

The Earth Around Us

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THE ENVIRONMENT

Introduction

The solid earth or, the lithosphere, is surrounded by a series of concentric spheres known as (from the outermost) the atmosphere, the hydrosphere and the biosphere. The landforms on the surface of the earth are the result of interactions among these spheres. The mineral resources we possess and the water on the surface and below the ground are results of such interactions. We see these interactions in various cycles, e.g., the oxygen cycle, the rock cycle, the landform cycle and the water cycle (Figure 1), that are in operation.

Take a close look at where we live on this earth and on this island. The land that surrounds us—that is, surrounds our city, town, village, school or home—is known as the environment. The purpose of today's programme is to take a look at what the environment is and how our activities affect it.

The relationship between man and his environment is two-way. The environment has a dominating influence on the way a man lives. Man affects the environment in the way he makes use of it. This relationship may be beneficial or it may be harmful to either man or his environment or both. Later, we shall look more closely at some examples of this two-way relationship.

Sri Lanka and its Environment

Environmental conditions in Sri Lanka vary from region to region (Figure 2) and, therefore, influence the lives of the people in different ways. For example, the environment and the lifestyle of the people in the Hill Country are different from those in the Dry Zone. The environment and the lifestyles of the people in the coastal regions differ from those in the Hill Country and the Dry Zone.

DEFORESTATION

Forests are an essential part of our environment, especially in an equatorial country such as ours. It is said that every country needs 40 percent of its land surface to be covered with trees. Although this may once have been true of Sri Lanka, unfortunately, it is not so now. Today, forests cover only about 22 percent of Sri Lanka's land surface, or about half of what is needed for our survival.

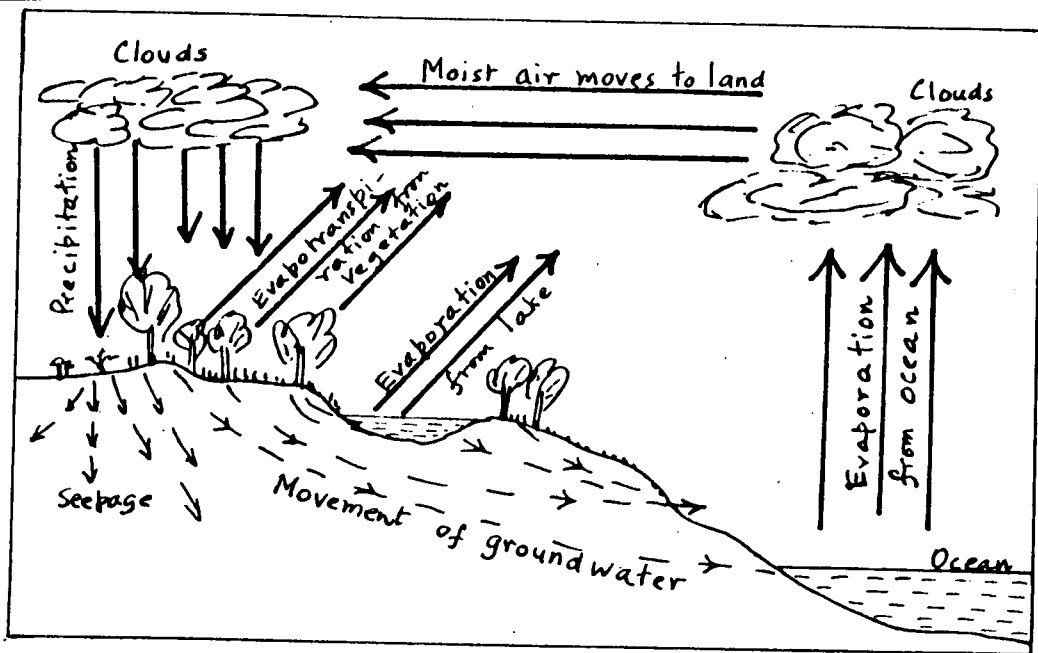


Fig. 1. The Water Cycle

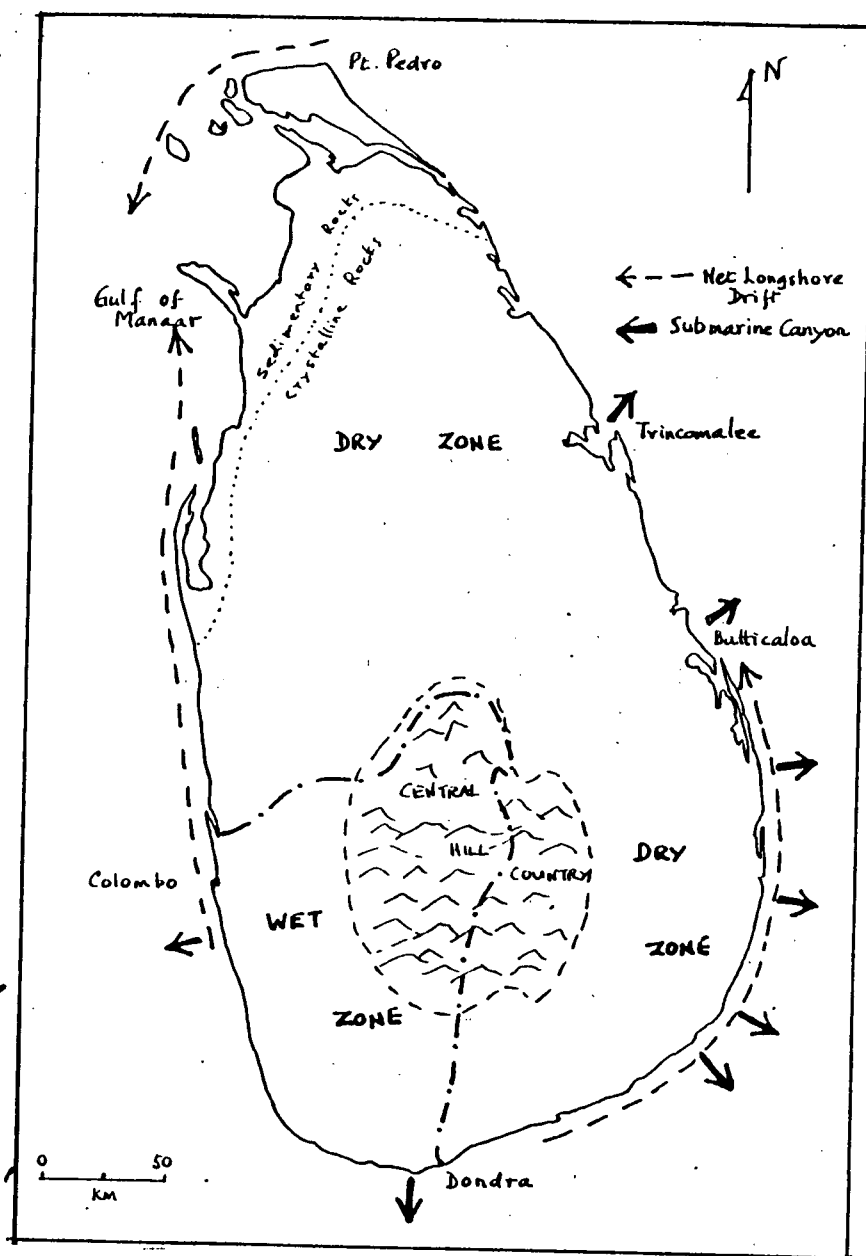


Fig. 2. Sketch map of Sri Lanka showing main environmental zones, directions of longshore drift and main submarine canyons.

