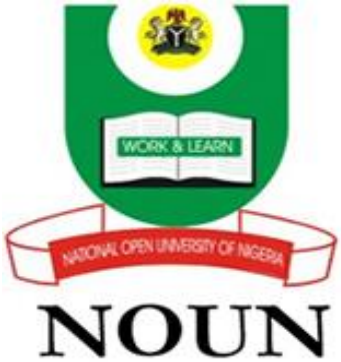

NATIONAL OPEN UNIVERSITY OF NIGERIA

SPATIAL ORGANISATION OF SOCIETY
TPM 205

FACULTY OF MANAGEMENT SCIENCES

COURSE GUIDE

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CONTENT

Introduction

The course Spatial Organisation of Society (TPM205) is a first semester core course which carries two credit units for the second-year level B.Sc Transport Management students in the Faculty of Management Sciences at the National Open University, Nigeria. This coursework will be useful in your academic pursuit and help to gain in-depth insight into the Spatial Organisation for Society.

This course guide is built partially on prerequisite knowledge that have been gained in the first year, however, its simplicity will make the student assimilate faster and practice questions at the end of each unit. This will also prepare the student for the examination purposes. It suggests some general guidelines for the amount of time required of users on each unit in order to achieve the course aims and objectives successfully. It also provides users with some guidance on their tutor marked assignments (TMAs) as contained herein.

Course Content

The course is made up of fourteen units (four modules) spread across fourteen lecture hours and covering areas such as man-environment interaction, the basis of man- environment interactions, the spatial and functional relationships of settlements and finally the movement over space and transport networks.

Course Aims and Objectives

The course attempt to explain the concepts and conceptual framework of Spatial Organisation and Society, Man and the Environment, the approaches to the study of Man – Environment relationships, Human response to the Environment, Spatial and Functional Relationship of Settlements and Transport Modes, Cost and Benefits. Also, the course is prepared in a manner that the users would easily enhance their previous knowledge. The course aims, is to help users develop critical thinking skills about man and his environment, how to understand the different approaches to the study of Man – Environment Relationship and distinguish between Spatial and function Relationship of Settlement. However, the overall aims of the course will be achieved by:

(i) Examining the concept of environment and the society, man and the environmental interaction and the Global Environmental Issues and Protection.

(ii) Explaining the distinction between Spatial and Functional Relationship of Settlement

(iii) Describing the importance of the Environment to Man.

(iv) Discussing Human responses and consequence to the global environmental changes

(v) Understanding Transportation Benefit, Costs and Modes.

Working through the Course

To successfully complete this course, you are required to read the study units, referenced books and other materials on the course. There is a self-assessment exercises called Student Assessment Exercises (SAE) in each of the unit. At some points in the course, you will be required to submit assignments for assessment purposes. At the end of the course there is a final examination. This course should take about 10weeks to complete and some components of the course are outlined under the course material subsection.

Course Material

The major component of the course and what you have to do and how you should allocate your time to each unit in order to complete the course successfully on time are listed as follows:

1. Course guide
2. Study unit
3. Textbook
4. Assignment file
5. Presentation schedule

Study Unit

There are 14 units in this course which should be studied carefully and diligently.

Module 1: Man-environment interaction

Unit 1: Man and the Environment
Unit 2: The Environment and its Components
Unit 3: Man, Society and the Environment
Unit 4: The Approaches to the Study of Man-Environment Relationship
Unit 5: Global Environmental Issues and Protection

Module 2: The Basis of Man-Environment Interaction

Unit 1: Importance of Environment to Man
Unit 2: Human Consequences and Responses to the Environment.
Unit 3: Human impact on the Environment and Waste Management

Module 3: Spatial and Functional Relationship of settlements and activities in Space

Unit 1: Spatial Relationship of Settlements
Unit 2: Functional Relationships of Settlement

Module 4: Movement over Space and Transport Network

Unit 1: Transport Network
Unit 2: Benefits of Transportation
Unit 3: Mode of Transportation
Unit 4: Transportation Costs and Rates

References and Other Resources

In each of the unit there is a list of references and further reading. The students should try to get as many as possible of those textbooks and materials listed. The textbooks and materials are meant to deepen their knowledge of the course.

Assignment File

There are assignments on this course and you are expected to do all of them by following the schedule prescribed for them in terms of when to attempt them and submit same for grading by your tutor. The marks you obtain for these assignments will count toward the final mark you obtain for this course. Further information on assignments will be found in the Assignment File itself and later in this Course Guide in the section on Assessment. There are four assignments in this course. The four course assignments will cover:

Assignment 1 - All TMAs' question in Units 1 – 5 in Module 1.
Assignment 2 - All TMAs' question in Units 1 - 3 of Module 2

Assignment 3 - All TMAs' question in Units 1 &2 of Module 37
Assignment 4 - All TMAs' question in Units 1 - 4 of Module 4

Presentation Schedule
The presentation schedule included in your course materials gives you the important dates for this year for the completion of tutor-marking assignments and attending tutorials. Remember, you are required to submit all your assignments by due date. You should guide against falling behind the schedule.

Assessment
There are two types of assessment of the course. First are the tutor-marked assignments; second, there is a written examination. In attempting the assignments, the students are expected to apply the information, knowledge and techniques gathered during the course of study. There is need to submit assignments to the tutor for formal assessment, which is in accordance with the deadlines stated in the Presentation Schedule and the Assignments File. The work submit to the tutor for assessment will count for 30 % of the total course mark. At the end of the course, the students will need to sit for a final written examination of three hours duration, which counts for 70% of the total course mark.

Tutor-Marked Assignments (TMAs)
There are four tutor-marked assignments in this course. You will submit all the assignments. You are enjoined to work all the questions thoroughly. The TMAs constitute 30% of the total score.
The assignment questions for all the units in this course are contained in the Assignment File. You will be able to complete your assignments from the information and materials contained in your text books, reading and study units. However, it is desirable that you demonstrate that you have read and researched more widely than the required minimum. You should use other references to have a broad viewpoint of the subject and also to give you a deeper understanding of the subject.
When you have completed each assignment, send it, together with a TMA form, to your tutor. Make sure that each assignment reaches your tutor on or before the deadline given in the Presentation File. If for any reason, you cannot complete your work on time, contact your tutor before the assignment is due to discuss the possibility of an extension. Extensions will not be granted after the due date unless there are exceptional circumstances.

Final Examination and Grading
The final examination will be of three hours' duration and have a value of 70% of the total course grade. The examination will consist of questions which reflect the types of self-assessment practice exercises and tutor-marked problems you have previously encountered. All areas of the course will be assessed Use the time between finishing the last unit and sitting for the examination to revise the entire course material. There might be the need to review the self-assessment exercises, tutor-marked assignments and comments on them before the examination. The final examination covers information from all parts of the course
Course Marking Scheme

The table presented below indicate the total marks (100%) allocation.
Assessment Marks
Assignment (Best three assignment out of the four marked) 30%
Final Examination 70%
Total 100%

How to Get the Most from This Course

In distance learning the study units replace the university lecturer. This is one of the great advantages of distance learning; you can read and work through specially designed study materials at your own pace and at a time and place that suit you best.

Think of it as reading the lecture instead of listening to a lecturer. In the same way that a lecturer might set you some reading to do, the study units tell you when to read your books or other material, and when to embark on discussion with your colleagues. Just as a lecturer might give you an in-class exercise, your study units provide exercises for you to do at appropriate points.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next is a set of learning objectives. These objectives let you know what you should be able to do by the time you have completed the unit.

You should use these objectives to guide your study. When you have finished the unit, you must go back and check whether you have achieved the objectives. If you make a habit of doing this you will significantly improve your chances of passing the course and getting the best grade.

The main body of the unit serves as guide to the students if they will require reading from other sources. This will usually be either from your text books or from a readings section. Some units require you to undertake practical overview of historical events. You will be directed when you need to embark on discussion and guided through the tasks you must do.

The purpose of the practical overview of some certain historical economic issues are in twofold. First, it will enhance your understanding of the material in the unit. Second, it will give you practical experience and skills to evaluate economic arguments, and understand the roles of history in guiding current economic policies and debates outside your studies. In any event, most of the critical thinking skills you will develop during studying are applicable in normal working practice, so it is important that you encounter them during your studies.

The self-assessment questions are interspersed throughout the units, and answers are provided to them at the ends of the units. Working through these tests will help you to achieve the objectives of the unit and prepare you for the assignments and the examination. You should do each self-assessment exercises as you come to it in the study unit. Also, ensure to master some major historical dates and events during the course of studying the material.

The students should take note of the following practical strategy for working through the course. If they run into any trouble, they should consult their tutor. It is necessary to remember that the tutor's job is to help the students. When they need help, they shouldn’t hesitate to call and ask the tutor to provide it.

Read this Course Guide thoroughly.

- ✓ Organize a study schedule. Refer to the `Course overview' for more details. Note the time you are expected to spend on each unit and how the assignments relate to the units. Important information, e.g. details of your tutorials, and the date of the first day of the semester is available from study centre. You need to gather together all this information in one place, such as your dairy or a wall calendar. Whatever method you choose to use, you should decide on and write in your own dates for working by each unit.
- ✓ Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they get behind with their course work. If you get into difficulties with your schedule, please let your tutor know before it is too late for help.
- ✓ Turn to Unit 1 and read the introduction and the objectives for the unit.
- ✓ Assemble the study materials. Information about what you need for a unit is given in the `Overview' at the beginning of each unit. You will also need both the study unit you are working on and one of your text books on your desk at the same time.
- ✓ Work through the unit. The content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit you will be instructed to read sections from your text books or other articles. Use the unit to guide your reading.
- ✓ Up-to-date course information will be continuously delivered to you at the study centre.
- ✓ Work before the relevant due date (about 4 weeks before due dates), get the Assignment File for the next required assignment. Keep in mind that you will learn a lot by doing the assignments carefully. They have been designed to help you meet the objectives of the course and, therefore, will help you pass the exam. Submit all assignments no later than the due date.
- ✓ Review the objectives for each study unit to confirm that you have achieved them. If you feel unsure about any of the objectives, review the study material or consult your tutor.
- ✓ When you are confident that you have achieved a unit's objectives, you can then start on the next unit. There is need to proceed unit by unit through the course, this will enable you pace your study so that you keep yourself on schedule.
- ✓ When you have submitted an assignment to your tutor for marking do not wait for it return `before starting on the next units. Keep to your schedule. When the assignment is returned, pay particular attention to your tutor's comments, both on the tutor-marked assignment form and also written on the assignment. Consult your tutor as soon as possible if you have any questions or problems.
- ✓ After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this Course Guide).

Tutors and Tutorials

There are some hours of tutorials (2-hours sessions) provided in support of this course. You will be notified of the dates, times and location of these tutorials. Together with the name and phone number of your tutor, as soon as you are allocated a tutorial group.

Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties, you might encounter, and provide assistance to you during the course. The tutor-marked assignments should be mailed to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone, e-mail, or discussion board if you need help. The following might be circumstances in which you would find help necessary.

Contact your tutor if.

• You do not understand any part of the study units or the assigned readings

• You have difficulty with the self-assessment exercises

• You have a question or problem with an assignment, with your tutor's comments on an assignment or with the grading of an assignment.

You should try your best to attend the tutorials. This is the only chance to have face to face contact with your tutor and to ask questions which are answered instantly. You can raise any problem encountered in the course of your study. There is need for you to prepare a question list before attending them, for you to gain the maximum benefit from course tutorials. You will learn a lot from participating in discussions actively.

Summary

This course, Spatial Organisation of Society (TPM 205) exposes the users to the rudiments of Transport Management such as the concepts and conceptual framework of Spatial Organisation of Society, the concept of environment and the society, man and the environmental interaction and the Global Environmental Issues and Protection. It explains the distinction between Spatial and Functional Relationship of Settlement, the importance of the Environment to Man, Human responses and consequence to the global environmental changes and Transportation Benefit, Costs and Modes.

On successful completion of this course, you would have developed crucial thinking skills with the material necessary for efficient and effective discussion of elementary transportation management issues, most especially in relation to Man -Environment Interaction both theoretically and practically. However, to gain a lot from the course please try to apply anything you learn in the course to term papers writing in other transport management courses. We wish you success with the course and hope that you will find it both interestingly intuitive and courteously functional.

MODULE ONE

MAN-ENVIRONMENT INTERACTION

Unit 1: Man and the Environment
Unit 2: The Environment and its Components
Unit 3: Man, Society and the Environment
Unit 4: Approaches to the Study of Man-Environment Relationship
Unit 5: Global Environmental Issues and Protection

UNIT 1: Man and the Environment

CONTENTS

1.0 Introduction

The environment is very important to Man, this is in terms of obtaining food, water, fuel, medicines, building materials and other things. The developments taking place in the science and technology world, have helped man greatly in the exploitation of the environment to his advantage. The natural resources derive from the environments are of immense benefits to man and its over-utilisation can at the same time result to environmental damage. The effect of this damage is significant, due to the fact that it affects all human activities, including health and socio-economic development of the local communities and the nation. This module thus examines the various definitions of Environment, man and his relationships with the environment, the importance of the natural resources to man and the problem of over-utilisation of these natural resources to man.

2.0 Objective

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

- Define and know the meaning of Environment
- Describe the meaning of the term “Environmental Management”

- Examine the interdisciplinary perspectives of Environmental Studies.
- Explain the relationships that exist between human activities and the environment
- Identify the importance of natural resources to man
- State the problems, causes and consequences associated with over-exploitation of natural resources.

3.0 Main Content

3.1 Definitions of Environment

Environment is originally derived from a French word "Environ" which means "Surrounding". It is a widely used word which has a broad range of definitions, meanings and interpretations. Environment can be referred to as a nature, the natural landscape together with all of its non-human features, characteristics and processes (Daley & Kent, 2013). The environment might not have been influenced or have been imperceptibly influenced by human activities, thus the term "environment" is associated with diverse descriptions and various assumptions and beliefs.

The environment can also be conceived to include human elements. This considered agricultural and pastoral landscapes as being not only part of the environment, but all other elements of the earth's surface such as urban areas as important constituents of the environment. This environment normally exists in some kind of relations to human and does not exist in isolation. This simply suggests that Individuals, objects, elements and systems influence, and are at the same time influenced by their surroundings. The environment can thus be regarded as a 'space' or a 'field' in which networks of relationships, interconnections and interactions between entities occur (Darley & Kent, 2013).

The Canadian Environmental Protection Act, CEPA (1999) defines Environment in terms of the earth's components which include: air, land and water, all layers of atmosphere, all organic and inorganic matter and living organisms and the interacting natural systems that include all the components referred to above. This definition also takes into cognizance the human and non-human factors that exist in the environment.

Douglas and Holland (1947) described environment as the combination of all the external forces, influences, and conditions, which play significant effect on the life, nature, behaviour, and the growth, development and maturation of Individual. The authors consider the environment from psychology point of view. They perceive environment as those external forces that play significant influence on man's life.

According to Boring, Langfield and Weld (1961), the Environment is anything that affects a man except his genes. This definition affirms that the environment consists of external forces which influence the growth and development of an individual right from conception.

There is also similar definition from Woodworth and Marquis (1948) who wrote that Environment covers all the outside factors that have acted on individual since he began life.

The individual is exposed to numerous environmental forces which are purely external in nature. These external forces are divided into physical and social or cultural forces.The food, water, atmosphere, school, village are examples of the physical forces while parents, friends, family, teachers, community, society, means of mass communication, religious places and libraries constitute the social forces. These different environmental forces have strong continuous influence on individuals which start from the cradle to the grave (Mangal & Mangal,2019).

Self-Assessment Exercise
What is the meaning of the term "Environment"?

3.1.1 Meaning of Environmental Management

The concept of Environmental Management is very dynamic and hence it is not easily defined. There are different definitions given by various authors, which makes the concept difficult to define but in this module; effort will be made to consider some of these definitions and its suitability for the purpose of this course.

Environmental management is defined as a systematic approach of planning, designing, coordinating, leading and controlling all the activities and functions of any entity to have a desired outcome in terms of enhancing environmental quality (Mudasser, 2014). This definition attempts to address environmental problems in any entity, through methodical application of management functions. This approach will not only enhance the quality of the environment but result to attainment of the desired goals for the concerned entity.

Basu & Xavier Savarimuthu (2018), define environmental management as the understanding of the structure and function of the earth system, as well as of the ways in which humans relate to their environment. In other words, environment management is concerned with the monitoring changes in the environment, predicting the future changes, maximizing human benefit and minimizing environmental degradation brought about as a result of human activities.

Environmental management is defined by Jolly (1978), as a process through which natural and artificial resources are allocated to make optimum use of the environment in satisfying basic human needs at the minimum, and if possible, on a sustainable basis. This definition considers the importance of optimum utilization of resources for environmental sustainability.

According to Basu & Xavier Savarimuthu (2018), Environmental management is concerned with the decision about the use of natural resources, the pollution of habitats and the modification of ecosystems. It can then be regarded as a political activity because those decisions are never neutral or objective; on the contrary, they are value laden and they reflect the exercise of power by particular groups over others.

They further argue that it is naïve to conceive of environmental management as basically 'the management of the environment' because humans do exert such influences on the earth system; but it is more concerned with the management of human activities and their impacts than with the management of the natural environment *per se*.

Environment management has been described as a set of diverse activities. It may be practised by individuals and groups emphasizing or valuing one element above another. It also involves many spatial scales, ranging from the local to the global.

Environmental management has many diverse goals such as the desires to control the direction and pace of development, resource optimisation, minimization of environmental degradation and avoidance of environmental disaster. It is concerned with pressing issues of justice and even of survival (Basu & Xavier Savarimuthu, 2018).

Environmental managers can be members of the academia, policy-makers, employees in non-governmental organisation (NGO), public and private sectors, and individuals or groups who make decisions about resources exploitation and issues related to pollution. However, there are some types of activity which are common to environmental managers. They steer the process of developments; ensure that critical environmental limits are not exceeded; work to reduce and mitigate environmental issues; and are concerned with increasing the adaptability and resilience of human societies in the face of environmental change and hazards.

From this point of view, environmental management may be defined as the system that anticipates and avoids, or solves, environmental and resource conservation issues (Basu & Xavier Savarimuthu, 2018).

Self-Assessment Exercise

“Environmental Management as a concept is very dynamic and is not easily defined”. Discuss.

3.2 Interdisciplinary Perspectives of Environmental Studies.

The study of Environment involves every aspect which affect man, its interaction with the surroundings and its pursuit to live. Environmental studies therefore, can be regarded as interdisciplinary, which comprises discipline such as anthropology, archaeology, biology, chemistry, economics, engineering, geology, health sciences, law, management, physics, political science, sociology, statistics and technology.

The physical sciences including geography, geology and atmospheric science help in understanding the basic concepts of structural and functional organization, as well as the physical characteristics of the environment. Mathematical science is used in environmental modeling while engineering and urban planners provide solutions to pollution management, waste management, green building and green energy.

Economics make possible better understanding of the social background that is required to achieve growth and development. The management studies help to formulate policies, backed up by legislation required for its implementation. The study of environment is also related to philosophy, ethics and cultural traditions which make it a multifaceted discipline.

This is why Experts in Environmental Science can fit in as Consultants or Managers in Engineering, Public Health, Waste Management and other Industry. They can also be employed as Architect of landscape design, Urban planner and Transport manager. Environmental Studies is becoming an emerging discipline that is not only concerned about concepts, theories and ideas about environmental issues but is founding practical global solution that will lead to environmentally responsible and sustaining life styles (Basu & Xavier Savarimuthu,2018).

Self-Assessment Exercise

"Environmental Studies is a multifaceted discipline which makes it to be different things to different people" Discuss.

3.3 The relationships between human activities and the environment

The environment represents the physical surroundings or place in which man lives. This includes the land, sea and the atmosphere. There is interaction between man and his environment through his activities on the environment and conversely the environment affects man as well. The man altered the environment, for instance by cultivating on land for farming; while the environment affects man when he responds to the climatic changes that take place in his environment. This man-environment interaction result to both positive and negative influence.

The spate of industrialisation that is taking place in Europe, North America and the other parts of the world greatly influence human's relationship with the environment. This is because prior to era of industrialization, the effects of human activity were not very significant.

The technologies that were used during this era did not have great impacts on the environment. The Pre-industrialisation era was predominantly agrarian, the people used hand tools such as hoes and cutlasses or simple technologies which have little influence on the environment. The emergence of industrialization has brought about drastic changes in the mode of production and greater exploitation of natural resources which consequently have increased human impact on the environment. The changes that human activities have brought to the environment can be discussed under two broad types:

(i) Natural Resources and (ii) Wastes Production.

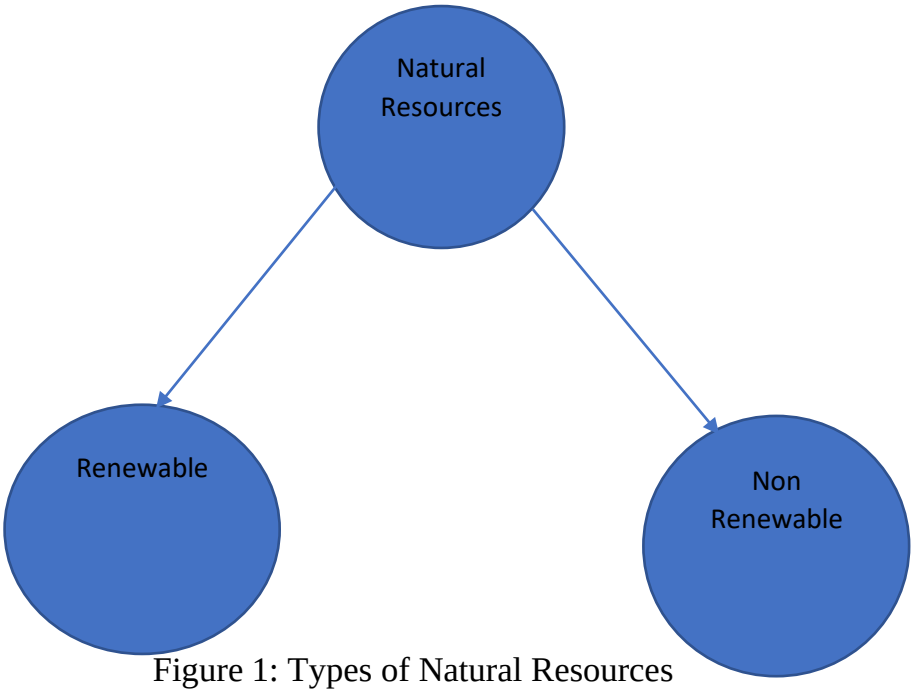

Figure 1: Types of Natural Resources

Natural resources

Natural resources can be described as those resources that came directly from nature or that are still in their natural form. The common examples of natural resources are stone, wood, water, animals and plants. There are also physical resources that are made by man. The examples of physical resources include paraffin, petroleum, roads, vehicles and houses. Man depends on food and water for survival, and needs energy for numerous purposes, from domestic cooking to major industrial processes. Goods such as clothes, transport, buildings, tools and all other items used in the household require different resources for their final production. The needs for these resources become more as the population increases and consumption per person increases with the socio-economic development in the society. This makes the issue of depletion of natural resources a grave concern to the environmentalist. The natural resources can be grouped into Renewable and Non-Renewable resources (Fig 1).

Renewable and non-renewable resources

The Non-renewable resources cannot easily be replenished by natural means as they are consumed. The examples of Non-renewable resources are minerals and fossil fuels such as petroleum, coal and gas. They are formed over many years by natural processes through decayed plants and animals. Renewable resources are easily regenerated over short time period by natural processes. The examples include solar energy, which are not modified or used up by humans while others, such as water, are altered when we use them and can be over-exploited or damaged such that the resource is no longer available for use (The Open University, 2016).

Wastes Production

The wastes are produced from wide varieties of man activities on the environment, such as from agriculture, industry and mining, as well as the one from the bodily wastes. There are Household or municipal waste which are generated from variable sources where different human activities are encountered. The municipal solid waste that are generated from the developing countries are mainly from households (55–80%), followed by market or commercial areas (10–30%). The later types of wastes are generated from industries, streets, institutions and other sources (Nabegu, 2003; Abdou-Shafy & Mansour, 2018).

Self-Assessment Exercise

Write short notes on Natural Resources and Waste Productions. Provide examples where necessary.

3.4.1 The importance of natural resources to Man

The environment become very important to man when the society is faced with situations such as economic crises, wars, and unending societal problems. This is so because the environment basically becomes the only home that man has which provides him the necessities of life like air, food, shelter and other needs. The Natural Resources are important to man in the following ways:

(i) Natural resources help to maintain balance for the environment. In other words, the natural systems are in a state of equilibrium. This means when one element is disturbed all the other elements get interrupted in the entire system.

The natural communities of plants and animals exist, and is maintained by competition, adaption and other interactions. There is balance of relationship between the members of a community and their nonliving environment.

(ii) Natural resources can be conserved through the 3Rs (Reduce, Reuse and Recycle) which help to cut down on waste that is thrown away.

(iii) It serves as source of Government revenue for economic development of a country. In Nigeria, Petroleum is the main source of foreign exchange earnings and has contributed to her rapid economic growth in sectors such as transportation, construction, manufacturing, and government services.

(iv) It serves as a source of energy for human use. The energy sources include petroleum, wood, coal, oil, gas, tar sands, and hydro power.

(v) Natural resources have great potential for creating significant number of jobs in agriculture and extractive, manufacturing, transportation, communication and other industries. The examples of agriculture and extractive industries are oil and gas exploration, mining, dredging, farming and quarrying. Dredging helps in preventing flooding and have significant impact upon the wildlife that lives in and around a watercourse. The manufacturing industries are mainly those which produced finished goods and services, while communication industries examples include advertising, computer databases, home videos, motion pictures, public relations, publishing, telecommunications, telegraphs, television, radio, and other information industries. The transportation industries are companies such as airlines, trucking, railroads, shipping, and logistics firms. The energy sources such as petroleum products, biofuels and natural gas are used for transportation.

(vi) It reduces poverty and brings about improve standard of living for the people. The people depend upon natural resources directly for their livelihoods and as such it plays a significant role in their poverty reduction efforts.

(vii)It is used to grow food for man. The natural resources such as food and water are very essential for human existence. The importance of natural resources to man existence can therefore not be understated (The Open University, 2016).

Self-Assessment Exercise

What is Natural Resource?

Why do you think it is significant to man?

3.4.2 The Problems, Causes and Consequences of Natural Resources Over-exploitation

There is over-exploitation of natural resources when it is over used to the point of diminishing returns. It is also referred to as over-harvesting, it is applicable to medicinal plants, grazing pastures, game animals, fish stocks, forests, and water aquifers. Examples of over-exploitation include overfishing, overhunting etc. The continued over exploitation can lead to the destruction and extinction of natural resources, this is why effort must be made to preserve and protect the ecosystem. Wastes is therefore inevitable anytime there is over-exploitation. Wates can be described as unwanted materials or substance that is of no use.

The common sources of wastes are domestic, commercial, industrial and agricultural wastes. The bodily wastes from humans now constitutes as serious threats to the environment. This can be in form of open defecation to the environment. The examples of commercial wastes are plastics and paper.

Food leftovers, bottles, plastics and aluminum cans are examples of domestic wastes while examples of Industrial wastes are dirt and gravel, masonry and concrete, scrap metal, oil, solvents, chemicals and scrap lumber. Agricultural wastes include cattle waste, weed, husk and vegetables.

Open defecation can lead to water borne disease in water and food that have been contaminated so, the health workers must provide services that will ensure effective public health system and positively impacts the quality of life of the people.

The wastes generated from the various source above can cause pollution of air, water and soil. Pollution is the introduction into the environment of substances which is liable to cause harm to humans and other living organisms. There are wastes which contain organic materials such as fat from the hides and toxic chemicals including some human carcinogens. The greenhouse gases such as carbon dioxide, methane and nitrous oxide, may be released to the environment. This waste contributes to human-induced climate change.

The major causes of overexploitation of resources include over population, deforestation, technological advancement, poor soil management, pollution, mining and erosion.

The consequences of overexploitation of these natural resources include, Desertification, extinction of species, forced migration, soil erosion, oil depletion, ozone depletion and increase greenhouse gas (The Open University, 2016).

Self-Assessment Exercise

What is waste?

Elucidate the various sources of wastes in the Environment.

4.0 Conclusion

The environment is very important to man because it serves as its home and provides him the basic necessities of life like air, food, shelter and other needs.
Man interacts with his environment through his activities on the environment and conversely the environment affects man as well. This interaction between man and environment result to both negative and positive influences that are of particular interest to the academics, environmentalists, government, policy makers and other stakeholders. The positive influences give focus to the importance of natural resources to man while the negative influence consider the problem of ever exploitation of natural resources. The environment therefore, needs to be protected and sustained for man to be able to harness its benefit to the optimum.

5.0 Summary

Environment can be asset or liability to man depending on how it is utilized and managed. This module considers some basic conceptual definitions about the environment, the interdisciplinary perspectives of Environmental Studies and the relationships existing between human activities and the environment. The importance of natural resources to man was also discussed. The unit ended with exploring the problems, causes and consequences associated with over-exploitation of natural resources.

6.0 Tutor-Marked Assignment

(i) Explain clearly the term "Environment".
(ii) What is Environmental Management?
(iii) Briefly enumerate the goals of environmental management
(iv) (a) Define the term "Natural Resources"
(b)Why is Natural Resources important to Man?
(v) Differentiate between Renewable and Non-Renewable Resources.
(vi) "Environmental Studies affects every aspect of Man". Discuss this statement in relation to the Interdisciplinary nature of the study of Environment.
(vii) Why is Environmental Studies an interdisciplinary discipline?
(viii) Describe the major changes that human activities can bring to the environment.
(ix) (a) Examine the term "Over-exploitation" of Natural Resources.
(b) What are the problems of Over exploitation of Natural Resources?
(x) Identify the problems and the consequences of Over-exploitation of Natural Resources.
(xi) Mention the major causes of overexploitation of resources.

7.0 References

Abdou-Shafy, H.I. & Mansour, M.S.M. (2018). Solid waste issue: Sources, Composition, Disposal, Recycling, and Valorization. Egyptian Journal of Petroleum.27(4):1275-1290.

Basu, M. & Xavier Savarimuthu, S. J. (2018). Fundamentals of Environmental Studies. Cambridge University Press, 2018. DOI**:**https://doi.org/10.1017/9781316336328

Boring, E.C, Langfield, H.S., & Weld, H.P (Eds).(1961). Foundations of Psychology. Indian edition. John Wiley, New York.

Daley, B. & Kent, R. (2013). Environmental Science and Management. Centre for Development, Environment and Policy (SOAS University of London).

Douglas, O.B. & Holland, B.F. (1947). Fundamental of Educational psychology. Macmillan, New York

Jolly, V. (1978). The Concept of Environmental Management Development. Foram 8(2):13–26

Mangal, S. K & Mangal, S (2019). Psychology of Learning and Development. PHI Learning Pvt. Ltd., New Delhi, India.

Mudasser, M. (2014). Environmental Management: Concept, Types and Importance. Khulna University, Bangladesh, Department of Urban and Rural planning.

Nabegu, A.B. (2003). An Analysis of Municipal Solid Waste in Kano Metropolis, Nigeria. Journal of Human Ecology.31(2):111-119

The Canadian Environmental Protection Act, CEPA(1999). Canadian Environmental Protection Act, 1999. Accessed on 23rd June, 2020. Available at: https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/publications/canadian-environmental-protection-act-1999.html

The Open University (2016). Study Session 1: Human Interactions with the Environment. 1760 Solihull Parkway Birmingham Business ParkB37 7YDUnited Kingdom. Accessed on 23rd June, 2020. Available at: https://www.open.edu/openlearncreate/mod/oucontent/view.php?id=79926&printable=1

Woodworth, R. S. & Marquis, D. G. (1948). Psychology. Henry Holt, New York.

UNIT 2: THE ENVIRONMENT AND ITS COMPONENTS

CONTENTS

1.0 Introduction

Man is surrounded by the environment and other organisms that are on the surface of the earth. In other words, man is surrounded by both abiotic and biotic factors. This made man an inseparable part of the environment, thus making him has a very close relationship with the environment in which he lives. There are different kinds of socio-cultural activities that normally take place every day in the environment where man lives, this directly or indirectly affects his social life. This led to different life styles of the people across countries and continents in the world. Lifestyle can be perceived in terms of work and leisure behaviour patterns, activities, attitudes, interests, opinions, values, and income distribution.

2.0 Objectives

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

- Describe the basic components of the Environment
- Explain the meaning of Ecosystem
- Discuss the major types of the Environmental Ecosystem
- Examine the functions of the Ecosystem

3.0 Main Content

3.1 Components of the Environment

The environment represents the aggregate of all the conditions which provide support to the living things; including the humans. The environment thus, comprises both the natural and human-made systems. The natural environment supports the living things while the built environment, which is human-made system is supported by the natural environment. The situation of the natural environment helps to determine the quality and survival of life on Earth.There are many classifications of the components of the Environment, in this study unit, attempt will be made to consider these various classifications.

The first classification of environment is based on the three important constituents which are:
(a) Physical
(b) Biological
(c) Social

(a) The Physical environment are soil, water, air, climate, temperature, light etc. They are referred to as the abiotic constituents of the environment. This environment determines the type of the habitat or living conditions of the human population. It is further divided into three parts namely:
(i) Atmosphere (gas)
(ii) Hydrosphere (liquid)
(iii) Lithosphere (solid)
These represent the three important states of matter constituting the environment. This physical component of environment basically consists of non-living things like air, water and soil. All these nonliving things have great influence on all living organisms, including man. Water and temperature are the most important abiotic components affecting living beings. The larger proportion of man's body weight is water. Air provides oxygen for man's respiration. Also, all living beings including plants & animals require oxygen for their existence. The Soil is very important for all living beings to create their habitat. Plants are grown in the soil and man use it to construct their houses where they live. The ground water in the soil is also important for drinking and farming activities. The abiotic component is made up of the following:

1) Location – this is in terms of exact location of a place on the earth. Other factors relating to locations are climate, temperature, rainfall, forest, availability of water and other natural resources.

2) Terrain – this is in terms of altitude or degree of slope of the physical environment.
3) Geological structure - is the presence and composition of underline rocks. It determines land forms and the occurrence of mineral wealth.

4) Climate – this is the most dominant component of physical environment. It can be determined through temperature, rainfall, humidity and sunlight. It can affect plant growth, type of soil, occupation etc.

5) Energy - the sun is the main source of heat and light in the environment. It is also the life-giving force for the plant and animal world (University of Mumbai, 2013; Your Article library, 2014).

(b) The biological environment is also known as biotic component of environment. This consists of all living things such as plants, animals and small micro-organisms like bacteria. It interacts with the abiotic component of the environment.

This interaction of the two components led to the development of various ecosystems like pond ecosystem, marine ecosystem, desert ecosystem etc. The biotic components influence the living organism, plants, animals and man. They are interlinked and form a food chain. There is Biosphere which is the self-sufficient large ecosystem of the earth. The ecosystems consist of three different types of living organisms which are:
(i) Producers or autographs
(ii) Consumers or heterotrophs
(iii) Decomposers and reducers.
The Producers are green plants and other photosynthetic bacteria which produces various organic substances such as carbohydrates, proteins etc through water, soil and light energy. Consumers feed on the organic food produced by the green plants. The Decomposers bring about the decomposition of dead plants and animals, which return the various important minerals needed for the running of the biogeochemical cycles (University of Mumbai, 2013; Your Article library, 2014).
(c) The social constituent of environment consists of various groups of different living organisms like birds, animals etc. Man is regarded to be the most intelligent living organism, he builds house, prepares food and releases waste materials to the environment. Man is described as a social animal by Aristotle the Greek philosopher. He makes various laws and policies which are necessary for the proper functioning of the society (Your Article library, 2014).
The three components of the environment discussed above give rise to four important zones. These are Atmosphere, Hydrosphere, Lithosphere and Biosphere. There is continuous interaction among these zones which involve the transport of various elements, compounds and energy forms.

Self-Assessment Exercise
Describe the major components of the environment.

Atmosphere: is a complex mixture of a number of gases, water vapour and a variety of fine particulate material which is divided into four major zones based on temperature. The zones are namely:
(i) Troposphere - this is above the earth's surface; it extends to a height of 20 kms above the equator and 8 kms over the poles. It is also the lowest layer of the atmosphere, where humans live, all weather occurs and most clouds appear. The temperature in this layer normally decreases with height.
(ii) The Stratosphere – It is thick and is an important zone of the atmosphere, because it contains the 'Ozone' layer. In this zone, the ozone layer is warm because it absorbs ultraviolet (UV) rays from the sun
(iii) The Mesosphere - the zone has gradual decline in temperature to about 90°C. The zone is the layer above the stratosphere. The temperature decreases with height, just the same way it does in the troposphere

(iv) The Thermosphere – this is the uppermost layer of the atmosphere. There are increases in temperature with height because it is directly heated by the sun. Also, most of the constituents of this zone are in an ionized state. The fluid system though forms a gaseous envelope around the Earth, its boundaries are not easily defined. They can be arbitrarily defined as the Earth's atmosphere interface and space interface (University of Mumbai, 2013).

Hydrosphere: is described as the total amount of water on a planet, this includes water that is on the surface of the planet, underground, and in the air. It is of great importance for life molecule to survive. Water has a number of physical and chemical properties which enables the molecule to act as best suited medium for life activities. The water moves from earth surface to atmosphere through hydrological cycle which seems to be like a closed system. It takes about 3000 years for a drop of water in ocean to evaporate but takes just an average of 9 days in the atmosphere before falling back to earth (University Corporation for Atmospheric Research, UACR, 2020). It is the most abundant substance on the Earth's surface; with the oceans covering about 71% ~~water~~ of the planet. The glaciers and ice caps, covering additional areas on the earth surface. It is also found in lakes and streams. There is increasing demand for global water resources everyday though the available pure fresh water has been on decrease. Thus, there is need to make precious use of the fresh water, make adequate provision for its storage and conservation (University of Mumbai, 2013; Your Article library, 2014; National Geographic Society, 2020).

Lithosphere: is simply the solid, outer part of the Earth, this includes the brittle upper portion of the mantle and the crust. This outer boundary forms a complex interface with the atmosphere and hydrosphere; it is also the environment in which life evolved. Lithosphere has crustal system composed of various layers which includes: outer most layer of the earth structure and the crust (National Geographic Society, NGS,2015). In general, the earth crust is composed of three major classes of rocks which are Igneous rocks, sedimentary rocks and metamorphosed rocks. The interaction between the crustal system of the lithosphere, atmosphere and biosphere takes place where continental crust is exposed above the sea-level. The crustal material becomes exposed to inputs of solar radiant energy, precipitation and atmospheric gases at the land/air interface. These inputs are often modified by the effects of the living systems of the biosphere. Under the influence of these inputs, crustal rocks are broken down by weathering process and are transferred to fine porus crustal layers called soil. (University of Mumbai, 2013; Your Article library, 2014; National Geographic Society, 2020)

Biosphere: this is made up of the parts of Earth where life exists. It extends from the deepest root systems of trees to the ocean trenches, to lush rain forests and the high mountaintops**.** Biosphere can be described as all the zones on the Earth in which there is life. In other words, it means the entire bio-resources of the earth. The steps involved in the origin of life on earth is very complex and require several centuries.

