

# Preservation of the Environment

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The environment may simply be defined as all of the external factors that affect an organism. These factors, whether they be other living organisms (biotic factors) or non-living variables (abiotic factors) such as soil, climate and light, all interact to make up what is known as an ecosystem.

All living beings have clearly altered the earth's environment but certainly humans have done so on a scale unparalleled by any other species. This statement is adequately supported by such factors as man's destruction of the world's tropical rain forests to create grazing land for cattle and by the drying up of almost three-quarters of the Aral Sea, (once the world's fourth largest fresh water lake) for irrigation purposes.

As a result of man's drastic alteration of the earth's natural environment, scientists, environmentalists and other concerned citizens around the globe are today compelled to comprehend the long-term consequences that human actions have on ecosystems. In this way, measures can hopefully be taken in time to lessen the impact of human activity on the natural world thus leading to the preservation of the environment for all posterity.

In recent times, the issue of environmental preservation has gained almost paramount importance because of its increasing social, economic and even political implications. While endeavouring to comprehend the vast nature of environmental preservation however, it is almost imperative that all of the major preservation factors be given individual consideration. As such, the next few pages of this research paper is dedicated to providing the reader with a broad and comprehensive, though by no means exhaustive, analysis of these factors.

Population growth is considered by many to be the paramount cause of the world's environmental problems. Today, there are over 6 billion people on

the planet and as the world's population continues to increase, more natural resources would be used up, more pollution would be generated and more habitats would be destroyed.

It is a fact that population growth rates are lower in developed countries than in developing ones. However, it is also essential to bear in mind that since larger amounts of resources per person are used in the developed countries, each citizen from a developed nation has a much greater environmental impact than a citizen from a developing country.

In order to reduce population growth, evidence now exists suggesting that the most important factors necessary are democracy and social justice. In addition, recent research proves that increased literacy rates, women rights and the availability of birth control information are all also vital ingredients to help lower population growth rates.

Over the past century, it has been estimated that global temperature has increased by about 1°C. This is quite a drastic increase when one considers the fact that during the last Ice Age, temperatures were only 2.2°C lower than they are at present. Atmospheric scientists have determined that at least half of that drastic 1°C increase has been due to man's activities and that if man continues his callous activities, then temperatures may very well increase by up to 3.5°C over the next century.

Even such an apparently modest rise in temperature has the capacity to change climate patterns, affect agricultural production, disrupt wild life distribution and even cause the melting of the polar ice caps, thus leading to a rise in sea levels and a subsequent inundation of low-lying coastal areas.

Global warming is therefore clearly a very serious problem that man has to cope with as the new millennium progresses. It is caused primarily by the greenhouse effect where gases like carbon dioxide



permit the sun's radiation to heat the earth but prevent the escape into space of the infrared energy radiated back out by the earth. Excessive greenhouse gases, particularly carbon dioxide, are produced primarily by the burning of fossil fuels.

The problem of global warming is further compounded by the depletion of the ozone layer of the atmosphere which is the layer responsible for shielding the earth from harmful ultraviolet (UV) rays. The ozone layer is primarily attacked by chlorofluorocarbons (CFCs) which are used in refrigeration, cleaning solvents and aerosol sprays. As more and more UV rays are allowed to pass through the ozone layer, the increased radiation would ultimately lead to an increase in skin cancers and cataracts as well as a depletion of the world's oceanic plankton.

According to the Microsoft Encarta Encyclopaedia 2000, pollution may be defined as the contamination of the earth's environment with materials that interfere with human health, the quality of life, or the natural functioning of ecosystems. It is therefore immediately obvious that while some environmental pollution is due to natural causes such as volcanic eruptions, the majority is as a result of indiscriminate human activities.

In general, all pollutants may be classified into two groups: biodegradable and non-degradable. Biodegradable pollutants are materials such as sewage and fruit and vegetable peelings that decompose rapidly by natural processes. These pollutants become a problem only when they are added to the environment faster than they can decompose. Non-degradable pollutants on the other hand are materials that either do not decompose or decompose very slowly so that once contamination occurs, it is extremely difficult or even impossible to remove these pollutants from the environment.