Why are Forests Necessary?

1. The leaves of trees provide humus to the soil and maintain its fertility (Figure 3).
2. The branches of the tall trees provide a canopy that protects the soil from the impact of rain. The force of rain drops that fall directly on to the earth's surface causes soil erosion (Figure 4). Soil erosion causes the beds of rivers and reservoirs to be raised, which in turn increases the danger of flooding (Figure 5).
3. Destroying forests means losing our sources of firewood, which produces 55 percent of the energy needs of the country.
4. Part of the moisture in the air comes from evapotranspiration. Cutting down the forests means reducing that source and, hence, lessening of rainfall (Figure 6) resulting in the lessening of groundwater and water for irrigation as well.

How are Forests being Destroyed?

1. Increasing population means increasing demand for land to cultivate and to build on, which results in clearing of more forests to provide the necessary land.
2. An enormous amount of illicit felling of valuable timber trees goes on all the time.
3. By *chena* cultivation. Secondary shrubs, bushes and thorny trees that grow on abandoned *chena* lands do not have the beneficiary effects that the forest that pre-existed the cultivation, because the soil has already lost its fertility. It has been found that if *chena* land is left uncultivated for about 10 years, it regains its soil fertility.

How can we Prevent the Destruction of Forests?

1. Plant useful trees.
2. Discourage people in our villages from practicing *chena* cultivation.
3. Form vigilante groups that will report illicit felling of trees.
4. Stop setting fire to dry grass just for the fun of seeing the grass burn. Stop friends from doing the same.
5. Talk to friends, parents, elders and any others about the value and the use of trees to us. Make them aware of the environment in which we live, and of the essential part that trees play in that environment. Explain to them that by destroying trees we only hurt ourselves.

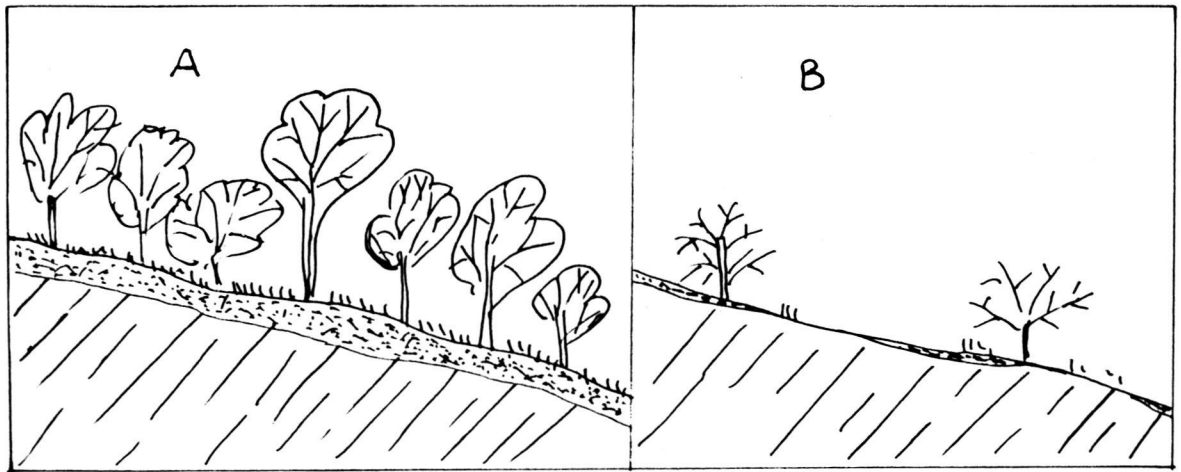


Fig. 3. A. Forested slope with rich topsoil due to fallen leaves from trees.
 B. Deforested slope with thorn scrub; topsoil removed, infertile soil remains.

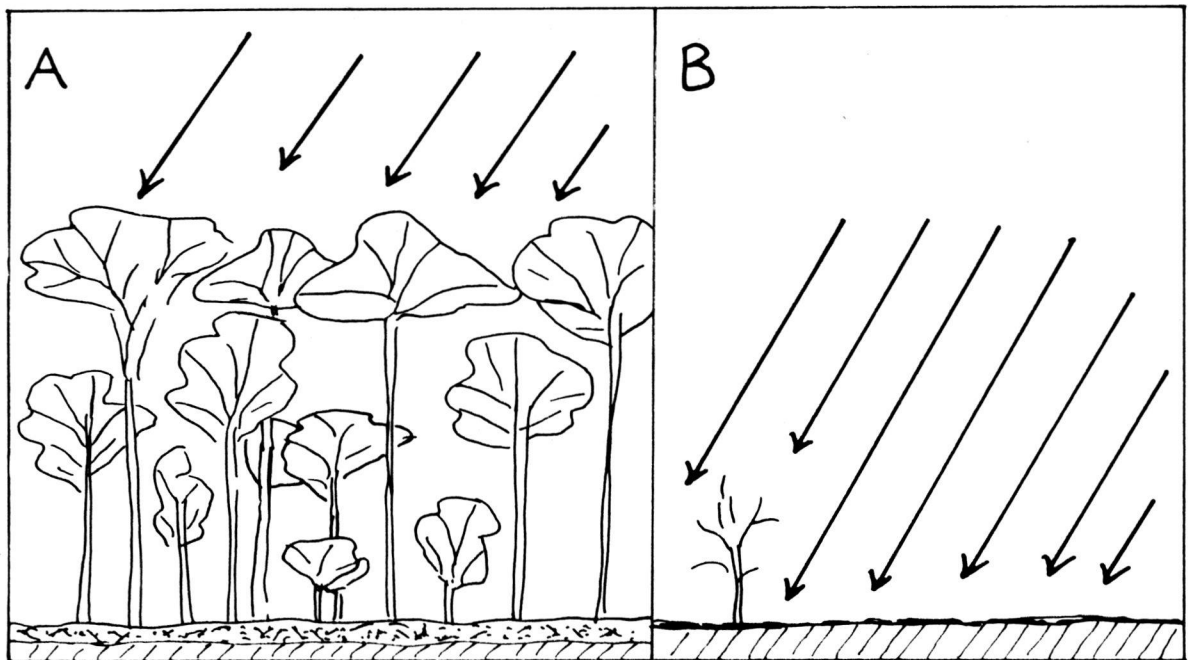


Fig. 4. A. Forested land with canopy; soil protected from impact of rain.
 B. Deforested land without canopy; soil exposed to impact of rain.

