

## **ELEMENTS OF ENVIRONMENTAL STUDIES**

**BY**

**K. E. ENERIJIOFI**

[Kingsmore1luv@gmail.com](mailto:Kingsmore1luv@gmail.com); [kenerijiofi@sau.edu.ng](mailto:kenerijiofi@sau.edu.ng)

### **INTRODUCTION**

This chapter consists of six sections. The first section examines the concept of environmental science, environmental scientist and the environment. The second section deals with ecology, which will provide an insight into interactions between living and non-living things in the environment. The third is the ecosystem, which can be studied structurally and functionally. Section four examines interactions within an environment. Section five examines the challenges of environmental degradation. Finally, section six deals with the importance of environmental studies.

#### **Concept of Environmental Studies**

Environmental studies, also referred to as environmental science, is a multi-disciplinary science concerned with the relationship between elements of the natural ecosystem and man. It can also be understood as the study of how man and other species interact with one another and with the non-living environment of matter and energy. Environmental science is a multidisciplinary science that integrates a wide range of disciplines including: physics, chemistry, biology, geology, geography, resource technology, engineering, resource conservation, population dynamics, economics, politics, sociology, psychology and ethics (Singh, 2006; Odokuna and Abah, 2003).

**Environmental scientist:** This is a person who studies and works in the field of environmental sciences (Singh, 2006).

#### **Concept of Environment**

It means the surrounding external conditions influencing the growth or development of people, animal or plants in their living or working conditions. Man cannot exist or be understood in isolation from other forms of life. Hence, environment can also be referred to as the sum total of conditions, which surround living things (Singh, 2006; McDougal, 2008).

## **Elements of Environment Studies**

The environment consists of the interacting systems of physical, biological and cultural elements. These elements are inter-related, individually as well as collectively.

**Physical elements:** Physical elements are space, landforms, water bodies, climate, soils, rocks and minerals. They determine the variable character of the human habitat, its opportunities as well as limitations.

**Biological elements:** Biological elements such as plants, animals, microorganisms and man constitute the biosphere.

**Cultural elements:** Cultural elements such as economic, social and political elements are essentially manmade features, which make cultural milieu (Singh, 2006).

## **Types of the Environment**

There are three types of environment which include:

**Physical:** This refers to geographical climate and weather or physical conditions where an individual lives. The human races are greatly influenced by the climate.

**Social:** This includes an individual's social, economic and political conditions where he lives. It consists of the moral, cultural and emotional forces which influence the life and nature of individual behaviour.

**Psychological:** Although physical and social environments are common to the individual in a specific situation, yet every individual has his own psychological environment, in which he lives. The Psychological environment enables us to understand the personality of an individual. The person and his goal form psychological environment.

## **Structure of the Environment**

The Environment is both physical and biological. It includes both living and non-living components (Adesiyani, 2005; Taylor *et al.*, 2010).

### **Physical Environment**

The Physical Environment is classified into three broad categories namely, Solid (lithosphere), Liquid (hydrosphere) and Gas (atmosphere).

### **Biological Environment**

It consists of Plants (flora) and Animals (fauna). Thus, the biotic environment is divided into floral and faunal environments. All the organisms work to form their social groups and organisations at several levels. Thus, the social environment is formed. In this social environment, the organisms work to derive matter from the physical environment for their sustenance and development. This process gives birth to economic environment. Man is most skilled and civilized of all the organisms. This is the reason why his social organisation is most systematic.

### **The Physical Man**

The Physical Man is one of the organism populations or biological community. He is in need of the basic elements of the physical environment like habitat (space), air, water and food. Besides, like other biological populations, he releases wastes into the ecosystem.

### **The Social Man**

The Social Man performs the following functions:

- (a) Establish social institutions.
- (b) Form social organisations.
- (c) Formulate laws, principles and policies.
- (d) Take steps to safeguard his existence, interest and social welfare.

### **The Economic Man**

The economic man derives and utilises resources from the physical and biotic environment with his skills and technologies. The economic function makes the man transports matter and energy from one component of the ecosystem to the other. There may be any following two situations:

- (a) His exploitative functions may be in harmony with the natural environment. Such, functions do not necessarily involve change in the working of the ecosystem.
- (b) These functions may exceed the critical limit. Consequently, the equilibrium of the environment is disturbed and a great number of environmental and ecological problems crop up. These are detrimental to man and besides the whole population of human species in a given ecosystem (Singh 2006).