Pollution on the whole can also generally be classified as either point-source where pollutants come from specified, localised and identifiable sources (for example, sewage pipelines) or non-point-source where the pollutants come from dispersed and/or uncontrolled sources (for example, contaminated water runoff for urban areas). Yet, a further classification of pollution can also be made depending on whether the effects of the pollutants are immediate or delayed. Primary effects are said to occur immediately after

contamination while secondary effects are those effects which are delayed or which may persist into the environment for several years.

Because of the complex relationships between organisms and their ecosystems, the effects of pollution can often have far-reaching consequences that are not always immediately apparent. For example, in the 1950's and 1960's, residents living near Minamata Bay in Japan developed nervous disorders, tremors and paralysis in a mysterious epidemic. It took the death of more than 400 individuals before the authorities realised that a local industry had released mercury into the Bay which accumulated in the bodies of the local fish and eventually in the bodies of people who consumed the fish.

Apart from posing a direct threat to human life, indiscriminate pollution could irreversibly harm such ecosystems as forests, coral reefs and wetlands which all contribute to the enhancement of air and water quality and even to the provision of food and medicines.

Another significant effect of pollution of the environment is the phenomenal cost of prevention and cleanup activities. For developed countries, the cost of maintaining national carbon dioxide emissions at 1990 levels is estimated at 2% of the gross domestic product. As an example of the figures involved, the total expenditure to reduce pollution in the United States in 1993 was \$109 billion.

Besides the deleterious effects that pollution of the environment has on health, natural resources and the economy, there are also dangerous social implications to be considered. This is amply demonstrated by the fact that recent research has shown that toxic waste incinerators, chemical plants and solid waste dumps are more often than not located in low-income and minority communities where there is little or no informed community involvement in local decision-making processes.

Today, it is a fact that the majority of our industrial and transportation needs are met by the burning of fossil fuels. Unfortunately though, this results in a vast number of pollutants being released into the atmosphere containing harmful levels of carbon, sulphur and nitrogen. As these air pollutants accumulate, they are inevitably responsible for a variety of problems such as smog, global warming and acid rain.

Smog, which can cause serious health problems, is usually found in urban districts where there are large numbers of automobiles. Acid rain on the other hand is not limited to specific districts and can affect large areas. It is formed when sulphur dioxide and nitrous oxide are transformed to sulphuric acid and nitric acid in the atmosphere and return to the earth as precipitation. Acid rain is an enormous threat to the environment because very few species are capable of coping with such acidic conditions. In fact, the problem is so acute that already acid rain has made numerous lakes so acidic that they no longer support fish populations. If acid rain continues unchecked, it has the capacity to destroy countless forests, lakes and perhaps entire ecosystems.

Water is indeed one of the prime necessities of life. Unfortunately, though an estimated 1.3 billion people lack a safe supply of drinking water and at least 5 million deaths per year can be attributed to water-borne diseases. This comes as little surprise however when one considers the fact that in developing countries, over 95% of urban sewage is discharged untreated into rivers and bays.

The primary causes of water pollution are sewage, industrial water and agricultural chemicals. Point sources of water pollution such as the discharge from oil tankers and factories can be controlled to a certain extent. However, non-point sources such as contaminated runoff from agricultural lands is almost impossible to control.

Close to 80% of the earth's surface is covered with water. For years, the immense oceans of our planet have therefore seemed as though they can serve as limitless dumping grounds. However, the consistent influx of raw sewage, oil spills and garbage has eventually begun to exhaust even the vast diluting capabilities of our oceans so that today, extensive tracts of coastal waters are being polluted. This is a fact that certainly does not augur well for the 950 million people worldwide who depend on fish as their prime source of protein.

Apart from the more widely discussed topics of air and water pollution though, such issues as soil pollution, noise pollution and solid and hazardous waste management are today fast becoming major problems.

Soil pollution can generally be described as a build-up of toxic chemical compounds, salts,

pathogens or radioactive materials that can harm plant and animal life. In several areas around the world, undesirable soil management practices have led to serious problems such as the degradation of soil quality and enhanced erosion.