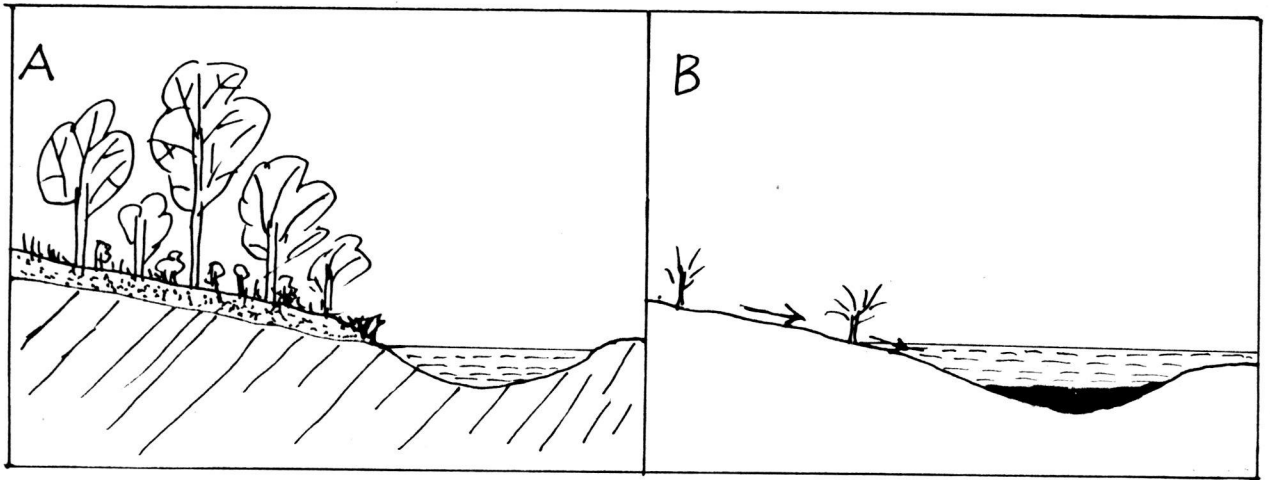


Fig. 5. A. Forested slope has minimal soil erosion; reservoir bed free of silt.
 B. Deforested slope has maximum soil erosion; silting up (i.e., raising) of reservoir bed leads to flooding of banks.

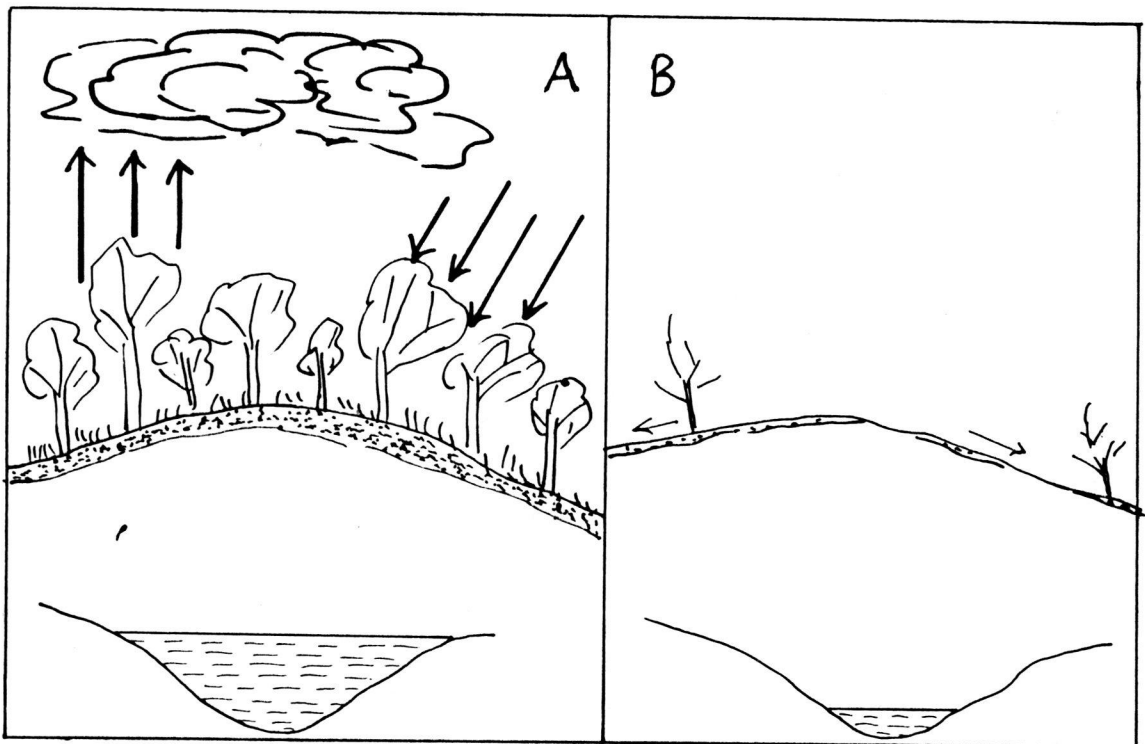


Fig. 6. A. Evapotranspiration from leaves of trees encourages cloud formation and rain. Reservoirs and tanks are full.
 B. Deforestation leads to absence of evapotranspiration - hence no clouds form and no rainfall. Reservoirs and tanks are empty.

EROSION

Erosion is the wearing away of the land surface by ice, wind, waves, rain, running water and variations in temperature. It is the natural process by which hills are worn down to plains and coastlines are receded leaving rocky offshore islands. Unfortunately, we human beings hasten these natural processes by our own behaviour. We look at two types of erosion where human behaviour hastens the process, namely, coastal erosion and soil erosion.

Coastal Erosion

Coastal erosion along the southwestern coast of Sri Lanka has, in recent years, become a serious problem, especially during the period of the southwest monsoon, mid-May to mid-August each year. At this time of the year the seas are rough, the southwesterly winds are strong, and large waves are driven on to the shore where they break with great force and erode the land. (These storm waves may sometimes wash the beach sand on to the roads.)

Although coastal erosion is a natural process, it has become much worse in recent years by man's activities such as the following:

1. Mining of offshore coral from reefs (which form a natural barrier to the land and cause waves to break before reaching the land) reduces the reef area and causes the storm waves to break on the land (Figure 7).
2. Removal of sea sand from the beaches. This results in an imbalance between the supply to and removal of sand from the beach, thus causing damage to it.
3. Removal of coastal vegetation, which helps to bind the sand and prevent it being washed away.
4. Building of unfavourable structures like groynes along the beach.

Of these, the mining of coral has probably the worst effects on the coastline. It has been estimated that between 15,000 and 20,000 people are engaged in coral mining. The mined coral is the raw material for the lime-burning industry, a very common industry along the coast. Some of this coral is even transported 40 to 50 km inland. Several lime kilns burning coral can be seen by the side of the road near Ambepussa, half-way between Colombo and Kandy. Coral extracted from reefs is sold to tourists.

Soil Erosion

Soil erosion is intensified when vegetation is removed and the soil is exposed to the force of rain drops falling on it (Figures 3 and 4). The removal of grass and other vegetation from sloping grounds is a common practice. Many years ago it was realized that a considerable quantity of fertile top soil was removed annually by this practice. The solution to this was found in 'contour terracing.' However, this method is expensive, time-consuming and needs consistent maintenance.

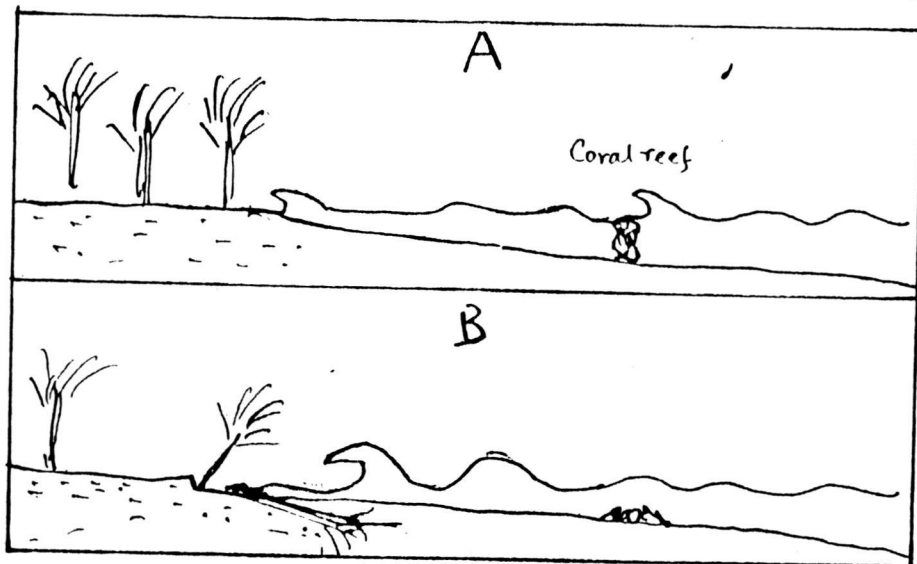


Fig. 7. A. The presence of an offshore reef causes waves to break before reaching the shoreline, and so lessens erosion.

