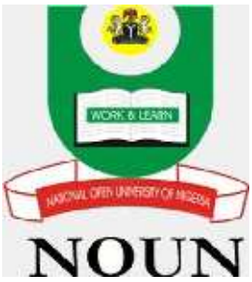

NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: ESM 211

COURSE TITTLE: GLOB AL ENVIRONM ENTAL ISSUES

ESM 211 GLOBAL ENVIRONM ENTAL ISSUES

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UNIT 1: ECOSYSTEM CONCEPTS AND GAIA HYPOTHES IS

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1.0 INTRODUCTION

Now that you have gone through the course guide you would have acquired a global view of what this Unit is about, how it links specifically to the course. This Unit will aid you to acquire basic understanding and refresh your memory on ecosystem concepts since you have studied about ecology in your ESM 112: Introductory Ecology class. Note that this Unit contains many ecosystem concepts that were not mentioned or not treated in details in ESM 112. Shall we first have a view of what you should learn in this Unit, as outline in the Unit objectives below.

2.0 OBJECTIVES

At the end of this Unit you should be able to:

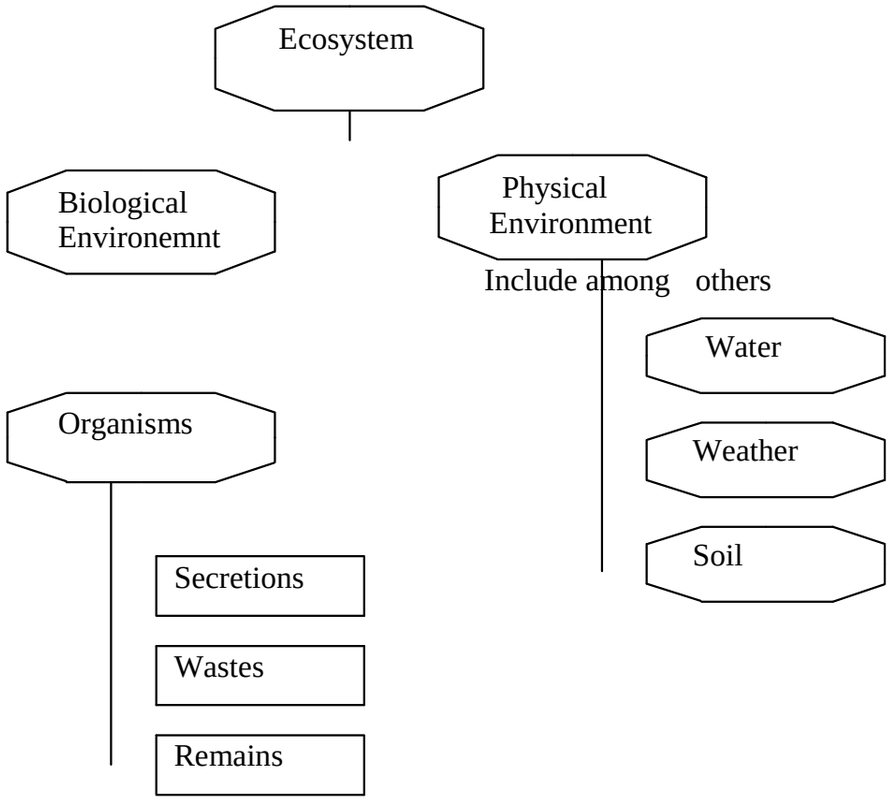
- Define ecosystem
- Mention ten ecosystem concepts
- Differentiate the relevance of these ecosystem concepts within an ecosystem.
- Explain the Gaia Hypothesis

3.0 ECOSYSTEM DEFINED

The ecosystem may be defined as a composition of biological community and physical environment (Cunning ham, Cunningham & Saigo, 2005). The total numbers of organisms existing and interrelating within a specific location constitute the biological community. This community has been described as the biotic environment (Ahove, 2006). This includes organisms and their products-secretions, wastes and remains the physical environment weather, soil, water, minerals and so on.

The ecosystem may be simply descr ibed as specific ecological units with specific location and boundaries. It deals with the study of how these organisms or species interacts with the physical environment.

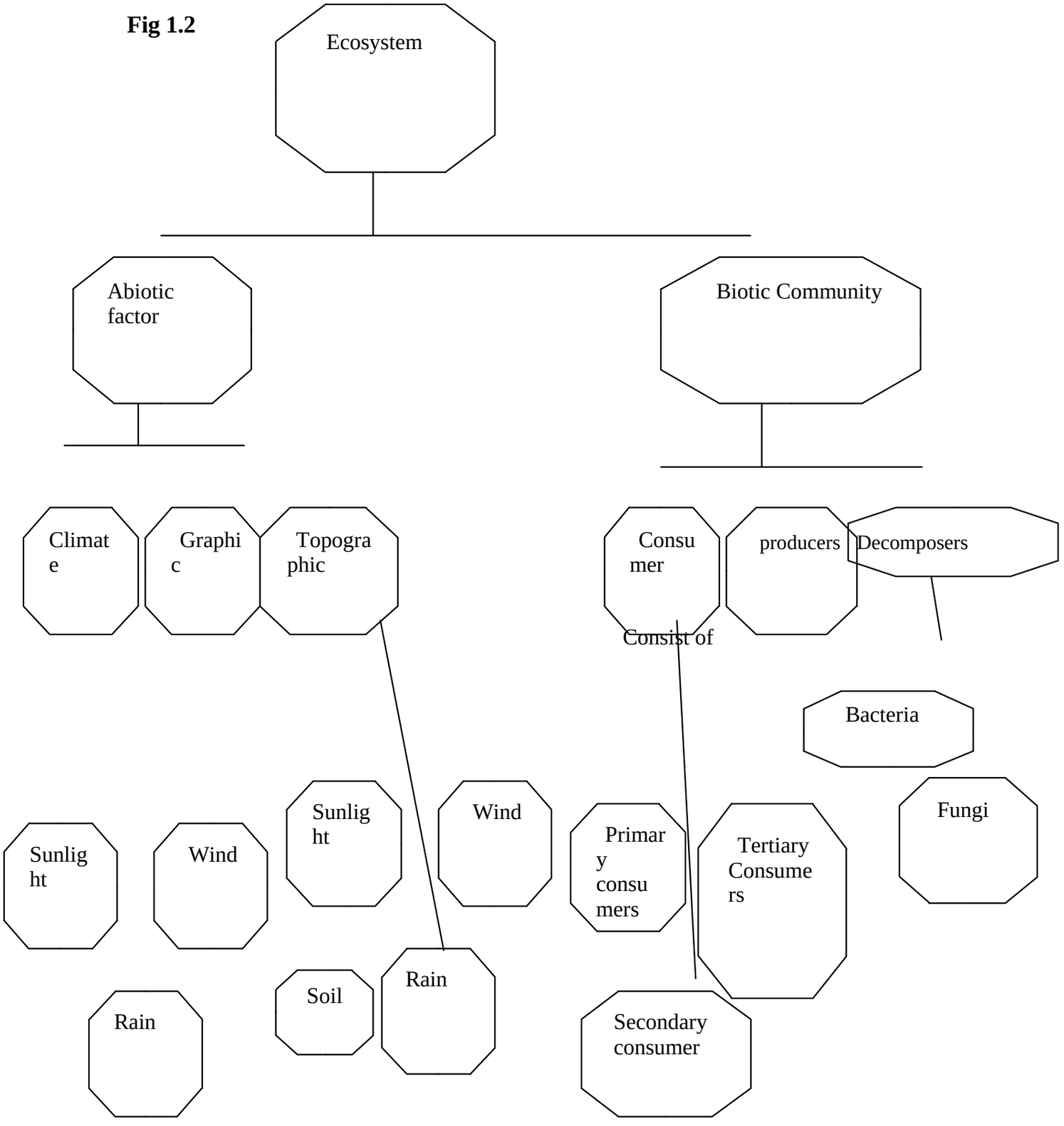
Fig 1.1: A concept map employed in expl ai ning the Ecosystem as a concept.



Engr. & Smith (2002) defines the ecosystem as a specific in which interrelationships occur between a community and the physical environment. The community was also said to be a gathering of all the interacting species of organism within a specific location. It is important for you to understand clearly that the physical environment influence the type of organisms-plants and animals that may be found in an ecosystem.

You will notice in an ecosystem that the Climate condition influences the plants, plants utilizes minerals in the soil and feed animals. Further more animals d isperse p lant seeds, plant secretions enriches the soil, and as well aid the process of water evaporation which in fluences the climate condition of the ecosystem.

Fig 1.2


Ecosystem
Abiotic factor
Biotic Community
Climate
Graphic
Topographic
Consumer
producers
Decomposers
Consist of
Bacteria
Fungi
Sunlight
Wind
Sunlight
Wind
Primary consumers
Tertiary Consumers
Rain
Soil
Rain
Secondary consumer

Exercise 1.1

a. Identify important parameters similar in the definitions of Cunningham, Cunningham & Saigo (2005), Engr. & Smith (2002) and Collins Dictionary of Environmental Science.

b. Write out these similar ities

c. (i) Which of these three defin itions do you prefer?

(ii) State your reason or reasons.

Collins Dictionary of Environmental Science (1 990) defines the ecosystem as any SYSTEM where interdependence and INTERACTION exists between living ORGANISMS and their immediate PHYSICAL, CHEMICAL and BIOLOGICAL environment.

3.1 ECOSYSTEM CONCEPTS

For you to fully understand the various forms of interdependence and interactions that occur among the var ious species or organisms within the ecosystem it is important to articulate some important concepts. I want you to realize that some ecological concepts have been d iscussed in Units two and three of introductory Ecology your first year course.

But the concepts that will be d iscussed in this unit were not discussed in ESM 112. However, I will advice that you refresh your knowledge on ecosystem in units two to five.

The concepts that will be discussed in this unit are:

- Producers
- Consumers
- Decomposers
- Herbivores
- Carnivores
- Omnivores
- Symbiosis
- Parasitism
- Commensalism
- Mutualism

3.1.1 Producers

The basic organisms in and ecosystem are those that are responsible for the production of food at the base level. The organisms perform this role through the process of photosynthesis (and may hardly be through chemosynthesis). These organisms are thus referred to as PRODUCERS.

3.1.2 Consumers

Consumers are organisms that eat producers (primary consumers) while organisms that feed on pr imary consumers are referred to as secondary consumers (Cunningham, Cunningham & Saigo, 2005). The secondar y consumers are usually consumed by the tertiary consumers.

3.1.3 Decomposers

These organisms are responsible for the final breakdown and recycling of tiny broken bits of organic materials in the ecosystem. Cunning ham, Cunningham & Saigo (2005) are of the opinion that decomposers are the most important organisms in the ecosystem after the producers. This is because their actions make nutrients available to generations of organisms thus preventing these nutr ients being hidden as organic compounds of dead organisms and other forms of wastes. Can you imagine a world without the presence of decomposers?

3.1.4 Herbivores

These are organism whose mode of feeding is adapted to vegetation only. The d igestive including teeth and jaws of these organisms or animals are fashioned to feed on plants.

3.1.5 Carnivores

These organisms are tagged carnivores because they basically eat the flesh of other living organisms. Their mouth and digestive track are designed to tear, crush and digest the flesh of other organisms or animals.

3.1.6 Omnivores

These organisms mode of feeding are adaptive to both flesh and plants. Humans fall into this class of mode of feed ing. Our teeth are designed for an Omnivores d iet, with a combination of cutting and crushing surfaces that are not adapted for herbivores or carnivores mode of feeding.

3.1.7 Symbiosis

This is an intimate relationship between organism which involves body contact. In this relationship either or both organisms gain in one way or the other from the relationship.

The organisms in this relationship are always of different species. Symbiosis has been classified into three groups.

1. Parasitism
2. Commensalism
3. Mutualism

3.1.8 Parasitism

This is a relationship in an ecosystem where one organism is referred to as parasite because it lives in or on another organism, (Host) from which it derives nourishment. Several parasitic relationships usually involve two more host species with different phases in the parasites life cycle (Engr. & Smith, 2002).

For instance, some worm parasites adult have their reproductive stage in a carnivore, definitive host, while their early stage that reproduces asexually is in another animal, intermediate host, the carnivore feeds on.

Another form of parasitic relationship deals with animals that convey the parasites from one host to the other. The organisms that carry these parasites are termed as vectors. So you will realized by now that the Female Anophelis Mosquito which conveys the malaria parasites from one human to another is a vector parasite.

When parasitism occurs on the surface of the host it is termed as Ectoparasitism. If it occurs within the host it is termed as Endoparasitism. This implies that Ecto refers to Outer while Endo refers to Inner .

Plants as well as animals can be parasitic and interesting ly some humans. The historical culture of a particular group of Africans says that they mix milk with blood drawn from cows to serve as Food. Is this not parasitism?

Anyway parasitism is a very common technique for survival in the ecosystem. Engr. & Smith (2002) make bold to say that if we were to group all living things in the world, there would be more parasitic than non-parasitic relationships. Do you think this statement could be true? To what extent do you agree or disagree?

3.1.9 Comme nsalism

Commensalism is a relationship in which an organism benefits while the other is not harmed (Engr. & Smith, 2002).

The relationship between sharks and Remoras in the Ocean is a very good and well known example of commensalism remoras possesses sulkers on the top of their heads that they can use to attach to the shark. Any time the shark feeds, it detaches itself and remora use the opportunity to pick bits of food that the shark drops accidentally. After feeding, the remora reattaches itself. In this relationship the shark is unhurt.

It is important for you to realize that some parasitic relationship may evolve into commensalism. This possibility is linkable to the little harm parasites inflict on their host while the host evolve survival strategies. Thus, with the process of time the host may suffer no harm.

3.1.10 Mutualism

Mutualism is derived from the word mutual implying benefits to parties involved in the relationship. Several mutualistic relationships are Obligatory, where the species depend on one another for life s survival. But some of others contrary is the case, however they are more successful when involved in a mutualistic relationship.

An example of this is found in Acacia, a thorny tree which gives nutrients in sugar solutions in the stems. A particular species of ants feed on this which they protect from, other animals by way of attack, from feed ing on the tree (Engr. & Smith, 2002).

Exercise 1.2

1. Without making reference to this subsection (1.3) make an outline in your note book on all the ten concepts of the ecosystem discussed.

2. Which one of them do you consider most important and why?

3. When humans rob Honeybees of their honey and chickens of their egg s would you describe this as parasitism?

I. Find the answer to this question from twelve indiv iduals six children (Less than 18 years, 3 boys and 3 girls) and six adults (18 and above, 3 male and 3 female).

II. Draw a table to indicate their response being Yes of No on the basis of children Adult and gender.

3.2 GAIA HYPOTHESIS

The Gaia Concept named after Gaia Greek goddess of the earth, was devised by a British scientist James Lovelock in 1979. The hypothesis relates to the role of living organisms in ensuring a climatic balance on earth. The hypothesis says that the earth is a single organism that has a self-regulating and self-organizing potential (Collins, 1990)

Living organisms always moderate their immediate environment, as much as they can, this brings about an optimal environment for life with adequate oxygen and carbon-dioxide for animals and plants species respectively. The sever al activities and relationship in the ecosystem with scientific research has continued to show the relevance of Lovelocks hypothesis. The activity of living organisms in the ecosystem with themselves (biotic factors) and non-liv ing elements (abiotic factors) has continues to ensure that there is equilibr ium in the earth.

4.0 CONCLUSION

This first unit has been able to re enforce the concepts of the ecosystem as a Unit system of living and non-living things and their interactions. The interactions and mode of feeding of living organism is what has ensured the continual existence of the ecosystem.

The concept of the ecosystem was corroborated with the Gaia hypothesis which suggests that the biotic factors relates with one another and the abiotic factors to ensure equilibr ium of our single complex earth.

5.0 SUM M ARY

The central focus of this Unit was to define the term ecosystem, which the composition of biolog ical community and the physical environment. There are several concepts that are able to this definition. This unit gave ten of such concepts, termed ecosystem concepts These concepts are:

Producers, Consumers, Deco mposers — Herbivores, Carnivores, Omnivores — Mode of feeding in the ecosystem

All living things usually fall in among of three.

Symbiosis, Parasitism, Commensalism, Mutualism — Mode of Interaction in the ecosystem

The Gaia hypothesis buttress the ecosystem concept which proposes that the living community ensures a balance on earth (ecosystem) as they interact with one another in the community and with the physical environment. In addition ensuring the continual function of the several biochemical cycles essential for life. Can you perceive the beauty and organization of our beautiful blue planet? Have you ever read or heard of any other planet with such beauty and self-replenishing organization? If none, then support the crusade of a sustainable distinguishing Earth. We have no other home, at least, in the physical.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Mention two examples each of:

i. Herbivore

ii. Carnivore

iii. Omnivore

2. State two examples of (i) Endorparasite and (ii) Ecotoparasite and their host.

7.0 REFERENCES AND OTHER RESOUR CES

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UNIT 2: HUM AN POPULATION AND E NVIRONM ENT

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1.0 INTRODUCTION

Human Population is a key component of the biotic factors of the environment (recall ESM 102, units, one and two). This therefore demands adequate consideration and constant monitoring to ensure environmental sustainability.

Consider a car with people in excess of the space. The common too much of everything is bad app lies here. Thus, the phenomenon of over population deserves adequate attention world especially in Sub-Saharan Africa where poverty and illiteracy has been the major factor behind excessive human population. This statement is especially true about Nigeria. Don t you think so?

The human population was below a billion for thousands of years. The advent of science and technolog y during the mid-nineteenth century created the opportunity for the one billion population mark.

Interestingly, the second third and fourth billion were attained quite quickly. Today the world population is over 6 billion and by 2050 it has been pred icted to hit the 9 billion mark. This is serious, Don it you think? Can you fathom the factors that may be responsible for this, despite

several natural and human induced disasters, diseases and war claiming thousands of lives on daily basis? I don t want to bore you.

Let us get to the business of what you will lear n in this unit as outline below in the stated objectives.

2.0 OBJECTIVES

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

- Define the term human population
- Mention three major factors influencing population growth
- Outline four effects of human population on the environment.
- State three strategies for the control of human population especially in sub-Saharan Afr ica

3.0 POPULATION: A CONCE PTUAL CLARI FICATION

Collins dictionar y of environmental science says population is a group of individuals usually of a single species that inhabit a specific location at a particular per iod (Dobson, Forbes & Holier 1990). Human population may therefore be referred to as the total number of peop le (irrespective of gender, race, colour or ethnicity). That lives within a sp ecific geographical location within a specified per iod. These groups of people are boiend ed within geographical area or location. It is the geographical area that defines the people s community or country. The concept of time or specific period is also a relevant factor in defining the human population. Thus human population is defined given with a time frame. The essence of the relativity if time is hinged on population dynamics.

Overpopulation may be defined as excessive human population in a given area, at a particular per iod or time, such that the natural resources are not able to support the population. At other times, the natural and human made resources (social facilities) can no longer support the population.

Exercise 2:1 Look up the following words in your Dictionary and Biology Text book

1. Population 2. Over-population.

Compare these defin itions with what is outlined in this unit with the view of mentioning similarities and differences with these defin itions

Having done this, come up with your own defin itions of population and over population. When you meet with your course mates compare and discuss on the various definitions you all come up with.

Kindly ensure you carry out this exercise. Ok? Good! Shall we proceed please?

These are other terms we need clarify this sub-section. These are

- Population growth
- Population explosion
- Population crash (Jones et al, 1990).

Population Growth: - This is a permanent growth in population size due to favourable in birth rate relative to death rate and /or immigration over emigration. Maximum growth in human population occurs during a period referred to as DEMOGRAPHIC TRANSITION.

Exercise 2.2: What is Demographic Transition? Does this question agitate your mind? Well that is my expectation and intention. So, you need to consult any or some of these resources to find out the meaning of this term or:

1. Geography or Environmental Dictionary.
2. Any text book on population /Demography
3. The Internet - You may wish to log on to www. Goggle. Org search machine

Having done this explains in your own words the term Demographic Transition, and outlines the stages involved.

Population Explosion: This is a sudden and often unpredictable speedy growth in human population.

Population crash: - This phenomenon refers to a sudden and catastrophic reduction in the population size as a result of the inability of the geographic location to support the population. This experience occurs when the population has seriously out weighed the carrying capacity of the natural environment that supplies the basic requirement for food, water, space and sometimes oxygen or clean air.

3.1 HISTORY AND STATUS OF HUMAN POPULATION

The world is increasing by more than 76 Million people per year (Okebukola, 2002). The next 20 minutes you spend with this text, 3,500 babies will be born into this world. Can you imagine that amount of new births? Perhaps you can fathom the graphic imagery of the cries of these babies as they are ejected from their mother s womb or otherwise. The world s average growth rate is 1.31%. China, India, Indonesia, Pakistan and Nigeria accounts for more than 50% of the world s increase in population interestingly, the population of the developed world is about 1 billion while that of developing world is above 5 billion. It is essential to point out that; the population of the world had remained relatively static at 300 million from ADT to 1, 000 AD. In 4 years the world s population reached 1 billion in 1938. Ironically, it took only 100 years for the

world population to hit 2 billion in 1930 In 45 years (1975) we had gotten to 4 billion why?

Exercise 2.3:

Based on your knowledg e so far in this course, outline three factors that may be directly responsible for the world s population of 4 billion between 1930 and 1975.

The immediate past UN secretary General, Kofi Annan mentioned in 1999 at the UN session on population, that since the first population conference 25 years ago, fertility in developing nations has reduced from 5 to less than 3 kinds, family p lanning has increased from 30% to 60% further more, child mortality has gone from 140. Per 1,000 live births to only 80, while expectancy has risen to 60, from 59 years, and the number of women who die in child birth has also reduced.

Wor ld s growth rate has declined from 2% to 1.3% per year. He however lamented that many women cannot choose when to be pregnant. So, how is it in your home or community - do women having a say on when to be pregnant?

Okebukola (2002) mentioned that population growth rate var y seriously among of the world, from neg ative among Eastern European countries to very hig h growth rate among some African and Asian nations. Two thirds of the world s population is in 88 nations that exhibit growth rates between 0.5 and 2% annually. Afghanistan, Angola Blerkina Faso, Gaza Atrr ip. Malanri, Mali, Nigeria Somalia Uganda and Yemen are countries with fertility above 6.5 births per woman. Thank God Niger ia was not found within this circle.

The lowest infant mortality rate is in Japan, at 4 deaths per 1, 000 births. The highest is in Sierra Leone at 169.5 infant deaths per 1,000 births .In about 71 nations and territories in Africa, Asia, the Middle East and Latin America more than 40% of the population is under 15. A little hig her than 95% of the teenagers live in less -developed nations whose gover nment are yet to fulfill the basic need of it s citizenr y for social and infrastructural ser vices. It is worthy of mention that Afr ica has 13% of the world population and 69% of the world s H/V or AIDS case. Soil, the popu lation of the Afr ican continent is expected to reach 1. 8 billion in 2050 from its current status of over 800 million.

3.2 EARTH S CARRYIN G CAPACITY

Akpan (2002) refereed to a study by FAO (in the late 70s and early 80s,) that only on World soils between 3.9 and 32.4 billion people could be fed, based on the level of agricultural improvement.

Meadows, Meadows & Randers (1992) had ear lier predicted that we have alread y executed earth carr ying capacity. Hence the earth cannot no longer sustain food production so we are on the way to ecological catastrophe.

The Earth s carrying capacity may be defined as the optimum population size that it can support indefinitely within a specific set of environmental cond itions.

Biologist often illustrates carrying illustrated with capacity as the balance between natural resources and the number of people. This may be simple organism __ water flea species Daphnia. The population of Dap hnia continues to grow until a limiting factor an envir resistance. This causes the population to slow down unit the population fluctuates around a theoretical optimum size the population size will then var y overtime depend ing on the variability of the environmental input.

Adopt ed from Jone et al 1990)

Social scientists relative to biologist as consid ered above view human resources as the critical on the earth s carrying capacity, and accentuate social limits to growth.

Akpan (200) however, outlined five limiting factors to the earth s carr ying capacity. Physical and chemical cond itions soils, water climate & Energy

- Technical and logistic difficulties

These relates to lack of infrastructure, planning delays and breed ing cycles

- Economic problem and Limitation these includ e debt crises, lack of investment capital, incentives, market mechanisms and prices.

- Ecological constraints and feed backs.

These issues here are ecological feed backs, acidification, desertification, pollution, erosion and several others.

- Social cultural and political restrictions

Issues such as peace, political stability, and agricultural policy trade policy and restrictions, education, agricultural training and entrepreneurial skills are considered.

Can you imagine how many people the earth can sustain or feed if we take cognizance of the five factors outlined above? I n the words of Akpan (2002) the scandal of famines in Afr ican is not a result of agriculture approaching carrying capacity. It is mostly a consequence of massive policy failures, corruption, ethnic conflicts, ignorance and incompetence of ruling elites

If we could manipulate these five factors favorably and quick ly too, we are sure that the earth carrying capacity is able to sustain more billions of people, possible 20.

You will however realize that human resource is the central issue. Human ability to:

- Prevent wars with sold iers destroying harvest and potential lands

- Agree on free trade for agricultural products

- Distribute agricultural land to far mers

- Provide credit facilities to far mers
- Develop high yield seeds
- Adapt agricultural technology to the agro-climatic and socio-cultural conditions of and reg ions and use it carefully to avoid environmental problems.

3.3 FACTORS THAT INFLUENCE POPULATION GROWTH

The population of the world has been influenced over the years by certain factors these factors according to Engr. & Smith (2002) include:

- Biological Factors
- Social Factors
- Political Factors

Biological Factors

Some countries that have hig h birth rates and high death rates, if the birth rates out weight the death rate, then there will be population explosion as it is in Afghanistan and Ethiopia. Nation like this experience very hig h mortality rate among children as a result of d isease and malnutrition. Some other nations have high bir th rates and low death rates and will grow extremely rapid ly; this is currently witnessed in Mexico and Syria. Here infant mortality rates are moderately high. Japan and the United Kingdom are examples of nations with low birthrates, and death rates ratio is close to the birth rates. These countries and other developed economics have low infant mortality rates and a steady population growth. A cardinal factor that influences the rate of human populations is the population of women who are actively procreating and the number of children each woman will have dur ing this per iod.

You must know these:

TOTAL FERTILITY RATE

This is the number of children born (dead or alive) per woman in her lifetime.

REPLA CEMENT FERTILITY

Where the total fertility rate is 2.1, the terrain replacement fertility applies. This is a situation where the parents can be replaced by their sibling. Here the population of the community is usually stable over time.

- ZERO POPU LATION GROWTH

Where the population of birth is same as death, this term applies.

