

"We need a worldwide ban on dumping mine waste in rivers, a practice which is effectively prohibited in developed countries, like the US, Canada and Australia," D'Esposito says Environmental and development groups fear that BHP is pushing to be allowed to continue polluting the Ok Tedi river. "River systems should not be used to dispose of mine waste," said Brian Brunton, a spokesperson for a coalition of Papua New Guinea community groups. The coalition, including the Environmental Law Centre, NANGO, NGO Environmental Working Group, the Pacific Heritage Foundation and Greenpeace Pacific, said if mining continued, "BHP should cease pushing overburden from the ore into the river and a new safe way should be found to deal with tailings, even if this means the mine should be smaller, and new
technology found to extract greater metal content." Community groups fear that BHP is considering adding its shareholding in the Ok Tedi Mine to the list of copper projects it is closing or selling. "BHP shareholders should bear the environmental cost of mine closure, and should not be allowed to offload their environmental responsibilities onto the PNG taxpayer and the government of PNG," Brunton said that in 1996 BHP was forced to commission the reports into the environmental and social impacts of the mine as a result of a landmark legal settlement to a class action taken by 30,000 Papua New Guinean villagers. The landowners launched a $4 billion damages claims against BHP in the Victorian Supreme Court in Australia for economic loss and environmental damage and argued that BHP should be forced to build a tailings dam. BHP responded by secretly drafting legislation for the Papua New Guinea Government, a 30 percent shareholder in the Ok Tedi mine, making it a criminal offence for those found to have taken legal action against BHP in courts outside PNG. The legislation included provision for those found guilty to be imprisoned for up to five years. BHP was found guilty of contempt of court, causing its share price to plummet. Many groups involved in the Ok Tedi issue are not persuaded that BHP has learned any lessons from the Ok Tedi debacle.

August 11, 1999

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**Govt Will Give Go-Ahead for Ramu Only After Full Study**

PORT MORESBY: The environmental plan for the US$838 million (K2.3 billion) Ramu Nickel Project will not be approved until all the key issues have been addressed and steps taken to minimise all adverse impacts. Rural Development and Environment and Conservation Minister William Ebenosi gave the undertaking on Friday while responding to reports in The National about possible marine environment destruction by the deep-sea tailings disposal plan for the project. Mr Ebenosi said that when he approves the project "no environmental stones will be left unturned," implying that the Office of Environment and Conservation (OEC) will do a thorough job. He said projects of the magnitude of the Ramu nickel mine, with wide ranging environmental issues, many of which are significant, require thorough evaluation by technical officers in OEC and in certain circumstances outside expert advice is sought to support OEC technical officers' work. Mr Ebenosi said this was the case with the Napa Napa oil refinery outside here and the PNG to Queensland gas project and the Ramu project evaluation is following suit. He said a special task force consisting of technical officers of OEC and other line government department agencies, including National Fisheries Authority and the Department of Mineral Resources have visited the project site, conducted field investigations and held consultation meetings with all communities in the project area. He said that internal review consultations and evaluations have identified the following key issues:

- Deep-sea tailings impact on water quality and fisheries and other marine resources;
- Aerial emissions from the processing plant;
- Sediment control and rehabilitation;
- Social impact issues.

He said the OEC has sought both government and outside support funding including that of Ramu project developer, Highlands Pacific Ltd, for expert
reviews but denied the OEC had received K100,000 from Highlands Pacific. Mr Ebenosi said that "independence from the developer and transparency of the process in the review carried out by the expert consultants is essential and will be strictly maintained."

*The National, August 16, 1999*

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**1.3 Activity 12**

*Examine the articles above (or other more recent articles you have collected) and outline the different types of decisions which have been made.*

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**Conservation**

The natural environment must be looked after. A damaged Earth will not grow food. Damaged (polluted) seas will not produce fish. Damaged (cleared) forests will no longer provide homes for animals. The natural environment needs to be looked after (conserved). You can conserve and protect your environment in these ways:

- Use the same garden land without cutting down more forest
- Grow trees for firewood on grassland instead of cutting down forests
- Grow trees for houses and furniture
- Do not light grass fires
- Grow trees and plants which will attract wildlife such as birds and butterflies
- Recycle, that is use old things to make other things

People who support conservation may become members of organisations, including:

- Friends of the Earth, who are committed to the preservation and sensible use of the environment
- Greenpeace, who work as a pressure group to save endangered wildlife, particularly whales and seals

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**Chevron lauded for environment policy**

A leading environmentalist who has been visiting PNG and studying its unique forest environment for over 20 years has described Chevron’s petroleum development areas in the country as the nation's best kept national parks. Writing in the *New York Times*, Dr Jared Diamond said the environmental safeguards practiced by Chevron at Kutubu and Gobe provided the best protection of wildlife, water and vegetation anywhere in the country. The Kikori Basin, whose many rivers and streams run through the areas where the oil wells are located, is a unique part of the world with immense bio-diversity and species of plants and animals which are still being identified by science," he said. Dr Diamond said he was pleased to note that the environment in the Kikori...
Basin is better protected since the Chevron operations started because of the strict environmental regime. He said: “Flying over the Kikori area, I was astonished to find that I couldn’t see oil wells. The whole area retains its original cover of rain forest, which grows up to the edges of the few roads, camps, wells and drill sites. Chevron PNG director Dr Moseley Moramoro said Dr Diamond’s comments are testament to Chevron’s worldwide commitment to environmental best practice.