B. The destruction of the coral reef causes waves to break with full force on the shoreline.

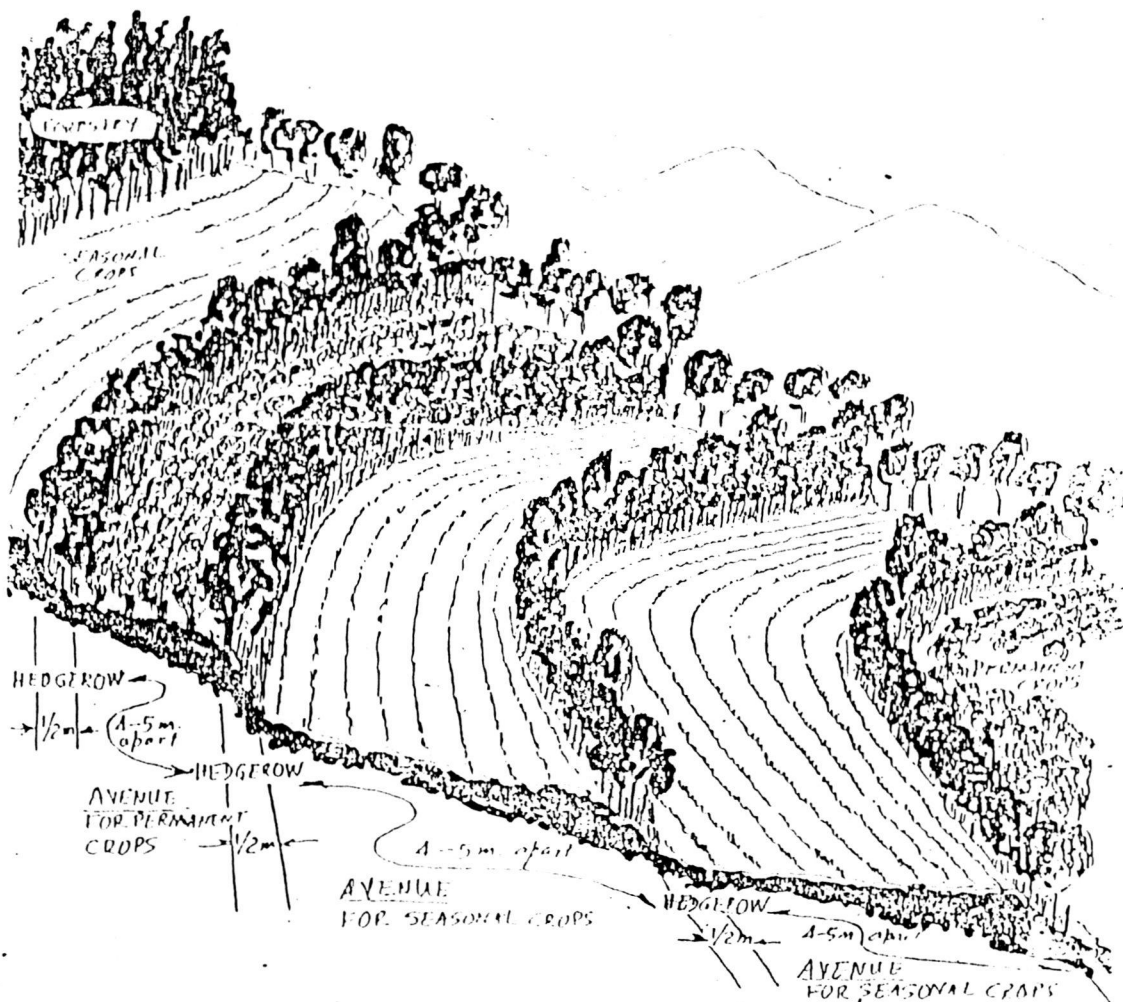


Fig. 8. Cartoon showing layout of the SALT system. (Reproduced from "A Manual on how to farm your hilly land without losing your soil" (Mindanao Baptist Life Centre, 1990).

In recent years a new soil-conservation method known as Sloping Agricultural Land Technology (SALT) was worked out in the Philippines. The SALT method is now being increasingly practiced in Sri Lanka (Figure 8).

Researchers at the IFS who were involved in testing SALT on a plot of land close to the IFS describe the method thus: "In this method, hedge-rows of fast-growing, nitrogen-fixing trees and shrubs are planted close to each other along the contours every 4 to 5 metres along the slope (Figure 8). The hedge-rows are lopped every 6 to 8 weeks, and the lopping is used as mulch for the soil between the hedge-rows and as cattle fodder. Mulching thus protects the soil from erosion, checks weed growth, conserves soil moisture and, upon decomposition, supplies essential plant nutrients to food crops and cash crops that can be grown in the avenues." This method is environmentally sound and is much less costly than conventional methods of contour terracing and draining.

Landslides

Landslides are a natural phenomenon (sometimes aggravated by man's practices) which also lead to erosion of the land surface. There are many kinds of landslides which take place on different scales. Landslides could range from small earthslips that affect a few cubic feet of earth to large rockfalls (Figure 9), debris avalanches and landslides in which thousands of cubic feet of earth and rock may move a few miles down slope.

Landslides are brought about by many causes, the chief of which is heavy rainfall concentrated in a relatively short time. Other factors that cause landslides are rock type, slope of land, and poor drainage. When there is heavy rainfall, the ground gets water-logged, the land becomes unstable and it slides. In highly jointed rocks, the surfaces become slippery due to their clayey nature, and blocks of rock slide down (Figure 10). Steep slopes are not stable. When such slopes are cultivated or built on, landslides are more likely to occur on them (Figure 11).

When a piece of land is becoming unstable and may be subject to landslides, the following warning signs appear:

- the water that flows down the slope, or the run-off, becomes a sheet of water;
- curvilinear cracks appear on the ground;
- cracks appear on the walls and floors of houses;
- electricity and telephone cable poles begin to slant;
- a road or railway line sinks; and
- springs appear in unlikely places.

Here are some remedial measures that can be taken when there are signs that a landslide may take place:

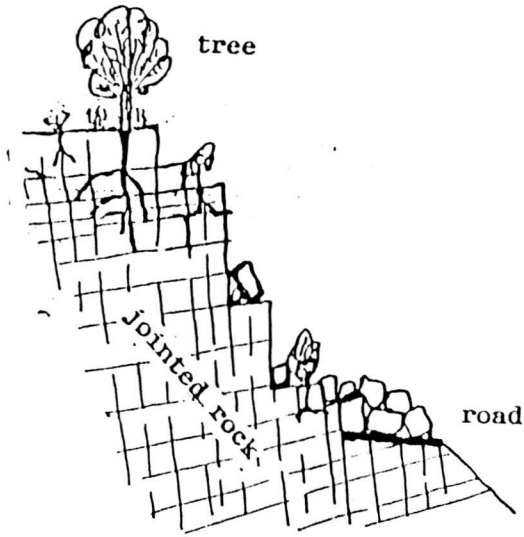


Fig. 9. Rock-fall, where rocks are highly jointed and loosened by roots of trees.