The term 'solid waste' encompasses all unwanted solid materials. Each year, billions of tons of solid waste are generated which are usually buried in landfills. However, many landfills quickly become overfilled and pose serious contamination threats to air, soil and water. Of particular mention too, is the fact that cities in economically developed countries produce far more solid waste per capita than citizens in developing countries. In addition, the waste materials from developed countries usually contain high levels of synthetic materials that take longer to decompose than the primarily biodegradable waste materials of developing countries.

Hazardous waste can either be solids, liquids or gases that are harmful to humans and the environment. They are generally non-degradable in nature and usually pose tremendous environmental and health risks in their use, storage, transportation and disposal. Examples of hazardous waste include toxic chemicals and radioactive materials. Every year, approximately 400 million metric tons of hazardous waste is generated globally - the majority by developed countries. However, it is not an uncommon practice for industrial firms in the developed countries to pay poorer countries to accept shipments of solid and hazardous waste.

Noise pollution consists of any unwanted noise that can cause hearing loss, high blood pressure, sleep loss, stress and loss of productivity. Noise pollution is usually more prevalent in densely populated areas but it may be limited or even eliminated by a variety of means. These include sound-proofing doors, windows and ceilings, using ear protection (particularly in noisy industrial environments), and by planting vegetation to absorb and screen out unwanted noise.

Indeed, the magnitude of the pollution problems thus discussed appears to be overwhelming. Luckily though, there are several means by which pollution can be controlled, reduced or even totally eradicated. These means range from simple recycling and composting to participation in International



agreements and the passing of extensive legislation that limit pollution.

By extracting and reusing certain waste materials, recycling can help to significantly reduce solid waste pollution. In addition, by utilising composting, we not only effectively deal with organic garbage but also we also create a very useful natural fertiliser. The key to solving the solid waste problem though, lies not only in recycling and reusing but also in reducing. By altering the way products are designed or manufactured to make them easier to reuse can significantly reduce the amount of waste generated in the first place.

On the international front, International Agreements such as the Montreal Protocol on Substances that Deplete the Ozone Layer (1987) and The Basel Convention on the Control of Transboundary Movements of Hazardous Waste and Their Disposal (1989) effectively serve to help preserve the environment once they are adhered to.

Pollution can also be fought by citizen groups formed at national, regional and international levels which apply pressure for legislation to be passed and enforced that would lead to environmental preservation. Greenpeace International and Friends of the Earth International are outstanding examples of activist organisations that do all in their power to fight environmental pollution.

Finally, the use of environmentally-friendly technology has also been an effective means of combating pollution. For example, cars now emit fewer nitrogen oxides than in the 1970's, power plants now burn low sulphur fuels and lead has been removed from gasoline. However, environmentally-friendly technology is not always available to developing countries that often have to sacrifice environmental quality for economic growth. In this regard, developed countries could assist by providing the necessary technological aid.

As many of the problems mentioned on the past few pages approach critical proportions over the course of this century, it is absolutely imperative that man begins to find viable long-term solutions. Among possible solutions include comprehensive legislation and regulations that govern levels of pollution. However, achieving this can be a long and tedious process as legal battles are always fought between the persons who believe that industry and

development are being unnecessarily stifled and those who argue that the environment is being exploited beyond repair.

In any event though, it would be erroneous to state that no progress has been made. Indeed, when the first major international conference on environmental issues took place in Stockholm, Sweden in 1972 only 11 countries had environmental agencies. The United Nations Environmental Programme was created at that conference and a mere 10 years later, the number had grown to 106. Yet another event that exemplified just how much importance environmental issues have gained is the United Nations Conference on Environment and Development (also known as the Earth Summit) which was held in 1992 in Rio de Janeiro and which was the largest gathering of world leaders ever in history. The results of this conference were agreements to reduce the emission of gases that lead to global warming and plans to protect endangered species and habitats.

Nevertheless, the signing of agreements though a step in the right direction is still not enough. It is still a sad fact that species are today dying out at an unprecedented rate – minimum estimates are at least 4,000 species annually though some scientists believe that this number may even be as high as 50,000 annually.

As we move into the new millennium, the absolute and irreparable destruction of the earth's environment is a real possibility. It is therefore imperative that we soon find a workable balance between sustainable development and environmental preservation. To this end, it is absolutely essential that conservation strategies become more widely adopted and alternative sources of energy be sought. In this way, we can hopefully reverse the unfortunate trend of environmental degradation and replace it instead with one of environmental preservation.

