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LDP 613 ENVIRONMENTAL ISSUES IN PROJECT MANAGEMENT

GENERAL INTRODUCTION

Welcome to this course on environmental issues in project planning and management. This course has been prepared to introduce you to the environmental issues in project planning and management. The course has been designed to cover nine major areas which include: General principles of environment; Environmental Impact Assessment (EIA); Environment and development; Environmental Education; population and environment; global Environmental Conservation issues; Energy conservation and environment; Climate change and ozone loss; management and conservation of natural resources. These topics have been dealt with in different lectures of this module starting from lecture one upto lecture nine.

In this course unit your academic performance will be assessed as follows:

1. Take away assignments (Term papers)
2. Timed tests (CATS- one hour)
3. Final Examinations (Three hours)

Take away and timed tests constitute course work which comes to thirty percent (30 %) of the total marks, while the final examination constitutes seventy percent (70 %) of the total marks.



General Objectives

At the end of this course unit you should be able to:

1. Explain the meaning of Environment, ecology and Ecosystem as applied in project planning and management.
2. Describe the role of Environmental Impact Assessment within projects in Kenya.
3. Underline the historical development of environmental education
4. Explain the relationship between environment, development and population growth.
5. State the socio-economic benefits of environmental conservation and issues of global peace.

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The third preliminary activity is the **allocation of work**. This involves allocation of responsibilities to be carried out and by whom. What should be noted here is that there are several alternatives of allocating the activities and it varies from one country to another. For example, in the U.S.A, the practice is that the developer conducts the assessment while the Environment Protection Agency serves in a review and “watch dog” capacity. In other countries like in Bahrain, the government agency actually carries out the environmental impact study.



In text Question

What is the current practice in Kenya as regards work allocation?

Whatever model of allocation of work is to be followed the primary thing here is that allocation of work should be done early in the life of the project.

The next preliminary activity that follows the **allocation of work** is the description of the proposed action. It involves coming up with a write up which should be brief (not more than ten pages) that specifies exactly the action that the study is intended to solve; the list of constraints to be encountered and the proposed action to be taken. The activity of writing a description of a proposed action is technical in nature and it is normally recommended that the writing of the proposed action should be done by the co-coordinator or an equally qualified person.

The last of the preliminary activities is the **review of the all existing laws**, regulations and ordinances that would apply to the proposed action. The motive behind this action is to identify any areas of conflict and iron them out at the earliest.



Take Note

The list of preliminary activities listed above is not exhaustive. It is limited to activities that are necessary in many projects

under water coastal areas all around the world. This area is home for about 15 percent of the world population today.

	Intext Question In own opinion how does development and environment affects one another?
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3.4 The Relationship between Environment and Development

The relationship between the natural environment and development is very critical especially as it touches on how development affects the environment. Increased production of goods and services has been sought through different combinations of labour, raw materials accumulated capital and available technology. The manner and conditions in which these factors are related can be determined within the context of the level of development attained within specific period of time. The idea that development is possible only when the resources are available supports our idea that development is related with our environment. It should be re-emphasized that the environmental issues are of great importance to the development process of a particular region or place and should therefore be considered as an integral aspect of development.

The current concern with the environment has arisen at a time when the energies and efforts of the developing countries are being increasingly devoted to the global goal of development. Indeed, the compelling urgency of the development agenda has been widely recognized in the last decade by the international community and has more recently been endorsed in the proposals set out by the United Nations for the second Development Decade.

The problems experienced by the industrially advanced countries have, to a large extent, brought about the current concern with environmental issues globally. These problems are themselves very largely the outcome of a high level of development. The creation of large productive capacities in industry and agriculture, the growth of complex systems of transportation and communication and the evolution of massive urban conglomerations have all been accompanied in one way or the other by damage and disruption to the environment. These disruptions have

Kenya is one of the countries that is giving attention and priority to how it handles its waste, and this has resulted in the emergence of companies offering environmental services for resource recovery and recycling. To reduce the impacts of waste and unwanted resources on the environment it is important to educate the populace about waste items and how they can be processed or recycled.

There are several resource recovery systems in place and facilities that have been developed to deal with these issues. Natural recovery systems make use of food, organic and green waste and are then dealt with in in-vessel compost systems, whilst materials collected for recycling include glass, plastic bags, metals and paper. Automated and manual methods are used to sort materials from construction sites, such as brick, tiles and concrete and after being sorted are re-used for road base and construction materials. E-waste (electronic waste) comes from items such as old computers which are taken apart in order to recover materials like cabling, aluminium, copper, glass and plastics. Bioreactor landfills are deployed to generate green energy through the capturing of biogas from municipal waste. There is also help provided for councils to award innovative technologies which can be used to recover recyclables. We can all help out when it comes to waste management and recycling products. It may not seem effective to recycle products as a household, but put all those households together and you will produce a result. It is each person's responsibility to do what they can to conserve resources, reduce landfill volumes and produce new materials using less energy. Some cities in developed nations keep a record of their resource recovery systems in order to identify if they are working effectively, evaluate them and update them if necessary, this information can then be passed onto other areas or nations to help them in the recycle challenge. Deciding to recycle is a simple step and surprisingly easy to start. If you are unsure where to begin there are lots of resources, including the local environmental sector, who will be eager to teach you how to recycle your leftover waste and improve on your environment.

3.5.2 Environment Pollution

Pollution is the introduction of contaminants into an environment that causes instability, disorder, harm or discomfort to the ecosystem i.e. physical systems or living organisms. Pollution can take the form of chemical substances or energy, such as noise, heat, or light.

5.5 Impact of Development on the Environment

The socio-cultural roots of our present environmental crisis lie in the paradigms of scientific materialism and economical determinism, which fail to recognize the physical limits imposed by ecological systems on economic activity. The economies must expand within ecosystems, which have limited regenerative capacities. The emergence of the concept of sustainable development in recent years has brought in the general realization that societal perceptions must shift towards ecological determinism so as to achieve qualitative growth with the limits of ecosystem carrying capacity. In the past, environmental aspects of industrial developments were usually not taken into account seriously, as it was believed that this was almost inevitable and almost necessary for the economic development. Environmental movement, for all purpose, had its beginning in 1972, the year of the Stockholm Conference.