- AGE DISTRIB UTION

This is the number of individuals in a particular age group

TABLE 2.1 Populat ion Characteristics of Selected Countries (2000)

Country Current Population (Millions)	Birth per 1000 Individuals	Death per 1000 Individuals	Infant Mortality rate (death per 1000 live births)	Total Fertility Rate (children per woman per life time)	Rate of natural Increase (annual %)	Time needed to Double Population (years)
World Russia 6,0	22.0 8.4	9.0 14.6	57.0 16.5 5.0	2.9 1.2 1.3 1.5	1.4 (-0.63)	51 - - - 770
Ger many 67.3 145.2	9.0 10.0	10.0	4.0 6.0 6.0	1.6 1.7 1.3 1.5	(-0.1) (-	546 462 178
Sweden 82.1 8.9	11.0 12.0	11.0	4.0 6.0 7.0	2.1 1.8 4.0 2.6	0.08) 0.1 0.1	120 79 69
Belgium United 10.2 59.8	9.0 11.0	10.0	31.4 80.0	2.5 2.8 3.3 2.7	0.15 0.4 0.6	62 46 40 39
Kingdom Japan 126.9 30.8	15.0 15.2	11.0 8.0	19.0 37.9	6.7 6.1 4.7 6.1	0.9 1.0 1.1	36 29 28 25
Canada United 275.6	30.1 19.0	7.0 9.0	21.9 72.0		1.5 1.72 1.8	23
States China 1,264.5 11.3	21.8 23.0	6.5 20.1	31.5 116.0		1.95 2.4	
Zimba bwe 37.0 65.3	27.0 23.9	8.0 6.8	149.8 24.6		2.49 2.76	
Argentina 24.8 1,002.1	45.1 43.0	5.8 9.0	79.7		3.07	
Turkey 99.6 64.1	33.2 41.8	4.4 21.1				
Uzbekistan 26.7 16.5		18.2 5.6				
India Mexico 5.0		11.1				
Ethiopia						
Afghanistan						
Syria Togo						

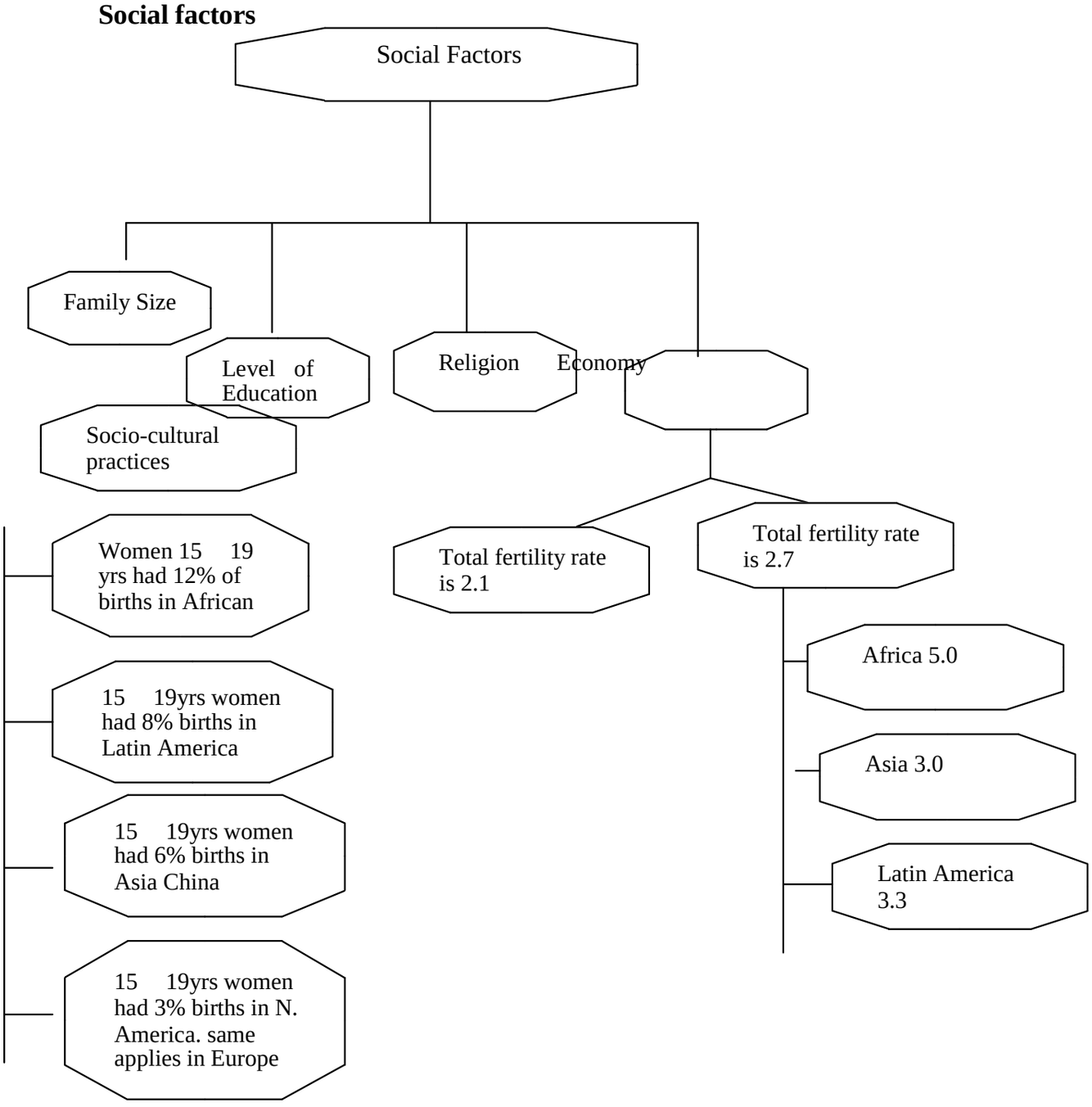
Source: Data from wo rld Population data Sheet 2000, Population Reference Bureau, Washington, D.C

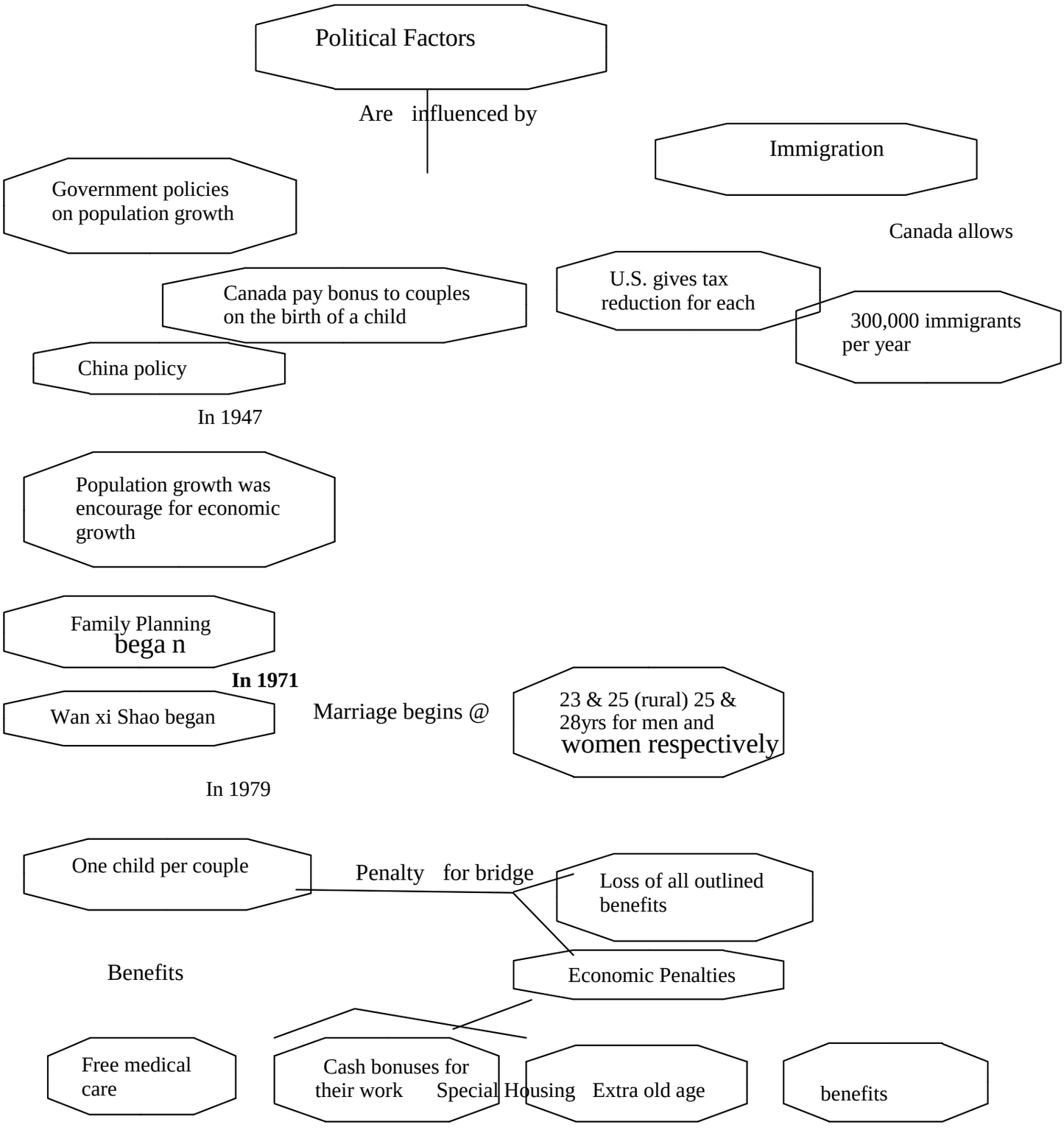
SOCIAL FACTORS

There are several social factors that influence population growth. These factors are hig hly

interrelated as they singly or combine to influence population. These factors interrelationship are schematically explained using the concept mapping technique below

Social factors





*Wan Xi Shao Later (marriages), Longer (Intervals) between births) & Fever (children)

FIG: 2.2 Concept Map showing several Political Factors that influence population growth

3.4 EFFECT OF POPULATION GROWTH ON ENVIRONM ENT

Human population increase is not without its effects on the environment. Some of these effects discussed by Ahove (2001). Engr. & Smith (2002) and Ahiadu & Ahove (2005) and are outlined below

Population growth will p lace more demands on the fin ite natural resources on earth and consequently the earth carr ying capacity. I hope you recall our discussion in section 3.2 of unit 1. Do you?

The implication of this is that: there will be increase in the loss of forestland for the purpose of infrastructural developments

- Desertification will be on the increase especially in developing nations that many not be able to control it due to poverty and high level of illiteracy.

- Pollution of air, water and land and waste generation will be on the increase since more waste and pollution will be generated by larger population. The propensity of management of these problems is another challenge to environmentalists.

- There will be more demands for food, thus more pressure on lands for agricultural purposes. This will led to biodiversity loss

- There will be more demands for mineral resources such as gold, sand, oil, coal and several others. This will led to scarcity of these resources which will affect their economic value. This may br ing about increase in poverty of nations that may not be able to manage these resources either in the raw state or finished product for economic improvement.

Exercise 2.3

Nigeria has many natural resources, agreed. In the p ast forty years have we been able to manage these resources, raw or finished product, as a means of moving our economy from third world to first world?

Form a group with your classmate and discuss on how we can maximize these resources in view of our current population.

3.5 CON TROLLING POPULATION GRO WTH FOR ENVIRONM ENTAL SUSTAINABILITY

To sustain our environment which is our beautiful blue planet we must check the growth of the world s population. This is more essential in developing economies were population growth has not been controlled significantly. Strategies that may be employed include among others the following:

Family a nd fertility control mechanism.

These involves making deliberate efforts in limiting the number of children, celibacy, using chang es in body temperature, use of mechanical barriers and surg ical techniques to prevent egg-sperm contact.

Others include chemicals that prevent maturation or release of sperm or eggs or implementation of the fetus. Examp le is the use of pills (estrogen and progesterone for females and gossypol for males).

Also, physical barriers such as IUD can be used (Cunningham, Cunningham & Saigo, 2005).

Sex Educati on: Adults and adolescent should be exposed to sexuality education to reduce the possibility of unwanted pregnancies, ignorance and unnecessary worries.

Child Gender Influence: The education and use of techniques to influence the gender of a child s birth may be useful birth control technique, especially in sub-Saharan Afr ica where the desire for a particular sex sometime led s to larger families. These methods include:

1. Use of Ov ulation Period: the propensity for a male child s conception is mating on the 14th day (fertile period) starting from the first day of menstruation cycle (Olagunju, 2002). This may be based on the ability of the Y chromosome to fertilize the egg before the X chromosome - which determines the girl child.

2. Use of Alkaline / acid based medium Olagunju (2000) mentioned that the use of acid

base spermicides creates favourable environment for the X chromosome- (girl) but the use of alkaline base medium is favourable for Y - chromosome (boy). A woman who desires either sex may employ the favourable medium.

Local technique: Accept with caution A woman in desiring a male child is required to take in more salt to create an alkaline environment in her bod y -s alt is sod ium Hydroxide which is a strong alkaline.

Women favourable for girl child are advised to take in more unripe fruits - citrus Acid. Reduction of either is also advised in favour of desire sex.

Douching with salt water on sugar solution was also proposed before mating.

3. **Body Temperature: The Y - chromosome is favourable to low body temp erature while** the X - chromosome is otherwise. It is advised to have sex when climatic temperature favours your desired gender. All other times body temperature may be manipulated to be cold - taking a cold bath or having exercise to keep temperature up.

However, women that are romantic been theorized for generate more temperature during romance thus have the propensity for a girl

4. Educati on Policy

A very good education policy will help to check population growth. This is especially true and important for the girl - child who may be forced into early marriage. But with education this will be much more difficult.

5. Populati on Policy

The government has to play this role such that the populace will be enthusiastic is co-operating with the policy. Child s example was articulated in Section 3.3 using a concept mapp ing techniques to explain the social factors. I do hope you remember this section ver y well? If these strategies are implemented any where in the world be sure that population growth will be relatively checked.

4.0 CONCLUSION

How many humans will be in the world 50 year s from now? Can you guess? Will the world population continue to grow in this manner ? If so, then it will be alarming. Most demographers have predicted that the world s population will stabilize sometimes this century. Then there will be about 8 - 10 billion peop le on earth.

The United Nations population Fund (UNFPA) is the World s leader in searching for funds for population and reproductive health in over 40 nations. UNFPA s activities has actively controlled population increase especially in developing nations. I f we do the right thing we will get the rig ht result.

5.0 SUMM ARY

Human population growth is a key factor influencing the status of the world s finite environmental resources. The world s population overcame its slow growth as a result of biolog ical, socio- cultural and political factors that emerged as a result of human quest for a better life. This has placed stress on the earth s carrying capacity. The driving force world over human population today is on how to control population for sustainable use of the earth s natural resources. This unit has thus being able to take you through these d iscussions and you have been able to carry out some useful exercises to help understand their unit better.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Define the term Human Population in your own words.
2. State three basic factors that can influence human population in your community.
3. Mention two each of the consequences and control measures of population growth in Nigeria.

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UNIT 3: DEFORESTATION

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1.0 INTRODUCTION

This third unit will consider yet another vital global environmental problem - deforestation. Annual World Wood Consumption is estimated at 3. 7 billion metric tons. This being more than the combination of plastic and steel consumption. Little wonder that every second, forest worth the size of a standard football (soccer) field is being deforested globally. This gloaming picture, is basically linkable to population explosion wor ld over, has ranked deforestation as a top priority to environmentalist world over. The tropical forest alone is the home to more than 10 billion species of biodiversity. The deforestation of these forests may mark the beginn ing of the final destruction of humanity. I hope this will not be the case. Our focus in this unit is on destruction of forests especially the rain forest zone.

2.0 OBJECTIVES

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

- Define deforestation
- State four major causes of deforestation
- Outline the consequences of deforestation
- Mention habits that you will inculcate to reduce deforestation

3.0 DEFINITION OF DEFORESTATION

Deforestation has been described by many scientists and environmentalists in var ying manner.

- It is a total change from forest to agriculture, urban areas, or desert.
- It is the logging of forest zones even if it is selective with rap id possibility for re growth.
- FAO describe it as forest loss with a range of 9 million to 12.3 million ha per year. The implication of this is that about the area of a football field is deforested ever y second around the globe (Cunning ham & cunning ham, 2002; cunning hum, cunning hum & Saigo, 2005).
- Jones et al (1990) describes it as a permanent clearing of forest land and converting it to non-forest uses. The World Resources Institute considers deforestation as the most pressing land use problem.

The exact coverage of d eforestation may be d ifficult to estimate because of the remoteness of several areas from which forest is removed, the lack of written records for deforestation and the counteracting effect of afforestation.

EXERCISE 3.1

1. Identify one similar ity in the definitions stated above.

2. Mention any differences you notice in any two definitions stated earlier.

3. State three reasons for the difficulty in obtaining a precise estimate on deforestation.

3.1 STATUS OF DEFORESTATION

The problem of d eforestation is as old as human quest for settlement and improved quality of life. The current status of the world s deforested forest is quite alar ming. This problem is more pronounced among less developed economic societies. Ironically most of these forest products are not consumed by the less developed society s world over.

The values of deforestation are hig hlighted below as articulated by Jones et al (1990), Cunningham & Cunning ham (2002) and Cunningham, Cunning ham & Saigo (2005).

- Wor ldwide we lost 9 - 12. 3 million ha of forest per year between 1990 and 2000 to deforestation. This occurred mostly in tropical Afr ica (5.3 million ha / yr.) and South America (3.5 million ha / yr.).

- Congo and Amazon River basins posses currently highest rates of deforestation in the world. Congo currently loses about 4 million ha of forest per year.

- In 1997 forest fires on Borneo and Sumatra and made worse by serious drought led to the loss of 20,000 km2 of forest. The fires were set both to clear land for agr iculture and to hide illegal logging.

- In 1999 31, 000 fires out break were spotted via satellite in a single month in Brazil rain forests.

- Remote sensing experts estimate that about 20 million acres per year were being cut or burned in the Amazon basin alone.

- Interestingly, Brazil has the largest tropical forest in the world, ironically it has the hig hest rate of deforestation in the world.

- Indonesia and Malaysia combined is loosing as much forest as Brazil in a year.

- Major tropical rain forests were lost in Ivor y Coast, Niger ia, Liber ia, Guinea and Ghana with a rate of deforestation seven times more than the world s average. Senegal, Sierra Leone, Madagascar and Cameroon are also faced with similar problem.

- In North America - Haiti once had 80% forestation, currently it is mostly d estroyed and the land lies barren and eroded.

- In Central America near ly 66% of the old growth tropical forest has been deforested in the

last 30 years.

- Siberia, in Eastern Russian, is larger than Amazonian forest with 25% of the world s timber reserves. What an amazing benefits to this nation. The sad news however is that the zone has been classified as the most destructive harvest of trees world over.

EXERCISE 3.2 REFLECTION

1. Nations with poor education appears to have experienced deforestation mostly. Think and reflect on this based on the outlined facts above.

2. What other factors have you reflected on, that may be a possible linkage?

   Can you link population growth, and level of poverty? Reflect and identify others

3.2 CAUSES OF DEFORESTATION

Human population growth and poverty are primarily linkages to the causes of deforestation according to international agencies such as FAO and inter governmental bodies. Okebukola & Akpan (2004) discussed on the major causes of deforestation.

- Logging Commercial logging groups and individuals cut down mature trees that have been selected for their timber. They defend their trade by saying that this method of logging ensures that the deforested trees will naturally re grow.

In most cases, this is untrue due to the nature of rainforests and of logg ing practices. This is because large areas of forest are destroyed in order to remove only a few logs. The heavy equip ment used to penetrate the forests and create roads causes extensive damage. Trees are felled and soil is compacted by heavy machiner y, decreasing the forest s propensity to recover. The felling of one selected tree as the call it, tears down with it climbers, vines, ep ip hytes and lianas. A large hole is left in the canopy and complete regeneration takes several years.

Removing a field tree from the forest causes even further destruction, especially when it is carried out carelessly. It is believed that in many South East Asian countr ies between 45-74% of trees remaining after logg ing have been substantially damaged or destroy (WWF). The tracks made by heavy machiner y and the clear ings left behind by loggers are sites of extreme soil disturbance which beg in to erode in heavy rain. This causes siltation of the forests, rivers and streams. The lives and life support systems of indigenous people are disrupted as is the habitat of hundred of birds and animals.

Reflection: How will you feel if this is your native home

Little if any industr ial logging of tropical forests is sustainable. The International tropical Timber

Organization (ITTO), the body set up check the international trade in tropical timber, found in 1988 that the amount of sustainable logging was on a world scale, negligible. Aside from its direct effect, logging contributes significantly to deforestation through the building of roads, which are subsequently used by landless farmers to gain access to rainforest areas. These displaced people then clear the forest by slashing and burning to grow enough food to keep them and their families alive, a practice, which is, called subsistence farming. Most of the timber on the international market is exported to rich countries. There, it is sold for hundreds of times the price that is paid to the indigenous people whose forests has been plundered. The timber is used in the construction of doors, window frames, crates, coffins, furniture, plywood, chopsticks, household utensils and other items.

- Agriculture Shifting Cultivation. Shifted cultivators are words used for people who have moved into deforested zones and begin small-scale operations. These are described as landless peasants who have followed roads into already damaged rainforest areas. Shifted cultivators are currently being blamed for 60% of tropical forest loss. Hence they are blamed for more damages. The reason these people are referred to as shifted cultivators is that most of them have been forced off their own land. For example, in Guatemala, rain forest land was cleared for coffee and sugar plantations. The indigenous people had their land taken over by government and explorations. They became shifted cultivators, moving into rainforest areas of which they had no previous knowledge in order to sustain themselves and their families.

The basic factor pushing landless migrants into the forests is the inequitable distribution of agricultural land. In Brazil, for instance, approximately 42% of cultivated land is owned by only 1% of the population. Landless peasants make up 50% of Brazil's population. This will obviously create a great gap between the rich and the poor. Once displaced, the shifted cultivators move into forest areas, often with the encouragement of their government. In Brazil, the slogan Land without men for men without land was developed to help persuade the people to move into the forests.

After a time, these farmers encounter the same problems as the cash crop farmers. The soil does not retain its fertility for long. They are forced to move on, to shift again, going further into the rainforest and destroying more and more of it. Obviously the shifted cultivators have become the agents for destruction but not the cause. Shifted Cultivators do not move into pristine areas of undisturbed rainforests. They follow roads made principally for logging operations. Shifted cultivators are often used by the timber industry as scapegoats. Yet logging roads lead to an estimated 90% of the destruction caused by the slash-and-burn farmers.

- Agriculture - Cash crops and Cattle Ranching Undistributed and logged rainforest areas are being totally cleared to provide land for food crops, tree plantations or the grazing of cattle. Most of this product is exported to rich industrialized countries and in many cases, are grown for export while the local populace goes hungry. Too bad! Because of the delicate nature of rainforest soil and the destructive nature of modern day agricultural system, the productivity of cash crops grown on rainforest soils declines rapidly after a few years.

EXERCISE 3.3:

Make a list of three communities in Nigeria where the aforementioned exper ience is a reality.

Monoculture plantations - they produce only one species of tree or one type of food - on rainforest soil is an example of non-sustainable agriculture.

They are referred to as cash crops since the focus for their planting is to make money quickly, with little concern about the environmental damage that they are causing.

- Fuel-wood The United Nation s Food and Agriculture Organization (FAO) says that 1.5 billion of the 2 billion peop le worldwide who depend on fuel-wood for domestic use are over cutting the forests. This problem is worst in drier regions of the tropics.

- Large Dams In India and South America hundreds of thousands of hectares of forests have been taken over by the building of hydroelectric dams. The popular idea is that new dams had to be built or otherwise these nations would suffer an energy crisis. But, a recent study by the World Bank in Brazil has indicate that sufficient generating capacity already exists to satisfy the expected rise in demand for power over the medium term, the energy is used more efficiently (WRM). The construction of dams not only destroys the forest but often uproots tens of thousand of peop le, destroying both their land and their culture. The spread of waterborne diseases has increased rapid ly. Downstream ecosystems are damaged by dams, which trap silt, holding back valuable nutr ients. Reduced silts lead to coastal erosion. The sheer weig ht of water in dams has in Chile, Zimbabwe, and Greece led to earthquakes. The irrigation and industrial projects powered by dam s lead to further environmental damage. Irrigation leads to salination of soils and industry leads to pollution.

- Mining and Industry Mining and industr ial d evelop ment lead to direct forest loss due to the clear ing of land to establish projects. Native people are displaced. Roads are constructed through previously inaccessible land, opening up the rainforest. Severe water, air and land pollution occurs from min ing and industry.

- Coloni zation Schemes In the past governments and international aid ag encies hold the opinion that by encouraging colonization and transmigration schemes into rainforest areas, they could alleviate some of the poverty felt by the people of the financially poorer countries. However, it has become increasingly obvious that such schemes have failed, hurting the indigenous people and the environment. The scheme incorporates the relocation of millions of people into sparsely populated and forested areas. In Indonesia, the Transmigrasi program, begun in 1974, is believed to be the primar y cause of forest loss in Indonesia, causing an average annual loss of 200,000 hectares. The resettled peop le suffered the same problem as shifted cultivators . The soil is not fertile enough to be able to sustain them for very long. Even after such projects have officially ended the flow of shifted cultivators continues as the area remains opened up. The World Bank estimates that for every resettler under the official transmigration project, two or more unofficially move into the forest due to the drawing effect of the Programme

- Tourism The creation of national parks has undoubtedly helped to protect rainforests. Yet, as national parks are open to the public, tourism is damaging some of these areas. Often, national parks are advertised to tourists before adequate management plans have been developed and implemented. Inadequate fund ing is allocated for preservation of forests by government departments. Governments see tourism as an easy way to make money, and therefore tourism is encouraged whilst strict management strategies and given far less government support Ecotourism, or environment fr iendly tourism, is designed to tourists on environment. Unfortunately, many organizations that advertise themselves as eco-tourist establishment are in fact exploiting

- Exploitation by Industr ialized Nations

- Poverty and Overpopulation

Excretes 3.4

Make a list of any of these causes applicable in Niger ian situation?

- Exploitation by Indust rialized Nations Wealthy nations have been consuming so much of their own nature resources that they are no longer sustaining their growth population and consequently they are turning to the world s population is using 80% of the world s resources

Despit e that many native: - people are claming their culture and rights, they face stiff opposition, as the government in their own counties have often adopted the same growth syndrome as their Western neig hbors, with the emphasis on maximizing exports, revenues and exploiting resources for short -term gain. The problem is made worse by the low pr ice for most Third World exports on the international market. This imbalance in trade will continue to make poor countries poorer.

- Poverty a nd Overpopulation Poverty, while undeniably responsible for much of the damage to forest, and especially the rainforests, is to a large extent been brought about by the activities to the rich industr ialized nations and the Third World elite s who seek to emulate them. Development have been perceived solution to world poverty, hard ly helps those whose is most important the cause rather than the cure for poverty. Fact and figures have blamed to overpopulation for the cause of deforestation but unforfunnetdly if is currently used by many government and aid agencies as an excuse for inaction. In tropical countries, pressure from human settlement comes about more from inequitable land distr ibution than from population pressure. In general most of the land is owned by a small but powerful elite which displaces farmers into rainforest areas. So long as these enlists maintain their grip on power, lasting land reform will be difficult to achieve.

Reflection: What is your perception of the current land reforms being embarked upon by he current president , Musa Ya Adua

Overpopulation is not a problem exclusive to Third World Countries An ind ividual in an industr ialized countr y is likely to consume in the order of sixty times as much of the world s resources as a person in a poor county.

3.3 Effects of Deforestation

The forests future looks gloomy those that are still alive except for some expanses in Brazil and Afr ica, are likely to die or be severely damaged within the coming 25 years. If nothing is done to check world population growth and control deforestation especially in the tropic, there may be only 20, 000 square miles of rain forest left on the globe by 2050, nothing by 2000 (Olubukola & Akpan, 22004). Some of the effects of deforestation are hig hlighted below:

Airs &Land Pollution: In Brazil, half a million prospectors have engaged in the gold rush into the jungles, and ear exhuming more than 70 tons of the metal each year. Their machinery spews exhaust into air: mercur y used to extract gold from the sand poisons r ivers and fish.

Erosion & flooding : Thus forest in steep areas, logging not only destroys the forest, but also quick ly erodes open ground. During rainfall, soil is washed into the sea; habitants lose trees soil to till, and life on the river inexorably changed . Heavy salutation has clogged hydroelectric reservoirs, irrigation canals, and coastal harbors. (The reservoir that provides water to fill the Panama Canal s 50-mile waterway, for example, is slowly filling with topsoil. These are concern that someday there may not be enough water to float tankers through the lochs).

Loss of Medicinal plants: Several valuable chemical compounds are naturally for med in the forests Alkaloids from the rosy per iwinkle, a small plant that originated in Madagascar have proven very effective in treating Hodgkin s disease and childhood leukemia. Curare made from a plant that growth only in the Amazon is used in heat operations as a muscle relaxant. More than 225 rain forest plants from Costa Rica alone are through to be the potential anti-cance agents. Many scientists hold the view that solution to HIV/AIDS May ver y well lie somewhere in the rain forest. Unfortunately we are cutting these forests, potentially life-saving tropical plants may disappear forever.

- Loss of native people their lang uage & culture Teas concern shown intrusions for the deep into the rain forest that scattered or decimated the native settlers. More than 1,000 tribes of indigenous people are through to be close to extinction these colonists came with alien diseases and homeland are being destroyed. The encroachment has led to repeated violence and lives lost, mots notably among the native rubber tapers who have fought the roads and settlers since, they first appeared, bull unfortunately they have been forest leaders of the tapers and workers alike have been threatened -and some murdered- by landowners, cattlemen, and hired guns.

- Green house Effect Possibly the most contemporous and destructive legacy of deforestation is the contribution to the greenhouse effect. Deforestation releases more than a

- billion tons of carbon into the annually. When trees are cleared, the carbon they contain, as well as some of the carbon in the under lying soil, is oxidized and released into the air. This

Exercise 3.5 Make a list of some diseases that you know have been end through chemica l or subst ances extract ed from the forest. B e sure t hey have been prevented scient ifically.

release occurs rapidly if the trees are burned, but slowly if they decay natural. The removal of the these trees also consequently led to the increase in Co2 in the air, since the number of trees to remove Co2 in the air have been reduced by defor est faction the importance of rain forest to the global environment is immeasurable. They are linked to weather and climate patterns we still t fully understand. Yet nearly every second another acre is lost to logging or farming. Perhaps the greater irony in their destruction is that since 1900, the average rainfall in the forests has decreased by as much as 10 percent deforestation is the cause; fewer trees men less water into the air in vapor form, and so loess returns to the tree as rain someday soon, like the buffalo of the America West, rain forest may liv es only in legends and Tarzan movies what is your view about their prediction.

