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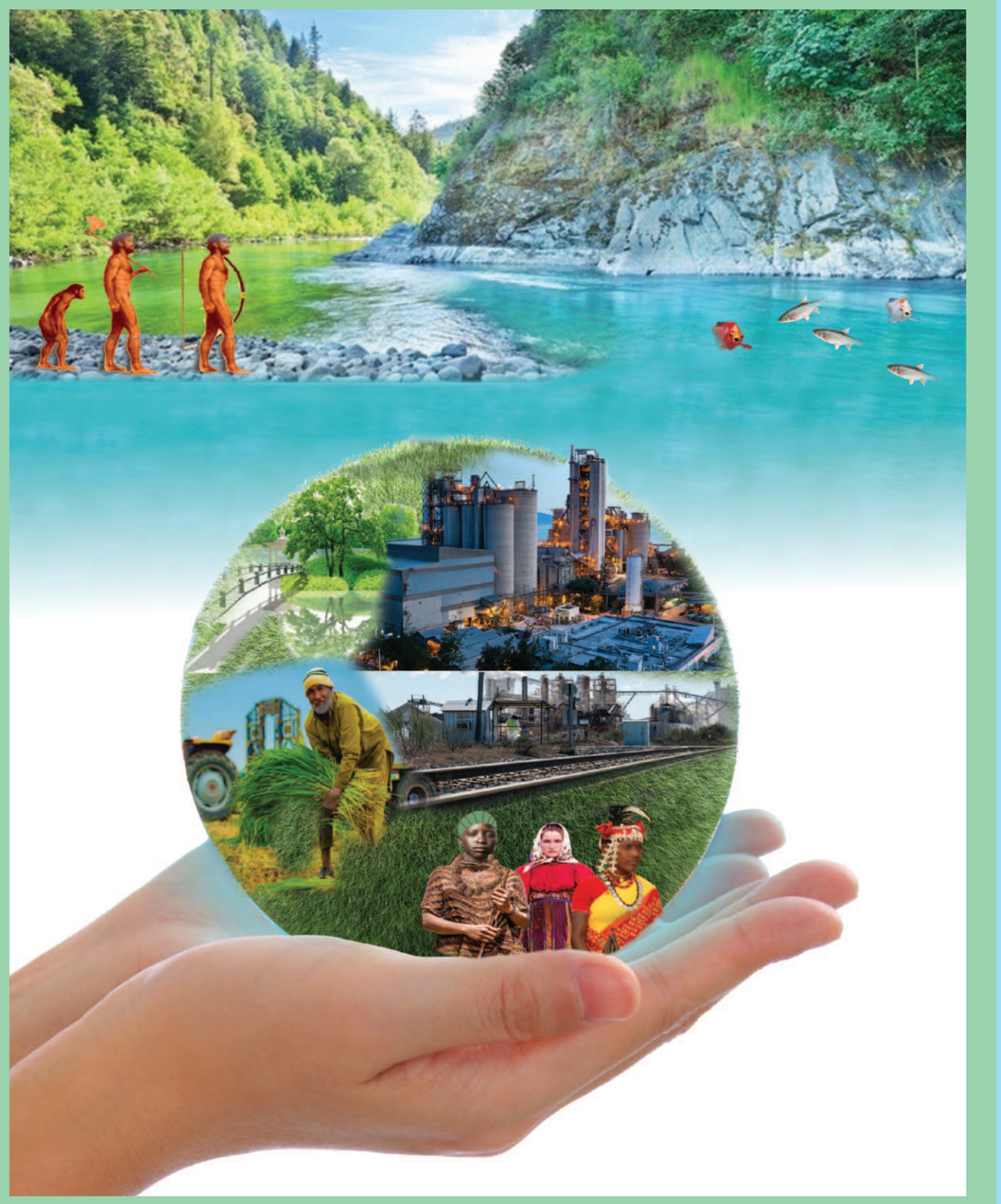
BANC-106
HUMAN ECOLOGY: BIOLOGICAL AND CULTURAL DIMENSIONS



BANC-106

HUMAN ECOLOGY: BIOLOGICAL AND CULTURAL DIMENSIONS

School of Social Sciences
Indira Gandhi National Open University

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BANC-106 HUMAN ECOLOGY: BIOLOGICAL AND CULTURAL DIMENSIONS

Course Introduction

Human ecology is the study of the interactions of humans with their environments. This course explores theoretical, methodological and applied issues in the study of human culture and social activity in relation to ecological systems and the environment. This course focuses on important human ecological relationships, through examining ecological principals and thinking (and their limitations), and the interrelationships of environments with cultures and ways of life. The course emphasizes both analyses framed in terms of Western understandings of environmental parameters, and local understandings of environment and environmental relations. The course also includes contemporary topics in human/ environment relationships with a focus on environmental sustainability.