There is considerable uncertainty about the details of atmospheric composition, the processes involved and even the sequence of events leading to the formation of living cells. The conventional view held that the earliest organism on the planet earth were heterotrophic prokaryotic bacteria. Subsequently, autotrophic prokaryotes & eukaryotes start appearing as stepwise evolutionary changes (Your Article library,2014; National Geographic Society, 2020).

The second classification of Environment is based the two types namely: (a) Micro environment and (b) Macro environment.
Micro environment – this refers to the proximate local surrounding of the organism while the Macro environment can be described as all the physical and biotic conditions that is external to the organism.

The third classification of Environment is based on the following major components.
(a) Natural and physical component – this can be further divided into two types namely abiotic or non-living and biotic or living component as earlier discussed in this unit.
(b) Culture or human components – these are all the man-made and artificial characterstics of human society. Man stays in physical or natural environment but he changes this natural environment to suit his needs and requirements. In other words, he develops a kind of cultural environment for himself.
(c) Social environment – this can be perceived from the nonmaterial aspect which include the norms, values, ideas knowledge etc. The material aspects are the manifest forms of the nonmaterial aspects.
(d) Economic environment – these are basically the different types of economic activities developed by man. Each kind of the economic activity has its own requirement of resources as well as technology.
(e) Political environment – this takes into consideration the type of environment and its ideological principles. The various important factors such as production, consumption, use of resources etc. are determined by the strategies and policies advocated by the government and the policy makers. This consequently has influence on the level of development and progress in the society. Thus, environment is a very complex phenomena which need to be given serious attention (University of Mumbai, 2013).

Self-Assessment Exercise

Define the term “Atmosphere”
Critically examine its major zones.

3.2 The Environmental Ecosystem

The ecosystem consists of both living and non-living things that are found in a specific natural setting. Plants, animals, insects, microorganisms, rocks, soil, water and sunlight are some of the major components found in the ecosystems. It can be described as the structural and functional unit of ecology where the living organisms interact with each other and the immediate environment. In other words, an ecosystem is simply a chain of interaction between organisms and their environment.

3.2.1 Types of Environmental Ecosystem

The ecosystem falls into one of two or three categories: terrestrial or aquatic and small, medium or large. The Terrestrial ecosystems are land-based, while aquatic are water based. The small-scale ecosystem is called micro ecosystem and its example is a pond. A medium scale ecosystem is known as messo ecosystem and its example is a forest.

The large ecosystem is called biome and tropical rainforest is a good example of this type of ecosystem.

The following two basic types of ecosystem are discussed:

(i) Terrestrial Ecosystems

The Terrestrial ecosystems are exclusively land-based ecosystems and they are as follows:

(a) Forest Ecosystems- this consists of several plants, animals and microorganisms that are living in coordination with the abiotic factors of the environment. It can also be described as a land mass covered in trees. The forests greatly help in maintaining the temperature of the earth and are the major carbon sink.

(b) Grassland Ecosystems – in this ecosystem the vegetation is dominated by grasses and herbs. They can be found in prairies, savannas and steppes but are typically found in tropical or temperate regions, although they can also exist in colder areas as well. Trees are sparse or non-existent, but flowers may be interspersed with the grasses. Grass is good for grazing animals. The examples include, temperate grasslands, savanna grasslands etc.

(c)Tundra Ecosystems – these types of ecosystems are not in Nigeria; they are devoid of trees and are found in cold climate or where rainfall is scarce and are usually covered with snow for most of the year.

It is known for large stretches of land and rock, and sparse layers of low vegetation such as mosses, lichens, herbs, and small shrubs. This surface supports few but unique variety of animals. The examples include the ecosystem in the Arctic or mountain tops.

(d) Desert Ecosystem – they are found throughout the world and are regions with very little rainfall. The vegetation is sparse or non-existent in this ecosystem, and any animal species, such as insects, reptiles and birds, must be highly adapted to the dry conditions. The days are hot and the nights are cold (Harris, 2018; Encyclopedia Britanica, 2020).

(ii) Aquatic Ecosystem

Aquatic ecosystems are ecosystems present in a body of water and it can be further divided into two types, namely:

(a) Freshwater Ecosystem - This is an aquatic ecosystem that basically includes lakes, ponds, rivers, streams, bogs, swamps and wetlands. It has no salt content in contrast with the marine ecosystem. They are subdivided into those in which the water is nearly stationary, such as ponds, and those in which the water flows, such as creeks. They are home to more than just fish: algae, plankton, insects, amphibians and underwater plants also inhabit them.

(b) Marine Ecosystem - Marine ecosystems differ from freshwater ecosystems in that they contain saltwater, and this make it supports different types of species than does the freshwater.

They are the most abundant kind of ecosystems in the world and encompass not only the ocean floor and surface but also tidal zones, estuaries, salt marshes and saltwater swamps, mangroves and coral reefs. Examples include seas and oceans (Harris, 2018; Encyclopedia Britanica, 2020).

Self-Assessment Exercise

(a)What is Ecosystem?

(b)Write short notes on the following and Give examples for each:

(i) Micro ecosystem

(i) Messo ecosystem

(iii) Biome

3.2.2 Functions of the Ecosystem

The functions of the ecosystem are given as follows:

(a) It regulates the essential ecological processes, supports life systems and render stability in the environment

(b) It is responsible for the cycling of nutrients between biotic and abiotic components of the environment.

(c) It sustains a balance among the various trophic levels in the ecosystem.

(d) It enables the minerals to be cycled through the biosphere.

(e) The abiotic components of the ecosystem help in the synthesis of organic components, which requires the exchange of energy.

(f) Eco-system greatly influence the transfer of food energy and nutrients from one source to another source.

(g) Eco-systems provide materials as well as services necessary for human beings survival and development.

(h) The different forms of eco-system are beneficial to the living organisms because they bring about positive impact on the environment (University of Mumbai, 2013).

Self-Assessment Exercise

Discuss the major functions of ecosystem

4.0 Conclusion

The environment is very important to man, it is where he lives and source for his food, air and other essential needs. Human through his interactions with the abiotic and biotic environment is able to determine the quality of life he lives on Earth.

The interactions taking place between the two components of the environment consequently led to the development of various ecosystems which regulate the essential ecological processes and stability in the environment. Hence, this makes man become inseparable from his environment.

5.0 Summary

This unit focuses on the basic components of the environment by considering the various classifications, the conceptual definition of ecosystem and the various types of environmental ecosystem. The unit finally considers the functions of the ecosystem.

6.0 Tutor-Marked Assignment

(i) Vividly examine the major types of living organisms in the ecosystem.
(ii) Write brief notes on the following types of Environment
  (a) Physical
  (b) Biological and
  (c) Social
(iii) Distinguish between abiotic and biotic environment.
(iv) What are the major components of the abiotic environment?
(v)What is cultural environment? Specify the major types of cultural environment.
(vi) Describe the difference between Terrestrial and Aquatic Ecosystem.
(vii) Enumerates the key roles of ecosystem to man.

7.0 References/Further Readings

Encyclopedia Britanica (2020). Tundra Ecosystem. Accessed on 2nd July, 2020. Available at: https://www.britannica.com/science/tundra

Harris, A. (2018). Types of Environmental Ecosystems. Accessed on 23rd June, 2020. Available at: https://sciencing.com/types-environmental-ecosystems-8640.html

National Geographic Society (NGS,2015). Lithosphere. Accessed on 10th December, 2020. Available at: https://www.nationalgeographic.org/encyclopedia/lithosphere/#:~:text=The%20lithosphere%20is%20the%20solid,of%20the%20upper%20mantle)%20below

National Geographic Society (2020). Hydrosphere. National Geographic Society. Available at: https://www.nationalgeographic.org/encyclopedia/hydrosphere/

National Geographic Society (2020). Lithosphere. National Geographic Society. Available at: https://www.nationalgeographic.org/encyclopedia/lithosphere/

National Geographic Society (2020).Biosphere. National Geographic Society.Available at: https://www.nationalgeographic.org/encyclopedia/biosphere/

The University Corporation for Atmospheric Research (UACR, 2020). The Water Cycle. Accessed on 10th December, 2020. Available at: The Water Cycle | UCAR Center for Science Education

University of Mumbai (2013). Basic Concepts Nature, Ecology, Environment. Available at: http://archive.mu.ac.in/myweb_test/M.A.Part%20-%20II%20-%20Paper%20VII.pdf

Your Article library (2014). Environment and Its Components (Explained With Diagram). Available at: https://www.yourarticlelibrary.com/essay/environment-and-its-components-explained-with-diagram/44682

UNIT 3: MAN, SOCIETY AND THE ENVIRONMENT

CONTENTS

1.0 Introduction

Society exists, as a product of coming together of people with the same cultural values and norms in a particular geographical location. The individuals as a family unit come together to form a society. In other words, family serves as an important unit in the societal formation. There is a kind of relations between man and society, this explains why individual development can bring about development in the society. The Society subsists as a kind of social environment in which man lives. An individual developing within the framework of a social system therefore, depends on the whole system of social standards and an autonomy which is necessary requirement for the existence and development of the system. This unit consequently considers conceptual definitions of the society, its features and types.

2.0 Objectives

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

- Define the concept of Society
- Describe the basic features of Society
- Examine the major types of Society

3.0 Main Content

3.1 Conceptual Definitions of Society

The term "society" originated from a Latin word "socius" which means association, togetherness, gregariousness, or simply group life. It can be defined as a relatively large group of people who share common and distinct culture, occupying a particular geographical location, with sense of identity, having all the necessary social arrangements to sustain itself (Doda, 2005). This definition simply considers society as a group of people with similar and distinct culture and interest, who live together in a particular geographical location.

This cultural value can be measured in terms of symbols, language, norms, values, and artifacts while interests may be in terms of civilization and social values.

Calhoun et al (1994) define a society as an autonomous grouping of people who reside within common territory, having a common culture (shared set of values, beliefs, customs etc.) and are linked to one another through regularised social interactions and interdependent roles and statuses. This definition is similar to that of Doda (2005) and it described society as a group of people with the same values, beliefs, customs, ethos and other characteristics, who reside together within the same geographical zone.

Society can be considered from the dynamic perspective and under such situation it will be viewed as a system, focusing on the bounded and integrated nature of the society. This described society as a dynamic system evolving historically and inevitably towards complex industrial structures. This definition can be regarded as Sociologists conceptualization of a society. They believe that society is a complex system of social groups but this argument has been criticized by the contemporary Sociologists who saw it as overlapping, dynamic, and fluid network of economic, political, cultural and other relationships at various levels of social interaction that exists among the people. This conception by the contemporary sociologists has been regarded as analytically powerful reflection of the reality in the modern world (Swingwood, 1991; Doda, 2005).
Durkheim (1982), who is one of the founding fathers of sociology defined society as the combination of social facts and values, a sense of collective consciousness for social integration.

Society is also considered from a different perspective as a system of usages and procedures, of authority and mutual aid, of many groupings and divisions, of controls of human behaviour and of liberties (MacIver,1931)

According to Cooley (1930), Society is a complex of forms or processes each of which is living and growing by interaction with the others, the whole being so unified that what takes place in one segment affects the rest of the whole.

Giddens and Sutton (2017), described Society as the structured relations and institutions among a large community of people which cannot be reduced to a simple collection or aggregation of individuals.
The last four definitions have clearly shown that society as a concept has different meanings by different writers; It is therefore, difficult to arrive at universally accepted definition by all authors. This does not necessarily mean that society means different things to different people, it only suggests that these different authors view society from different perspectives and only underscore one or two aspects of the definition more than the others. Society can therefore, be defined as the bringing together of people with common or distinct cultural values and shared beliefs, for the purpose of living together and maintaining continuous interactions in a particular region.

Self-Assessment Exercise

"Society as a concept has different meanings to different writers, it is therefore, difficult to arrive at universally accepted definition by all authors". Do you agree? Justify your answer.

3.2 Features of Society

The society is normally characterized by patterns of relationships between individuals who share a distinctive culture and institutions. The patterns of relationships are in the form of interactions that take place between two or more people, groups, or organizations. The institutions are grouped into the informal institutions such as customs, or behavior patterns that are of importance to the society, and the formal institutions created by the government and public services. The society can thus be described as the sum total of these relationships among its constituent members. Man is regarded as a social animal because he lives in the society. There are other creatures such as animals or other beings who also live alongside with man in the society. This makes human society in comparison with other societies to be uniqued in several respects. Society can therefore, be understood in a broader context by considering its following basic features or characteristics:

(i) Society is usually very relatively large group of people, in terms of size and population but most social groups are greatly small. Society can then be described as large and complex social group where people interact with one another and share similar culture and territory.
(ii) . Co-operation: there is usually co-operation between members in the society. This fosters support and unity among the members. In the absence of cooperation, the entire structure of the society may collapse. Cooperation forms the very basis of social life in any society.

(iii) Distinct culture – this serves as the most important attributes of the society. The members share common and distinct culture which sets it unique from the other population groups.

(iv) Competition: there is usually competition among members due to the urge to attain any object or objects which are limited in supply. This boils down to the theory of survival of the fittest which means the continued existence of creatures which are best adapted to their environment and the extinction of others. This is a popular concept in the Darwinian theory of evolution.

(v) Defined space or territory: this means the populations that make up a given society are found in a definite geographical area and the people consider it as their own.

(vi) Feeling of identity and belongingness: this means there is also the feeling of oneness among the members of the society. This feeling of identity emanates from the regularised pattern of social interaction that exists among the various groups in the society (Henslin and Nelson, 1995; Giddens, 1996; Calhoun et al., 1994; Doda,2005).

(vii) Common origin: the members of the society believed they have common origin and historical experience. This makes them feel that they also have common destiny.

(viii) Common language: the members may speak a common mother tongue or a major language which often serve as a national heritage for the concerned society.

(ix) Independence: this means that the society has all the necessary social institutions and organizational arrangements to sustain the system. In practical sense a society is not an island of itself, there is a kind of interdependence amongst one nation and the others. Inter– societal relations normally exist whereby, people interact socially, economically and politically. Human being cannot exist in isolation, there must be interdependence between him and others in the society.
(x) Likeness – this in every social group serves as the primary basis of mutuality. Intimacy may be impossible amongst members where there is no understanding. Likeness stimulate group feeling amongst the members in the society.
(xi) Conflict – this is a prevalent phenomenon in every society. It is not only cooperation but conflict that is necessary in societal formation. They must coexist for a healthy society to emerge.
It must be noted that sometimes not all the above may apply to all societies, due to the variation in the level of economic and technological development of the society (Doda, 2005; Your Article library,2014).

Self-Assessment Exercise
What are the important features of a Society?

3.3 The major types of Society
The distinction in regard to the types of society is so important that sociologists generally classify it along the spectrum of the level of industrialization that is taking place in a particular society. This can be viewed from the three periods of preindustrial, industrial to postindustrial era. The more-advanced societies share a political authority. The society can also be defined in terms of its technological sophistication. This implies that as society advances, so its level of technology. The societies with simple technology are greatly influenced by the changes in their environments, while the industrialized societies because of their technological sophistication have more influence over their surroundings and thus develop different cultural features. The classifications will therefore be considered from the Pre industrial, Industrial and Postindustrial Society.
The Postindustrial classifications of Society by scholars are based on the level of economic, political and technological development while the Preindustrial societies are

basically small, rural, and dependent largely on local resources. The economic production during this era was limited to the amount of labor a human being could provide, and there were few specialized occupations. The industrial Societies witnessed the period of industrial revolution in European countries when goods are produced by the machines and there was great technological breakthrough.

(A) The Preindustrial Societies

The first classification focuses on the Preindustrial era. This takes into account the temporal succession and the source of economic organization (Lensiki, Nolan & Lensiki, 1995). There is a kind of transformation from one form to another when societies modernised. The societies under this classification have limited economic production in relation to what human labour could produce and there were very few specialized occupations. The following types of societies are discussed under this classification:

(i) Hunter-gatherer societies.

This is the simplest type of society that is in existence today and may be regarded as the oldest. The economic organization is based on hunting and gathering. The basic structure of the human society until about 12,000 years ago, were based on kinship or tribes These societies demonstrate the strongest dependence on the environment and relied on their surroundings for survival by hunting wild animals and foraged for uncultivated plants as food. The societies were basically nomadic, they moved to a new area to find sustenance and were common group until several hundred years ago, but today only a few hundred remain in existence, such as indigenous Australian tribes who are sometimes referred to as “aborigines,”. There is also the Bambuti, a group of pygmy hunter-gatherers who can be found in the Democratic Republic of Congo. These groups are quickly disappearing as the world’s population explodes.

(ii) Pastoral Societies

The pastoral societies are those whose livelihood is based on pasturing of animals, such as cattle, camels, sheep and goats. The human societies began to tame and breed animals and to grow and cultivate their own plants. The Maasai villagers who are good example of pastoral societies, rely on the domestication of animals as a resource for survival. They were able to breed livestock for food, clothing, and transportation, and created surplus goods. The Herding, or pastoral societies remained nomadic because they were forced to follow their animals to feed on fresh grounds. In this period, there emerged specialized occupations, and the societies commenced trading with local groups.

(iii) Horticultural societies

In these societies the economy was based on cultivating plants by the use of simple tools, such as digging sticks, hoes, axes, etc. The societies developed, based on the newly developed capacity for people to grow and cultivate plants.

Previously, the depletion of crops or water supply forced pastoral societies to relocate. They search for food for their livestock. Horticultural societies are usually formed in

areas where rainfall and other conditions would allow for the growing of stable crops. The Societies like hunter-gatherers largely depended on their environment for survival, but they don't abandon their location to search for resources. They instead, decided to have permanent settlements. This led to more stability and more material goods. This consequently form the basis for the first revolution in human survival.

(iv) Agricultural Societies.

This society, which is still dominant in most parts of the world, is based on large-scale agriculture, which largely depends on ploughs using animal labor. There was Agricultural Revolution about 3000 B.C.E., which made farming not only possible but profitable. The farmers learned how to do crop rotation and reuse waste products such as fertilizer, which result to better harvests and more surpluses of food. There are new tools for digging and harvesting which were made of metal, this made the farm implements more effective and durable. The human settlements grew into towns and cities, some of which became centers of trade and commerce. This period also ushered in more contemplative and thoughtful activities, such as music, poetry, and philosophy. The period became known as the "dawn of civilization" because of the development of leisure and humanities that heralded this era. The craftspeople provide support for themselves through the production of creative, decorative, or thought-provoking aesthetic objects and writings. The abundant resources translate to more divisive social classes. This phenomenon made those with more resources to enjoy better living and developed into a class of nobility. This led to increase difference in social standing between men and women. As cities expanded, the ownership and preservation of resources became a major problem.

(v) Feudal Societies

There was a strict hierarchical system of power based around land ownership and protection under the feudal societies. The nobility, who are also known as lords, placed vassals in charge of pieces of land. The vassals in return for the resources gotten from the land, promised to fight for their lords. The lands were cultivated by the lower class or peasants who in return for maintaining the land were guaranteed a place to live and given protection from the enemies. The Power was handed down through family lines, with peasant relations serving lords for generations. This social and economic system of feudalism later failed and was replaced by capitalism and the technological development of the industrial era (Doda, 2005; OpenStax, 2017).

(B) Industrial Society

The second classification of the society is one in which goods are produced by machines powered by fuels instead of by animal and human energy. There was a dramatic rise in technological invention in Europe in the eighteenth century, this led to the era known as the Industrial Revolution.

This period marked the increase in the number of new inventions which greatly had influenced on people's daily lives. Tasks that would have required months of labour to

complete became achievable in a matter of days. There were lot of inventions during this era such as that of steam engine, textile mills, mechanical seeders and threshing machine, paper, glass and gas light which resulted to increase productivity, quality education and health care, better products and development of cities and towns.

There was rise of urban centers, the workers flocked to factories for jobs, and the populations of cities became increasingly diverse. This led to the emergence of new generation of people who became less preoccupied with maintaining family land and traditions but are more focused on wealth acquisition and attaining upward mobility for themselves and their families. The people moved to new environments and were faced with problems of filth, overcrowding, and poverty. There was power shift from the hands of the aristocracy and "old money" to business-savvy newcomers who amassed fortunes in their lifetimes. The concerns over the exploitation of workers later led to the formation of labor unions and laws that set mandatory conditions for employees. The introduction of new technology at the end of the nineteenth century though served as the end of industrial age, however, much of the social structure and social ideas like family, childhood, and time standardization formed the foundation for the industrial society (Doda, 2005; OpenStax, 2017).

(C)Postindustrial Society

The third classification was the postindustrial or digital societies, also known as the Information societies. This era happens to be a recent development. The post-industrial societies are not rooted in the production of material goods, but are based on the production of information and services. The economy of these societies is driven by knowledge and not material goods, power lies with those in charge of storing and distributing information. The adherents of a postindustrial society are likely to be employed as sellers of services, for example, the software programmers or business consultants; instead of being producers of goods. The social classes are divided by access to education, since without technical skills, the people in postindustrial societies are likely going to lack the means for success.

The Postindustrial classification may also give focus on the level of economic and technological development of nations. This is used to measure the level of development by countries in terms of their economic and technological attainment. In this classification, we have the First World, Second World, The Third, Fourth, Fifth and Sixth World countries. They are discussed below:

(a) The First World countries are the highly industrialised and economically successful countries such as USA, Japan, Britain, United Kingdom, France, Italy, Germany, Canada Australia, New Zealand and Western European Countries.

They are developed and industrialized countries which are characterized by political stability, democracy, the rule of law, predominantly capitalist economy, economic stability and high standard of living.

(b) The Second World Countries-this category is followed by the Second World countries that are regarded as more stable and more developed than the third-world countries but are less-stable and less-developed than the first world countries. The examples of countries in this category include almost all of Latin and South America, China, Russia, Turkey, Thailand, South Africa, Czech Republic, Hungary, Poland, Romania, and others. They are sometimes referred to as emerging markets. The third World Countries are described as a class of economically inferior nations. They are nations mostly in Asia and Africa that were not aligned with either the United States or the Soviet Union.

(c)The third world countries: this includes countries such as Brazil, Croatia, Estonia, India, Lithuania, Kazakhstan, Romania, Serbia, Slovenia, Kenya, Mauritius, Morocco, Nigeria, Tunisia, WAEMU, Bahrain, Jordan, Kuwait, Lebanon, Oman, Bangladesh, Sri Lanka, Vietnam and others.

(d) Fourth World Countries - this is a term used to describe the most underdeveloped, poverty-stricken, and marginalized countries of the world and are regarded as the "poorest of the poor". The countries under this category are having extremely low income per capita and limited natural resources. They consist of those nations excluded from mainstream society, for example, the Aboriginal tribes in South America or Australia; and nations without sovereign status, such as the First Nations groups throughout North, Central, and South America.

They are also labeled by the United Nations as the Least Developed Countries, or LDCs. They include the following nations: Angola, Benin, Burkina Faso, Burundi, Central African Republic, Chad, Comoros, Democratic Republic of the Congo, Djibouti, Equatorial Guinea, Eritrea, Laos, Maldives, Nepal, Yemen, Kiribati, Samoa, Solomon Islands, Tuvalu, Vanuatu, Haiti and others.

(e) The Fifth World Counties – this applies to small nations or micronations that are having strong and established national identities, with small territories or are completely virtual.
The examples include Operation Atlantis, Republic of Minerva, principality of Fredonia, Republic of Rose Island, Global County of World Peace, Asgardia, Free Republic of Liberland.
(f) The Sixth World countries- the term applies to serious nations without strong and established national identities which are usually younger than 4 years old.

They are very likely to fail (Giddens, 1996; McGirk, 2001; Doda, 2005; Sellars & Simon,2006; BBC, 2015; Asgardia, 2018; Fandom, 2020; Investopedia, 2020; World Population Review, 2020).

Self-Assessment Exercise
Briefly discuss the major types of society under the Preindustrial Classification.

4.0 Conclusion
There is no way we can have a good knowledge of man interaction with his environment without considering the types of society he lives. Man as a social animal depends greatly on his social environment for survival. Society is formed on the basis of coming together of people of common and distinct culture, occupying a particular geographical location. This can be in form of different family units and social groups developing to community. The family can be described as an important unit of any society. In other words, the nature of family existing in a particular place determines the kind of society that will be obtained in that community. It is therefore, no doubt that a healthy family brings about positive development in the society.

5.0 Summary
This unit examines the concept of Society and its relevance to man. It has been learnt in the unit that society is a group of people with similar and distinct culture and interest, who live together in a particular geographical zone. The basic features of Society were also discussed. The important features of the society that were mentioned are, it is usually relatively large group of people, there is usually cooperation among members, who have common identity, language and interests. In addition, the members live together in a particular location and have common and distinct culture. The types of Society were also considered and this include the Preindustrial, Industrial and Postindustrial society. The Postindustrial society is the modern civilization, where the economies were not only transformed but the societies were at the same altered.

6.0 Tutor-Marked Assignment

(a) Mention the major types of Society and specifically state where countries like Nigeria and Kenya can be classified in terms of their economic and technological attainment.
(b) “Man is a social animal”. Discuss this in relation to the significant features of Society.
(c) Describe the term “Industrial Society”. What makes this type of society to be different from the feudal society?
(d) What is society? Elucidate the major criteria used to classify societies into different categories.
(e) Society can be described as a group of people living together in a geographic zone. Explain.
(f) Discuss the main features of society. Why is one society better than the other society?
(g) List and discuss the major types of society under the Postindustrial category.

(h) The distinction in societies is very important in terms of the variation that exists in the level of industrialization of a particular society to that of others. What are the possible types of society based on the level of industrialization?
(i) There are countries which are the most underdeveloped, poverty-stricken, and marginalized of the world and are regarded as the "poorest of the poor". They have very low income per capita and inadequate natural resources. Give five examples of these countries and discuss others under this categorization.
(j) Examine the major types of Society. What are the important attributes of Societies?

7.0 References/Further Readings

Asgardia (2018). Archived copy. Asgardia. 19 January 2018. *Archived from the original on 16 November 2016. Retrieved 24 November 2016.*

BBC (2015). Balkans: Czech man claims to establish 'new state'". BBC News. 16 April 2015.

Calhoun, C., Donald, L Jr & Suzanne, I. K. (1994). Sociology. 6th Ed. New York: McGraw Hill.

Cooley, C. (1930). Sociological theory and social research. New York: H. Holt and Company

Doda, Z. (2005). Introduction to Sociology. Debub University, Ethiopia. In collaboration with the Ethiopia Public Health Training Initiative, The Carter Center, the Ethiopia Ministry of Health, and the Ethiopia Ministry of Education

Durkheim, Émile. 1982 [1895]. *The Rules of the Sociological Method*. Translated by W. D. Halls. New York: Free Press.

Fandom (2020). The Sixth World. Accessed on 7th July 2020. Available at: https://fifthworld.fandom.com/wiki/Sixth_World

Fandom (2020). Fifth World Wiki. Accessed on 7th July 2020. Available at: https://fifthworld.fandom.com/wiki/Fifth_World

Giddens, A. & Sutton, P.W. (2017) Essential Concepts in Sociology. 2nd Edition. Polity Press, United Kingdom.

Giddens, Anthony. 1996. Sociology. 6th Edition. London: Macmillan

Henslin, James M. and Adie Nelson. 1995. Sociology: A Down-to-Earth Approach. Canadian Edition. Scarborough, Ontario: Allyn and Bacon

Investopedia (2020). First World Definition. Accessed on 7th July, 2020. Available at: https://www.investopedia.com/terms/f/first-world.asp

Investopedia (2020). Fourth World Definition. Accessed on 7th July, 2020. Available at https://www.investopedia.com/terms/f/fourth-world.asp

Investopedia (2020). Second World Definition. Accessed on 7th July, 2020. Available at https://www.investopedia.com/terms/s/second-world.asp

Investopedia (2020). Third World Definition. Accessed on 7th July, 2020. Available at: https://www.investopedia.com/terms/t/third-world.asp

Lensiki, G; Nolan, P & Lensiki, J. (1995). Human Societies:An Introduction to Macrosociology. Seventh Edition. New York: McGraw-Hill.

MacIver, R. M. (1931). Society. Its structure and changes. New York: Ray Long and Richard R. Smith, Inc

McGirk, J. (2001). "Yogi's disciples want to create new utopia". *The Independent*. London (UK). p. 17. Archived from the original on 2013-05-17.

OpenStax(2017) Introduction to Sociology 2nd Edition. Rice University, Houston, Texas 77005. Available at: http://cnx.org/content/col11762/1.6

Sellars, J. R. & G. D. Simon (2006). *Micronations: [the Lonely Planet guide to home-made nations]*. London: Lonely Planet Publications. pp. 28–33. ISBN 978-1-74104-730-1.

Swingwood, A (1991). A Short History of Sociological Thought. London. 2nd Edition. McMillan

World Population Review (2020). Fourth World Countries 2020. Accessed on 7th July, 2020. Available at: https://worldpopulationreview.com/country-rankings/fourth-world-countries

Your Article library (2014). Six Basic Elements or Characteristics which Constitutes Society. Accessed on 6th July 2020. Available at: https://www.yourarticlelibrary.com/society/6-basic-elements-or-characteristics-which-constitutes-society-927-words/8506

UNIT 4: APPROACHES TO THE STUDY OF MAN-ENVIRONMENT RELATIONSHIP

CONTENTS

1.0 Introduction

The study of the relationship between man and the environment has been the focus of environmental scientist. Man has established relationship with his environment since the primeval time through man's constant interaction with the nature. This is in terms of the way he breaths, drinks, eats and receives energy and information in relation to the environment where he lives. It is therefore, incumbent for man to be sensitive to any changes in the environment, because of its importance to him. An adverse environmental change will not only have devastating effects on man but might also cause a serious danger to the entire human race and vice versa. This unit therefore, attempts to examine the various approaches to the study of man-environment relationships.

2.0 Objectives

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

- Discuss the various Scientific Approaches to the study of Man-Environment Relationship
- Describe the significance of Determinism Approach to the study of Man-Environment Relationship
- Elucidate the relevance of Possibilism Approach to the study of Man-Environment Relationship
- Explain the significance of Probabilism Approach to the study of Man-Environment Relationship
- Identify the importance of Teleological Approach to the study of Man-Environment Relationship

3.0 Main Content:

3.1 Approaches to the study of Man-Environment Relationship

The following scientific approaches to the study of man-environment relationship are discussed:

(i) Determinism Approach

This is one of the scientific approaches to the study of man-environment relationships. The approach is based on the tenet of "earth made man" which means that the physical environment is having complete control on man and his activities. In other words, man is subordinate to the natural environment in which he lives. The entire aspects of human life are totally depended and controlled by his physical environment. Human life aspects consist of the physical, mental, emotional and spiritual levels.

Charles Darwin's work in 1859 laid the groundwork for the concept of environmental influences on man and other organisms while E. Huntington's postulation that 'climate not only influences human life but also his birth' shows that he was a strong advocate of environmentalism.

Environmental determinism was used by early academic geographers such as Carl Ritter, Ellsworth Huntington and Ellen Churchill Semple to explain social variation that occur within different geographical locations. They alleged that individual and natural character, culture, health, religion, economic practices and social life are all derived from environmental influences.

Friedrich Ratzel, a German Geographer is generally considered as the pioneer of environmental determinism school of thought. He is also known as father of human Geography and coined the term Lebensraum which literarily means the "living space". The work titled: "Anthropogeography or Outline of the influences of the Geographical Environment upon History" was attributed to him. He emphasized that man lives under the nature's laws; and his cultural forms is adapted and determined by the forces of nature.

Environmental determinism's popularity began to decline in the 1920s inspite its success in the early 1900s, this is basically as a result of its claims that were found to be wrong. The critics of this school of thought, claimed it was racist and tend to perpetuate imperialism. Carl Sauer in 1924 also argued that the determinism approach led to the generalizations of an area's culture and did not give room for results based on direct observation or other research. This phenomenon led geographers to develop the theory of environmental possibilism to explain cultural development. Environmental determinism by the 1950s was nearly replaced in geography by environmental possibilism, thus ending its prominence as the main theory in the discipline. However, despite its dwindling popularity determinism approach became an important element of geographic history. The determinism approach originally represented an attempt by early geographers to explain the patterns they saw developing across the globe. The core point of this approach is that human achievement is determined by the natural environment, incorporating location along with geophysical and biophysical features.

This may include cultural modifications, and some extend controls from material to intellectual life. (Lewthwaite, 2001; Mairs,2007; Shamim,2016; Ashok,2018; Briney,2020).

(ii) Possibilism Approach

Alfred Hettner, a German Geographer is generally considered as one of the pioneers of Possibilism school of thought. This approach is also known as Possibilistic approach. However, a French geographer Paul Vidal de la Blache, became the first active advocate of possibilism, even earlier before Hettner. The doctrine of possibilism tries to explain man relationship with the environment in a different way by putting him at a higher level and regards it as an active agent. The doctrine assumes that the environment provides opportunities to man and he being an economic man chooses from those possibilities.

The possibilist believes that man is totally free from environmental influence, but use technology, attitude, habits, and values of human to bring about changes in the physical environment (Fekadu, 2014).Blache stated that the environment sets limitations for cultural development, but it does not wholly define culture. In other words, culture is defined by the opportunities and decisions made by humans in response to dealing with such limitations. The other possibilism advocates were Jean Brunches, Isaiah Bowman and Carl Sauer.

Lucien Febvre, a French historian was the first who coined the term possibilism and contrasted it with environmental determinism. Febvre remarked that ‘man is a geographic agent and not the least. He ubiquitously contributes his share towards investing the physiognomy of the earth with those ‘changing expressions’ which are the special charge of geography to study’. The possibilism approach emerged through the criticism of environmental determinism and overtone of teleological approach. The environmental determinism since inception was attacked by dissenting voice who believed that there is no doubt that physical environment influences man and his activities but there is ample scope for man to change the environment so that it can become suitable for man and the society.

Environmental possibilism attempt to explain that humans use tools and technology to either alter or address their environmental concerns despite the limitations placed by the environment on them. People for example wear raincoat during raining period and use heavy coat during harmattan season to protect their body against the cold during the period. One of the main arguments raised against possibilism approach is that in spite of the opportunities available to human beings in some physical setting, they cannot go against the instructions set by the physical environment. Griffith Taylor also criticize the possibilism approach by saying that geography is not the study of only, all the problems related to natural environment and humans, human or 'cultural landscape'. There should be effort made to encourage the study of the physical environment and promote humanism in geography (Shamim, 2016; Bansal,2018).

(iii) Probabilism Approach- this simply explain that as the humans view their environment, the characteristics of that environment provides cues as to the probability of certain outcomes.

The environment presents not only what is possible, but what choices would be more or less likely to be made under those particular circumstances. The term "Probabilism" is coined by O. H. K. Spate as a compromise between environmental determinism and possibilism. The Determinists believed that the environment defined the human response, while possibilists held that the environment offered people a number of possibilities. The people could then decide on the opportunities to be followed. Probabilism approach admitted that people had the freedom to choose from these opportunities. Spate argued that the choice was highly constrained, and that the environment made some human responses more probable than others. Probabilism approach was an attempt to resolve a debate which geographers had contended, for most part of the twentieth century, but came when the controversy was dying down, as geography switched from the discussion about how the environment affected humans to probing how people are affected by the environment.

Spate, a British geographer, presented the view that although the physical environment does not uniquely determine human actions, it does nonetheless make some responses more likely than others. Human action is represented as not so much a matter of an all-or-nothing choice, or compulsion, but a balance of probabilities (Flowerdew,2009; Ankurkhtn, 2017).

(iv) Teleological Approach

This approach is based on man's religion as being superior to the nature and all other creatures. Carl Ritter, a German geographer was a teleologist and regarded as one of the founders of modern geographical thought. Teleology attempts to understand events in relation to their underlying purposes. Teleological explanations are often viewed as the opposite of mechanical explanations, where the events and observations are seen as products of major causes such as the 'laws of nature'. Ritter asserted that all phenomena are spatially distributed according to the plan of God for mankind. He had a strong believe in God as the planner of the universe and had a vision of an ordered and harmonious universe. He did not see the shape of the continents as accidental but rather as determined by God. This form and location of the continents therefore, enabled them to play the role designed by God for the development of human kind. The other advocates of Teleological approach include Immanuel Kant, David Hume, Baruch Spinoza, Arnold Guyot, John Stuart Mill and William Paley. The Teleological approach of man-environment relationship has led to excessive and rapid rate of exploitation of natural resources in North America, Western Europe and other parts of the world where these countries have their colonies. The environmentalists and other scientists have held this religious tradition responsible for the present-day ecological crisis that is ravaging some part of the world. This has also stimulated the Europeans to spread all over the world in search of unexplored land and resources.

This consequently, has led to the establishment of colonies in all of the continents they have gone. The natural resources are being exploited without considering the after effect of this over exploitation on the environment. The major problem of the teleological approach is that it cannot be tested empirically and therefore does not qualify as scientific explanation. (Your Article Library, 2014; Shamim,2016).

4.0 Conclusion

There is no doubt that the various scientific approaches that have been considered in this unit had greatly influence the philosophical basis of human-environment relationship. It had also shown the various contributions by scholars to the development of geographical thoughts and the study of environmental sciences. In brief, it can be stated that the man has influence on the environment just as the environment influences man. Therefore, both Man and nature are equally important to bring about the desired solution to the global climatic and environmental problems.

5.0 Summary

This unit discusses the various approaches to the study of man-environment relationship. The approaches that were examined include: the determinism approach, the probabilism approach, the possibilism approach, the teleological approach, the ecological approach and the geographical approach. All these approaches have made significant contributions to Geographical thoughts and the society – nature relationship.

6.0 Tutor-Marked Assignment

(i) Distinguish between Determinism and Possibilism Approach to the study of man-environment relationship.

(ii) What is the significance of Probabilism approach to the study of man-environment Relationship?

(iii) Discuss the major scientific approaches to the study of man-environment relationship.

7.0 References/Further Readings

Ankurkhtn (2017). Nature of Human Geograph. Accessed on 11th July 2020. Available at: https://geog365.wordpress.com/2017/08/24/nature-of-human-geography/

Artz, M & Esri, J. B. (2009). What is the Geographic Approach?. Accessed on 12th July, 2020. Available at: https://www.esri.com/news/arcnews/fall09articles/what-is geographic.html

Ashok (2018). Study of Approaches of Environmental Studies.Journal of Advances and Scholarly Researches in Allied Education.15(12):284 – 286. Available at: http://ignited.in/I/a/78852

Bansal, T. (2018). *Possibilism in Geography* (Doctoral dissertation, Department of Geography Ranchi College, Ranchi University).

Briney, A. (2020). What Is Environmental Determinism?" ThoughtCo, Feb. 11, 2020, thoughtco.com/environmental-determinism-and-geography-1434499.

Catalano, R. (1979). Health, behavior and the community: An ecological perspective. NY: Pergamon Press.

Fekadu, K. (2014). The paradox in environmental determinism and possibilism: A literature review. Journal Geography and Regional Planning.7(7):132-139. DOI: 10.5897/JGRP2013.0406

Flowerdew, R. (2009) Probabilism. International Encyclopedia of Human Geography. Accessed on 11th July 2020. Available at: https://www.sciencedirect.com/topics/earth-and-planetary-sciences/environmental-determinism

Gitterman, A. (2009). The life model. In A. Roberts (Ed.), The social workers' desk reference (2nd ed.) (pp. 231-234). New York: Oxford University Press.

Lewthwaite, G.R. (2001). Environmental Determinism. In International Encyclopedia of the Social & Behavioral Sciences, 2001.

MacArthur, R. (1972). Geographical ecology: Patterns in the distribution of species. Princeton: Princeton University Press.