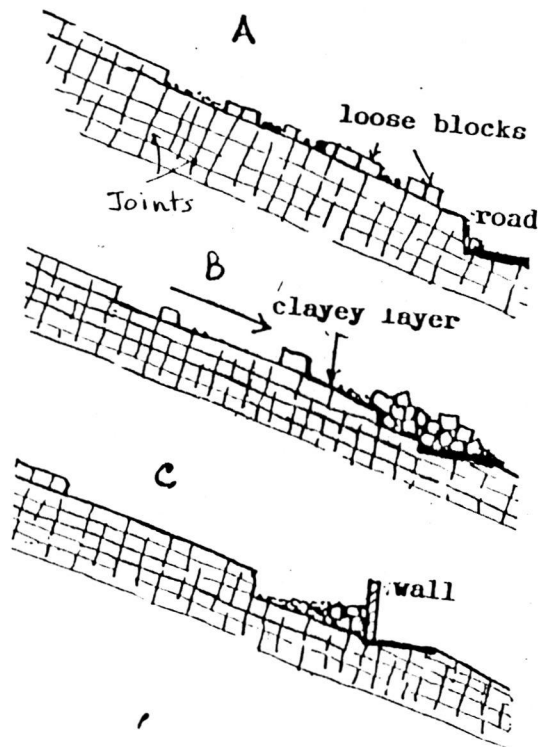


Fig. 10. Rock slides in highly jointed rocks, where dip of joints coincides with slope. Blocks slide on clayey layer. (A, B) C. Road can be safeguarded by building a wall at the foot of the slope.

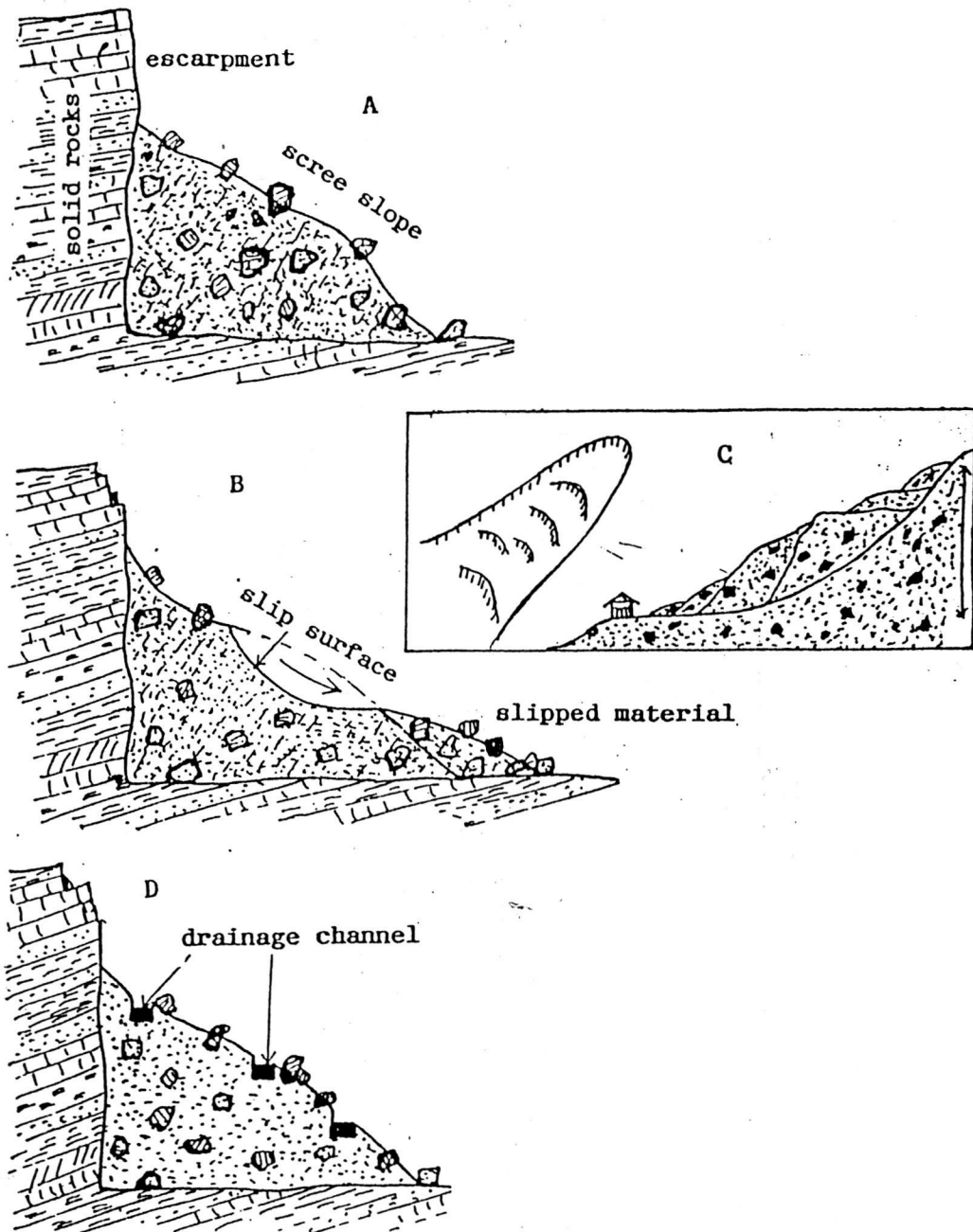


Fig. 11. Landslides on steep, scree slopes.

- A. Scree slope below escarpment.
- B. Landslide on scree slope.
- C. Landslides at Giddawa, Kandy District;
Left - in plan; right - in section.
- D. Drainage channels on scree slope to
prevent landslides.

- Make sure that there is an adequate system of drainage to take away as rapidly as possible any excess water that falls on the ground. Either enlarge existing channels or build new ones or do both to drain the excess water.
- Plant vegetation that will protect the surface of the land and bind the soil together.
- Terrace the land (Figure 13) and so reduce the steepness of the slope and increase the stability of the land.
- Examine the larger boulders on the edges of escarpments, if any, for their stability (Figure 12).

Among the measures taken in different parts of the country to stabilize the land are reforestation, planting of cashew, bamboo, rushes and other soil-conserving plants, control of land use on various types of slopes, and monitoring (after training) of high-risk areas by senior students and teachers in *maha vidyalayas* close to such areas.

What you can do in the area where you live or around your school is to keep a look out for signs of instability during heavy rains. When such signs appear, inform the police or the AGA, and take what measures you and your family or classmates can take to ensure your safety.

POLLUTION

What is Pollution?

Environmental pollution is the introduction of matter and energy into the atmosphere, hydrosphere, lithosphere and biosphere in quantities and amounts that are higher than normal, so producing undesirable effects on the environment. Things that pollute are called *pollutants*.

Water pollution is by disease-producing bacteria and viruses (*biological pollution*) and by chemical elements and compounds in solution (*chemical pollution*). Suspended solids causing turbidity are also pollutants of water.

Air pollution is by gases and solid and liquid particles of organic and inorganic matter.

Thermal pollution is due to infusions of energy into air and water, thus causing those fluids to become abnormally heated.

Noise pollution is release of energy into the environment by emission of sound waves.