Exercise 3.6

Discuss an example of a forest, which once existed in Nigeria. Are there any d iscer nable impacts of the deforestation on the inhabitants of the area?

Controlling Deforestati on

If we don t quickly reduce deforestation of the world s remaining tropical forest we will lose one of our most important defenses against predicted global war ming impact and bring about a mass extinction of wildlife. We will also lose sources of food, fuel, and new drugs that may cure AIDS and some types of cancer, and numerous raw materials. To control deforestation some environmentalist (Mille 1999) have made the following suggestions:

1. There must be worldwide ban and enforcement on imports of timber, wood products, beef or other goods that directly or indir ectly destroy or degrade our forest.

2. Provide aid and debt relief for especially developing economics ban commercial logg ing cattle ranching and other negative uses of tropical forest but emphasize economically and ecolog ically sustainable harvesting of rubber, nuts fruits, and other renewable resource that over time provide twice the net income derived from logging and three that from cattle ranching

1. Demarket at least 5% of the current world s tropical forest as reserves and parks protected from unsustainable development; participating tropical counties world act or relief from some of their debt (debt-for-nature swaps)

2. Rehabilitate degraded tropical forests and watersheds. Federal or central Government should

3. Provide financial incentives to villagers and village organization for establishment of fuel- wood tress and tree farms on abandoned and degraded land with suitable soil

4. Phase out and halt funding for, dams tree and crop plantations, ranches, and colonization

programs that threaten tropical forests.

5. Include indigenous tribal people women and pr ivate local conservation organization in the planning and execution of tropical forest plans.

6. Provide indigenous people with title to tropical forestland s that they and their ancestors have lived on sustainable for centuries with the condition that these lands cannot be used in unsustainable manner cannot be sold. The Colombians government has done his by giving indigenous tribes compete control of two -thirds of the country s land area in the Amazon basin with the condition that they must never sell the land.

7. Require an extensive environment impact assessment for any proposed development project in tropical forests and used internationally accepted standards for such

8. Banks and inter national lending agencies from lend ing money for environmentally destructive projects.

9. Support effective family planning methods and strategies that solve poverty problems and unequal distr ibution of land.

3.5 HABIT THAT WILL CHECK DEFORESTATION

If you and I can inculcate the right habits a vast number of area of forests will be conserved. Some of these habits are articulated below:

- Make use of both sizes of your papers including these back of scratch papers.

- Buy books, greeting carts, news pr int and other paper print material made from recycled reuse and recycle our paper products

- Use your e-mail rather than your surface mail. Store, use and transmit your information. In digital /electronic for m As much as possible avoid printing or use of pr inted materials.

Your can send greeting card via the Internet rather than buying cards.

- Purchase products made from good wood or other certified sustainable harvest wood, (Cunning ham Cunningham & Saigo, 2005)

- And if you build, conserve wood as much as possible. Use water board, particleboard, laminated beans or mother composites rather than use of plywood and timber produced made from old growth trees.

4.0 CONCLUSION

Deforestation is a sever global environmental problem that has been dr iven by global population growth the pressure to clear land for far ming, commercial ranching and uncontrolled and selfish economic exploitation of forests. Consequently deforestation led to soil erosion, alteration has climates through and hydrological cycle. The extensive extinction of several

biodiversity species whose sur vival are dependant on the forest is a ver y sensitive issue that will continue to e a treat to obtaining solution to human health problems. The most controversial effect of deforestation are the difference in the oxygen and carbondiaoxide balance the atmosphere, this speedup ALBEDO and greenhouse effect (Jones et al 1990).

5.0 SUM M ARY

Deforestation has been defined by many authors in various ways. In sum, it is the clearing of virg in forestland for the purpose of non-forest friendly activities. The status of the world forest is a g loomy p icture 1990 and 2000 about 912.3 million ha of forest were lost at a the size of a football field per second. This problem is quite pronounced in the tropical forests of the world. The problem of deforestation is likable to logging. Agriculture poverty fuel wood crisis construction Dams, over population min ing and industry, colonization schemes and another emerging factor -Tourism. The consequences of deforestation are obviously see in our air and land pollution, Erosion and flooding, loss of Biodiversity, loss and extinction of native settles culture and language and the greenhouse effect.

To control this problem several strategies were proposed which includ e among other ban on timber imports that directly tropical forest, reserve 5% of current tropical forest as protected pack and few others. I mportantly some habits you and in need to inculcate to reduce the demand for paper and products made from trees were highlighted. If we inculcate these virtues less trees will be cut because less demand and supply

Do you agree to this proposed idea? Why not! So be a crusader for what you knowledge) and where you are (you home or office). That s the way to save the life of trees.

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6.0 TUTOR MARKED ASSIGNM ENT

1. Explain four reasons of deforestation in Niger ia
2. State two obvious consequences of any of the above reasons
3. List four habits you prefer to exhibit as a means of controlling deforestation in Nigeria.

UNIT 4: BIODIVERSITY LOSS AND CONSERVATI ON

Table of Content

1.0 INTRODUCTION

Human pressure on the environment has not only resulted into deforestation as also resulted onto biod iversity loss. This unit therefore seeks to explain the concept and essence biodiversity and highlig ht its consequence. Biodiversity conservation strategies are also enumerated. I want you to realize that this unit interact, so ensure you do exercise outlined as you have do in the three pervious units.

2.0 OBJECTIVES

At the end of this uni t, you should be able to:

- Explain the concept of biod iversity
- State the Concept of Biodiversity Loss
- Identify the reasons for biodiver sity loss
- State the consequences of biodiver sity loss
- Mention techniques for biod iversity conser vation.

3.0 BIODIVERSITY:- Conceptual Background

The existences of varieties of living organisms is not for the fun of it. It is a life - spice of - Varieties within each var iety existing for a specific purpose. This underscore the need to have a clear understanding of the concept of Biodiversity.

Biod iversity many be simply defined as the entire living organism, plants, animals fung i and microbes, that exist on our planet (IUCN, 1990), It may also be refereed to as the var iety of organisms which subsume their genetic constitutes and the ecosystem where they may be found. Nzewi (1999) describes it as the wealth of the liv ing would, the var iety of life forms the planet, which includes the millions of plants and animals.

So you have three definitions attempted the second and Nzewi the third. Ensure you so play them that you can recall them by heart or at least express them in your won words ok?

Did it occur to you at the on set of this unit that the term BIODIVERS ITY BIOLOGICAL Diversity stresses d ifferent kinds of life so we have different k inds of life on earth are influenced or varied in their location d epend ing on the climatic condition. Biodiversity can be measured from three d ifferent angles and each is essential for the preservation of the earth. Cunningham, Cunningham, & Saigo (2005) articulated them as:

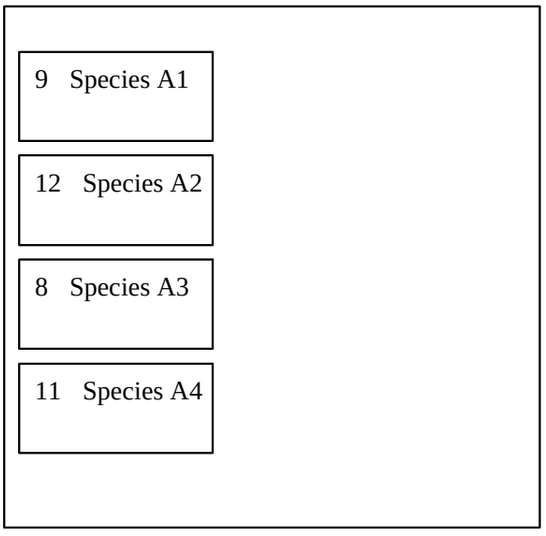
- Genetic diversity
- Species diversity
- Ecological diversity

Genet ic diversity evaluates the var iety of different versions of a particular genes within individual species. For instance, a particular genes is responsible for colour among Nigeria within this group you still have d ifferent shades of colours:- i.e different shades of dark skin

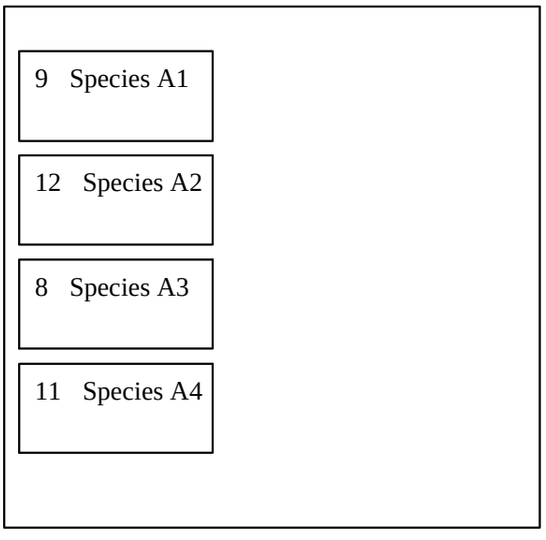
Species diversit y g ives us an idea of the numerical value of the different kinds of organism within specific communities or ecosystem.

Ecological Diversity:- measures the abundance and comp lexity of a biological ecosystem plus the number of niches, tropic levels and ecolog ical processes that trap energy, sustain food webs and recycle materials within the system.

I want you to realize that within this species diversity, there is a difference between species richness (the sum of species in a community and species evenness (the comparative abundance of individual within each species). Shall we consider this illustration together. Imagine two ecosystems. A and B, each within 4 species and 40 ind ividual plants.



Ecosystem A



Ecosystem B

Figure 4:1: Two ecosyst ems wit h same species richness but varied diversity.

Your will realize from the above d iagrammatic illustrations both ecosystems have the same total (amount) of species (40) and the same var ies of species or richness (4). Now imagine you were walk ing through these two ecosystems one after the other, you will have the impression that ecosystem A is much more diverse as a result of your tendency encountering a greater variety compared with ecosystem B.

Exercise 4.1

1. From figure 4.1, identify the name and total number of the species that dominated ecosystems B.

2a. Calculate the difference between the highest lowest population of the four species in each ecosystem.

2b. Which ecosystem has a hig her range or difference?

Note:- the closer the range the more diverse the ecosystem.

3.1 RELEVANCE OF BIODIVERSITY

The basic need of human today aside from water & oxygen Diversity in p lants and animals in the ecosystem ensure a source of food to humans. Apart from feeding us, plants Provide oxygen.

- Medicines Good food does not exclude any one from so many of the drugs and medicine used today are from plant for examp le morphine emp loyed in the relieve ser ver pains (cancer patients) is derived from plant (opium poppy) and quinine used for treating malar ia is also from plant. It is estimated that more than 25% of all medicines available today are derived from tropical plants (Peyton. et al. 1995). The value of this natural source of medicines and maintaining a r ich diversity of species will enhance our chances of finding the cr itically needed medicines to cure existing or new diseases (Eguabor, 1999)

- Energy

Biod iversity is of importance to humans in that plants are a source of energ y. Wood is utilized and appized approximately 1.5 billion people across all cultures, to fulfill 90% of their fuel needs.

If properly managed, wood may serve as a r enewable source of energy. However, wood supplies cannot be replenished fast enough to meet the growing energy demands.

There are other source of wood which are by-products of industrial processes and are regarded and treated as east. Theses include sawdust, rich husks, corn cob coconut and palm kelnel shells. These are alternative sources of energy that have not been fully har nessed.

- Wood for Building

Another sig nificant use of the world s biodiversity is in the form of wood. Products for construction and building. Although the indiscr iminate use of timber for wood leads to deforestation the importance of wood as one of the mater ials for build ing houses cannot be easily & quickly ig nored.

The processing and use of wood in build ing also provides trade and a Sources of many people. The way out of this dilemma is to control logging encourage planting of income to trees and research into alternative uses of wood for building.

- Tourism and Revenue

In many countries a significant portion of the tourist generate revenue is directly related to the Biod iversity of that country. Tourists visit a particular area to view wildlife and actual system. In Nigeria the Yankari Game Reserve in Bauchi State as tourist traction is well k nown. In some countries such as Kenya. Botswana tourist industry is central wild life reserves. These tourist.Industries also provid e emp loyment for local resident s who serve as guides and do other jobs.

- Aest het ic and Conservation of Species This aspect has been overlooked but these variety of plants and animals add to the aesthetics of our surrounding. For this reason people travel thousand of kilometers to view these variety of plants and animals irrespective of the financial Perhaps the most important reason for biodiversity conservation is to prevent ex extinction of these plants and animals. Many plants and animals are already endangered or extinct. In Nigeria these include lion, leopard, whales, Dama gazelle, ostrich (Lawal, 1994)

Exercise 4. 2 Project .

1. Find out within your community the relevance of biod iversity from the following groups of indiv iduals.

a. Basic school Pupils

b. Secondary school students

c. Tertiar y students

d. Non_ schooling populace

Interview five randomly selected individuals from each group ask them to mention or list four most important relevance of biodiversity. I f any of the relevance to what you have learnt give a score of 5 and lower score depending on the level of correctness. Find the average for each group and also the total average for all the four groups. Hig hest possible score for any group is 20. point.

1. Based on your result asses for pass (20- 10) and fail for less than 10.

Now conclude, what will likely be the attitude of citizens towards biodiversity in view of their assessment on the knowledge on relevance of biodiversity

3.2 BIODIVERSITY LOSS: Clarification of Concepts

Biod iversity loss implies the extortion or rarity of biological diversity _ plants and animals. When a particular species has been extinct or has been classified or enlisted into the groups of rare organisms them the term biod iversity loss is applicable. This implies that the species has been lost or close to been lost.

It is important to outline the level of rar ity of species relative to extinction which is the highest level. Therefore loss or biod iversity loss becomes a relative term to what extent is the loss of the species this question makes the parse level of rarity important in this units. So note that there are two issues about biodiversity loss. First is the lost (extinction) of biodiversity and secondly is process of being lost (rarity) which exist in stages.

Now let us clarify these concept and outline them chronologically in the descending order of being lost

- Extincti on:- This is when a species cannot be found of species cannot be found, of located within the ecosystem. The species is said to have disappeared

- Endangered species:- These are species that have the highest probability of being extinct if current unfavorable activities against them or their environment is not checked

- Vulnerable species:- These species have been seriously exploited and /or have been forced to a habitat or inhabits a seriously unfriendly environment. These species because they are unlikely to adapt to this environment or if the exploitation trend is not checked will graduate to the endangered rarity.

- Threatened species:- These species are threatened as a result of their small number usually within the local setting. It is however possible for species to graduate out of the rarity categories or difficult for classification into any of the three rarity classes outlines earlier so, they could be said to be out-of danger or indeter minate species (Jones et al 1990) as the case may be.

- Out-of danger species:- These are at one time or the other categorized into any of the three rarity groups (Endangered, Vulnerable or threatened) but have favourable responded to conservation strategies and the rarity of their survival is no longer in place. This does not imply that they cannot retrogress into rarity of human negative attitude to and environmental degradation on the species habitat resuscitates.

- Indetermi ne species:- These are species that falls within the three rarity groups but due to inadequate infor mation is difficult to provide appropriate classification

- More on Extinction Jones et al (1990) mention that of all known extinction that have occurred from 1600AD,75% of the mammal and 66% of Avian extinction are as a result of human activities. Human is the primary cause, followed by habitat destruction.

3.3 CONSEQUEN CES OF BIODIVERSITY LOSS

Biodiversity loss has various consequences for life and support for existence in the plant. The consequences of rap id world population growth, with it s attendance effect of modern-agriculture and industrial technology convey one painful message to man. If such action continue unabated, the world s natural environment would soon be consummate leaving only man-made. Technology -based environment The few plant and animal species most often in demand by human those that face the problem of extinction. The imp lication of their loss may be far-reaching since without food. It may also mean removing predators which keep other pests and diseases in check.

Biod iversity loss will obviously lead to the disappearance of wild lie. Increasing cutting down of forests (deforestation) is bad in itself, but most importantly implies a loss of many valuable species and animals. This is also usually followed by a loss of edible and medicinal plants. In Nigeria for instance, we have lost most of our indigenous species and vegetable because they could only thrive in the forests that have been left untouched.

Another effect of Biodiversity loss is the possib le spin-off effect that might make it impossible for a nation to sustain her socio-cultural her itage. A nation s Biod iversity is a stock of potential and actual resources for meeting the essential requirements for self survival with respect to food, water, shelter and protection from inimical forces or organisms.

Extinction of species lead to the promotion and dependence on one types of species (Genetically unifor m). Large scale mono-crop plantation are often grow from a sing le parent stock. Leaving the entire crop at risk to rapid attack by diseases, pest and nclement weather. For example, in the 1970s a virus attacked large swaths of genetically uniform rice crops in south East Asia threatening food security in the highly populated region. Several thousand varieties of wild were screened for resistance to the d isease and fortunately a saviour was found in a single species of weed-like rice from India. If all the farmland in India had also succumbed to the genetically uniform rice as the rest of South East Asia, the resultant effect on food secur ity would be better imagined then exper ienced (Nzewi, 1999).

3.4 REASONS FOR BIODIVERSITY LOSS

Biod iversity loss is basically traceable to human influence. Some of these factors that lead to biodiversity loss are:

Table 4.1 Endangered and Threatened species, world wide

Mammals	2,133

Birds	2,123
Reptiles	454
Amphibians	231
Fish	1,159
Insects and other invertebrates	3,374
Total fauna	9,474
Plant (Floura)	7,022

Fauna- Animals

Source: Cunningham et al (2005)

Over-Exploitation: this is the excessive exploitation of plant and animals species for food, medicine or other industrial uses. The irony of the experience id that those plant and animal species which support life are over-exploited even to the point of extinction. The ones that are used survive and 29 fast disappearing economic plant species in Niger ia to include the traditional food wrapper (Thaumtcoccus danielle), the traditional species such as piper guneenois and Paricia bicolar, and the medicinal Irvingia gabonensis

Destruction of Habitat:- The problem of population growth leads to competing land for agriculture demand for food, fiber and wood products, large number of trees are felled for establishment and infrastructural development.

Deforestation: This problem has led to other environmental problems such as desertification, accelerated soil erosion, declining soil fertility and loss of agricultural land, flooding and siltation of water bodies. These are the consequences of the loss of our tropical rainforest that influence water flow, protect watershed, regulate climate, produce oxygen and harbour our genetic sources of biodiversity. Nest (1991) mentioned that nearly 40% of Niger ia was originally clad with Tropical Deciduous forest while the remaining (Northern parts) were tropical woodland . Sahel and Savannah did not exist a century ago. Today, only 10% of the rainforests is left in reserves and inaccessible highland; the rest of the original rainforest having being reduced to patchwork.

Genetic Erosions: This is usually due to reduction in genetic diversity as a results of individuals or population less Genetic erosion also due to adoption of improved varieties or abandonment for other crops resulting in loss of land races and primitive e.g. in the wake of modern agriculture, cultivators. Local bean varieties are no longer cultivated to any appreciable extent. Genetic erosion could also be due to abandonment of traditional agro-ecosystems by the indigenous population, socio- economic and cultural and lack of scientific interest in wild edible plants.

Introduced species:- Human sometimes intention or unsuspiciously allows the growth of

exotic plants, which compete with and destroy the native plants. For example, nipa palm introduced in the coastal areas has naturalized and is speeding at a very rapid rate replacing the mangroves. According to Petters (1993) the nipa is moving with such rapidity that unless its presence is documented and checked as an ecological hazard, just like the water hyacinth, Nigeria may loss all its mangrove vegetation within the next decade.

Changes in farmi ng system:- The tradition farming system involved mixed cropping which is an approximation of natural plant comminutes. With increased agricultural research, monocropping is emphasize. The negative effect of modern agriculture and biodiversity conservation run through the entire ecosystem. It accelerates soil improvement such that with the nutrient composition of the soil change, plant species which exert heavy demand on the soil are destroyed.

Polluti on: When we pollute rivers, lakes and oceans, we are causing tremendous har m to distinctive species, ecosystem and habitats that influence the productively &benefits provided by ecosystems. If the types of species in any ecosystem changes, the ecosystem ability to absorb pollution, maintain soil fertility and microclimates, cleanse water and provide other valuable service is altered. It takes time to adjust.

Urbanizati on: The earlier we realize this the better for humanity. Do you agree? Our modern industries and the city jointly generate large volumes of waste in form of paper bags, plastic containers broken glass and other physical and non- biodegradable wastes which are usually dumped into water wage oil spillage from oil p ipelines, industry, boat and automobile engineers normally form a thin film on the surface and thus act to prevent oxygen from the atmosphere from dissolving and circulating freely for use by plants and animals whose lives depend on it.

Biodiversity Conservation

Biod iversity conservation involves a wide spectrum of activities and behaviours includ ing protection of p lants and animals species from reckless exploitation sustaining food production without damage to the soil, maintaining or even raising the level of cleanliness and the aesthetics of the environment.

3.5 BIODIVERSITY CONSERVATION PRACTICES

- Environment Educa tion: The key factor in any successful conser vation practice is environment education. The individual und erstand what why and whose interest it serves.. Some of the most popular approaches in Nigeria are the mass media and environment projects. Posters are sometimes displayed to depict some aspects of the general abuse on the environment. Newspapers. Newsletters, magazine and Booklets are published which give more detail on environment problems and their car e.

- Yout h Programmes:- The rationale being that any far-reaching, permanent and

meaningful progress can only be made if the youth of the country are properly informed of the unique relation the exists between sustainable resources and human survival.

Animashaun is (1995) id ea is that the school environment activities by -step gradation from the st year in school through the last, of environment problem and practical ways of preventing and solving them. The potency of the strategy that children are more receptive to new experience than adults and these would grow with them as they mature.

- Farmi ng Practices:- Mixed farming system is predominant in the forest zone and is characterized by root crop dominance with cereals p laying secondary roles in cultivation. In southern Niger ia, the creep ing ground or pumpkin, small vegetables, yams on mounds with the climbing stems trained on poles, occasional stands of maize and raised cassava, are all grown together as a mixed cropp ing system.

- Religious / Totemic Practices:-. Totems refer to animal or plant species and occasionally other things, which are held in special regard by a particular group of peop le in a society. In Nigeria, many communities practice this and it help s to conserve biodiversity. For instance, in Idemili, North and south LGA of Anambr a State, the python used to be revered and worshipped, and anybody who k ills it must perform an elaborate burial ceremony for it. Presently when most ind igenes of the area are Christians and no longer worship the p ythons they do not see the need to kill it since p ythons in that area are har mless. Python are thus abundant in the area. Other communities have their own symbols and those comminutes the revered species thr ive (Nzewi 1999).

- Use and Reuse The Forest: Several forests have been over-exp loited yet under utilized what a paradox rather exploiting the forest should use the forest by extracting or harvesting its produce such as fruits. Nuts, Oils, Rubber. Essences medicinal p lants and other natural products. Forest extraction makes sense, because it can provide a life will keep people liv ing and working and it conserves the forest.

- Reclaim & Reuse Deforested Zones: We can reclaim and reuse the already deforested and degrade zone. In the Amazon region, for instance, there is plenty of degraded land to go around the Indians and other natives. In the late 1960 s the government of Brazil granted huge subsidies to encourage big investors to transfor m the forest into pastures. This was accomplished but was degraded after six years. When it was clear that a huge mistake the big land owners left and the result is expanse of abandoned pastureland wither ing away.

- Waste Recycling: Industries should be made to set up waste processing and effluent plants to help recycle wastes, instead of sending unthread wastes into bodies of water or dump sites to constitute health hazards to millions of people.

- Industrial Replacement/ Modification: Industr ies that use hazardous gases should be rep laced with those that use environmental-friendly gases. For instance in Europe America and Japan industries have begun a costly rep lacement of that noxious CFCs with hydrochloro-florocarbons HCFCs which break down more easily and causes 95 percent less

damage to the Ozone layer other companies are also going for the HFCs hydrofluorocarbons which eliminate the problem CFCs (Osifo Whiskey et al, 1990)

- Rural Development

Government should address socio-economic problem in the poverty-str icken rural areas in the country by setting up industries that should absorb people who depend solely on the land for their livelihood. This is one of the more efficient options to reduce biodiversity loss. Another k ind of investment/development is supp lying Kerosene stove and gas cookers to rural women in order to discourage them from using fuel wood in their cookers. By so doing the conservation message will get through to the people. For instance to tell poor hungry families to conserve trees in their backyard for waster of efforts. Without providing them with alternatives which are kerosene stoves gas cooker.

- International Co-Operation

As part of the agenda for global action to protect the environment governments of the world, Nigeria inclusive, are urged to ratify, strengthen and fulfill their obligations under treaties such as the UN climate convention, the Biodiversity. Convention and the kyoto protocol. The Climate change convention se t legally binding targets and time-table for parties to the United Nations Framework Convention on climate change (NUFCCC) for the control of emission gases and also set targets emission reduction proposed emission trading among nations joint implementation of activities and voluntary assumption of commitments

3.6 NIGERIA CON SERVATION FOUNDA TION (NCF) EFFORTS

The Nigerian Conservation Foundation (NCF) with the co-operation of Federal Environment protection Agency (FEPA) and of relevant international bodies are help ing to protect the rainforest and species of other ecosystem. Their effort include policy interventions, conservation action and environment education backed by strategic awareness campaigns.

NCF S B iodiversity Conservat ion Efforts are outlined below:

1. Okomu Eildlife sanctuary founded in 1985 is a 122 sq km of tropical rainforest located within Okomu Forest Reserve. Managed by Edo State Government. This is a home to endang ered white-throated monkeys African forest elephant and to trees of economic importance.

2. Gashaka Gumpti National Park in North-Eastern part of Niger ia. The park harboours some of the rarest primate species in Africa: Rhesus monk eys. Brown-beaked scrub robin butterflies and chimpanzees a sur vey indicate two new plant B Cola caricefolia and Octosknema borealis added to Nigeria flora. The project is jointly executed by NCF/WEF UNK/National Park Service.

3. Cross River National park at Ikom which is home to the pristine rainforest of south -

eastern Niger ia. It holds about 20% of the world total k nown species of butterflies. Lowland gorillas, drill monkeys, the bare-headed rock fowl, Banner man s weaver and the while -throated barbler are found. It also harbours the Cactus spectabilis which is Nigeria s national p lant.

4. Stubbs Creek Forest Reserve project which lies within Global 200 Ecoregions prior ity list recently published by WWF for nature. The Global habitat. It is the only significant left in the south-eastern coastal areas of Niger ia. It is strategically important because it acts as a natural buffer between the coast and the main land. It also checks marine erosion and provid es breeding ground for aquatic fauna. The project has integrated conservation and rural develop ment programmes for the sustainable utilization of 300 sq km of mangrove and rainforest reserve in the south -eastern coastal area of Nigeria.

5. Hadejia- Nguru Wetland s Project is located in the north-eastern region of Nigeria. It is the site of a vast wetland that is flooded seasonally by the Hadejia-Jama are Komadougou-Yobe rivers. The site is a wintering ground for thousand of migrant palearctic birds, this is a major spectacle which attracts bird watchers to site between the months of October and March every year.

4.0 CONCL USION

The concept of biodiversity loss stems from the relevance of biodiversity conservation to human survival and comfort includ ing other organism. Species diver sity world wide is estimated between 5-30 million with only about 1.4 million having been named by scientist. Niger ian biodiversity structure ind icate about 4/b/4 plant species, 274 mammals, 831 bird and 200 fresh water fishes. As environmentalist we should abide by these code to save the loss of our beautiful diversities of p lants and animals:

- .respect all liv ing things, for each is a kink in the chain that supports life on earth
- take from nature only what can be replaced, so no species will disappear,
- . Not buy products of endangered animals, plant or forest;
- . Keep my neighborhood clean and will respect the environment wherever
- call attention to cases of pollution and any other abuse of nature ;
- not pollute the air, water or soil;
- . Support organized groups and officials defending nature
- . Not waste fuel or energy supply;
- set an examp le of good conservation conduct and show o others why it is important for ever yone to do so;

• . Rejoice in the beauty and wonder of nature all the days of my life.

If you and I can keep to this ten commandments and teach other same, our biodiversity will be preserved and the tide against their loss will be over I tell you the truth, life will be better and sweeter and on our big beautiful blue planet. Then ever you can the proudly say life is first in the mist of conserved biodiversity diversity and perhaps in the mist of electronics (LG).

5.0 SUMM ARY

Simply stated biodiver sity is the extent of living resources in an area. There are ethical, ecological and economic reasons for preserving our biodiversity. Human activities is the key problem in biodiversity loss due to exploitation and environmental degradation the consequences of our actions are visib le with the reduction and extinction of several plants and animals. If we continue to abuse these organism in the end human kind is the loser. The reservation, education, enforcement of conservation of conservation laws, favourable habits to biodiversity habits to biodiversity and few others help a great deal.