After Stockholm Conference of 1972 even the erstwhile underdeveloped countries have realized the environmental degradation can be disproportionately more than economic development unless suitable safeguards are not provided from the beginning. It has also been felt that the effects of pollution in all its aspects may not remain limited to the boundaries of developed and developing nations. The hazards of Green House effects and the depletion/disruption of ozone layer of the world atmosphere have become more real than just postulations. In Kenya for example, our environmental thinking took its cue from the developed countries and perceived the preservation of the threatened species both flora and fauna. Later two areas related to prevention of any further degradation and depletion of basic natural resources and life support system of land, water and vegetation were identified. The need to preserve the country's production base and to combat industrial pollution and insanitation in the interest of public health has been felt. Institutional arrangements such as National Committee for environmental planning and coordination was set up after independence, which was followed a little later by the creation of Pollution Control body.

Environmental degradation affects developing countries more fundamentally, than it does the developed world. It is universally recognized, in developing countries, that, while economic development is an essential process to erase poverty and hunger, at the same time, it is equally important, to protect the environment from pollution at regional as well as national and global

natural processes. The relationship between carbon dioxide, oxygen and living organisms is well known. Now it appears that perfectly normal human activities such as agriculture and cattle breeding are also contributing to air pollution and to bringing closer the realization of the two dangers just mentioned. It has been found that methane gas accounts for about 16% of the warming effect of the atmosphere, and that about two thirds of the methane gas emissions are caused by decomposition in irrigated field, and in the guts of cattle! It is ironic that life providing activities, such as agriculture and cattle breeding are, are now threatening our survival on this planet, and possibly also the survival of the planet itself. It is obvious that we need to continue to produce food for the ever-growing population.

The excessive population growth in today's third world countries is not the cause of the present precarious situation. This is the result of a long accumulation of industrial waste and thoughtlessness on the part of the more developed nations. However, the third world, partly because of the large numbers of inhabitants that it needs to feed, clothe and provide amenities for, is aggravating the situation. The third world is faced with a very serious dilemma, and unless it can contain the population growth and at the same time materially improve the conditions of its population, it will not be able to fulfill some of the legitimate aspirations of its peoples. To do so, it necessarily needs to turn to industrialization, with all the inherent consequences involved.

In Africa, developing countries are already suffering the consequences of deforestation. Considerable parts of the tropical rain forests of Africa are already gone. The increasing need for firewood has also denuded much of the other forests of Africa, and the increasing rate of desertification is well documented. Loss of arable land is a very serious matter because it affects the livelihood of a large part of the African rural population. Deforestation and desertification also have an important impact on the climate of the region. Shifting patterns of rainfall, or lack of it, are also well documented. The number of human beings who need food and fuel directly affects both processes.

Global climatic changes, brought about by global warming will have a considerable negative impact on life on earth, and, like all other continents, Africa will also be affected. Shifts in climates with the modifications in the existing ecological zones will affect the fauna and flora

children on cultural values. Cornstock and the other leaders of the movement, such as Liberty Hyde Bailey, helped Nature Study garner tremendous amounts of support from community leaders, teachers, and scientists and changed the science curriculum for children across the United States.

A new type of environmental education- Conservation Education emerged as a result of the Great Depression and Dust Bowl during the 1920s and 1930s. Conservation Education dealt with the natural world in a drastically different way from Nature Study because it focused on rigorous scientific training rather than natural history. Conservation Education was a major scientific management and planning tool that helped solve social, economic, and environmental problems during this time period.

The modern environmental education movement, which gained significant momentum in the late 1960s and early 1970s, stems from Nature Study and Conservation Education. During this time period, many events – such as Civil Rights, the Vietnam War, and the Cold War – placed Americans at odds with one another and the U.S. government. However, as more people began to fear the fallout from radiation, the chemical pesticides mentioned in Rachel Carson's *Silent Spring*, and the significant amounts of air pollution and waste, the public's concern for their health and the health of their natural environment led to a unifying phenomenon known as environmentalism.

Ultimately, the first Earth Day on April 22nd, 1970 – a national teach-in about environmental problems – paved the way for the modern environmental education movement. Later that same year, President Nixon passed the National Environmental Education Act, which was intended to incorporate environmental education into K-12 schools. Then, in 1971, the National Association for Environmental Education (now known as the North American Association for Environmental Education) was created to improve environmental literacy by providing resources to teachers and promoting environmental education programs.

In Europe it was during the industrial revolution in the nineteenth century that awoke the attention of the masses towards environmental education. During the period the living conditions of most European countries showed that environmental problems were approaching an unhealthy

like. Nevertheless, environmental problems are not confined to cities alone; they also exist in the rural areas. It is therefore pertinent to note that problems related to both urban and rural deterioration have been with us for centuries. Man as herbivore and carnivore, with a very wide dietary range, is remarkably well equipped to exploit the variable habitats of the world. As a hunter, fisherman and forager, he feeds on a substantial number of different plant and animal species.

When natural systems and ecosystems are used unwisely by man, they may rapidly become unstable with associated severe and sometimes essentially irreversible effects. Historically speaking, the first small population of human beings probably appeared on earth between one and two million years ago, probably on the continent of Africa. Since then, the human population has spread out to occupy virtually the entire land surface of the planet and by the last decade of the last century it numbered over 5 billion individuals. In their quest to provide subsistence, shelter and recreation for specific demographic units, human beings have learned to modify and exploit the environment to their advantage in a great variety of ways.

