

ENVIRONMENTAL SUSTAINABLE

The earth is believed to have originated over 4600 million years ago. Although there are numerous hypotheses about the origin of earth, the hypothesis that it was formed from hot gases and cosmic dust can be considered as the most explicable one. Most theories assume that the earth began in a gaseous state, evolved through a liquid state and finally became partly solid. It has been estimated that the life on earth appeared over 3500 million years ago. However, the human species evolved 100000 years ago while the modern man (*Homo sapiens*) has only a 10000 year history. Nevertheless, world's human population has grown to a staggering 5.4 billion in recent years and this figure is expected to reach 6 billion by the beginning of 21st century. according to statistics, Sri Lanka's current population of about 16.5 million is increasing by 200000 a year and is not

expected to stabilise in the near future. Some estimates suggest that, at such a rate of growth, the population of Sri Lanka could expand to 35 million within the next five decades.

Despite its increase in numbers, the human population on earth is continuously facing severe problems such as malnutrition, disease, poverty, unemployment, illiteracy etc. As a result, the sustenance of human population of about 6 billion will be a major problem in years to come. Therefore, many problems including food production, medical facilities, sheltering, clothing, employment etc. have to be overcome to prevent the extinction of human race from the face of the earth.

On the other hand, we have but one small world. It possesses only limited natural resources. In his attempts to

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to environmental pollution and other global ecological problems.

1. Destruction of tropical rain forests

According to Lord Buddha, the forest is a peculiar organism of ultimate kindness and benevolence that makes no demand for its sustenance and extends generously the products of its life activity and it affords protection to all beings offering shelter, even to the exeman who destroys it. The tropical rain forests are a major gene pool for future generations as they contain considerable genetic diversity. The plants to be found there include some that have yet to be adequately characterized or their potential use to be determined. With the destruction of the forests, not only the useful flora and fauna but also the undiscovered plant and animal species of potential benefit to man will disappear. Some estimates say that more than 40,000 plant species would disappear forever between now and the middle of the 21st century. Loosely speaking, the word species refers to those groups of individuals sampled from populations closely resembling each other in most characters.

It is generally accepted that there are three main goals for the conservation of individual species;

1. The aesthetic value of diverse organisms and associated educational aspects.
2. The environmental importance of species in that each organism interacts with other species and the removal of one can have repercussions on the whole ecosystem and the environment.
3. The potential exploitation of the species as a source for genes of agronomic or other value.

Man (*Homo sapiens*) is just one species among the myriads of organisms that the long course of biological evaluation has brought

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forth. His survival will depend on the conscious understanding of nature's laws that link his socio-economic environment with the biophysical environment. Some estimates suggest that, tropical forests which house immense biodiversity are being lost at the rate of 11 million hectares every year. The sad truth is that at least 25,000 plant species are now threatened.

The other side of this problem is also quite sorrowful. Part of the cut down forest material is usually burnt. This process requires a huge amount of oxygen (O₂) and releases carbon dioxide (CO₂) in a large quantity as well. As unique solar energy converters, plants are the ultimate source of all the food and oxygen that support the entire living world. Plants also synthesize thousands of other molecules important for our lives, and this they do at normal temperatures and pressure without polluting the environment. With the destruction of the forests and subsequent burning of unwanted forest material, we not only lose energy converters but we also add more CO₂ to the atmosphere. Carbon dioxide is also produced by burning fossil fuels. Its molecule can absorb some heat (mainly infra-red radiation) and radiate it back to the earth making atmosphere warmer. This phenomenon is called greenhouse effect. Assuming an annual worldwide growth of 5 percent in fossil fuel consumption it is estimated that by the year 2020, the resulting increase

in CO₂ in the atmosphere would raise the earth's temperature by about 2°C from the level of 1860 when mankind began to burn fossil-fuel in appreciable quantities.

The exposed topsoil resulted by destruction of tropical rain forests is eroded by winds or water. Accelerated soil erosion not only lowers soil productivity, but also disturbs the downstream hydrological regimes, adding to the misery of populations concentrated along the river banks. In contrast to its destruction, the existence of rain forests may promote the recycling of nutrients between the soil and the plants. The plants "fix" the nutrients so preventing them from being washed away. The forest canopy can protect the topsoil from erosion, so reducing the formation of water streams by heavy rains. A land under a forest canopy absorbs more water from rains than an exposed one. Tropical rain forests also promote the evapotranspiration which cools the tropical air and contribute to the formation of clouds. These clouds reflect solar radiation and take part in global air circulation so carrying warm tropical air to higher latitudes.