Mairs, K. (2007) Islands and Human Impact: Under what Circumstances Do People Put Unsustainable Demands on Island Environments? Evidence from the North Atlantic. An Unpublished PhD Thesis, University of Edinburgh, 2007

Park, R., Burgess, E., & McKenzie, R. (1925). The city. Chicago: Chicago University Press.

Raffestin, C. & Lawrence, R. (1990) "An Ecological Perspective on Housing, Health and Well-being,"The Journal of Sociology & Social Welfare:17(1). Available at: https://scholarworks.wmich.edu/jssw/vol17/iss1/9

Shamim, Md (2016). Concept, scope and Approaches of Environmental studies. University of Chittagong, Bangladesh.

Teater, B. (2014). Social work practice from an ecological perspective. In C.W. Le Croy (Ed.), Case studies in social work practice (3rd ed.). Belmont, CA: Brooks/Cole.

Wicker, A. (1979). An introduction to ecological psychology. Monterey, CA: Brooks/Cole Publishing Company.

Young, G. (1983). Origins of human ecology. Stroudsberg, PA: Hutchinson Ross Publishing Company.

Your Article Library (2014). Geographical Paradigms: A Historical Perspective (With Graphs) Available at: https://www.yourarticlelibrary.com/geography/geographical-paradigms-a-historical-perspective-with-graphs/24619

Your Article Library(2014). Carl Ritter: Biography of Carl Ritter (1779-1859) https://www.yourarticlelibrary.com/biographies/carl-ritter-biography-of-carl-ritter-1779-1859/24568

UNIT 5: GLOBAL ENVIRONMENTAL ISSUES AND PROTECTION

CONTENTS

1.0 Introduction

Global environmental problems have become a major discourse not only in academic community but also in Governmental organisations because of its impact on the citizens and nations in the world. The global environmental issues in the form of climate change, global warming and environmental degradation have significant influence on environmental and health issues, political stability, poverty and sustainable development. It has therefore, become very imperative for these environmental issues to be addressed by the policy makers, environmentalists, government agencies and other stakeholders, in other to have a cleaner environment. One of the ways through which a safer environment can be achieved is by developing an effective environmental protection policy. This unit is therefore, outlined as follows: Climate Change, Global warming, Environmental Degradation and Environmental Protection.

2.0 Objectives

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

- Explain what is meant by climate change.
- Describe the factors causing the climate change
- Elucidate the effects of Climate Change on weather and human activities
- Explain the Strategies required for combating the Climate Change
- Explain the meaning of Global Warming
- Discuss the consequences of global warming effects on earth surface
- Explain the solutions to the Global Warming problems
- Discuss the meaning of Environmental degradation
- Identify the factors causing Environmental degradation
- Describe the meaning of Environmental Protection
- Recognize the various control measures for Environmental Protection

- Understand the Importance of Environmental Protection

3.0 Main Content
3.1 Climate change

The words Climate change and Global warming are often used to mean the same thing (Manstrandrea and Schneider, 2009) but in reality, they mean different thing. Global warming can be simply described as increase in surface temperature, while climate change includes global warming and other things that increasing greenhouse gas amounts will affect (Sodangi and Izge, 2011). In this unit, it will therefore, be assumed that the words are not the same thing. Climate change may be regarded as broader term that incorporates both global warming and other observed changes in climate such as burning fossil fuels for electricity and powering of vehicles, clearing of forests for farms and cities, and the release of "greenhouse gases" into the atmosphere.

There are many definitions of Climate change, attempts will be made to consider few of these definitions as given by different authors. National Aeronautics and Space Administration (NASA, 2020) described Climate change as a long-term change in the average weather patterns which come to define Earth's local, regional and global climates.

These changes in Earth climate are brought about by human activities, particularly fossil fuel burning, that increase heat-trapping greenhouse gas levels in Earth's atmosphere, resulting in rising Earth's average surface temperature.

The Intergovernmental Panel on Climate Change (IPCC, 2001) defines climate change as change in climate over time which may be due to natural variability or human activity. This definition considers natural and human factors as the main causes of climate change. Manstrandrea and Schneider (2009) state that climate change is a long-term alteration in global weather patterns which can be in form of increases in temperature and storm activity, often linked to the potential consequence of rising levels of heat trapping gases known as greenhouse gases. This retains the radiant energy provided to the earth by the sun in a process known as the greenhouse effect.

According to Riedy (2016) Climate change" is a change in either the average climate or climate variability that persists over an extended period. This definition focuses on natural climatic change but recent scientific observations and models have shown that the Earth's climate change is also due to human activity (Riedy, 2016). The enhanced greenhouse effect results in "global warming" which is simply an increase in the Earth's average temperature. The impacts of climate change have been very devastating for both natural and human systems and as a result of this, it has been regarded as an existential threat to human civilisation. According to the United Nations Institute for Training and Research (UNITAR, 2013) the goal of Climate change science is to understand the physical, chemical, biological and geological processes, and the interactions among these processes, that produce climate change.

It is believed that the future climates can be predicted based on natural phenomena and projected based on assumptions of future human activities.

(a)The factors causing Climate Change

The following are some of the factors causing Climate change:

(i) The Greenhouse effect – this is considered as the main contributors to climate change and it is described as a natural process that warms the Earth's surface. There is Greenhouse effect when the Sun's energy reaches the Earth's atmosphere, and is reflected back to space and the rest is absorbed and re-radiated by greenhouse gases. The Greenhouse gases include water vapour, carbon dioxide, methane, nitrous oxide, ozone and other artificial chemicals like chlorofluorocarbons (CFCs).
The absorbed energy normally warms the atmosphere and the Earth surface by maintaining its temperature at around 33 degrees Celsius warmer than it would otherwise be, thus allowing life on Earth to exist. (The Department of Agriculture, Water and the Environment,2020).

(ii) Deforestation: this is another factor that is causing Climate change. The forests provide many social, economic and environmental benefits such as defense against climate change and facilitate photosynthesis which produces Oxygen (O_2) and consumes Carbon dioxide (CO_2) known for effecting global warming (Manstrandrea & Schneider, 2009). The greater number of these trees are being cut down through human activities, thus leading to the reduction of the trees or deforestation (Whitefield, Davidson and Ashenden, 1998; Syrquin, 2008: Sodangi and Izge, 2011).

(iii)Volcanic emission - this is one of the natural causes of climate change, it occurs through the emission of CO_2 from volcanos to the atmosphere.
This amount of CO_2 discharge to the atmosphere is relatively small in comparison to the one that is being released by human activities. There has been increase in Concentration of CO2 since the industrial revolution of the mid 1700s (Paehler, 2009; Riebeek, 2010; Kaddo, 2016).

(iv) Ozone layer depletion: This is caused by the depletion of the ozone layer when the atmosphere becomes impure as a result of the dangerous gases or repellents being released from industries, exhaust pipes of vehicles, air conditioning devices and refrigerators. The materials that are being emitted contain substances such as chlorofluorocarbons (CFC), carbon monoxide (CO_2), hydrocarbons, smoke, soots, dust, nitrous oxide and sulphur oxide which deteriorate the ozone layer (Ringius, 1996; Manstrandrea & Schneider, 2009). Aerosols is also part of the causes of ozone layer depletion. They are defined as solid and or liquid particles which are suspended in the air (Wang et al., 2001; Zhang, Ho & Shen, 2012). They are one of the most important components of the atmosphere.

There have being increasing interest in the studies of atmospheric aerosols due to its impact on the climate, chemical heterogeneous reactions in the atmosphere, which affect the environmental quality, and the associated problems of visibility and health issues (Menon et al., 2002; Watson, 2002). This interest has cut across the fields of meteorology, chemistry, physics, space science, environmental science, medical science, and public health, thus making aerosols studies becoming a multidisciplinary discipline (Zhang, Ho & Shen, 2012). Aerosols are also known as particulates, they are air-borne particles that absorb, scatter and reflect radiation back into space. There are natural aerosols and the one caused by Human activities such as the burning of fossil fuels and slash-and-burn farming techniques. The effect of aerosols on climate change is still being debated, but climate scientists strongly think that light-coloured aerosols have cooling effect on climate and dark-coloured (soot) lead to the warming of the climate (Manstrandrea and Schneider, 2009).

(v) Farming: this is another contributor to the climate change. It can be in the forming of clearing of forests for farming, burning crop residues, submerged land, cattle rearing and the use of fertilizer. All these activities can release greenhouse gases to the atmosphere and cause climatic change (Rosenzweig & Hillel, 1995; Sodangi and Izge, 2011).

(b) The effects of Climate Change on weather and human activities

Climate change have affected almost all aspects of the planet, the following are some of the probable impacts of climate change on weather and human activities:
(i) Possibilities of extreme weathers – this may be in the form of rising maximum temperatures, rising minimum temperatures, sea rise, higher ocean temperatures,
an increase in heavy precipitation (heavy rain and hail), draughts, flooding, shrinking glaciers and thawing permafrost (MyClimate, n.d)
(ii) Energy – it plays an important role in many aspects of human's lives. Electricity is used for lighting and cooling and fuel for transportation, heating, and cooking. The energy production and use depend on water consumption, use of goods and services, transportation, economic growth, land use, and population growth. The increases in temperature may likely increase the energy demand, as well as change the amount of electricity to produce and deliver for consumption. In a warm climate, there will be more electricity used for air conditioning and less natural gas, oil, and wood for heating. Flood and storms sometimes can damage power lines and electricity distribution equipment. Railways and marine transportation are vulnerable to climate change, for instance heavy rainfall and storms can wash out railway beds while changes in precipitation could affect marine transportation by reducing the navigability of the rivers (CCSP, 2008; EPA,2015).

(iii) Agriculture and Food Supply - Agriculture and fisheries highly depend on the climate, because increases in temperature and carbon dioxide (CO2) may result to increase crop yields; and marine disease outbreaks have been linked with the changing climate.

The severity in droughts and floods could pose challenges for farmers and threaten food security. Also, extreme temperature and precipitation may prevent crops from growing.

(iv) Human Health - the impacts of climate change endanger human's health by the food he eats, the water he drinks, the air he breathes, and the way the weather affects him. The degree of these health risks will depend on the ability of public health and safety systems to address these changing threats, as well as factors such as an individual's behavior, age, gender, and economic status. Exposure to extreme heat can lead to heat stroke and dehydration, cardiovascular, respiratory, and cerebrovascular disease. Extreme weather events and storm surges can increase the risk of people's exposure to contaminants. Also, High temperatures can increase cases of *Salmonella* and other bacteria-related food poisoning which can results to gastrointestinal distress and death (CCSP, 2008; USGCRP, 2009). Heat stress can increase livestock vulnerability to disease, reduce fertility, and milk production. Ocean acidification can also endanger the sensitive of ecosystems upon which fish and shellfish depend for survival (USGCRP, 2014a; USGCRP, 2014b; US EPA,2015).

(v) Society - Climate change could affect the society through its impacts on social, cultural, and natural resources. In other words, it could affect human health, infrastructure, and transportation systems, as well as energy, food, and water supplies. The geographic location where people live influence their vulnerability to climate change e.g. population grow rapidly in the coastal areas where most people are sensitive to coastal storms, drought, air pollution, and heat waves. The coastal areas in Nigeria include Lagos, Ondo, Delta, Bayelsa, Rivers, Akwa Ibom and Cross Rivers States.

The people's abilities to cope with climate change impacts differs, for instance poor people may have a difficult time coping with changes because they have limited financial resources to cope with heat, relocate or evacuate, or respond to increases in the cost of food. The cities are more densely populated than suburban or rural areas therefore increase in heat waves, drought, or violent storms in cities would definitely affect larger number of people than in suburban or rural area (USGCRP, 2014; USGCRP, 2016).

(vi) Ecosystems – the climate has an important environmental influence on the ecosystems. Climate change not only affects ecosystems and species directly but also interacts with the other human stressors such as development. In both the land and aquatic environments, plants and animals can move to higher elevations at a median rate of 36 feet per decade, and to higher latitudes at a median rate of 10.5 miles per decade. This may mean a range expansion for some species, for others it may mean movement into less hospitable habitat, increased competition, or range reduction. This may result to some species having nowhere to go because they are already at the top of a mountain or at the northern limit of land suitable for their habitat.

This situation consequently leads to local extinctions of both plants and animals in the affected areas. There may be Climate change and shifts in ecological condition which can result to the spread of pathogens, parasites, and diseases. This in turn, could have serious effects on human health, agriculture, and fisheries. Also, Climate change along with habitat destruction and pollution, is one of the important stressors that can contribute to species extinction (IPCC,2014; USGCRP, 2009; USGCRP, 2014).

(c) Strategies for combating the Climate Change

The issue of climate change has generated serious debates and discussions both in the academic community and the governmental level, it has therefore become imperative to find remedies to these problems of climate change, particularly in Nigeria and the World at large. The following measures are considered as part of the solutions needed to tackle the adverse effect of climate change in our environment:

(i) Development of alternative power or energy sources

The Wind power generation converts the wind energy into electric energy through a specially designed blade. It is becoming the fastest-growing energy resources in the world for being able to use the wind, a renewable source of energy, to generate electricity with little or no impact on the environment. Furthermore, the wind turbines are beneficial to use because it does not need to be powered by water before it operates. The Wind power save the world million metric tons of carbon dioxide emissions every year, thus helping to mitigate climate change and preserve the planet for future generations. One of the challenges faced by wind power is that birds and bats fly into the spinning blades and may cause it to malfunction.

This problem can be solved by building wind turbines in areas where there is a high concentration of migrants. The wind turbines blades can also be made to rotate only above certain wind speed that will reduce the activity of bats and birds (Kaddo,2016; U.S. Fish and Wildlife Service, 2017).

(ii) Construction of Green Buildings

This involves the design of a building by taking into consideration the health and wellbeing of both its occupants and the environment. It's construction, operation and maintainenance are, basically for the purpose of minimizing its impact on the environment and offering a healthy work environment. This includes: reduction in the water and energy consumption, minimizing greenhouse gas emissions, use of eco-friendly building materials, decrease in landfill waste, short commute times, promoting the use of renewable transportation and IoT connectivity, encouraging the planting of more trees, green roofs or community gardens in the environment.

Green buildings help to reduce the effects of climate change on the environment by means of their energy efficiency and promotion of greater green and sustainable communities.

The use of light bulbs with less energy and more efficient heating and cooling systems assist in reducing the amount of carbon dioxide that is being emitted from the buildings. This reduces the dependency on fossil fuel for electricity, which consequently bring about reduction of greenhouse gases (Kaddo,2016; IEREK, 2018).

(iii) Methane Leaks

Methane is a greenhouse gas emitted by human activities, for example it can be in form of leakage from natural gas systems and the raising of livestock, and natural sources such as wetlands. It has a direct influence on climate, and indirect effects on human health, crop yields and the quality and productivity of vegetation. Methane is a greenhouse gas that contributes to the growth of climate change. However, the upgrading of the equipment used in transferring, storing, and producing oil and gas may limit methane leaks. Methane is regarded as second to carbon dioxide in its importance to climate change. Its presence in the atmosphere affects other greenhouse gases, such as tropospheric ozone, water vapour and carbon dioxide. Effort to stop methane emissions may help reduce its effect on climate change, increase crop yields and prevent premature deaths. These emission reductions could be achieved with net savings and could be of benefits for the climate, public health and agricultural production. The emission reduction from methane leaks takes the following forms:

- ✓ Collecting, capturing and using of landfill gas
- ✓ Diverting organic waste
- ✓ Implementation of guidelines on healthy dietary choices
- ✓ Improve animal health and husbandry
- ✓ Improve manure and animal feed quality
- ✓ Improving anaerobic digestion of solid and liquid waste by food industry
- ✓ Increase recovery and utilization from gas and oil production
- ✓ Performing pre-mining degasification and recovery and oxidation of methane from coal mines
- ✓ Promoting farm-scale anaerobic digestion to control methane emissions that may result from livestock
- ✓ Recover and use gas and fugitive emissions during oil and natural gas production
- ✓ Reduction of leakage from long-distance gas transmission and distribution pipelines
- ✓ Regular aeration of continuously flooded rice paddies
- ✓ Separate and treat biodegradable public waste, and turn it into compost or bioenergy
- ✓ Upgrading of wastewater treatment with gas recovery and overflow control

- ✓ Upgrading primary waste water treatment
- ✓ Use of selective breeding to reduce emission intensity and increase production

(The Climate and Clean Air Coalition,2013; Kaddo,2016).

Self-Assessment Exercise

What is Climate Change? Vividly examine the effects of Climate Change on weather and human activities.

3.2 Global Warming

Global warming is one of the major environmental issues that is calling for attention from individuals, policy makers, government and supranational bodies all over the world in the recent years. It causes severe damage to the biotic and abiotic components of the environment. Global warming can be defined as the long-term heating of temperature due to human activities, mainly through fossil fuel burning, which increases heat-trapping greenhouse gas levels in the atmosphere. The term is frequently used interchangeably with the term climate change, though the latter refers to both human- and naturally produced warming and the effects it has on the planet. Climate change, in other words, is described as a long-term change in the average weather patterns which have come to define the earth's local, regional and global temperatures. Global warming is most commonly measured as the average increase in earth surface temperature. It is also known as the greenhouse effect because the experience is very similar to what happens in a green house. The important ones among the greenhouse gases are carbon dioxide, methane, nitrous oxide ozone, chloroform carbons (CFC's). Out of all these greenhouse gases, the carbon-dioxide accounted for 60% of the total warming effect. These greenhouse gases trap the radiations and the net result is that the earth surface gets heated which resulted to the global warming. The global warming is also being referred to as greenhouse effect because carbon dioxide which accounted for the largest proportion of the greenhouse gases is responsible for the global warming (University of Mumbai,2013; NASA,2020).

Globally accepted consequences of global warming effects are as follows:

(i) It can reduce the moisture levels in current fertile zones and turn them subsequently into dry lands and desert. This means global warming may gradually lead to desertification.

(ii)It can lead to more acidic oceans due to the absorption of some of the excess emissions. The increase in the ocean acidification causes serious threat to underwater life, most especially, for the creatures having calcium carbonate shells or skeletons, including mollusks, crabs, and corals.

(iii) It can result to droughts because as more greenhouse gas emissions are released into the air, this cause air temperatures to increase. This may lead to more moisture evaporating from land and lakes, rivers, and other bodies of water.

There is increase evaporation in plants soil when the temperature becomes warmer, this affects the plant and results to reduction in rainfall. In a situation where this led to droughts it has serious consequences on people's livelihoods, agriculture, water supply, transportation and health (The climate Reality Project, 2016)

(iv) It can result to higher death rates of humans. This makes global warming become the biggest global health threat of the 21st century. It has serious effect on children, the elderly, low-income communities, and minorities. There is usually increase in the incidence of illness, emergency room visits, and death as temperature spikes (The Natural Resources Defense Council, NRDC, 2016).

(v) It can result to the creation of "Climate refugees". The Climate refugees are those people who suffer from climatic conditions such as drought, floods etc. The climatic condition of these people leads to starvations and displacement. This situation is regarded as one of the most visible symbols of global warming (University of Mumbai, 2013).

(vi). It causes frequent and harsh weather. High temperature worsens various kinds of disasters like storms, heat waves, floods and droughts. In a warmer climate, the atmosphere collects, retains and drops more water. This change weather patterns by making wet areas become wetter and dry areas to become drier (The Natural Resources Defense Council, NRDC, 2016).

(vii) It can result to a high wildlife extinction rate. The rapid changes affecting the land and animals may make the animals inhabiting the land to disappear if they don't adapt quickly enough. It is the law of nature that some will make it why some wouldn't make it (NRDC, 2016). The Intergovernmental Panel on Climate Change (2014) noted that many land, freshwater, and ocean species are shifting their geographic ranges to cooler climes or higher altitudes, in an attempt to escape global warming.

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Solutions to the Global warming problems

The adverse effect of Global warming on humans, other living and nonliving things in the planet can be very serious and that is why it is necessary to take some steps that will make the world habitable and safer to live. The following are some of the solutions to tackle the global warming scourge.

(i) The use of alternative energy sources – this involve the use of alternative energy sources like wind, solar, bio mass, geothermal and hydro which are clean in nature.

These alternative energy sources unlike the fossil fuels, natural oil and gas which can cause damage in the earth's environment; do not release pollution or toxic gases to the environment. They are considered to be environmentally friendly and pose no threat to ecological balance (Shahzad, 2015).

(ii) Reduction in the use of vehicles: the effect of global warming on the environment can be addressed if there is reduction in the use of vehicles. This will reduce the amount of gas emission to the environment. However, there have been little success in this area due to the insatiable demands for cars by organisations and individuals.

There have been increase in number of people that use bicycles and public transport, while few other prefer to walk. The fuel economy and emission rates are important factors that need to be considered in regards to the choice of cars to buy or use.
(iii) Encouraging Sustainable Agriculture & Forest Management – there is need to make the better use of natural resources through improved farming and livestock production. The people should adopt new method of farming which is characterized by the use of machinery, fertilizer, pesticides and insecticides. There is need to stop deforestation of arable land and make more food available to the people.
(iv) Recycling of waste – this is also one of the means of tackling adverse global warming. The people should adopt responsible consumption habits with regard to food (particularly meat), clothing, cosmetics or cleaning products. They should learn to convert their waste to reusable or green products.
(v) Delivering Energy and Water efficiency – this can be achieved by reducing energy consumption through the use of LED light bulbs, solar bulb etc. Water efficiency can also be achieved through the use of less costly and water saving devices such as water timers, tank bags, grey water diverters, dual flush toilet converters, rainfall shutoff devices etc. Water conservation is not only important for the budget but also for the environment. In other words, it will prevent water wastage and saves cost.

(vi) Maintaining sustainable infrastructure – there is always the release of carbon dioxide from the building to the environment as a result of heating, air conditioning, hot water and lighting. The carbon dioxide emissions can be reduced by building low energy houses or renovating the existing ones.

(vii) The conduct of research by educational institutions – this will enable people to understand and address the problem of global warming. It will also influence their attitude and behaviour about the causes of global warming and it will help them adapts with the possible consequences of global warming (Solar Impulse Foundation, 2020).

Self-Assessment Exercise
(a) Explain the meaning of the term “Global Warming”.
(b) Critically examine the consequences of global warming effects on earth surface.

3.3 Environmental Degradation

The third environmental issue that will be discussed in this unit is environmental degradation. It is defined as the deterioration in the quality and quantity of environment such as air, water, soil, forest, animal life etc. It can also be described as the unfavourable change in the surroundings which occurs directly or indirectly as a result of human interruptions in the use of resources, energy, power and organisations. The common examples of environmental degradation are deforestation, soil erosion, fall in the levels of ground water, depletion of the ozone layer, combustion from automobiles, water pollution, throwing waste in the river, usage of chemical fertilizers and pesticides, burning of coal and mineral oil etc.

The following are some of the causes of environmental degradation:

(i) Attitudinal change – Initially, man has respect for the nature but now he exploits the environment for his selfish reasons. This attitudinal change has led greatly to environmental degradation because of his insensitivity towards the environment. The materialistic attitude by man also led to exploitation of the natural resources which consequently resulted to environmental degradation. The advancement in technology and rapid industrialisation have increased per capita demand for natural resources beyond the capacity at which the ecosystem can maintain its balance. This made the need for water, food, energy, clothing, shelter, employment, education and health to have a heavy toll on the resources. The attitudinal change determines how people support or oppose government policy on tackling the global warming problems. In Nigeria, for instance, the government encourages the planting of trees to prevent environment degradation but most people because they don't know the importance of this policy are still cutting trees. The way someone perceives about something negatively or positively affects the way s/he reacts to that thing. Attitudinal change is therefore a cardinal factor that helps in shaping people's perceptions about whether they should support or oppose government policy that is aimed at addressing global warming issues (University of Mumbai, 2013; Abun & Racoma, 2017).

(ii) Increase in Population – high population growth rate normally results in increase population. The more the population of the people increases the more the resources will be required to take care of the population. The increase population therefore, means that more people are likely to live below the poverty line and in that situation, there will be more pressure on the natural resources. The earth's resources gradually become depleted. This pressure on natural resources may contribute to environmental degradation due to over exploitation of the natural resources. This means that excessive population growth rate can have a harmful effect on the environment.

(iii) Industrialisation- the effort to achieve economic development by some countries often lead to environmental degradation. This effort is called industrialization and it involves the use of the natural resources. It brings about growth in the industries and made available to the people increase production of goods and services at a cheaper price. Industrialisation also led to improve standard of living and creation of new job opportunities for the people.

The use of technology has greatly brought about environmental changes that are beneficial to mankind but it normally occurs in natural environments where things are ecologically related to one another.The changes therefore, might produce negative effects that are sometimes not anticipated such as pollution, water borne diseases, toxic wastes and other environmental degradation problem (Zaman, Khan, Khan, Saleem & Nawaz, 2011).

(iv) Urbanisation- this involves the movement of the people from rural areas to cities with the hope of having better and more prosperous life. Urbanisation is often characterized with the increased populations in cities and suburbs, this made it to be associated with the advancement of civilization. The natural resources are used more in urban areas because there are more people than those who stay in the rural areas. This made the urban cities to generate more waste than the rural areas, and hence, are responsible for over exploitation of the natural resources. The high consumption level in urban cities requires large amount of natural resources. This leads to the generation of increasing amount of wastes. Thus, unsustainable urbanization may have disastrous effect on the environment leading to land degradation. There will be need for serious planning to manage the problems associated with the urbanization like pollution, land degradation, insufficient water availability, waste-disposal problems, and high energy consumption.

(v) Natural disasters – environmental degradation reduces the capacity of the societies to deal with disaster risk such as storms, erosion and floods. People are becoming more vulnerable to the disasters every year as a result of its increasing incidence and severity. Environmental degradation reduces the capacity of the environment to protect the communities from natural hazards and offer other important services such as food, firewood, medicines.

(vi) **Modernisation –** this can be said to be a direct result of industrialization and urbanization. Man always desire to bring about improvement and development in his environment. The pattern of economic development that takes place in any society resulting from modernization affects the nature of environmental problems in that particular society. New method of Agricultural production involves the use of machines, artificial chemicals and fertilizers. The chemical and fertiliser pollute water killing fish stocks which may affect people who depend on fishing for living. This new method of agriculture also requires the use of large portions of land, resulting in deforestation and floods. The over exploitation of this natural resources led to environmental degradation.

Self-Assessment Exercise

(a) Define the term "Environmental Degradation"

(b) What are the major causes of Environmental degradation?

3.4 Environmental Protection

The issue of environmental protection has become necessary as a result of increasing environmental problems in the country such as continuous exploitation of land, drought, desertification, destruction of biodiversity, pollution, degradation, deforestation, desertification, global warming, waste generation, ozone depletion and climate change among others. The Government in most countries have found it necessary to enact rules and regulations that will mitigate the effect of these environmental problems on the people.

The issue of environmental regulations came to the forefront in Nigeria, when there was a national public outcry against illegal dumping of toxic waste in Koko, South west Nigeria by an Italian vessel in 1987.
This led to the Federal government establishment of the Federal Environmental Protection Agency (FEPA) in 1988. The State Environmental Protection Agency (SEPA) were subsequently established in the 36 states of the Federation. The renewed interest by the Nigerian Government in Environmental Management and Protection in 1998 led to the establishment of the Federal Ministry of Environment and the State Ministries of Environment in 1999. The Federal Ministry of Environment presently serves as the apex organ for all environmental policies in Nigeria. The other agencies responsible for the enforcement of environmental regulations in Nigeria are:
(i) the National Environmental Standards and Regulations Enforcement Agency (NESREA), which was established in 2007. This agency replaces FEPA.
(ii) the National Oil Spill Detection and Response Agency (NOSDRA) established in 2009 as a result of heightened agitation to remedy and stop the environmental damage of oil production in the Niger Delta (Aina,1989; Agabi,1995; Adekunle,1998; Mabogunje,1999; Nabegu, Mustapha & Naibbi, 2017).

Meaning of Environmental Protection

There are various definitions of Environmental Protection given by various authors, attempt will be made to consider some of these definitions. Environmental protection can also be referred to as environmental conservation, species conservation, nature conservation or nature protection. According to the Glossary of Environment Statistics, Studies in Methods (1997), Environmental protection is described as any activity to maintain or restore the quality of environmental media through the prevention of the emission of pollutants or reducing the presence of polluting substances in environmental media. This includes:

(a) changes in the features of the goods and services,
(b) changes in the way goods and services are consumed,
(c) changes in the production techniques,
(d) treatment or disposal of residuals in independent environmental protection facilities,
(e) recycling, and
(f) prevention of degradation in the environment.

This definition primarily focuses on Environmental Protection as any activity that is aimed at restoring the quality of the environment either by reduction or prevention of polluting substances. It can also be defined as programs that are aimed at reducing risks to the environment from contaminants such as hazardous materials and wastes, fuels, and oils.

The programs normally address the pollution prevention measures and regulatory compliance by providing procedures for safely working with these materials, inspecting the storage vessels and locations, and designating preventative maintenance procedures. This includes environmental emergency plans, which provide the appropriate actions to be taken in the event of a spill or release (The Pennsylvania State University, 2015). This definition give focus to the area of risk reduction in the environment from the contaminants.

Environmental protection is any measure that is taken to conserve, maintain or preserve the state of the environment through the reduction of pollutants or anything that can bring about its degradation.

The conservation of the environment is intended at keeping it safe and healthy and reduce the overutilization of the natural resources. This effort is believed will ensure the taking care of all the components that make up the environment.

Preservation is also used concurrently with the term conservation. The preservation of the environment do not alter the environment but is aimed at keeping the environment unchanged so as to leave it intact.

Protection can be described as the human activities on the environment which are sustainable and help to avoid damage or harming of the ecosystem (Important India, 2016).

The Business Dictionary (2020) defines Environmental Protection as strategies and procedures targeted at conserving the natural resources, preserving the environment and in some cases, reversing its degradation. In this definition, the focus is on the preservation and conservation of the natural resources in the environment.

Environmental protection is the set of measures that are taken at both public and private levels to take care of the natural habitat. This involves the preservation of the environment from deterioration and contamination. This measure can be in the form of prevention or limiting the felling of trees, better treatment of waste, prohibit the hunting of animals, reduce the consumption of energy, pesticides, fuels and other pollutants, minimize noise, reduce and recycle garbage (Wiki Didactic, 2013). This is a very broad definition that touches almost the entire area of environmental protection.

All the above definitions have shown that Environmental Protection can be described as any effort or policy that is aimed at restoring, preserving, conserving the quality of the natural resources or reducing risk of the contaminants in the environment.

The effort can be taken by the individuals, government agencies, supranational bodies or religious organisations.

The various control measures for Environmental Protection

The following are some of the measures that are put in place to mitigate environmental problems:

(i) Reforestation.

This is the re-growing of forests which have earlier been cut down using tree species that are native to the geographic area.

Trees play important roles to man, they serve as water catchment, air purification and home to many other living species. The environment can be protected through planting of trees in the environment or along the sea beaches. Trees planted along the sea beaches help to reduce the chances of harmful waste reaching the sea and oceans. Its also prevent the dunes to be formed on the sea coast. Reforestation is also known as afforestation. It plays an important role in overcoming deforestation and restore the natural balance of plant life on the planet.

(ii) Green technologies.

This is another step that can be taken to surmount the issue of environmental problems. Industries and most companies are making effort to go green in their production activities. This can be done by the companies by the adoption of more environmentally friendly gases that are not harmful for production and the use of wind and solar energy. Also, the adoption of renewable energy in production will reduce the harmful effect of chemicals on the environment.

(iii) Reduction in the use of chemicals.

This is not only applicable in factories but also important in agricultural sector where pesticides and fertilisers are used in farming. These chemicals end up in the water bodies and become harmful to man. In situation, where fewer chemicals are used there will be lesser waste. It is therefore, very necessary that reasonable amount of chemicals that will be not injurious to human's health should be used in the factories

(iv) Use of public transport.

The cars, trucks, and buses which are powered by fossil fuels are the major contributors to air pollution. The automobile emits more than half of nitrogen oxides in to the air, and serves as a major source of global warming emissions. The rate of this emission can be reduced by minimizing the number of cars on the road and the use of cleaner vehicles. People can decide to use public transport or bicycles and families can share cars rather than individual using their vehicles or bicycles.

(v) Creating Public Awareness.

The people need to be educated about the importance of environmental protection. This will greatly help them to be aware of what to do to mitigate some of the environmental problems that may arise now or in the future. They should be educated on reusing and recycling of waste items from consumption or disposal.

The use of energy savers as well as collection of rain water, conservation and tree planting are some of the good environmental habits that should be encouraged. This can help in living a healthy and sustainable environment.

(vi) Encouraging Sustainability.

There is need to reduce or eliminate waste and use the environment in an eco-friendly way. The whole idea about sustainability centered around the reduction in the use of natural resources, so that the resources will not become depleted. Sustainability can be attained by using more of fluorescent tubes, rechargeable batteries, renewable energy, and use renewable bags for shopping (Important India, 2016).

Importance of Environmental Protection.

The environment is very important to man in several ways, attempt will be made in this section to consider the various means by which it is beneficial to man. The environment provides support for man and at the same time, it is necessary for his existence. It also gives succour to living things, it is therefore, very essential to protect it from degradation. The following are some of the importance of environmental protection to man:

(i) Protection of lives.

The environment provide supports to every living thing on earth. The environment needs to be protected for better health to be achieved. This affirms the saying that "if we destroy the environment, the environment will destroy us." The environment therefore, needs to be protected because it sustains life.

(ii) Adverse effect of scientific development.

There have been lot of inventions that have been made over the years which have brought development and favourable changes to living but despite this, they have at the same time brought harm to the environment.

The emission of harmful gases from factories into environment, dredging of oil in the sea and cutting of trees have consequently brought about environmental problems which call for immediate action. There is need to protect the environment against these problems so as to be able to make it continue to play its significant role to mankind.

(iii) Safety against highly toxic substances.

The chemicals that are used in producing certain products such as plastics are highly toxic and may be very dangerous to man's health and the environment. Toxic substances are released to the environment during the plastic production process and even after use. The toxins may also leak into the soil and ground water resulting to contamination which affect growing of plants and may be injurious to hormones of many living things.

(iv) Biodiversity purpose.

Biodiversity is simply the variety of life that can be found in a particular habitat or territory. It is very imperative that for the environment to be a better place, biodiversity must be a part of it. Plants during the day use carbon dioxide, while humans breathe in oxygen and breathe out carbon dioxide. The plants make use of the part of the carbon dioxide breathe out by man.

This is a form of exchange plan in which the plants reduce carbon dioxide in the air, which in turn benefits humans. This has shown that each living organism has a role to play in the environment and this makes the world a better place for all.

(v) Ethical or Moral obligation.

Man owes the environment a moral obligation because it gives support to him and other living species. The only way that man can pay the environment back is by protecting it in all ways possible. Natural resources and the environment can be regarded as the heritage of the nation, the state therefore, should be responsible for the preservation of the common good, with the involvement of the citizens.

(vi) Safety against environmental hazards.
The water bodies have become the dumping grounds for dangerous chemicals and most of the waste from factories are thrown into the lakes and oceans. These chemicals and wastes end up in the food web, for example the mercury in the fish. The humans eat the fish and the end result could be serious diseases. The exposure to harmful gases in the air is a threat to man's life, hence the need to maintain safety against environmental hazard is very essential.
(vii) Economic reasons.
There is need to conserve and protect the natural resources for economic reason because it can bring about development and be more profitable in the long term than destroying the natural resources. The degradation of resources may lead to the economic losses for the country.
(viii) Cultural Purpose.
The environment is being protected for cultural reason. This is as a result of their technical and cultural importance. There are some cultural event and historical artefacts which should not be allowed to disappear. There are areas that should be retained for cultural reasons, together with the human populations that dwell there. This include architecture, crafts, dance, language, music, historic remains, etc., are some of the important aspects of a country's wealth and heritage.
(ix) Social reasons
There is conservation of the environment for social reasons. This can be in the form of looting of natural resources, pollution and the deterioration of the environment. The consequences of these actions on the people and societies can take the form of diseases, social unrest, unrestricted access to land, space and food. This situation normally leads to poverty and economic crisis.
(x) Legal reasons.
The environment can be protected for legal reasons. Environmental regulations are normally contained in the constitution, international treaties and the legislation. It is essentially based on the following three aspects: (a) sorting of space and allowing different options for use of resources (b) preservation of the environment, cultural and historical heritage of each country (iii) conservation of the natural resources and maintenance of the production base (Wiki Didactic, 2013; Important India, 2016).

Self-Assessment Exercise
(a) What is Environmental Protection?
(b) Enumerate the various measures that can be taken by Individuals and Government to mitigate the effect of Environmental Problems.

4.0 Conclusion
There is no doubt that environmental problems pose as a serious threat to the human existence and therefore, it must be addressed to make life comfortable for the people. Environmental problem affects both the biotic and abiotic environment, thus making it difficult for man to determine the quality of life to live.

The challenges caused by climate change, global warming, environmental degradation and other environmental problems are so enormous that urgent steps need to be taken to mitigate its effect on both the people and the environment. This has become very necessary to make the world habitable and safer to live.

5.0 Summary

The global environmental issues have become a front burner one, which is generating a lot of concern in the recent time from the individuals, government, non-governmental organisations, religious bodies and other supranational organisations. In this unit, attempt has been made to examine the issues of climate change, global warming and environmental degradation, its causes and effect on the people and environment. These environmental problems are linked to the issue of environmental protection. Environmental protection is all about the steps to be taken to mitigate the effects of these environmental problems on the people. Finally, the unit has discussed the various measures that are used for Environmental Protection and its importance to man.

6.0 Tutor-Marked Assignment

1(a). What is Climate Change?
(b) Distinguish between Climate change and Global Warmimg.
2. Vividly discuss the various strategies that can be used to combat climate change.
3. Critically examine the various solutions to the Global warming problems.
4(a). Define the term "Environmental Degradation"
(b) How can attitudinal change and urbanization cause environmental degradation?
5(a) Explain the term "Climate Refugees"
(b) Mention five forms of emission reduction of methane leaks.
(c) What is Green House effect in relation to climate change?
6. Describe any Five importance of Environmental Protection
7. Why is it necessary to protect the environment?
8. Enumerate any five controlling measures used to protect the environment.
9. What are the consequences of Global Warming effects on the environment?
10. What are the major sources of climate change?

7.0 References/Further Readings

Abun, D. & Racoma, A.P. (2017). Environmental Attitude and Environmental Behavior of Catholic Colleges' Employees in Ilocos Sur, Philippines. Texila International Journal of Academic Research.4(1):1 – 30.

Adekunle, A.D. (1998). In Search of Partners in a Context of Multiple Regulators: The Perspective of an Operator in Nigeria Oil Industry. A paper presented at the International seminar on the Petroleum Industry and the Nigerian Environment Abuja Sheraton Hotel & Towers, Africa.

Agabi, J.A. (1995) Introduction to the Nigeria Environment. In Nigerian Environment, National Conservation Foundation. Macmillan Nigeria Publishers Limited, Lagos, Africa.

Aina, E.O.A. (1989). New Direction for Sustainable Development in Nigeria. A paper delivered at the International Workshop on the Environment and Sustainable Development in Nigeria at the NICON NOGA HILTON Hotel, Abuja, Africa

Business Dictionary (2020).The definition of Environmental Protection. Accessed on 31 July, 2020. Available at: http://www.businessdictionary.com/definition/environmental-protection.html

Chris Riedy(2016). Climate Change. Chapter In book: Blackwell Encyclopedia of Sociology, Publisher: Blackwell, Editors: George Ritzer.