In Africa, in the early days of the Holocene period when the Sahara was particularly wet, the abundant fauna and flora in the area favored man's pre-occupation with hunting and gathering. But when the drying process of the present day Sahara region became more pronounced by 5,000 B.C., adverse environmental changes in the area had already driven the early African inhabitants to more complex adaptation and development of efficient ways of exploitation the habitat. By this period, the inhabitants of the Nile Valley had already learned to till the land in seasons, sow and irrigate it in order to get a more regular and abundant food supply.

While agriculture and settlement had become possible in the area by this period, a similar process was taking place elsewhere although it may not have been at the same pace. As the Stone Age, the culture of hunting and gathering became enriched by Neolithic traits, the adoption of agricultural practices led to man's specialization and division of labor. Whereas the adoption of agriculture marked the genesis of a more intensified exploitation of the habitat, the resultant multiplication and localization of food supply entailed by this phenomenon boosted population growth; it was because of this that the need for permanent human settlement arose. An era of

Among third world cities, only Buenos Aires had over million people by 1950. By 1980, 22 cities counted more than million people. By the year 2,000 the number of city dweller may have doubled; 61 cities with over 4 million inhabitants and few exceed a staggering 10 million.

5.4.4 Rural Settlement and the Environment

Irrigation and drainage in settled lands has brought about abrupt and sweeping transformations in natural systems. The controlled distribution of water over cultivated lands and the withdrawal of excessive water through drainage have immediate effects on the crop-producing capacity of the land. It also affects both the quantity and quality of downstream flows.

The sudden appearance of extensive areas of irrigated crops in sub-humid and arid ecosystems triggers the potential for dramatic changes. These systems become inherently unstable. Because of intensive management of irrigation, arid ecosystems which have a limited capacity to assimilate, withstand and respond to inputs of water, chemicals and energy, find it difficult to adapt to alterations in species diversity, numbers of organisms and the stability of their interrelationships.

The modification of aquatic ecosystems through irrigation practices results in:

- Shifts in humidity and sedimentation
- Nutrient concentration
- Transport and resultant eutrophication of fresh waters
- Wide distribution of pesticides and herbicides
- Dissemination of aquatic weeds and phreatophytic plants, and
- Bacterial and viral contamination
- It also leads to the spread of parasite vectors.

Although irrigation may bring many benefits upon human health (improving nutrition, water supply and community facilities), it also has deleterious effects through chemical pollution and distribution of diseases such as malaria and schistosomiasis.

production takes place in these forests and their degradation is an environmental tragedy. Inevitably, much of the forests cover will be lost by the year 2,000 through complete conversion to other uses and by severe degradation. By that year, there will be an estimated minimum loss of tropical forests of 12.5 per cent.

In Kenya, natural forests are protected by government policy through the Ministry of Environment and natural resources. As a result, there is still natural vegetation called highland forest which covers certain isolated parts of the Kenya highlands where it is found at altitudes ranging from, 1,976 meters to 2,736 meters. Mount Kenya, Mount Elgon and the Aberdares have this forest belt. At the Coast are found Witu Forests, Midagedi forests, the forested Kayas, Gongoni forest, remnants of the Shimba Hills forest, Sokoke forest and Ramisi River valley forest. Clearly, a government protection policy had to be enacted because many of these existing forests have been reduced considerably by lumbering. In fact charcoal burning is the greatest threat to Kenya's vegetation cover and the demand for charcoal is accentuated by increasing human settlement in Kenya's urban centers where oil and gas prices are becoming increasingly prohibitive.

From the foregoing information, it is clear that, although desertification is exacerbated by severe drought, its principle cause is human overexploitation of dry lands through over-cultivation, overgrazing, poor irrigation practices and deforestation. This proves the fact that even though the study of ecological change is still rudimentary, there is evidence to show that human settlement and community lifestyle have often been a dynamic element in the disfigurement of the environment.

A. Settlement and the Pollution of the Environment

Nowadays, protection of the global environment is closely connected with a set of issues such as the depletion of the stratospheric ozone, the long range transport of pollutants, live in large settlements, burn fossil fuels and use technology to meet his needs. The process of air pollution accelerated during the industrial revolution with the introduction of steam power for factories and with greater concentrations of population in manufacturing centers. The number and variety

of pollutants increased still more markedly with the development of modern chemical technology in the 19th century.

B. Population Explosion and Settlement Problems

The growing size of urban areas is changing the whole pattern of land use. Fast metropolitan growth leads to degeneration of shelter and quality of life in suburban areas: slum sectors inevitably mushroom and soon become today's biggest challenge to mankind. Nairobi's and Kampala's slum and squatter settlements continue to grow and along with them, the social consequences of poverty. They provide sanctuaries for deviant patterns of social behavior including crime and prostitution.

Slums are unquestionably deplorable. They not only breed physical sickness but also overcrowding, lack of privacy and deprivation of the basic amenities of life can be demoralizing. Besides, it is a sad fact that any growing town soon has to fringe such undesirable quarters.

The populations of the urban settlements are being augmented by three sources:

- a) the population explosion in the poorer and more backward parts of the cities;
- b) the rising unemployed rural population seeking employment opportunities in the city; and
- c) The attraction of the city which the rural population sees as a provider of a better quality of life and amenities such as hospitals and schools.

As rural populations are being siphoned off into urban settlements, these three reasons combine to give population growth the form of an urban explosion. But the juxtaposition of people with different levels of income, different races, produces in the city (unlike in the countryside) a social environment with unanticipated psychological effects. Though efforts are being made to cope with the development of the cities, problems often arise faster than they can be solved. The city is becoming more complex and the environmental degradation is practically unstoppable. Will mankind win or lose the struggle?

The question of human settlement has exposed the crises that exist in urban centers. But environmental problems are not confined to urban settlements alone. They also exist in rural

Oral Contraceptives (the Pill): This involves regular intake of pills as prescribed by a physician. Pills are a combination of synthetic forms of the hormones progesterone and estrogen. Oral contraceptives stop ovulation by interfering with the cyclical Hormonal changes required for ovulation and make the cervical mucus thick and impenetrable to sperm. Pills are taken every day in a 21 or 28-day cycle depending on the pill type. A whole cycle must be taken on schedule to work effectively.