### **Components of the Environment**

The environment consists of three components namely: atmosphere, hydrosphere and lithosphere.

**Atmosphere:** The atmosphere is the protective blanket of gases like nitrogen, oxygen, argon, carbon (iv) oxide, and trace gases.

**Hydrosphere:** The Hydrosphere comprises all types of water resources such as oceans, seas, lakes, rivers, streams, reservoir, polar icecaps, glaciers, and ground water. Nature has about 97% of the earth's water supply in the oceans, about 2% of the water resources are locked in the polar icecaps and glaciers. Only about 1% is available as fresh surface in rivers, lakes, streams, and ground water fit to be used for human consumption and other purposes.

**Lithosphere:** This is the outer mantle of the solid earth crust. It consists of minerals occurring in the earth's crusts and the soil e.g minerals, organic matter, air and water.

### **Functions of Components of the Environment**

#### **The atmosphere**

- (a) Sustaining life on the earth.
- (b) Saving it from the hostile environment of outer space.
- (c) Absorbing most of the cosmic rays from outer space and a major portion of the electromagnetic radiation from the sun.
- (d) Transmitting only ultraviolet, visible, infrared radiation (300 to 2500 nm) and radio waves (0.14 to 40 m) while filtering out tissue damaging ultraviolet waves below about 300 nm.

#### **The hydrosphere**

- (a) Domestic purposes like in drinking and bathing.
- (b) Agricultural purpose such irrigation
- (c) Industrial and commercial purposes like brewery industries and manufacturing.

#### **The lithosphere**

- (a) Contains minerals such as gold, dynamite for man's good (Singh, 2006; Hallman, 2000).

### **ECOLOGY**

Ecology is the study of interactions between organisms and their environment. All environment have biotic (living) and abiotic (non living) components. The biotic components consists all living organisms in a particular place while the abiotic include non living components like temperature

and moisture. It should be put on record that the biotic components are affected by the abiotic components of the environment (Russell *et al.*, 2008; Adesiyani, 2005).

The hierarchical levels of interacting units in ecology are discussed below:

**Individual:** It is a specie of organisms occupying a particular place.

**Population:** It is a group of organisms of the same specie occupying a particular place. A population is a group of interacting individuals, usually of the same specie, in a definable space. In this way we can speak of population of students in school and the population of fishes in a pond (Attama, 2007).

### **Factors Regulating Population**

The following factors regulate population of an environment:

- (i) Physical attributes of the environment (e.g. climate).
- (ii) Quantity and quality of food.
- (iii) Disease (host-parasite relationships).
- (iv) Predation.
- (v) Inter-specific and intra-specific competition.

**Community:** A community is a group of interacting population living within a particular place.

**Ecosystem:** This is the total complex of biotic and abiotic components in a habitat.

**Biome:** A large scale vegetation type and its associated microorganisms and higher animals.

**Biosphere:** This is the region where living organisms and their interactions occur within the environment (McDougal, 2008).

## **ECOSYSTEM**

An ecosystem can be defined as any spatial or organizational unit, including living organisms and non-living substances, interacting to produce an exchange of materials between the living and non-living parts (Yadav and Mishra, 2011). The ecosystem can be studied in either structurally or functionally (Taylor *et al.*, 2010).

### **Structural Aspects of an Ecosystem**

The structural aspects of an ecosystem include a description of the arrangement, types, numbers of specie and their life histories, along with a description of the physical features of the environment.

### **Functional Aspects of an Ecosystem**

The functional aspects of the ecosystem include the flow of energy and the cycling of nutrients.

### **General Characteristics of an Ecosystem**

The following are the general characteristics of an ecosystem.

1. The ecosystem is a major structural and functional unit of ecology.
2. The structure of an ecosystem is related to its species diversity. The more complex an ecosystem is, the higher the species diversity.
3. The relative amount of energy required to maintain an ecosystem depends on its structure. The more complex the structure, the lesser the energy it requires to maintain itself.
4. The function of the ecosystem is related to energy flow in material cycling through and within the system.
5. Ecosystems mature by passing from less complex to more complex states.
6. Both the environment and the energy fixation in any given ecosystem are limited. They cannot be exceeded in any way without causing serious undesirable effect.
7. Alterations in the environment represent selective pressures upon the population to which it must adjust. Organisms, which fail to adjust to the changed environment, will die.