Environmental pollution has reached alarming proportions in the highly industrialized countries of the 'North,' and in the megacities of the world in the 'South,' such as Hong Kong, Bangkok, Calcutta, Bombay, Cairo, Lagos, Buenos Aires and Rio de Janeiro. Atmospheric pollution in the industrialized countries of the world is caused by fuel combustion, chemical industrial processes, smelting and refining of ores, mining, quarrying, forest fires, dust storms and volcanic dust. Owing to such activities associated with industries, carbon dioxide, sulphur dioxide, lead and dust particles cause smog and haze in the air. There are certain cities (e.g.,

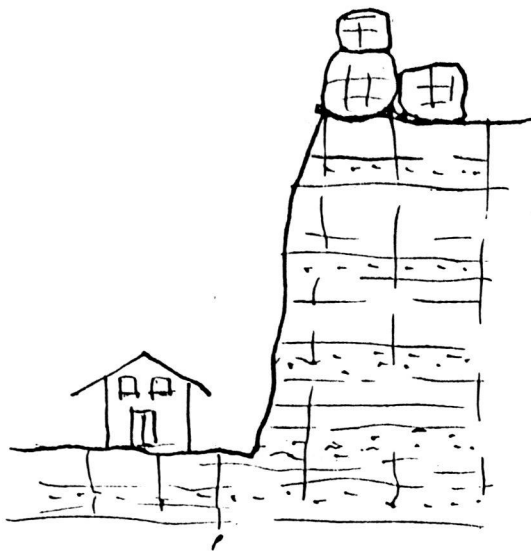


Fig. 12. . Loose block perched at edge of escarpment and held in place by sand and small stones.

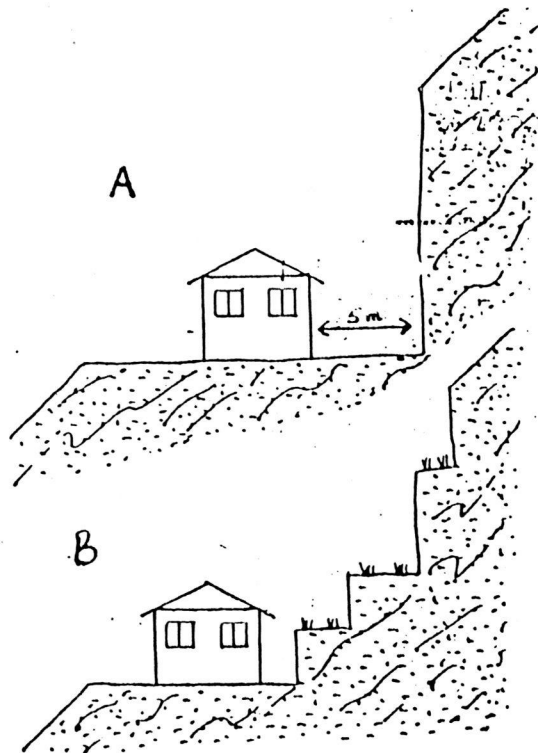


Fig. 13. A. Building too close to steep embankment; possible damage from earthslip.
 B. Preventive terracing of embankment.

Mexico City) in the world where a permanent haze or smog is present, and this is the result of pollution of the atmosphere.

Examples of Environmental Pollution

1. The release of sulphur into the atmosphere causes sulphuric acid to form and this has led to the phenomenon of 'acid rain'.
2. The Chernobyl disaster: radioactive matter was released from a nuclear energy plant in Russia.
3. Setting fire to hundreds of oil wells in Kuwait.
4. The oil spill created by the Iraqis.
5. The release of industrial waste and sewage into rivers and seas (e.g., the Rhine River and the Mediterranean Sea).

Here in Sri Lanka, although environmental pollution has not yet reached alarming proportions, it is going on. We should be aware of the forms this pollution take. Let us look at some of these forms of pollution.

Water Pollution

1. All over the island, water (surface and groundwater) is being polluted by people urinating and defecating on the ground. They do so because they lack toilet facilities. As a result of water being polluted by this habit, 65 percent of the people of Sri Lanka suffer from bowel diseases such as diarrhoea, dysentery, typhoid and infective hepatitis. (It has been reported that 8 to 10 children die of diarrhoea daily in Sri Lanka.) Boiling the water we drink and washing our hands well after going to the toilet and before we eat, the basic rules of sanitation, are preventive measures against such diseases. One way in which people can contribute to reduce water pollution is by using proper lavatories.
2. Groundwater can become polluted by wells being sited below latrines and by garbage dumps and landfills being badly located (Figure 14).
3. Pollution increases downstream in rivers and streams (Figure 15) by the ways that people make use of their water.
4. Uncontrolled disposal of industrial and domestic waste also pollutes both surface and groundwater. Industrial waste (Figure 16) includes tons of solids like sawdust and fibre dust and millions of gallons of effluents from mills and factories (e.g., textile, steel, petroleum, tyre, leather, paper, rubber, canning and food processing). It has been reported that 77 percent of untreated sewage from Colombo was at one time dumped into the Kelani River; that the mid-city canal in Kandy and Kandy Lake are some of the most highly polluted stretches of water in Sri Lanka because of sewage and

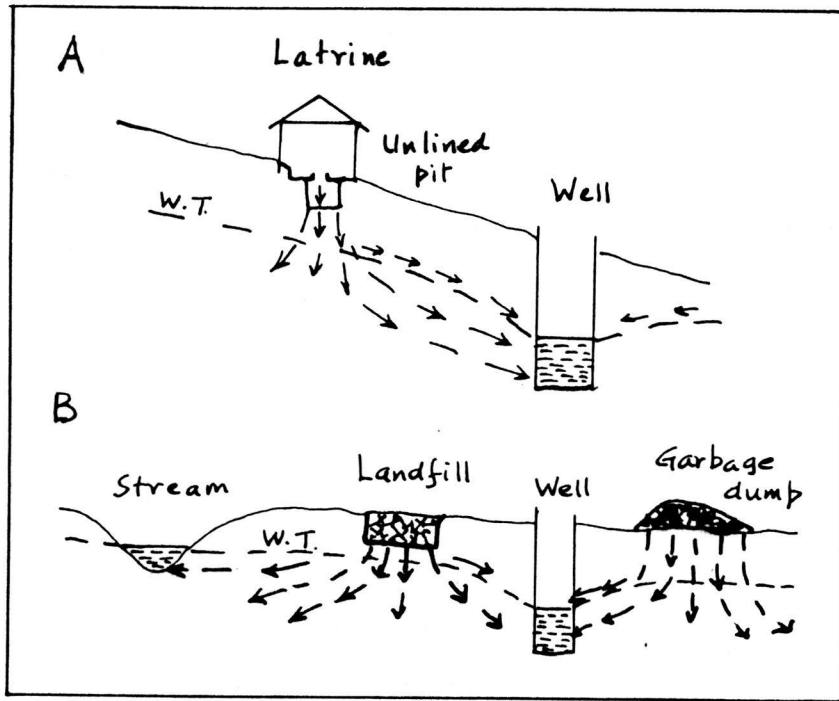


Fig. 14. Groundwater pollution
 A. Pollution of well by unlined pit latrine on slope above it.
 B. Pollution of well and stream by leachates from garbage dump and landfill.