Condom: The condom is a sheath or thin rubber (latex) envelope which is put on a man's erect penis before intercourse to collect the semen, hereby keeping the sperm from entering the woman's vagina.

Diaphragm: This is a soft rubber cup with a stiff but flexible rim around the edge which is inserted into the woman's vagina before intercourse. The diaphragm covers the entrance of the uterus; as a further measure contraceptive cream or jelly is spread on the surface which lies against the cervix in order to block sperm movement.

Vaginal contraceptives: These are foams, creams, jellies, tablets, sponge (today) and suppositories - all chemical substances containing spermicidal. Before intercourse, the contraceptive is inserted into the vagina, where it spreads over the vagina and cervix. These contraceptives render the sperm inactive.

Periodic abstinence (rhythm, natural family planning, fertility awareness): This requires the couple to refrain from sexual intercourse during the estimated time of fertility. Ways to determine a woman's approximate time of ovulation and her fertile time include; keeping records of the menstrual cycle, the body temperature and the consistence of the cervical mucus (Billings ovulation method).

Despite persistent emphasis on family planning, population control methods have not proved as successful as expected in reducing the population growth rate. This is attributed to the following factors. Contraceptive methods are not 100 per cent effective. These /are chances varying between 0.2 and 30 per cent that women ' using various contraceptive methods can still get

Environmental conservation is sensible use of the earth's natural resources in order to avoid excessive degradation and impoverishment of the environment. It should include the search for alternative food and fuel supplies when these are endangered (as by deforestation and overfishing); an awareness of the dangers of pollution; and the maintenance and preservation of natural habitats and the creation of new ones, e.g. nature reserves, national parks, and sites of special scientific interest (SSSIs).

The scientific discipline concerned with the ways in which Earth's biological diversity is lost and the development of solutions to protect the natural functioning of **ecosystems** and the **species** that reside within them. Extensive surveys of **habitats** provide valuable information on the number, kind, and health of species that reside there. Combining this information with knowledge of how various factors (such as habitat destruction, overharvesting, pollution, introduced species, and the effects of **global warming**) contribute to species decline and **extinction** enables scientists and wildlife managers to design protection plans for vulnerable forms. Often, protection plans involve the setting aside of large parcels of existing habitat, the elimination of foreign species, and the restoration of areas previously altered by human activity. Climate change, reduced forest cover, depletion of fresh water basins, pollution, drought and famine are testament to the urgent need for interventions to restore balance within the environment and its ecosystems. The MDG 7 calls for ensuring environmental stability by increasing forest cover and protecting water catchment areas, among other actions.

Environmental protection is a practice of protecting the environment, on individual, organizational or governmental level, for the benefit of the natural environment and (or) humans. Due to the pressures of population and our technology the **biophysical environment** is being degraded, sometimes permanently. This has been recognized and governments have begun placing restraints on activities that caused **environmental degradation**. Since the 1960s **activism** by the **environmental movement** has created awareness of the various **environmental issues**. There is not a full agreement on the extent of the environmental impact of human activity and protection measures are occasionally criticized. **Academic institutions** now offer courses such as **environmental studies**, **environmental management** and **environmental engineering** that study the history and methods of environmental protection.

Reduced soil erosion. A dense cover of plants and mulch holds soil in place, keeping sediment out of lakes, streams, storm drains and roads; and reducing flooding, mudslides and dust storms.

Improved air quality. Trees, shrubs and turf remove smoke, dust and other pollutants from the air. One tree can remove 26 pounds of carbon dioxide from the atmosphere annually, equaling 11,000 miles of car emissions. One study showed that one acre of trees has the ability to remove 13 tons of particles and gases annually. 2,500 square feet of turf absorbs carbon dioxide from the atmosphere and releases enough oxygen for a family of four to breathe.

Lower attic temperatures. Trees shading homes can reduce attic temperatures as much as 40 degrees. According to the EPA, urban forests reduce urban air temperatures significantly by shading heat sinks such as buildings and concrete and returning humidity to the air through evaporative cooling.

Natural resource conservation. By using trees to modify temperatures, the amount of fossil fuels used for cooling and heating is reduced. Properly placed deciduous trees reduce house temperatures in the summer, allowing air conditioning units to run 2 to 4 percent more efficiently. The trees also allow the sun to warm the house in the winter.

Green roofs cool urban hot spots. Led by cities such as Chicago and Toronto, as well as a number of universities, evidence is mounting that green roofs (i.e. roofs totally or partially covered with vegetation) can play an important role in saving energy, reducing the urban heat island effect and adding more green space to a built environment.

Cooler summer days. Lawns will be 30 degrees cooler than asphalt and 14 degrees cooler than bare soil in the heat of summer.

Natural resource conservation. Homeowners can “grasscycle” by leaving grass clippings on the lawn when mowing. The clippings quickly decompose and release valuable nutrients back into the soil to feed the grass, reducing the need for nitrogen by 25 to 50 percent. Modern mulching lawn mowers make “grasscycling” even easier, and homeowners can reduce their mowing time by 30 to 40 percent by not having to bag clippings.

On the one hand, pragmatic eco-revisionists have ‘attributed so many of environmentalists’ failures to the incuriosity about the human (read: social) sciences, like social psychology and their scientific fetishization of the ‘natural’ sciences.’’²⁷ At the same time some anthropologists have taken this criticism a step further by challenging conservationists about their detachment from indigenous people in their pursuit of conservation. In a much publicized article for *World watch* magazine, anthropologist Mac Chapin recently critiqued the work of the Nature Conservancy, the World Wildlife Fund, and Conservation International by asserting that ‘as corporate and government money flow into the three big international organizations that dominate the world’s conservation agenda, their programs have been marked by growing conflict of interest and by a disturbing neglect of the indigenous people whose land they are in business to protect.’