6.0 TUTOR M ARKED ASSIGNM ENT

1 Explain the concept of biod iversity

2. State the Concept of Biodiversity Loss

3. Identify three reasons why you will prefer to work against biodiversity loss

4. State four consequences of biodiversity loss in Nigeria

7.0 REFERENCE AND OTHER RESOUR CES

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UNIT 5: DESERTIFICATION

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1.0 INTRODUCTION

Several parts of the world where human population growth has witnessed desperate individuals. Who over graze animals on the vegetation. Trees are also cut down for energy generation. The combination of these consequences combined with wind erosion makes the soil to loss it s fertility. Thus, the potential of the land to sustain vegetation further depreciates. Desertification is found throughout the world but more common in North Africa and parts of Asia.

Desertification indicators, causes, consequences and control techniques are among areas we shall discuss in this unit. By the time you end this unit, you would have developed favourable attitude that will combat this problem based on the knowledge you would have acquired.

2.0 OBJECTIVES

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

- Explain simply how desertification occurs

- Mention major indicators of desertification
- List the causes of desertification
- State the consequences of desertification
- Analyze techniques to control desertification.

3.0 UNDERSTANDING DESERTIFICATION AND DESERTS

Akpan (1999) described desertification as the gradual extension of the deserts into areas there where no deserts. A desert is a large area of barren land that is waterless and treeless and often sand-covered. Deserts lie within the 15o to 30o parallels of latitude north and south of the equator. They lie in the trade wind belt on the western parts of the countries where Trade Winds are offshore. They are bathed by cold currents, which produce a desiccating effect so that moisture is not easily condensed into precipitation. This results in dryness or aridity.

Deserts are ecosystems that experiences on the average less than 25 centimeters (10 inches) of precipitation per year. The absence of water is usually the influence factor that an area will become a desert (Enger & Smith, 2005). The period and how precipitation occurs varies in different deserts. While some experience precipitation usually as snow or rain but some can comes in the form of thunder showers at in frequent intervals. The rate of evaporation is high in deserts, but plants and flowers usually thrive during the moisture duration.

All deserts are not necessarily all year round hot, dry and devoid of life. Many are contrary to this. Aside from the Sahara desert, deserts of the South Western United States and Mexico that are hot most of the year. Others such as North Western United States and the Gobi Deserts in central Asia have been reported to very seriously, cold in winter and a tolerable cool summer.

Reflection: Imagine you have to take a field trip to each of these categories of aforementioned deserts. What are the most essential things you will need for a three days survival trip within each ecosystem.

Many people have assumed that few species live in deserts. There are many species but they are usually in numbers as individuals. Living organism in deserts have developed adaptive features for survival.

Areola et al (1991) reported that the bare rock surfaces are heated by the direct sun rays the sun during the day, and because of the rapid radiation at night, the rocks cool quickly. Thus the rapid expansion and contraction of the rocks caused by the high diurnal range of temperature, leads to extensive mechanical weathering. In addition to this, chemical weathering is fairly active, partly because of the presence of small quantities of water in the air. The weathered material may be subjected to wind and water erosion. It should be noted that running water is an important agent of desert denudation. This is because although the rainfall is extremely low in desert areas, it is intensity when it does occur leads to extensive denudation.

TYPES OF DESERTS

(a). Rocky Desert

They are usually called hamada desert. It consists of large stretches of bare rocks clear sand and dust by the wind. Examp les are found in the Sahara desert e. g. the Hamada el Homra in Libya

(b). Stony Desert

They are referred to as reg or serir desert. It comprises of extensive sheets of angular pebbles and gravels that the winds are not able to blow off. Examp les are found in Egypt and Libya.

(c). Sa ndy Desert

This is also known as erg or Koum desert. It is typified by a sea of sand which shows the popular idea of desert scenery. Examples are found in Libya and Turkestan.

(d). Bad Lands

In badlands, the hills are badly eroded by occasional rain storms into gullies are ravines. Examples are found in South Dakota and Arizona in the U.S. A.

(e). Mountain Deserts

These are found on highlands such as plateaux and mountain rang es. Erosion has d issected desert highlands into harsh, serrated outlines of chaotic peaks and cragg y ranges. Examples are the Ahaggar Mountains and the Tibesti Mountains in the Sahara Desert (Akpan 1999).

3.1 DESERTIFICATION INDICATORS

- Kola-Olusanya (1999) outline the three main indicators of desertification: Physical, Biological (vegetation and animal) and Social/economic. Expect deserts renchrochement where these exist:
- Decrease in soil depth
- Decrease in soil organic matter
- Decrease in soil fertility
- Soil crust formation/compaction
- Appearnce/increase in frequency/sever ity of dust/sandstorms/dune formation and movement
- Salin ization/alkanization

- Decline in quality/quantity of ground water
- Decline in quality/quantity of surface water
- Increase seasonally of spr ing and small streams
- Alteration in relative reflectance of land (albedo change0.
- Biological indicators of desertification: Vegetation
- Decrease in cover
- Decrease in above-ground biomass
- Decrease in yield
- Alteration of key sp ecies d istribution and frequency
- Failure of species to reproduce successfully.
- Biological indicators of desertification: Animal
- Alteration in key species distr ibution and frequency
- Change in population of domestic animal
- Change in herd composition
- Decline in livestock production
- Decline in livestock yield
- Social/economic indicators of desertification
- Change in land/water uses
- Change in settlement pattern (abandonment of villages)
- Change in population (biological) parameters
- Demographic evidence, migration statics, public health information
- Change in social process indicators
- Increased conflict between groups/tribes, marginalization, migration, decrease in incomes, decrease in assets, change in relative dependence on cash crops/substance crops.

As much as 35% of world s land surface, which covers about 6.1 billion hectares can be classed

as dry land s: and 1.5 % of the world s land surface is semi-arid.

3.2 CAUSES OF DESERTIFICATION

There are three major causes of desertification (Olagunju 1999).

1. Climate Facto rs:- Intence and prolonged occurrence of adverse weather conditions as a result of rainfall, leading to drought.

2. Edapt ic Factors: this refers to the soil types, mostly sand y, with poor presence of organic matter due to scanty vegetation cover, low fertility, hig hly susceptible to wind and water erosion.

3. Biot ic factors - this refers to human interaction and animal dependence on vegetation for survival.

3.2.1 Desertification: The Human Factor

Desertification stems from vegetation degradation, usually due to human and animals interacting with the ecosystem. These are linkable according to Olagunju (1999) to the following:

1. Population Expansion: The ever growing human and animal populations requires equal increase in the demand for forest resources. This results in over exploitation, which leads to desertification.

2. Over-Exploitation of Vegetation: Man s irrational action in exp loiting forest resources for fuelwood, poles and livestock folder has resulted in the depletion of soil fertility and cover.

3. **Overgrazing: The increase in livestock population plus the decrease in the amount of range** land available, the consequence of overgrazing on vegetation has been tremendous.:

4. **Bush B urning: The act of bush burning as a part of the conventional farming system causes** the loss of undergrowth, useful tree barks that are of medicinal value and soil- based micro flora and fauna, including depletion of soil fertility. The menace of uncontrolled bush-burning remains high especially where hunters and Fulani herdsmen set fire to the bush in order to hunt wild animals and obtain new growth of grasses for their animals respectively. This practice turns large areas of forest cover devoid of vegetation.

5. **Shifting Cult ivation and Over-cultivation: the practice of farming a piece of land and** abandoning it for a more fertile piece after a period of 305 years (or after noticing reduction in crop yields), has rendered large areas of land desolate in Sokoto State (Gadzama, 1991). Moreover, the extension of agr icultural activities to the marginally productive areas (of Borno, Kano, Katsina, and Sokoto State), for examp le, p loughing and irr igation, which may produce a few good harvests in short term, may also lead to ecological degradation. In the long run. Moreover, destructive agricultural techniques for large scale cash crops farming, with heavy application of chemical fertilizers, can lead to serious land deterioration around

Lake Chad.

3.3 CONSEQUEN CES OF DEFORESTATION

A Environmental Effects

- Effect on Vegetation: few vegetation makes the soil susceptible to wind and water erosion, lead ing to formation of sand dunes, and reduction in the capacity of the soil to support agriculture.

- Effect on Water supply: Large amounts of water are lost through evaporation due to lack of vegetation cover. As a result, many boreholes have dried up.

- Effect on livestock: Mass death of livestock results in the process of travelling great distances in search of food and water, and diseases (e. g. rinderpest) are usually rampant at this critical per iod.

- Effect on Soil Fertility: in the absence of vegetation, the organic matter content of the soil disappears, leaving a lot of salts which do not favour agricultural crops.

- Effects on Crop Yields: reduction in crop yields results from disintegration of the soil, short rainstorms and leaching of nutrients

B Socio-Economic Effects

- Migrat ion: An alar ming rate of rural -urban migration results due to the extreme food shortages and lack of rural employment (e.g Gidan Kaura village in gad a local Government Area in Sokoto State).

- Pressure on Available Infrastructure: In affected communities, only women, old men and little children are left in a pathetic state of inadequacy of such amenities as housing, food, medicine etc.

- Social Vices: The cities are filled with loiterers and beggars with high incidence of crime and truancy among idle immigrants from affected communities.

- Famine and ma lnut rition: Reduction in food production and subsequent nutrient, intake of both humans and animal results in hig h mortality among both populations.

- Indust ria l Raw Materials: Since the 1972 drought (in Sokoto State). There has bee an irregular and inadequate supp ly of industrial raw materials such as cotton seed and tanning materials.

3.4 CONTROLLING OF DESERTIFICATION

There are short- and long-term measures for the control of desertification.

A Short -Term Cont ro l Measurement : These provides a temporary short period of establishment. Examples include:

1) Preservation of Existing Veget at ion

The available vegetation in gazetted forest reserves and other wooded areas should be properly and Laws against ind iscriminate felling of trees bush-burning and overgrazing should be strictly enforced while those on the protection of planted trees should be enacted. There is also need to evolve scientific management practices for sustaining adequate supply of goods and services from the forests. Moreover, apart from increasing the number of grazing reserves, there is also need to establish and implement grazing reserve laws and by- laws to improve the pasture.

2) Increase of Soil Nutrient

Adequate attempt should be made to encourage the use of manure and fertilizers to improve growth rate of the existing vegetation.

3) Alternative Energy Sources

The use of gas cookers, kerosene stoves, solar energy devices and wood stoves for heating and cooking reduce pressure on the forests for example the purchase of 42, 000 kerosene stoves by the Sokoto State Government for resale to Civil servants at subsidized rates is working commendation.

B Long - Term Technique: These are techniques whose effects manifest after a long per iod of establishment. Examp les include:

1) Tree Planting Campaign :

Such exercise is backed up by Government policies. Strategies for educating the general public on the dangers of an environment devoid of trees need to be evolved. Moreover, the general public should be mobilized to make afforestation a people s programme in order to restore enough tree-cover.

2) Sand Dune Fixation

This is the planting of grasses on the dunes to reduce movement of sand particles followed by the introduction of tree species (That is, stabilization of moving dunes)

3) Communa l/ Individual Wood lots Program me

This is for the provision of more trees in the environment for the benefits of poles, fodder and shade, fruits, gums and resins, and other commercial products.

4) Farm - Forest Practice

The farm forestry programme distributed seedling to farmers free of charge to plant their farms, to protect water and nurture to maturity. Moreover, the use of in situ conservation where existing trees are protected from destruction of protect the soil from erosion (as wind breaks) and serve as fodder and shade for man and animals.

5) Shelter belts establishment

The Arid- zone Afforestation Programme, Ecological Disaster Relief Programme. Forestry II Project, the State Forestry services, Drought and Desertification Control and State Environmental Protection Programmes have established conventional shelterbelts, as the most effective way of protecting the solid. For examples, the 65 gazetted forest reserves and 2000km of shelter belts in Sokoto State.

4.0 CONCLUSION

Desertification is basically a human induced global environmental problem threatening biodiversity conservation including human s quest for better quality of life.

Desertification indications are not showing favourable sings especially in the tropical regions of the world with developing economics. The consequence of desertification are biting hard against humanity and expect we rise fast to the challenge of employing conservation techniques desertification will proved unabated.

5.0 SUMMARY

The abuse of the land especially among communities witnessing population explosion is common. You have also learnt that them are five types of deserts and there are three major indication of desertification physical biological and socio-economic. Desertification as we learnt is due to climatic, edaphic and biotic factors. The consequences of desertification were highlighted which are broadly classified into environment and socio-economic factor, Controlling desertification is not impossible. We discussed on the short and long-term measures at the same time individual corporate and government metal roles in controlling this problem discussed.

6.0 TUTOR MARKED ASSIGNMENT

1a Explain the term desertification
b what are deserts
2 State three individuals and Two governments responsibilities in the control of desertification
3 Mention four facts that promote Desert encroachment

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UNIT 6: GLOBAL WARM ING AND GREEN HOUSE EFFECT

Table of content

1.0 INTRODUCTION

The last module, Unit 1-5 focused on the environment as an ecosystem and how human population has raised global environmental issues such as deforestation, biodiversity loss and desertification.

The next five Units- Module 2 will focus on global environmental issues related to climate change, sea pollution coastal erosion. Burning of fossil fuel to ensure human sur vival and support comfortable lifestyles have induced global war ming . This Unit intends to explain the relationship between g lobal warming and green house gases are d iscussed and the consequences and control measures for global warming

2.0 OB JECTIVES

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

- Explain the term global warming
- Mention the consequences of global warming
- Analysis the impact of the major four green house gases.
- Outline control measure taken to control global war ming.

3.0 GLOBAL WARM ING AND GREEN EFFECTS: C onceptual Clarification

The g lass-roofed structure where p lants are grown is called a greenhouse. Usually the walls are also made of glass. A green house creates an artificial environment by careful control of

temperature, light, humidity, air quality, soil moisture and heat levels. (A hove, 2001)

The glass windows of a greenhouse allows in sunlight. The sunlight warms up objects inside the greenhouse. These objects then g ive off heat. The glass of the green house, however, does not let out the heart. If the green house lacks ventilation all the heat stays locked inside and the temperature rise. The green house effect also accounts for the fact that the inside of a car become hot if its windows are wound up in a sunny day.

Reflection:- What happens when you open the door of the car described above.

The earth and its atmosphere are lik e a giant green house. Like the g lass windows of a green house, the atmosphere is nearly transparent to short wave and visible solar radiation. Part of the energ y absorb on by the Earth is radiated to the atmosphere as long wave vapour, which absorbs much of the long wave radiation before partial radiation back to the surface of the earth. This cause the earth and its atmosphere to warm up which had remained nearly constant until the 20th Century. When the bur ning of fossil fuel such as coal, fuel oil, petrol, Kerosen, diesel and natural gas began to release large quantities of carbon dioxide into the atmosphere.

The combustion of fossil fuel has brought about an ever- increasing rise in the carbon dioxide concentration in the atmosphere. The rap id eradiation of the tropical ranforests- is depleting the earth s plant growth and dimin ishing their capability for absorbing carbon d ioxide. The unabsorbed carbon d ioxide r ises to the upper atmosphere and blocks the re-radiation of solar energ y back into space. This precip ates a global temperature increase called the greenhouse effect which scientists say is causing the ice caps to melt.

The term greenhouse effect is used as an analogy to illustrate the global warming phenomenon.

Global war ming may be described as the gradual increase in global temperature as a result of the effects of greenhouse gases. The greenhouse effect is the phenomenon experienced in a greenhouse used for plant where heat or warmth are traped within.

This exper ience of heat within the greenhouse is what is used as an analogy to illustrate the g lobe as a g iant greenhouse where heat is traped leading to global warming

Carbon dioxide emissions from the combustion of fossil fuels coal, oil, gas) play a crucial role in accentuating the greenhouse effect and, by extension, g lobal war ming. These emission are still

increasing. since 1950, they have multiplied fourfold over the past five years they increased by 5.5%, as against 7.4% over five preceding years. However, this slight shr inking is due mainly to the collapse of the eastern block countries.

Chins, with a number of developing countries (Braizil, India, Indonesia etc,) has considerably increased their emissions. But albeit to a lesser degree, so have the United States, which spews more carbon dioxide into the atmosphere than any other country, Japan-another major producer- and, the countries of Europe.

Table 5. 1 Global carbon Dioxide Emissions (%) By Developed Count ries

S/N	Country Global C02 Emission (%)	
(a)	United States 23	
(b)	China	14
(c)	Russia	7
(d)	Japan	5

3.1 GREEN HOUSE EMISSIONS.

These green house gases are projected to cause an increase in the average temperature of the troposphere. According to Miller (1991) the major ones are:

(1) Carbon dioxide
(2) Chloro-fluro-carbon (CFC)
(3) Methane
(4) Nitrous oxide

Carbon dioxide (C O2)

This gas is thought to be responsible for 49% of human- caused input of greenhouse gases. Major sources are Fossil-fuel burning (80%) and deforestation (20%). Industrial countries account for about 76% of annual emission. It remains in the atmosphere for 50-200 years.

Chlo rofluoroca rbon (CGC2) These gasses are responsible for 14% of the human input of greenhouse gasses and by 2020 will probably be responsible for about 25% of the input. CFCs deplete ozone in the stratosphere. Major sources are leaking air cond itioners and refrigerators, evaporation of industrial solvents, production of plastic, forms and propellants aerosol spray cans. CFCs remain in the atmosphere for 65- 135 years, depend ing on the typ e gas. They generally have 1,500-7,00 times the impact per molecule on global war ming than each molecule of carbon d ioxide. It takes between 10-20 years to reach the stratosphere.

Methane (CH) This gas is responsib le for about 18% of the human input of greenhouse gases. It is produced by bacteria that decompose organic matters in oxygen poor environments. About 40% global methane emissions come from water -logged soils bogs, marshes and rice paddies. Global warming may increase methane emissions from these sources by 20% -30% and thus amplify global war ming. Other sources of billions of cattle, sheep, the guts of termites, the d igestive

tracts of billions of cattle, sheep, p igs, goats, horses, and other livestock. Some methane also leaks from coal seams, natural gas, wells, pipelines, storage tanks, fur naces, dr yers and stoves. Natural sources produce an estimated on third of the methane in the atmosphere, and human activities produce the rest. CH, remains in the troposphere for7-15 years and each molecule is about 25 times more effective in war ming the atmosphere than a molecule of carbon dioxide.

Nitrous Oxide (N2 O) This gas is responsib le for 6% of the global warming. It is released from the breakdown of nitrogen fertilizers in the soil, livestock wastes, and nitrate -contaminate ground water, and by biomass bur ning. Its average stay in the troposphere is 120 years. It also depletes ozone in the stratosphere. The global war ming for each molecule of this gas is about 230 times that of a car bon dioxide molecule. These g ases are referred to as greenhouse gases not because they are green in colour but because they induce the greenhouse phenomenum on earth.

3.2 CONSEQUEN CES OF GLOBAL WAR MING

- A war mer global climate could have a number of possible effects. Chang es in food production, which could increase in some areas and drop in others. Current climate models projects 10-70% declines in the global yield of key food crops and a loss in current cropland area of 10-50% especially in most poor countries.

- Global warming would also reduce water supplies in some area. Lakes, streams, and aquifers in some areas that have provided water to ecosystems cropland s, and cities for could shrink or dry up altogether. This would force the entire population to migrate to areas countries with adequate water supplies- if they could

- Global war ming will also lead to a change in the makeup and location of many of the world s forests. Forests in temperate and subacretic regions, leaving more grassland shrubland in their wake

- Climate change would lead to reductions in biodiversity in many areas. Large-scale forest d ie back s would cause mass extinction of p lant and animal species that cannot migrate to new areas. Fish would die as temperatures soared in streams and lakes and as lowered water levels concentrated pesticid es.

- In a warmer would, water in the world s oceans would expand and lead to a rise in sea level. Even the modest rise of 48 centimeters (19inches) projected to occur by 2100 one-third of the would destroy most coral reefs, contaminate coastal aquifer s with salt water storing oil and other declining global fish catches. The war ming at the pole will cause ice sheets and glaciers to melt even partially, the global sea level would r ise the more.

- In a warming world, weather extremes are expected to increase in number and severity. Prolonged heat waves and droughts could become the norm in many areas, taking a huge toll on many humans and ecosystems. As the upper layers of seawater warm hurricanes, typ hoons, tornadoes, and violent storms will increase in intensity and occur damaging more frequently.

- Atmosphere warming also affects the respiratory tract by increasing air pollution in winter months and increasing exposure to dust, pollens, and smog in summer months. Sea level rise will spread infectious d isease by flood ing coastal number of environment refuges.

- Global warming also poses threats to human health. According to 1995 International Panel on Climate Change (IPCC) report, global warming would bring more hear waves. This would double or triple heat-related deaths among the elder ly and people with heart d isease. The spread of war mer and wetter tropical climates from the equator would br ing malaria, yellow fever, dengue fever, and others insect-borne diseases to for merly temperate zones.

-

Exercise 3.1 State three consequences of global warming you witnessed in your community or state.

3.3 CONTROLL ING GLOB AL WARM ING

Dealing with global war ming, we have two options (Miller, 1991). We either slow it down or adjust to its effect. It may be wiser to employ the two options without wasting much time, because human and many other species learn to live under necessary changes. Steps that can be taken in dealing with this problems include.

1. Banning all production and uses of chlorofluoro carbon and halons. This is one of the best steps we must take, because we can either d o without these chemicals or introduce substitutes to protecting the atmosphere from both g lobal warming and ozone depletion.

2. Cutting current fossil fuel use 20% y 2000 and 50% by 2010 and 70% by 2030. The largest users of fossil fuel such as the United States and Russia should cut their use about by 35% by the year 2000. 160 countries signed the 1997 kyoto protocol which requires industrial nations reduce their greenhouse emissions to an average of 5.2% below 1990 levels between the years 2008 and 2012. As weak as the treaty appears, it appears to generate controversies among government of nations especially between the U.S. and Japan. Since the U.S. Senate hasn t even considered is anti- fossil fuel cut, the Japanise Government also decided (in July, 2001) that she will not rectify the protocol. Kyoto

- Greatly improving energy efficiency. This is the quickest, cheapest, and most effective method to reduce emissions of carbond ioxide and other air dur ing the next two to three decades.

- Shifting to perpetual and renewable energ y resources that do not emit CO2 over the next 30 years. Ultimately the world must move away from fossil fuels for most of its energy, even if we cut carbon d ioxide emissions in half. Otherwise emissions would begin to rise because of increasing population and industr ialization.

- Increasing the use of nuclear power to produce electricity if a new generation of much safer reactors can be developed and the problem of how to store nuclear waste safely for thousands

of years can be solved. Israel and France are noteworthy examp les in his area.

• Placing heavy taxes on gasoline and emissions fees on each unit of fossil (especially coal) burned to reduce emission of carbon dioxide and other air pollutants. Some of the tax revenue should be used to improve the energy efficiency of dwellings and heating systems for the poor in Developed Countries and less Developed Countries and to provide them with enough energy to offset higher fuel prices.

• Sharply reducing the use of coal, which emits 60% more carbon d ioxide per unit of energy produced than any other fossil. Using the world s estimated coal supp lies would produce at least six fold or eight -fold increase in atmospheric carbon d ioxide.

• Switching from coal to natural gas for producing electricity and hig h temperature heat in countries, such as the United States and the Russia, that have ample supp ly of natural gas which emits only half as much carbon dioxide per unit of energy as coal. Switching to natural gas also sharp ly reduces emissions of other air pollutants because bur ning natural gas still emits CO2. This is only a short -term method that helps buy time to switch to an age of energ y efficiency and renewable energy

• Slowing population growth. If cut greenhouse gas emissions in half and population doubles, we are back where we started. Especially in countries with hig h illiteracy rate and poverty.

• Planting trees. Everyone -even student should plant and care for at least one tree every six months. This is an important form of earth care, but we should recognize that tree planting is only a stopgap measure for slowing carbon -dioxide emissions. Trees must be continually carbon dioxide in the atmosphere. To absorb the carbon d ioxide putting into atmosphere each year, would have to plant an average of 1, 000 trees per person per year.

• Recycling CO2 carbon-dioxide released dur ing industrial processes.

• Build ing lakes to protect coastal areas from flooding as the Dutch have done for hundred of years.

• Banning new constructions on low- lying coastal areas. This should be enforced strictly especially Lekki on the Victoria Island of Lagos State, Niger ia where several hectares of wetland have been used for construction of houses.

• Storing large supp lies of key foods throughout the world as insurance against disruptions in food production

Exercise 3.2: Based on your knowledge, explain four techniques you will employ to control the consequences you mentioned in Exercise 3.1

4.0 CONCLUSION

We have known about the greenhouse effect and its possible consequences for decades. We also know what needs to be done at the international, national local, and individual levels. Research must be expanded to help clear up the uncertainties that continue to exist. But to most environmentalists and many climatologists this is no excuse for doing nothing or very little now.

5.0 SUMMARY

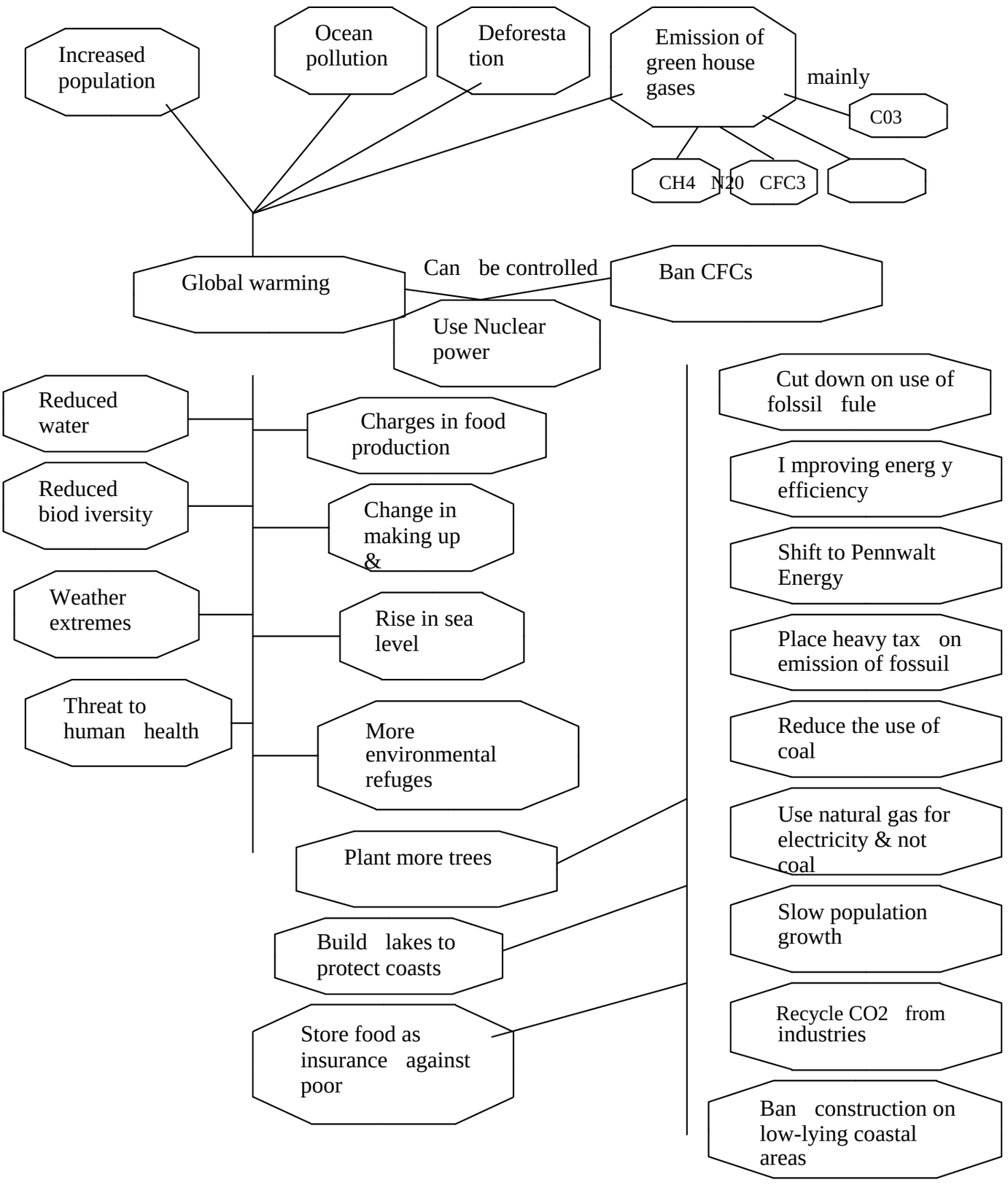
This unit set out to discuss on a contemporary climatic global problem-global warming. Global warming was defined as the gradual increase in global temperature as a result of green house emissions induced by humanity over several decades. Green house effect is the phenomenon of experienced in a green house, where plants are kept for nursery and warmth is retained. This experience is analogous to our experience of a warmer world over the years.