Environmental Protection Agency (EPA, 2015). *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2013*. U.S. Environmental Protection Agency (EPA).

Glossary of Environment Statistics, Studies in Methods (1997). Definition of Environmental Protection. Series F, No. 67, United Nations, New York.

Important India (2016). Environmental Protection: Meaning, Importance, and Protective Measures Available at https://www.importantindia.com/23737/environmental-protection/

Intergovernmental Panel on Climate Change (IPCC, 2014). Settele, J., R. Scholes, R. Betts, S. Bunn, P. Leadley, D. Nepstad, J.T. Overpeck, and M.A. Taboada. Terrestrial and Inland Water Systems. In: *Climate Change 2014: Impacts, Adaptation and Vulnerability*. Part A: Global and Sectoral Aspects. *Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L. White (eds.) Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

International Experts for Research Enrichment and Knowledge Exchange (IEREK, 2018). Climate Change: Issues and Solutions. Accessed on 24th July 2020. Available at: https://www.ierek.com/news/index.php/2018/08/08/climate-change-issues-solutions/

Kaddo, J. R.(2016). "Climate Change: Causes, Effects, and Solutions" (2016).A with Honors Projects. 164. http://spark.parkland.edu/ah/164

Mabogunje, A.L.(1999) Nigerian Environment in the New Millennium. Africa.

Manstrandrea, M. D. & Schneider, S. H. (2009). Global Warming. Microsoft Encarta® Online Encyclopedia.

Menon, S., J. Hansen, Nazarenko, L & Luo, Y (2002). Climate effects of black carbon aerosols in China and India, Science, 297, 2250– 2253.

MyClimate(n.d). What are the effects of climate change? Available at: https://www.myclimate.org/information/faq/faq-detail/what-are-the-effects-of-climate-change/

Nabegu, A.B, Mustapha, A.B. & Naibbi, A.I. (2017). Environmental Regulations in Nigeria: A Mini Review. International Journal of Environmental Sciences and Natural Resources. 1(5): 555573. DOI: 10.19080/IJESNR.2017.01.555573

National Research Council (NRC, 2008). *The Potential Impacts of Climate Change on U.S. Transportation*. Transportation Research Board Special Report 290. National Research Council (NRC).

Riebeek, H. (2010). "Global Warming." Global Warming: Feature Articles. NASA, 3 June 2010. Web.

Ringius, L. (1996). Climate change in Africa - issues and challenges in agriculture and water for sustainable development. CICERO Report, 1996.

Shahzad, U. (2015). Global Warming: Causes, Effects and Solutions. Durreesamin Journal, Australia.

Sodangi, I. A. & Izge, A. U. (2011). Climate Change: Causes and Effects on African Agriculture. Journal of Environmental Issues and Agriculture in Developing Countries. 3(3).

Solar Impulse Foundation (2020). How to stop global warming? Accessed on 29th July 2020. Available at: https://solarimpulse.com/global-warming-solutions

Syrquin, A. (2008). EU Commission discusses soil degradation and climate change. Jerusalem Post. *http:/www.jpost.com/servlet/satellite?cid*

The Climate and Clean Air Coalition (2013). What is Methane? Accessed on 24 July 2020. Available at: https://www.ccacoalition.org/en/slcps/methane

The Climate Reality Project (2016). The Facts About Climate Change and Drought. Accessed on 26th July 2020. Available at: https://www.climaterealityproject.org/blog/facts-about-climate-change-and-drought

The Department of Agriculture, Water and the Environment (2020). Greenhouse effect. © Department of Agriculture, Water and the Environment 2020, Australia. Available at: https://www.environment.gov.au/climate-change/climate-science-data/climate-science/greenhouse-effect

The Intergovernmental Panel on Climate Change (IPCC, 2001). The report Climate Change 2001: The Scientific Basis. In Houghton, J.T., Ding, Y., Griggs, D. J., Noguer, M.; van der Linden, P. J., Dai, X.; Maskell, K. and Johnson, C. A. (eds) Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: University Press, ISBN 0-521-80767-0.NASA, 2020.

The National Aeronautics and Space Administration (NASA,2020). Overview: Weather, Global Warming and Climate Change**.** Available at: https://climate.nasa.gov/resources/global-warming-vs-climate-change/

The National Aeronautics and Space Administration (NASA,2020).Overview: Weather, Global Warming and Climate Change. Accessed on 26th July 2020. Available at: https://climate.nasa.gov/resources/global-warming-vs-climate-change/

The Natural Resources Defense Council (NRDC, 2016). Are the Effects of Global Warming Really that Bad? Accessed on 26th July 2020. Available at: https://www.nrdc.org/stories/are-effects-global-warming-really-bad

The Pennsylvania State University (2015). Definition of Environmental Protection. Environmental Health and Safety University Park, PA 16802-2116

The United State Global Change Research Program (USGCRP, 2009). *Global Climate Change Impacts in the United States*. "Climate Change Impacts by Sectors: Ecosystems." Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

The United State Global Change Research Program (USGCRP, 2014). Groffman, P. M., P. Kareiva, S. Carter, N. B. Grimm, J. Lawler, M. Mack, V. Matzek, and H. Tallis, 2014: *Ch. 8: Ecosystems, Biodiversity, and Ecosystem Services. Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 200-201.

The United State Global Change Research Program (USGCRP, 2014). *Climate Change Impacts in the United States: The Third National Climate Assessment.* Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe (eds.). United States Global Change Research Program.

The United State Global Change Research Program (USGCRP, 2014). *Climate Change Impacts in the United States: The Third National Climate Assessment*. Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe (eds.). United States Global Change Research Program. 841 pp.

The United State Global Change Research Program (USGCRP, 2014b). Ziska, L., A. Crimmins, A. Auclair, S. DeGrasse, J.F. Garofalo, A.S. Khan, I. Loladze, A.A. Pérez de León, A. Showler, J. Thurston, and I. Walls, 2016: *Ch. 7: Food Safety, Nutrition, and Distribution.* The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. U.S. Global Change Research Program, Washington, DC, 189–216.

The United State Global Change Research Program (USGCRP,2009). *Global Climate Change Impacts in the United States*. Karl, T.R., J.M. Melillo, and T.C. Peterson (eds.). United States Global Change Research Program. Cambridge University Press, New York, NY, USA.

The United State Global Change Research Program (USGCRP,2014). Hatfield, J., G. Takle, R. Grotjahn, P. Holden, R. C. Izaurralde, T. Mader, E. Marshall, and D. Liverman, 2014: *Ch. 6: Agriculture. Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 150-174.

The United State Global Change Research Program (USGCRP,2014a). Hatfield, J., G. Takle, R. Grotjahn, P. Holden, R. C. Izaurralde, T. Mader, E. Marshall, and D. Liverman, 2014: *Ch. 6: Agriculture. Climate Change Impacts in the United States: The Third National Climate Assessment*, J. M. Melillo, Terese (T.C.) Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, 150-174.

The United State Global Change Research Program (USGCRP,2016). *Impacts of Climate Change on Human Health in the United States: A Scientific Assessment*. Crimmins, A., J. Balbus, J.L. Gamble, C.B. Beard, J.E. Bell, D. Dodgen, R.J. Eisen, N.Fann, M.D. Hawkins, S.C. Herring, L. Jantarasami, D.M. Mills, S. Saha, M.C. Sarofim, J.Trtanj, and L.Ziska, Eds. U.S. Global Change Research Program, Washington, DC. 312 pp.

The Climate Change Science Program (CCSP, 2008). *Effects of Climate Change on Energy Production and Use in the United States*. A Report by the U.S. Climate Change Science Program and the subcommittee on Global change Research. Wilbanks, T.J., V. Bhatt, D.E. Bilello, S.R. Bull, J.Ekmann, W.C. Horak, Y.J. Huang, M.D. Levine, M.J. Sale, D.K. Schmalzer, and M.J. Scott. Department of Energy, Office of Biological & Environmental Research, Washington, DC, USA.

The Climate Change Science Program (CCSP,2008). *Analyses of the effects of global change on human health and welfare and human systems*. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. Gamble, J.L. (ed.), K.L. Ebi, F.G. Sussman, T.J. Wilbanks, (Authors). U.S. Environmental Protection Agency, Washington, DC, USA.

The Intergovernmental Panel on Climate Change (2014). Climate Change 2014 Synthesis Report Summary for Policymakers. Accessed on 26th July, 2020. Available at: https://www.ipcc.ch/site/assets/uploads/2018/02/AR5_SYR_FINAL_SPM.pdf

U.S. Fish and Wildlife Service (2017). Impacts of Wind on Wildlife: How to Make Wind Power More Wildlife Friendly. Available at: https://www.fws.gov/radar/windpower/

United Nations Institute for Training and Research (UNITAR, 2013). Fundamentals of Climate Change Science. United Nations Institute for Training and Research.

United States Environmental Protection Agency (US EPA, 2015). *Climate Change in the United States: Benefits of Global Action: Shellfish.*

Wang, M. X., Zhang, R. J. & Pu, Y. F. (2001). Recent research on aerosol in China, Advances in Atmospheric Sciences, 18(4), 576–586.

Watson, J. G., (2002).Visibility: Science and regulation, Journal of Air Waste Management Association, 52, 628–713.

Whitefield, C. P., Davidson, A.W. & Ashenden,T.W. (1998). The effects of nutrient limitation on the response of Plantago major to ozone. *New Phytologist*, 140, 219-230.

Wiki Didactic (2013). What is the meaning of Environmental protection? Concept, Definition of Environmental protection. Accessed on 31 July 2020. Available at: https://edukalife.blogspot.com/2013/03/environmental-protection.html

Zaman, K; Khan, H; Khan,M.M; Saleem, Z & Nawaz,M. (2011). The impact of population on environmental degradation in South Asia: application of seemingly unrelated regression equation model. Environmental Economics.2(2): 80 – 88.

Zhang, R; Ho, K. & Shen, Z. (2012). The Role of Aerosol in Climate Change, the Environment, and Human Health. Atmospheric and Oceanic Science Letters, 5(2):156-161.

MODULE TWO

THE BASIS OF MAN-ENVIRONMENT INTERACTION

Unit 1: The importance of Environment to Man
Unit 2: Human Consequences and Responses to the Global Environmental Changes
Unit 3: Human impact on the Environment and Waste Management

UNIT 1: THE IMPORTANCE OF ENVIRONMENT TO MAN

CONTENTS

1.0 Introduction

The environment is vital to both living and non-living organisms, it serves as habitat for the living organisms while the non-living organisms form an essential part of the environment. The basic difference between the animal and man when it comes to the environment where they live is that animal change themselves for the environment while man change the environment for themselves. Environment can be described as neighbourhood and the surrounding conditions of organisms, the influences, or forces, by which the organisms are influenced, transformed, grew and developed. This unit considers the importance of environment to man, the significance of environmental education, the importance of studying environmental sciences and skills required to succeed as Professional in Environmental Sciences.

2.0 Objectives

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

- Discuss the importance of environment to man
- Outline the significance of Environmental Education
- Explain the importance of studying environmental sciences
- Identify the skills required to succeed as Professional in Environmental Sciences.

3.1 The importance of environment to man are discussed below:

(a) Provides Healthy Ecosystem

The man's entire life support system depends on biosphere or the global ecological system in which all living things are interdependent. This biosphere or ecosystem consists of smaller ecosystems like the rainforests, oceans, the desert and the tundra. An ecosystem has living and non-living parts, whether it is terrestrial or aquatic. The non-living parts are the soil, water, air, and nutrients while the living elements are plants, animals, micro-organisms, and humans.

There is need for the ecosystem to be healthy and has all the chemical elements and nutrients circulating in a cycle while supporting millions of species. These species help in the process of goods and services that are useful for man consumption (Kinhal, 2020).

(b) It provides Food Chain

The plants depend on sunlight, water, and elements in the soil and air to create food for themselves; and are in turn eaten by animals and micro-organisms. The man who are usually at the top of the food pyramid in any ecosystem use plants and animals for food. There are also earthworms and small insects, like bees, pollinating plants, which form part of the environment without whom the food chain would be broken.Man should therefore, not disrupt the chain and cause problems of shortage of food; for the important roles it play in making possible food security (Kinhal, 2020).

(c) Natural Resources and other Products are derived from the Environment

According to Kinhal(2020), the most important natural resources and plants derived from the environment are:

- **Water** - this is very important and necessary for man, for it to be declared a human right by the United Nations
- **Medicines** - Many plants are used as medicines and are even now exploited by modern pharmaceuticals for drugs, syrup and tablets.
- **Clothing** – they are normally produced from plants like wood pulp, cotton, hemp and jute. It may also be from animal products like silk, wool, and leather while the synthetic clothes are produced from petroleum products.
- **Wood** - forests or plantations is used as fuel or in construction and furniture industry.
- **Biofuels -** the resources for example bioethanol, are extracted from wheat, corn or biomass crops like willow.
- **Fossil fuels -** such as coal, gas and crude oil used in transportation, energy generation and production of plastics and chemicals are all useful for man utilization.

(d) It provides Air Quality and Disaster Control

The trees and forests in the environment play an important role in regulating air and climate.

Trees release oxygen to the air and use carbon dioxide from the air when they produce their food through photosynthesis. This process helps to regulate and maintain the carbon cycle. This is the reason why the cutting of the trees leads to global warming.
Its also remove pollutants in the air. The shades from the trees moderate temperature by making warm places to be cool and provide warmth in cold areas. Natural ecosystems can either prevent or mitigate severe events and disasters (Kinhal, 2020).

(e) It serves as a source of Natural Beauty

The environment is a source of natural beauty. Nature is enjoyed for recreation, sports such as skiing in snow or rafting, and tourism. It is also considered necessary for man's proper physical and mental health. However, the planet is in danger for the fact that some species of both animals and plants are nearing extinction. Also, beautiful, open spaces are disappearing as new buildings and factories are built (Kinhal,2020).

Self-Assessment Exercise

Why is the Environment Important to Man?

3.2 Significance of Environmental Education

Education generally provides knowledge about things in the world and turn it into better idea. It enables people to develop a perspective about life, build opinions and have independent view about situations in life. It forms the basis of everything in today's world, including environment. Environmental Education communicates knowledge about the present situation and future prospects of nature or environment. It enables people to know about all the problems relating to the environment, and make them to be involved in preserving it. Environmental Education is more than providing information about the environment, it is described as a process which allows individuals to explore environmental issues, engage in problem solving, and take action that will bring improvement to the environment (United States Environmental Protection Agency (US EPA,2018).There is need to study Environmental Sciences in schools curricula so as to make the people to be sensitized and encouraged to find innovative solutions to the environmental problems that daily confront them. However, the following are some of the reasons given for integrating environmental studies into the school curricula:

(i) Awareness

It is very necessary to be informed about the steps to be taken towards protecting the environment, this can only be made possible from studying subjects related to the ecosystems. People need to be able to know the environmental problems that is confronting the world and how environmental sustainability can be achieved. The people therefore, should have good knowledge about environmental sciences and be ready to apply this knowledge practically, to solve problems that may arise from the environment.

(ii) Sustainability

The earth's resources should be effectively used for it to be able to cope or meet up with the daily demand from the people. The present demand by the people have shown that the resources are not adequate, due to its excessive use. This scenario definitely will have dire consequences on the future generation if the situation is left unchecked.

The knowledge of Environmental Education is believed would help people to understand the danger of overexploitation of these resources and guide them on what to do to prevent this from happening.

(iii) Health Benefits

The depletion of the environment may have disastrous effect on man's physical and metal fitness. People are often encouraged to come in contact with nature because of its healing power. Environmental Education exposes student to natural cure and Ecotherapy, which sometime take place outside the classroom. Natural treatment greatly helps patients overcome such diseases as depression, heart ailments, blood pressure, insomnia and poor eyesight among others. The fact remains, that person who is closest to nature may likely be healthier than those who are not close to the nature.

(iv)Artistic Imagination

Locations that are with natural surroundings are usually best for artists to do their works. The artists' work such as poetry, painting, sculptures etc. are all products of imagination which are inspired by nature. Environmental education makes people to recognize this creativity and be exposed to artworks.

(v) Awareness of Environmental Threats

The people are made aware of the danger that may likely occur in their place and can run to safer and better places. They know the rescue drills for natural calamities and how to use greens better. Environmental Education can make people to be aware of environmental threats and make them to be well informed about how they will handle the crisis situation anytime it happens.

(vi) Use of Renewable Energy

Environmental education makes people to know more about the importance of renewable energy. The non-renewable sources of energy like petrol, diesel etc serve as the major sources of the world's pollution. Environment Education therefore, provides enlightenment to people about the use of renewable sources like solar energy, wind energy etc. This use of renewable resources is one of the means of combating global warming and the awareness about of environment is being spread through cinema and digital media as well. The Social Media campaigns daily publish more information on environmental conservation which are of importance to the people. All these initiatives go a long way in helping to make the world a better and safer place to live. (Claro Energy,2015).

Self-Assessment Exercise
What is Environmental Education?
Outline the major significance of Environmental Education to the Nation.

3.3 The importance of studying environmental sciences

Environmental science is a study which covers the physical, biological, and information that relate to the environment and the solutions to these problems.
The study of environmental science is committed to the learning of earth processes, evaluating alternative energy sources, the effects of climate change, and pollution control among others. Acquiring a degree in the Environmental Sciences would enable somebody to be in a good position to fix the environmental problems that are daily confronted by man. The professionals in this field are the only the one that can help to reverse the damage that might have been done to the environment by man and other organisms. The environment is of importance to living and nonliving organisms, it affects everything from climates to animal survival and air quality amongst others. The following are some of the common environmental problems that may be of interest to an Environmental Scientist:

- Climate Change
- Deforestation
- Ecosystems
- Endangered Species
- Land Management
- Overpopulation
- Public Health
- Waste Disposal and Pollution
- Water

Environmental Science has been considered as one of the fastest growing professions in the U.S. and it is expected that by 2026 the job employment will jump up by11%.
This has shown that with a degree in environmental science, one is not in a declining job market and there is a growing need for experts in this field. The following are some of the popular environmental science jobs that graduates in this discipline can be offered:

- Agricultural Engineer
- Antarctic Researcher
- Coral Reef Sanctuary Manager
- Environmental Lawyer
- Environmental Science Professor
- Laboratory Technician
- Oceanographer
- Park Ranger

- Solar Panel Engineer
- Toxicologist
- Wastewater Technician

Graduate of an environmental science program can choose from the following five different career sets:

- Environmental Science
- Agriculture and Forestry
- Environmental Policy and Planning
- Sustainability and Green
- Public Health (Unity College, 2020).

Self-Assessment Exercise
Specifically discuss the importance of studying environmental sciences.

3.4 Skills that are required to succeed as a Professional in the field of Environmental Science

In every profession there are skills that need to be possessed for somebody to succeed. This is why it is important for somebody that is a greenhorn in a particular profession to have knowledge of the skill set, s/he needs, to succeed in that profession. The following are some of the skills required to succeed as a professional in the field of Environmental Sciences:

- Analytical skills – the skills are needed to carry out this set of process: identify problems, develop a plan that will be needed to address the problem, perform a rigorous analysis of the issue, and arrive at independent conclusions. The person with this skill normally has the ability to collect and analyze information, problem-solve critical issues, and make valuable decisions. In other words, s/he has the ability to investigate a problem and find the right solution in a timely, and efficient manner (Doyle, 2020; Unity College, 2020; University of Nebraska, 2020).
- Communication skills – this is very important because having strong analytical skills is nothing if the analysis cannot be shared with others. This skill should complement analytical skill for better result to be achieved in the organization. The communication skills can be done through oral presentation, memo, email and report. Communication skills involve clear presentation of complex problems, correct usage of scientific language and reporting methods, good writing of proposals and research reports, design of effective presentations and perfect negotiation between conflicting viewpoints (University of Michigan, 2011; Doyle, 2020)

- Interpersonal skills - are traits that are relied upon when somebody interacts and communicate with others. The skill covers a variety of scenarios where communication and cooperation are very essential. The interpersonal skills involve the ability to communicate and build relationships with others in the organisation. A person must be an effective communicator before s/he can build successful interpersonal relationships. The person must be able to not only effectively communicate his needs and goals, but must also learn to listen to and understand others. It also means learning to solve problems intelligently and efficiently. The development of interpersonal skills is beyond creating success within the family but extends to success in school, professional life, and the community in general (Hunter, 2006; Basile & Walters2007; Indeed, 2020)

- Problem-solving skills – the skills help to determine the source of a problem and find an effective solution to that problem. Although problem-solving is often identified as its own separate skill, there are other related skills like creativity skills, emotional intelligence etc. that contribute to this ability. The examples of some key problem-solving skills include the following, active listening, analysis, research, creativity, communication, dependability, decision making and team-building. These skills are important in every career at each level in the organization. Environmental scientists are problem solvers, they conduct research on environmental and health problems, so as to determine their causes and solutions (EnvironmentalScience.org, 2020; Indeed, 2020).

- Self-discipline - this trait develops over time, no matter the career level or industry. It can help in achieving personal career goals by supporting the success in the job search or in the current role. Self-disciplined individuals do rely on a group of other traits, such as:ambition,focus,organization, persistence, resilience, responsibility and strong work ethic. The skills help in completing tasks, surpassing milestones and eventually reaching specific goals (Indeed, 2020).

The skills above are very important whether or not a person has direct experience in any of the environmental sciences field, they are all traits that can be learnt and developed in the course of training. The study of environmental science is full of passion and hope for those who have chosen to be in this industry. The continuous global environmental issues make this career choice of interest to anyone that is looking for job stability and a guaranteed long-term career in job involving clean environment (Unity College, 2020).

Self-Assessment Exercise

What are the skills required to study Environmental Sciences?

4.0 Conclusion

The environment will continue to remain important to man not only because of its positive impacts but its adverse effects on the people. The world is daily faced with the issues of climate change and global warming, which are having far-reaching and long-lasting impact on the natural environment, the ecosystems and the people.
It has therefore, become very imperative to take urgent steps that are required to address this environmental problem. There is also need for professional in the field of environmental sciences that will provide the necessary solution to these environmental problems. It is hoped that the efficient management of waste will bring about Environmental Sustainability.

5.0 Summary

The unit gives focus on the importance of the environment to man amongst which include the following: it provides healthy ecosystem, food chains, air quality and disaster control, serves as a source of natural beauty, and natural resources are derived from it. The significance of environmental education and the importance of studying environmental sciences were also discussed. Environmental education creates awareness, provides health benefit and help people to know about the use of renewable energy. It was also learnt that the studying of Environmental Sciences would enable people to fix the environmental problems that are confronted in their day to day activities. The section ends with the discussion of skills that must be developed by the Professional in the field of Environmental Science before they can be successful. The followings skills were discussed: analytical, communication, interpersonal, problem solving and self-discipline. These skills are very necessary to be learnt and developed by individuals that want to be successful as professional in the environmental sciences.

6.0 Tutor-Marked Assignment

1. Give the importance of environment to man?
2. Discuss the major significance of Environmental Education
3. State the importance of studying environmental sciences
4. Identify the basic skills required to succeed as Professional in Environmental Sciences.
5. Examine the basic reasons for studying environmental sciences.
6. Enumerate the basic skills that are essential to become a successful Professional in Environmental Sciences
7. Mention the common types of environmental problems that are of interest to an Environmental Scientist.
8. List the types of environmental science jobs that can be offered to graduates in this discipline.
9. Discuss the types of natural resources and plants that can be derived from the environment.

10. Describe any four skills that are essential for a successful professional in the Environmental Sciences.

7.0 References/Further Readings

Basile C.G., Walters B.J. (2007) Interpersonal Domain: Building Interpersonal Skills Through Environmental Studies. In: From Principles of Learning to Strategies for Instruction with Workbook Companion. Springer, Boston, MA. https://doi.org/10.1007/978-0-387-71086-0_13

Claro Energy (2015). Environmental Education: 5 Reasons Why is it Important https://claroenergy.in/environmental-education-5-reasons-why-is-it-important/

Doyle, A. (2020). Analytical Skills definition, lists and examples. Accessed on 4th August, 2020. Available at: https://www.thebalancecareers.com/analytical-skills-list-2063729#:~:text=Analytical%20skills%20refer%20to%20the,these%20skills%20in%20everyday%20work.

EnvironmentalScience.org (2020). Environmental Science Careers.Accessed on 18th June, 2020. Available at: https://www.environmentalscience.org/careers

Hunter, B. (2006). The importance of reciprocity in relationships between community-based midwives and mothers. Midwifery. 22 (4):308-322

Indeed (2020). Interpersonal Skills: Definitions and Examples. Accessed on 04 August, 2020. Available at: https://www.indeed.com/career-advice/resumes-cover-letters/interpersonal-skills

Indeed (2020). Problem-Solving Skills: Definitions and Examples. Accessed on 04 August, 2020. Available at: https://www.indeed.com/career-advice/resumes-cover-letters/problem-solving-skills

Indeed (2020). Self Discipline: Definition and Examples.Accessed on 04 August, 2020. Available at: https://www.indeed.com/career-advice/career-development/self-discipline

Kinhal, V. (2020). Why Is Our Environment Important? Accessed on 18th June, 2020. Available at: https://greenliving.lovetoknow.com/Why_is_Our_Environment_Important

United States Environmental Protection Agency (US EPA,2018). What is Environmental Education? Accessed on 04 August, 2020. Available at: https://www.epa.gov/education/what-environmentaleducation#:~:text=Environmental%20education%20is%20a%20process,make%20informed%20and%20responsible%20decisions.

Unity College (2020). Why Study Environmental Science? What Can I do with a Degree? Available at: https://unity.edu/environmental-careers/why-study-environmental-science/

University of Michigan (2011). Earth & Environmental Sciences.The University of Michigan Career Center, Division of Student Affairs, in cooperation with the College of Literature, Science, and the Arts. Accessed on 04 August, 2020. Available at: https://careercenter.umich.edu/article/earth-environmental-sciences

University of Nebraska (2020). Knowledge & Skills Gained. Accessed on 04 August, 2020. Available at: https://www.unomaha.edu/college-of-arts-and-sciences/environmental studies/academics/knowledge-skills-gained.php

Unit 2: Human Consequences and Responses to the Global Environmental changes

CONTENTS

1.0 Introduction

The effect of environmental changes on man have been considerable, this is in terms of human consequences and responses to these changes. The consequences manifest in the form of their migration from one place to another, changes that are brought about in their way of living, their farming methods and the changes in individual and group behavior. The response to these changes in the global phenomenal until recently have been treated, as if they were local; people responses are not organised at the individual level but only as government policies. Thus, they have consequently found it difficult to respond by consciously altering the course of the global changes themselves. However, there have been shift in the way things are now from what it used to be in the past. There has been effort towards the formation of environmental movement and Non-Governmental Organisation that serve as pressure groups in responding to these global changes. This unit is therefore, aim at examining human consequences to the Global Environmental Changes; the concept of human consequences and the importance of human responses to the global environmental change. The next section examines human response to environmental changes as to whether to mitigate now or postpone mitigation to the global changes to the future date. This is followed by the Human Systems that are affected by the Global Environmental Change.

2.0 Objectives

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

- Define the term “Human Consequences” in relation to the Global Environmental Change.
- Describe the variety of Human Responses to Global Environmental Change
- Discuss the Human responses as to whether to mitigate or not to mitigate global warming
- Identify the key human systems that may be affected by the Global Environmental Change.

3.1 Human Consequences to the Global Environmental Changes

There is need for people to be mindful of whatever action they take now because of its effect in the future. Human actions affect values, and the effect of these actions cause global changes that normally take decades to centuries to be realized. It has therefore, become imperative to protect the values of those who might likely be affected by these global environmental changes in the future. The uncertainty about the workings of the global environmental systems and the difference in circumstances and values the people that will be affected may probably live make it difficult to determine how present actions will affect them in the future. Hence, the human consequences on global change can be forecasted in the future by taking into consideration the following factors:

- the future of social and economic organization,
- the future state of the natural environment,
- the proximate effects of global change on those values,
- the responses that humans will have made in anticipation of global change or in response to ongoing global change and
- the values held by the members of future social groups (National Research Council, 1992).

The factors above form a dynamic, interactive system. The human societies for centuries adapt to their environments and have influence on the environments. The human values are likely to promote behavior that will be consistent with adaptation; and the values and social organization affect the way humans respond to the global change. This probably may be through the changing social organizations, values, or the environment itself.

The human consequences of global change can be defined as the difference that exists between the state of humanity at the end of one grand scenario and the state of humanity of a base case or reference scenario, which has a different natural-environment component. This means a particular change in the natural environment has different consequences depending on the scenarios assumed for society, values, and responses (National Research Council, 1992).

Self-Assessment Exercise

Define the term “Human Consequences” in relation to Global Change. What are those factors that determine human consequences on global change?

3.2 Human Responses to the Global Environmental Changes

There are variety of human responses to global change but effort will be made to consider the following analytic distinctions, that are popularly used as the range of human responses to the global environmental changes:

(a) Experienced Versus Anticipated Change

The response to environmental change in this case may be as it is experienced (post facto) or as it is anticipated. People respond to environmental change in the past by experience but now due to increasing scientific knowledge it has been based on anticipatory responses.

Policy makers and others are now faced with a variety of options, some of which may be taking anticipatory action or awaiting the experience of global change.

(b) Deliberate Responses Versus Actions with Incidental Effects

This involves human actions taken deliberately in response to the global change. This can be in the form of planting trees to check deforestation or constructing farm terrace to prevent erosion. The response to environmental change can be incidental when it is unplanned and is likely to happen to achieve the intended purposes. This can be in the form of high taxes on gasoline, enacted for reasons unrelated to the global environment, but assist in encouraging the purchase of small, fuel-efficient automobiles which slow down the pace of global warming. This technological change, through the high taxes have made it possible for those countries without high gasoline taxes or companies that produce fuel-efficient automobile to respond to the challenge of global warming. The incidental responses to global change are important because they could become tomorrow's deliberate responses and are essential for informed policy decision making to be made.

(c) Coordinated Versus Uncoordinated Responses

The human response is coordinated, when it is through the policies of governments or trade associations and is aimed at eliciting the same action from many actors. The human response is uncoordinated when it involves independent actions of households or small firms. These two types of response can be either anticipatory or post facto and both can affect global change either deliberately or incidentally. However, there are situation in which coordinated and uncoordinated responses can be related to each other, most especially, when coordinated actions by governments and industries create new options for uncoordinated actors, prohibit responses, or raise or lower their costs (National Research Council, 1992).

3.2.1 Interventions at Different Points in the Process

There is human intervention at any point in the cycle of interaction between the human and environmental systems. This is to enable the protection against threats to what human value. Mitigation is generally used to describe interventions on the human causes or actions that prevent, limit, delay, or slow the rate of undesired impacts by acting directly or indirectly on environmental systems. It can operate at various points in the causal cycle. This may be in the form of direct interventions in the environment to counteract the effects of other human actions, or direct interventions in the proximate human causes and interventions in the human systems that lead to global change, which is intended to have an indirect or downstream effect on the proximate causes.

There is also human intervention on the response side of the cycle which is generically called adaptation. Individuals, Organisations and Societies can take steps in adapting to the climate change and help the plant and animal to survive as well.
Adaptation can be reactive actions when human responds to conditions that have already changed while it is anticipatory when there is planning for climate change before its impact is felt by the people (United State Environmental Protection Agency (US EPA,2016). There are important distinctions among adaption which include:

(i)Blocking – this type of adaptation prevents undesired proximate effects of environmental systems on what human value.
For example, a drought may threaten farm crops; so, the development and adoption of drought resistant crops will break the connection between environmental change(drought) and famine. This action will help in preventing crop failure.
(ii) Adjustments – this is another type of adaptive response which prevents or compensate for losses of welfare that would otherwise result from global change.
Adjustments neither mitigate environmental change nor keep it from having effect on what people value, but rather intervene when a loss of welfare is imminent or after it has begun to be manifest. Examples include provision of food shipments or financial assistance after evacuation, to the people still living in areas stricken with flood or drought
(iii) Anticipatory adaptation – this is used to improve the robustness of social systems, so that an unchecked environmental change would give less reduction of values than would otherwise be the case. This does not alter the rate of environmental change, but lowers the cost of any adjustments that might become necessary. For instance, Farmers that diversify in agricultural production release less greenhouse or ozone-depleting gases than monoculturists (National Research Council, 1992).

Self-Assessment Exercise
Distinguish between Mitigation and Adaptation as forms of human response to Global change.

3.3 Human response to Environmental Changes

This section considers the issue of whether to mitigate or not to mitigate on Human response to Environmental Changes. There are two approaches involved in responding to climate change and these are mitigation and adaptation. Mitigation is defined as reduction in the flow of heat-trapping greenhouse gases into the atmosphere, which can be done either by decreasing sources of these gases or increasing the "sinks" that accumulate and store these gases.
Adaptation is defined as adjusting to actual or expected future climate (United Nations Intergovernmental Panel on Climate Change, 2014[a]; United Nations Intergovernmental Panel on Climate Change 2014[b]).

The world has become a global village and whatever happens in any part of the world has a spillover effect to other part of the world within a shorter period of time.

The U.S. energy use which threatened the global environmental change is a good example of an issue which later became a matter of urgent concern to the whole world. The most important consequence of global change is conflict, so the debate on responses to a global change is between advocates of immediate mitigation to the issue of global warming and those who would want it to be postponed to the future date.

According to the National Research Council (1992), the following are some of the arguments raised by those proponents who suggested the postponement of mitigation on the issue of global environmental change to future date:

i. There is uncertainty about global change – there is incomplete knowledge of the relevant properties of the atmosphere, oceans, biosphere, and other relevant systems that make up the global warming, hence there is uncertainty about its future occurrence. Therefore, expending resources now to prevent changes that may not occur in future can be wasteful and the mitigation efforts may bring about undesirable changes.

ii. Adjustment may make Mitigation to be unnecessary – this means that there is tendency for the human systems to adjust to global climatic changes much faster than they are likely to occur. The doubling of atmospheric carbon dioxide levels has been forecasted, will take place about 80 years from now. This is in contrast to the situation in financial markets that will adjust in minutes, administered-market prices in weeks and the labour markets in years. This implies that what the individuals and organizations will do in anticipating climate change may be enough that organized, governmental responses will be unnecessary.

iii. May result to fighting the wrong war – the level of technological and social changes can remove certain problems without the use of any mitigation efforts through the change in the offending technology or the obsolescence of the technology. For example, there is no more explosion of boilers in trains because the steam engines are no more in use.

iv. Possibility of Better policy options – the discovery of more effective and less costly interventions than those now available through research, may discourage the use of any future mitigating efforts for the global change.

v. Possibility of taking action now may be more costly – the proponents suggest that the postponement of action to the future will be less costly because of continuing economic progress. They believe that if people had invested in the past to prevent today's environmental problems, their expense would probably have been made on the wrong problems. This would have amounted to an inequitable transfer of resources from a poorer generation to a richer one.

The Proponents of immediate mitigative action put forward the following arguments:

i. Immediate action is more feasible and effective: the proponents argue that taking immediate action is more effective than postponing it to later date. This can be in terms of cost, damage and loss that may result from delaying action till later period.

The delaying of policy actions can lead to costs or economic damages such as costs to health, costs from sea level rise, and harm from increasingly severe storms, droughts, and wildfires. These costs are borne by the present and future generations (National Research Council,1992; Furman, 2014).

ii. It encourages adjustment to slower change: immediate action is judicious because of the longtime lags in the global environmental system which make it easier to adjust to change gradually. There is usually long-time delay in getting the effect of global change, so by the time it becomes clear that a response is needed; it may be too late to prevent catastrophe, most especially if the change occurs very fast. In a situation where there is no possibility of catastrophe happening, mitigation which slows the rate of change can be made in time. For example, the nonhuman organisms such as tree can adjust to climatic change by migrating, as seedlings move to more favorable locations. This is also the case with human adjustments to major environmental change.

iii. It serves as insurance against disaster: immediate policy action in the face of possible catastrophic outcomes is like taking out insurance against flood and fire. The insurance expenses are manageable, but the expenses of catastrophe may not be easily quantified.

iv. It prevents irretrievable error: there is need for immediate policy action to be taken against potentially irretrievable losses, most especially in situation that may call for species extinction. There are some species that are valued for themselves and their loss is irretrievable; there are also those valued only for what benefits they may have for humanity; which loss may be irretrievable. Generally, there is need for immediate mitigation efforts for these species not to be lost.

v. It prevents high-risk environmental experiments: there are various efforts that are now made in conducting large-scale uncontrolled experiments on the global environment by changing the face of the earth and the flows of critical materials at remarkable rates. There is need to limit the pace and extent of such experiments because of the unexpected consequences that may follow. Also, there is possibility that most of these experiments are likely going to fail. There is support for any mitigation efforts that will slow ongoing human interventions in the environment, but generally not those that would stop global warming change.

vi. Economic arguments do not take into consideration some environmental goods: The environmental goods are non-market goods, such as clean air, clean water, landscape, green transport infrastructure, public parks, urban parks, rivers, mountains, forests, and beaches. They are a sub-category of public goods. The fact remains that the costs and benefits of postponing action are not always similar, for instance, where the current economic activity damage the human life support systems, it may be impossible to determine the cost that may result from this loss. Economic arguments cannot deal with some things like the balance of nature; which is the stable state that natural communities of animals and plants exist, maintained by adaptation, competition, and other interactions between the members of these communities and their nonliving environment.

The balance of nature may be in terms of benefit which people place on intrinsic or spiritual value. In a situation where people want to preserves such values, mitigation will be the only acceptable approach.

vii. Other justification: this includes the investments in energy efficiency that provide an excellent return on investment even with narrow economic calculations. This may achieve the benefits of mitigation at no extra cost, while providing other benefits (National Research Council,1992).

Self-Assessment Exercise

What is mitigation and why may it be postponed to address global environmental change in the future?

3.4 Human Systems that may be affected by Global Environmental Change

This section considers the seven human systems that are affected by the global change. They are: individual perception; markets; sociocultural systems; organized action at the subnational level; national policy; international co-operation; and the global human systems. They are briefly discussed as follows:

(i) The Individual Perception

The Individuals notice the effects of change and normally decide either to make adjustments or not. The individual behaviour in relation to the consequences of global change are measured in three distinct ways: the individual judgments and choices, the aggregation of the individual responses and individuals as Social and Political Actors.

The decision makers normally start their decision process by obtaining inputs from individuals, whether themselves or their advisers. There is need for assessment before determining the responses to global change. This make the knowledge about human judgement and decision to be relevant to understanding responses to the global change. Also, consequences of global environmental change often depend on the aggregated responses of very large numbers of individuals. This is well illustrated in the case of U.S. energy conservation where millions of people have decided to buy more fuel-efficient automobiles, reset their thermostats, and reinsulate their buildings. Also, there were millions of consumers who stopped buying aerosol cans when they learnt that it was releasing harmful CFCs to the ozone layer. The Individuals, if they were appropriately mobilized, can be powerful actors at both the community and national levels. The Individual perception and judgment determine the support for social movements, such as the environmental movement. The individual perception affects human response by linking individuals to the concerted actions of government and industry. Those actions, in turn, influence individual behavior both directly and through their effects on the markets (National Research Council,1992).