Anthropologists and conservation scientists have encountered this debate before in various guises. An article in *Conservation Biology* by Schwartzman et al. (2000) that gave primacy to indigenous conservation practices had sparked a similar heated debate with responses from conservationists such as Redford and Soderstrom (2000). Interestingly enough the disagreement here was between staff scientists at major environmental groups—some of whom were more unequivocally sympathetic to indigenous concerns over conservation priorities. Such a divergence highlights the ‘varieties of environmentalism’ that Guha and Martinez Allier (1997) have alluded to in their work on social movements. Yet environmentalists are collectively also accused all too often by those on the Right of the political spectrum for being too positional and uncompromising in their approach to problem-solving and not interacting adequately with free-market interests. Even Conservation International, which is often accused by more traditional environmentalists of accepting large contracts and grants from oil companies and development donors, is just as much criticized by industrialists for not willing to compromise enough on extractive projects in ecologically sensitive places such as Madagascar.

Environmental and human rights groups are thus often lumped together by critics of non-governmental organizations (NGOs), such as Sebastian Mallaby (2004) or Clifford Bob (2005) who decries their unwillingness to compromise on urgent development projects. The formation

	said the search for alternative food and fuel supplies when these are endangered (as by deforestation and overfishing); an awareness of the dangers of pollution; and the maintenance and preservation of natural habitats and the creation of new ones. Again we have said that Green spaces are a great benefit to our environment. This is because they filter pollutants and dust from the air, they provide shade and lower temperatures in urban areas, and they even reduce erosion of soil into our waterways We went on to say that distinct trends exist regarding conservation development. Where we have indicated that while many countries' efforts to preserve species and their habitats have been government-led, those in the North Western Europe tended to arise out of the middle-class and aristocratic interest in natural history, expressed at the level of the individual and the national, regional or local learned society. Lastly we have concluded by saying that using conservation measures as a direct means of resolving an armed conflict is the most consequential use of environmental peace-building; yet this approach is still in early stages of global acceptance.
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	6.9 References Grove, R.H. (1995) <i>Green Imperialism: Colonial Expansion, Tropical Island Edens, and the Origins of Environmentalism, 1600-1860</i> New York: Cambridge University Press Grove, R.H. (1997) <i>Ecology, Climate and Empire: Colonialism and Global Environmental History 1400-1940</i> Cambridge: Whitehorse Press
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carbon dioxide in the air and they are quick and easy to construct and expand.

However wind energy also has some disadvantages. Wind energy requires steady winds for it to function well otherwise one will require backup systems when winds are low. Wind energy will also use a lot of land especially if wind is harvested on a large scale. These will require wind farms which will consume a lot of land. It can also be said that wind energy systems can make noise when they located near populated areas. Some critics have also alleged that wind turbines suck large numbers of birds into their wind stream

Despite these disadvantages, increasingly many governments and corporations are recognizing that wind is a vast climate benign, renewable energy resource that can supply both electricity and hydrogen fuel at an affordable cost. If its current growth rate continues, wind power could produce ten percent of the world's electricity by 2020.

Water Power

Hydroelectric energy is an important source of energy for the world today. Electricity can be produced from flowing water in many forms as explained below.

- a) Large scale hydropower can be generated by building a high dam across a large river to create a reservoir. Some of the water stored in the reservoir can then be allowed to flow through huge pipes at controlled rates, spinning turbines and thereby producing electricity.
- b) Small scale hydropower can be generated by building a low dam with no or small reservoir across a small stream. Then the stream's flow of water is used to spin turbines to produce electricity.

- c) Pumped storage hydropower can be produced by using surplus electricity from conventional power plant to pump water from a lake or a reservoir to another reservoir at a higher elevation. When more electricity is needed, water in the upper reservoir is released and flows through the turbines thereby generating electricity on its return to the lower reservoir.
- d) The flow of tides and waves of the ocean can also be used to spin turbine to produce electricity.

The advantages of water power are many and varied. It is relatively inexpensive when compared with other sources of energy. The efficiency of water power is high and is estimated at eighty percent (Miller, 2005). Water power is also clean and it does not require burning of fuel, does not pollute the atmosphere and does not produce any radioactive or other waste when in operation.

That said, water power also has disadvantages.

	In-text Question Can you think of the disadvantages of water power over other sources?
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It has been argued that water falling over high dams may pick up nitrogen gas which enters the blood of fish, expands and kills them. In addition, dams constructed to receive water drop sediment that would otherwise reach the sea and replenish the sand on beaches. It is also conceivable that when dams are placed along a single river, they interfere with the river flow and flood over usable land.

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Currently research is on going in different countries to establish whether hot dry rock zones which is found anywhere about 8 -10 kilometers beneath the earth's surface can provide affordable geothermal energy.