2. Industrial emissions and effluents, vehicle exhaust emissions, uncontrolled sewage works, badly maintained agricultural units

Many factories as well as industrial units use water from reservoirs or rivers for either cooling of engines and machines or for their washing purposes. Elevated water temperatures reduce dissolved oxygen levels while increasing the rate of chemical and biological activity in rivers or lakes. This water may also contain suspended solids and they can eventually smother rivers or lake beds so modifying the ecosystem. Increased turbidity (the cloudiness of a liquid caused by fine suspended particles) prevents light reaching aquatic plants which ultimately result in their death. Oil and other effluents released from industrial units can prevent oxygen absorption so the dissolved oxygen levels

will decline and it may inhibit the normal growth of aquatic flora and fauna.

High concentrations of nitrate ions in water are caused by fertilizers and by the breakdown of organic nitrogen compounds by oxidation. Excessive phosphate concentration in water can be caused by waste water (detergents) and fertilizers getting into the streams and rivers. In bodies of fresh water containing high concentrations of nutrients including phosphates and nitrates, aquatic plant growth (specially algae) is particularly strong. Eventually the resulting waste products can no longer be broken down by oxidation due to lack of oxygen. This gives rise to anaerobic decomposition of dead plants (putrefaction) resulting in the production of toxic substances such as hydrogen sulphide. The process by which an excess of nutrients stimulates the growth of algae and other plants to such extent that they clog waterways is called eutrophication.

Although it has been suggested that domestic sewage dropped to a river or lake could be useful for aquatic animals, particularly for fish, experience has shown that the beneficial effects are negligible compared to serious illnesses and diseases that can be caused by various pathogenic microorganisms in the sewage. Besides, emissions and effluents can change the acidity of water. Excessive acidity or alkalinity can be harmful for the aquatic flora and fauna. Among heavy metals harmful for human beings in some industrial wastes, paints, pesticides etc., lead, cadmium, mercury and zinc are the most common. They are toxic not only to human beings but also to other animals, plants and microorganisms. For example, lead released from sewage sludge, some industrial effluents or petrol fumes is absorbed into the blood stream and finally accumulates in bones.

is inhaled, it displaces the oxygen in the blood and reduces the amount of oxygen carried to the body tissue. It may dull mental performances and can slow reactions of even an otherwise healthy person. Moreover, nitrous oxide is also present in vehicle exhaust emissions which is another greenhouse gas. Nitrous oxide can also be produced by electric-power plants and intensive agricultural practices. Volcanos and burning fossil fuels can produce nitrogen dioxide, another nitrogen-containing gas. This gas is toxic to humans and animals and contributes to acid rains. The major component of acid rain is however sulphur dioxide. This toxic gas along with nitrogen dioxide is formed in active volcanos, heavy industry and in the process of burning of fossil fuels. Acid rain may directly damage some plants. For example, it may cause leaf damage in evergreen trees. Acid rain increases the acidity of soil and subsequently mobilizes such heavy metals as aluminum, zinc

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Mineral oil products ranging from petroleum and heating oils to lubricating oils pose a considerable threat to the environment if handled improperly. They damage the flora and fauna and render the ground water unfit for consumption. Due to their low surface tension, these oils are able to permeate through very small pores which are impassable for water.

In vehicle exhaust emissions there can be carbon monoxide (CO) which is a colorless, odorless, poisonous and flammable gas. The significant source of carbon monoxide is the combustion process when carbon is partly oxidized to carbon monoxide instead of fully to carbon dioxide. The largest single source of CO is the internal-combustion engine. When carbon monoxide

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There are several greenhouse gases viz carbon dioxide, methane, CFC, nitrous oxides and low level ozones. Whatever its source, releasing of these gases to the atmosphere may lead to the greenhouse effect causing global warming. Global warming may ultimately cause melting of the polar ice caps and subsequent extensive flooding of low lying countries like Maldives, Egypt and Bangladesh. Depletion of the ozone layer could be a reason for a global catastrophe since ultra violet - B radiation is harmful to humans, animals and plants. Pollution of the environment by various sources can also eventually lead to catastrophic consequences.