The causes of global warming are basically as a result of:

- Increase in population
- Deforestation
- Emission of greenhouse gases
- Ocean pollution

Four major greenhouse gases were highlighted these are: Carbondioxide, Chloro-fluoro-Carbon, Methane and Nitrous Oxide. Eight consequences of global warming were discussed which include among others rise in sea level, weather extremes and threats to human health. Strategies for controlling global warming were analysised.

Fig 6.1: Concept mapping highlighting in su mmary the causes,
conseq uences and control of glabal warming



6.0 TUTOR M ARKED ASSIGNM ENT

1. Explain the term global warming

2. a. Mention the names and symbols of the four major greenhouse gases.

   b. Analysis the global war ming impact made by human emissions of (1) carbondioxide (2) any other named green house gas.

a. Why is carbodioxide the major culprit among the four greenhouse gases.

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UNIT 7: OZONE LAYER DEPLETION

Table of content

1.0 INTRODUCTION

In the previous Unit we talked about a major g lobal environmental issue related to climate change global war ming. This Unit we will also discuss on another very important global environmental problem. This time around we are talking about Ozone Layer Depletion.

I often like to describe g lobal warming and Ozene Layer Depletion as the twin environmental issue affecting climate change. This is because the consequences of this twin are not only similar but interwovened-causing climate change.

I strongly believe you will get the best out this unit as long as you keep focused. We shall talk about the discovery of ozone, Ozone as a natural screen and the cause of its dep letion. Further more we will highlig ht the consequences of Ozone layer dep letion on humanity, other organisms and the p hysical environment. The strategies adopted so far in the control of Ozone depletion will also be retriated.

2.0 OB JECTIVES

At the end of this Unit, you should be able to:

- Mention major Ozone layer depleting substances
- Outline the consequences of Ozone layer dep letion
- Discuss any four strategies for the control of Ozone layer dep letion

3.0 OZONE UNCOVERED

According to Charles Bigelow in his article, Hole in the ozone screen the world was sensitised to the ozone problem in 1986. In may 1986, a paper written by scientists from the British Antarctic survey at Halley Bay appeared in the scientific Journal Nature. In this paper they described what came to be known as the hole in the Ozone layer, or ozone screen. The research at Halley Bay collected data on many different characteristic of the atmosphere, including the total concentration of ozone in the cloumn of air over their heads. The Halley Bay scientists used a device called Debsons spectrophotometer, which measures the absorption of sunlig ht by ozone. Their observations and others made subsequently, shows that ever y spring time in Antarctica, there is a massive d epletion of the atmosphere concentration of Ozone. Exercise 6.11. using your world map, locate the region- Antarctic.

Exercise 6.1

Using your world map, locate the region Antarctic

3.1 THE OZONE SCREEN

Both d ioxygen and trioxygen have very important physical function for us in that they screen out harmful ultraviolet light wavelengths below 24nm, and troioxygen screens our the equally dangerous U V B from 240to 320nm. Our sun emits the rad iation that keeps us war m and alive. Most of the radiation is in the visible region of the spectrum, where it can be seen, but some is in the invisible ultraviolet region. Ultraviolet light is hig h energ y light meaning that when it is absorbed by molecules, it may break chemical bonds, thereby changing the molecule. This is why ozone is formed in the stratosphere. UV-C is absorbed by d ioxygen molecules which are then slit into two oxygen atoms (o). each of these combines with another 02 molecule to make 03 molecules. Two things are needed to makes ozone in the stratosphere oxygen (0 2) and UV light.

Ozoen (03) also absorbs UV light, but in the B-region. Large quantity of Uvray would cause unwanted reactions leading to cataracts, skin damege cancer, and mutation. Life sur vives on land because the ozone screen is in place filtering out UV-B. the ozone screen is sometime called ozone layer, because its hig hest concentration occurs in the stratosphere, about 25km above the surface of the Earth. However, the ozone screen is in an equilibr ium concentration which is the result of a steady formation and destruction.

3.2 CHEM ISTRY OF THE OZONE LAYER DEPLETION

A University of California scientist called Rowland, has wondered about an important industrial chemical called chlorofluorocabons (CFCs). This compound was invented about the late 1930s been found to have very important applications because they had desirable physical properties, and one very important chemical property is that CFCs are essentially inert. They do not react with anything, so they don t react with living organisms, including humans, they are therefore non-toxic, and perfectly safe around people, if any few cylinders of these gases were emptied in crowded room, nobody would notice.

Rowland knew that industries world over had been using about one million tonnes of CFCs a year and that it ultimately end up in the atmosphere. He asked himself this question: what is happening to all this stuff? He thus speculate that the CECs, once in the atmosp here, would move slowly up to the stratosphere, which may take a maximum of about 25 years to attack the ozone layer.

His reaction he explained experimentally when he found that UV light can break the CFCs molecules (stepi) knocking chlor ine atoms out of them.

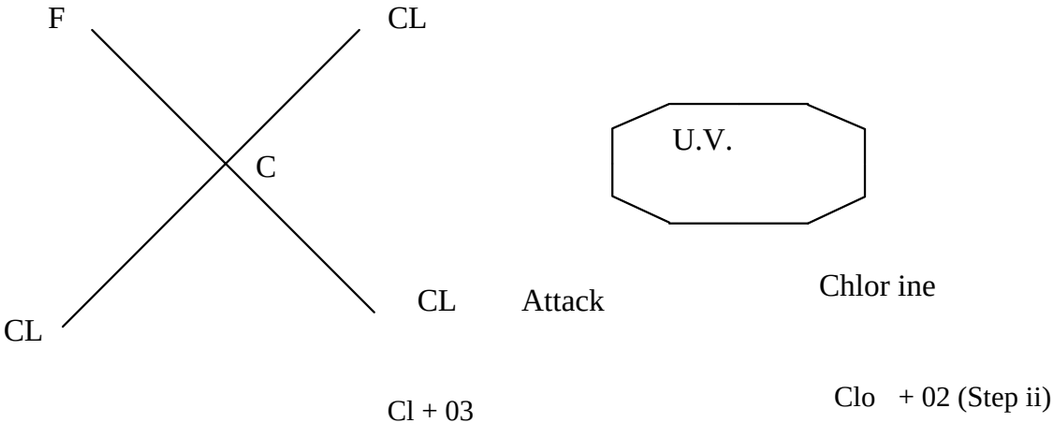


Fig. 6.1:

He discovered that if he added some ozone in his reaction vessels, the chlor ine atoms it destroyed, thus liberating d iatomic oxygen (Step ii).

So the so-called chemically inert CFCs will react if you expose them to highly energetic UV light. Rowland s work led him to the conclusion that the actual chemical culpr it was not just the chlor ine atom, but rather an unusual molecule made up of one atom of chlor ine and one atom of oxygen called chlor ine monoxide-CLO.he thus further explains how this CLO continues to deplete the ozone layer with the equations below.

Breaks up

CLO

CL+O

CL+O3 CLO +O2

O+O3

2O2

When CLO absorbs UV light, it splits into chlorine atom and one - oxygen atom, each of which attack ozone molecules, The CLO is not used up in the process, and can go on and destroying more ozone molecules. CLO is infact what is called catalyst in chemistry.

3.3 MAJOR OZONE DEPLETING CHEM ICALS

1. Cloroflurocarbon (CFCs) It was first d iscovered by a chemist Thomas Midgley. They are der ivatives of simple hydrocarbons (Methane, ethane etc) with the hydrogen atoms comp letely rep laced by chlorine and fluorine atoms. Developed in the late 1930s as stable odour less, non-toxic, noncorrosive and noflammable refrigerants. These highly versatile chemicals are also found in widespread use as aerosol spray propellants, form- blowing agents and sloveents. CFCs are comp letely synthetic, with no natural sources, the absence of hydrogen atoms makes them largely non-reactive with other chemicals in the lower atmosphere. The ozoen dep letion porentials of CFCs range from 0.6 to 1.0 with having the value 1. 0. last In the stratosphere for 65-110 years and can attack thousands of O3. It is removed by forming downward to the troposphere and is removed by rain.

2 Halons: They are synthetic chemical similar to CFCs that invludes bromine, chlor ine and hydrogen. Developed as non-corosive fire extinguishers, they are substantially more powerful ozone dep leters than CFCs. These halons are classified below

   a. Methly Chloroform (CH3CCL3): This is also a synthetic industrial solvent used for cleaning precision parts and metal sur faces and for dry cleaning. Because it of hydrogen atoms, it is chemically reactive in the lower atmosphere. Thus, less of the methlychoroform emitted at the Earth s surface reaches the stratosphere and destroys ozone, giving it an ozone depleting potential (ODP) of 0.1

   b. Carbon tetrachlor ide (CCL4) is a synthetic chemical with an ODP OF 1.1 Almost all production in industr ial countries serves as feedstck in the production of other chemicals.

   c. Methyl Bromide (CH3Br) is the only currently world wide controlling ozone dep leting chemical with both human and natural sources. Oceanic alg ae emit 60 - 160 thousand metr ic tons per year, while human emissions come primarily from biomass burning (10-50 thousand tons) and agricultural use as a soil or crop fumig ant. It s ODP is currenly estimated as 0.6

d. Hydrochlorofluorocarbon (HCFCs) were developed as substitutes for CFCs. They are similar in structure, but retain some hydrogen atoms. Consequently, they react chemically in the lower atmosphere and have less effect on stratosphere ozone. Their ODPs range from 0.01-0.11. Production and use of HCFs is now increasing rap id ly as CFCs are phased out.

e. Hydrofluorocarbons (HFCs) were also developed as CFCs substitutes. Because neither nor bromine, they do not deplete ozone (ie their ODP is 0.0), but they have been proposed for control because they are powerful greenhouse gases. Collectively, all ozone depleting compound s are called ODCs.

3.4 CONSEQUEN CES OF OZONE LAYER DEPLETION

With less ozone in the stratosphere more biologically harmful ultraviolet radiation will reach the earth s surface. This form of UV rad iation damages DNA molecules in animals including our very skin. Do you realise that for every 1% loss of ozone leads to a 2% increase in the UV radiation striking the earth? And consequently leasing to 5% -7% increase in skin cancer ?

The followi ng are the effect of Ozone depletion:

1. Increase in the cases of skin cancers running into millions annually. His includes curable and incurable cancers.

2. A sharp increase in eye cataracts (the cloud ing of the eye that causes blurred vision and eventual blindness) and severe sunbur n in peop le and eye cancer in cattle.

3. Suppression of the human immune system which would reduce our defenses against a variety of infection diseases, an effect similar to AIDS virus.

4. Decreased yields of important food crops such as corn, rice Soyabean and wheat, due to gradual loss of chlorophyll in plants.

5. Reduction in the growth of ocean phytoplankton that form the bases of ocean chains and webs and help remove carbondioxide from the atmosphere.

6. Degradation of paints (build ing, etc), colours (from cars materials including wears especially when exposed to too much sunlight), plastics and other polymer materials.

7. Increase in global temperature and it s attendant consquences.

Exercise 7.1 Form a group of three and discuss with your course mate on how these consequences has affect each one and families

3.5 CONTROLLING OZONE LAYER DEPLETION

Models of atmospheric processes indicate that just to keep CFCs at 1987 levels would require an immediate 85% drop in total CFC emissions throughout the world. Analysists believe that the first step toward this goal should be an immediate worldwide ban on the use of CFCs in aerosol spray cans and in producing p lastic form products. Cost effective substitutes are already in use is some electrical app liances like refrigerators and aerosols. Automotive service shops should be required to recycle CFCs from auto motive air cond itioners and the sale of small cans of CFCs by consumers to charge leaky air conditioners should be banned totally. CFCs have been phased put currently in several developed and developing countries with few excerptions.

The next step would be to phase out all other users of CFCs, halons, car bon tetrachloride, and methyl chloroform. Substitute coolants in the refr igeration and air codition will probably cost more. But compared to the potential economic and health consequence of ozone depletion, such cost increases would be minor.

Other international co-operation to protect the ozone layer in the past include the following:

- March 1977: a meeting sponsored by the United Nation Environmental Programme (UNEP) in Washington, D.C., prepared a non-binding world plan of Action to protect the ozone layer and established a small international scientific advisory body.

- January 1982: international negotiations for a treaty on the ozone layer began.

- March 1985: twenty nations and the European Community (EC) singed the Vienna Convention after three years of negotiations. The convention included measures to co-operate on research and monitoring but contained no controls on ozone depleting substances. A resolution signed at the same time authorised continuing negotiations toward a treaty to include controls.

- September 1987: Twenty- four nations and the EC signed the Montreal protocol committing themselves to reduction production and use of CFCs by half by 1998 and to freeze production and use of halons by 1992. Develop ing countries were granted a 10 yars per iod to meet both oblig ations.

- May 1989: At their fir st meeting in Helsinki, parties to the protocol made no change to agree to more commitments but decided that their next meeting would both consider stronger control measures and seek to develop financial mechanism to support developing countries in controlling ozone dep leting substances. The meeting also sought to clar ify a number of ambiguos terms in the protocol and to define procedural obligations such as reporting.

- June 1990: The London Amendments to the Montreal Protocol adopted at the meeting of the conference of the Parties, increased the stringency of control measures. The amendments required elimination of both CFCs innovations by 2000 (with possible exemptions for essential uses to benspecified); broadened the set of controlled chemicals to include methyl chloroform, carbon tetrachloride and a few CFCs not originally covered by protocol. It also established a multilateral fun of 16-24 million dollars over three years to support phase outs in developing countries consuming less

than 0.3 kilogams per capital (Article 5 Countr ies). Developing countr ies retained their 10 years grace period for all controls.

- June 1991: The third meeting of the conference of the Parties, in Nairobi, made no chang es to core commitments. The meeting addressed such matters as defin ing the tasks of the Implementation Committee and clarifying the protocol s sanction provision.

- November 1992: At the fourth meeting of the parties, the Copenhagen amendments advanced the phase out dates to 1994 for halons and to 1996 for CFCs, methyl chloroform, and carbon tetrachloride. HCFCs were placed under control for the first time with all but 0.5 percent to be eliminated by 2020 and the remainder by 2030.

- Industrial countr ies production of methyl bromide was frozen at 1991 level starting in 1995. Developing countries obligations regarding HCFCs and methyl bromide were left while unspecified, wile they retained their 10 year grace per iod for their phase outs. The multilateral fund was reauthorized on a permanent basis.

- November 1993: the fifth meeting of the parties, in Bangkok, made no changes to core commitments but confir med three- year funding of 510 million dollars for the Multilateral fund (more than double the previous funding level) and following an assessment panel s recommendation that three be no essential use exemption to the 1994 halon p hase out in industr ial countries.

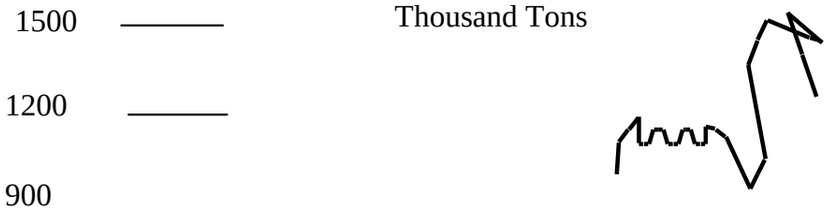
- October 1994. The sixth meeting of the parties, in Nairobi, again left core commitments unchang ed, but followed an assessment panel;s recommendation that 11,000 tones of essential use exemptions be granted in the case of the 1996 CFC phaseout

- November 1995: The seventh meeting of the parties was held in Vienna to commemorate the tenth anniversary of the Vienna Convention and considered revisions to the protocol s commitments.

- In 1997, 160 countries signed the Koyoto protocol, which requires industrial nations to reduce their greenhouse emissions to an average of 5.2% below 1990 level between the years 2008 and 2012. There is currently a deadlock on this reduction of carbon dioxide, emitted from fossil fuel especially among developed nations. Alternatively, reduction of other greenhouse gases such as methane, and Nitrous oxide should be focused on negotiations carbond ioxed reduction is still on. This is essential because, these other greenhouse gases in totality is responsible crisis, even through each gas is present in the atmosphere in much smaller quantities relative to carbondix ide.

4.0 CONCLUSION

Fig 6.1 CFC, AT LEAST ONE SUCCESS STORY



Source: UNESCO SOURCES, 1997

Yet, as this last graph show, the worst is not inevitable. The inter national community managed to reach an agreement on cutting the amount of ozone -destroying chlorofluorocarbons (CFCs released into the atmosphere and stayed on target. The ingred ients of success were a alert, public awareness and-especially- economically viable alternatives. But the cuts will not come too soon. Even if all countries respect the commitments they have made, the ozone layer will not return to normal before the middle of this century (2050). In the meantime, abnor mally high levels of ultra- violet radiation will continue.

5.0 SUM MARY

In this Unit, you have learnt about one of the most essential g lobal environment issue- Ozone depletion. You have learnt that ozone layer is a natural screen that was uncovered by Rowland about 1986.

You will also recall that this unit hig hlighted, how the Ozone layer is being eaten-up by man-made chemicals, using equations for each stage.

Two broad categorizes of Ozone depleting substances were mentioned these are:

- Chlorofluorocarbons
- Halons

The consequences of and control measures for check ing Ozone layer dep letion were discussed.

6.0 TUTOR M ARKED ASSIGNM ENT

1. What is the relevance of Ozone in the stratosphere to humanity?
2. State three consequences of Ozone layer Depletion on humanity.

7.0 REFERENCES AND OTHER RESOUR CES

Ahove, M.A.N (2001) Environmental Management and Education: An introduction. Lagos Golden pen books.

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UNIT 8: AIR POLLUTION AND ACID RAIN

1.0 INTRODUCTION

The pervious unit focused on ozone layer depletion being global atmospheric problem induced by human activity.

This unit will yet discuss on another global problem induced by human activity although it is common in industrial urban location. Unit Eight therefore has air pollution and acid rain as its focus.

2.0 OBJECTIVES

At the end of this uni t you should be able to:

- Mention the names and symbols of major air pollutants
- State the effect of air pollution on human health
- Outline the consequences of air rain on liv ing organism and the physical environment

3.0 MAJOR AIR POLLUTION & ACID RAIN

As clean air moves across the earth s sur face, it collects var ious chemicals produced by natural and human activities. Once in the troposphere, these potential air pollutants mix vertically events and horizontally, often reacting chemically with each other or with natural components of the atmosphere. Air movements and turbulence help dilute potential pollutants, but long-lived pollutants are transported great d istances before they return to the earth s surface as solid

particles, liquid droplets, or chemical d issolved in precipitation.

Hundreds of air pollutants are found in the troposphere. However trace amounts of the major classes of pollutants cause most outdoor air pollution:

1. Carbon oxides - carbon monoxide (CO) and carbon dioxide (CO)
2. Sulphur oxide - sulp hur dioxide (SO) and sulphur trioxide (S0)
3. Nitrogen oxide - nitric (No), nitrogen dioxide (NO2) and nitrous
4. Volatile organic compounds (VOC) - hundred s of compounds such as methane (CH4)
5. Suspend ed particulate matter (SPM) - thousands of different types of solid particles such as dust (soil), soot (carbon), asbestos, and lead, arsenic, cadmium, nitrate (N) and suphate (SO) salts, and liquid drop-lest of chemicals such as tetraoxo sulp hate (VI) Acid (H SO4) oil d ioxins, and var ious pesticides
6. Photochemical oxidants - ozone (O3), hydrogen peroxide (HO2) hyfroxyl radicals (OH2), and aldehydes such as for maldehyde (CH O) formed in the atmosphere by the reaction of oxygen, nitrogen oxides, and volatile hydrocarbons under the influence of sunlight.
7. Radioactive substances -radon -222, iodine-131, strontium -90, plutonium-239, and other rad io-isotopes that enter the atmosphere as gases or suspended particulate matter.
8. Heat- produced when any kind of energy is transformed from one form to another, especially when fossil fuel are burned in cars, factories, homes, and power plants.
9. Noise- produced by motor vehicles, airplanes, trains, industrial machiner y, construction machiner y, law moweres, vacuum cleaners, sirens, earphones, radios, cassette players and live concerts.

A pr imar y air pollutant, such as sulphur dioxide, directly enters the air as a result of natural events or human activities. A secondary air pollutant, such as sulphur acid, is one that is formed in the air through a chemical reaction between a primary pollutant and one or more air components.

3.1 SOM E EFFECTS OF AIR POLLUTION

3.1.1 Effect on Huma n health

Human respir atory has a number of mechanisms that help protect us from air pollution. Hair in our nose filters out large particles. Sticky mucus in the lining of our upper respiratory track captures small particles and dissolves some gaseous pollutants. Automatic sneezing and coughing mechanisms expel contaminated air and mucus when pollutants irritate our resp iratory system. Our upper respiratory track is lined with hundreds of thousands of tiny, mucus-coated hairs called cilia. They continually wave back and forth. Transporting mucus and the pollutants they trap to our mouth. Where it is either swallows or expelled.

Years of smoking and exposure to air pollutants can overload or deteriorate these natural defenses, causing or contributing to a number of resp iratory diseases such as lung cancer, chronic bronchitis. Elder ly peop le, infants, pregnant women, and persons with heart d isease, asthma, or other respiratory diseases are especially vulnerable to air pollution- Recent evidence on test animals ind icates that nitrogen dioxide- a common pollutant from automobile exhaust-

may encourage the spread of cancer throughout the body especially deadly melanoma.

Fine particles are particularly hazadous to human health because they are small enough to penetrate the lung s natural defenses. They can also bring with them droplets or other particles of toxic or cancer causing pollutants that become attached to their sur faces.

3.1.2 Effect on Plants

Several exposure of leaves to air pollutants can br eak down the waxy costing that helps prevent excessive water loss and damage from diseases, pests, drought, and frost. Such exposure also interferes with photosynthesis and plant growth, reduces nutrients uptake, and causes leaves or needles to turn yellow or brown and drop off. The effects of chronic exposure of some trees to multiple air pollution may not be visible for several decades. But suddenly large numbers being dying off because of soil nutrient depletion and increased susceptibly to pest, diseases, fung i moss and drought. This p henomenon is known as wald sterben (forest death).

3.1.3 Effects on Materials

Each year air pollutants cause tens of millions of dollars in damage to various materials. Fallout of soot and grit on build ings, cars, and clothing requir es costly clearing Air pollutants have discolored irreplaceable marble statues, historic build ings and stained g lass Windows throughout the world.

Exercise 8.1

1a. Identify three Air pollutants within your community

b. Write down the names of these pollutants and compare them with the 9 major air pollutant you lear nt in this unit

3.2 Acid R ai n

When electric power plants and industrial plants burn coals oil their smoke stacks emit large amounts of sulp hur dioxide, suspended, particulate matter, and nitrogen oxides. To reduce local air pollution and meet government standards to spew pollutants above the inversion layer. As more power plants, and industries began using this fair ly cheap output approach to controlling local pollution in the 1960s and 1970s pollutant in downwind areas began to rise.

As emissions of sulphur dioxid e and nitric oxide from stationar y sources are transported long distances by winds, they form secondar y pollutants such as nitrogen dioxide, nitr ic acid vapour, and droplet containing solutions of Sulphate and nitrate salts. These chemicals descent to the earth s surface in wet form as acid rain or snow and in dr y form as gases, fog, dew, particles. The combination of dry deposition and wet deposition of acids and acid- forming compound s onoto the surface of the earth is known as acid rain. Other contributions to dep osition comes from emissions of nitr ic oxide from massive numbers of automobiles in major urban areas.

3.3 Common Effect of Acid Rain

Acid deposition has a number of har mful effects, especially when the PH falls below 5.1. Includ ing:

1. Damag ing statues, building, metals and car colours
2. Killing fish aquatic p lants, and micro- organisms in lakes and streams
3. Weakening or killing tress, especially conifers at high elevations, by leaching calcium, potassium and other plants nutrients from soil.
4. Damag ing tree roots by releasing ions of aluminum, lead, mercury and cadmium into the soil.
5. Making trees more susceptible to attacks by diseases, drought and fungi and moss that thrive under acidic conditions.
6. Stunting the growth of crops such as tomatoes, soyabeans, carrots and cotton.
7. Leaching toxic metals such as copper and lead from city and home water pipers into drinking water.
8. Causing and aggravating many human respirator y diseases and leading to premature death.

4.0 CONCLUSION

The problem of Air pollution and Acid rain is a reality the consequences of which are obviously noticed on human hearth animals plants and sever al other materials

We need to improve on our health air pollution monitoring technique legislation and enforcement. If we do these our world we be better for this - I mean your world - Nigeria.

5.0 SUM M ARY

So far we have endeavored to talk together on Air pollution and Acid rain. We described how air pollution occurs and outlined nine major air pollutants these are Co2, SO/SO, NO/N0, VOCs and SPM. Others are photochemical oxidants. Radio active substances, heat and Noise pollution

Effects of pollution on human health other organism includ ing and other materials were discussed.

Acid rain or acid precip itation was also discussed. The effects of this deposit on human, animals, pants and other materials were outlined.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Mention the names and symbols of any five major air pollutants
2. State two effects of air pollution on human health.
3. State one each of the consequences of acid rain on
   i. Plants
   ii. Cars

iii. Metals
iv. Build ing
v. Human.

7.0 REFERENCES AND OTHER RESOUR CES

Miller, G.T, (2001). Environmental Science Working with the Earth. Mc Graw-Hill. New York.

UNIT 9: OCEAN: USE AND ABUSE

Table of Content

1.0 INTRODUCTION

In the previous Unit we discussed on air pollution and acid rain as g lobal environmental problem induced by human activity. This unit on ocean- use and abuse seeks to explain the role or usefulness of the ocean to the earth and especially to humanity.

Unfortunately the beneficial of the ocean (humans) are the one working against the benefits acquirable from the ocean. This unfavourable action may be summed as pollution.

2.0 OBJECTIVES

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

- Discuss on the roles of the ocean to human.
- Outline global observations on ocean pollution
- Mention specifically substances that are commonly known as ocean pollutants.

HUM ANS ACTIVITIES ON WATER BODIES

3.0 Basic Facts

The water that we use comes from two sources: surface water and groundwater. Water that infiltrate into the ground or return to the atmosphere by evaporation or transpiration is not called surface water. Surface water includes Oceans, seas, lakes, streams, wetlands, and so on.

Some water seep s into the ground and fill pores (spaces or cracks) in the soil and rocks since the. The area where all available pores are filled by water is called ground water (Miller, 2001)

It was not unit the first colour picture of Earth came back from space that we knew our planet

look blue and not red like mars. But little understanding of Geography may help anyone to guess (Ahove, 1998). Over 70% of the surface of the globe is ocean about 330 million square kilometers or 360 million square km when coastal water are also include. In fact all the landmass of the Earth would fit into the pacific Ocean alone and with room to space.

The ocean plays a vital role in sustaining life on Earth and the p icture that is emerging from observations world over is not comforting for modern science, the sea is the very source of life on Earth. It is so to speak, the amniotic fluid which all living forms spring. Throughout history the oceans have been vital to human civilization as a resource base, as a route to other land and other people or as an outlet for population overflow. Over 90% of the planet s living non-living resources are found within a few hundred kilometers of the coasts. On or near these coasts live two third or 60% of the world s population (UNESCO Sources, 1998).

3.1 USEFULNESS OF OCEAN TO HUM ANITY

1. Monetary

The ocean is not just a kind of vast, self-rep lenishing stock cupboard it is more like a giant economic community providing significant a resources the mar ine ecosystem is. I f we had to pay for all the services and goods the ocean provides, such as regulating gases in the atmosphere, cycling nutrients, biological control, food production, raw materials and recreation, the total bill, the authors of the analysis, say would come to about 21,000 billion U.S Dollarsa pere coastal ecosystems (IYO, 1998).

2. Food for Huma ns

About 80 percent of the wor ld s biodiversity live in the ocean, much of it undiscovered. The largely unexplored deep sea may be home to 10 million species we know nothing about. According to the United Nations food Agriculture Organization (FAO), an estimated 12.5 million fisher men vessels, land around 90 million tones of fish per year, the fishing industry provides a livelihood directly or indirectly to about 200 million people of small islands and coastal areas of developing counties, such as West Afr ica, seafood is main source of animal protein.

But according to FAO this once abundant resources has been fished near to exhaustion. FAO says, 70 percent of fish stocks are currently either fully exploited, overfished or in the process recovering from overfishing. Every year about 27 million tones of fish are thromn. Back, either because they are inedible, unwanted or are too small to be marketed . Meanwhile factory trawlers rake the seabed for bottom- feed ing species, destroying their fragile habitat rather like harvesting a vegetable garden with a bulldozer.

3. Energy from the Seas

The ocean contains a very large-but finite- reserves of fossil fuels -oil and gas that are a valuable potential energy sources. The available figures as at 1992 put global off shore reserves to 35.5 billion tones and of gas at 21.4 trillion tones. These resources are already being exploited in many parts of the world. Other potentila sources of energy include mechanical energy from

waves, tides and currents and the thermal energy from the heat stored in the sea. So far, it is the ethnological and economic obstacles to tapping these resources that makes them so expensive.