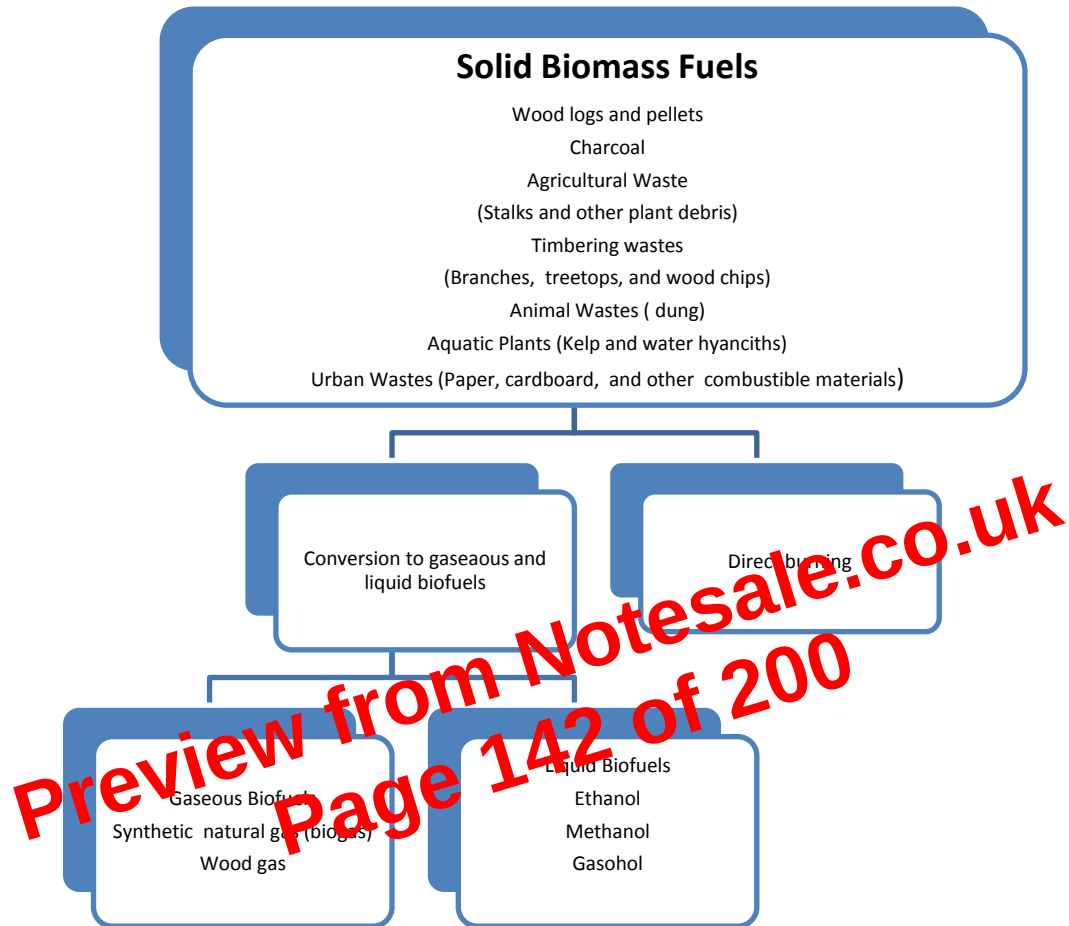
Activity 7.3

1. Explain how electricity can be generated using hydro power plants
2. List the advantages of using hydro power over other sources of energy
3. Describe how the earth's combined Heat can be used to produce geothermal energy.

Biomass Energy

Biomass consist of plant materials and animal wastes that are used as sources of energy .Biomass is available in many forms like wood logs , charcoal , plant debris , cow dung ,water hyacinths and paper. In order for biomass to produce energy, it can be burned directly as a solid fuel or converted into gaseous or liquid bio fuels.

Fig: 7.3: Principal types of biomass fuel



Source: Adapted from Miller G.2005 p 404

According to G. Miller (2005) burning wood and manure for heating and cooking supplies about eleven percent of the world's energy and about

The efficiency of a device is measured by dividing the actual delivered energy by total potential energy available as given in the equation below:

$$\text{Percentage of efficiency} = \frac{\text{Actual delivered energy}}{\text{Total potential energy}} \times 100$$

7.6.2 Strategies and Benefits of Energy Conservation

In order to have sustainable development, available energy should be optimally used in such a way that it mitigates the various risks associated with the current global energy production and consumption patterns.

One way of achieving this goal is for countries to develop strategies to improve energy efficiency and promote the culture of energy conservation. It should however be noted that the strategies used to improve energy efficiency and promote energy conservation should consider the specific fuel mix and the technologies employed in each sector of development together with the efforts made to improve energy management.

According to World Resources Institute (WRI, 1990) conservation measures reduced per capita energy use by five percent and growth domestic product grew by thirty two percent among industrialized nations during the period 1973 to 1985. Similarly in California, U.S.A, both public and private initiatives towards energy conservation resulted in substantial economic and social savings and proved to be three to five times cheaper than new power plants (WRI, 1988).

	Non-renewable energy sources are mostly associated with the emission of greenhouse gases, global warming, urban air quality and acid rain. We also discussed conservation of energy of energy and stated that conservation of energy refers to better utilization of available energy thereby contributing to higher efficiency and minimizing wastage. The benefits of energy conservation include reducing pollution and environmental degradation; improving local economy; prolonging the supply of fossil fuels and creation of employment opportunities Finally we ended the lecture by looking at strategies which can be used to save energy in industrial related projects. The common strategies suggested for saving energy in industrial related projects include cogeneration; replacing energy wasting electric motors; recycling of processed materials and switching to higher efficiency lightening
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LECTURE EIGHT

CLIMATE CHANGE AND OZONE LOSS

Lecture Outline

Nitrous Oxide

Nitrous oxide is a greenhouse gas, accounting for around six percent of the heating effect of greenhouse gases in the atmosphere. According to 2006 data from the United States Environmental Protection Agency, industrial sources make up only about twenty percent of all anthropogenic sources, and include the production of nylon, and the burning of fossil fuel in internal combustion engines. Human activity is thought to account for thirty percent; tropical soils and oceanic release account for seventy percent.

However, a 2008 study by Nobel Laureate Paul Crutzen suggests that the amount of nitrous oxide release attributable to agricultural nitrate fertilizers has been seriously underestimated, most of which would presumably come under soil and oceanic release in the Environmental Protection Agency data. Atmospheric levels have risen by more than fifteen percent since 1750. Nitrous oxide also causes ozone depletion. A new study suggests that nitrous oxide emission currently is the single most important ozone-depleting substance (ODS) emission and is expected to remain the largest throughout the 21st century.

Each year we add 7-13 million tons into the atmosphere by using nitrogen based fertilizers, disposing of human and animal waste in sewage treatment plants, automobile exhaust, and other sources not yet identified. It is important to reduce emissions because the nitrous oxide we release today will still be trapped in the atmosphere 100 years from now. (World Book Volume 13)

Chlorofluorocarbons (CFCs)

8.3.2 Evidence of Global Warming

	In text Question Can you show evidence that global warming is presently occurring?
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Further, global warming will seriously disrupt the marine ecosystem. The flooding of many coastal wetlands as a result of the rising temperatures would mean the loss of an essential nursery for many fish and shrimp species. This could in turn reduce the quantities of seafood available for human consumption.