### **Division of the Ecosystem**

The ecosystem can be divided, from the energetic view point, into three types of organisms: producers, consumers, and decomposers (Taylor *et al.*, 2010; Yadav and Mishra, 2011).

#### **Producers**

Photosynthetic algae, plants and bacteria like cyanobacteria are the producers of the ecosystem. All other organisms depend upon them directly or indirectly for food.

#### **Consumers**

They are herbivorous, carnivorous, and omnivorous animals, they eat the organic matter produced by other organisms.

#### **Decomposers**

They are not able to produce their own food like animals. They include fungi, non - photosynthetic bacteria and invertebrates like the Annelids (Earthworm) that decompose dead organic matter.

## **Habitat**

Habitat can be defined as the particular place within an ecosystem where living things are located. It includes all features of the environment in a given locality. For example, water is used as habitat by aquatic organisms and it comprises three major categories namely: marine, brackish and freshwater habitats. Each of these categories may be subdivided into smaller units such a freshwater habitat such as lakes, ponds, puddles, rivers or streams. The land is a habitat for numerous terrestrial organisms. It includes many major categories of landmasses, which are called biomes. Biomes are distinct large areas of earth made up of flora and fauna such as deserts and tropical forests. Soil is also used as a habitat by a variety of microbes, plants and animals (McDougal, 2008; Yadav and Mishra, 2011).

## **Biotic or Biological Factors**

The biological (biotic) factors of ecosystem include all the living organisms such as plants, animals, bacteria and viruses. Each kind of living organism found in an ecosystem is specie. A specie is an individual which has the following features:

- (1) They are genetically alike.
- (2) They are capable of freely inter breeding and producing fertile offsprings.

## **Abiotic Factors**

The non-living part of the ecosystem includes different kinds of habitats such as air, water and land, and a variety of abiotic factors.

The main abiotic factors of the ecosystem are:

- (1) The climatic factors such as solar radiation, temperature, wind, water currents, rainfall.
- (2) The physical factors such as light, fire, pressure, geomagnetism,
- (3) Chemical factors such as acidity, salinity and the availability of inorganic nutrients needed by plants.

## **INTERACTIONS WITHIN THE ENVIRONMENT**

Man live in the environment, therefore he interacts with it because he cannot live alone. The interaction of man with his environment result in a lot of interactions/relationships as will be discussed below:

**Mutualism:** This is a type of symbiosis where each organism in the relationship benefits from the association. Such as the relationship between cellulose degrading bacteria and ruminant animals. The cellulose degrading bacteria provide nutrient for the ruminant by degrading cellulose while the cellulose degrading bacteria gain protection from ruminant animals. Fixing of nitrogen is made possible through the association between *Rhizobium* species and leguminous plants. The *Rhizobium* species gain protection and nutrient from the leguminous plants while the leguminous plants gain nitrogen in the form of nitrate (Hallman, 2000; Wiley *et al.*, 2011).

**Commensalism:** In this type of relationship, a particular specie benefit and the other is unaffected. It is rare in nature as few species are unaffected by their interactions with one another. One possible example is the relationship between cattle egrets, birds in the heron and the large grazing mammals with which they associate (Hallman, 2000; Wiley *et al.*, 2011).

**Parasitism:** This is a type of interaction in which one specie, the parasite, uses another, the host, in a way that is harmful to the host. One population (predator) feeds on another (prey). Parasites rarely kill their hosts quickly because a dead host is useless as a source of nourishment. Tapeworm and other parasites that live within a host are endoparasites. They complete their life cycle within the host. Ectoparasites live outside their host like leeches, aphids and mosquitoes. Some plants like mistletoes live as ectoparasites on the trunk and branches of trees (Hallman, 2000; Wiley *et al.*, 2011).