and lead in the soil. This may eventually result in levels of those materials in the soil which are toxic to plants. Gases like sulphur dioxide may enter the leaf via the stomata (the small pores normally found on the underside of plant leaves) and individual cells can be killed or their chemical reactions altered. Sulfur oxides including sulfur dioxide can cause temporary and permanent injury to the respiratory system, irritating the upper respiratory tract and the lung tissues. Sunlight promotes nitrogen oxides (in presence of ultra-violet rays) to combine with hydrocarbons to form a complex variety of secondary pollutants called photochemical oxidants. These oxidants include "low-level ozone", nitrogen dioxides, aldehydes etc. They together with solid and liquid particles in the air make up what is commonly known as smog (a dense smoky fog). This "Low-level ozone" is a greenhouse gas as well. Ozone also accelerates the cracking of rubber.

3. Landfill sites

Landfilling is a method of disposal of domestic, industrial and agricultural waste by burial in disused quarries and pits. As a result of the break down of organic wastes by microbial activity under suitable conditions "Landfill gases" like methane and carbon dioxide can be produced. Methane is highly explosive when its concentration in the air is between 5-15%. It can also restrict plant growth. Moreover, methane is a greenhouse gas.

Methane, nitrous oxides and chlorofluorocarbons (CFCs) damage the ozone layer which is located 25 to 50 km above the earth's surface. Ozone layer protects the earth from ultra violet radiation (specially UV - B) absorbing the radiation, but where it is depleted, more harmful UV-B radiation reaches the earth. In recent times, some significant "holes" in the ozone layer have been detected. CFCs are used in the manufacture of aerosol sprays, refrigerators and blown plastics. These gases are con-

sidered to be the major agent for damaging of the ozone layer. Because one CFC molecule traps 10000 times more heat than a CO₂ molecule, it is the most potent greenhouse gas.

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The earth has supported civilized man for more than 5000 years and agricultural man for twice that period. But now we have reached a stage in Mankind's history on the earth where resources are being overexploited to such an extent that our own existence is at stake. At over 5.4 billion population with a predicted doubling in the next century the utilization of natural resources and production of consumer goods will have to be more efficient. This may be done, avoiding the production and release of toxic by-products, minimizing the production of pollutants and finishing with minimal wastes which can be recycled either directly or through nature without pollution. It is to be hoped that zealous attitude of regulatory authorities or their bureaucracy will play the key role in the protection of the environment. Control of the pollution is of vital importance. Well planned agricultural production on a scientific basis, industrial complexes designed for efficient production with minimal pollution of the environment can help to overcome the global environmental problems. Moreover, alternatives for

fossil-fuel have to be sought. Indeed in many less developed countries solar and wind energy, biogas etc. may have the potential to be more available and dependable as sources of energy for agriculture compared to other forms. Utilization of substitutes for chlorofluorocarbons could prevent the depletion of ozone layer to a considerable extent.

Cultural, social, religious and non-government organizations as well as the government may play an important role in solving environmental problems. Likewise, each member of the society should know his obligations in the protection of the environment. We must consciously be protectors of the environment by all means. Only then can we achieve further successes in human civilization.

NARESA SILVER JUBILEE

Young Writers' Competition

NARESA will be conducting a competition among school children on "Popular Science Writing". The best article in each of the language media (Sinhala, Tamil and English) will receive a prize of Rs. 750/-.

School-goers under the age of 20 years (on 31/12/93) will be eligible to compete. The article, written on any theme pertaining to "Popular Science" not exceeding 750 words, should be typewritten on A4 size paper, double spacing one side only, leaving margins of 2.5 cm. A certifying statement from the Principal to the effect that the written material is original, and belongs to the competing student, is necessary.

Entries close on : 30/09/1993

Science & Technology Exhibition

Young Innovators Competition

Three cash prizes and three other merit certificates will be awarded for the best exhibits submitted for the above exhibition.

The Competitors should be school-goers under 20 years of age on 31/12/93. The exhibit must be an original innovation conceptualised by the competitor, certified as such by the principal of the school.

For Working models service facilities will be available.

Closing date for written application, detailing the planned innovation, preferably with appropriate drawings, will be 30/09/1993.

**Details From : Secretary
 Science Education Committee
 NARESA**