(ii) Markets

The uncoordinated human responses to global change will be affected greatly by markets in term of its effect on the prices of commodities and factors of production in local and world market. The economic theory stipulates that producers and consumers respond to changing relative incomes, prices, and external constraints. This means that if the market signals are allowed to reach individuals the responses will be relatively rapid and efficient. There are many forms of uncoordinated adjustment to climate change by markets such as the altering of people patterns of consumption and production. However, the conditions specify by economic theory for efficient adjustment are not generally met in the case of the global environment. The effects experienced by those not directly involved in economic transactions, are not priced in markets today, for example, someone who emits a ton of carbon into the atmosphere may produce great damage to the future climate but would not pay for the damage. Economists have suggested approaches to the problem of developing well-functioning markets to guide responses to global change. They suggest that governments should intervene with policies that meet at least one of these criteria: (a) it should have long lead times so that they must be undertaken now to be effective; (b) they must likely be economical even in the absence of global change; or (c) the penalty from waiting a decade or more to undertake the policy is extremely high.
These criteria suggest four kinds of intervention, which include:
(i) Government should encourage quasi-market mechanisms before shortages occur.
(ii) Governments to support systems of risk-adjusted insurance for flood plains or hurricanes or international climate insurance.
(iii) Government to support research and development on inexpensive and reliable ways of slowing or adapting to global change.
(iv) Governments to promote needed knowledge, collect and distribute data about global change that will enable rational response.

(3) Sociocultural Systems.
The Social organisation as a form of social unit lies between the individuals who are predominantly indigenous and formal organised units of governments and international organisations. The Social organisation include the families, clans, tribes, and other social units that are closely knitted together by blood, duty, unity and love. The sociocultural systems are the oldest form of the social organisation in the human history. They have undergone substantial change, despite this, the informal groups connected by these bonds still exist and influence behaviour which is independent of the government and markets. The Sociocultural systems are important in relation to global change in two ways namely:
(i) there are some long-lived social units, whose survival may be threatened by global change. These social units have developed interaction with their environments that may be adaptable by others as strategies for response.
These Indigenous people have developed technological and social adaptations that make them maintain balance with the local environment.

The Sahelian peoples for instance have developed adaptation to an environmental regime of recurrent drought. Agricultural systems based on indigenous models can be profitable in a market economy, for instance, the Japanese complex systems that prevent soil degradation and tolerate soil acidity and aluminum toxicity are considered better than annual cropping system (ii) the informal social bonds can have important effects on individual and community responses to global change. It also had effects on the implementation of organized policy responses. The individual behaviors in response to global environmental change may be affected by informal social influences. There is tendency for people to imitate individuals they like or respect, or follow the unwritten norms of interpersonal behavior, and preferentially receive information from sources they consider reliable. These types of influences are significant to determine the social response to natural disasters, particularly those that strike quickly and with short time warning, such as floods and major storms ((National Research Council,1992).

(4) Organized Responses outside Government

There are three types of social actors, aside the governments which may make substantial, organized responses to the global change and they include: the communities, social movements, and corporations and trade associations. They all form a vital link between behavior at the individuals, firms, households, institutional and national level.

The community is more than a shared place of residence, it can be described as a unit in which people earn their living, engage in political activity, raise their children, and carry out most of their lives. It responds to the stresses of environmental change both in uncoordinated ways and through organized activity. Communities respond to the local impacts of global environmental change in different ways; where they are diverse, they provide valuable buffers against hardship as individuals and households share resources and where they are similar there is no buffering. This probably explain why traditional relationships and patterns of action, tension, and rivalry within a community helps in time of crisis, or may prevent organized action that would help in coping with or take advantage of local changes. Also, in situation where global change disrupts traditional patterns of community life, it generates stress and conflict that can become violent. The Environmental movement organizations have been playing key roles in matter concerning national and even international responses to global change.

Most of their activity at the national level have been directed to bringing about the change in public policy. Their influence on public policy depends on the political context in which they operate, and in particular on their relationship with the political parties.

In political systems where participation is via large party, such as the United States, they maintain loose alliances with political parties. In systems where small parties can play a serious role in influencing policy, the movements either form tight alliances with parties or act as parties in themselves.

These structural differences affect movement strategy and have resulted to sharp differences in how environmental problems are conceptualized. Generally, environmental groups in their relations to the political parties usually find themselves in conflict with corporations, trade associations, and often with government officials.

In the United States, the environmental groups enjoy high degree of public support, the corporations and their representatives have far greater financial and personnel resources, but less public support while the government falls between the two (National Research Council,1992).

(5) National Policy

In most countries, the consequences of global change are determined through the international agreements and national policy decisions that affect the ability to respond at local and individual levels. The focus is primarily on differences between nations in their environmental policies and the policy process. There are differences in National environmental policies in most countries, partly due to differences in public attitudes. This became more obvious with the kind of attitude shown towards environmental issues from country to country in the early 1970s. It was noticed that environmental issues were much more politically relevant in Japan and the United States than in Europe; but during the 1980s, the reverse has been the case. This probably might be due to the variations in national economic performance, actual environmental quality and national political cultures. The attention on environmental concern in Japan was towards public health protection, while in Germany high priority has been given on the protection of nature, with the United States and Great Britain falling some-where in between.

These differences in focus, definitely are likely to explain for different nations' responses to various kinds of global environmental issues. This also probably explain why policies vary, because each nation's political system responds to public concerns in its characteristic way. In democratic nations, there are variation in political features. The Nongovernmental organizations that are concerned with environmental development issues are not well organized in the same manner in all countries. The citizens in these counties display different propensities to join voluntary organizations which are concerned with environmental development issues, and the organizations have no similar access to the policy process everywhere. For instance, the United States, with its constitutional system based on the separation of powers, provides nongovernmental organizations access to shape public policy while in contrast, more centralized political systems, such as France and Japan, strictly restrict participation by citizens' groups. In country with Parliamentary systems and proportional representation, such as Germany, there is formation and representation of political parties that are committed to the environmental development issues. Most environmental problems, whether domestic or global require substantial changes in terms of what firms produce and how they produce it. In situation where these changes increase costs, businesses are likely to oppose them and the changes may likely not occur. As a rule, environmental policies are more likely to be effectively implemented, if it will benefit financially the investors and managers in some industries and firms.

The issues of environmental regulation extend beyond that of the business, it not only imposes additional burdens on producers; it also affects the relative welfare of consumers, employees, and taxpayers.

The burdens may be mainly nonmonetary or monetary, concentrated or dispersed, and relatively visible or invisible, but the fact remains that in all cases it has important political consequences. There are variations in Environmental policy systems in their approaches to regulation. Regulations may control emissions at the source, by establishing environmental quality standards, or by establishing exposure standards. It can be coordinated by a single regulatory body or dispersed among a variety of regulatory authorities; relatively centralized in the national government, as in Great Britain or administrated primarily by local governments, as in the Federal Republic of Germany. It can be anticipatory, requiring firms to get permission before they can act, as with mandatory environmental impact assessments, or may take place after the fact.

The consequences of global change depend mainly on decisions made in government agencies and other large organizations; because knowledge about the decision process is potentially relevant to responses by both governmental and nongovernmental organizations. Specialists on decision processes typically distinguish among the phases of the decision process, such as understanding the phenomena, identifying viable options, and selecting an alternative. The Government agencies involved in responding to global change rely on information from experts to gain understanding, but must make it available in a useful manner to their leaders, who are mostly non-experts, and must interpret the conflicts between, and uncertainty within, expert judgments.

The decisions within government agencies and other large organizations on environmental problems are affected by factors such as standard operating procedures, preassigned divisions of labor, accounting systems, organizational cultures bureaucratic politics, organizational hierarchy, bargaining and negotiation processes, leadership practices, and the control of information by constituent individuals and subunits with goals having partly coincidence with those of the organization as a whole(National Research Council, 1992).

(6) International Cooperation

There would be need for sustained international cooperation because of its importance in the overall human response to global environmental changes. This is because without cooperation from national actors, the efforts to manage some large-scale environmental changes such as ozone depletion and global warming may appear bound to fail. The current agreements among the advanced industrial countries to phase out the use of chlorofluorocarbons (CFCs) may not solve the problem of ozone depletion unless China, India, and other developing countries are persuaded to use substitutes for CFCs in their increasing bid for the production and consumption of refrigerants.

There is need for international action that would address these environmental problems because activities in one country produce spillover effects or externalities which is affecting other countries. The concern about the global environmental problems, is now majorly with international arrangements which focus mainly on mitigating the global environmental changes rather than adjusting to them.

It is hope that in the future, as global changes become realities, there will be more demands for international cooperation to adjust to the impacts, that will ensure buffer stocks of food crops are developed or mechanisms that will handle flows of environmental refugees (National Research Council, 1992).

(7) Global Social Change

There are number of ongoing changes in human systems that helps in shaping the future of the human society. Social change has been described as a way in which human interactions and relationships transform cultural and social institutions over time, that has a profound impact on the society. There is no society that has ever remained the same forever, change always happen and it is regarded as inevitable (Dunfey, 2019). The most interesting thing about change is that it is possible to collectively influence it. The social change does not only take place at the local level, it occurs at the global level and that is why it important to examine its influence on global environmental changes. In other words, the global social change makes people feel the consequences of the global environmental changes. The National Research Council (1992) gave the following reasons as some of the global social changes that may affect the ability of human systems to respond to such change or mitigate the forces of global change.

i. Population Distribution and Size – increase in population may lead to more vulnerability in natural hazards, concentrated pollutant emissions and global systemic changes, most particularly in urbanized areas. These vulnerabilities may decline in the urban areas through economies of scale in resource use, environmental protection, diversification of sources of income by rural households, decrease in population growth rates, and increase concern for environmental amenities.

ii. Market Growth and Economic Development – the spatial reach and dominance of market forces in the world trade have been widening even in countries with central planning and command economies. The effects on the human driving forces of global change and on the ability to respond are not discernible. The expansion of the market has allowed for the checking of inefficient and degrading uses of the environment.

However, this ceding of control to the market can make the state or community reduce their ability to manage environmental problems profitably. Also, at the local level, the sustainable practices that is connected with a subsistence or mixed economy may be abandoned for unsustainable profit-oriented ones. The increased wealth that is normally goal of free-market policies generally increases the ability to respond to threatening change and may raise the standard of environmental quality expected by the population.

iii. Socioeconomic Marginalization – the global spread of capitalism has made some individuals, groups, and countries to be forced into a position of diminishing control over needed resources. This has reduced their options for survival and responses to global change.

The Indigenous sociocultural systems of social security are crumbling, with new capitalist economies doing little to replace the lost safety nets. The economically marginalized individuals and groups may sometimes degrade the environment for their subsistence. They may also lack the resources to respond effectively to natural or human-induced damage. This extends to the Marginalization and impoverishment of nations, which have the same consequences for national policies and actions.

iv. Geopolitical Shifts - the declining tensions between East and West bloc may facilitate human response to global environmental change. This may take the form of reallocation of funds from military uses, reduce potential for widespread nuclear and/ or chemical warfare, redefining national security to consideration of environmental, military and ideological threats. It may also be the shift of policy towards building trust between powerful nations that will result to cooperation instead of conflict. However, the net effect of such geopolitical shifts may be very hard to predict.

v. International Information/Communication Networks – The global explosion in information and communication technology is believed to have uncertain implications for response to global change. This may facilitate societal response by making it easier for scientists and policy makers to cooperate and share information, disseminate it to the public, and organise worldwide pressure for response. However, the network may serve as misinformation or create barriers to response. This can be through spreading information that some nations may gain from the environmental change does bringing about split or conflict amongst countries.

vi. Democratization – It is realized that increasing democratization may influence human response by providing more power to people being affected by environmental change and also give more power to those who are opposed to measures for environmental management and protection. Democratization may also slow responses, in comparison to the situation under authoritarian regime where by decisions are made by the leadership. The net effects on response to global change, therefore, depend on conditions existing in the particular countries.

vii. Scientific and Technological Growth – this involves the exponential growth in scientific and technological knowledge, which both drives environmental change and increases the capacity to respond to it. This increases the ability to detect and understand threatening global environmental changes such as the ozone hole, provision of alternatives to destructive products and practices, for instance the production of substitutes for CFCs and the emergence of new energy sources to replace the old ones.

This may create major changes in the structure of human society and new global environmental problem. The implications of this phenomenon for global environment remain uncertain for a long time.

viii. Resurgence of Cultural Identity – there is worldwide resurgence of cultural identity or differentiation in recent decades; in terms of deeply held attachment to groups (e.g., ethnic, religious, tribal, states) and the associated movements by these groups for autonomy of expression and decision. The resurgence manifests in the forms of ethnic nationalism in the Soviet Republics and the overt hostility, especially in Islamic countries, to the possibility of cultural invasion of Western values. The impact of this resurgence on response is most likely to be felt when the global changes or possible responses to them are perceived as threats to the values or livelihood of a particular group or when the response requires cooperation between groups already in conflict. It can therefore, be argued that the global social change may make the resource use either more or less extensive and at the same time make effective human response either easier or harder to accomplish.

Self-Assessment Exercise

Describe the major Human Systems that may be affected by Global Environmental Change

4.0 Conclusion

There is no doubt that human consequences and responses are very vital to the understanding of how the increasing global environmental problems can be addressed before it become insurmountable and a threat to human life. Government now enjoy the support of new actors such as the communities, social movements, and corporations and trade associations which responds to the stresses of environmental change both in uncoordinated ways and through organized activity. The efforts at responding to global environmental changes should not be done only at local level but also sustained through the international cooperation because without cooperation from the national actors, the efforts to manage some large-scale environmental changes and global warming may definitely be bound to fail.

5.0 Summary

The Unit has examined the concept of human consequences and considers the factors that can be used to forecast the human consequence on global change in the future. It has also explored the various types of human responses to the global changes both in term of popular analytical distinctions and interventions at the different point in process. The arguments as to either to go for immediate mitigation or postpone mitigation have been extensively investigated. Finally, the unit has discussed the important Human systems that may be affected by the global environmental change.

6.0 Tutor-Marked Assignment

(i) Explain the term "Human Consequences" in relation to Global change. Discuss those factors that can be used to forecast in the future, the effect of human consequences on Global Change.
(ii) What are the popular distinctions of human responses to the global environmental Changes?
(iii) Outline and discuss in detail the major types of Adaptation to Global Environmental Changes.
(iv) What are the arguments put forward by the Proponents of immediate mitigative Actions against Global Environmental Change?
(v) How does Market forces as one of the elements of Human Systems, affect the Global Environmental Change?
(vi) Examine the importance of Sociocultural systems in relation to the global change.
(vii) What is Global Social Change in relation global environmental change? Outline the important elements of the Global Social change that may affect the ability of human systems to respond to such change.
(viii) Give the distinction between National Policy and International Cooperation as important elements of the Human Systems in relation to the Global Change.
(ix) Provide arguments for and against mitigation as policy measures that are required to address global environmental change.
(x) Write short notes on the following types of Human Responses to Global Environmental Changes:
(a) Experienced and Anticipatory Change
(b) Deliberate Response and Action with Incidental Effect
(c) Coordinated and Uncoordinated Response

7.0 References/Further Readings

Arts & Entertainment Television Networks (2018). September 11 Attacks. Accessed on 20th August, 2020. Available at: https://www.history.com/topics/21st-century/9-11-attacks

Dunfey, T. S. (2019). What is Social Change and Why Should We Care?. Accessed on 20th August, 2020. Available at: https://www.snhu.edu/about-us/newsroom/2017/11/what-is-social change#:~:text=Social%20change%20is%20a%20concept,don%27t%20really%20even%20understand.&text=Sociologists%20define%20social%20change%20as,long%2Dterm%20consequences%20for%20society.

Furman, J. (2014). The Cost of Delaying Action to Stem Climate Change. DIANE Publishing Company, USA.

National Research Council (1992). *Global Environmental Change: Understanding the Human Dimensions*. Washington, DC: The National Academies Press. doi: 10.17226/1792.

United Nations Intergovernmental Panel on Climate Change (2014[a]). Summary for Policymakers. In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

United Nations Intergovernmental Panel on Climate Change (2014[b]). Summary for policymakers. In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field, C.B., V.R. Barros, D.J. Dokken, K.J. Mach, M.D. Mastrandrea, T.E. Bilir, M. Chatterjee, K.L. Ebi, Y.O. Estrada, R.C. Genova, B. Girma, E.S. Kissel, A.N. Levy, S. MacCracken, P.R. Mastrandrea, and L.L.White (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 1-32.

United State Environmental Protection Agency (US EPA,2016). Climate Change – Overview. Accessed on 19th August, 2020. Available at: https://19january2017snapshot.epa.gov/climatechange/adaptation-overview_.html#:~:text=Individuals%2C%20organizations%2C%20and%20communities%20can,change%20before%20impacts%20have%20occurred.

UNIT 3: HUMAN IMPACT ON THE ENVIRONMENT AND WASTE MANAGEMENT

CONTENTS

1.0 Introduction

People have greatly depended on land for survival through their numerous daily activities on the environment. These activities are usually in the form of farming, business, communication, science and technology. Human activities, as a result, strongly have impact on the environment, which are both positive and negative. The disastrous effects of human activities on the environment probably have caused the extinction of some plants, living and non-living organisms in the ecosystem. Examples of extinct animals include: Sabre Toothed Cat, Dodo, Woolly Mammoth, Great Auk, Stellers Sea Cow, Tasmanian Tiger, Passenger Pigeon, Pyrenean Ibex, Baiji White Dolphin and West African Black Rhinoceros (OneKind Planet, 2016). The International Union for Conservation of Nature and Natural Resources (IUCN, 2015), listed 30 mammalian species as "critically endangered" which in other words mean they are possibly extinct. There are also, 116 extinct species of Plant listed by the International Union for Conservation of Nature (IUCN, 2016). The examples of extinct Nonliving things include: Dead languages; lost or forgotten cultural practices; discontinued commercial products, and others. Human interactions on their environment have, therefore, brought about dramatic changes to the world in unprecedented manner.

This unit is divided into two sections, the first section examines the various impact of human activities on the environment such as overpopulation, pollution, climate change, global warming and others. The second section gives focus on Waste management. In the section, attempt is made to define the concepts of waste and waste management, the types of wastes, methods of waste managements and recycling of the waste and its benefits.

2.0 Objectives

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

- Describe the various human impact on the Environment
- Define the term “Waste”.
- Explain the meaning of Waste Management
- Discuss the major types of Wastes
- Identify the important methods of Waste Management
- Explain the meaning and types of Recycling.
- State the benefits of Recycling

3.1 Human impact on the Environment

There are several ways in which human activities have affected the environment where they live. Man in his bid to settle down in an environment may need to modify it so as to become suitable for living and in the process, there are some damages that are caused to the environment. In this section, the following are some of the impact that are caused by human activities to the environment:

(a) Overpopulation

There is overpopulation when a species' population exceeds the carrying capacity of its habitat. It can result in situation where there is an increase in births or fertility rate, a decline in the mortality rate, an increase in immigration, or an unsustainable biome and depletion of resources. The norm is that when there is overpopulation the individuals will have to limit the available resources needed to survive (Pimentel,1994; Pimentel,1999; Parambi, 2013).

The most serious effect of overpopulation is the degradation of the environment which consequently result to rigorous damage of the ecosystems. There is also the problem of dependency on coal and fossil fuels for energy, because the larger the population, the more fossil fuels will be needed by the people. The use of fossil fuels results in plenty amounts of carbon dioxide being released into the air. This can threaten the extinction of thousands of species and further worsen the problem of forest depletion. People continuously requires more space, thereby causing devastation to the ecosystems and increases CO_2 levels. This increase in CO_2 have ravaging effect on the environment.

(b) Pollution

Pollution is another important effect of human activities on the environment. It can be in the form of the trash thrown out on the road, to the millions of metric tons of toxic substances pumped into the atmosphere every year. Pollution affects indispensable resources such as air, water, and soil which requires millions of years to replenish.

(c) Global Warming

This is arguably the greatest cause of impact to the environment and it emanates through CO_2 levels from respiration to more detrimental causes like burning fossil fuels and deforestation. The CO_2 levels globally every year have been consistently on increase.

The highest level of CO_2 before 1950 was about 300 parts per million but the current measurements of CO_2 levels have exceeded above 400 PPM.

This increase of CO_2 emission contributed to the planet's average temperature increase. This also causes arctic land ice and glaciers to melt, leading to rise in the ocean levels and more water absorbing more heats.

(d) Climate Change

This is connected to the historical development of industry and technology. The increase in temperatures drastically change the Earth's weather pattern. This probably explain why some areas experience longer growing seasons, while others become barren wastelands or deserts. It has become evident that poor air quality and rising temperatures are harmful to the ecosystems. It also has adverse biological effect on people leading to increased cases of asthma and cancer (Alexander,2020).

(e). Genetic Modification

Genetically modified organisms (GMOs) are described as plants, animals or microorganisms in which the genetic material, Deoxyribonucleic acid (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination. GMOs have been a major contributor to the survival and prosperity of humans. The Genetically Modified crops increase agricultural productivity without the use of environmentally harmful pesticides. The disadvantage is that it might pose as hazards to human health in form of toxicity and allergies (Qaim, 2010; WHO, 2014). Herbicide such as glyphosate have been used to eliminate weeds but there are cases where certain weeds have developed resistance to some of these herbicides. This makes the weeds choked out crops and the only way out to make the planted crops grow is to till the land. Tilling involves the turning over of the soil to kill the weeds, however, this process causes the soil to dry faster and making its fertility life span becomes shorter. Fertiliser is used to replenish the depleted soil, thereby, introducing new set of problems to the environment, which may cause disastrous consequences for agriculture (Alexander,2020).

(f) Ocean Acidification

Acidification is normally caused when CO_2 dissolves into the ocean bonding with seawater creating carbonic acid which reduces the pH levels in the water. The acidity depletes the calcium concentrations in the ocean and affects marine organisms, such as coral, plankton and crustaceans to form their shells and skeletons leaving them vulnerable to storm damage. However, it must be stated that acidification is not the only threat to the water as there are other human activities that cause severe changes.

(g)Water Pollution

This occurs as a result of the contamination of water bodies, due to the human activities. The garbage together with excessive amounts of fertilizer through rains and floods are usually dumped into the ocean causing pollution. It is the number one threat to all aquatic life and also the lead cause of reduced biodiversity. Water pollution is not only of great concern to the aquatic organism, plants, humans, and climate but also alters the ecosystem. The effect of water pollution on human is very catastrophic, presently it serves as the major environmental cause of disease and death in the world, it is responsible for an estimated 9 million premature deaths.

The harm to any of the organisms in the environment can create a chain effect, endangering the entire ecosystems (The Lancet, 2017; Inyinbor, *et al.,* 2018; Denchak, 2018; Alexander,2020).

(h) Deforestation

This can be described as the permanent removal of trees to make room for something besides forest. Deforestation include such human activities as clearing of the land for agriculture purposes or grazing, cutting of tree for fueling, construction or manufacturing (Derouin, 2019). The increase in the population is accompanied with the need for more food, materials, and shelter; which are all obtained from forestry. In other words, this trend has led to the large number of trees being cut yearly on the planet. The cutting of these trees in large number is not having a good effect on both human and animals because the trees are the largest producers of oxygen. Deforestation, therefore, serves as a major threat to their survival and also increases greenhouse gases within the atmosphere which leads to further global warming. It is very imperative that these human activities should stop for environmental sustainability to be achieved (Alexander,2020).

(i) Acid Rain

This is also known as acid deposition, it is a broad term for any form of precipitation with acidic components, such as sulfuric or nitric acid that fall from the atmosphere to the ground in wet or dry forms. It includes rain, snow, fog, hail or even dust that is acidic. This normally occurs any time humans burn coal, and sulphur dioxide and nitrogen oxides are released into the atmosphere. These compounds rise up and accumulate in the clouds until the clouds become saturated and rain acid, causing havoc on the ground beneath. The rain acid then accumulates in water bodies which are especially harmful to lakes and small bodies of water and deplete the soil of essential nutrients. Also, the trees absorb the acid accumulate toxins that damage leaves and slowly kills large areas of forest. It can completely eliminate entire species of fish and cause a snowball effect of damage to the ecosystem (United States Environmental Protection Agency, US EPA, 2019; Alexander,2020).

(j)Ozone Depletion

This is defined as the gradual thinning of Earth’s ozone layer in the upper atmosphere caused by the release of chemical compounds containing gaseous chlorine or bromine from industry and other human activities. It is considered as a major environmental problem because it increases the amount of ultraviolet (UV) radiation that reaches Earth’s surface. It also increases the rate of skin cancer, eye cataracts, genetic and immune system damage to man. The fact remains that most chemicals that deplete the ozone layer have been banned, but the chemicals that have already been released can take upwards of 80 years to reach the upper atmosphere, so it will take some time before our protective boundary will be fully functional. The need to support the earth is therefore very imperative, because the society needs to help itself in order to survive (Encyclopedia Britannica, 2020; Alexander,2020).

(k) Overfishing

This can be described as catching too many fish at once, so that the breeding population becomes too depleted to recover. This can also be regarded as wasteful types of commercial fishing that draw in massive amounts of unwanted fish or other animals, which are then discarded. Pollution is considered as number one threat to all aquatic life and is the lead cause of reduced biodiversity.

Biodiversity is defined as the variability among living organisms from all sources, and their ecological complexes in the ecosystems. The various sources of living organisms include terrestrial, marine, and other aquatic ecosystems. The water and water life-forms are some of the most important natural resources to man. Fishing is not inherently bad but when not properly regulated, it can be detrimental to the oceans and people. Fish also serves as a source of protein to billions of people in the world (Millennium Ecosystem Assessment, 2005; Alexander, 2020; Environmental Defense Fund, 2020).

Self-Assessment Exercise

Write Short notes on the following

(a) Acid Rain

(b) Ocean Acidification

(c) Climate Change

(d) Genetic Modification

3.2 Waste Management

3.2.1. Definition of Waste

Waste is a natural part of the life cycle and normally occurs when any organism returns substances to the environment. The raw materials are taken in by Living things and excreted as wastes, which are recycled by other living organisms. These wastes need to be managed in order to reduce their effect on the aesthetics, health and the environment. It can be defined as any discarded, rejected, abandoned, unwanted or surplus matter, whether or not intended for sale, recycling, reprocessing, recovery and purification by a separate operation from that which produced the matter to be waste, which may be of value or not.

The wastes are usually generated in the households, offices, schools, hospitals, and industries; and there is no society that is immuned from day-to-day issues connected with waste disposal. The way waste is handled often depends on its source and characteristics, as well as legal regulations that govern its management (South Australia, Environment Protection Act, SA EPA,1993; EPA,2005; 2006; The Environmental Literacy Council, 2015).

3.2.2 The Meaning of Waste Management

The concept of waste management can be distinguished from that of waste because it involves the collection, removal, processing, and disposal of materials that are generally considered as waste. The waste materials can be solid, fluid, gaseous, nontoxic or even hazardous, and are generated through human activity.

The wastes are often managed by sending it to landfills or burning it in incinerators. However, these options usually come with significant environmental problems. The goals of waste management are to minimize waste, reduce the amount of materials consumed, cost-effectively dispose non-hazardous waste, and dispose the hazardous waste at minimal risk to human health and the environment. There are variety of methods used to manage wastes which include: landfilling, incineration, and composting. There is also, separation of usable materials from the wastes for recycling. (Ecolife Dictionary, 2011; The Environmental Literacy Council, 2015)

Self-Assessment Exercise

Define Wastes and Waste Management.

3.2.3 Types of Wastes

According to the Environmental Literacy Council (2015), the following are the major types of wastes:

(i) Municipal Solid Waste (MSW)

These are basically wastes collected from residences, commercial buildings, institutions such as hospitals and schools, and light industrial operations. The wastes consist primarily of used paper, containers and packaging, food wastes, yard trimmings, and other inorganic wastes. It also includes industrial sludge, which may be hazardous or non-hazardous, that are generated from mining, construction, and manufacturing processes. This type of waste if properly managed, does not pose as a serious threat to human health or the environment.

(ii) Hazardous Waste

This waste material is flammable, corrosive, reactive, or toxic and it can be in the form of a solid, liquid, or gas. The term “Hazardous Waste” though often evokes an image of items marked with skull and crossbones, but there are many hazardous wastes that are products used every day such as paint, used oil from cars, batteries, shoe polish, and even laundry detergent. There are also products that generate hazardous waste during the process of their production. There is usually legislation made for businesses which generate hazardous wastes, that guide them to manage the wastes from generation to disposal. The waste can also be treated to change its biological, chemical, or physical characteristics to make it less hazardous or to reduce its total volume. There are some hazardous materials that can be recycled if it will be environmentally safe to do so, but this can be very expensive. Other leftover waste is then safely disposed of by the business, to further neutralize any adverse effects that it may has on human health or the environment. In many industries effort is made to reduce waste generation by modifying their manufacturing processes or replacing hazardous materials with less hazardous or non-hazardous substitutes.

(iii) E-Waste

These are wastes generated from the electronic equipment used by businesses and individual consumers that are nearing the end of their usefulness. This may be from used computers, fax machines, copiers, and televisions. There are some of these e-waste components containing hazardous materials which make their disposal difficult, for example the cathode ray tubes in computer monitors and televisions.

These hazardous wastes are sometime banned by the Government or Regulatory Agencies from regular trash disposal as a safety measure for Human Health. This result to many of the old electronics being abandoned due to the uncertainty about how to manage them. However, many of these products can be reused, refurbished, or recycled (EPA,2005; 2006; The Environmental Literacy Council, 2015).

Self-Assessment Exercise

Distinguish between Hazardous Waste and E-Waste.

3.2.4 Methods of Waste Management

The following are some of the popular methods of waste management that are commonly used by individuals, industries and institutions:

(i) Land Filling: this is a region of land on to which waste is deposited. This is done to avoid any contact between the waste and also the encompassing atmosphere, significantly the groundwater. They are divided into three groups namely:

(a) Open dumps or unsanitary landfill – this is usually in low lying area or natural area where there is no measure taken for collection of leachates as well as gas emissions. This group of landfills are mostly found in developing countries.

(b). Semi-controlled or monitored landfills – in this type of landfill, the disposed wastes are compacted and waste dumps are covered by topsoil layer; this is done so as to reduce the nuisance that may result from the garbage dump. Generally, all kind of wastes such as municipal, medical and industrial etc. are dumped without segregation. There are no collection systems for leachates and gas emissions.

(c). Sanitary landfills – this type is generally available in developed nations. It has all facilities such as collection system for leachate and gas emissions. Also, there is provision for leachate treatment and use of this treated leachate. There is control for the gas emissions that may be generated from waste incineration and biological treatment of waste (Tchobanoglous et al., 1993).

(ii) Incineration: this refers to the combustion of solid waste materials that lead to ash and slag residues and gas emissions. This method does not eliminate waste, instead it generates waste. The fact remains that physical matter could not be destroyed, so the burning really transforms the first waste materials into many new forms such as: gas emissions, ash, slag and liquid discharge. These new forms are often difficult to take care of than the first raw waste materials (Narayana, 2009).

(iii) Composting

This is a natural process of waste management but it has adverse effects on the environment, as a result, there must be regulated decomposition of organic matter that are contained in the waste through biological processes. The outcome of this decomposition may lead to nutrient-rich products such as the humus. Waste composition involves the mixing of a combination of vegetable residuals, animal wastes, soil matters and water to create humus.

The quantity of compostable material of developing countries constitute about 75–85% of the waste. However, composting has been regarded as the most appropriate choice to handle Municipal Solid Waste in developing countries (Maheshwari & Deswal,2017)

There is what is called the "waste hierarchy," which means the order of priority of actions to be taken to reduce the amount of waste generated and improve the overall waste management processes for a sustainable living. The waste hierarchy, which is also known as the 3R's are: Reduce, Reuse and Recycle.

Reduce – simply means there should be reduction in what is produced and consumed. This is essential for waste management because if there is less waste, then there will be less to recycle or reuse.

Reuse – this involves finding another use for the products or items purchase; or finding bargains for old items or go trash picking and get things refinished. In other words, to reuse items or repurpose them for different use from what they are originally intended for is called Reuse.

Recycle – is the transformation of item or product into a raw material that can be shaped into a new item. There is current shift from 3Rs to 4Rs (Recover). Recovering process is a product of industry benchmarking or technological breakthroughs in more innovative companies and it is used after the 3Rs have failed. All these processes are very essential for waste management. However, the following are examples of few materials that cannot be recycled: Plastic bags or recyclables inside plastic bags, takeaway coffee cups, disposable nappies, cords, garden waste, polystyrene (foam), aerosol can, bubble wrap, single-use rechargeable and batteries, syringes or medical waste, dead animals, oils, ceramics, ovenware, styrofoam and light bulbs (Insider Intelligence, 2018;Conserve Energy Future,2020; NetWaste,2020).

Self-Assessment Exercise

What is waste management? Clearly describe the major types of landfilling method of waste management.

3.2.5

(a) Definition of Recycling

Recycling as a concept can be defined as the process of converting waste materials into new materials and objects. The ability of a material to reacquire the properties it had in its virgin or original state determines it recyclability (Villalba *et al.,* 2002).

Recycling serves as an alternative to "conventional" waste disposal that can save material and help lower greenhouse gas emissions. Recycling can help in preventing the waste of possibly useful materials and reduce the consumption of the fresh raw materials. This helps in reducing energy usage and air pollution from incineration and water pollution that comes from landfilling.

Recycling of waste materials is the process use to convert waste material to new products. In other words, the three basic phases in recycling are the collection of waste materials, their processing or manufacturing into new products, and the purchase of those products, which may then themselves be recycled. The waste materials that are recycled are iron and steel scrap, aluminium cans, glass bottles, paper, wood, and plastics.

These waste materials serve as substitutes for raw materials originally obtained from such scarce natural resources as petroleum, natural gas, coal, mineral ores, and trees. Recycling helps reduce the quantities of solid waste deposited in landfills, which have become increasingly expensive. It also reduces the pollution of air, water, and land which originated from waste disposal.

There are two types of recycling namely: the internal and external recycling. The Internal recycling, involves the reuse in a manufacturing process of materials that are a waste product of that process and this is common in the metals industry. It is also found in the distilling industry, where after the distillation, spent grain mash is dried and processed into cattle feed.

External recycling involves the reclaiming of materials from a product that has been worn out or rendered obsolete; a good example is the collection of old newspapers and magazines for repulping and manufacturing into new paper products. The materials are usually collected by any of the three main methods namely:

(a) Buy-back centres: in this method there is purchase of waste materials that have been sorted and brought in by consumers

(b) Drop-off centres: in this situation the consumers deposit waste materials but are not paid for them; and

(c)Curbside collection: in this collection method the homes and businesses sort their waste materials and deposit them by the curb for collection by a central agency. The choice of whether and how much to recycle depends basically on economic factors in the society. The level of affluence in the society and the presence of cheap raw materials encourage people's tendency to discard used materials or purchase recycled products. Also, recycling can only become attractive if it is economically feasible; in terms of cost of reprocessing waste been less than the cost of treating and disposing materials or processing new raw materials (Encyclopedia Britannica, 2020).

(b) Benefits of Recycling

(i)Preservation of natural resources

There is limited natural resources, they are scarce and are in very short supply. It is therefore, necessary to recycle some of the wastes to augment for the shortfall in the resources. Paper and wood are recycled to saves trees and forests. Plastic is recycled to reduce environmental pollution because it is made from fossil fuel hydrocarbons which is one of the contaminants to the environment. The recycling of metals also means there is less need for risky, expensive and damaging mining and extraction of new metal ores. Glass recycling reduces the need to use new raw material for its production.

(ii) Protection of the ecosystems and wildlife

Recycling serves as protection of the ecosystem, because it reduces the need to grow, harvest or extract new raw materials from the Earth. There is diminish in the harmful disruption and damage being done to the environment as a result of recycling.

This result to fewer forests being cut down, lesser diversion of rivers, fewer displaced animals, and less pollution. The waste if not recycled could have been blown or washed into rivers and seas and end up polluting coastlines and waterways and becoming harmful to the people.

(iii) Decrease in demand for raw materials

The increasing demand for new products has led to over exploitation of the natural resources due to its scarce supply. This has led to increase level of poverty and rise in the population of vulnerable people in the society. There are lot of people being displaced from their homes due to the wanton destruction and exploitation of these natural resources. There is also environmental pollution by wastes that are released from the industries. The argument in support of recycling is that, it is far better to recycle the existing products than to produce from new raw materials that will damage the ecosystem.

(iv) It saves energy

The products that are from the recycled materials requires less energy than those made from new raw materials. The energy saves from making new product from recycled aluminium is 95%, recycled paper is 40%, recycling one glass bottle could power an old 100-watt bulb for 4 hours and a new equivalent LED bulb would last longer.

(v) It reduces climate-changing carbon emissions

The less energy on sourcing and processing new raw materials from recycling produces lower carbon emissions.

This process also keeps potentially methane-releasing waste out of landfill sites. The reduction in carbon dioxide and other greenhouse gases being emitted into the atmosphere is vital for stopping disastrous climate change.

(vi) Recycling is cheaper than waste collection and disposal

Recycle waste has been found to be six times cheaper to dispose than general refuse. This means the more there is recycling, the less waste is put in the bin and the more money is saved. Recycling is therefore, good for households, businesses and local public services.

Recycling food and green waste generate lots of valuable compost that can be used to grow more food and other crops. A new deposit return scheme being introduced for cans or bottles by some organisations do encourage recycling because of the financial incentive it offers to those who make use of the offer.

(vii) It creates job opportunities

This is another important benefit recycling offers to the large number of unemployed in developing countries. There are opportunities for new jobs to be created directly in recycling industry and more jobs in supply chains and other related sectors connected with the recycling industry (Friends of the Earth Limited, 2018).

4.0 Conclusion

The impact of human activities on environment has been so significant and numerous that it cannot be treated as a trivial issue. The impact of these activities has been both positive and negative on human life. There is need to improve on this positive impact for better living to be sustained while the negative side must be addressed so that the danger of global change may be mitigated or reduced to the minimal level. Also, the wastes generated to the environment need to be managed in a cost-effective manner and disposed at a minimal risk to man's health and environment.

There may be need for the conversion of these wastes to new products through the 3 R's (i.e. Reduce, Reuse and Recycle) of waste management.

Self-Assessment Exercise

Define Recycling? Why is it important to man and the environment?

5.0 Summary

The unit is divided in to two sections namely: the impact of human activities on the environment and waste management. The first section examines the various ways in which human activities have influenced the environment in which they live.

This is in terms of such factors as overpopulation, pollution, climate change, global warming and others. The other section gives focus on the conceptual definition of waste, waste management and recycling. It also examines the types of waste, methods of waste management and benefits of recycling wastes.

6.0 Tutor-Marked Assignment

(i) What are the impacts of human activities on the environment?
(ii) What is waste? Discuss the various types of wastes.
(iii) Vividly expatiate on the key methods of waste management. Which of the methods will you recommend for developing countries?
(iv) Why is recycling necessary?
(v) What is recycling? Briefly discuss the basic types of recycling.
(vi) Examine the various collection methods of material for recycling.
(vii) Describe the major types of wastes. Which of these types does not pose as a serious threat to human life?
(viii) Mention examples of 10 items that cannot be recycled.
(ix) Give five examples of waste materials that can be recycled.
(x) Clearly explain the 4 R's of waste management hierarchy.