Having already given a broad overview of environmental problems and preservation issues, the remainder of this research essay will now focus on one particular problem area as it relates to the region. The selected study area is none other than the Buccoo Reef of Tobago which has now unfortunately become a mere shadow of what it once was. Even so, the Reef is still one of our indigenous natural wonders with its vibrant ecosystem supporting a plethora of life. As such, it is a matter of great urgency that the Reef

be protected at all cost and that we start reversing the long history of maltreatment that the Buccoo Reef has had to suffer.

Buccoo Reef lies to the north-north-west of Tobago (latitude 11°11'N and longitude 60°50'W). It encompasses an area of about 7 square kilometers and is characterised by five emerging reef flats.

Coral reefs represent the most complex aquatic system found on earth and are generally located in shallow marine waters where the temperature is never cooler than 20°C. The reefs are formed by the accumulation of the calcium containing exoskeletons of coral animals, calcareous red algae and mollusks. Coral reefs grow upward at about 1cm to 20cm per annum so it is easy to understand the thousands of years that Buccoo Reef took to form.

Apart from supporting over 30 species of coral (including most of the known species of soft coral and all of the species of hard coral), the Buccoo Reef also supports hundreds of species of fish and crustaceans. Because of the great diversity of marine life that the microhabitats of the reef support, it is vital that all efforts be made to maintain the Buccoo Reef in as pristine a condition as possible.

In recent times, many coral reefs around the world have been in consistent decline. This has primarily been due to pollution, destructive fishing practices and nutrients in runoff from agricultural areas that cause large algae booms that smother coral. In addition, extensive damage is also caused by a variety of coral diseases, many of which were unknown until recently.

Unfortunately, the Buccoo Reef of Tobago has not been able to escape unscathed. Even though the Reef was designated as a marine park back in 1973, a lack of any serious enforcement of preservation regulations has resulted in no positive amelioration of conditions at Buccoo Reef.

From its dense mangrove to the outermost reef, the Buccoo Reef is a biologist's delight. With its enormous variety of fish such as Jacks, Barracuda, Wahoo, Tapon and Tuna, as well as large marine creatures such as Reef sharks, Groupers, Sea turtles, Eagle rays and Manta rays, the Buccoo Reef's survival is not only important for its diverse ecosystem but also for its valuable eco-tourism potential for the people of Tobago. Tragically though, all of this has now come under a very real and urgent threat primarily due to man's activities on the island.

From the 1930's onward, the local villagers of Bon Accord and Buccoo Reef have always exploited the Reef's resources by such activities as spear-fishing and diving for conchs, lobsters and sea eggs. By the early 1960's however, the locals' exploitation of the Reef began to be overshadowed by tourism-related activities.

With the explosion of tourism on the island, the issue of inadequate control of the local authorities has now come to the fore. Boat tours, illegal fishing, reef-walking and the increasing market for curio items produced by the Reef have all stretched the Buccoo Reef's resources and regeneration capabilities to the limit. Additionally, many persons are now extremely concerned with the water quality of the reef as nitrates and phosphates, silt from erosion, toxic chemicals and excessive fresh water runoff give rise to bacterial and fungal agents that are detrimental to coral reef ecosystems.

Apart from the enormous physical and chemical stresses to which the Buccoo Reef is subjected, there is also the danger of ships running aground and causing extensive damage and deposits of toxic lead and toxic paint oxides that have residual effects for over a year.

In spite of the daunting environmental challenges facing the Buccoo Reef, there is great hope of significant restoration should the general community, the private sector and the government all come together in a united effort.

One such effort already under way is the Buccoo Reef Trust. It is a non-profit organisation that was specifically created to assist in addressing the threats facing Tobago's marine environment and to explore opportunities for the sustainable development of marine tourism, fishing and aquaculture in the Caribbean region as a whole. The fundamental aim of the Buccoo Reef Trust is therefore to build and operate the Tobago Marine Research Centre as an internationally recognised institution of research and education on tropical reef ecosystems and sustainable aquaculture.