(The National, February 1, 2000)

**EU commits K22.5m for eco-forestry plan**

The European Union is committing K22.5 million to Papua New Guinea for a five-year ecoforestry program. Prime Minister Sir Mekere Morauta signed the financing agreement yesterday… Sir Mekere said: ‘PNG is faced with a dilemma … the need to have access to resources for development is very urgent and it is forcing us to exploit resources in a manner that is not sustainable.’ Sir Mekere said to use and conserve resources at the same time is an ideal situation and he thanked the European Union for their support.

The Eco-Forestry program, to be financed via the European Development Fund (EDF), is a follow-up on the on-going Lands Region Environmental and Community Development Fund (LRECF) program, which concludes this year. ..The new program will continue to encourage sustainable, income-earning logging practices in rural communities and having a significant emphasis on eco-forestry policy development and the marketing of eco-timber. The program would be based in West New Britain, but with a national outreach with particular attention to Bougainville. During the life span of the program, responsibility for sustaining the activities would gradually be handed over to the Government, NGOs and the private sector.

(Post Courier, March 15, 2000)

**Conserving water**

Water is a vital substance, and there would be no living things without it. Clean fresh water has no colour and no taste or smell. A clean, convenient water supply is necessary for good health and hygiene.
How to conserve water in your school

Being free of the burden of having to pay for water results in a lax attitude towards its use. This is particularly evident in schools, where students do not feel and responsibility to conserve water. This negative attitude in turn spreads when students take it home with them.

Below are some simple tips on how to conserve water in school:

- Check that toilets are not leaking
- Turn off taps tightly after use
- Use buckets instead of a water hose for cleaning
- Use compost around plants to prevent excessive water loss
- In the staff room, wash mug and plates in a basin of water and turn off taps while you are soaping the dishes

How to conserve water in the home

These simple methods can be used to conserve water in the home without significantly affecting your lifestyle.

- Take shorter showers, and do not leave shower running continuously (for example, when soaping your body or shampooing your hair)
- When brushing your teeth, don't leave the tap running; better still, use a glass of water to rinse your mouth
- Install aerated taps which are inexpensive and reduce flow by up to half
- Wash vegetables in a basin or a pan of water, not under a running tap
- Install a dual flush toilet system - so that urine can be flushed with a half flush. Each full flush of a toilet uses 6 litres of water!
- Turn off the tap when soaping your hands
When you wash your vehicle, use a bucket to fetch water instead of a water hose.

How to conserve water at work

A significant portion of water is used in the workplace for cleaning, food and drink preparation, in toilets, in washrooms and gardens.

- When cleaning outdoors (pathways or pavements) use a broom rather than a water hose
- Use basins to clean mugs and plates in the staff room instead of running taps
- Report leaks to maintenance; and encourage management to install water saving devices like dual flush toilet systems, aerated low-flow taps etc.

1.3 Activity 13

Design a poster suitable for a lower primary classroom on any aspect of conservation e.g. clean beaches.

Wildlife management and preservation

The conservation of PNG’s biodiversity is complicated by traditional land tenure and the government’s reluctance to alienate the people involved. There are few totally protected areas. Prior to independence, only two national parks were established and only two have been since, but others have been proposed. The National Parks Board also recognises provincial parks and local parks, better known as Wildlife Management Areas. These are intended as multipurpose areas, especially for the management of specific types of wildlife used for food or other functions. They are popular in aiding local communities to prevent over-exploitation of wildlife, for example the eggs of scrub turkeys (megapode) and certain kinds of bird of paradise, and are the responsibility of the communities using the areas. An advantage of this arrangement is that, as with any plans for commercial exploitation of a particular area, the rights of the people living in the area are given priority. Guidelines are clearly established in local Land Use Management Plans. Also important is the concept of Protected Species, in which all wildlife belongs to the traditional landowners but with the same restrictions as in Wildlife Management Areas.