7.0 References/Further Readings

Alexander, D. (2020).11 Ways Humans Impact the Environment. Accessed on 01 September, 2020. Available at: https://interestingengineering.com/11-ways-humans-impact-the-environment

Alexander, D. (2020).11 Ways Humans Impact the Environment. Accessed on 01 September, 2020. Available at: https://interestingengineering.com/11-ways-humans-impact-the-environment

Conserve Energy Future (2020). The 'Reduce, Reuse, Recycle' Waste Hierarchy. Accessed on 05 September, 2020. Available at:https://www.conserve-energy-future.com/reduce-reuse-recycle.php

Denchak, M. (2018). Water Pollution: Everything You Need to Know. Accessed on 2nd September, 2020. Available at:https://www.nrdc.org/stories/water-pollution-everything-you-need-know

Derouin, S. (2019). Deforestation: Facts, Causes & Effects. Accessed on 03 September, 2020. Available at: https://www.livescience.com/27692-deforestation.html

Ecolife Dictionary (2011). Definition of Waste Management. Accessed on 01 September, 2020. Available at: http://www.ecolife.com/define/waste-management.html

Encyclopedia Britannica (2020). Ozone depletion. Published by Encyclopedia Britannica, inc. Accessed on September 03, 2020. Available at: https://www.britannica.com/science/ozone-depletion

Encyclopedia Britannica (2020). Recycling. Accessed on 31st August, 2020. Available at: https://www.britannica.com/science/recycling

Environmental Defense Fund (2020). Overfishing: The most serious threat to our oceans. Accessed on September 03, 2020. Available at: https://www.edf.org/oceans/overfishing-most-serious-threat-our-oceans

EPA, Municipal Solid Waste Generation, Recycling, and Disposal in the United States : Facts and Figures for 2006.

EPA, The National Biennial RCRA Hazardous Waste Report (Based on 2005 Data), December 2006.

Friends of the Earth Limited (2018). 7 Benefits of Recycling. Accessed on 4th September, 2020. Available at: https://friendsoftheearth.uk/natural-resources/7-benefits-recycling

Insider Intelligence (2018). 17 things you should never recycle — even if you think you can. Accessed on 05 September, 2020. Available at: https://www.insider.com/things-that-dont-belong-in-recycling-2018-4

International Union for Conservation of Nature and Natural Resources (IUCN, 2015). The IUCN Red List of Threatened Species. International Union for Conservation of Nature and Natural Resources (IUCN). Retrieved 3 December 2015.

International Union for Conservation of Nature and Natural Resources (IUCN, 2016). The IUCN Red List of Threatened Species. International Union for Conservation of Nature and Natural Resources (IUCN). Retrieved 8 September 2016.

Inyinbor, A. A., Adebesin B. O., Oluyori A. P., Adelani-Akande T. A., Dada A. O. & Oreofe T. A. (2018). Water Pollution: Effects, Prevention, and Climatic Impact, Water Challenges of an Urbanizing World, Matjaž Glavan, IntechOpen, DOI: 10.5772/intechopen.72018. Available from: https://www.intechopen.com/books/water-challenges-of-an-urbanizing-world/water-pollution-effects-prevention-and-climatic-impact

Maheshwari, S & Deswal, S. (2017) Role of Waste Management at Landfills in Sustainable Waste Management.International Journal on Emerging Technologies 8(1): 324-328.

Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC.

Narayana, T., 2009. Municipal solid waste management in India: From waste disposal to recovery of resources?. Waste management, 29(3), pp.1163-1166.

NetWaste (2020). What Can and Can't be Recycled. Accessed on 05 September, 2020. Available at: https://www.netwaste.org.au/recycle-it/what-can-be-recycled/

OneKind Planet(2016). Top Ten Extinct Animals. Accessed on 01 September, 2020. Available at: https://onekindplanet.org/top-10/top-10-worlds-extinct-animals/

Parambi, T. (2013). Combating the Social and Economic Effects of Overpopulation. Dhirubhai Ambani International Model United Nations 2013 (PDF). *Daimun*. Archived from the original (PDF) on 22 December 2018. Retrieved 29 September 2014.

Pimentel, D., Bailey, O., Kim, P., Mullaney, E., Calabrese, J., Walman, L., Nelson, F. & Yao, X. (1999). Will limits of the Earth's resources control human numbers?. Environment, Development and Sustainability.1: 19-39.

Pimentel, D., Harman, R., Pacenza, M., Pecarsky, J & Pimentel, M. (1994). Natural resources and an optimum human population. Population and environment. Springer.15(5): 347-369. DOI: 10.2307/27503358. Available at: https://www.jstor.com/stable/27503358

Qaim, M. (2010). The Benefits of Genetically Modified Crops—and the Costs of Inefficient Regulation. Accessed on 02 September, 2020. Available at: https://www.resourcesmag.org/common-resources/the-benefits-of-genetically-modified-cropsand-the-costs-of-inefficient-regulation/#:~:text=Genetically%20modified%20(GM)%20crops%20have,risk%20of%20allergies%2C%20for%20example.

South Australia, Environment Protection Act (SA EPA,1993). Waste: Guidelines. Environment Protection Authority GPO Box 2607 Adelaide SA 5001. Accessed on 3rd September, 2020. Available at: https://www.epa.sa.gov.au/files/4771336_guide_waste_definitions.pdf

Tchobanoglous, G., Theisen, H. and Vigil, S., (1993). Integrated solid waste management: engineering principles and management issues. McGraw-Hill, Inc.

The Environmental Literacy Council (2015). Waste Management. Accessed on 31st August, 2020. Available at: https://enviroliteracy.org/environment-society/waste-management/#:~:text=Communities%20use%20a%20variety%20of,of%20usable%20materials%20for%20recycling.

The Environmental Literacy Council (2015). What is Waste? Accessed on 31st August, 2020. Available at: https://enviroliteracy.org/environment-society/waste-management/what-is-waste/

The Lancet (2017). The Lancet Commission on pollution and health. *The Lancet*, Vol. 391, No. 10119.

United States Environmental Protection Agency (US EPA, 2019). What is Acid Rain? Accessed on 03 September, 2020. Available at: https://www.epa.gov/acidrain/what-acid-rain

Villalba, G., Segarra, M., Fernandez, A. I., Chimenos, J. M., & Espiell, F. (2002). A proposal for quantifying the recyclability of materials. Resources, Conservation, and Recycling, 37.

World Health Organisation (WHO, 2014). Frequently asked questions on genetically modified foods. Accessed on 02 September, 2020. Available at: https://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/

MODULE THREE
SPATIAL AND FUNCTIONAL RELATIONSHIP OF SETTLEMENTS AND ACTIVITIES IN SPACE

Unit 1: Spatial Relationship of Settlements
Unit 2: Functional Relationships of Settlement

UNIT 1: SPATIAL RELATIONSHIP OF SETTLEMENTS

CONTENTS

1.0 Introduction

The word “Spatial” can simply be defined as anything relating to or occupying the space. Spatial relation is described as how some object is located in space in relation to some reference object. In a situation where the reference object is much bigger than the object to locate, the locating object is usually represented by a point while the reference object is represented by a bounding box. (Freeman,1975; Mark, & Egenhofer,1994; Merriam Webster Online Dictionary, 2020). Spatial relationships can also be referred to as any sort of interaction between two locations, whether they be specific locations or regions. A city and the surrounding farms with other cities are examples of a spatial relationship. It might be measured in terms of the flow of people between the two locations or the flow of goods for the flow of messages. Also, it can be used to describe the relationship between an urban core and its suburbs based on the movement of people, caused by changing rents and transportation costs. This relationship can be described with the gravity model, and its complexity can be described with a simple information theory measure (Bass, 2017).

It is very essential to know the spatial point pattern of human settlements and their geographical associations, because they are vital in comprehending the drivers of land use and land cover change. Also, it is vital in understanding the relationship between environmental and ecological processes on one hand and cultures and lifestyles of the people on the other hand.

There is significant spatial variability in both settlement pattern and its impact on Earth's ecosystem. Settlements provide a spatial focus on human activity and acts as the most fundamental link between the people and Earth. It also reflects the interaction of people with the surrounding environment.

Thus, there is a link between spatial relations and settlement (Small,2004; Gude, *et al.*, 2006; Fragkias & Seto, 2009; Lin *et al.*, 2012; Zhang *et al.*,2014).

In this unit, the focus will be on the conceptual definition of settlement and types of settlement.

2.0 Objectives

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

- Define the term Settlement
- Explain what is the Hierarchy of Settlement Pyramid
- Describe the order of size for settlement
- Distinguish between rural and urban types of settlement
- Differentiate between compact and disperse human settlement

3.0 Main Content

3.1 Rural vs. Urban

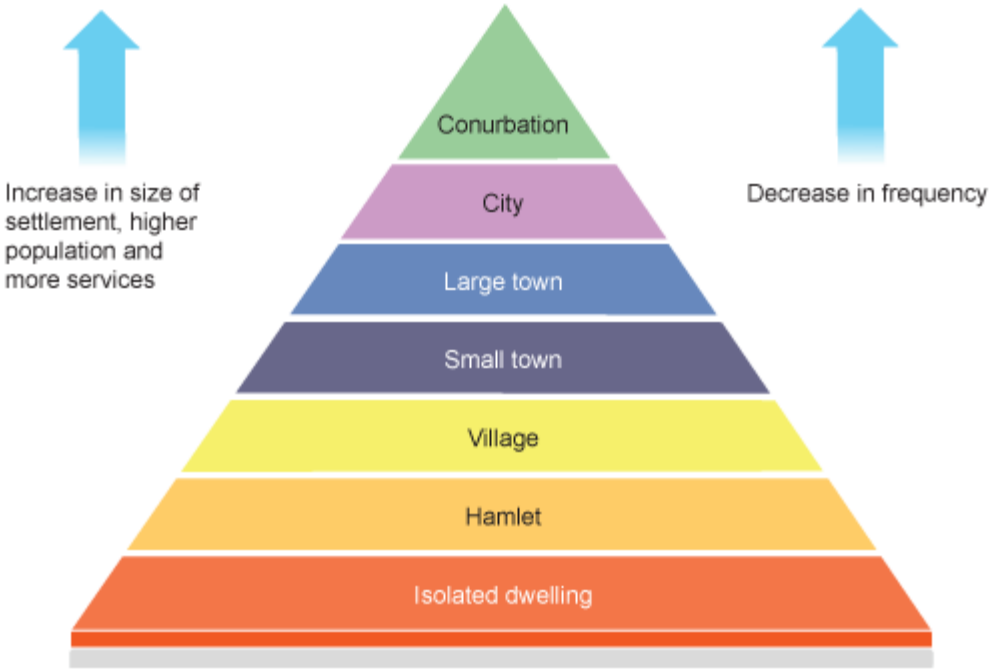
A settlement is organized human habitation which may be classified as either rural or urban. In a big city there are lots of people while in a small town there are just a few people. The city and town are both settlements. To distinguish between different types of settlements, they often classify the settlements as either urban or rural.

Urban – the settlements are usually large and are densely populated with many people. The urban settlements are built up area or any city with a population of 10,000 people or more.

Rural – the settlements are generally small and are sparsely populated. They are referred to as the countryside or everywhere that is outside urban areas. They are farmland, forest, desert or savanna and contain small settlements of less than 10,000 people e.g. hamlets and villages. They also have low density of population with few people. The urban settlements are mostly involved in non-agricultural occupations, while rural settlements are most engaged in agricultural occupations. Many farmers may therefore, be living in a sparsely populated area, and fewer living in a densely populated city.

SETTLEMENT HIERARCHY

Settlement hierarchy can be defined as a way of arranging settlements into a hierarchy which is based upon their population or some other criteria.



Hierarchy of Settlement
Source: The Geographer Online (2015).

The hierarchy of settlement provides the order of importance of settlement in terms of their sphere of influence. It is a pyramid showing the hierarchy of settlement from the smallest to the largest size. The diagram indicates that the larger settlements and conurbations have a much larger sphere of influence than the smaller ones. In other words, the larger settlements and conurbation attract people from a wider area because of the facilities they offer whereas a small hamlet or village may only have a sphere of influence that is narrower. The population of people living in a settlement is not always a good way of determining the hierarchy of a settlement but sometimes the types of services that are found in a settlement determine its hierarchy. A settlement normally has a site and a location. The site can be described as the land area on which the settlement is built, which can be at the base of a hill, by a riverside or a plain. The location is its position in relation to other cultural features or settlement in the area.

Classification of settlements

The Settlements are classified according to their pattern, size, housing density and the functions they perform.

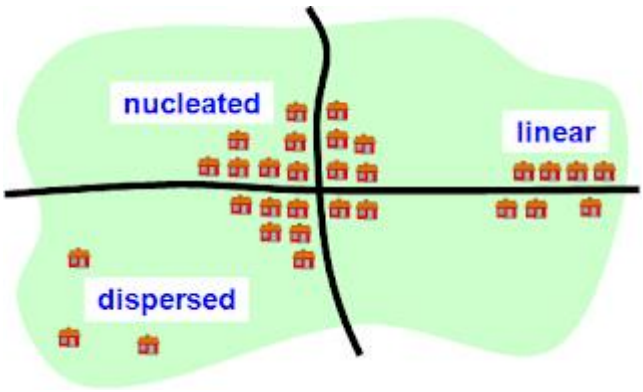


Fig: Types of Settlement
Source: Primary School Geography Encyclopedia (n.d).

Classification according to pattern
There are five types of settlement grouped according to their pattern, these are as follows:
(i) An **isolated settlement -** This is a single farm or house that is very remote from any other one, it is usually found in farming or hunting rural communities. It can also be described as any settlement with little or no contact with the world. This might be due to its geographic remoteness, or its access to modern methods of travel or communication. The settlement can also become isolated as a result of politics, social standing, a declining economy, race, religion and war.

(ii) A **dispersed settlement –** This can be several houses, which are scattered or dispersed that are found in a community. It is also known as circular settlement; it lacks any form of grouping or clustering. Also, it is a widely distributed collection of houses and farms having no business place or religious building. The people build their houses or apartment along a circular path.

(iii) A **nucleated** or **compact settlement** – In this type of settlement, the buildings are clustered, linked by roads, and has a nearly circular or irregular shape. The settlements can be either cultural or urban, depending on the size and the functions they perform. The houses are usually grouped closely together, often around a central feature like a church, bar or village green. This closeness among people makes communication quicker and easier than in linear and dispersed settlements. It also makes easier the performance of joint tasks such as the buying and selling of goods and services. In Nucleated settlements the buildings are often clustered around a central point. The location of the nucleated settlement can be determined by a range of factors such as: easy to defend, close to a water supply or located at a route centre.

(iv) A **linear** or **elongated settlement** – In this type of settlement the building forms a straight or curved line, following a line of movement, such as a road, river, coastline or the foot of an elongated escarpment. It is normally small to medium-sized settlement or group of buildings formed in a long line.

There is transport route, such as a road, river, or canal in the settlements while there are also some physical restrictions, such as coastlines, mountains, hills or valleys. These settlements may have no obvious center, such as a road junction but have a long and narrow shape.
It can also be described as a type of settlement whereby people settle and build homes along a transport route. This will enable people get easy access to transport themselves and their goods and services. This settlement is found in rural area, but linear developments may constitute extensions of towns on their outskirts.

(v) The **integrated nucleated** and **linear** settlements – This type combines the characteristics of both types of settlement and they are star-like. They often occur at junctions, and a number of them are found in urban settlements (Wayback Machine, 2013; Joshi, 2014; Steemit,2017).

Classification of Settlements according to Order of Size

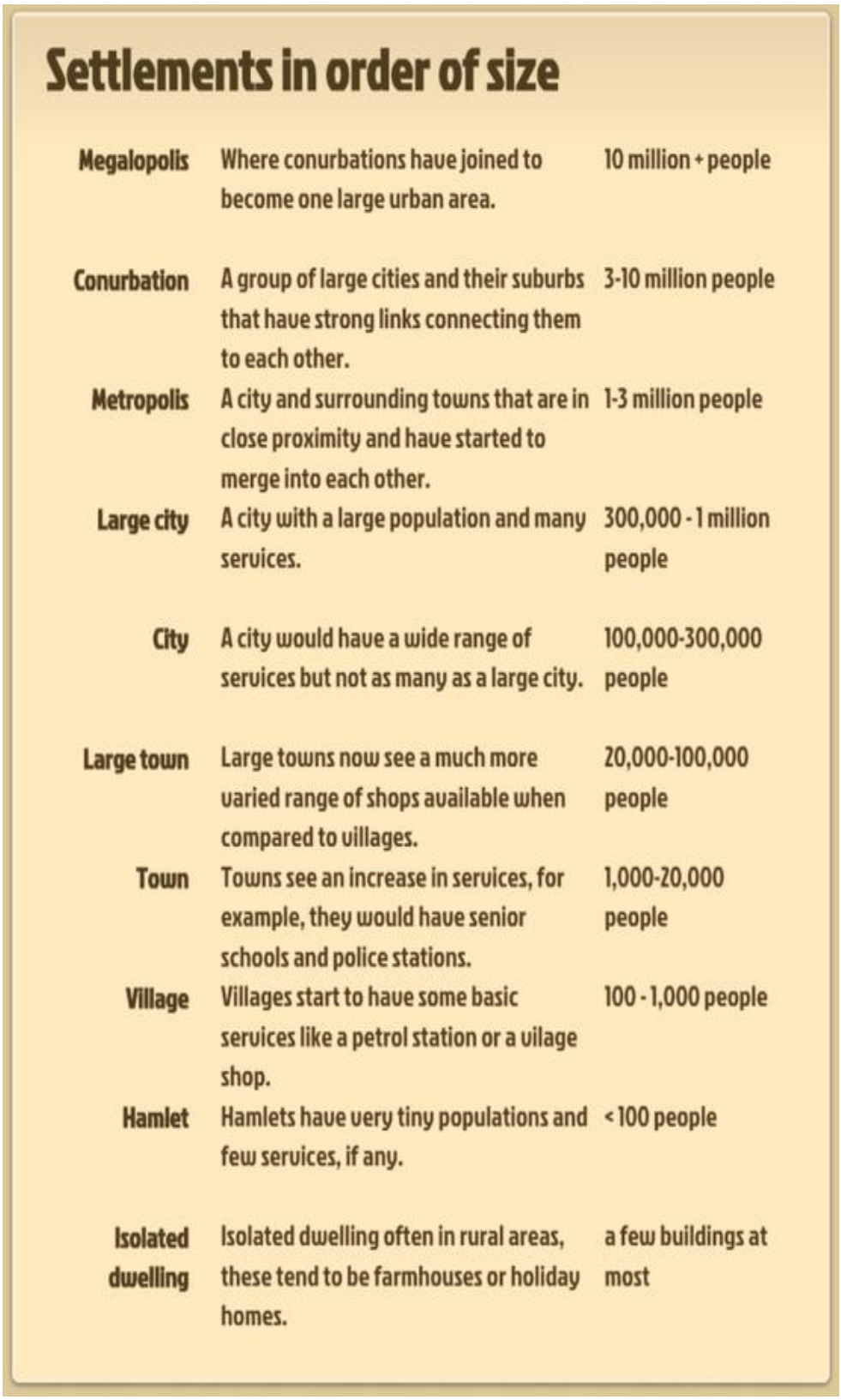
The Size and housing density can be used to classify settlements into rural and urban. Rural settlements are usually small in size and have low housing and population densities. Urban settlements are usually larger in size and have many houses built close together.

The rural settlements can further be broken down into the following categories: homestead, farmstead, hamlet and village.

(a) A single homestead or Isolated dwelling is just one compound, usually isolated and owned by a family, and may be far to the next one.
(b) A farmstead normally consists of two or more homesteads, dispersed in a farmland and occupied by up to fifty individuals.
(c) A hamlet is made up of several dispersed, nucleated or linear homesteads with shops, schools or other service centers. It is occupied by some hundreds of persons who are engaged in primary activities such as farming, hunting and fishing.
(d) A village is similar to an hamlet, it may be dispersed, nucleated or both nucleated or linear, but the has more homesteads and its population may be up to several thousands. The people engage in primary occupations, but also engage in craft and cottage industries, and service centers like schools, post offices, health centers and markets.

Urban settlements can equally be graded into the following types of settlements:

(a) Towns - These are the types of urban settlements with up to several thousand of persons. The houses are built together and the emphasis is more on secondary and tertiary rather than on primary occupation. They have large chain stores, and many other social and commercial facilities.



The Size Order of Settlement

Source: The Geographer Online (2015).

(b) Cities – They are the major towns of a country such as the state capitals which have administrative functions. The old concept of a city having a walled town is no longer tenable as cities nowadays are with no fences and are generally larger than towns.

(c) A conurbation is when two or more towns or parts have grown and joined together to form a large urban area of 1 million persons or thereabouts. The boundary between original towns becomes blurred and cannot easily be demarcated from one another.

(d) Megapolis - These are several cities or conurbations which have grown over the years and have joined together to form a massive sprawling urban settlement. It is always difficult to known where one original city ends and the other begins. This is the highest in the hierarchy of urban settlements (The Geographer Online, 2015; Steemit, 2017).

Distinction between Rural and Urban Settlements

The rural and urban communities are distinguished from each other by considering the following criteria:

(1) Occupation - The rural community is involved in agriculture though a few people are engaged in non- agricultural pursuits. In urban community, the people are engaged in non-agricultural pursuits like manufacturing, trade and commerce, service and other career jobs.

(2) Size - The size of the rural communities is usually small while the size of the urban communities are normally larger than the rural communities.

(3) Density of population – In most rural community the population is low while in urban community, it is high.

(4) Environment – Those that are living in the rural areas are close to nature while people in urban areas are usually surrounded more by man-made environment and they are often isolated from nature.

(5) Societal homogeneity-heterogeneity: The rural communities are more homogeneous while the urban communities are more heterogeneous.

(6) Social Stratification – The rural communities are stratified more on caste or social background and less on class basis, the urban communities are stratified more on class or status basis.

(7) Mobility – The form of mobility in rural areas is more of, from villages to villages and villages to cities, while that of the urban areas is more of, from one city to another city.

(8) Relations - In the rural areas the relations among people are predominantly personal and relatively durable while in urban areas, the relations among people are more secondary, impersonal, casual and short-lived.

(9) Infant mortality - In rural areas the infant mortality rate is one and a half time more than the rate found in urban areas (i.e. 80:49 ratio).

(10) Labour force participation rate - In rural areas, the labour force participation rate is more than three times than that found in urban areas.

(11) Child labour - The number of children that are working in the rural areas is 10 times more than those working in the urban areas (Your Article Library, 2014).

Self-Assessment Exercise
What is a Settlement? Vividly discuss the classification of settlements according to Order of Size.

3.2 Compact vs. Dispersed

The other way to classify types of human settlements involves how close together the people live. Compact or Nucleated settlements are those in which there is a large number of houses built very close to each other while dispersed settlements are those in which houses are set apart and often interspersed with fields.
A nucleated village can also be described as a type of settlement pattern which has homesteads clustered around a central point called a nucleus. The focal point depends on location and culture, which may include a church, park, sports stadium, market, etc.
They are towns where buildings are close together, often clustered around a central point. Its location can be determined by a range of factors which include being easy to defend, closeness to a water supply or located at a route centre.
A dispersed settlement is also described as the scattered pattern of households in a particular area. This type of settlement is very found in the rural regions. It contrasts with those normally found in nucleated villages (The Geographer Online, 2015; Your Article Library, 2014; FindAnyAnswer.com, 2020). The distinction can be further summarized in tabular form as follows:

The differences between Compact Settlements and Dispersed Settlements

Compact Settlements	Dispersed or Scattered Settlements
The settlements are found in the fertile plains and valleys.	They are found in highland, chilly areas and semi-arid areas.
High population density due to productive land.	Population is low due to barren land
Houses are very compact and congested with narrow streets.	Houses are dispersed and scattered.
People help each other in agriculture and protect themselves against floods. There is security of lives.	People live in isolation and have no security like in compact settlements.
The size of settlements is often large.	The size of settlements is often small.
Agriculture is the major occupation of the people.	The people are engaged mainly in Fishing, cattle rearing etc.
They have problems of sanitation and drainage.	There are no such problems.
Size of farms are usually small and close	Size of the farms are large and usually

to the settlement.	isolated.

Self-Assessment Exercise
Differentiate between compact and disperse settlements.

4.0 Conclusion

The spatial relationships between man and his environment is very vital to the understanding of how man occupies the space and optimizes the use of natural resources in the environment. It broadens the knowledge about human settlements in terms of its sphere of influence. It explains why the larger settlements or urban communities attract people from a wider area and small hamlets or rural communities have a narrower sphere of influence. The movement of people from one location to another and the flow of goods between one place to another are measured by the spatial relationships. All these interactions between man and his environment are very essential to the understanding of the spatial point pattern of human settlements.

5.0 Summary

This unit examines the spatial relationships of settlements by considering what is settlement; and the different types of settlements in terms of order of size, pattern and the functions they perform. In the unit, it was learnt that the settlements are often classified into either urban or rural communities. The various criteria that distinguish rural from urban settlements were discussed. There are five major types of settlements pattern that were also given focus and these include: isolated, disperse, compact, elongated and integrated nucleated and linear settlements.

6.0 Tutor-Marked Assignment

(i) Illustrate with the aid of diagram, the Hierarchy of Settlement Pyramid**.**
(ii) Distinguish between rural and urban settlements.
(iii) Describe the various classification for the rural settlements according to the Order of Size.
(iv) Outline the various classification for the urban settlements according to the Order of Size.
(v) What are major types of classification of settlements according to their pattern?
(vi) Write short notes on the following:
(a) A Settlement
(b) A Village
(c) A City
(d) Metropolis
(e) Megapolis
(vii) Compare and Contrast between the Compact and Disperse Settlement.

(viii) What is the distinction between a Linear and Isolated Settlement?

(ix) Explain the term "Integrated Nucleated and Linear" settlements. What makes it to be different from a Scattered Settlement?

(x) What is a Settlement? Clearly explain the classification of settlement according to the order of size.

7.0 References/Further Readings

Bass, B. (2017).What does the term "spatial relationship" represent in geography? Accessed on 7th September, 2020. Available at: https://www.quora.com/What-does-the-term-spatial-relationship-represent-in-geography

FindAnyAnswer.com (2020). What is the difference between dispersed and nucleated settlements? Accessed 7 Sep. 2020. Available at:https://findanyanswer.com/what-is-the-difference-between-dispersed-and-nucleated-settlements

Fragkias, M. & Seto K. C. (2009). Evolving rank-size distributions of intra-metropolitan urban clusters in South China. Computers, Environment and Urban Systems.33:189–199. doi: 10.1016/j.compenvurbsys.2008.08.005.

Freeman, J. (1975). The modelling of spatial relations", Computer Graphics and Image Processing, Elsevier. DOI: 10.1016/S0146-664X (75)80007-4

Gude, P.H., Hansen A.J., Rasker R., & Maxwell B. (2006). Rates and drivers of rural residential development in the Greater Yellowstone. Landscape and Urban Planning Journal.77:131–151. doi: 10.1016/j.landurbplan.2005.02.004.

Joshi, M. (2014). Various Settlement Pattern. Accessed 7 Sep. 2020. Available at: https://prezi.com/cwd1hrtloqsf/various-settlement-patterns/

Lin, Y.P., Hong N.M., Chiang L.C., Liu Y.L., Chu H.J. (2012). Adaptation of land-use demands to the impact of climate change on the hydrological processes of an urbanized watershed. International Journal of Environmental Research and Public Health.9:4083–4102. doi: 10.3390/ijerph9114083.

Mark, D. M. & Egenhofer, M. J. (1994). Modelling Spatial Relations Between Lines and Regions: Combining Formal Mathematical Models and Human Subjects Testing.

Merriam Webster Online Dictionary (2020). Definition of Spatial. *Merriam-Webster.com Dictionary*, Merriam-Webster. Available at: https://www.merriam-webster.com/dictionary/spatial. Accessed 7 Sep. 2020.

Primary School Geography Encyclopedia (n.d) Settlement Pattern. Accessed 7 Sep. 2020. Available at:http://geography.parkfieldprimary.com/the-united-kingdom/settlement-patterns

Small, C. (2004) Global population distribution and urban land use in geophysical parameter space. Earth Interactions.8:1–18. doi: 10.1175/1087 3562(2004)008<0001:GPDAUL>2.0.CO;2.

Steemit (2017). Classifying settlements. Accessed 7 Sep. 2020. Available at: https://steemit.com/geography/@donfelix/classifying-settlements

The Geographer Online (2015). Definition of Settlements. Accessed 7 Sep. 2020. Available at: https://www.thegeographeronline.net/settlements.html

Wayback Machine (2013). English heritage thesaurus Archived 2007-09-14 at the Wayback Machine, 23-05-2013

Your Article Library (2014). Rural-Urban Differences: Demographic and Socio-Cultural Characteristics**.** Accessed 7 Sep. 2020.Available at: https://www.yourarticlelibrary.com/difference/rural-urban-differences-demographic-and-socio-cultural-characteristics/39322

Zhang, Z., Xiao, R., Shortridge, A. & Wu, J. (2014). Spatial Point Pattern Analysis of Human Settlements and Geographical Associations in Eastern Coastal China — A Case Study. Int J Environ Res Public Health.11(3): 2818–2833.doi: 10.3390/ijerph110302818

UNIT 2: FUNCTIONAL RELATIONSHIPS OF SETTLEMENT

CONTENTS

1.0 Introduction

Functional relationship of settlement is an attempt to consider how human settlements develop along the functional classification. Recall that in the earlier discussion on rural and urban settlements, it was stated that the rural settlements are basically agrarian communities or those which engage in primary activities while urban settlements are basically non-agrarian or those which engage in secondary and tertiary activities with fewer people involving in agricultural activities. The functional classification of settlement can also be considered from the kind of economic activities engaged by the people living in these human settlements. It must be stated that there is no rigid rule concerning the rural-urban classification, this is because some settlements that are considered as villages in some places may be regarded as towns or cities in other places. However, there are several recognized methods that are used to classify settlements as urban such as site and situation of towns, population, size and functions, their social and cultural environment, etc. Out of all these methods of classification, the functional basis, is widely accepted and reliable, for the fact that, the urban settlement is defined as a unit characterized by non-agricultural activities (Siddiqui, Bajpai & Bansal. n.d.).
This unit examines the various functional classifications put forward by scholars. It also discusses the classification of cities based on age and the significance of studying human settlements.

2.0 Objectives

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

- Describe the various functional classifications of settlement by scholars
- Discuss the classification of cities based on age.
- Elaborate on the significance of studying human settlements.

3.0 Main Content

3.1 Functional Classification of Settlement

In Settlement Geography, functional classification of a settlement is an attempt to group towns and cities into their economic function. The employment and occupational data are often used in the functional classification approach. In other words, the towns and cities are classified on the basis of their dominant function. According to Velapurkar, Rathod and Kalgapure (2008), the most meaningful basis of classification for settlement is that of function, because it is determined principally by occupational structure. In this section the following functional classifications will be given focus:

(1) **Aurousseau's Classification.**

Aurousseau made his classification into six, with twenty-eight subtypes. The six classifications were namely: administrative, defence, culture, production-towns, communication and recreation. This classification though is simple, suffers a major drawback of over-generalization. There are some of the classifications that are specific to a particular country and the method of determining their cut off for a major category is subjective. The economic activities are not taking into consideration in this classification. There is also problem of mixing up of both locational and functional characteristics, for instance, towns performing function of 'transfer of goods' are put in communication-class group. However, despite these criticisms the classification marks a significant stage and provides a foundation for the modern approaches to functional categorization (Aurousseau,1921; Siddiqui, Bajpai & Bansal. n.d).

(2) Harris's Classification

This remedied the deficiencies of the former subjective and judgement-based classifications by identifying quantitatively dominant function out of multifunctional character of cities. Harris used two sets of information namely: (a) employment and (b) occupational figures reduced to percentages; to indicate the cut-off points for urban activities varying in importance. There were nine principal categories of towns identified by Harris and these include: manufacturing (M), retailing (R), diversified (D), wholesaling (W), transportation (T), mining (S), educational (E), resort or retirement (X) and others (P). This classification also suffers its defect and is considered not universally viable. The metropolitan districts are used as functional units because the industry-group data were not available during that time. This consequently result to the number of cities which were too small to be metropolitan districts being left unclassified (Harris, 1943; Ghosh, 1998; Siddiqui, Bajpai & Bansal. n.d.).

(3) Howard Nelson's Classification

This classification removed the shortcomings of the earlier ones by using a stated procedure that could be objectively checked by other workers. Nelson base his method of classification entirely upon major industry groups. This industry groups were as listed in the 1950 Census of Population for standard metropolitan areas, urbanized areas and urban places of 10,000 or more population.

There was omission of groups like agriculture and construction, and this led to the final list of nine activity groups which are: manufacturing; retail; professional services; wholesale; personal service; public administration; transport and communication; finance, insurance, real estate and mining. He solved the problem of city specialization, and the degree of specialization above the average; by giving margins of different degree to different size classes. The problem of city specialization was solved using Standard Deviation Statistical Technique. A city can become specialized in more than one activity and to varying degrees. This led to each city having activity that qualify for plus 1, plus 2, or plus 3 SDs above the mean (Nelson,1955; Siddiqui, Bajpai & Bansal. n.d).

(4) Balasubramanian's Classification

This functional classification is also done to differentiate the Settlement patterns into the following categorization:
(a) Agricultural villages
(b) Fisherman's villages and
(c) Pastoral Huts (Balasubramanian, 2015).

(5) Functional classification of the Indian cities

The functional classifications of urban places or cities in India differ from state to state and from author to author. However, the most common functional classification used are as follows:

(i) Administrative town/city

Its main function is to administer the country, state or any other administrative unit. This includes not only the capital cities of the country, but also that of the states, districts and other administrative divisional headquarters of the country. The legislative, executive and judiciary duties of all the respective units are placed under the control of the Administrative town/city. The Examples of such administrative towns in Nigeria include all the 36 State capitals, FCT Abuja and Local Government Headquarters.

(ii) Defensive Towns:

The defensive towns are mainly for the defence and security purpose of the country. They have barracks, cantonments, and training facilities for the armed forces, airfields, and harbours for warships located in strategic places.
These military installations are usually not close to the town, this is done for security reason. This usually led to the division of land use between the military and the civilian in those defensive towns.
However, due to the development and expansion, most of these military installations are now in the cities/towns. In Nigeria, the examples include, Sobi Barrack, Ilorin; Jaji Staff College and Nigerian Defence Academy in Kaduna State; Ikeja Cantonment in Lagos; and Nigeria Military School in Zaria.

(iii) Cultural Centres:

There are numerous activities performed in these towns and cities, such as religious, educational and recreational functions. There are also, colleges, libraries, hostels, churches, playgrounds, parks and shopping centres found in cultural centres and the level of environmental pollution in these places is very insignificant.

(iv) Collection Centres:

The towns/cities falling under this type of classification are engaged in mining, fishing, ports activities and lumbering. These towns/cities may also have some allied industries such as refineries, smelting industries, manufacturing industries and equipment manufacturing industries. The examples of collection centres in Nigeria are Ajaokuta, Jos, Port Harcourt, Lagos, Aladja, Obajana, Lokoja, Patigi etc.

(v) Production Centres:

These are towns/cities where there are concentrations of manufacturing industries, they can easily source their raw materials and have ready made markets for their products. They have good roads and rail networks for the movement of the raw materials and finished products. There is usually segregation of houses and establishments in these towns and cities into official quarters for staff and labourers. The examples of Production centers in Nigeria include Ibadan, Lagos, Kano, Port Harcourt, Kaduna, Zaria etc.

(vi) Towns of Diversified Functions:

There is a large number of activities that are conducted in these towns. They perform multifunctional activities such as capital cities and at the same time serves as the commercial, manufacturing, cultural and recreational centres.

This probably may be due to the change in space and time, for instance, a defence town may become restrictive due to expansion. Lagos and Kaduna are good examples of Diversified Towns. There is need to take into consideration some cities that have experienced changes in their functional character. These are important cities in the past but have disappeared because they have lost their strategic, administrative, manufacturing or commercial importance. The examples include Nigerian cities such as Zungeru, Oloibiri, Lokoja and Kanji.

(vii)Residential Towns:

They are basically to house a concentration of population and their land is devoted to houses, parks and hospitals. The towns are well-connected with the major cities and there are good road networks for easy accessibility of workers to their place of works.

(viii) Resorts/Recreation Towns:

These are mainly urban places which cater for the recreational needs of the people. They may be seaside recreation, game reserves, mountain climbing, cultural attractions, historical monuments, sports facilities, national parks etc. They normally have hotels and guest houses to accommodate visitors or guests.They also provide other facilities such as sporting facilities for golf courses, swimming pools, trekking and skiing; and entertainment facilities, such as theatres, cinemas, night clubs and children parks.

(ix)Transfer and Distribution Centres:

The main functions performed by the towns/cities are the trade, commerce and services. They are concerned with the transfer and distribution of goods, this makes retailing and wholesaling important trade of this categorization. It has several types of towns such as, market towns, sea ports and financial towns. Market towns have large number of markets, with wide range of shops, stores, warehouses, cold storages and wholesale markets. They also have banks, insurance companies and other financial organizations. Lagos, Ibadan, Kaduna, Kano, Port Harcourt, Onitsha, Aba, Abuja, Owerri, Enugu, Ilorin are examples of such towns in Nigeria (Siddiqui, Bajpai & Bansal. n.d).

(6) Mitra's Classification of Indian Cities:

Mitra (1974) grouped the towns /cities into three major functional types, which are namely: manufacturing town, trade and transport town and services town. The majority of the cities have no clear specialization in one economic activity and have diversified economic base.

This indicates that the diversified city with multiple functions form the most common and representative type of cities.

Self-Assessment Exercise

What is functional classification of Settlement? Discuss Harris and Aurousseau's Classification of cities.

3.2 Age Classification of Settlements

This classification examines the history of the development and age of the town. There is difference in the structure and arrangement of towns from one place to another place due to many factors amongst which include the differences in site, function, history of development as well as age of the town. In other word, the development of towns may be due to the socio-cultural, economic and historical basis. For example, there may be development of villages into towns as a result of expansion, in terms of increase in residential building or suburban growth. In this section, there is attempt to explore the earlier works of some scholars on the age classification of settlements and they are discussed below:

(a) **Taylor's Classification:**

Griffith Taylor, who was an English-born geographer and anthropologist made attempt to identify the different stages in the development of the cities by classifing cities into these six categories:

(i) Sub-infantile- this is the initial cluster in a single ill-defined street town.

(ii) Infantile – in this classification, there is no clear differentiation between industrial, commercial and residential area. There is a tendency for the bigger houses to be located near the margins but there are no factories.

(iii) **Juvenile -** There is segregation of an extensive commercial quarter towards the centre of the town with no separation of function. Also, the residential area has no clear differentiation.

(iv) Adolescence – in this phase there is clear differentiation of residential zone.

(v) Early maturity – there is a differentiation of residential zone but this disparity between the adolescence and early maturity stage lies only in the level of their differentiation.

(vi) Mature -there was separation of commercial area in this stage. There was also separation into four zone of residential houses, ranging from mansions to shacks.

This classification is remarkable from an academic point of view, but is unpractical as no specific determinants have been stated. It is also applicable only to western cities under a particular economic system (Taylor,1949; Siddiqui, Bajpai & Bansal. n.d.).

(b) Mumford's Classification:

Lewis Mumford was an American historian and sociologist; he was influenced by the work of Scottish theorist Sir Patrick Geddes, and suggested six stages of development of cities which are:

(i) Eopolis: this explains that urbanisation originates from the the rural background. The early men were hunters, as they slowly learned, they became producers and settled in the village. They were also involved in fishing and mining and with time based on their religion, set up a temple, cathedral or mosque. This subsequently, led to the development of a market.