According to the Stockholm Environment Institute, the natural ecosystem can only adapt to a temperature rise of, at most 0.1 degrees centigrade per decade. This means that any temperature changes that go beyond the 0.1 degrees centigrade in a decade will have harmful or beneficial impact on the surrounding environment. Studies have shown that Boreal forests are the most sensitive to climate warming (Bolin's et al., 1986). While other studies on individual trees under controlled conditions have shown that increased carbon dioxide levels promote growth, at least in the short term. Climate change may also affect the frequency of outbreak of plant disease. For example, diseases like potato blight and wheat rust are mostly triggered by specific weather conditions (WRI, 1988).

Impacts on Climate and Precipitation

Global warming also affects the climate and the frequency of rainfall in any part of the world. The most widely recognized consequence of global warming is the rise in the sea level. When temperatures rise, the oceans will warm and expand, and the polar ice caps in Greenland and Antarctica may partially melt, causing sea levels to rise (Titus and Siedel, 1986). It is estimated that if the average temperatures rise from 1.5 degrees to 4.5 degrees centigrade, the rise in the sea levels will be between 20 to 140 centimeters. This rise in the sea levels is enough to flood vast unprotected tracts of coastal land in countries like Indonesia, India, Bangladesh and Egypt. Another threat will be the flooding of several Island nations which lie in the Pacific and Indian oceans and the Caribbean sea. Among the countries or nations that will be affected include island states like the Maldives, Tuvalu and Kiribati. It is out of this threat that the Island nations have formed an association called the Association of Small Island States (AOSIS) with the aim protecting their interests and also applying pressure to industrialized nations to cut down on the emissions of greenhouse gases.

countries. Disruption of food and water supplies could lead to the spread of diarrhea and other diseases associated with lack of water and food.



Activity 8.1

1. Explain the following concepts:
 - a. Global Warming
 - b. The Greenhouse effect
2. List some of the greenhouse gases and explain how they contribute to the global warming
3. List three human activities that increase the input of greenhouse gases into the troposphere and could enhance the earth's natural greenhouse effect
4. Name any three impacts of global warming

8.4 The Stratospheric Ozone Layer

Stratospheric ozone depletion is a concern because the ozone layer in the stratosphere keeps 95-99% of the sun's ultraviolet radiation from striking the earth. A number of consequences can result from increased levels of UV (ultraviolet radiation) striking the earth, including: genetic damage, eye damage and damage to marine life. Increased UV radiation in the lower atmosphere, called the troposphere, can result in increased amounts of photochemical smog. Photochemical smog is already a health hazard in many of the world's largest cities.

The decrease of stratospheric ozone was first reported in 1974 and the decrease was quickly linked to the increasing presence of a class of manmade compounds called CFC's or chlorofluorocarbons. Many countries of the world have moved to reduce the use of CFC's but because of the slow rate of air mixing between the lower and upper atmosphere it is theorized that stratospheric CFC's will stay at a significant level well into the next century.

Naturally occurring chlorine has the same effect on the ozone layer, but has a shorter life span in the atmosphere.

Other ozone depleting compounds include the following:

- Methyl bromide widely used as fumigant
- Carbon tetrachloride that is highly toxic and cheap
- Methyl chloroform used as a cleaning solvent for clothes and metals and as a propellant in more than 160 consumer products such as correction fluid, dry cleaning sprays and other aerosols
- N-propyl bromide, increasingly used as solvent for degreasing and cleaning metal parts
- Hexachlorobutadiene, also increasingly used as a cleaning solvent and
- Hydrogen chloride emitted into the stratosphere by space shuttles

8.4.3 Effects of Ozone Depletion

Must we care about the ozone loss given that it is happening so many miles from the earth's atmosphere? This question can best be answered after our discussion on the effects of ozone loss. Ozone loss has devastating consequences not only on human health but also on other living and nonliving creatures like wildlife, climate change, food and forests, and even air quality. It can affect important food crops like rice by adversely affecting cyanobacteria, which helps them absorb and utilize nitrogen properly. Phytoplankton, an important component of the marine food chain, can also be affected by ozone depletion. Studies in this regard have shown that ultraviolet rays can influence the survival rates of these microscopic organisms by affecting their orientation and mobility.

Let us now briefly discuss the effects of ozone on each of these items:

Ozone depletion and human health

A major effect of ozone depletion on human health is the occurrence of eye disorders. Strong ultra violet radiation from the sun can cause inflammation of the cornea, the outer coating of the eyeball, leading to photokeratosis or "snow blindness". Symptoms of this kind of infection

1993 (Bangkok), 1995 (Vienna), 1997 (Montreal), and 1999 (Beijing). It is believed that if the international agreement is adhered to, the ozone layer is expected to recover by 2050. Due to its widespread adoption and implementation it has been hailed as an example of exceptional international co-operation with Kofi Annan quoted as saying that "perhaps the single most successful international agreement to date has been the Montreal Protocol". It has been ratified by 196 states.

The treaty is structured around several groups of halogenated hydrocarbons that have been shown to play a role in ozone depletion. All of these ozone depleting substances contain either chlorine or bromine (substances containing only fluorine do not harm the ozone layer). For each group, the treaty provides a timetable on which the production of those substances must be phased out and eventually eliminated.