People hunt animals for food, fur, skins, feathers and sometimes just for fun (sport). The Convention on International Trade in Endangered Species (CITES) has a list of hundreds of plants and animals. Selling or exporting these animals or their products is illegal without a special licence. PNG’s protected species list began in the 1920s to protect the bird of paradise and egret from extensive commercial exploitation of their valuable plumes. It later included most birdwing butterflies and long-nosed echidnas. Since independence, many more have been added as part of PNG’s cooperation with international conservation objectives.

Some endangered PNG animals are protected by special laws in PNG. The government has made them its property (national animals) to ensure their protection. The PNG law says it is
illegal to take, kill, disturb, possess, buy, sell or export a national animal. National animals cannot be killed with shotguns, but they can be killed by Papua New Guineans in traditional ways for traditional purposes. They cannot be sold. The government may give permission for national animals to go to zoos or to be used for scientific purposes.

**Kau Rainforest Museum and Wildlife Area**

In 1963 the Didipa clan set aside over 300 hectares of its forest as a Wildlife Conservation Area. On the west side of the main coast road out of Madang, not far from the turn-off to the Jais Aben Resort, is a rough track leading to the Kau Rainforest Museum & Wildlife Area, owned and operated by the Didipa clan. Here you can learn about the traditional uses of plants for food and medicine and get some insights into the ecological relationships between local species (including humans). Did you know that the sticky juice of the Breadfruit tree can be used as glue? Or that the juices of two local vines can be used as contraceptives? In recent years, other groups from all over PNG have studied the clan's methods. Its Kau wildlife area is a model for environmentally sound and culturally aware village development. It is a popular attraction for travellers with an interest in environmental issues.

1.3 Activity 14

*Identify three protected species in PNG other than butterflies and birds of paradise and design a brochure to educate people about these species.*

*Use the example above to write a description about a national park, wildlife reserve or protected area somewhere else in PNG.*

**Recycling**

Recycling is a way of turning waste products into something useful. Composting is an inexpensive and hygienic method of converting food and garden waste into garden mulch and soil nutrients. Much of the household waste is a combination of discarded packaging, such as aluminium, glass, plastic, steel and paper. Much of this waste can be made into other items.
Sustainable development

Sustainable development is development designed so that the environment will not be adversely affected. There are limited resources in the world, and sooner or later these will be used up if present practices continue. This is why there is increasing emphasis throughout the world on avoiding wasteful use and methods, on recycling, and on conservation of resources. Continued economic growth is not acceptable if it means the ultimate destruction of habitats and environments and the exhaustion of the world’s resources on which human life depends.

1.3 Activity 15

Choose an industry in PNG and suggest ways to develop the industry as well as protecting the environment.
Glossary

**Biosphere**  
is the thin layer around the planet which includes all life on earth

**Change**  
is a transformation from one form to another over time. Changes in the environment take place at different rates; some changes in the environment take place so slowly as to be barely noticeable in a human lifetime

**Competition**  
is an indirect or direct rivalry for the same resources

**Conservation**  
is the considered use of resources for the benefit of all life on earth, the wise use of natural resources, keeping in mind the long-term interests of the community as a whole

**Degradation**  
a reduction in the quality, value and character of the environment caused by overgrazing, over clearing, over cropping, soil erosion etc

**Ecosystem**  
is a community of living things and their surroundings. Ecosystems contain a system of overlapping relationships called food webs dependent on simpler food chains

**El Niño**  
atmospheric and oceanic disturbance in Pacific region caused by changing currents

**Endangered species**  
species in serious risk of disappearing from the wild state within one or two decades if the factors causing endangerment continue

**Energy**  
is the ability to set matter in motion. Energy can take many forms: heat, light, sound, electrical energy and chemical energy. It can be stored as potential energy or released in movement as kinetic energy. The origin of all energy forms on earth is the sun where it is released by nuclear reactions

**Environmental ethic**  
a system of moral principals by which actions and proposals which affect the environment may be judged

**Fossil fuels**  
fuel sources such as plants and trees that produce carbon dioxide when burnt

**Global warming**  
increase in the average temperature of the earth’s surface

**Greenhouse effect**  
way in which gases in the atmosphere warm the Earth by letting sunlight in but keeping reflected heat energy trapped inside

**Greenhouse gases**  
naturally occurring gases in the atmosphere such as carbon dioxide

**Heritage**  
is the parts of the environment to which we respond and which we want to keep for future generations. A community's heritage is made up of three components: the natural environment, the historic environment and the results of interactions of people and their environment

**Interactions**  
involve the reciprocal relationships between people and the total environment

**Management of resources**  
is the considered use of non-renewable and renewable resources bearing in mind both the needs of people but also the conservation of the resource base for the future

**Population**  
is a group of inhabitants of a particular place

**Pollution**  
is the presence in water, air or soil of wastes, or other substances harmful to living things

**Radiation**  
transmission of heat and/or light via particles or rays

**Recycling**  
is the treatment of products after use to serve as raw material for new products, or finding or adapting to alternative uses and thus extending the life of the products
### Resources
are those things for which there is a perceived present or future use. Resources can be renewable (we can obtain more, e.g. water, air, timber) or non-renewable (once used, no more can be obtained, e.g. coal, bauxite).