(ii) Polis: As more villages developed, people found they have certain things in common with their neighbour. This made settlements developed into a brotherhood of traders. The traders later became richer because of accumulation of wealth from nearby villages. There was extension in religious establishments and market squares. This led to social stratification in which people belonging to the higher hierarchy occupy central place while the others at the lower level took peripheral places.

(iii) Metropolis: The small towns and villages in the area come together as a single entity and became city which has a compact site, good water and food supply, ample land etc. This later becomes metropolis, the mother of city. As the city streamlines its production, there was surplus which is characterized by the specialization of trades.

(iv) Megalopolis: this is marked by more diversity of cultures. There was migration which brought about increase indifference between the people and class struggle. This situation led to downward developments which result to decline in the city.

(v) Tyrannopolis: The economic under this situation slowly metamorphoses into more or less parasitic state. This stage is marked by the indifference, and People are involved in pomp and pleasure. This was what happened towards the end of the Roman era.

The situation in the city worsened and people began to flee towards the countryside. This consequently led to booms and slumps in the commercial activities of the city.

(vi) Necropolis:in this stage, the city decays further and civilization follows a downward trend. There were war, famine and diseases which led towards the city destruction. Also, the cultural institutions eroded greatly (Mumford,1938; Siddiqui, Bajpai & Bansal. n.d.).

Self-Assessment Exercise

Succinctly explain the age classification of settlement. Appraise Mumford's Classification of cities.

3.3 Significance of Studying Settlements

The following are some of the significance of settlement studies:

(a) It provides a clear understanding of where, why and how people settle in temporal frame.
(b) The study of settlement provides a clear understanding of division of labour and how people are engaged with the various types of production.
(c) It gives knowledge about the modern needs of growing communities and behavior of the inhabitants.
(d) It presents a better picture of the location and deployment of additional or new facilities in a settlement
(e) It offers a well understanding of pioneer, secondary and other settlements.
(f) It evokes the comprehension of the impacts of planned and improper settlements.
(g) It enables deeper comprehension of inter and intra-regional relationships for modelling the geospatial structure of the regional economy.
(h) It gives information about the socio-cultural values and ethic of the people
(i) It aids in understanding the better conditions for improved quality of life with reference to housing, sanitation and environment.
(j) It assists in developing industries and provide other amenities in either rural or urban communities.

Ekistics can be described as the science of human settlements. The study of Human settlements will help in creating the cities of the future (Singh,1998; Siddiqui, Bajpai & Bansal. n.d).

Self-Assessment Exercise
What is the importance of studying settlements?

4.0 Conclusion

It is apparent that from the discussion in this unit, that of all the various methods of classification for human settlements, the functional classification proves to be the most reliable and widely accepted. The functional classification groups the towns and cities into economic and dominant function. The urban settlements such as towns and cities are given consideration under the functional classification because they are entities which are characterized by non-agricultural activities. The rural entities are basically involved in agrarian activities.

5.0 Summary

The unit examines six various forms of the functional relationships of settlements amongst which include: Howard Nelson, Balasubramanian, Aurousseau, Harris, Mitra and functional classification of Indian cities. Taylor and Mumford's classification were also discussed under the age classification of settlements. The last section appraised the importance of settlement studies.

6.0 Tutor-Marked Assignment

(i) Discuss Howard Nelson and Balasubramanian's Classification of functional settlement.
(ii) Describe any Five of the most commonly used functional classification of Indian cities.
(iii) Write short notes on the following:
(a) Defence Towns
(b) Administrative Towns.
(c) Towns of Diversified Functions
(d) Cultural Centres
(e) Resorts Towns.
(iv) Is it possible to have only one-function town? Vividly expatiate on why cities may become multi-functional.
(v) Discuss Taylor's Classification of urban settlement.
(vi) What is the significance of settlement studies?
(vii) Distinguish between Mitra and Howard Nelson's Functional Classification of Settlement.
(viii) Enumerate the various methods of classifying settlements. Which of these methods is recommended as reliable?
(ix). Differentiate between Taylor and Mumford's classification of human settlements.
(x) What are the features of Collection Centres and Residential Towns?

7.0 References/Further Readings

Aurousseau, M. (1921). The distribution of Population: A constructive Problem. Geographical Review. Vol 11 Pp 563-593.

Balasubramanian, A. (2015). Human Settlement Systems. University of Mysore. Karnataka State, India.

Ghosh, S. (1998). Introduction of Settlement Geography, Sangam Books Ltd (November 16, 1998)

Harris, C.D. (1943). A Functional Classification of Cities in the United States. Geographical Review. Published By: Taylor & Francis, Ltd. Vol. 33, No. 1 (Jan., 1943), pp. 86-99

Mitra, A. (1974). A Functional Classification of India's towns. Delhi: Institute of Economic Growth, 1974.

Mumford, L. (1938). The Culture of Cities. New York: Harcourt, Brace 1938. pp. 34.

Nelson, H.J. (1955). A Service Classification of American Cities. The Journal Geography. Vol. 31, pp. 195.

Siddiqui, M.A., Bajpai, D., & Bansal, T. (n.d.). Classification of Cities – Age and Functions Classification of Urban places – Age and Functions.

Singh, R.Y. (1998). Geography of Settlement. Rawat Publication.

Taylor, T.G. (1949). Urban Geography: A Study of Site, Evolution, Pattern and Classification in Villages, Towns and Cities. Methuen's Advanced Geographies, Methuen.

Velapurkar, B.G, Rathod, H.B., & Kalgapure, A.A. (2008). A Study of Functional Classification of Urban Settlements in Latur District (M.S.). International Research Journal. Vol. II, Issue-5.

MODULE FOUR
MOVEMENT OVER SPACE AND TRANSPORT NETWORK

UNIT 1: TRANSPORT NETWORK
CONTENTS

1.0 Introduction

Transportation plays a key role in the movement of goods and people from one location to another location or one place to another place. This probably explains why Ullman (1954), said that Transportation is a measure of the relations between areas and is therefore, an essential aspect of geography. However, it must be stated that, it is not only essential in geography but all aspects of human life. Transportation of all types form the network and the channel through which the modern society emerged. It also integrates the social phenomenon and changes that take place everywhere. Transportation can be regarded not only as basic human activity but also a movement in space. It is thus, an exploratory factor in the spatial patterns which is assumed by the human activities (Wagner, 1960). This unit examines the meaning of transportation, spatial flow patterns, functions, importance and purpose of transportation.

2.0 Objectives

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

- Define the term “Transportation”
- Describe the various types of Spatial flow Pattern.
- Discuss the Purpose of Transportation.
- Explain the importance of Transportation
- Elucidate the purpose of Transportation.
- Examine the Problems of Road Transportation
- Understand the Solutions to the challenges facing Road Transportation.

3.1 Conceptual Definition of Transportation

Transportation is described as the moving of whatever that comes out of one location to the next location. This may for example mean the transporting of something from a manufacturer to a distributor and from a distributor to a customer, or from a distributor to the final customer. This term is sometime called transport (Logistics Bureau, 2012).

Encyclopedia Britannica (2019) define Transportation as the movement of goods and persons from one place to another place; and the various means through which such movement is accomplished. This definition is almost the same with the earlier one above, but it is different by specifically mentioning what is being moved, which are goods and persons. In this definition, there are forms of transportation for the movement of goods and persons such as the road, rail, sea and air transportation.

The New Standard Encyclopedia (1990) define Transportation as all means of travel and of moving persons and goods from one place to another place. This definition is also the same as the earlier ones given above. It simply defines transportation as a means of traveling goods and services from one place to another one.

Transportation can therefore, be defined as the movement of goods and services from the place of surplus to the place where there is deficit or shortfall. This imbalance may be due to natural causes or human made.

Self-Assessment Exercise
What is Transportation?

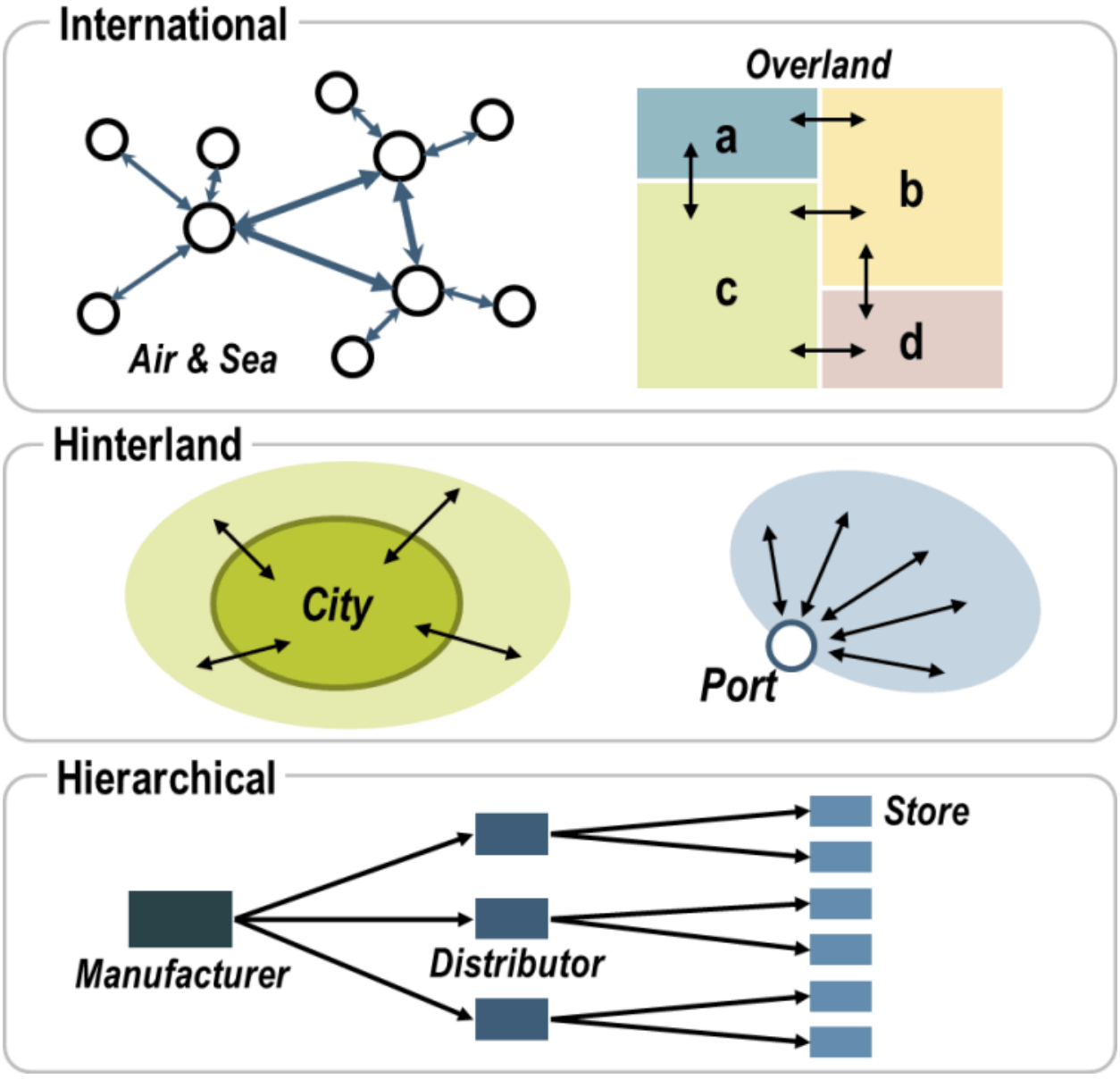
3.2 Spatial flow Patterns

The Spatial flow patterns can be classified into the following categories:

- **International (trade) patterns -** this normally occur between nations and include entities such as trading blocks such as European Union, NAFTA etc. or dependent territories such as colonialism. The flows indicate the nature of the transactional environment and is through networks such as air and maritime transportation or the overland flows.
- **Hinterland patterns -** this usually occurs between a service center which may for example be a city or a transport terminal such as a port; and its market area. The pattern is of a regional scale and it reflects the organization of markets.
- **Hierarchical patterns –** this can be mostly found within the industrial or commercial sectors and include distribution-related movements through a supply chain. It is normally from the suppliers to the customers. The flows normally reflect the spatial organization of distribution.

The movement from one place to another must therefore take into consideration its geographical setting which in turn is linked to spatial flows and their patterns. The concept of flow can be discussed from the following four major components:

(a) Geographical – this explains that each flow has an origin and a destination and consequently, a degree of separation. This consequently, means that flows with high degrees of separation would tend to be more limited than flows with low degrees of separation.
(b) Physical – it explains that flow involves specific physical characteristics in terms of possible load units and the conditions in which they can be carried. This indicates that flows depending on the transportation mode, can be atomized or massified.



Types of Spatial Flows
Source: Rodrigue (2020). The Geography of Transport Systems. Fifth Edition. New York: Routledge

(c) Transactional – this means for the realization of each flow, it has to be negotiated with providers of transport services, such as booking a slot for a bus travel or an air travel seat. The flow is related to a monetary exchange between a provider and the user of transportation services.

(d) Distribution – the flows are normally organized in sequences where the more complex are involving different modes and terminals. This makes many transport flows to be scheduled and routed to minimize costs or maximize efficiency, often through the intermediary locations (Rodrigue, 2020).

Self-Assessment Exercise
Mention the major classifications of Spatial flow Patterns.

3.3 Purpose of Transportation

The key purpose of transportation is to overcome space and this can be done by surmounting human and physical constraints such as distance, time, administrative divisions, and topography. These constraints become friction to any movement and this is known as the friction of distance or space. In an ideal world, there would be transportation at no effort in terms of cost and time and there would be unlimited capacity and spatial reach. In such circumstances, it means geography would not matter. In the real world, this is not the case because geography can be a significant constraint to transport since it trades space for time and money and it can only be partially circumscribed. Thus, it can be assumed that there would be no transportation without geography, and likewise there would be no geography without transportation.

It can also be argued that the goal of transportation is to transform the geographical attributes of freight, passengers, or information, from a point of origin to the destination, and in the process come up with an added value. This results to substantial operational differences between transportation modes which often operated separately. The ease at which this is done varies considerably and is commonly labelled as mobility. The specific purpose of transportation can then be said to be fulfilling a demand for mobility. This is because transportation can only exist if it moves passengers, freight, and information around; otherwise it will have no purpose.

One of the important purposes of transport is its geographic nature, because it facilitates movements between different locations. It plays a role in the structure and organization of space and territories, which depends on the level of development. The purpose of the emerging modern forms of transportation such as the railways and maritime shipping, was to expand spatial coverage through the creation, expansion, and consolidation of national markets (Rodrigue, 2020).

Self-Assessment Exercise
What are the purposes of Transportation?

3.4 Importance of Transportation

Transport is one of the most important human activities, it is a vital component of the economy and plays a key role in spatial relations for two or more locations. It builds valuable links between regions and economic activities; and between people and other individuals in the society. The following are some of the importance of transportation:

(i) **Historical**. - Transport modes have played important historical roles such as in the rise of civilizations, for example in Egypt, Rome and China; in the development of societies and also in national defense for example in Roman Empire, American road network.

(ii) **Social** – through transportation there is access to healthcare, welfare, and cultural or artistic events. It thus performs a social service function to the society and help in shaping social interactions by favoring or inhibiting the mobility of people.

(iii) **Political** – this explains the role governments play in the development of transport as sources of investment and regulators. This role is undeniable as governments often subsidize the mobility of their populations through highways, public transit, etc. The demand for transport is mostly for economic needs while it may be for communication purpose such as for national accessibility or job creation. It thus, plays important role in national building.

(iv) **Environmental** – there is no doubt that transportation has many advantages but its consequences on the environment are very devastating. It has adverse effect on air and water quality, noise level and public health. It is therefore, necessary to take into consideration all decisions relating to transport by evaluating the corresponding environmental costs.

(v) **Economic** – the evolution of transport is linked to the economic development. It became obvious that the construction of transport infrastructures also led to the development of a corresponding transport industry such as car manufacturing, air transport companies, etc. The transport sector contributes to the value-added of economic activities, it enables economies of scale, it has effect on land value and the geographic specialization of regions. There is growing trend in the importance of transportation and this can be identified in the following purview:

• **Growth of transport demand** – there have been considerable growth of the transport demand in relation to individual or passengers as well as freight mobility. This is as a result of large movement of passengers and freight; and also, the longer distances over which they are carried. This trend in the mobility growth in recent time, has led to the multiplication of the number of journeys involving a wide variety of modes that service the transport demands.

• **Reduction of costs** – there are several transportation modes that are very expensive to own and operate such as ships and planes, but there has been dropped in costs per unit transported. This scenario has made it possible to overcome cost of larger distances and also enjoy the comparative advantages of space. Hence, the share of transport activities in the economy has remained quiet constant in time.

• **Expansion of infrastructures** – there have been expansion in new service areas and additional capacity to the existing networks. This is to service the new areas such as Roads, harbors, airports, telecommunication facilities and pipelines; and thus, make transportation infrastructures a major component of land use in developed countries (Rodrigue, 2020).

Self-Assessment Exercise
Enumerate the key importance of Transportation?

3.5 Problems of Road Transportation

The road transport serves as the most important form of transportation commonly used in Nigeria, it accounts for 90% of passengers and freight movement. This has led to the negligence of the other means of transportation such as the rail, air and sea in Nigeria. It has also resulted to the poor maintenance of the roads and other problems such as traffic congestion and accidents. Transportation plays a key role in the economic development of any country. It connects people and places and enhances their cultural, economic, and social interactions. Road transportation is needed by the people for their day to day activities, to commute to their places of work or study, move their products and services, for inter-city and intra-city travel, etc. Nigeria has the largest highway and road networks in Africa. However, the state of road transportation is very poor, below are some of the reasons given for the deteriorating condition of these roads:

(a) Poor road infrastructure – this serves as one of the major problems of road transport in Nigeria. There are some of the recently constructed road infrastructures which are poorly built with low-quality materials due to the corruption from both the agency or institution awarding the road contracts and the construction companies. This makes travelling to become very difficult and sometimes almost impossible especially during the raining season. There are many of the roads covered by water during the raining season due to lack of proper drainage.

This poor state of the road networks has led to some part of the road being marked as dead or danger zones due to the number of accidents that normally occurred daily on these spots.

(b) Poor road maintenance - this is another major problem contributing to the poor state of road infrastructures in Nigeria. Most of the major road networks have been constructed long time ago. This has made them become old and worn out. The failure by the Government to attend to them on-time made the condition of such roads become worse. In most cases, repairs are not started until a major damage occurred which makes it more difficult and expensive to maintain the road. Also, this makes the repairs that are eventually carried out, to be poorly done.

(c) Road congestion - there is congestion due to rapid urbanisation and in the Nigerian major cities. The congestion occurs because the transport demands exceeded the supply and capacity of the road networks available. Rapid urbanisation and overpopulation mean there are more vehicles on the road which result to the heavy use of these roads. This causes damage to many of the networks and other problems like pollution and accidents. Lagos, Ibadan, Port Harcourt, Benin, Kano, Kaduna, Owerri, Ilorin, Enugu are some of the cities with extremely high level of road congestion in Nigeria

(d) Accidents - the rate of road fatalities is high in Nigeria. It must be stated that most of these vehicular accidents are caused by road and human factor. The road factors are in the form of bad roads, abandoned sites or ongoing sites of repairs, traffic jam or road congestion. The human factors are caused by reckless driving, disobeying of traffic light and signs, ill-tempered and impatience driving. This has become one of the major problems which the government needs to tackle.

(e) Poor state of other means of transport- this is especially explaining the poor state of railway transport in Nigeria. The rail transport has become one of the major intercity transport systems used in most developing countries. There are subways in major cities in developed countries which reduces the demand for road transport. Also, heavy loads are transported by railway; it reduces the load on the roads and the danger posed by lots of heavy trucks and lorries that ply these roads. The provision of adequate rail transport, will reduce the congestion, the transport demand and also fatalities that have become common phenomenon in Nigeria roads.

(f) Environmental pollution – the major environmental pollution problem of road transport in Nigeria are air and noise pollutions. The air pollution is usually caused by carbon monoxide, hydrocarbons, lead, and nitrogen emission from the exhausted pipes of vehicles. This emission poses a serious threat to the health and quality of life of motorist and the people. Also, the noise from the vehicles and their horns pose as another major health problem to the people (Legit online Newspaper, 2017; Business Day Online Newspaper, 2019).

Self-Assessment Exercise
Discuss the major problems of Road Transportation in Nigeria.

3.6 Solution to the challenges facing Road Transportation.

The following solutions have been recommended to address the challenges facing road transportation in Nigeria:
(a) The government should place priority on the rehabilitation of the roads, properly fund and monitor the rehabilitation.

(b) there should be regular road maintenance and repairs on major high ways connecting the city to the other city and rural communities. Good road should be constructed from the city to the hinterland. This will help in opening up the hinterland for easy accessibility and increase flow of goods and services to the urban cities. There is also the need for proper drainage facilities along the road networks. Also, functional traffic lights should be put in place at major junctions in the towns and cities. There is need for the proper education of traffic users on how to obey traffic rules and regulations. This will enable strict enforcement of the rules and regulations for the road users and appropriate punishment given to the culprits or offenders.

(c) Also, there is need for the government to invest in other forms of transportation like rail, air and sea so that there will be reduced demands for road transport.

(d) The problem of corruption should be addressed by ensuring that contracts for road construction are awarded on merit to the contractors. The works should be supervised to ensure that quality works are done and where there are cases of poor job being done, the contractors should be black listed. There should be investigation of any corrupt cases that becomes public knowledge, so that it will serve as deterrent to others who may want to be involved in such unethical practices.

Self-Assessment Exercise
Describe the major solution to the problems of bad road in Nigeria.

4.0 Conclusion
Undoubtedly, without any gainsaying, Transportation plays key role in the economic development of a country. It forms an important part of the society and play a key role in the spatial relations of people and things in their environment. It facilitates the movement of goods and services from where there is surplus to the place where there is deficit. This makes possible communication and other forms of exchange amongst people. Transportation offers a lot of advantages but also has its own problems like the use of large space or land and environmental pollution. This situation, therefore, call for good transportation planning that will ensure effective management of the problems.

5.0 Summary

The unit is divided into six sections namely: conceptual definition of transportation; spatial flow patterns; purpose and importance of transportation; problems and solution to poor transportation. In the unit it was established that, Transportation is very important not only in building valuable links between regions and economic activities but also between people and other individuals in the society.

6.0 Tutor-Marked Assignment

(i) Define the term "Transportation".
(ii) Describe the various types of Spatial flow patterns.
(iii) Discuss the major components in the concept of spatial flow
(iv) "There would be no transportation without geography, and there would be no geography without transportation". Discuss this in relation to the purpose of transportation.
(v) Why is Transportation a necessity to man?
(vi) Vividly discuss the Economic Importance of Transportation.
(vii) Why is Transportation Important?
(viii) "Transportation is an essential Human activity" Discuss.
(ix) Expatiate on the key challenges that are facing Transportation in Nigeria.
(x) What are various ways that can be used to tackle Transportation Problems in Nigeria?

7.0 References/Further Readings

Business Day Online Newspaper (2019). Why Nigeria should develop other transport modes. Oct 31, 2019

Encyclopedia Britannica (2019). Transportation Technology. Accessed on 18th September, 2020. Available at: https://www.britannica.com/technology/transportation-technology

Legit online Newspaper (2017). Problems of road transportation in Nigeria. Accessed on 18th September, 2020. Available at: https://www.legit.ng/1132835-problems-road-transportation-nigeria.html

Logistics Bureau (2017). Transport and Transportation: Do They Mean the Same Thing?. Accessed on 18th September, 2020. Available at: https://www.logisticsbureau.com/what-is-transportation/#:~:text=How%20Would%20you%20Define%20%E2%80%9CTransport,goods%20from%20a%20manufacturing%20facility.

Rodrigue, J. (2020). The Geography of Transport Systems. Fifth Edition. New York: Routledge, 456 pages. ISBN 978-0-367-36463-2

The New Standard Encyclopedia (1990). The New Standard Encyclopedia Book Set with World Maps Inside. Standard Educational Corp. 200 W Jackson Blvd: Chicago, Cook, Illinois, USA.

Ullman, E.L. (1954). Transportation Geography. University of Washington Seattle, Washington

Wagner, P.L. (1960). The Human Use of the Earth, Free Press, New York.

UNIT 2: BENEFITS OF TRANSPORTATION

CONTENTS

1.0 Introduction

The transport systems prevailing in every economy are closely related to the socio-economic and economic changes that are taking place in that economy. The movement of the people, freight and the levels of territorial accessibility are also fundamental to the changes in the economy. There is likely going to be increase in economic opportunities where the transportation infrastructures are able to meet up with the mobility needs and ensure access to markets and resources. The regions of the world have been affected differently by the economic development, right from the time of the industrial revolution in the nineteenth century to the globalization era and economic integration processes of the late twentieth century. Hence, the International, regional and local transportation systems have all become fundamental components of the economic activities. This has consequently made a greater share of the wealth in these economies to be linked to trade and distribution. However, with these positive impacts of the transportation on economic and socio-economic systems, there are also the negative consequences on the people and environment (Rodrigue, 2020). In this unit, attempt is therefore, made to examine the economic and socio-economic benefits of transportation.

2.0 Objectives

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

- Discuss the economic benefits of Transportation
- Describe the environmental consequences of pollution from transport activities
- Distinguish between accidents and congestion in relation to transportation
- Examine the socio-economic benefits of Transportation.
- Outline the negative impacts of transportation on individuals and the society

3.0 Main Content
3.1 Economic Benefits of Transportation

The transport sector as an important component of the economy, impact on the development and the welfare of the people. This means, efficient transport systems provide economic and social opportunities and benefits that greatly influence the economy. On the other hand, the deficient transport systems can have an economic cost in terms of reduced or missed opportunities.
The economic impacts of transportation on the economy can therefore, be considered from the following perspectives:
(a) Direct impacts - This relates to accessibility change where transport enables larger markets and saves time and costs.
(b) Indirect impacts - This relates to the economic multiplier effect in which the price of commodities drops and their variety increases.

There are differences in the level of mobility from one economy to another, this makes the economies not share the same mobility. The ones with greater mobility are often those with better opportunities to develop than those with scarce mobility. Hence, reduced mobility normally hinders development while better mobility represents a catalyst for development. In other words, mobility serves as a reliable indicator of development. Economic development is therefore, connected with transitions in passenger mobility from nonmotorized (i.e. walking) to motorized forms of transportation. This simply indicates that the initial stage of transition involves the development of collective forms of transportation (such as tramways, subways, buses) while the individual forms of transportation (i.e. the automobile) followed and became more prevalent. The economic importance of the transportation industry can therefore, be examined from a macroeconomic and microeconomic perspective:
(i) Macroeconomic level – At this level, the importance of transportation for the whole economy is given consideration. The transportation and the mobility it confers are linked to a level of the output, employment and income within the national economy.
(ii) Microeconomic level – It assesses the importance of transportation for specific parts of the economy. In this situation, the transportation is linked to producer, consumer and production costs. This allows for the importance of specific transport activities and infrastructure to be assessed for each sector of the economy.
Transportation link together the factors of production between the producers and consumers. It results to efficient division of production through an exploitation of geographical comparative advantages, as well as the means to develop economies of scale and scope. This makes the economic growth to be increasingly linked with transport development (Rodrigue, 2020).

It has been ascertained that at each stage of human societal development, there has been a particular transport mode developed or adapted and throughout history there is no single mode of transport which has been solely responsible for the economic growth.

The economic opportunities were limited in the Pre-Industrial Revolution era, due to the low capacity to move commodities over long distances, because activities were very localized in scale and scope.

However, with the emergence of the industrial revolution there was unhindered greater economic opportunities, initially with the development of inland canal systems, steamships and then railway systems. This brought about expansion in transportation of Passenger and freight as well as production and consumption while new markets and resources became available. This consequently made the development of one transportation mode to be built on the opportunities developed by another, such as maritime and canal shipping. Also, the growth of a new mode of transportation led to the decline of others, such as the collapse of the inland canal networks in the late nineteenth century because of the rail competition.

There was the development of the mass production system at the beginning of the twentieth century. This made the mass production increasingly relied on the commercial opportunities introduced by road transportation. In the later part of the twentieth century, globalization became a possibility with the joint synergy of maritime transportation, roadways, railways, air and telecommunications. This makes the economic opportunities became global in scale and scope and in the recent time, new opportunities came up with the convergence of telecommunications and information technologies, that support a higher level of management of production, consumption and distribution. This scenario made some regions benefit from the development of transport systems, while others are marginalized by a set of conditions among which inadequate transportation plays a role. Transport by itself though may not be a sufficient condition for development, however; the lack of transport infrastructures may serve as a limiting factor on development. This makes it difficult to determine the relationship between transportation and economic development. The following factors may therefore, explain the variety of possible influences on the relationship:

(a) Timing of the development - This varies as the effects of transportation can either precede, occur during or be after economic development. The lag, concomitant and lead impacts can make it difficult to separate the specific contributions of transport to development. Thus, each case study then appears to be specific to a set of timing circumstances that are difficult to replicate elsewhere.

(b) Types of impacts - The impacts vary considerably. Its spectrum ranges from the positive through the permissive to the negative. There are cases, in which transportation impacts promote, while in others they may hinder the economic development in a region. In fewer cases, if any, the direct linkages can be clearly established. The cycles of economic development show the conceptual perspective about how transport systems evolve in time and space, these include the timing and the nature of the transport impact on economic development. In concise term, transport technology can be linked to the following five major waves of economic development where a specific mode or system emerged:

(i) Seaports. This is linked with the early stages of European expansion from the sixteenth to eighteenth centuries where there is support for the development of international trade through colonial empires. These developments were constrained by limited inland access.
(ii) Rivers and canals – This were remarkably the first stage of the industrial revolution in the late eighteenth and early nineteenth centuries. This period was linked to the development of canal systems in Western Europe and North America, and it was mainly for the transportation of heavy goods. This allowed for the development of rudimentary and constrained inland distribution systems.
(iii) Railways - The second stage of the industrial revolution which occurred in the nineteenth century was intimately linked to the development and implementation of rail systems. This enables a more flexible inland transportation system.
(iv) Roads - The greater part of the twentieth century saw the development of road transportation systems and automobile manufacturing. This made the individual transportation became a commodity available to the masses, particularly after the World War II. The process was reinforced by the development of highway systems in most of the regions.
(v) Airways and information - The development of global air and telecommunication networks in conjunction with the globalization of economic activities took place in the later part of the twentieth century.
This led to the emergence of new organization, control and maintenance capacities. The electronic communications became consistent with transport functions, especially in the rapidly developing realm of logistics and supply chain management.
The Technological innovation and economic growth are closely related and can be articulated within the concept of cycles or waves. The diffusion phase of each wave is represented by technological innovations, creation of entirely new industrial sectors, and opportunities for investment and growth. The Five waves are identified as follows:
(a) 1st wave (1785–1845) - This depended on innovations such as water power, textiles and iron. In England, the beginning of the industrial revolution which occurred there, was mainly focused on simple commodities such as clothes and tools. This made the conventional maritime technology relied on sail ships. This led to the creation of large colonial/trading empires, mainly by the British, the French, the Dutch, and the Spanish. Also, there was significant inland waterway systems constructed.
(b) 2nd wave (1845–1900) – There was massive application of coal as a source of energy, mainly through the steam engine. This encouraged the development of rail transport systems, which open new markets and give access to a wider array of resources. The development of steam engine had a similar impact for maritime transportation and allowed for further commercial exploitation.
(c) 3rd wave (1900–50) - In this period, electrification was a major economic change as it enabled the usage of a variety of machines and appliances. This led to the development of urban transit systems (i.e. the subways and tramways). There was the development of the internal combustion engine which marked another significant improvement on which the whole automotive industry was created.

(d) 4th wave (1950–90) – This post-World War II period represented significant industrial changes in the technological development such as in the production of plastics (i.e. petrochemicals) and electronics gadget (i.e. television). This resulted to jet engine expanding the aviation industry towards the mass market.
(e) 5th wave (1990–2020) - This current wave relies on information systems, which have modified the transactional environment with new methods of communication and more efficient management of production and distribution systems. This era led to the emergence of new industries such as computer manufacturing and software programming, but more recently e-commerce.
The contemporary trends have emphasized that economic development now depend less on relations with the environment (resources) and depend heavily on relations across space. This is probably due to the fact that while resources remain the foundation of economic activities, the commodification of the economy has been connected with higher levels of material flows. Also, the resources, capital and even labor have shown increasing levels of mobility, most especially for multinational firms which may benefit from transport improvements in two significant markets such as:
(a) Commodity market – this explains the improvement in the efficiency with which firms have access to raw materials and parts as well as to their respective customers. This led to the expansion of opportunities in acquiring and selling a variety of commodities that is necessary for industrial and manufacturing systems.
(b) Labor market - this is in terms of improvement in the access to labor and a reduction in access costs. This can be achieved by improved commuting (i.e. local scale) or the use of lower cost labor (i.e. global scale) ((Rodrigue, 2020).

An efficient transport system brings about positive economic changes and provides market accessibility that link the producers and consumers. The major impacts of transport on economic development are discussed as follows:

(i) Geographic specialization – The improvements in transportation and communication bring support to the process of geographical specialization that increases productivity and spatial interactions. A region would normally want to specialize in the production of goods and services for which it has comparative advantages (or the least comparative disadvantages) compared to other region as long as appropriate transport is available for trade. The economic productivity is promoted by geographic specialization which is supported with efficient transportation.
(ii) **Large-scale production** – There will be mass production of goods and services through economies of scale if larger markets can be accessed. This can be possible through efficient transport system. Therefore, the more efficient is the transportation system, the larger the markets and the larger will be the scale of production.

(iii) Increased competition – An efficient transport system results to increase in the potential market for a given product or service, and so does competition. This makes a wider array of goods and services become available to consumers through competition and this reduces the costs, promote quality and innovation.
(iv) Increased land value - There is usually increase in the value of land which is adjacent to or serviced by good transport systems as a result of the utility it confers to many activities. The one related to residential activities may not enjoy this kind of increase land value. This is applicable to the land located near airports and highways, that are near noise and pollution sources, which usually has diminishing land value (Rodrigue, 2020).

Self-Assessment Exercise
What are the major waves of economic development?

3.2 Socio Economic Benefits

One of the socio-economic benefits of transportation is that it influences the formation of urban societies. Transportation greatly contributes to the formation, size and pattern, and the development of societies, especially in the development of urban centers. It helps in the distribution and consumption of goods and services from one place to another. In other words, It closes the spatial gap between producer and consumer. There is scarcity of natural resources to satisfy the needs of life and the resources are also not evenly distributed. This can result to the difference in standard of living in different societies. Transportation plays a key part in the mobility of resources and people from one particular location to another place. These include transfer of knowledge, skills and technology from a place where they are in excess or abundance to where there are urgent needs for them. There is separation of work and residence, as well as greater mobility in the society, this represents a major change in modern social life. This becomes possible as a result of transport development, which enables people to live in a better environment. It also makes people travel for recreational purposes and sporting fixtures, etc (Mathew, 2009). The positive economic impacts of transportation have been earlier discussed, there are also significant negative impacts that it has on individuals or the society among which include the following:

(i) Mobility gaps - There is always the issue of mobility gap despite the fact that, it is one of the fundamental components of the economic benefits of transportation. The variations in mobility are likely to have substantial impacts on the opportunities of individuals because its needs do not always match with its requirements due to such factors as lack of income, time, means and access. This makes people's mobility and transport demands depend on their socio-economic situation. In other word, the higher the income, the higher the mobility, which lead to substantial mobility gaps between different population groups. There is problem of gender gaps in mobility, as women tend to have lower incomes than men. The mobility gaps are also prevalent for long-distance travel.

The development in air transport, has resulted to a smaller segment of the global population having a very high level of mobility for their business or leisure, while the greater majority of the population has little mobility.

(ii) Costs differences – There is usually higher costs for goods from those locations with low levels of accessibility because most of these goods are imported from long distances location. The higher transport costs that come up with this, inhibit the competitiveness of such locations and limit opportunities. The higher prices paid by consumers and industries impact on their welfare and competitiveness.
(iii) Congestion – This occurs when parts of the road network are used above the design capacity. It is the outcome of such a situation with its associated costs, delays and waste of energy. The distribution systems that rely upon on-time deliveries are particularly vulnerable to congestion and the resultant loss that may be incurred in such situation.
(iv) Accidents – There are usually cases of accident when using transport modes and infrastructure. The vehicles are never safe, they are sometime dangerous and have their own pain. Accidents normally occur as a result of human errors and various forms of physical failures such as mechanical or infrastructural. This can lead to injuries, damage and even deaths. The rate at which accidents occur is proportional to the intensity in the use of transport infrastructures. Accidents have important socio-economic impacts on the society which include healthcare, insurance, damage to property and the loss of life. The road is considered as the most dangerous medium for transportation, and accounted for about 90 percent of all transport accidents on the average. The country with the highest car accident death rates in the world is China. It has more than 110,000 fatalities per year (300 per day), due to the recent growth in vehicle ownership in the country ((Rodrigue, 2020).
The pollution from transport activities has a wide range of environmental consequences and it may be in any of the following form:
(a) Air quality – There is emission from the internal combustion engine of vehicles which serves as pollution to the air. This relates to acid rain and may be a potential threat for the global warming. The emission can lead to respiratory and cardiovascular illnesses.
(b) Noise – This serves as a major irritant from transportation, it has adverse effect on human health and welfare. Noise can take any of the following form: psychological disturbances, for examples: perturbations, displeasure, functional disturbances, for examples: sleep disorders, loss of work productivity, speech interference or physiological disturbances, for examples: health issues such as fatigue, and hearing damage. The noise and vibration from trains, trucks, and planes are major irritants to the people.
(c) Water quality - This can come from accidental and nominal runoff of pollutants from transport such as oil spills. They are sources of contamination for both surface water and groundwater.

(d) Land take - Transport consumes large space when all of its supporting infrastructure and equipment are considered. The planning associated with these structures does not always consider aesthetic value as normally the case with construction of urban highways. These visual impacts that come up with the construction of the transport infrastructures have adverse consequences to the quality of life of nearby residents.

Self-Assessment Exercise

Discuss the negative impacts of transportation on individuals and the society

4.0 Conclusion

Transportation can bring about positive changes into the society if effectively managed. It led to the development of urban centers and help in closing the spatial gap between the producers and consumers. It therefore plays key role in the economic development of a region. There is going to be increase in economic opportunities where the transportation infrastructures are able to meet up with the mobility needs and ensure access to markets and resources. However, despite the positive impacts that transportation has on the individual and society it also has its own negative impacts. It is therefore, imperative that there should be effective management of transport infrastructures that will result to the economic development of the region, country or state.

5.0 Summary

The unit has basically given focus to the economic and socio- economic benefits of transportation to the individual and the society. The positive impacts or benefits of transportation have been discussed extensively in the unit. Also, the negative impacts have been highlighted. There can be economic development only if, transport infrastructures are effectively managed.

6.0 Tutor-Marked Assignment

(a) Discuss the economic benefits of transportation.
(b) Enumerate the socio-economic benefits of transportation.
(c) Describe the key environmental consequences of pollution from transport activities.
(d) Examine the major cycles of economic development for transport systems.
(e) Deliberate on the economic importance of the transportation industry from macroeconomic and microeconomic perspective.
(f) How can multinational firms benefit from transport improvements?
(g) What is Mobility gap in relation to the negative impacts of transportation?
(h) Explain the direct and indirect impacts of transportation on the economy.
(i) What are those factors that make it difficult to determine the relationship between transportation and economic development?
(j) Differentiate between accidents and congestion in relation to the impacts of transportation on individual and society.