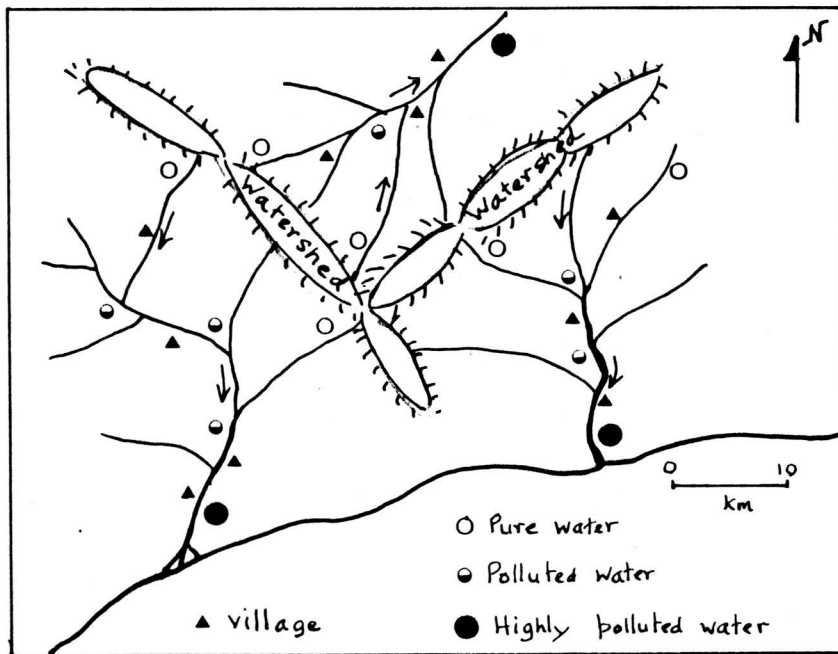


Fig. 15. Pollution of streams and rivers in river basins; river water becomes increasingly polluted from source to mouth.

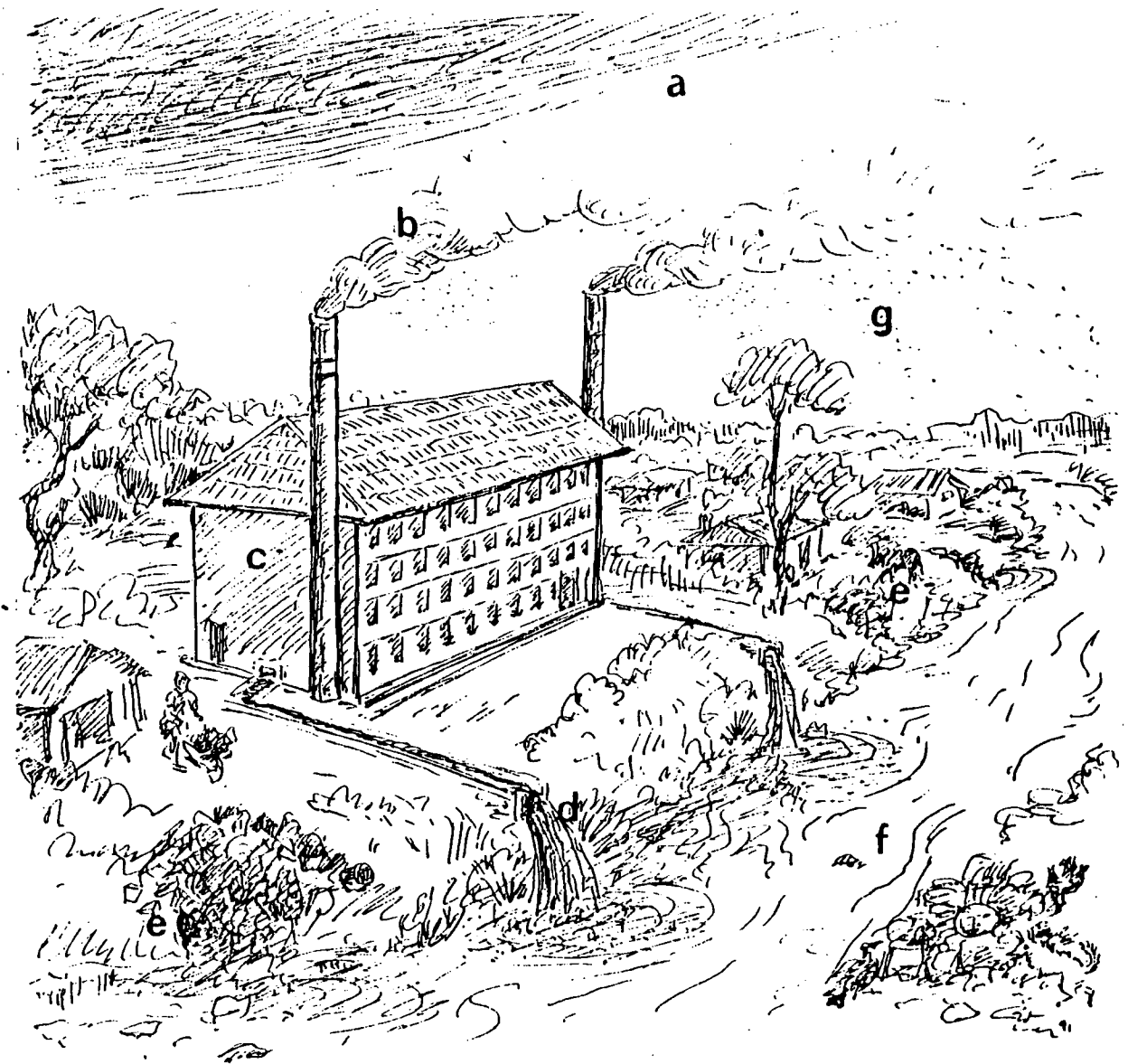


Fig. 16. Sketch showing air and water pollution from industrial and domestic sources.

(a) smog layer, (b) smoke, (c) factory, (d) effluents,
(e) garbage dumps, (f) stream, (g) dust.
(Drawn by Mr. T.B. Karunaratne)

domestic waste being dumped in them; and that Moratuwa and Ratmalana are some of the areas worst affected by industrial pollution.

Air Pollution

1. At present, 45,000 to 50,000 vehicles are registered each year in Sri Lanka. Petrol consumption increased from 400,000 metric tons in 1970 to 630,000 metric tons in 1986. It must be over 700,000 metric tons now, in 1991. Therefore, vehicle exhaust emission must be high where vehicles are most concentrated, and a layer of smog (smoke plus fog) is known to form over Colombo, at times, at about 4,000 ft. above sea level. In addition to smoke, exhaust emissions contain carbon monoxide, unburnt hydrocarbons, sulphur dioxide and oxides of sulphur and lead, which can cause damage to lungs. The worst cases of vehicle exhaust emissions are the black diesel fumes from buses. The people who live alongside of the roads on which these buses run must suffer badly from lung damage. Unfortunately, there is no monitoring of the actual effects of diesel and petrol fume emissions as yet in Sri Lanka.
2. Another form of air pollution is cement dust from the cement factories at Kankesanthurai and Puttalam. This dust covers the vegetation in those areas and enters the lungs of the factory workers, so causing a lung disease known as pneumoconiosis.
3. Dust and gases from rock quarries, rock-crushing plants, burning rubber, charcoal-making plants and pesticide factories also pollute the air.
4. The stench from open garbage dumps and polluted lakes like the Beira Lake adds to air pollution.

Noise Pollution

The sound of vehicle horns, especially in towns where silent zones are supposed to exist, the noise of large vehicles like lorries and vans accelerating their engines as they drive, the blasting of rocks in quarries, the blasting forth of loudspeakers from public meetings, temples and mosques—these are all offensive to our ears and are a form of environmental pollution.