4. Minerals

The abyssal plains of the deep -sea bed in many ar eas strewn with mineral nodules- mostly made of manganese, but also containing copper, nickel and cobalt. Pipelines could, theoretically, be used to vacuum the nodules into ships, but this is till too expensive to be worthwhile. The ocean floor is also a major reserve of sand and gravel which are needed for construction.

5. New Life Fo rms

In 1993, divers explor ing the continuous seabed more than 3,500 meters under the North Eastern Pacific discovered a community of giant tube worms, and bacteria that live in underwater volcanic vents, without oxygen or sunlight, under great pressure, in temperatures well over 200C and in a hig hly toxic environment containing poisonous hydrogen sulphid e. Similar communities have been discovered in deep vents off the coasts of Japan. These new life for ms do not depend on photosynthesis, but actually thrive on the superheated, poisonous water and smoke.

Scientists - especially from the Woods Hole Oceanographic institution in the USA and the Japan Marine Science and Technology Centre (JAMESTEC) have found that these thermopile (heat loving) bacteria live in symbiosis with the large organisms, transforming the hydrogen supplied into nutrients . These bacteria have potential uses for waste treatment, food processing oil well services, paper processing, min ing app lications, and in the U.S dollars per year. Japan is already investing research into potential value is 3 billion industrial use for these new life forms.

6. MARINE BIOTECHNOLOGY

According to Elisabeth Mann Borgese, marine biotechnology may still be in its infant, but Japanese scientists, who are leaders in the fleld, have already isolated 3.000 pharmaceutical active substances from marine animals and p lants. A successful product, especially if it is an antiviral or anti -cancer drug, can be worth 1 billion U.S. dollars or more annually in world sales one such drug, used to treat herpes, currently maintains sales up to 1000 million U.S. dollars a year.

7. MARINE RAINFORES TS

In tropical areas, mangrove swamps and coral reefs provide complex living communities that protect the coastline from erosion and serve as habitats for an extraordinary diversity of plants and fishes.

Mangrove forests are resilient, unique ecosystems that provide breeding ground for fish as well as protecting coasts from erosion and the effects of storms, while filter ing some noxious chemicals. They are, however, sensitive to oil spills and disturbances to the freshwater content of their environment. In some countries, mangrove forests are being cleared at a catastrophic rate to provide space for aquaculture fishponds - do not perform the vita ecological functions of the mangroves yet create toxic effluent.

8. A VAST, INTERCONNECT ED SYSTEM

Although the oceans and their adjacent seas each have their own names, they are more like one, moving snake than the massive lakes we may imagine them to be. At the surface, warmed by the tropical sun (sometimes reaching 30c) is transferred by an ocean current towards hig h latitudes and the poles.

Where the atmosphere is very clod (for example, at the poles) there can be a major transfer between the deeper layers of the ocean and the warmer surface water. Warm water from the tropic travels towards higher latitudes, where it meets clod air. Here, some of this water evaporates (forming fog and rain) and, as a result, the surface layer becomes cooler (as low as -20c), denser and more saline. This denser water slowly sinks as it returns towards the equator on the global conveyor belt. This conveyor belt moves very slowly- about I mm/ sec taking as long as 1,000 year s for a complete cycle.

3.2 Ocean Ab use: Pollution

Without the Ocean the earth would be as barren and inhospitable as Mars. Top on the list of the catalogue of problem facing the Ocean is pollution. More than 77% of marine pollution originates from land and nine- tenths of this is concentrated along the coasts where the ecological equilibrium is incredib ly fragile. The major culprits are agriculture, waste- water and other industr ial effluents. Fertilizers and pesticides contaminate rivers and other waterways they carry to the sea oil sp ills, one among the most obvious forms of pollution.

The steel, paper, textile, and agrochemical industries, among others, also pour their effluents into watercourse as factories spew toxic gases into the atmosphere. Traces of DDT can be found as far away as Antartica. About 0% of the total atmosphere pollution falls directly into the Oceans or may be carr ied down by rain. Traces of metals. Including posonous mercury are omnipresent in Seas and Rivers. Organic and inorganic matters are increasing ly found at the extreme end the food chain, notable in the mammary glands of whales and dolphims. Plastic objects and containers of all kinds, abandoned nets and other fishing equipment lead each year to the death of millions of animals that swallow or get trapped in the debr is.

When the United Nations General Assembly agreed to declare 1998 the I nternational year of the Ocean, they hoped it would serve to draw attention to the essential, but finite resources of the Ocean and to show that there are already signs of stress from human activity, and to stimulate individuals, communities, organisations, and government to take action now to use the Ocean in ways that can be sustained for future generations. The year of the Ocean aims to obtain a commitment towards adequate protection of our Ocean resources. The health of the Oceans, and the wise, safe and sustainable use of the Ocean resources, should be an axiom for all government to accept and honour for the term benefit existence of their respective and collective peoples.

The capacity of the Ocean is huge, in terms of heat transfer, recycling so-called green house gasses linked to global war ming, absorbing pollution and sustaining marine life. But this capacity is in finite, not limitless. The Ocean is also ver y slow to react but when sig ns of stress appear, their effects can carr y on for decades, even centuries. This evidence of stress often first appears around the edges, on the coasts.

He mounting tide of pollutants dumped into the ocean is a biological time -table of unknown magnitude, with a fuse of indeterminate period, that threatens the very existence of not only Marine life, but all life on earth says Elizabeth Dowdewell, Executive Director of the United Nations Environment Programme (UNEP). An estimated 100.000 man made chemical have been introduced into our daily life. Most of them end up in the Ocean (IYO, 1998).

The UNEP global Environment Outlook as at 1998 made some alarming observations on marine pollution:

1. An estimated 75% of Marine pollutions land -based, not accidents such as oil spills but human s daily activities;

2. About 70% of the waste discharged into the pacific receive no treatment;

3. Large quantities of agricultural and other contaminants are discharged to streams that flow into the Caribbean resulting in pollution from phosphorus, nitrates and pesticides;

4. About 50% of the Countries in West Asia have an oil - based economy which supply some nations the resources to develop an extremely intensive agriculture which have resulted to the pollution of the food chain, of rives and marine areas;

An alarming 1.2 million barrels of oil are spilled into the persian Gulf each year. In addition, sewage deposit provides an overabundance of nutrients in the coastal waters, that cause algae rapidly to proliferate and decay, starving the water of oxygen, consequently the death of fish and other Marine life. Some species of algae bloom are toxic and can lead to food poisoning via shellfish.

The has led to the ban of the consumption of shellfish from some areas of Europe and North America. The drain of pesticides and fertilizer into water surface are example of what are known as persistent organic pollutants POPS. For example, the Arctic is being hit POPS arriving from other parts of the world. These are affecting the reproductive capacity and disease resistance of some predators in the region. Consequently, reports show that higher than normal levels of some of these chemicals have been found in the bodies of people in this region who have a diet rich in the fat of Marine animals.

4.0 CONCLUSION

You have learnt that our beautiful blue planet remains so as long as we take good care of the oceans of the world. To do this is for our benefits knowing fully well that we cannot fathom the depth of the benefits humanity have and will continue to gain from a clean sea.

The only choice is to keep the oceans clean and free from pollution so we get the very best from our ocean anywhere it is located.

5.0 SUMMARY

We have come to the end of the ninth Unit of this course.

So far, we d iscussed on some essential facts, that the ocean is a basic source of water on earth. Also that there is an interaction between surface and ground water- but ocean is an example of surface water. 70% of the earth is covered by ocean little wonder the earth looks blue from outer space.

We also discussed in details the relevance or usefulness of the ocean. These usefulness includes financial benefits,, food, energ y, mineral resources and discover y of organisms that would be of benefits to some aliment. This may also be solution to some d iseases that are yet to find cure.

The effects of ocean pollution and some specific pollutants were mentioned.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Explain why the earth looks blue from space and not red like Mars.
2. Discuss on any five roles the ocean p lays as benefits to human .
3. Outline global observations on the state of ocean pollution.

7.0 REFERENCES AND OTHER RESOUR CES

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UNIT 10: GLOBAL FRESH WATER

Table of Content

4.0 Conclusion

5.0 Summary

6.0 Tutor Marked Assignment

7.0 Reference and other Resources

1.0 INTRODUCTION

Fresh water is an natural resource of fundamental importance. Without fresh water life is a disaster on earth. There is no known alternative to fresh water especially for humans. No other liquid can be replace it. In this unit, our focus is on fresh water.

2.0 OBJECTIVES

At the completion of this unit, you should be able to:

- Give a profile for the global distr ibution of fresh water
- Discuss the limits of global fresh resource
- List the causes of wastage and degeneration of fresh water resource

3.0 FRESH WATER ON EARTH: GEOGRAPHICAL SPREAD

There is a large quantity of fresh water on Earth, almost 1500 million cubic kms, but most of it is useless for us as it contains too much of salt. Total amount of available fresh water on our planet is only about 84.4 million cubic kms. The total g lobal distribution of fresh water on earth s crust includ ing ground water and water present as vapours in the atmosphere is g iven in table 10. 1. much of the water on earth s surface and ground water represents deposits which have accumulated over along period of time. Its input via precip itation exceeds the output, small amounts of fresh water accumulate as left over stock in ice-deposits lakes and reser vois or underground. This is however large the deposit may be tends to disturb the natural system and the resource base in the long run and is d etrimental to the environment. (Okebukola & Akpan, 2006).

Table 10.1 Global dist ribut ion of Fresh Wat er

1.	Water in snow caps, ice sheets, glaciers etc.	24,000,000
2.	Surface ponds, lakes and reservoirs 280,000	
3.	Water in streams and rivers	1,2000

4.	Water present as soil moisture 85,000	
5.	Underground water	60,000,000
	Total amount of fresh water on our planet	**84,366,200**

3.1 FRESH WATER AVAILABILITY

One essential source of fresh water for terrestr ial life is precipitation. The moisture condenses in the atmosphere and forms rain, dew or snow which are brought back to earth s surface. Table 10.2 gives infor mation about the quantities of fresh water evaporates form earth s surface, the total amount of precip itation and annual surface runoffs. Etc.

Exercise 10.1

1. Make a list of sources of fresh water in Niger ia

Table 10.2: Annual water budget of our planets

Evaporation from sea surface	452,600
Evaporation from land surface	72,500
Precip itation of ocean surface	411,600
Precip itation on land surface	113,500
Surface and ground water runoff	41,000
Total evaporation from land and sea surface 525,100	
Total precipitation on land and sea surface 525,100	

You will observe from table 10.2 that oceans contribute about 4,52, 600 cubic kms of water annually to atmosphere but receive only 4,11,600 cubic kms as precipitations. The deficit is balanced by 41,000 cubic kms of surface and sub- surface runoff which they receive. On the other hand, land surface receives 1,13,500 cubic kms of water as precipitation. The excess amount of drained off as surface and ground water runoff to oceans so the amount of water present in sea, on land surface, underground water, water present in atmosphere as vapor etc. are in a state of dynamic equilibr ium. The excess water received by land surface, about 41,000 cubic kms has to flow back to sea- it can not be retained on earth s crust ordinar ily.

The total annual precipitation of 5, 25,100 cubic kms is not evenly distr ibuted over earth s surface at a given point of time, the amount of perceptible moisture present in the atmosphere is maximum at equator begin equivalent to about 44mm of rains. At a latitude of 400 - 500 North and South, the available perceptible moisture would e about 25mm during summers and 10mm during winters as rain equivalent. At poles this yield ranges from 2mm in winters and 8mm in summers as rain equivalent. The amount of perceptible moisture in atmosphere is subject to large var iations which depend on a number of factors. Whoever, it does make the equatorial belt the wettest zone. Rainfall decreases as we move out on either side of equator acquir ing a seasonal character

3.2 LIMITATIONS OF GLOBAL FRESH WATER

Just like any natural resources, global fresh water resources, also have their own limitations. There is a final limit upto which humankind can draw water available in various deposits on earth s crust, without damaging the natural resources base or without causing any ad verse chang es in the environment around. What is this limit? Opto what extent will the withdrawal of fresh water by humanity be ecolog ically sustainable?

We have huge deposits of fresh water on earth s sur face as well as in its sub-sur face layers. Water in these deposits is in a state of perpetual movement from one compartment to another. However, inputs in each compartment are balanced by an equal output, so that a state of d ynamic equilibrium is maintained. I f withdrawal from any of these exceeds the input, the pool size diminishes. Total annual precip itation on land surface has been estimated to be 1, 13500 cubic kms and loss via evapo-transpiration about 72, 500 cubic kms. Therefore, there is a net gain of about 41, 000 cubic kms on land sur face, which tr ickles out, drains down and flows back to the sea. This is the extra amount which can be safely used by humankind without causing any detrimental effect on ecology or environment because it use does not disturb the existing deposits n earth s surface. Any over-draft beyond this quantity either from surface deposits of ground water diminishes the natural resources base which in turn could bring about adverse changes in a drastic change and desertification follows.

Of this 41, 000 cubic kms of surplus water about 27, 000 cubic kms consist of flood flow which rush down to sea, too quickly to be of use. It is only about 9, 000 cubic kms which can serve humanity.

The ill effects of withdrawal of more water than the total annual input may be drastic. In United States, some states namely Colorado, Kansas, Nebraska, New Mexico and Oklahoma, relied heavily on the underground fresh water aquifer called Ogallala for the supp ly of fresh water. Its deple tion due to huge over-drafts in these states caused the total agricultural area to decline by 15%.

3.3 HUM AN S WATER REQUIREMENT

Water is required virtually ever y sphere of human life. It is needed for direct consumption or for washing, cleaning, cooling, transportation or even for waste disposal, I ndirectly, major sectors of human activity which require water can be grouped as follows:

- Irrigation
- Industries
- Livestock
- Thermal power generation
- Domestic requirements
- Hydro-electric generation, fishes, navigation and recreational activities.

About 3, 500 cubic kms of water are drawn for human use ever y year. Agricultural sector is the biggest consumer of fresh water. Almost 76% of the total water used by humankind has to be diverted to grow food. To produce 20 tons of organic matter in terms of fresh weig ht, 2000 tons of water have to be provided to the roots. Most of it is lost in transpiration. Water needed is 3 tons for ever y 5 tons of dr y organic matter produced. Following agriculture, thermal power generation (6.2%) and industries (5.7%) are the biggest consumers of fresh water. Domestic

requirement and livestock management taken together consume only 4.3 % of the total water drawn. Navigation, fisheries, hydro-electric power generation, recreational activities etc. also require a huge quality of water, much of which flows down to the sea.

The amount of water drawn for human use is never used up completely. A large fraction is returned to the surface deposits or stream flown often in a polluted state which can be used again as such or after treatment to remove impurities. Out of the total quantity of water drawn (3, 500 cubic kms) the amount of water irrecoverably consumed is estimated to be about 2, 200 cubic kms.

3.4 CAUSES OF FRESH WATER WASTA GES

Okebukola & Akpan (2000) outline the following issues lik able to watages and degeneration of fresh water.

- Reckless Over-Consumption and M isuse

  Water is often misused reck lessly. Taps are kept running while people do other things. Everywhere we tend to use more water than is actually necessary, often because it is available in plenty or because we can afford the wastage. Such an attitude causes over consumption and wastage.

- Polluti on of Natural Waters

  These aquatic systems have also been used as a convenient means of disposal of waste waters. Both running and stagnant waters are capable of degrading the d iscarded materials into simple and har mless constituents. However, in stagnant waters the products of decay and decomposition persist in the system whereas in running waters they are carr ied away with the water currents. With a sudden rise in human population the volume of wastes are no longer within the capable f decomposing these impurities. Most of our bodies streams can r ivers have become polluted and unfit for human use.

- Eutrophication of Nat ural Wa ters

  Eutrophication is a natural p henomenon which involves gradual enrichment of nutrient ad development of p lant and animal life in a lifeless water body. Natural eutrophication is, however, a very slow. This process is accelerated by addition of wastes and waste waters which contain plenty of nitrates, phosphates and organic matter. While phosphates and nitrates are essential plant nutrients, decay and decomposition of organic matter yield plenty of p lant nutrients. Addition of wastes an sewage causes the water body to become exceeding ly rich in plant nutrients. Blooms of algae and other organisms appear and make the water useless.

- Pollution of Underground Water table

  Underground water deposits receive their waters from surface waters which percolate down the upper strata of soil and rocks. Though soils possess an efficient biological machinery which effectively degrades impurities present in the water, a number of materials resistant to degradation as well as non- degradable matter may pass through the upper layers of the soil and pollute the underground waters. Salts of chromium, cadmium, mercury, lead etc may be present in underground waters in concentrations sufficient to cause har mful effects on a liv ing system.

- Depletion of Underground Water Table

  Pressure of demand on underground water resources has gone up considerably. Every year more and more water is drawn up from sub-sur face layers whereas recharging of underground water has been slowed down. Massive deforestation has caused disappearance of plant cover over a large area of land sur face. In the absence of plant cover, most of the rain water flows fast and down quickly in streams and rivers. Little of it percolates down to sub-surface layers to recharge the ground water stock.

3.5 MANAGEMENT OF FRESH WATER

The follow management techniques we d iscussed by Okebukola and Akpan (2000) for effective fresh water conservation.

- Water Economy, Re-Use and Recycling

  Much of the surp lus water is returned to sur face flow in an impure state. A little can be done to reduce the over- consumption. We waste because of its easy availability. If a water meter is installed and money charged for every bucket of water we use, water consumption in domestic establishments, livestock management and industries would drastically decline.

  Power generation is another sp here of human activity where in a large amount of water is needed. Most of it, however, is used as coolant (about 90-95%). Irrecoverable consumption is only 5-10%. Water used once may be used again for another purpose. All processes do not require good-quality water. Agricultural runoffs from fields can likewise be used to irrigate land down the stream while an efficient use of water with conditions of proper drainage can sig nificantly reduce the agr icultural runoffs.

- Development of an efficient distribution system

  Water resources are not distributed evenly. Therefore, transport of water from one place to another becomes an essential part of water conservation efforts. Many river basins have plenty of water which flows down unused to the sea. This surplus can be diverted to dry regions through a system of canals and pipes. Water drawn out from underground water can not be transported to zones where underground water can not be tapped.

- Reducti on of Pollution and Recycli ng of Water

  Pollution spoils hug e quantities of our surface water. All possible efforts should be undertaken to divert waste waters to some treatment plant instead of releasing them into our surface waters. While treated water can be safely discharged in our aquatic systems, it also may be recycled where there is more pressing need.

- Enha ncement of Surface Storage Cap acity

  About 27, 000 cubic kms of fresh water which rush down to the oceans through streams and rivers of the world as flood flow are of no use to humankind. We can store this water in tanks and reser voirs for use during dr ier seasons. This can be done by erecting embankments and dams which check the flood-flows and detain water for longer duration on land surface. Through a system of pipes and canals the water can be supplied wherever needed. The potential energy, the energ y of water flow as it moves from a hig her place to lower may be

used in hydroelectric power generation, while the reserviors which develop behind the dam may be used for fisheries and other recreational activ ities.

- Improvement of Underground Storage Capacity

An enormous amount of fresh water is stored in underground deposits. It represents accumulation over a long period of time. Every year, about 10-15% of total precipitation enters the ground water table. These deposits reg ularly feed streams and rivers dur ing periods.

Groundwater deposits are cheap and easily obtainable source if freshwater-except for the cost involved in its withdrawal. We can improve the ground water storage capacity of earth crust by providing an effective plant cover over the soil surface. Plants obtains most of their water from soil moisture and keep the surround ing cool and humid, thereby, preventing loss of excessive water through evaporation.

- Augmentation of Existing supplies of fresh water

Many regions of the world with scanty rain fall have no other choice but to augment their water supplies buy other means. This can be done by:

(i) Desalination of sea water: A huge store of water exists in our ocean. Only if the salt content of sea is removed we can use the water for consumptive purpose. This can be done by desalination p lants, which are essentially huge distillation sets operated on solar energy. Desalinization plants are alread y under operation in many countries. However, these plants are ver y expensive.

(ii) Artificial rain making: in general only 20-30% of the moisture content of atmosphere over a locality precipates as snow or rains. It has been observed that clouds with temperatures ranging between 50-200C nearly always lack condensation nuclei over which moisture condenses to form droplets of water. Small particles of substances like silver iodide, sodium chloride, dry ice (solid C02) etc, are injected into a thick layer of clouds (cumulus clouds), around which moisture condenses and droplets of water form which sink down as rains. In a number of countries active experiments are being carr ied out in this direction. However, the process of artificial rain making is still in an experiment stage.

4.0 CONCLUSION

95% of world s water is in the ocean. The rest is in snow, ice, bodies, of fresh water and ground water comprise the rest. Fresh water sustains the value of life.

Jus as we take the air we breathe for granted, we hardly think of our dependence on fr esh water. We worry for too regular ly about its pollution and effects per haps since water comes to some of us so cheaply and easily. Yet many rural dwellers spend up to six hours a day retrieving water from distant, and often polluted streams, so far, no dead ocean has been found, rendered lifeless from human waste. But several lakes, r iver, around the world have been read their last rites in just the past 40 years. The challenge now to you and I is to resurrect them and keep others from similar exper ience.

5.0 SUM M ARY

Much of the water on earth s surface and underground water represents deposits which have accumulated over a long period of time. An important sources of fresh water terrestrial life is precipitation. Like all other natural resources, global fresh water resources, also, have their own limitation.

Irrigation, industr ies, livestock, management thermal power generation, domestic requirement, and hydro- electric generation are some sectors of human activity which require water. The future estimates of water consumption provide a grim picture. Reckless over consumption and misuse as well as pollution of natural waters are some of the causes of wastage and degeration of fresh water resources.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Outline and d iscuss five causes of fresh water wastage and degeneration
2. Mention and Explain four Management Methods of fresh water conservation.

7.0 REFERENCE AND OTHER RESOUR CES

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UNIT 11: SOLID WASTE MANAGE MENT

Table of Content

1.0 INTRODUCTION

This unit is the beginning of another module. This module will focus on waste management related issues energ y and biotechnology

The goals of unit 11 however is to stimulate discussion and cr itical think ing on what constitutes waste categorize solid waste and highlight management techniques.

The last century and especially after the second world war there has been a dramatic increase in the production of waste, ind icating unprecedented g lobal levels of economic activity. This can be attributed to the industrial and scientific revolution that proceeded world War II , especially in contemporary developed nations. The increase in waste stream of western economies can be attributed to factors such as cheaper consumer products, the proliferation of packaging chang ing patterns of taste and consumption, and the demand for convenience prodcts (Gand y, 1994)

2.0 OBJECTIVES

At the end of this unit you should be able to

- State the definition of waste
- Mention solid waste categories
- Highlight strategies for managing waste

3.0 DEFI NITION WASTE

Several definitions have been mentioned of what constitutes a waste or what a waste is. These

defin itions vary from individuals based on their perception of waste. Barrow (1993) says waste is something for which we have further use and which we wish to get rid of. From this definitions a waste is any mater ial we wish to dispose off, but these materials any still be very useful for other purposes but may not be, for the individual that wants to dispose it or perhaps he does not realise its economic value. On the other hand the individual who wants to dispose it may realize the usefulness or economic value of the waste but may be realize the keep the mater ial any further as a possession for whatever reason that is reasonable enough for that individual.

Barrow (1993) defined waste as any damaged defective or superfluous materials that any end-up being hazardous. Waste can be defined as, what we assume to be no longer of use to use (Osuafor, 2000). She argued that as long as a commodity, which may even be value, is too much to contain it becomes a waste.

Waste is any substance for which the user have derived benefits from and needs be disposed , or has perceived that the substance or materials is not of value or importance to him and therefore wish to dispose off. This does not imply that the perceived waste is useless, except by the user who has disposed it or may realized its useless but that usefulness may not be meaningful or important to the individual who has disposed it.

Production of wastes is inevitable, this is because most environmental wastes are by- products of inevitable and profitable human activities upon which our continual sur vival hinges on and the demand for improved quality of life. Faced with this need, the challenge before us is to evolve techniques of manag ing humans, numerous waste without depriving future generations of their benefits from the environment. This develop ment will go a long way in minimizing waste s negative impact on the physical environment, and will lead sustainable development.

3.1 WASTE CATEGORI ZATION

Waste may be categor ized on the basis of sources of generation, which include;

I Domestic waste

Ii Industrial / Agricultural waste

Iii Mining and Exploration waste

Iv Nuclear waste

Another form of classification of waste could be based on its state. This implies;

I Solid waste

Ii Liquid waste

Iii Gaeous waste

3.2. SOLID WASTE: A Critical Review

Solid waste according to Douglas (1992) is an extremely heterogeneous mixture of constituents that appears to vary according to season, the solid characteristic of the neighborhood and which has changed lifestyles. But Miller (2000) defined solid waste as any unwanted or discarded mater ial that is not liquid or gas. (2000) says solid wastes are non- liquid, non-gaseous residue from manufacturing industries, construction firms, cooking recreation or agriculture. Solid wastes generated from a number of sources , which include homes, hospital, schools, market businesses and a few other, are referred to as MUNICIPAL SOLID WASTE.

3.2.1 CLASSIF ICAT ION OF SOLID WASTE

S/N	Types	ESSENTIA L COMPOSITION	SOURCES
1.	Agricultural waste	Harvest residue, garden prune, manure, Anima waste dead fish Abattoir waste	Animals farms, farms Animals feeds, Abattor
2	Abandoned Vehicles	Bicycles. Automobiles & Trucks	Homes Mechanic workshop Road sides
3.	Construction & Demolition waste	Lumber concrete, empty cement bags, plaster, tiles. Roofing pipe, roofing sheets, planks, conduit pipe wire	Construction & Demolitions sites
4	Industrial wastes	Scrap metal, p lastic paper fly ash (removed by air -pollution control equipment in industrials &electr ical power plants), cinders, sludge from industrial waste treatment plants, glass	Chemical industries, g lass industries manufacturing companies
5	Municipal Solid waste		
6	Organic waste	Waste from cooking and cooked food or left over papers, wood, unused wooden furniture, rages, cartons, flowers, trees dead pats.	Street, parks beaches, households institutes & businesses in or near urban places
II	Inorganic waste Incombustible	Metals, cans metal foil, stones, ceramic, g lass	Same as above

	Combustible	Rubber, plastic nylon, leather	Same as above
6	Mineral waste	Earth & Rock from mining extractive and relining	Mines, process & mineral refunding p lants.
7	Radioactive/ Hazardous waste	Pathological waste, explosive, radioactive materials poison hazardous chemical & pesticid es	Industries and Institutions
8	Sewage treatment residue	Coarse screening, grit septic tank sludge & chambers	Sewage treatment plants

Solid waste constitutes a major problem to countries world over. The United States, with about 4.6% of the world s population produces about 11 billion tons of the worlds solid waste miller, 2000). On the other hand, Nigeria with about 2% of the world s population (120 million) generates about 12 million tones of solid wastes. This pred iction is based on the estimate of Eko (1997) that the averaged solid waste generated by Nig eria with a population of 100 million was found to be 10 million. This implies hat on the average each individual will generate 10 tones of solid waste per year. The population of solid waste collection and disposal has become one of the most intractable environment problems facing us today especially in many of our urban areas.

3.3 STRATEGI ES FOR MANAGING WASTE

There are several strategies used for managing waste (Ahove,2007)

(1) Open dumping:_ That is, deposition of solid and liquid waste in a land d isposal site, left uncovered, with little or no regard for control of scavenger, d iseases, air pollution, aesthetics and water/ and pollution problems.

Advantage

(1) Very easy to operate within a short period

(2) It is not expensive

Disad vantage

1. It is a disease breeding strategy
2. It results in air - pollution when burnt
3. The leaching results in contamination of groundwater, and surface water.

4 The bad odour and contaminated water can affect man, animals, and plants. (quite unsightly)

5 Land use becomes a big problem

1. Sanitary Land Filling: It is an upgraded version of open dump ing strategy. Here, the land

site is located. The waste are spread in thin layers, compacted, and covered with a fresh layer of soil

Advantages:

1. It minimizes pests and aesthetic loss, d iseases, air-pollution and water pollution problem
2. It is good for land reclamation or it enhances the land value

Disad vantages

1. If not well managed, it can degenerate into open-dump
2. There might not be space for land fill site, because of human activities (house construction, far ming etc)

However, it requires a high level of commitment, changed attitude and sincerity of purpose.

3. Secured Land fulfilling: The use of a land storing hazardous solid and liquid wastes, usually stored in containers and buried. Such sites are restricted and monitored.

Disad vantages: Not safe for neighboring inhabitants

4. INCINERATION: a strategy in which solid liquid or gaseous combustible material is burnt on a piece of land (in a pit) or in a container.