### Sea level change
rise and fall of level of the sea resulting from causes other than tidal movement.

### Sustainable development
balancing the capacity of the earth's essential ecosystems with the needs of future generations. For development to be sustainable it must take account of social and ecological as well as economic factors, and of the long and short term advantages of alternative actions.

### Technology
involves the application of human knowledge, skills, techniques and processes to practical problem solving situations in all aspects of human life. It extends beyond the tools and technical inventions of a society.

### Waste
is anything left over or superfluous such as excess material or by-products.


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*The National* – various issues
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Case study - sea level change in PNG

Awareness drive on rising sea levels

PORT MORESBY. Authorities in the East New Britain Province are embarking on an intensive community education campaign to alert villagers in the coastal areas and the islands on the impact of rising sea levels on their homes, food gardens and their crops.

"The education program will help prepare coastal communities for the impact of rising sea levels on their lives and their future," Kokopo MP Sir Rabbie Namaliu said in a statement yesterday. He said a committee of officials is in place to address all aspects of the problem. "This committee will work closely with the authorities to implement what is necessary to safeguard lives," he said.

"There will eventually have to be mitigation and relocation programs and crop replacement schemes, for the worst-affected coastal communities. Many people will be reluctant to be relocated, but in some instances that will be unavoidable," Sir Rabbie said.

Sir Rabbie said international support would be necessary to implement the programs that are being planned. He was pleased that officers from the Department of Environment and Conservation are taking this matter before an international forum in Germany where it is hoped that international attention can be drawn to assist with relocation program and crop replacement schemes, among others.

"I want to thank the officers from the DEC for their advice on the impact of rising seas levels on parts of my Kokopo electorate," Sir Rabbie said. The officers led by senior scientist and UNDP consultant to the DEC Dr Sinion Saulei visited the Duke of York Islands and inspected coastal areas around Kokopo, the Bitapaka, Kokopo/Vunamarni and Raluana local level government areas last week. "They subsequently met with me and the Deputy ENB Governor (Leo Dion) and local level government leaders and local leaders to brief us on their visit. Apart from the sound advice they were able to give on the impact of rising seas levels as a result of climate change factors, they were able to give our officials advice on the impact of sea levels of the 1994 volcanic eruptions," Sir Rabbie said.

"Dr Saulei will be presenting a report on the impact of sea levels to an international conference of small island states on climate change in Germany in the near future," he said. "This will draw international focus to our problem and remind the international community that the remote Pacific island nations are also facing the impact of rising seas levels. When that happens, it will be easier to secure donor country and agency funding for programs to overcome the impact of rising seas levels," Sir Rabbie said.

(The National, 21-10-99)
THE Duke of York Islands in East New Britain, which have a population of around 20,000 people, are sinking at a rate of 10 to 15 centimetres a year. This is the clear message from the United Nations Development Program which recently carried out studies on the island. This is not only due to global warming. It is also because the islands lie in the volcanic zone between the New Britain and New Ireland plates, which are moving apart, causing them to sink.

The scientist who carried out the study, Dr Simon Saulei, said the islands were sinking at a rate of 10 to 15 centimetres a year and that already houses, wharves, roads, school building and aid posts, plus many trees and vegetation, were under water. Dr Saulei has strongly recommended to the provincial and national governments to seriously start thinking of relocating the people on the mainland now.

The Duke of York Islands lie in the St George Channel between New Ireland and East New Britain provinces. They are made up of one large island and several other smaller islands. The Islands lie in the electoral boundaries of Kokopo electorate. During the Independence weekend, in September, Kokopo MP Sir Rabbie Namaliu, who was on the islands, highlighted the concerns that the Islands were sinking. Since then the issue has caught the attention of national and international organisations and governments.

Last week Dr Saulei highlighted the seriousness of the situation on the local radio station after completing a study on the islands. He said the problem was a result of the rising sea levels due to global warming. Dr Saulei emphasised that the islands were sinking very quickly due to the volcanic nature of the area where the islands were located.

The government of East New Britain is moving to address the problem. The provincial government will look at ways of solving the problem after it studies a report by a government team which visited the Islands recently. The provincial investigation team was lead by senior Lands Office, Orim Ladi.

(News Courier, 28-10-99)

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Figure 16: Recent sea level trends in the Pacific region based on SEAFRAME data (until January 1998).
1.3 Activity 16

Examine the data in Table 2 and compare it with the newspaper articles. Does it match? Give possible reasons why or why not.

Field Study – coastal environments.