The Trust also has links with The University of the West Indies and with universities in North America and Europe that will provide students with unprecedented educational opportunities with the international marine science community.

Another organisation formed with a mandate to protect the Buccoo Reef and its associated sea-grass



and wetland ecosystems was the Reef Patrol Unit under the Marine Affairs Section, Division of Agriculture. However, with very limited resources, this Unit was unable to halt the decline of the Reef.

The case of the lack of resources for the Reef Patrol Unit epitomises the enduring problem that faces the Buccoo Reef. Certainly, over the years, adequate information has been forthcoming on which to take action. Since 1967, there has been recognition of the need to provide special protection for the Buccoo Reef. From 1967 onward, over 40 scientific studies have been conducted to more fully understand the biology, ecology, water quality and hydrology of the Buccoo Reef.

Of particular mention are the ecological studies conducted by the Institute of Marine Affairs (IMA) between 1984 and 1985. These studies, which were conducted at the request of the Tobago House of Assembly (THA), resulted in The Management Plan for the Buccoo Reef Marine Park being completed nearly 10 years later in January 1995. The Tobago House of Assembly officially accepted the document and agreed to implement its recommendations in June that same year.

The Management Plan was based on studies of various aspects of ecology, water quality, socio-economics, public education and legislative control. A proper management structure, legislative regulations, surveillance, park demarcation, moorings installations, pollution control and public education were all issues that the Plan addressed. Public consultation on the Plan was held but the response was disappointing. After the consultation, the plan is yet to be modified before being taken back to the stakeholders for further discussion and approval prior to implementation.

In order for the Management Plan to be effective, it is clear that comprehensive legislation is necessary. At present, there are at least 11 relevant pieces of legislation governing the use and conservation of the Buccoo Reef area. These include the Environmental Management Act of 1995 and the National Parks and Wildlife Bills of 1997. These legislative documents address many of the critical issues facing the Buccoo Reef but implementation continues to be a serious problem.

The Fisheries Division, which has responsibility for the management of the Buccoo Reef

Complex, has recently established the Buccoo Reef Action Group which has been meeting since May 1999. The Group, which comprises representatives of the Buccoo Village Council, reef boat operators and fishermen, seeks "*to preserve and conserve the Buccoo Reef through co-management, while educating the public about the reef, its ecosystem and its watershed.*" The Group is currently involved in the posting of information signs about the regulations governing the use of the Buccoo Reef Restricted Areas, the development of a reef education programme and the addressing of reef-walking issues.

One ambitious project that the Action Group put forward to the Fisheries Division was a volunteer Reef Warden programme. A meeting was held late last year to discuss the project and a proposal was to be developed by the Fisheries Division for submission to the THA. However, the follow-up meeting was cancelled and no further communication to the Group has yet been made by the Fisheries Division. This is yet another example of the inability of the powers that be to deal effectively with the implementation aspect of plans for the Buccoo Reef.

It is obvious that education can be a powerful tool in fighting many of society's problems. Those problems facing the Buccoo Reef are no exception. To this end, the Buccoo Reef Trust is planning an Educational Programme in collaboration with schools in Tobago, The University of the West Indies and several other Universities in North America and Europe.

One of the goals of the School Programme is to have lectures on various environmental topics as well as practical demonstrations. After construction of the Tobago Marine Research Centre (TMRC), schools would also be allowed to use its facilities for a variety of educational purposes.

It is also intended that the TMRC will offer university accredited courses in the fields of coastal and marine ecology and tropical aquaculture. The University of the West Indies has already indicated its willingness to work with the TMRC to establish relevant courses for local studies that would be acceptable for the transfer of credit to foreign universities. It is also hoped that visiting scientists would be resident at the laboratory to teach and supervise students as well as to provide lectures on reef ecology, aquaculture and related marine topics.



Perhaps the most successful educational plan that has actually been implemented to date though is the film entitled, "*Buccoo Reef: To Rescue and Restore*". This film, which was produced by the Buccoo Reef Trust in collaboration with the Tobago House of Assembly, highlights the challenges and opportunities for restoring the Buccoo Reef. Broadcast on national television, the film has been extremely successful in alerting the general public to the major issues concerning the Buccoo Reef.