Advantages:

1. It reduces the volume of waste by 8%
2. It removes odours and disease carr ying organic matter
3. It needs little land space

Disad vantages:

1. It is expensive and needs skilled labour.
2. If not well managed, it result in air- pollution and respiratory disease because of discharge of carbon monoxide, sulp hur dioxide, poisonous gas and harmful particles.

5. Co mposting: Dumping of boi- degradable solid waste into prepared pits, later covered with top solid, all allows to breakdown (through bacteria) to produce a humus-like end product

referred to as compost such biological decomposition of organic wastes under- controlled cond itions requires that wastes besotted to garbage pack

Advantages:

It converts organic wastes to solid conditioner, or for fertilization.

It improves crop yields

Disadvantage

Where the wastes are not properly sorted our before dumping some undercomposed metallic objects and nylon can obstruct plants growth.

6. Resources Recovery Plant Usage

This strateg y turns waste to useful resource health. There are 2 ways;

(a) Low Technology Approach: this requires homes and business houses to deposit recyclable waster paper, glass, metals and food scraps into separate containers for onward transportation to scrap dealers, compost plants manufacturing plants for recycling.

(b) High Technology approach: This requires collection trunks to transport mixed urban wastes to plant sites where they are spread and sorted out to recover glass,, iron, aluminum, and other valuable items which are later recycled to produce new products for market value. Other combustible wastes are later burnt to produce steam, hot water, electricity, etc.

Advantages It turns household, agricultural and industrial wastes to useful mater ials. .

Disadvantages: It can cause air- pollution if not properly managed.

Exercise 11:

Find out from 5 people each from

(i) Your class mate

(ii) Office mate

(iii) Members of your community on how they dispose their waste.

Nuclear and Toxic waste Disposal: Nuclear wastes are radioactive materials which are dangerous to most forms of life. Nuclear industries and uranium mills generate them

Toxic wastes are garroted from toxic chemicals and metals, which are poisonous to human being and the wildlife. Examples of metal wastes, which could be toxic are lead, mercury, cadmium and ar senic Toxic pesticides include DDT, aldrin, lindane, endosulfan, potassium and phosphine.

Disposal Methods:

Since majority of highly radioactive waste takes a number of years to decay, disposal takes

different for ms:

1. Dumping wastes in Poor countries e.g. The koko Waste dump of 1988. A German ship THE LINE, dumped toxic wastes at koko fort in Delta State of Nigeria, before it was removed back to EUROPE in same ship.

2. Storage in stainless steel tanks: The ultimate goal is soliciting the waste in glass through nitr ification. Such tanks are constantly cooled and monitored for a length of time

3 Exporting nuclear wastes to deserts in exchange for nuclear technological know- how e.g. Germany exports (waste to China for bur ial in G obi Desert

i) Effects of Nuclear & Toxic waste Disposal the effects are numerous on man, the flora and fauna of our environment, health problem such as convulsion, dermatitis, irritation of nose/ throat, anemia, skin burns, chest pains, blood disorders,

ii) Compulsion of manufactures to label their products with adequate disposal instructions (e.g. cans, yogurt, pure water e.t.c

4.0 CONCLUSION

Waste has been and will perhaps remain the focus of environmental attention and research for the fir st quarter of this century. This pred iction is based on the realization world over of the hazardous effect of mismanagement of waste on biodiversity, environmental quality and especially on human health. The search for improved quality of life scientific and technolog ical development, cum the problem of population stress on the environment will continue to make waste and its management a central focus for discussion. Critical in our better management of waste is the need of emp loying sustainable waster management techniques, which is an index to liv ing sustainable and economic enhancement.

5.0 SUM M ARY

Am sure you can now fate at least two definitions of waste and explain what is solid Waste. A side from these definitions we have able highlighted categories of solid waste which include among others agr icultural waste, municipal mineral and industrial waste.

Strategies for managing waste discussed for this study includes open dumping, sanitary land filling and composting among others the advantages and d isadvantages of these techniques were also discussed.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Critically review the definition of waste
2. Mention three waste management techniques

2b. State two each of the advantages and disad vantages of the methods mentioned above.

7.0 REFERENCE AND OTHER RESOUR CES

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UNIT 12: RECYCLING: A NEW REVOLUTION

Table of Content

1.0 INTRODUCT ION

The heart of the matter in waste management is recycling. I f we don t take it to heart the world would be really a filthy p lace to stay. This unit therefore seek to take you on a discussion tour in explain the concept of recycling and steps government and indiv idual you and I must take.

Since recycling is the heart of the matter in waste management, my question to you is what is in your heart?. Therefore the heart of the matter is a matter of the heart.

Recycling must be the matter in your heart. Enjoy your study.

2.0 OBJECTIVE

At the end of this unit, you should be able to

- List and explain examples of waste recycling.

- Discuss the economic factors that influence waste recycling.
- Define the concept of life cycle analysis
- Outline the roles of individuals and government towards recycling.

3.0 waste recycling: essential clar ification

Akpan (2001) says recycling is the collection separation, clean-up and processing of waste substances to produce economically valuable mater ial or product. Recycling can occur within the manufacturing process, like the paper industry where surplus fibres, mill off-cuts and damaged paper rolls are recycled back into pulping process. Also recycling takes place after usage where paper can be gathered, separately or extracted from the waste and then re-enter the paper making process. The benefits of using recyclable materials means that there is reduced savings in the production process, reduced emissions to air and water and on to land. Recycling may not always be the best environmental or economic option for a particular type of waste, so a full analysis of the processes involved in recycling versus treatment and d isposal must be made.

3.1 HOUSEHOLD WASTE RECYCLING: AN OVERVIEW

The composition of household waste is shown in figure 12.1

Diagram

Fgi 12.1: Typical composition of collected household waste in the U.K source : waste

management paper 28, recycling department of environment, HMSO. London 1992.

The theoretically recycling components include paper and board plastics glass, metals and putrescible materials. However, in some cases it is possible to recycle some of the wastes due to contamination.

Exercise 12. 1: Make a pie chart that similar to the on e above indicating a possible composition of household waste that may be generated within

(i) Your home

(ii) Your immediate community

Asid e from the putrecible waste such as food and garden waste that makes up over 20% of household waste, and it is estimated that about 50% of this material are potentially recyclable through the composting technique.

The recyclable mater ials present in household waste in ever y heterogeneous mix and the separation of the materials is one of the major reclaim the materials separately. (i) Bring Method and (2) Collect Method (Akpan, 2001).

- The bring method involve the segregation of recyclable materials for examples, pap er, plastic and g lass bottles, metals and textiles from household waste by the public delivery to a centralized collection pool.

The pools may be for bottle and p aper banks situated at the local mater ial or the local scrap merchant.

This method has a low advantages cap ital costs, easily accessible and can provide an easy method of segregating clean readily marketable materials.

Disadvant age: the take up of the schemes by the public can be low. In addition, the site can become unsightly with litter spillage and can be an attraction for vandalism.

- The collect method involve house to house kerbside collection of designated recyclable mater ials, source-separated by the householder and p laced in separate containers. Advantages: The Collect system is a convenience for the householder and hig her recovery rates of recyclable materials. Disad vantage: The collection costs are higher in that separate collections or purpose built vehicles with separate enclosures are required.

In addition, costs associated with the sorting of the mater ials and transport to the reprocessing facility are extra costs. However, these may be offset by the income from the sale of the recycled materials.

Exercise 12.2: Find out having discussed with literates (10) in your community on:

1. Which of the two systems would be suitable in our community?
2. Give reasons for their position.

Asid e from the br ing and collect methods are centralized materials recycling facilities where the household waste is brought to a central plant for recycling. The waste can be separated into recyclable materials, partially segregated or completely unsegregated.

The number of components in the waste will be influence the sorting and sep aration technology or manpower required for the mater ials recycling facility. Recycling facilities for unsegregated mater ials are designed to process household, commercial, and industrial wastes. Inevitably, the mater ials are contaminated, for example, with broken glass, food stuffs, etc, and recovery rates or recyclable materials are low.

The stages of separation include trammel screening, mag netic separation and manual sorting. Manual sorting is necessary to separate different types of plastic and d ifferent coloured glass, although the trend is towards an increase in mechanization of the process. An unsegreagated municipal solid waste mater ials recycling facility would recover approximately 15% of the waste stream as usable materials.

The remaining 85% is largely organic and can be used to produce a .

Fuel (refuse derived fuel, RDF), converted to compost or land filled

3.2 INDUSTRIAL WASTE RECYCLING

Industrial waste recycling involves direct recycling, where waste materials is recycled back into the manufacturing process in -house within the factory. For instance, broken glass would

normally be re-melted in the production process. Also, plastic off-cuts and scraps are also recycled during the manufacturing process. Other industr ial sources of waste are routinely recycled within industry.

An example is agricultural waste which is mostly landfilled or used as animal feed, and consequently the material does not enter the general waste pool of the community. Similar ly, construction and d emolition waste is often recycled on -site as aggregate or ballast in the construction of new buildings.

Other industrial wastes are often recycled, but ind irectly, as post-consumer waste. Commercial and industrial wastes are by their nature, very var iable in composition. Commercial waste would include waste from shops, offices , restaurants, and institutions such as schools. Office waste contains a hig h proportion of waste paper while resturants will have hig h proportions of putrescible waste, but also glass, metal cans and plastic packaging.

Industrial waste will be heterogeneous in its composition, and depends the product being made. Many large companies have separate waste collection and disposal arrangements, which may include recycling.

3.2.1 Plastics waste recycling.

Plastic polymers forms the majority of waste and the volume and types used is increasing interesting. The two basic types of plastic. Thermop lastics, which soften when heated and harden again when cooled. Thermosets, which harden by cur ing and cannot be re-molted. Thermoplastics are by far the most common and most recyclable.

Table 12.1 examples of applications of some plastics (see Warmer Bulletin 1992)

Plastic type	Typical application
High density polyethylene (HDPE)	Bottles for household Chemicals, bottles cap Toys housewares
Low density polyethylene (LDPE)	bags, sacks, containers
B. Thermosets	**Automotive electrical**
Epoxy resins	equip ment adhasives.

There are six main p lastics which ar ises in municipal solid waste. These are high density polyethylene (HDPE), low density polyethylene (LDPE), polyethylene, terephthalate (PET), polyprop ylene (PP), polystyrene (PS) and polyvin yl chlor ide (PVC). Separations of the plastics from waste is mainly by hand, either by the householder pr ior to collections or at a mater ials recycling facility. New development attempts to automate the separation scheme for segregating different types. For example separation schemes for segregration p lastic types using X-ray senses have all been researched (see Basta et al, 1995).

Recycling of plastics in municipal solid s waste is limited in practice to plastics containers, since the remaining p lastic is in the form of film which is difficult to separate. The separated plastic mater ial is processed by the end user by being granulated or palletized. Melted or partically melted and extruded to form the end product. The recycled p lastic may be added to virgin p lastic during the process. Outsets for single types of recycled p lastics include HDPE, PVC and PET.

Applications for plastics mixtures have included plastic fencing, traffic cones, and garden furniture. There is resistance from the customer market for recycling plastic to produce film which may be needed for food packaging because of the perceived associated health hazard.

The low-grade uses for mixed plastic recycled mater ials has led to research into alternative processing methods to produce high value products. One example is via tertiar y recycling of feedstock recycling where the plastic waste materials are petrochemicals that can be used as feedstock to make virgin plastic. The process has the advantage that mixed plastics can be used since all the feedstocks is reduced to petrochemicals. The plastics is identical to virgin p lastic and can therefore be used in any app lication.

3.2.2 Glass waste recycling

Glass bottles, jars, and other containers is made up of about 6-8% of household waste stream.

The recycling of glass container is well developed in some countries via the Bring method, with householders delivery to bottle bank s. The bank may be categorized in terms of the colour of the glass.

To overcome the problem of var ious colour glass and the need for sorting, a process method has been developed in which clear glass is covered with colour organic coating which, when the glass is being recycled, simply melt away. The outcome is that there is no need for coloured glass to be manufactured and consequently no limit to the amount of cullet which could be recycled.

Glass is manufactured from relatively cheap raw materials (silica sand, limestone and sodium carbonate), and it is energy intensive.

But glass recycling reduces the energy used since recycled glass melt at a lower temperature than the raw materials.

The techniques of waste g lass consist of several stages. The glass from the bottle banks is delivered to the recovery p lant and sorted by colour. It is then sorted by colour in separate bunker until required, when it is fed to conveyer belts, where ferrous materials such as bottle caps are removed by magnetic separation, and hand-sorting is to remove other unwanted contaminants.

The g lass is then crushed and screened and light-weig ht non-ferrous contaminants such as aluminum caps, plastics and paper labels are removed by vacuum suction. The crushed processed glass is then available for recycling into the glass making process(Akpan, 2001).

3.2.3 Paper Waste Recycling

The majority of recycled paper and board, about 88%, comes from commercial and industrial wastes streams and the remaining 12% from the domestic waste stream. The reprocessing required depends on the grade of paper collected as waste, ad the end-use. The hig her quality grades, collected for example, as paper mill production scrap pulp substitute for use in app lications such as printing paper tissues. Intermediate grades of waste paper, such as newspaper, require further processing to de-ink the paper and can be recycled back into the newspaper industry for newspr int. Low quality waste paper is used main ly for packag ing mater ial.

The recycling process used depends on the categories of waste paper and the end product. Initially the paper is pulped, followed by various stages of screening to remove contaminants, de-inking and further processing to clean and thicken the pulp. In the case of higher quality papers, a final bleaching stage may be include.

Recycling waste paper reduces the need for wood pulp from trees, but in some cases the wood is harvested as a commercial farming crop and recycling would clearly influence this market. In add ition, recycling can reduce the energy requirements by up to 40$ and water consumption by 60%. Also, emissions to air and water and solid waste can be reduced recycled paper is used in comparison to virg in paper.

There is a practical limit to the number of times that paper can be recycled because the fibres eventually break down or become too small for the paper making process. Estimates suggest that a maximum number of four recycles would be possible (Akpan, 2001)

Reflection

Do you know any recycling waste paper industry in Nigeria?

3.3 ECONOM IC OF RECYCLING

Waste recycling depends on several inter -related requirements, all of which has to be in p lace for an economically successful scheme to be attained.

These conditions are:

- A secure and stable supply of waste substances
- A suitable collection system and transportation to the recover y p lant
- A reliable materials separation and clean-up process to produce the end recycled markets

for the raw materials and products.

- Secure and stable market for the raw material and products.

Secure and stable supplies of waste are required for the market to invest in the long-term development of recycling process facilities.

Over-supply of waste or loss of markets for the end recycled products means that disposal costs for the treatment of the un-recycled waste become a factor in the assessment of the economic appraisal of the project.

The collection and transportation of the waste to the recycling facility should also be stable and able to undertake preliminary sorting of the waste.

Contamination of the materials is also a factor in determining the economic viability of a recycling scheme. Placing non-recyclable waste into the recycling collection container can mean at best an important increase in the time required for sorting and a consequent increase in costs, and at worst the scraping of the whole container load. The level of contamination by dirt, grease, food waste and so on, the recyclable materials means an increase in the level of clean-up of the materials and a further increase in costs.

Recycled materials, like any other commodity traded in the market place, are subject to supply and demand with the additional proviso that there will be competition from virgin materials. In addition, some recycled materials are traded internationally and therefore subject to competition from recycling schemes in other countries which may be subsidised or which produce recycled materials of higher quality.

The terms diversion rate and cost difference have been used to compare the costs of recycling.

Diversion Rate (%) = A/B x 100

Cost difference (%) = $\frac{C - D}{D} \times 100$

Where A = Amount of material recovered as recycled materials.

B= Total amount of waste generated

C= Cost of waste management with recycling

D= Cost of waste management without recycling

Exercise 12.3

What does a cost difference of -5% imply?

3.4 LIFE CYCLE ANALYSIS CONC EPT

Life cycle analysis is the analysis of a product is lifetime to assess its effect on the environment. The idea of life cycle analysis is a useful one on waste management and aid s in the determination of whether waste re- use, recover y or disposal is the best practicable environmental option. The life cycle analysis of a product involves making detailed measurements during the manufacture of the product from the mining of the raw materials, including the energy inputs used in its production and distribution, through to its use, possible re-use or recycling, and as final disposal. Akpan (2001) stressed that defin ing the boundaries of the life cycle analysis and the methodolog ies is vital, since it may var y from analysis to analysis. For example, some analysis have included the environmental impacts in terms of emissions to air, water and on to land when the final waste is disposed of in landfill compared with incineration. Others may include the life cycle analysis of the machinery used in the manufacture of the product.

3.5 PERSONAL STEPS ON RECYCLING

The following measures are recommended for every citizen:

- Learn what is and not recyclable, and what products recycled goods are used in.

Glass: Clear, amber, and green glass is recyclable; milk-white g lass, plate glass, light bulbs, fluorescent bulbs, and crystal are not.

Paper: Recycle all newsprint, corrugated boxes, egg cartons, telep hone books computer cards, and print-out paper. Waxed or plastic-coated cellophane cannot be recycled.

Aluminum: Recycle all cans, foil, TV trays, ice cube trays, aluminum, siding, widows, and lawn furniture.

Metals: Test all metals a magnet. If the magnet does stick to them, they can be recycled. Most ferrous metals, lik e cast iron, steel sheet metal, tin-coated metals cans, can be recycled. For non-ferrous metals like nickel, bronze, copper, brass, and lead first check with your recycler.

Pla stics: recycle all p lastic containers.

- Precycle: A new concept, it implies simply that you should consider the end result of ever ything you buy and where it will eventually rest. Choose products carefully, consider the environmental impact of each. It is safe? Is it reasonable? Is it recyclable?

- Consider designing or redesig ning your house/life style to accommodate recycling.
- Encourage recycled and recyclable goods at work, includ ing all stationary, brochures, and catalogues, as well as buying recycled packaging.

3.6 GOVERNMENT STEPS ON RECYCLING

- Recycling laws should be adopted by all tiers of government.
- Recycling operations should be provided with guarantees of minimum supplies, similar to those alread y offered to incinerators and landfill operators.
- Higher taxes should be imposed on non-recyclable or disposable products.

4.0 CONCLUSION

A study of the hierarchy of waste management shows that waste reduction is at the top, followed by re-use, recovery, and finally disposal.

Thus, the primary solution to the world s mounting garbage problem is source reduction. This means the less we create, the less we have to throw away. Reducing the amount of waste generated by placing limits on packaging and restricting the use of disposable products must priority of every nation s community s and individual s list of environmentally wise things to do. Next, we must beg in to re-use as many products as possible, from bags to boxes, and anything else that may have a life other than in the dump. Third, recycling must emphasized at home, work, and in every neighborhood. It is no longer a chore for hipp ies only, instead, what is gradually emerging across the world is a broad recycling structure initiated by government, private enterprise, and new technology.

Various urban governments are desig ning new sys tems for separating the variety of recyclables. States, localities, and private companies are building or contracting for such systems. Mandatory recycling laws are finally in a state of transition. It is time for the giant of Africa to be truly giant by being in the forefront of recycling technologies in Afr ica.

5.0 SUM M ARY

In this unit we have learnt that, recycling is the collection, separation, clean-up and processing of waste materials to produce a marketable mater ial or product. The segregation of household

wastes fore recycling may be carr ied out by the Bring and the Collect system. Recycling facilities also exist for unsegregated waste. Technologies have also been developed for recycling industr ial and commercial waste. Plastic, glass, paper, metals and tyres are examples of items that can be recycles. Some economic considerations influence waste recycling. In order to determine whether recycling or another waste management procedure is the best practicable environmental option, a life cycle analysis of a product is often carried out. Both the ind ividual citizens and government have important roles to play in the implementation of recycling programmes.

6.0 TUTOR M ARKED ASSIGNM ENT

1. Mention and explain three examples of waste recycling.
2. State 3 responsibilities each of individual and government towards recycling.

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UNIT 13: GLOBAL ENERGY CONSU M PTION

1.0 INTRODUCTION

In this century global environment issues cloud significantly influence pattern of energy use around the world. The goal of this unit is to create the awareness and realization of energy consumption pattern around the world - developed and developing nations

2.1 OBJECTIVES

At the end of this unit you should be able to

- List sources of energ y
- Mention nations that consumes more energy
- Differentiate electricity consumption pattern between developed and develop ing nations

3.0 GLOBAL ENERGY CONSUM PTION

Overview of global energy use

In the next thirty years wor ld energy use is likely to reach as much as 70 % Jennings 1996). It has been predicted that humankind year use an amount of fossil fuel that it took nature on average about one million years to produce. In 1990; global energ y expenditure amounted to an

annual 1. 3 billion Tones (Bt) of coal equivalent, four times greater then in 1950, and twenty times more than in 1850. (Okebukola & Akpan, 2003)

In 1992. 74.6 per cent of world energy came fr om fossil fuels, 13.8 per cent from biomass (wood, crop wastes, dung, etc) 5.9 per cent from hydro-power and 5.6 per cent from nuclear energ y (British petroleum 1993) About 1,200 million people living in developed countries consumed over two -thirds of this total energy supply, while less than one-third went to the 4,100 million people in the developing world so you realise that we are not the problem of energy consumption. So why so much consumption by developed nation over the past five year world energ y demand has increased by 35 per cent. Together, the USA, the largest producer of commercial energy and the for mer USSR, ranking second, account for all most 40 per cent of the world s energy supply. China is third in rank. Producing .8.8 per cent Africa produces 6. 4 per cent, and South Amer ica 4. 3 per cent.

Reflection

Can you compare USA and Afr ica consumption of energy country A countr y vs. continent

In terms of energy consumption, the USA is first in rank. In the USA per capita energy consumption is 320 g igajoules per annum (GJ yr- 1), a fall of 4 per cent during the past twenty years although total consumption has increased the by 17 per cent over the same period, but with its energ y intensity (energ y use per unit of economic output) showing a 17% decrease. By comparison, per capita per annum energy consumption is 9 Gj in India, 23 Gj in China and less than 1.5 Gj in the nineteen lowest rank ing countries, sixteen of which are in Africa: this same group of countries obtain 83-96 per cent of their total energy from tradition fuels. For recoverable energ y reserves, the following figur es are taken from the report by the World Resources Institute in collaboration with the United Nations Environment programme and the United Nations Development Programme. Global recoverable energy reserves are dominated by the USA and former USSR, with southeast Asia and countries around the Persian Gulf controlling 57 per cent of proved recoverable petroleum reserves: Saudi Arabia probably controls about 26 per cent. The former USSR controls 42 per cent of proven recoverable gas resaves and the Persian Gulf 25 per cent. In terms of hydroelectric power generation, the USA

(14 per cent.) and the for mer USSR (10 per cent) lead in installed capacity.

Exercises 1.3.1

1. What is Nigeria s crude oil reserve
2. What is the country s daily production

The consumption of energy in developing countries is r ising rap idly and by the end of this decade will dominate energy markets worldwide. In a report released in April 1994 by the International Energy Agency energy consumption in East Asia is expected to grow by about 150 per cent by 2010, while in the twenty two countries that belong to the Organization for Economic Co- operation and Development (OECD) for the same period the increase is predicted to be 28 per cent. Based on these energy consumption figures, by 2010 carbon dioxide emissions are expected to increase by as much as 160 per cent (to 2.6 Bt yr- 1) in. east Asia, and by about 29 per cent (to 13.4 Bt yr) in the OECD countries Even allowing for a growth rate in the demand for energy in the develop ing countr ies 1-2 per cent lower than the present trend, global demand is likely to exceed 100 million barrels a day of oil equivalent (mbdoe) by 2010, and possibly 200 mbdoe (peick ering and owen, 1997)

Coal, oil and nature gas account for 74.6 per cent of the global energy used with nuclear fuel supplying most of the remaining needs. Under-developed and developing nations, however, still tend to rely heavily upon other fuel sources such as wood, crop waste and dung. Oil accounts for roughly 38 per cent of commercial energy consumption, with natural gas contributing 20%. The growth in world energ y demand has stalled since 1990, mainly because of declining energy consumption in non-OECD Europe. Energy data for 1989, from the United Nation Statistical Office, provide a useful break down of the energy production and consumption by region and fuel type. Again, the industr ialized countries, especially the OECD countr ies consume substantially more liquid fuels than they produce and have a smaller but nevertheless negative balance of gas and solid fuel, a situation that is less common in developing countries. Coal remains the prime energy sources in Asia and Australia. While oil and gas account for more than 60 per cent of demand in all other regions.

Perhaps the biggest challenge for develop ing countries in relation energy consumption is to develop and implement technologies that help reduce the emissions of gases and particulate matter (dust and smoke), which have both local and possible global environment impacts. It is important that societies endeavor to use preferentially those energy resources that create the least pollutants as by -products.

Exercise 13.2

Arrange the following energy sources in order of increasing environment friendliness natural gas, coal, Petroleum oil What is the implication of your arrangement on energ y consumption patterns in Niger ia?

The way which developed countr ies provide their energy services to the developing world is important for the following reason (outlined by the US Office of Technology Assessment (OTA) 1992b).

3.1 GLOBAL ELECTRICITY CONSUM PTION

In the international Energy Outlook 2002 (IE02002). Worldwide electricity consumption is projected to increase at an average annual rate of 2. 7 percent from 1999 to 2020. The most rapid growth in developing Asia, where electricity consumption is expected to increase by 4.5 percent per year over forecast horizon. Robust economic growth indeveloping Asia is expected to lead to increased demand for electricity to run newly purchased home appliances, such as air cond itioners, refrigerators, stoves, space heaters, and water heaters. By 2020 developing Asia is expected to consume more than twice as much electricity as it did in 1999. Chain s electricity consumption alone is projected to trip le growing by an average of 5.5 percent per year over the forecast period.

Similarly in Central and South America high rates of economic growth are excepted to improve standard of living and increase the demand s of electricity for homes, buinsesses, and industry. The expected growth rate for electricity use in central and south America is 3.9% between 1999 2020. For Brazil, the region s largest economy and consumer of electricity, electricity use is projected to increase by 3.6% per year with increasing effort to bring electrification to rural population that have previously not rural populations that have previously not had access to the

national grid

Electricity consumption in the industrialize world is expected to grow at a more modest pace than the develop ing wor ld, at 1.9 percent per year- a considerably rate than has been seen the past,

13.4 Table world Net Electricity consumption by Region 1999-2020 (Billion killowathhous

Region	1990	1999	2005	2010	2015	2020	Average Annual Percent change 1999 - 2020
Industrialized countries	6385	7,517	8,620	9446	10,281	11,151	1.9
United states	2817	3236	3793	4170	2006	4916	1.9
EE/FSU	1906	1452	1651	1807	7548	2173	4.2
Develop ing Countries	2258	3863	4912	6127	4819	9082	4.5
China	1259	2319	3092	3900	2631	5858	5.5
India	551	1084	1523	2031	784	3349	3.8
South Korea	257	424	537	649	392	923	3.0
Other Develop ing Asia	93	233	309	348	1012	429	3.4
Central and South America	449	578	724	872	1249	1157	3.9
Total World	10,549	12833	15,182	17380	19835	22,407	2.7

The mix of pr imary fuel used to generate electricity has change a great deal over the past three decades on a worldwide basis. Coals has remained the domains fuel, although electricity

generation from nuclear power increased rapidly from the 1970 s through the mid-1980s andnatural gas fined generation has grown rapidly in the 1980s ad 1990s in the 1980 s and 1990s. in contrast, in conjunction with the hig h, world oil prices brought on by the m oil price shocks resulting from the OPEC oil embargo of 1973-1974 and the Iranian Revolutions of 1979m the sues of oil for electricity generation has been slowing the mid 1970s.

In the IEO20002 reference case, continued increases in the used of natural gas for electricity generation are expected worldwide. Coal is projected to continues to retain the largest market share of electricity generation, but its importance is expected to be diminished some what by the rise in natural gas use. The role of nuclear power in the world s electritricity markets is projected to lessen as rectors in the industrialized nations reach the end of their lifespans and few new reactors are expected to replace them. Generation from hydropower and other renewable energ y sources is projected to grow by than 50 percent over the next 20 years, but their share of total electr icity generation is projected to remain near the current level of 20 percent. Electricity markets of the future are expected to rely increasing on natural- gas -fired generation. This trend is evid ent throughout the world, as industrialized nations are intent on using combined -cycle gas turbines, which generally are cheaper to construct and more efficient to operate than other fossil-fuel fired generation technologies. Natural gas is also seen as a cleaner fuel than other fossil fuels. Worldwide, natural gas use for electricity generation is projected to gas-fired generation continue to improve and ample gas reserves are exploited. In the developing world, natural gas is expected to be used to diversify electricity fuel sources, particularly in reg ions like Central and South America, where heavy reliance on hydroelectric power has led to shortages and blackouts when reservoirs are low.