7.0 References/Further Readings

Mathew, T.V. (2009). Role of transportation in society - Lecture notes in Transportation Systems Engineering. Accessed on 15th September 2020. Available at: https://www.civil.iitb.ac.in/tvm/1100_LnTse/102_lnTse/plain/plain.html

Rodrigue, J. (2020), The Geography of Transport Systems. Fifth Edition. New York: Routledge, 456 pages. ISBN 978-0-367-36463-2

UNIT 3: MODE OF TRANSPORTATION

CONTENTS

1.0 Introduction

Transport is very important in the movement of goods and services from the producers to the consumers. The goods can be from the factory or depot to the wholesalers and retailers who serve as intermediary or link to the final consumer. Transport also perform other functions that are of great economic and social significance to man. It serves as a form of mobility of person from home to the place of work, it creates utilities of place and serves as indicator of regional development among others. This indicates that as the economy develops the need for transport becomes more vital. In this unit the different modes of transport are discussed and their various merits and demerits are also given consideration.

2.0 Objectives.

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

- Discuss the classification of Transportation based on Land Routes
- Describe the classification of Transportation based on Water Routes
- Describe the classification of Transportation based on Air Routes
- Deliberate on the importance of Intermodal Transportation
- Examine Telecommunication as a means of Transportation.

3.0 Main Content

3.1 Classification on the basis of land routes

The focus under this section will be centered on transportation mode such as path or track, road, rail, and pipeline.

(a) Roadways:
The Path or Track can be described as any cleared route which is used by pedestrians, animals, bicycles or other intermediate mode of transports (IMTs) such as pack animals, bicycles, wheelbarrows and carts (International Labour Organisation, ILO,2002). The road is the most common form of transportation. It can be in form of walking along the path or track routes, riding on horses, the use of wagons or bikes, traveling by cars or trucks, and it has been around for longer period than any other mode of transportation. It is the most utilized and widely used form of logistics. The top three states in Nigeria with the best roads are FCT, Abuja; Calabar, Cross Rivers State and Uyo, Akwa Ibom State (Arusuraire, 2018; Mihlfeld & Associates, 2018; Theintactone.com, 2019).

The merits of Road Transportation are:
(i) Economical – This mode of transportation is economical over short distances when compared with the railways.

(ii) Speedier movement: It is speedier than the railways when it comes to point to point service resulting in price stabilisation and consumer satisfaction. The transhipment of goods by road is faster and reliable than that of railways. The truck has a smaller capacity and make delivery of goods available within a shorter time than the railways over the same distance.

(iii) Greater accessibility to the remote hinterland – This mode of transportation has much beyond the capacity of railways, and is known for reaching impregnable market particularly the hilly or hinterland where the railways cannot easily reach.

(iv) Lesser conditions of service - It does not insist on strict packaging requirements because of least transhipments shocks to goods carried. The damage claims are settled faster in road transportation.

(v) It is a flexible mode of transportation because it is possible to make various stops according to the number of different shipments it is carrying

The demerits of Road Transportation are:

(i) Uneconomical - This is possible when it is for long distances. The haulage becomes costlier due to disproportionate rise in fuel and spare-parts expenses. The farther the distance covered by the vehicle the more the cost of fuel and vehicle maintenance.

(ii) It is fair weather friendly - Road transportation may be subject to vagaries of weather condition. In Africa, this explain why road transportation is faced with many difficulties during the raining period. This scenario may result in restricted movement of goods due to bad roads, blocked drainage along the road and the erosion that wash part of the road away.

(iii) Not suitable for bulk transport: This form of transportation is not good for the movement of bulky and heavy goods most especially for long distances destination. It has a major limitation of carrying capacity than the railways.

(iv) Traffic and road regulations may serve as a major constraint to its effectiveness, in terms of timely and safety delivery of cargoes.

(v) There is also the problem of shortage of good and experienced truck drivers. This and other factors contribute to high incidence of accidents on the highways. The fewer experienced ones do not care about obeying traffic regulations and some of the drivers are also into substance abuse which led to increase rate of fatalities on the road.

(vi) High level of insecurity – This has become another major threat to road transportation in Nigeria. There is no more safety of lives and properties due to the incessant attacks from the bandits and kidnappers that unleash their terror on the innocent ones when they travel from one place to another. This has led to reduction in the number of people that travel by road in present time in Nigeria.

Self-Assessment Exercise
Why is road, which is the most common and oldest form of transportation still considered important to man?

(b) Railways.

This mode of transportation was invented in the early 19th century and quickly became vital for the expansion of the western world for over two centuries. It is used more exclusively for the largest and bulk cargo traveling across land. Rail transport connects highly populated areas with large unpopulated area, thus making it ideal for long-distance and cross-country hauls.

The following are some of the merits of the rail transport:

(i) Great carrying capacity: Rail transport when ccompared to other means of transport, are known for bulk carriage of goods over long distances.

(ii) Economical: this mode of transportation works best most especially, for heavy goods that are carried over long distances. The cost of carriage is usually very cheap.

(iii) It is all weather modes: It adapts to the climatic changes and provide all season protection to the products moved on uninterrupted basis. It is the most dependable of all modes of transportation since it is not affected by rain and fogs compared to other modes of transport.

(iv) Freight containerisation: This mode of transportation makes possible freight containerisation on major routes which facilitates safe, uninterrupted and speedier movement.

(v) Source of International markets: It serves as the main sources of connections with the foreign markets. Goods are moved from the interior parts of the region to the points of overseas supply and shipping.
(vi) Better organized mode of transportation- It has fixed routes and schedules plan of operations. It offers a more certain, uniform and regular form of services compared to other modes of transportation.
(vii) It offers safe services – The rail transport is the safest form of transportation. It has little chances of accidents and breakdown compared to other modes of transport.
(viii) Public Welfare Service – It offers public utility services to the people and not set up for profit motive. The service charges are fixed at a very low rate so as to meet up with the demands of the poor. Their services can be regarded as national necessities.
(ix) Employment opportunities –It offers employment opportunities to many skilled and unskilled labour. There are so many people that depend either directly or indirectly on railways for their livelihood.
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The demerits of rail transportation:

(i) Costly for short distances: Rail transport may be costlier for short distances because of tapering and differential tariff rates.

(ii) Slow Speed: Railways when compared to other modes of transportation such as road and air transport, has slower speed of movement.
(iii) Possibility of delays – There is usually delay and sometime total cancelation of trip due to the occurrences of unforeseen circumstances. There are also problem of shortage of wagons and wear and tears of rail tracks.

(iv) High cost of Railway project – The cost of building railway lines, coaches, engines and equipment are exorbitantly high and this is why it is mostly financed by Government in most developing countries. The railway project is hardly handled by private sectors. There is also the problem of maintenance and repairs which further add to the cost of building and operating railways.

(v) Monopoly – The high capital outlay may lead to monopoly, and end up making it to work against public interest. The lack of competition may make it to be managed inefficiently at high cost of service.

(vi) Lack of flexibility – It is not possible to adjust its timing and schedule to individual requirements. This makes door to door services impossible for rail transport.
(vii) Involves more booking time – there is more time spent in booking and taking goods delivery for railways compared to road transportation (Your article library, 2014; Theintactone.com, 2019).

Self-Assessment Exercise
What are the demerits of Railways as a form of transportation?

(c) Pipelines
This is a form of transportation mode that is designed to move items like crude-oil, petroleum, chemicals, coal, lime-stone, iron-ore, copper concentrates and gas. The routes are practically unlimited, they can be laid on land or under water. Pipelines are not only use for transporting liquid substances but for solid substances after been converted into slurry. This form of transportation has brought relief on other types of surface transportation such as road and railway transportation.

The merits of Pipelines are:

(i) Economical - It is economical for the transportation of crude oil, coal and gas. This makes this mode of transportation ideal for gases and liquid.

(ii) Uninterrupted service - It presents all weather system to move the products and there is no wastage of time as it works round the clock to distribute the products and services.

(iii) No or little danger of wastage - There are little or no problem of wastage, spilling, evaporation, pilferage except where there is deliberate or accidental destruction of pipes.

(iv) Underground - The pipe-line are usually laid underground and, hence, may takes no additional space. It also has advantage of traversing through difficult terrain or underwater.

(v) Low Energy Consumption - This mode of transportation requires low energy consumption than that of truck and trains.
(v) It is devoid of human labour – Pipeline transportation requires less human labour and saves time. There is no need to disconnect hoses when transporting crude oil through pipeline.
(vi) Ideal for bulk carriage - Large volumes of crude oil and other petroleum products can be transported from producers to consumers. In other words, several million barrels of oil daily can be pumped daily through pipelines.

(vii) Safety and convenience – Pipeline transportation of oil and other liquids is safe and convenient. It can be used in transporting crude oil directly to refineries without any problem and it is more environment friendly provided the pipeline is given proper maintenance and prevented from bursting.

The demerits of Pipeline transportation are:

(i) Initial heavy investment – This mode of transportation has initial heavy cost of capital outlay though the subsequent operational and maintenance costs are minimal,
(ii) Danger of possible attacks: There is usually the danger of possible attack on the pipeline either during the peaceful time or when there is insurgency. They are more prone to attacks from bandits, militia men and the vandals thus jeopardizing the free flow of the crude oil or gas supply to the entire nation. This may result to the production activities been grounded to halt.
(iii) Prone to damage – Pipelines are exposed to damage because there are no separate lands mapped out for them, this make them to be subject to either man-made damage or natural disasters such as earthquake, landslide, volcanoes etc.
(iv) Vandalism – This is the deliberate destruction of the pipelines by criminals due to its unprotective nature, so as to disrupt the free flow of the products during the period of the crisis.
(v) Possible leakage and theft – There may be possible leakage and theft of the product transported through pipelines. The early detection of the leakage may not be possible with underground and under water pipelines.
(vi) Maintenance Problem – It may not be easy to carry out regular maintenance check up for the underground and underwater pipelines. This may allow for the spillage of the products been transported through the pipelines.
(vii) Fire accident – This may occur if there is leakage of highly inflammable substances from the pipelines. This may lead to environmental pollution and also the fire may not be easy to put off at the right time.

(viii) Compensation Problem – The oil company may not be willing to compensate or in some cases pay inadequate compensation to the landowners for damages, as the case with the Niger Delta People and oil producing communities in Nigeria. This is because the oil companies may feel it is not obligatory for them to do so the people.

(ix) Fixed capacity – In pipeline transportation there is usually a limit to the number of petroleum products that can be pumped through pipelines per unit of time. This limit can therefore not be exceeded and as result the capacity cannot be increased (Your article library, 2014; Theintactone.com, 2019).

Self-Assessment Exercise

What are the advantages of Pipelines over others surface transportation?

3.2 Water routes – inland and sea,
This is the cheapest and the oldest mode of transportation which operates on a natural track. Huge capital investment is not required for the construction and maintenance of its track except in case of canals. Water transport has the largest carrying capacity, and this make it appropriate for carrying bulky goods over long distances.

It is very indispensable for the movement of goods and services across borders. It consists of: (a) Inland water transport and (b) Ocean-transport.

(a) Inland Water Transport:

This basically consists of transport by rivers, canals and lakes.

(i) Rivers:

They are natural waterway which can be used as a means of transport and are suitable for small boats and big barrages. It played a very important role before the development of modern means of land transport. The importance has gradually declined due to a more reliable and cheaper transport services offered by the railways.

(ii) Canals:

They are artificial waterways that are made for the purpose of irrigation or navigation or for both. The construction and maintenance of its track may require a huge amount of capital investment. This makes the cost of the canal transport to be higher than that of river transport. The cost of providing water for the canals is another problem of this type of inland water transport.

(iii) Lakes – This can either natural like the rivers or artificial like the canals.

Advantages of Inland Water transportation are:

(a) Low Cost:

They do not require any cost of construction and maintenance. The cost of construction and maintenance of canals is not much and they are used, not only for transport purposes but also for irrigation, etc. Generally, the cost of operation of the inland water transport is very low. This makes it the cheapest mode of transport for the movement of goods from one place to another.

(b) Larger Capacity:

This mode of transportation is good for moving larger quantities of heavy and bulky goods such as coal, and, timber etc.

(c) Flexible Service: It offers more flexible services than the railways and can be adjusted to individual requirements.

(d) Safety:

There are minimum level of risks of accidents and breakdowns for this form of transport, compared to any other form of transport.

Disadvantages of Inland Water transportation are:

(a) Slow:

The Speed of Inland water transport is very slow and therefore make it unsuitable where time is an important factor.

(b) Limited Area of Operation:

This mode of transportation can be used only in a limited area which is served by deep canals and rivers.
(c) Seasonal Character – They cannot be operated for transportation throughout the year, because the river or canal may become freeze or the water level may go very down during certain period in the year.

(d) Unreliable:
The inland water transport may be unreliable because the river may change its course and cause dislocation in the normal route of the trade.

(e) Unsuitable for Small Business:
The rivers and canals may not be suitable for small traders, because it takes a longer time to carry goods from one place to another through this form of transport.

(b) Ocean transport:
This form of transportation is very vital for foreign trade and it has brought the different parts of the world closer and makes all the nations of the world to become one big world market. The seaports in Nigeria are managed by the Nigerian Port Authority, and major seaport include: the Lagos Port Complex, Apapa, Lagos State; Calabar Seaport,Calabar, Cross River State; Tin Can Island Port, Apapa, Lagos State and Delta Seaport, Delta State. The Delta Port includes the ports of Warri, Burutu, Sapele and the petroleum terminals at Escravos and Forcados. Others include: Rivers Port Complex, Rivers State which comprises the Port of Port Harcourt; Onne Port, Rivers State which are Located in three Local Government Areas of Rivers State: Eleme LGA, Bonny LGA and Ogu-Bolo LGA (Omipidan, 2019). Ocean transport is, apparently, the cheapest mode of transport and it includes:
(i) Coastal Shipping
(ii) Overseas Shipping

(i) Coastal Shipping:
This serves as one of the most important means of transport for the moving of goods from one part to another in a country. Coastal shipping is cheaper and quicker and most suitable for the carrying of heavy and bulky freights like coal, iron ore, etc. to distant places. Also, it serves only limited areas.

(ii) Overseas Shipping:
The following types of vessels are employed in the overseas shipping:

(a) Liners,
(b) Tramps,
(c) Tankers.

(a) Liners:
The ships have regular fixed routes, time and charges, they are collection of vessels under one ownership or a fleet. They normally offer a uniform and regular service and sail on scheduled dates and time, whether full of cargo or not.

(ii) Tramps:
They have no fixed routes and no set of rules or rate schedule. The ships do not sail till they have full cargo and can be chartered by exporters who are ready to sail anywhere and at any time. They are not as fast in speed as liners but are more suitable to carry seasonal and bulky goods.

(iii) Tankers:
They are specially designed to carry oil, petrol and such other liquids. They have a large capacity.

Advantages of Overseas Shipping:
(a) It operates on a natural track and is provided a readymade 'road bed' to sail. Huge amount of capital investment is not required for the construction and maintenance of its track.

(b) The smooth surface of sea, make it require comparatively tractive effort to operate. This results in a lesser cost of operation and make it the cheapest mode of transport.

(c) This form of transportation has the largest carrying capacity as compared to any other transport.

(d) The risk of having damage goods in transit is also less when compared to other modes of transport. However, the goods may be exposed to some of the 'perils of the sea'.

(e) Overseas shipping is the only suitable mode of transport for carrying heavy and bulky goods to distant places.

(f) It is also indispensable for foreign trade and business.

Disadvantages of Overseas Shipping
(a) Slow Speed
It takes longer period to reach destination compared to coastal shipping because of the longer distance involved in making voyage.
(b) More Risky:
Overseas shipping can be more risky when compared to other means because there is always danger of sinking ships or boats in high seas.

(c) High Tariff payment - The operators in most cases have to either turn around or comply with a tariff payment they were not prepared to pay.
(d) High regulations – There are frequent regulations been made by International Maritime Organization for the shipping companies which are intended to ensure the clean, safe and efficient global shipping practices.

The failure to comply with these regulations may lead to the sanction of the erring operators and at the same time hinder their free passage on the sea route. This regulation is having a massive impact on maritime shipping (Your article library, 2014; Mihlfeld & Associates, 2018).

Self-Assessment Exercise
Discuss the merits and demerits of Inland Water Transport.

3.3 Air routes

Airways:
This is the most recent mode of transportation. There was development in air transport after the two world wars and its peculiar characteristic is that there is no specific surface track for its operations. There are no physical barriers as in the case of other mode of transportation. The important advantage of this form of transportation is the fastness and speed. Its cost of operation may be very high and thus it is suitable for the rich passengers. The transport mode can be used to carry mails, light and costly cargo. There are four International Airports in Nigeria namely: Mallam Aminu Kano International Airport, Kano Murtala Muhammed International Airport, Lagos; Nnamdi Azikwe International Airport, Abuja; and Port Harcourt International Airport, Port Harcourt. There are seven major domestic airports in Nigeria which include: Enugu Airport; Kaduna Airport; Maiduguri Airport; Margaret Ekpo International Airport; Calabar; Sultan Saddik Abubakar Airport, Sokoto;Yakubu Gowon Airport, Jos and Yola Airport. Also, there are eleven other domestic airports which are namely: Akure Airport, Bauchi Airport, Benin Airport, Ibadan Airport, Ilorin Airport, Katsina Airport, Makurdi Airport, Minna Airport, Sam Mbakwe Airport, Owerri, Warri Airport and Zaria Airport (Federal Airports Authority of Nigeria, FAAN, 2016).

Merits of Airways:

(i) Fast Speed – This mode of transportation is the fastest means for the movement of cargo and passengers over distant places. It eliminates practically any form of spatial barriers.

(ii) All weather friend – It offers dependable service to passengers during the times of floods, wars, earth-quakes. This make it an all weather means of transportation, although sometime flights are cancelled due to bad weather conditions.

(iii) Provides Consumer satisfaction – Airways offer high level of consumer satisfaction to its passengers, this is due to its effectiveness in service delivery, fast speed and least damage to cargo.

(iv) Reduced inventory holdings - Its ability to provide fast and uninterrupted service, make it has fewer capital investments in the form of stocks of goods, most especially for the highly perishable items.

Demerits of Airways:
(i) It is very expensive – Air transportation is very expensive and there is limit to the weight of cargo that can be transported through this mode of transportation. This makes the mode of transportation suitable for light weight, high grade and costly items only.

(ii) Limited coverage: The planes cannot get to all the places compared to road transportation. This makes it connects to metropolis and some important cities where there are facilities for plane's landing and taking off.

(iii) Limited cargo capacity - The cargo capacity of a plane is much smaller compared to that of overseas shipping. This is because the plane's size works against the force of gravity.

Self-Assessment Exercise

Enumerate the important merits of Air Routes.

3.4 Intermodal Transportation

Intermodal transportation can be described as the type which involves the movement of freight by using two or more modes of transportation such as air, truck, railroad and steamship. This mode of transportation positively influences the way goods and services are moved from one region to another region.

Advantages of Intermodal Transportation are:
(i) Offers benefit of low cost – It operates at low cost compared to other methods of transportation. It is possible to transfer cargo from the costlier mode to the less expensive ones.
(ii) Flexibility – This mode of transportation offers greater flexibility in terms of the choice of mode of transportation to be used in moving the freight.
(iii) Saves money – The shipper can efficiently plan on the mode of transportation to be used that will be economical. This is possible because at least two modes of transportation can be used and the choice of the ones to be used may be based on the one that will be less expensive or bring more savings.
(iv) Allow for Creativity – This method of transportation allows for creativity in finding the most efficient way of transporting the cargo. The shippers are not restricted to a specific transportation mode and hence may be able to think about the mode that will offer the best option.

Disadvantages of Intermodal Transportation are:

(i) Low Speed

It sacrifices speed any time the cargo is transferred to a comparatively slower means of travel such as trains, which operate on fixed rails. This slow down the speed, unlike what would have been situation if it was by truck which offer a direct route. It is therefore, advisable that the intermodal transportation must reduce the amount of time spent waiting in depots for a new carrier to arrive or cargo to be unloaded, for it to operate at maximum efficiency.

(ii) Lack of Reliability

It is less reliable means of transportation because of its reliance on many modes of transportation. This may be particularly the case if one of the modes of transport to be used is railways which is susceptible to delays.

(iii) Damage

The shippers may be exposed to risk of damage as the freight is transferred from one method of transportation to another. This risk may be mitigated by taking the necessary insurance to offset the loss that may occur in such circumstances.

(iv) High Infrastructure Costs

It suffers from comparatively high infrastructure costs which may be incurred in moving the goods from one mode of transportation to another ones. There may be need to purchase heavy-duty cranes and equipment necessary to move the containers from ship to truck. This may result to additional overhead cost for the shippers.

Self-Assessment Exercise

What are the merits of Intermodal transportation?

3.5 Telecommunications

Telecommunications may be very difficult to define in terms of whether or not they are transport mode since unlike true transportation, they often do not have a physicality or involve the physical mobility of goods and services. Telecommunications are structured as networks with nearly unlimited capacity and very low constraints. This may include the physiography and oceanic masses that may impair the setting of cables and provide for the “instantaneous” movement of information at the speed of light.

Wave transmissions normally have limited coverage and often require substations, the kind that are for cellular phone networks. There are many telecommunication networks with high network costs and low distribution costs linked to the tertiary and quaternary sectors such as stock markets, business to business information networks, etc. The benefit of Telecommunications is that it may serve as better replacement for personal movements or mobility in some economic sectors, most especially where physical presence may not be obligatory. The situation in most service industries during the COVID 19 period offer a very good example of this experience, where some of the staff conducted their business activities from the four corners of their home (Theintactone.com, 2019). The adverse effect of Telecommunication networks on the environment includes the potential health

hazards caused by electromagnetic radiation (EMR) emissions from mobile phone towers and visual impacts of aerial cabling and mobile telephone towers which can result to environmental degradation (Parliament of Australia, 1996)

Self-Assessment Exercise
Explain why Telecommunications can be regarded as a modern mode of transportation.

4.0 Conclusion

The discussion on the various mode of transportation have shown that each mode has its advantages and disadvantages. Also, they all play significant roles in the economic development of any region. The important thing that needs to be done is determining the best transport mode that can be recommended for a particular purpose. There is need to take into consideration such factors as volume, speed, distance, and cost. It is strongly believed that by recognizing the best mode, will help in making the company or manager arrives at good decisions that are necessary to make the business successful.

5.0 Summary

This unit has examined the various classifications of transportation based on land, air and water routes. The disadvantages and advantages of each mode of transportation have also been discussed in details. There was also discussion on Intermodal transportation and Telecommunication as other forms of transportation. It has been observed that each of the mode can be recommended based on the factors such as volume, speed, distance and cost. Generally, transportation can be said to be playing a significant role in closing the spatial gap by moving the goods from where they are produced to where they are needed and consumed.

6.0 Tutor-Marked Assignment

(i)(a) Define Path or Track and explain what makes it different from the road.
(b) Discuss the demerits of road transportation.
(ii) The fact that most Railway Projects in developing countries are been handled by the Government can make them become Monopolists. What are the other criticisms of this mode of transportation?
(iii) In recent time, the Government in most Developing Countries are no longer giving priority to the construction of Railway lines. Why is it still considered as an important mode of transportation?
(iv) Describe Pipelines transportation. What are the major disadvantages of this form of transportation?
(v)Write short notes on the following types of vessels used in Overseas Shipping:
(a) Liners,
(b) Tramps,
(c) Tankers.

(vi) Differentiate between Coastal and Overseas Shipping.
(vii) What are the merits and demerits of Overseas Shipping.

(viii) What is intermodal transportation? Discuss the advantages and disadvantages of this mode of transportation.
(ix) Can Telecommunications be described as a form of Transportation?
(x) What are the demerits of Intermodal transportation?

7.0 References/Further Readings

Arusuraire, O. (2018). Top 3 States With The Best Roads In Nigeria. Accessed on 25th September, 2020. Available at: https://olatorera.com/top-3-states-with-the-best-roads-in-nigeria/

Federal Airports Authority of Nigeria (FAAN, 2016). List of airports owned and managed by FAAN. Accessed on 25th September, 2020. Available at:https://web.archive.org/web/20080203115930/http://www.faannigeria.org/nigeria-airport.php

International Labour Organisation (ILO, 2002). Rural accessibility: Footpaths and tracks - A manual for their construction and improvement. Rural Access Technical Papers (RATP) No. 6.

Mihlfeld & Associates (2018). The 6 Modes of Transportation. Accessed on 25th September, 2020. Available at: https://blog.mihlfeld.com/the-6-modes-of-transportation

Omipidan, T.S. (2019). List of Seaports in Nigeria And Their Locations. Accessed on 15th September 2020. Available at: https://oldnaija.com/2019/02/04/seaports-in-nigeria-and-their-locations/

Parliament of Australia (1996). Environmental Impact of Telecommunications. Accessed on 10th December 2020. Available at: https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Completed_inquiries/1996-99/telstra/report/c07a

Theintactone.com (2019). Transportation: Function, Cost & Mode of Transportation. Accessed on 15th September 2020. Available at: https://theintactone.com/2019/07/12/sclm-u2-topic-5-transportation-function-cost-mode-of-transportation/

Your Article Library (2014). 5 Commonly Used Transport Modes. Accessed on 15th September 2020. Available at:

https://www.yourarticlelibrary.com/geography/transportation/5-commonly-used-transport-modes/49185

Your Article Library (2014). Advantages and Disadvantages of Pipelines in India!. Accessed on 25th September, 2020. Available at: https://www.yourarticlelibrary.com/india-2/advantages-and-disadvantages-of-pipelines-in-india/19743

Your Article Library (2014). Advantages and Disadvantages of Railway Transport. Accessed on 15th September 2020. Available at: https://www.yourarticlelibrary.com/geography/transportation/advantages-and-disadvantages-of-railway-transport/42134

Your Article Library (2014). Water Transport: Kinds, Advantages and Disadvantages of Water Transport. Accessed on 25th September, 2020. Available at: https://www.yourarticlelibrary.com/geography/transportation/water-transport-kinds-advantages-and-disadvantages-of-water-transport/42133

UNIT 4: TRANSPORTATION COSTS AND RATES

CONTENTS

1.0 Introduction

Transport sectors are normally faced with the need to increase their capacity and at the same time cut down their running or operation cost. This situation calls for the transport users, most especially the individuals, enterprises, institutions, governments etc. to make good negotiation or bid for the transfer of goods, people, information and capital. This is because there is always changes in the cost of supplies, cost of distributions and locations, tariffs, salaries, marketing and fuel costs. All these amount to costs of doing business or operational cost. In other words, It is very important to factor in the startup costs, registration costs, rental costs, salary of employees and advertising cost when starting a new business. In addition, there are also cost of gathering information relating to the business, negotiation, enforcement of contracts and transactions. There must be decisions about how to route the freight and passengers at the minimal cost. This can be in terms of the movement of lighter and high value consumer goods like electronics and less bulky goods. The decision on transport cost has become important factor that need to be taken into consideration in any business because it accounts for substantial part of the production cost for most manufactured products. Therefore, the choice of a transportation mode that will be suitable for the movement of the people and freight from some place of origins to various destinations becomes important. The choice of transportation mode therefore, depends on factors such as the nature of the goods, the infrastructural facilities, origins and destinations, technology, and the distances (Rodrigue,2020).
This unit examines Transport Costs and Rates, the different types of transport costs and factors affecting transport costs and rates.

2.0 Objectives

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

- Describe the meaning of Transport Costs

- Discuss the different types of Transport costs and rates
- Define the term “Transport Rates”
- Distinguish between Transport Costs and Rates.
- Identify the factors affecting Transport costs and rates.

3.0 Main Content

3.1 Conceptual definitions of Transport costs

Transport costs can be described as a monetary measure of what the transport provider pays to offer transportation services to users. It is also defined as the expenses a company incurs when it transfers its inventory or other assets to another location. This include the payment to a trucking or shipping company, delivery for products, or the costs that are pass-over to the customer. The costs are usually in the form of fixed (infrastructure) and variable (operating) costs, which depend on a variety of conditions that are in relation to geography, infrastructure, administrative barriers, energy, and the mode of transportation used for the passengers and freight.

According to Business Dictionary (2020), transport costs are the expenses involved in moving products or assets to a different place, which are often passed on to consumers. The business usually incurs cost in bringing its products to the retailers in order to have them offered for sale to consumers. Other major components that have impacts on transport costs relate to transactions, shipments and the friction of distance. Transport costs also have impact on the structure of the economic activities and the international trade. In a competitive environment where transport costs are bidded, they are influenced by the rates charged by Transport Companies and the costs charged to the users (Farlex Financial Dictionary, 2012; Business Dictionary, 2020; Rodrigue,2020).

Self-Assessment Exercise

Define the term “Transport Costs”

3.2 Types of Transport Cost

The movement from one place to another is generally influenced by the transport costs. There is relationship between annual vehicle mileage and fuel costs for the passenger vehicle, which means the higher the fuel costs, the lower the mileage. Also, empirical evidence has shown that doubling the transport costs can reduce trade flows by more than 80 percent at the international level (Rodrigue,2020). In other words, this means the more affordable is the transport cost, the more frequent the movements and the longer may likely be the distance. In this section, the following variety of transport costs are discussed:

(i) **Freight on board (FOB) -** The price of any good is comprised of the factory costs and the shipping costs from the factory to the consumer. However, for the FOB, the

consumer pays for the freight transport costs. This makes the price of a commodity to vary in accordance to transportation costs and distance.
FOB can be literally interpreted as "Free on Board" or "Freight on Board". It is a shipping term used to indicate who is going to be responsible for the payment of transportation charges. The FOB terms express which party (vendor or retailer) will be liable for the transportation costs, the party that will be in control of the movement of the goods, and the date or time the title passes to the buyer. The freight hauler or delivery company such as DHL, FedEx, UPS, CONWAY etc. in most cases are not often involved in the payment of transportation cost. The FOB terms of sales may be “FOB delivered” or "FOB origin". The shipper will be responsible for all of the carrier’s costs if it is “FOB delivered” while if it is “FOB origin," then the title of the goods will be transferred to the buyers when they are shipped, and will incur all the transportation costs from the shipping location to the final destination (Hudson, 2020; Rodrigue,2020).

(ii) **Costs–Insurance–Freight (CIF)** – In this case, the seller delivers the goods on board the vessel or procures the goods already so delivered. The seller transfers the risk of loss of or damage to the goods when the goods are on board the vessel. The seller needs to arrange contract for and pay the costs and freight necessary to bring the goods to the designated port of destination. Also, the seller contracts for insurance cover against the buyer’s risk of loss of or damage to the goods during the carriage. The buyer should note that the seller is required to obtain insurance only on minimum cover. The cost-insurance-freight takes into consideration the price of the good, insurance costs and transport costs. There is uniform delivery price for all customers everywhere, with no spatially variable shipping price. This means the average shipping price is already built into the price of a good. Its cost structure can be expanded to incorporate several rate zones, such for the local, national and international zones (International Chamber of Commerce, ICC.2020; Rodrigue,2020).
(iii) **Terminal costs** – This costs structure relates to loading, transhipment and unloading. The two major terminal costs are: (i) loading and unloading costs that must be paid at the point of origin and destination, and (ii) intermediate or transhipment costs that can be avoided.
(iv) **Linehaul costs** – The costs structure in this case, are a function of the distance over which a unit of freight or passenger is carried. The weight of the goods is also a cost function when freight is involved and they commonly exclude transhipment costs. In other words, it can simply be defined as the costs of transporting goods over a route, which does not include the cost of loading or unloading (Rodrigue,2020; Mayhew, 2009).
(v) **Capital costs** – The costs apply to the physical assets of transportation, which are mainly those related to infrastructures, terminals and vehicles. This includes the purchase of fixed assets, which can often be a one-time event. There is need for capital investments for the maintenance of the physical assets which often depreciate over time.
There has been increase in the role of transport companies in development of transport sector in recent time. However, there has been changes in the nature of this role as a

result of the reduction in transport costs but growing infrastructure costs, due to greater flows and competition for land.

This has made it necessary for each transport sector to consider the variations in the importance of different transport costs, for instance, operating costs are high for air transport while terminal costs are significant for maritime transport. Also, there are technological changes and the associated decline in transport costs, which have weakened the links between transport modes and their terminals. This consequently, has resulted to less emphasis on industries and more importance given to manufacturing and transport services e.g. warehousing and distribution. There are new functions being added to transport activities which henceforth, facilitate logistics and manufacturing processes. This growth in the international trade has given rise to the development of specialized and intermediary firms providing transport services. These firms do not physically transport the goods, but help to facilitate the grouping, storage and handling of freight, processing the complex paperwork and financial and legal transactions that are needed in international trade. The firms include the freight forwarders, customs brokers, warehousing, insurance agents and banking, etc. (Rodrigue,2020).

Self-Assessment Exercise

Distinguish between Freight on Board and Cost-Insurance-Freight.

3.3 Meaning of Transport Rates

Transport Rates – This can be described as the price of transportation services paid by their users. It can also be defined as the negotiated monetary charge or price of moving a passenger or a unit of freight from a specific point of origin to a particular destination. They are often visible to the consumers; because there is need for the transport providers to give this information to secure transactions. The rates may not necessarily state the real transport costs.

There is usually the difference in the amount charged as costs and rates, which lead to either a loss or a deficit from the service provider. In public transit, rates are often fixed and a share of the total costs is subsidized by the government for the society. The goal is to make available to the people affordable mobility even if possible, at a recurring deficit. This is because public transit systems are rarely operated at a profit. The rates for freight transportation and many forms of passenger transportation (e.g. air transportation) are normally subject to a competitive pressure, which amount to the fact that the rate will be adjusted according to the demand and the supply. The rates either reflect the costs directly involved with shipping or cost-of-service or are determined by the value of the commodity or value-of-service (Rodrigue,2020).

Self-Assessment Exercise

What is Transport rate?

3.4 Factors affecting transport costs and rates.

The following are some of the most significant conditions affecting transport costs and rates:

(i) **Geography** – This factor is important according to the type of transportation mode used and the efficiency of the specific transport routes. There is usually higher transport cost in landlocked region than a plain terrain where the road is more accessible.
The effect of geography mainly involves distance and accessibility. The distance is the most basic condition which affect transport cost.
(ii) **Type of product** – There are different handling and packaging procedures for various products, for instance bulky or perishable products. This determines the ease at which some of the products can be transported, the easier it is to transport the product the lesser the cost of transportation and vice versa. There are some products that need to be stored or required the use of equipment before they can be transshipped. The cost of insurance for the movement of the goods and provision of amenities to ensure the comfortability of long-distance passengers are some of the factors that determine the different transport costs and rates.
(iii) **Economies of scale** – This factor is important when it comes to the quantity or units of goods that are been transshipped. The larger the quantities of good that are transported, the lower the unit cost. This means that bulk commodities such as energy (coal, oil), minerals and grains are likely to have lower unit transport costs if they are transported in large quantities. This is also applicable to the transshipment of larger containers, which is usually done at a lower unit cost.
(iv) **Energy** – Large amount of energy in forms of fuel are consumed by transport activities. The amount of fuel used by automobiles, vessels, railways, aero planes are substantial in terms of volume and price per usage. The fluctuation in the international price of fuels therefore, has effect on transport cost. This probably explains why there is usually changes in the cost of transportation and other associated costs.
(v) **Trade imbalances** – There is usually imbalances between imports and exports and this have impacts on transport costs. This means that if there is a negative trade balance, transport costs for imports will be higher than for exports. This is also applicable at the national and local levels where freight flows are often unidirectional, implying empty movements.
(vi) **Infrastructures** – This is in terms of the efficiency and capacity of transport modes and terminals, which has a direct impact on transport costs. There will be higher transport costs for poor infrastructures, delays and negative economic consequences and a developed transport system result to lower transport costs. Efficient transport systems are more reliable and can handle more movements.

(vii) **Mode** – The different modes of transportation are characterized by different transport costs. This is because each mode has its own capacity limitations and operational conditions. In situation where two or more modes are directly competing for the same market, this consequently, often results in lower transport costs.

(viii) **Competition and regulation** - This explains the complex competitive and regulatory
environment in which transportation takes place in developing countries. There is low cost of transport services in a highly competitive environment while there is high cost of transportation in limited competition such as oligopoly or monopoly. There are also, concentrations in many segments of the transport industry, namely maritime and air modes due to increase demand and international competition. This scenario led to more regulations, such as tariffs, cabotage laws, labour and safety which impose additional transport costs on international trade (Rodrigue, 2020).

Self-Assessment Exercise
What are the factors affecting Transport costs and rates?

4.0 Conclusion

Transport costs have significant effect on the economic structure of a region and at the same time play key roles in facilitating the flow of goods and services at the local, regional and international trade. This has made it imperative for the transport operators to increase the capacity of the transport mode used and cut down their running or operation cost. Transport operators and companies must therefore, engage in decisions that will ensure that the mobility of freight and passengers are coordinated at the minimal cost.

5.0 Summary

The unit briefly explores the meaning of what is transport costs and transport rates. It also discusses the various types of transport costs namely: capital, terminal, linehaul, freight on board and cost-insurance-freight. It was revealed that high transport cost can reduce trade flows. The unit ended with the appraisals of factors affecting transport costs and rates.

6.0 Tutor-Marked Assignment

(i) Distinguish between transport costs and rates.
(ii) Vividly discuss any five types of Transport costs.
(iii) Discuss the relevance of the various types of transport costs to the transport industry.
(iv) Write short notes on the following, in relation to transport costs:
    (a) capital cost
    (b) Linehaul cost
    (c) Terminal cost
(v) Outline the significant conditions that can affect transport costs and rates
(vi) How does competition and regulation affect transport costs and rates?
(vii) Mention the functions performed by specialized and intermediary firms in the transport industry.

(viii) “High transport costs can reduce trade flows” discuss this in relation to the major types of transport costs.
(ix) Discuss how geography, energy and the mode of transportation can affect transport costs and rates.
(x) Why may rates not necessarily be the real transport costs?

7.0 References/Further Readings

Business Dictionary (2020). Transport Costs. Accessed on 29th September, 2020. Available at: http://www.businessdictionary.com/definition/transportation-cost.html

Farlex Financial Dictionary (2012). Transportation Costs. Farlex Financial Dictionary © 2012 Farlex, Inc. Accessed on 29th September, 2020. Available at: https://financial-dictionary.thefreedictionary.com/Transport+Cost

Hudson, M. (2020). What Does Free or Freight on Board (FOB) Mean? Accessed on 29th September, 2020. Available at: https://www.thebalancesmb.com/retail-shipping-terms-fob-2890156#:~:text=The%20acronym%20FOB%2C%20which%20stands,transfers%20from%20seller%20to%20buyer.

International Chamber of Commerce (2020). "Incoterms 2010." Accessed Feb. 27, 2020. Available at: https://iccwbo.org/resources-for-business/incoterms-rules/incoterms-rules-2010/

Mayhew, S, (2009). A Dictionary of Geography (4th Ed). Oxford University Press, Print ISBN-13: 9780199231805

Rodrigue, J. (2020). The Geography of Transport Systems. Fifth Edition. New York: Routledge, 456 pages. ISBN 978-0-367-36463-2