From all of the information provided in the past few pages, it is obvious that the most fundamental problem facing the Buccoo Reef is one of too much talk and too little action. Certainly, a plethora of excellent ideas and plans concerning the Reef has been forthcoming but sadly they have achieved very little in terms of any tangible results.

It is important that we all realise that the issues concerning the Buccoo Reef cannot wait. Each day that goes by without any serious preservation measures in place causes the Reef to suffer increasing damage that may take years to repair if at all. Clearly, what is needed therefore is immediate and decisive action. Positive steps in this direction include activities of the nature of the first and second research projects which were started in April and August 2001 respectively. Of particular mention is the first research project which dealt with Integrated Water Quality and Coral Reef Monitoring in Tobago. The study focused on the impact of land-based discharges of nutrients from deforestation, sewage and agricultural activities on Tobago's coral reefs.

Over the years, one of the primary factors that has hindered the more adequate implementation of preservation plans for the Buccoo Reef has been a lack of finance. However, in recent times, several corporate sponsors have expressed their willingness to fund management projects in the Buccoo Reef area through the organising committee of the Angostura International Yachting Regata. More active pursuit of private sector investment in the Buccoo Reef area could go a long way in providing the necessary finances for protecting this national treasure.

In addition to private sector involvement though, international grant-funding will soon be available for a period of 18 months. This will hopefully allow implementation of much of the recommendations of the Management Plan.

Another possible means of making the various Buccoo Reef preservation organisations financially self-supporting could be the introduction of nominal user fees for the Buccoo Reef area.

In the recent film produced by the Buccoo Reef Trust, Mr. Orville London, Head of the Tobago House of Assembly, made reference to the fact that the average tourist spends approximately \$33,000. For Tobago, this results in an estimated revenue of \$750 million annually. Certainly, even a fraction of this money could go a long way towards the preservation of the Buccoo Reef. As such, the Government therefore has a responsibility to ensure that at least a reasonable portion of tourism receipts is directed towards preservation issues.

As an indication of the cost involved, let us assume that the Government was to hire 100 Security officers to ensure the enforcement of the regulations concerning the Buccoo Reef. At minimum wage, this would result in an annual bill of approximately \$6.1 million. Indeed, this sum is almost negligible when compared to the substantial returns that the tourism industry provides for Tobago. Ofcourse, there would be other costs involved in the overall Management Plan for the Buccoo Reef but from all of the figures quoted above, it can clearly be seen that adequate funding should not be a problem if appropriate financial management structures are put in place.

Financial matters aside, there are several other infrastructural works on the island that could be undertaken to help protect the Buccoo Reef. For example, the waters from storm drains and agricultural lands could be diverted to less sensitive areas. Work of this nature often requires little technical ability and as such, finances and labour for these projects can be provided by the Unemployment Relief Programme (URP). In this way, both preservation and employment problems are effectively dealt with.

In addition, all construction works, sand-mining and other related activities could be carefully monitored to ensure that the highest environmental standards are upheld. Farmers could also be educated so that their agricultural practices cause minimal harm to the surrounding environment.

Because of the very nature of coral reefs in general, it is very difficult for the implementation of the recommendations given above to the quantified by a particular timeframe or by a given budget.

While some idea of the figures involved is given above, the Buccoo Reef is a living and evolving ecosystem and as such, there is no "quick-fix" solution. The preservation of the Buccoo Reef is an ongoing project. Consistent action month after month, year after year and generation after generation is what is required to maintain the Buccoo Reef. Additionally, factors beyond our control such as natural disasters and coral diseases would cause the annual preservation cost to fluctuate.

Nevertheless, as far as the Buccoo Reef is concerned, maybe some day we would all realise that

perhaps no cost is too great to preserve this treasured piece of our natural heritage. For the sake of the Buccoo Reef and Mother Earth as a whole, it is indeed in our best interest to heed the alarm released in November 1992 entitled, "*Warning to Humanity*". This document which was signed by 1,500 scientists from around the world, including 99 Nobel laureates, issued the disturbing yet candidly veracious statement that "*human beings and the natural world are on a collision course,*" which "*may so alter the living world that it will be unable to sustain life in the manner that we know.*"