4.0 CONCLUSION

Scientists and visionaries of the 1900s could never have predicted the enormous growth of the world s energ y demand in the last century. Few could have imagined cars, planes, spaceships, electricity, nuclear power, computers, or television. Attempting to predict both the energ y levels and the resources that will satisfy peop le a century from now, in 2103, is just as difficult.

An efficient, non-polluting replacement for oil or gas will probably not be discovered anytime soon. The key to our energy future does not depend on the development of new technologies or

resources. Using the resources we have better and more intelligently will be the best way to conserve energ y for future use of the world. If efficiency is not stressed now, global warming and energy- related pollutants will alter the future long before new technologies can be discovered, tested , and implemented.

5.0 SUM M ARY

In this unit you have learnt about

- Wor ld energy consumption between 1970 and projection to 2020
- Coal oil and natural gas accounting for 74. 6% of global energy use
- Develop ed nation consuming more energy than develop ing
- U.S. A being knowledge fir st consumer of energy- total consumption out weight that of Afr ican

6.0 TUTOR M ARKED ASSIGNM ENT

1. List four sources global Energ y
2. Make a list of four hig hest energy consumer nation of the world in accenting order
3. Analysis the d ifference in electricity consumption nations, giv ing possible reasons for the gap.

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UNIT 14: TRANSP ORTATION AND ENERGY CONSUM PTION

Table of Content

1.0 INTRODUCTION

Welcome to Unit 14 which is apparently a continuation of the previous. You will find this unit more interesting because it is much more applicable to your daily life.

This unit will focus on energy consumption with specific reference to transportation. We shall review vehicular consumption rates, draw the implication of consumption rates on the environment and finally outline possible solution.

Am sure you will find it interesting. We shall go ahead p lease?

OB JECTIVES

After completing this unit you should be able to:

- Mention the passengers vehicle that consumes energy per passenger/km than any other
- Identify the cargo (goods) vehicle that consumers energ y per ton/km than any other
- Mention four gaseous emission from vehicles
- Outline the environmental consequences of high consumption of energy (fossil fuel) in vehicles.
- Articulate five ways of reducing energy consumption in vehicles.

3.0 ENERGY: A CONCEPTUAL FRAM EWORK

Energy has been defined as a capacity of a system to work. It is also expressed as a measure of such capacity, expressed as the work that it does in changing to some specific reference state. It

is measured in Joules (SI units).

The planet Earth can be consid ered a single great energy system which receives solar energy as an input. The flow of energ y constitutes a major renewable resource. Within the system many transformations occur between the different types of energy over time the Earth neither gains loses energy: it exists in that state of energy balance of homeostasis (Jones, Robertson, Hollier, 1990).

Over the millennia humans have attempted to channel energy sourced to suit their needs. The major source of energ y, the Sun cannot be controlled. Solar energy is used in agriculture as a passive energ y source to stimulate photosynthesis. Indeed, many other sources of energ y have been developed, most of which are based upon the combustion of wood, coal, natural gas or oil. These fossil fuels are non-renewable resources and attempts are presently underway, nevertheless, on a limited scale to find and utilize renewable alternative energy sources.

Some 99% of the energy used to heat the earth and all of our build ings come dir ectly from the sun. Without this input of essentially inexhaustible solar energy, the earth s average temperature would be 2400C (-4000F) and life as we know it would not exist. The remaining commercial energ y comes from extracting and burning mineral resources, obtained from the earth s crust, primarily nonrenewable fossil fuels(Miller. 2001).

The United States is the world s largest user (and waster) of energy. With only 4.6% for population, it uses 25% of the world s commercial energy, 93% from nonrenewable fossil fuels (85%) and nuclear energy (8%). In contrast, India, with 16.6% of the world s people, uses only about 3% of the world s commercial energy.

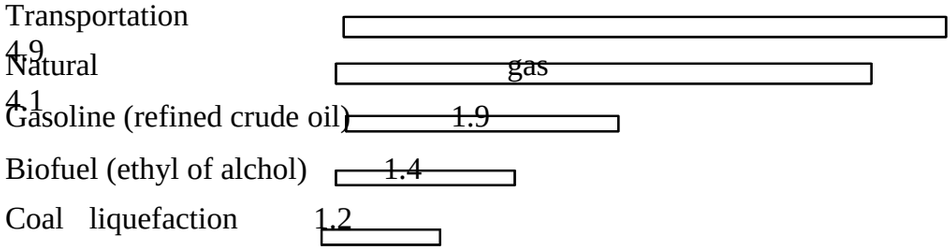

Fig 14. 1
(Set energy ratios consumption by th e tran sport system relative to energy demand by various *energy systems over their estimated lifetimes).*

3.1 TRANSP ORTATION AND ENERGY

What is the problem?

The transportation system in any nation makes sig nificant contributions to production, distr ibution, commeriscation, and integration in any economy. Generally, it accounts for 20-40% of all petroleum use. The transportation sector includes infor mal, non commercial, and non

organized transportation, pr ivate motorized passenger transportation, commercial motorized transportation and private freight transportation provided within fir ms.

Studies by Gelther (1994) found that the value added to production by the transportation sector is estimated as just about 5% for most countries. Its contribution is essential for economic development. In developing nations most transportation is by road (because rail networks are limited and are focused on exports) and includ es non-motorized transportation. A key role is also played by air transportation because of its relatively low capital requirement. In general, the industr y that supports the transportation sector is small and the demand is met by imports (Brazil, China, Ind ia, and Mexico are notable exceptions) the energy demands of the transportation sector differs among countries because of the market share and energy intensity of each mode and size as well as the population of the country.

Reflection

The Fundamental Problems

- The fundamental energy problem in this sector is the high cost of petroleum products. Which has increased the percentage of world income absorbed by petroleum costs. This is particularly so because petroleum is a finite resource fast diminishing.
- The transportation system is the sector with the greatest contribution to the environmental pollution today

3.2 THE AUTOM OBILE

The automobile industry is one of the most pervasive symbols of moder n development and culture, which serves as an apt metaphor for the ways in which humans change the global environment. Within cities, new modes of transp ortation exist (for example, shared taxis and min ibuses). Cars are owned by the wealthiest, and ownership rates var y with the cultural norms in different countries. Buses are 5 - 10 times more energy efficient than cars on the basis of passenger - mile costs. Because the number of car trips taken correlates to income, the share of the total expend iture on energy that is accounted for by gasoline and fusel fuel also increases with income (Sathaye & Meyers, 1994).

Automobiles emit car bon dioxide, which is added to the green house gases in the atmosphere; nitrogen oxides, which react in the atmosphere and rain down as acid precipitation; and other gases and particulate that contributes to smog and local air pollution in our urban areas.

Exercise 14.2

1. With the aid to table two above make graphic representation (histogram) in ascend ing order of the vehicles shown with respect to the amount of energy consumption per ton/km

2. Rank over the vehicles from the lowest to the most polluting on each pollutant below
   (1) CO (ii) No (iii) HC (iv) SO2 (v) CO2
3. Rank order this vehicles from the lowest ot the highest in terms of total amount of all emissions

In 1995 there were 500 million registered automobiles throughout the world, each of which consumes an average of nearly eight liters of fuel a day. Automobiles consume one-third of the world s production of petrol. As the population grows, so will the number of automobiles. In add ition, the average number of automobiles per person is going up, and the number of automobiles is increasing faster than the population, particularly in develop ing countries. Some estimate that if current trends continue, by 2025 there will be four times as many automobiles as there are today.

3.3 SOLUTIONS TO THE CON SEQUENCES OF ENERGY CONSUM PTION IN TRANSPORT

There are several solutions that have been proffered in solving the problem consequent upon the high consumption energy especially fossil fuel in the transport system. Some of the proponents of these solutions that are numerated below are Gelther (1994), GTZ (1999), Miller (2001), Olesen (1993) and World Bank (2002).

- Most important is to move passengers from cars to public transport and bikes. I f public transport is faster and cheaper than motoering, then most peole choose public transport. Improvements in public trnasport with additional and faster rail lines and business, as far ad possible. Improvement for bikers include bike lanes at all busroads, and bike routes through the cities. Motoring in cities can be made more expensive by parking toll on driving into or through city areas. This kind of taxation does not make it more exp ensive to drive outside cities, where good public transport system do not exist.
- Urban planning is another important element in reducing harmful effects due to city transport. The p lanning must reduce the transport demand as much as possible, and allow ever ybod y to use public transport and bikes.
- As much as possible ever ybod y should live in biking distance from their job. Dwellings must be placed within bik ing d istances from a station, and large shopping centers and workplaces

within walking distance.

- A number of other thing s effect traffic, e.g. abolition of transport allowance deduction would make it more attractive to live within staff quarters and thereby pollute less. Members of staff should simply p ay for rentage and not total deduction
- Environmental impact assessemtn fo energy and transport project should be carried out. Enviromental impact assessments of energy and transport projects usually come in after feasib liltity studies ere carr ied out. At that time, money is spent already for planning, and it mig ht be problematic to develop alternative choices. The EM offers a set of comprehensive data for various energy and transport systems. - one can use these data to identify alternatives, and to find the best solution already during the p lanning process. This early screening designed to study emission and cost impacts for many project alternatives before committing to any.
- There must be good possiblities for changing between cars and public transport, for example by driving to the neartest station, park the car and continue by public transport.
- There should be inspection of older vehicles, so they do not get more petrol drinking during time.
- Future investments in the transport sector ought to be spent on constructing faster rails and lig ht-rails and improving safety for bikes.
- Flying has been favoured above trains. By invest in high-speed trains, transport by train in can get a comeback. High - speed trains must be energy efficient, and must not have severe environmental impact.
- Urban p lanning should favour shortest possible commuting, and ensure that as many as possible are able to use public transport.

4.0 CONCLUSION

During the Stone Age, transportation by human only demanded his energy. Soon after human began ot emp loy animals as a means of transportation which may take days or weeks depend ing on the distance. The quest for survival and the desire for improved quality of life has made scientific and technological d evelop ment to evolve over transportation. These technologies have improved over the years with increased consumption of petroleum energ y by several millions of vehicles on land, sea and air. Recently environmental scientists began to raise alarming news on

the implication of increased consumption of fossil energy by the transportation system on the environment and especially on human health. One of the ways out was the develop ment of vehicles - specifically auto - car called Eco-cars that are fuel - efficient (i.e. consumes less fuel) while some are electric car - they use dry cell batteries. Several other measures are now in place that you and I can reduce the rate of consumption of fossil fuel energy in our transport system.

5.0 SUM M ARY

This unit has so far d iscussing on energy consumption in the transportation system putting into consideration the amount of energy that are usually consumed by different vehicles in the transport system. The unit gvae a conceptual definition of what energy is begin the measure of the capacity expressed as the work that it does in changing to some reference points.

Energy consumption in the transport system accounts for 20-40% of all petroleum products produced worldwide. This shows that transportations consumes a large percentage of petroleum products

6.0 Tutor marked Assig nment

1. State two fundamental problem related to transportation and energ y consumption.
2. Mention four gaseous emission from vehicles.
3. Outline three environmental consequence of hig h consumption of energy (fossil fuel) in vehicles.
4. List 3 strategies to solve the consequences listed above.

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UNIT 15: EROSION : CAUSES, EFFECTS AND MANAGEMENT

Table of Content

1.0 INTRODUCTION

In this unit you will lear n that:

Water and wind remains major factors of erosion and land degradation. They combines with climatic, topographical , and soil condition to reek havoc when allowed. Their effects include soil and fertility loss, land loss siltation of reservoiurs and aquatic habitats, bur ying of flora and fauna ad even desertification. While prevention is subtle, control entails making rig ht the facilitating conditions such as reducing slopes, and encourag ing permeability.

You are also likely to discour some of these experiences in your locality.

2.0 OBJECTIVES

At the end this unit you should be able to

- Define Erosion
- List types of erosion
- Mention the causes of water Erosion
- Outline the causes of wind Erosion
- Explain how to control of water Erosion
- Explain how to control water Erosion

3.0 EROSION DEFINED

Erosion is the wearing and removal of soil, rock fragment and bedrock through the action of rivers, g laciers, sea and wind seen Collins Dictionary of Environmental Sciences 1990).

Erosion may also be defined as the gradual removal of bits of rock or soil from its initial deposit by the means of wind, saves water glaciers, soil slip or by other human activities.

3.1 TYPES OF EROSION

- Soil Erosion: This is the accelerated removal of soil through several fluvial and Aeolian processes, at a rate grater than it is formed through pedogenesis.
- Pedogenesis : it is combined effect of a number of interconnected processes which result in the formation and development of soil. (see Collins dictionar y of Environment

Sciences 1990). Factors connected in this process include climate, topography, parent mater ial, vegetation and the activities of animals and humans. A times, erosion progressively removes the soil unoticed to many individuals, and may after a long time notice a lighter soil colour and appearance of rock pebbles close to the soil sur face than usual. This p heonmenon is referred to as sheet erosion.

It gradually removes the soil s nutrient, render ing it infertile. When this continues, it eventually leads Rill Erosion. Rill Erosion occurs often no newly cultivated lands. with increase in run off, the Rill Erosion gets deeper and develops into what is called Gully Erosion.

Common Process of soil Erosion

Sheet Erosion

Rill Erosion

Gully Erosion (Ahove & Oduwaiye, 200)

- Marine Erosion: The progressive removal of mater ials from a coast by the sea. There are four ways in which marine erosion can occur. First is by hydraulic action, which is the physical impact of waves and currents on the rocks and currents against coastlines? Third is attrition, which is the wear ing down of transported rock fragments by impact and fraction. Finally is corrosion, the chemical action of seawater on rocks such as limestone.
- Wind Erosion: The gradual washing away of soil and rock debr is by the wind. it is most common in arid and coastal areas but can occur in any climate if there is only spare vegetation cover and a lack of moisture to bind surface materials.
- Glacial Erosion: This is a gradual removal of materials from the bed and marine of a river channel .
- Fluvial Erosion: is a progressive removal of materials from the bed and margins of a river channel

Exercise 15.1 Identify from the list above, the k ind of erosion you have withnessed or a were of in your state or local government

3.2 TOPOGRAPHY

Ordinarily in the absences of water, land is exposed to the possible effects of wind and other climatic elements. And the effects are spectacular to an extent. However, when water is introduced the situation becomes highly remarkable. Consider, for example, when a drop of water hits the sur face of land from a height as with raindrop. The drop creates a tiny crater through the losening impact and suspension of the detached particles of soil. With many drops of water and coalescence of the splashes, a mild flooding develops. Depending/ seepage erosion or leaching may set in However, this gets conversed. to he spectacular lateral erosion with the interjection of slanting or sloping of the land.

As the degree of slope increase, erosion by water is geometrically increased. As the grad ient or percent of slope increase, the velocity of run-off water increase, which increase in erosion its erosion power.

Associated with this is the run of the land (topography) or the shape of the slope, that is the rising and falling of the landscape, resulting in var ying level of slope and rate of water erosion.

Exercise 15.2

Fill 6 petri- dishes with loamy soil and place 2 each on a flat surface, slope to the surface, respectively. Discharge 25cl of water on each dish through a per forated tin can held at 20 cm above the soil. Note and explain the level of soil and water loss from the 3 sets of dishes.

- Rainfall

After the activity it would be appreciated that the level of soil and water loss can be in fluenced by the duration and intensity of application of water. It is in fact a major factor in urban flash floods and erosion.

.Gave you heard recent Mozambican climate d isaster of 2000 in which it rained non-stop for days leading to enormous degradation of the landscape. The continuous downpour saturated groundwater and soil beyond filed capacity, causing flooding run-off and general erosion comp licating the situation further was the continuous flood ing from 9 other southern African

rives flowing through Mozambique. I n the same vein, rap id downpour of large amount of rain (intensity) which leaves little room for percolation through the soil cause the characteristic flash floods and erosion. Begin here as a paragrap h. The rainfall factor is a measure of the erosive force of specific rainfall. The erosion force or available energ y is related to both quantity and intensity of rainfall

- Removal of Vegetation

If we agree that so far the cause d iscussed can be associated as natural phenomena, the singular action of humans which leads to devegetation of the landscape aggravates erosion the most. The cover offered by the vegetation foliage reduces and temper the impact of the beating rain and water drops on the land thereby discouraging the loosening and suspension of soil particles. The sheer obstruction created by vegetation -p lant stems and root system also significantly affect the amount of sur face water erosion that could

- Soil Nature

The structure and texture of the soil contribute to water erosion that occurs on it. In a soil with large pore/air spaces for rapid infiltration (seepage) of water, build up of erosion run -off. Conversely on a poor-typical of a clayey-textured soil, erosion id facilitated. At times, as a result of direct exposure to a heavy downpour, silt and crumbs are knocked about to plug up air spaces, hampering infiltration and encouraging rapid run-off, flash floods and water erosion. The key physical soil factor which influences water erosion therefore remains the presence of seepage paths for water, that is the air spaces they determine the permeability of the soil which in turn effects the level of water erosion.

3.3 Effects of Water Erosion

The effect of running water over soil surface was described by Adara (2000) as being significant damage has occurred. Generally the first effect which effects the integrity of the land soil, is the lossening of soil particles followed by their suspension in the initial flood water which soon gains momentum in the presence of a slope loss of soil, soil fertility and land itself occur. It proceeds in stages now used to describe the effect of water erosion, that is, from sheet erosion to rill erosion and finally as gully erosion.

While gully erosion is the most spectacular, and observed in a fair ly defined location, sheet erosion id subtle and yet the most damaging the sheet erosion gradully degrade the topsoil(the

mani medium for agricultural productivity) with negative implication on soil fertility and crop yields. After the sheet erosion must have contiuned for some time, tiny runnels or furrowa are observed, signaling the beg inning of r ill erosion. Through the tiny runnels, the run-off water gains velocity and erosion power which widens the furrows, dislodging more soil particles. The resuly is a series of ridges across the land, devoid of most of its native silt content

- Damage on fertile la nd

Erosion damage is not confined to soil loss. This load was observed to have led to the salutation of water reservoirs, ponds, and streams. Apparently fishery resources and aquatic flora and fauna are adversely affected by siltation resulting from water erosion, the silt reduce the depth/ volume of water available while also burying precious flora and fauna including fish and shellfish eggs in the water body. The valley of the dead woods on the Itu-Calabar. Hig hway is another example, this resulted from eroded highway construction site which in turn changed the pH of the4 fresh water swamp which subsequently affected the trees native to the swamp negatively.

Reflect ion:

It is possible for water erosion to turn citizens to environmental refug ees in their active communities

Gully erosion reflects the terminal point for water erosion which has progressed long enough to become the spectacle one observes. At this stage, huge amount of soil is carried in rushing run- water, to be deposited in flood plains, or river beds, or into the ocean. Large arable lands which are crisis-crossed by gully erosion are usually difficult to mechanize and production level is seriously affected.

- Damage on Urba n land

Erosion in urban lands is usually observed in exposed construction sites and highway development areas where erosion rates are many times higher than the typical ones occurr ing on agr icultural land. In essence, ur banistion activities end up reducing permeability through compaction or make the soil imper vious and thus greatly increasing run-off. In fact, losses of soil as large as 100,000 tonnes per square kilometers to about 1 inche a year have been repor ted.

3.4 Management of Water Erosion

Adara (2000) provide detailed explanation on how to mange water erosion

The erosive power of water, running over the surface of the soil, depends on its power of brining soil into suspension and of carrying the soil load so brought in. these power increase very rapid ly with the velocity of flow and to some extent with the thick ness of the water sheet. Hence the fundamental pr inciple in combating soil erosion by water is the maintenance of the permeability of the soil, to reduce the amount of run-off as much as possible and ensur ing that when run-off occurs it takes place as thin sheets of slowly moving water. This latter point is difficult to achieve, for water running off a slope always tend s to form runnels, in which the flowing water is concentrated and hence its power of erosion increases; and these runnels collect as fast flowing flood streams which may soon begin to cut depgullies. Hence, the need to keep the length, for the longer the run the more the chance of funneling. The outright prevention of water erosion will eliminate water in the picture. This is because of the covert, unobtrusive downward erosion of solutes in the soil below the surface by water. The most feasible consid eration therefore should dwell on the control approaches. A series of approaches which tends to moderate the causes of erosion have been reported. In general, whenever a sloping soil is to be cultivated and exposed to erosion rains, the protect offered by crop cover needs to be supported by practices that will slow the run-off water and thus reduce the amount of soil carr ied. The most important of these practices for arable land are contour tillage, strip cropping on the contour, and terrace systems.

Case Study: Limited field stud ies have shown that contouring alone is effective in controlling erosion during storms of low or moderate intensity but provides little intention against the occasional ser ver storm that causes over of the contoured rows. Contouring alone appears to produce maximum average protection on slopes in the range of three to seven percent. Strip cropping alone with contouring provides more protections. In cases where both strip cropping and contour tillage are used the protection is double.

Terracing of land which involves the breaking of sloppy land into step-like series of flat beds helps to prevent water erosion. Establishment of cover- crops or mulching aids gradual introduction of water into the soil which in turns sips down without causing run-off. Other practices which control water erosion include organic manur ing, crop rotation, afforestation, and planned construction activities devoid of long exposure of bare land.

3.5 Causes of Wi nd Erosion

Kola-Olusaya (2000) described the causes of wind erosion as follows:

- Soil is basic to life. It is the pr imary means of food production directly supporting the livelihood of most rural people and indirectly ever y one. The processes of the degradation of the soil in preparation to wind erosion could either be by human or natural activities or could be a result of the combination of human and natural activities on the soil surface.
- This natural degredation involves the detachment and worsening of soil particles, by the wind and transportation and subsequent deposition in a process referred to as wind *deposition, elsewhere in the landscape.*
- Wind erosion is a process, which occurs mainly in the sudan-sahel belt where rainfall is low and soils are sandy. However it is localized both in space and time. It is most active in the dr y season in areas carrying a scanty vegetation cover or some at all. Wind erosion can be consid erable where airflow is not showed by vegetation topography etc, especially if the soils dr y out and no protective crust. Arable farming is likely to lead to seasonal peaks of wind erosion that coincide with periods when crop cover is reduced, soil is driest and most disturbed and wind most erosive.
- Typically, such periods are after tillage or flow summer/dry season harvest before the arrival of rain. Nearer the equator, wind erosion increases during dry season or if there is drought. Erosion episodes may be associated with wind s that occasionally blow from same direction other than the usual prevailing wind.

Exercise 15.3

1. Make a list of the natural activities that are capable of causing wind erosion
2. List the human activities that are capable of causing erosion.
3. Compare and contrast to establish which is a most serious cause.

See Niger ian Environmental Study team (NEST)

Nigeria, Threatened Environment. A national Profile. Page 48-58.

3.6 Effects of Wind Erosion.

The cost of wind erosion may be divided into direct (on-site) and indirect (off-site). The main direct cost is decline in crop productivity. Indirect cost includes smothering of young crops, roads bur ying by the drifting sand, burying of villages. For example the effect of wind erosion is a major problem in northwest Sokoto, where roads have sometimes been

comp letely buried by drifting sands. Dur ing the planting season, drifting sand often smother young crops. Areas, which are known to be particularly affected by wind erosion in Sokoto State, include the area between Tangaza and Gwadabawa and the areas between Gwambilla, melle and I llela. Wind erosion in also a menace on the cover sands of northern Kano. In Borno state, it is particularly serious on the ancient sand dunes of Manga country. Where the village of Kaska has been shifting progressively away from one of moving sand dunes.

Effect wind erosion an example f rom Kaska village 1986.

He hig hest of these active dunes stands at about 45-50 feet (14-15 metres) high, and together with a second one of about 30ft forms a for midable creeping front which has already comp letely buried not less than twenty houses and about a dozen, tress. Evidence of already comp letely buried houses can be seen from their exposed dark flat tops. How do the Kaska people feel the impact? NEST Research Team (1990) collected these observations. At the time of the visit, we sew a Soro in the process of being buried. The gate was facing the east and there was kuma tree (Ziziphus Sp ina-Christi about 10 feet in front of it. These sand dunes which have already completely bur ied the tree; at first piled up at the door , and then continued ton pour into it fill at least the roof of the Soro was pushed down. And a (the occupant of the house) on his part said that before he finally left the room he used to sir down and rest under the Kuma.

Further more, the greatest effect of wind erosion lies outright volumetric loss of soil and the decrease in the nutrient capacity of the soil. This particularly is a great minus for Nigeria a largely agrar ian nation. Apart from its agricultural impact. Slight or moderate degradation may be sufficient to restrict what can be grown (due to insufficient depth of soil or poor quality of soil) it may also, by reducing available soil moisture, reduce the land s resistance to drought.

Wind erosion has affected people in the following ways:

- Damag e to and sometime total loss of residential buildings, schools, electricity installations, industrial grounds, parches of savanna forest and wild life habitats and recreational areas.
- Enforced population resettlement as well as the alignment, relocation or

reconstruction of structures and

- Blind ness occasionally death of humans and livestock when they are trapped in the sandstorm (Igboruike, 1990).

Reflection

A lot of committees and panel reports and expert papers as well recommendations have been written on the mitigation of wind erosion in northern Niger ia.

Do you think the government (states and federal) have backed these reports with political will?

How far have they gone in all their efforts?

Do you foresee the problem of wind erosion abating in the nearest further?

3.7 Management Wi nd Erosion

Soil with a particle size range of 0.002 to 0.100mm are most prone to non-living structures, such as fences of bush- wood and wickerwork and occasionally to small-scale plantings. Shelterbelts are larger-scale p lantings, which give protection for at least 20 times their height down wind. Care is needed in sitting wind break s or shelter-belts to ensure that they are at 900 to the most damaging wind (not necessarily the prevailing wing). Cross- sectional shape and the permeability of the barr ier to air flow are also important. Spacing and heig ht also require attention (Zachar 1982) Shelterbelts are not instant solution. They take time to establish. Care most be taken to ensure that local people understand the need for and support the establishment of shelterbelts or erosion of wind- breaks. If they do not damage is likely. It is also important that the nearby (generally shallower-rooted) crops or pasture for moisture. (e.g bahama grass or stubborn grass).

Some trees or shrubs are particularly suitable for shelterbelts for not only do they slow the wind. But also they also supply fuelwood, fodder, compost, and mulch that can be used for soil improvement. Shelterbelts have been used to conserved soil moisture in dryland regions to boost crop (possibly by as much as 30 percent) or forage yield and help counter wind erosion (Barrow 1987 Weber & Stoney 1989).

There are many other ways (other than shelterbelts) of holding soil in place or catching that which has begun to move. Crops may be p anted in a suitable pattern, usually a grid pattern (coulisses). Study- soil-or sand-trapping grasses or herbs may be planted to stabilize areas of soil erosion, for example marram, grass (Ammophila spp) has been found effective in Europe for

sand dune protection neem tree and elephant grass. Simply laying a thatch of tree branches may be helpful. It may also be worth spraying soil or sand with compounds to stabilize it, many have been tr ied, for example latext emulsion; oil, waste paper or fibres and water (with or without seeds incorporated in the mulch) shredded bark to name a few.

Public Educa tion

Prevention of erosion rather than cure can be doe through public education of the menace of erosion; stressing the loss of production (especially to farmers and cattle rearers). In this type of education, the role of the public in tackling wind erosion should be stressed.

Subsidies and Incentives

Grants and loans should be given to encourage people who practice soil conservation. It is beneficial to equally reward those who help to improve soil quality.

Other preventive measures

- Government enacting anti-erosion laws and their strict enforcement.
- Discourage practices that cause soil damage.

4.0 CONCLUSION

It is evident that the cut-down or reduction of human induced activities that encourage wind and water erosion will go a long way to minimize the impact of erosion. Undoubtedly, though, it is not just the reduction or cut-down that will correct the years of soil degradation. But the reclaiming of the vast badland erected this agents of erosion. However, ultimately, environmental education with the aggressive drive will help in mitigating towards a total abatement and control of erosion wind action.

5.0 SUM M ARY

So far we have learnt about wind and water induced erosion - causes effects and management we also explore the process of wind erosion of wind erosion implant and the prevention

In its basic sense, erosion refers to the wearing away and removal of loss or particles of soil and

or soil components in solution suspension or freely. Taking p lace in solvent or carrier agent in erosion. This is also known as the degradation of the lithosphere by means of water. Next to water is a set of conditions which facilitate water erosion. These conditions are identified as topography/ slope, climatic, soil and vegetation related. Without their intervention water effect become limited to mere dissolution of soluble components of the medium (soil), or stagnation, or flooding

Causes of water Erosion: Adara (2000) outline the causes of water Erosion t o include

6.0 TUTOR MARKED ASSIGNM ENT

1a. What is Erosion

b. List four types of Erosion

c. Identify two, of the four you mentioned, that you have witnessed in Nigeria

2. Sate two cause of water Erosion

3. Mention two effects of wind Erosion

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