**Competition:** In a biological community, competition is for resources, not wins. It is the struggle between individuals or different populations for a limited resource. In an ecosystem, it may occur within the same specie or within members of different species. Individual plant competes with each other for light, space and nutrient (Hallman, 2000; Wiley *et al.*, 2011).

## **CHALLENGES OF ENVIRONMENTAL DEGRADATION**

The following are the challenges of environmental degradation:

**Air pollution:** It is the contamination of the atmosphere by poisonous gases. Natural processes such as volcanic activity and decomposition of refuse affect air quality. Also, Human activity like incomplete combustion of hydrocarbon to carbon (ii) oxide can also lead to air pollution. Air pollution can cause respiratory problems for people through acid rain, damages to ozone layer and may affect global temperature (Russell, 2008).

**Global warming:** It is the gradual increase in the average global temperature. The atmosphere traps heat and warm the earth in a similar way. The greenhouse effect is the warming of the earth surface and when this happens, the greenhouse gases in the air absorb and reradiate heat to the earth. An example of a greenhouse gas is carbon (iv) oxide. The greenhouse effect is necessary to keep the earth temperature stable. However, a continued increase in temperature results in serious environmental problems, such as melting of ice in the Antarctica, which leads to increase in sea level, displacement of people living along coastal lines and destruction of farm lands and livestock (Russell, 2008).

**Soil damage:** Fertile soil is used for agriculture, through which food is produced for the world. The greatest threat to soil is erosion. Erosion is a process of wearing away the top surface of soil and transported from one place to another either by wind, gravity or water. It destroys fertile soil that is needed to produce food. The removal of vegetation also affects soil fertility (Russell, 2008).

**Poverty:** Nigeria is a country with large land mass and endowed with enormous natural resources but it does not reflect in the lives of the majority of its over 160million citizens. Poverty impacts on the environment in several ways. The vast majority of our people are directly dependent on the natural resources of the country for their basic needs of food and shelter. About 60% of our people still live below the poverty line. Environmental degradation has adversely affected the poor who depend upon the resources of their immediate surroundings. Thus, the challenges of poverty and environmental degradation are two facets of the same challenge (Russell, 2008).

**Water pollution:** Water pollution is basically rendering the water unfit for human consumption and recreational purposes (Enerijiofi *et al.*, 2013). Water pollution arise from the use of fertilizers and pesticides in agriculture, livestock farming, industrial waste, oil runoff from roads, septic tanks and unlined landfills. Oil on the ground can be washed down the soil. Pesticides, fertilizers and waste seep into the ground. When pollutants runoff into rivers, both aquatic habitat and public water sources are contaminated affecting human life and the ecosystem (Enerijiofi *et al.*, 2013). The pesticide, DDT and Garmalin 20 harm many species (Russell, 2008). Runoff also increases the nutrients in water body which can lead to excessive growth of algae called bloom. The algae bloom depletes oxygen in the water body which, leads to loss of aquatic lives and subsequent water pollution (Agbabiaka and Oyeyiola, 2012).

**Disruption of ecosystem:** This results in loss of biodiversity, food supplies, potential cause of disease and balance of the ecosystem that supports life on earth. In as much as we want to meet the needs of the growing population, ecosystem disruption will always continue. Indiscriminate Deforestation, loss of biodiversity and consequently extinctions are some of the effects of ecosystem disruption. Biodiversity affect the stability of the ecosystem and the sustainability of populations. Animals like Zebras and Elephants are rare to find these days because most have gone into extinction due to disruption in the ecosystem by man (Russell, 2008).

### **IMPORTANCE OF ENVIRONMENTAL STUDIES**

Environmental studies enlighten us about the importance of protecting and conserving our environment. At present a great number of environmental issues have grown in size and complexity day by day, threatening the survival of mankind on earth (Singh, 2006; Russell *et al.*, 2008; Taylor *et al.*, 2010; Hallman, 2000).

**Environmental awareness:** It involves concerted efforts between individuals, groups, communities and government. It enlighten individuals, communities and government the responsibility of playing active role in environmental protection. Environmental awareness encompass advocacy and education. Advocacy involves making attempt to educate people, protect land and influence laws towards environmental protection. Education helps gain support for solving environmental issues. Ecotourism is a form of tourism that supports conservation of the environment.