8.5.5.1 Impact of Montreal Protocol

Since the Montreal Protocol came into effect, the atmospheric concentrations of the most important chlorofluorocarbons and related chlorinated hydrocarbons have either leveled off or decreased. Halon concentrations have continued to increase, as the halons presently stored in fire extinguishers are released, but their rate of increase has slowed and their abundances are expected to begin to decline by about 2020. Also, the concentration of the HCFCs increased drastically at least partly because for many uses CFCs (e.g. used as solvents or refrigerating agents) were substituted with HCFCs. While there have been reports of attempts by individuals to circumvent the ban, e.g. by smuggling CFCs from undeveloped to developed nations, the overall level of compliance has been high. In consequence, the Montreal Protocol has often been called the most successful international environmental agreement to date.

In a 2001 report, NASA found the ozone thinning over Antarctica had remained the same thickness for the previous three years. However in 2003 the ozone hole grew to its second largest size. The most recent (2006) scientific evaluation of the effects of the Montreal Protocol states, "The Montreal Protocol is working: There is clear evidence of a decrease in the atmospheric burden of ozone-depleting substances and some early signs of stratospheric ozone recovery."

Common resources are those resources which are used by all but belong to nobody. They are available beyond any national and international boundaries. They are sometimes referred to as global commons. Examples of common resources are oceans outer space air and solar energy. Environment problems facing common resources include pollution from industrial effluents, sewage dumping, direct dumping of hazardous chemical wastes and radioactive materials, and pollution from space exploration.

Shared resources on the other hand belong to more than one nation. Good example of shared resources are River Nile, the Mediterranean Sea and Lake Victoria which belong to more than one nation or country. For proper use and conservation of shared resources there is need for the nations concerned to have good co-operation between themselves and educate their nationals on the impending danger of resource depletion.



Activity 9.1

1. Identify five natural resources that have not been discovered in this lecture and classify them.
2. For each of the above resources identified discuss the practical conservation measures that are being taken to safeguard them against the possible dangers of depletion and extinctions.

9.3.2 Problems in Resource Utilizations

Most developing countries are usually faced with various challenges as they try to utilize their natural resources. It should be mentioned here that these challenges vary from one country to another depending on the nature of available natural resources, technological ability, infrastructure among other things.

Generally the following are some of the problems encountered while using the natural resources.

a) Lack of updated data on available resources

It is important that for any country to maximize on the national resources, a proper knowledge of the available resources and changes affecting such resources must be known. It is only after establishing the available resources that a proper system of their use can be established and implemented.

Some countries like Kenya have not done comprehensive exploration, mapping and documentation of their natural resources so that the country can fully be aware of the resource potential.

b) Inadequate Financial and Technical Know-how

It is recognized that efficiency in monitoring of resource use and the methods for exploration of the natural resources are constrained by lack of or inadequate capacity in terms of equipment and technical knowledge.

For example in the agricultural sector, farmers continue to apply absolute technology in irrigation schemes in which the utilization of water is inefficient and wasteful.

It should be mentioned here that all such techniques in resources utilization and management require specialized technical know-how and equipment, which is normally expensive for developing countries. Thus to ensure sustainable utilization and management of natural resources, there is need for adequate technical and financial assistance which can contribute towards the overall goal of protection and conservation of the resources.

(c) Poor and inadequate regulatory framework

poor or lack of regulations governing the exploration of various natural resources can result into over-exploitation of some natural resources and poor management of the same. Therefore there is need to develop effective laws that govern the use of management of natural resources. Related to this is the problem of inadequate enforcement of some legislation of governing the use of natural resources. For example in Kenya while there

are laws governing the exploitation of forestry and fishery resources, yet the problem has been lack of enforcement. This has led to indiscriminate use of destructive fishing methods and forest destruction.

(d) Lack of infrastructural facilities

Another problem affecting proper use of natural resources is inadequate infrastructural amenities. Poor or lack of infrastructure such as road network, telephone services, medical facilities and power can greatly hinder effective use of natural resources. Infrastructural facilities improve not only improve accessibility to natural resources but also help in reducing marketing or distribution costs and also help in diversification of resources use.

(e) Political stability

It goes without saying that political stability is paramount for any development to take place in any country. In some Third World countries and even in the developed nations, political reasons have made it impossible to use or manage the natural resources available in these nations.

For example in some African countries there has been mismanagement of the available resources because of wars or lack of political.

(f) Natural population growth

Over the year the population of most developing countries has been increasing steadily while the natural resources available have remained the same. This has executed pressure on the prevailing natural resources to sustain the demand of the increasing population.

For example forestry resources are being threatened by deforestation to create room for agricultural land. Similarly fish and wildlife resources are becoming victims to satisfy the increasing demand for food.

(g) Cultural beliefs and values

Some cultural beliefs and values can act as a hindrance to sustainable resources utilization. For example in Kenya traditional uses of sea xx, whales and dolphins by coastal people was Mombasa for food and medicinal purposes or as charms to scare away evil spirits or evils or ornamental and jewellery are direct threats to these living resources as demand to satisfy these beliefs and values

9.4 Principles of Conserving Natural Resources

Before we look at principles governing conservation of natural resources can you remind yourself the problems associated with resource utilization. Some of the problems can be minimized or completely eradicated if these principles are adopted by individuals, governments, private organizations or other stakeholders charged with natural resource conservation.

An important question arises as to who is responsible for conservation of natural resources. It should be noted here that responsibility for conservation of natural resources does not lie in the hands of the government alone. Everybody be it an individual, an organization or even a business enterprise must be involved in the process at one level or another. Further conservation of natural resources requires massive educational programme to create awareness because not all people in a region have the same perception of environmental utility and risks associated with it.

Another issue which is normally associated with resource use and conservation is the rise of conflicts because of the competing interests of the stake holders. There conflicts can occur between individuals, individuals and private organizations, individual and the government, private organization and the governor even between nations. While there are no universal principles of conserving natural resources, the following principles can be taken as ideal for conservation:

1. Conservation should be for development

Any form of conservation of natural resources to be adopted should be for the beneficial use to people who live around. In other words conservation means the use of natural resources now existing for the benefit of the society. Any programme of conservation of natural resources which does not benefit the society should be discouraged as it will be going against the best practices of natural resource conservations.