Although we have become used to noise pollution, it is still a pollutant that should be eliminated or, at least, regulated and controlled. Every citizen is entitled to certain privileges from the environment in which he or she lives and works. One of these must surely be a certain amount of peace and quiet and protection from noisy assaults on his or her ears.

CONSERVATION

The environment gives us many of the things that we need for living, such as air, water, minerals, soils and forests. Simultaneously, we damage and continue to damage those very things around us that are beneficial to us. We now need to ask ourselves some questions, such as: Should we protect our environment? Why? If the answer is 'yes,' then we should ask the question: How should we protect our environment?

Why Protect the Environment?

We should protect our environment because the environment in which we live is essential to our lives. It gives us air, water, land, soil, minerals, and forests among many other things. Living will be impossible without all these things.

If we do not protect our environment and allow various elements to be damaged or polluted, we will be exposed to diseases like lung cancer; we will destroy part of our food supply in the rivers and seas; we will continue to lose our fertile top soil and so make it increasingly difficult to cultivate our crops without adding more and more artificial fertilizers at more and more cost; and in turn add on more and more adverse effects to the environment;

We could go on and on listing many more bad effects on our lives if we do not stop the damage to and pollution of our environment.

How to Protect the Environment?

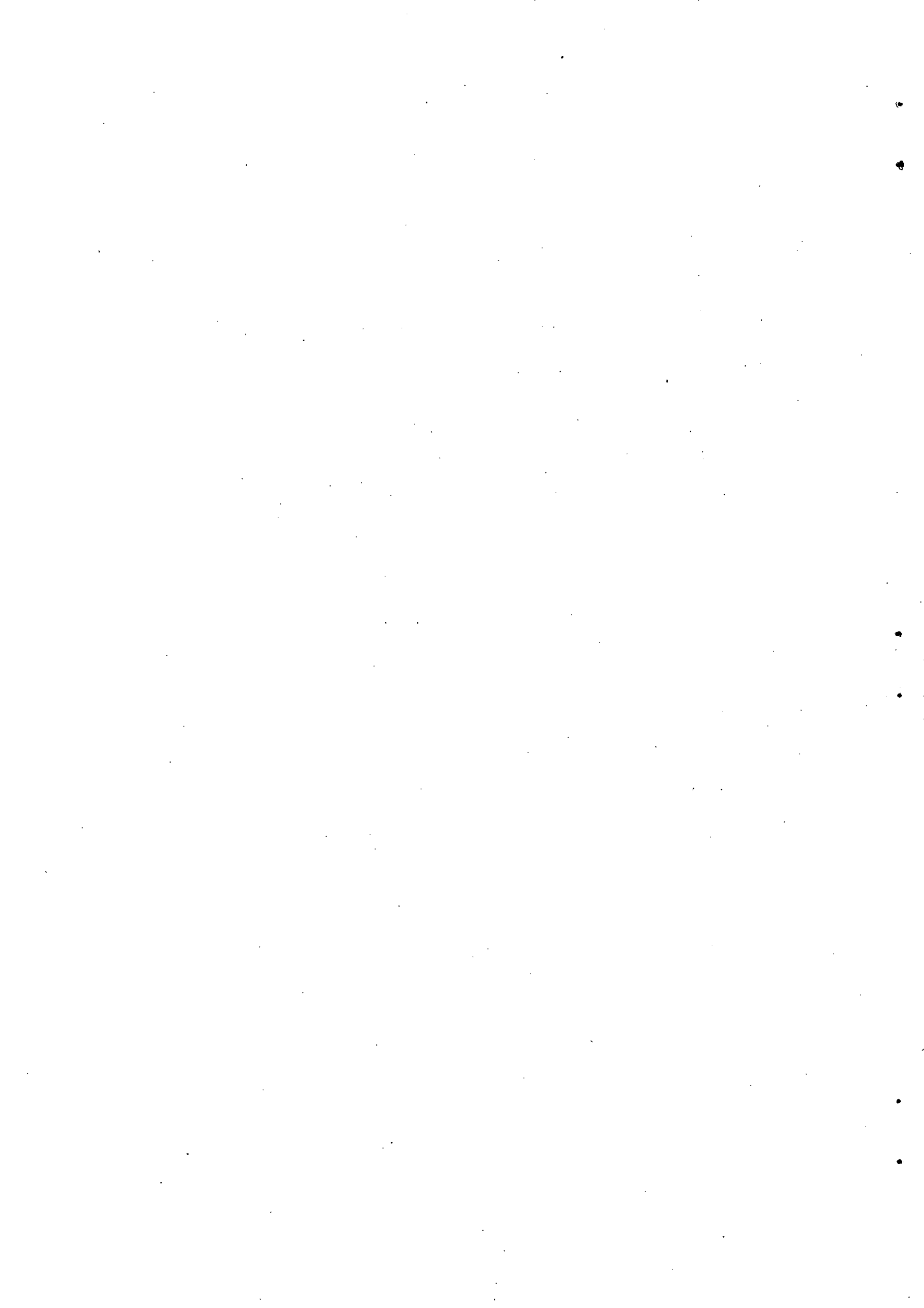
Much has been said about conserving or protecting the environment. We have, for example,

- a global programme called 'Caring for the Earth,'
- a Central Environmental Authority (CEA),
- the 'National Heritage Wilderness Areas Act No. 3 of 1988,'
- the Sri Lanka Environmental Congress,
- environmental protection societies at village level, and
- the 'National Report on Environment and Development' for the World UN Conference on the subject, to be held in 1992.

All this shows that conservation of the environment is very much the concern of people in many walks of life in Sri Lanka, from the highest levels of government to the village level, and of state and private organizations.

However, the question I want you to think about is: How can I, a schoolboy/schoolgirl, help to protect and look after my own environment? I have already shown you some ways in which you can do this. You can also do the following:

- Educate yourself about your environment, and learn about it in whatever way you can, e.g., have discussion sessions about the environment at school, start an environmental conservation club, make a large-scale map of the area around your village.
- All the schools in your town or group of villages could establish a field centre, where you could be taken on weekends and public holidays to learn about the environment.
- Be on the look-out for signs of pollution or damage to what you should now know to be your environment.



- Make sure at all times that what you, your classmates, your parents, your brothers and sisters and your neighbours do is not causing pollution and damage to the environment.
- Take positive action, such as:

Plant trees where they have been destroyed.

Do what you can to avoid erosion of the soil.

Do not dump garbage and waste on open ground.

Observe correct principles in siting wells and latrines.

Educate those who do not follow the basic rules of sanitation.

Do not break coral from the reefs to sell to tourists or for making lime.

Do not burn the dry grass on hill slopes.

These are some of the ways in which you yourself could contribute to protecting and conserving the environment.

CONCLUSION

I hope that one day environmental education will become a part of the normal curriculum of primary and secondary education in Sri Lanka. At present, school children are taught something about the earth in their 'science' course, but much more 'earth science' is needed in that course to make them better aware of the environment. Environmental conservation should become part of the learning process from the primary level right up to the secondary level. This has already been done in schools in our south-east Asian neighbour, Malaysia. It is a lead we should follow.

If we do not learn to look after our immediate environment from a young age, we will find it hard to look after it when we are older. If we do not look after our environment it will be damaged beyond repair and living in it will be finally impossible. When that happens we will have nowhere else to go and we, like the rest of the human race, will perish on the earth that was once ours.