**Conservation and Restoration:** Conservation means protecting already existing natural habitats while restoration involves cleaning up and restoring damaged habitats. Conservation prevents environmental issues that arise from ecosystem disruption. Restoration reverses damage to ecosystem.

**Technology:** Advances in technology has lead to great inventions in science. Technology does not bring about problems but also environmental solutions. Research and technology can help protect our environment by providing cleaner energy sources, better ways to deal with waste and improved methods for cleaning up pollution. E.g solid organic waste, which constitute environmental hazard, with the aid of technology can be converted to biogas. The biogas is used as fuel to drive cars and power industrial plants while the remaining waste serves as organic manure for plant growth.

**Reduce resource use:** The impact of humanity on the environment depends on how many resources are used. We can decrease our impact by reducing the resources. We can reduce our use of resources, such as water and fossil fuel for energy. We can reuse goods rather than disposing them. Furthermore, we can recycle waste to help protect the environment in a process referred to as recycling. Recycling prevents pollution. For example, recycling motor oil keeps toxic substances out of landfills.

**International Importance:** It is well recognised that environmental issues like global warming, ozone depletion, acid rain, marine pollution and biodiversity loss are not merely national issues but global, and hence, they must be tackled with international efforts and cooperation.

**Planning for the future:** Our survival and sustenance depend on planning for the future. Careful planning for the future can help us avoid damaging the environment and can help us solve the environmental issues we face. If we want a safe and bright future, we need to actively aim for it. There is need to plan so as to save the environment from destruction.

**Need to save humanity from extinction:** It is incumbent on us to save humanity from extinction.

## CONCLUSION

Environmental studies is as important as the existence of man on planet earth. The fact that we live in an era where there is unquantifiable, unwholesome, discriminate and indiscriminate disruption of the environment calls for an urgent solution to this issue. It should be made clear that the state of the environment determines the life span of man on earth. Do not forget the old axiom "cleanliness is next to Godliness". To put it straight, the environment reflects the state of man's health. Finally, this is a clarion call to all and sundry to keep our environment clean and safe for a guaranteed existence.

## REFERENCES

- Adesiyun, S. O. (2005). Man and his Biological Environment. Ibadan University Press, Ibadan, Nigeria. 196pp.
- Agbabiaka, T. O. and Oyeyiola, G. P. (2012). "Microbial and Physicochemical assessment of Foma River, Itanmo, Illorin, Nigeria: an important source of domestic water in Illorin Metropolis". *International Journal of Plant, Animal and Environmental Sciences*, **2** (1): 209 – 216.
- Attama, C. G. (2007). Fundamentals of Ecology. Jolyn Publishers. Nsukka. 243pp.
- Enerijiofi, K. E., Ekhaize, F. O. and Olatunji, E. O. (2013). The microbial load of Ujjiogba River, Edo Central Senatorial District, Edo State, Nigeria. Proceedings of the 4<sup>th</sup> Annual Biodiversity Conference held in University of Lagos, Lagos. Olajuyigbe, S. O, Coker, M. and Olaleru, F. (eds). pp78-82.
- Hallman, R. (2000). The living environment Biology. Amsco School Publications. New York. 629pp.
- McDougal, L. (2008). Life Science. Houghton Mifflin Company. United States of America. 736pp.
- Odokuna, L. O. and Abah, A. F. (2003). "Heavy metals Bisorption by three bacteria isolated from a tropical industrial area". *Global Journal of Environmental Sciences* **2** (2): 98-101.
- Russell, P. J., Wolfe, S. L., Hertz, P. E., Starr, C. and McMillian, B. (2008). Biology: the dynamic science. Thompson Corporation. 1289pp.
- Singh, Y. K. (2006). New Age Environmental Science. New Age International Publishers Limited. 310pp.
- Taylor, D. J., Green, N. P. O. and Stout, G. W. (2010). Biological Science 1& 2 Cambridge University Press. 984pp.
- Wiley, J. M., Sheerwood, L. M. and Woolverton, C.J. (2011). Prescott's Microbiology. McGraw Hill Companies. Inc. 8<sup>th</sup> edn. 1070pp.
- Yadav, P. R. and Mishra, S. R. (2011). Environmental Biology. Discovery Publishing House, New Delhi, India. 302pp.