Learning Outcomes

- To learn basic concepts, terminology and ideas found in the study of human ecology and anthropology;
- To develop a familiarity with relationships of human societies (pre and post industrial societies) and environments through understanding of human ecology, culture and adaptation;
- Describe different models and theories of human-environment relationship through time;
- Outline biological aspects of adaptation to various ecological zones and
- To develop effective knowledge of the relationships of economic activities and ecological relationships of human societies.

Course Presentation

The course has been divided into three blocks and a practical manual. Each block has been thematically arranged by eleven units. Let us discuss about each block in detail.

Block 1: The first block consist of four units will acquaint the learners with the basic understanding of the fundamentals of human ecology. In the first unit we will learn basic concepts of ecology. Second unit emphasize on understanding of human ecology. Third unit deals with the study of the relations among the population dynamics, social organization, and culture of human populations and the environments in which they live. The fourth unit discusses various methods of studying human ecology. Human ecology utilises various methods acquired from other classical disciplines that it synthesizes and incorporates. However, the methodology of human ecology is neither exclusively an analysis of individual objects nor synthesis of the problems

Block 2: The second block deals with the study of biological dimensions of human ecology. This block takes into account the human-resource relationships affect the human adaptation to diverse type of ecosystem such as desert, arctic, forest and others. In this block unit five describes different forms of adaptations and their applications to the humans to survive in various climatic conditions. The unit also explains the concept of habitat, ecosystem and ecology. Unit six

discusses the influence of environmental factors on human growth and development. Unit seven explains the relation between ecology and disease. Unit eight makes you understand the mechanisms of human adaptation to these environmental stresses. Human population has been exposed to a wide variety of different ecological stressors.

Block 3: The third block presents cultural dimensions of human ecology. The anthropological perspective of human ecology deals with the question "how man copes with his environment". Since human relations are not mainly biological therefore the development of culture context is necessary. Culture cannot be understood in isolation from the environment in which it evolved. In this block unit nine explores theoretical, methodological and applied issues in the study of human culture and social activity in relation to ecological systems and the environment. The unit ten deals with various modes of human adaptation in pre industrial societies. The unit eleven covers the cultural dimensions of each society and its dynamicity from one societal stage to another.

Practical Manual: For the anthropology learners it is very important to pursue research on human subjects. More specifically to conduct social research they should know the specialized procedures or methodology of research. This Practical manual would assist the learner how to prepare project synopsis, how to conduct fieldwork, data collection techniques, data analysis and report writing. The manual would guide the learners how to prepare whole project work.

Hope the course material act as a guide for you to achieve your goals. All the Best to all learners.

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BLOCK 1

FUNDAMENTALS OF HUMAN ECOLOGY

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UNIT 1 BASIC CONCEPTS OF ECOLOGY*

Contents

1.1 Introduction
1.2 Ecology
1.3 Scope of Ecology
1.4 Eco-sensitivity
1.5 Adaptations
1.6 Eco-sensitivity Adaptation
1.7 Acclimation
1.8 Acclimatization
1.9 Changes that occur during Acclimation and Acclimatization
1.10 Ecosystem
    1.10.1 Abiotic (non living) or Physical factors
    1.10.2 Biotic or living factors
1.11 Summary
1.12 References
1.13 Answers to Check Yours Progress

Learning Objectives

After going through this unit, you would be able to:

- understand what is Ecology and Scope of Ecology;
- describe the Eco-sensitivity Adaptation, Acclimation and Acclimatization; and
- know the important feature biotic and abiotic factors of ecosystem.

1.1 INTRODUCTION

The world in which we live consists of living organisms and non-living things. Often, the relationships between living and non-living things are clearly visible. Relationship between organisms and their environment are not only much complex but also interdependent, mutually reactive and interrelated. Ecology, deals with the various principles which govern such relationships between organisms and their environment (Sharma, 1996). In this unit we will learn basic concepts of ecology. Ecological concepts are general understandings (or facts) about ecosystems and ecosystem management.

1.2 ECOLOGY

In 1859, the French Zoologist, Isodore Geoffroy St. Hilaire (Encyclopaedia Universalis; 2010) had proposed the term ethnology for "The study of the relations of the organisms within the family and society in the aggregate and in the community". At about the same time the English naturalist, St. George Jackson Mivart coined the term hexicology, which he defined in 1894 as "devoted to the

* Contributed by Ajeet Jaiswal, Associate Professor, Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruarur

study of the relations which exist between the organisms and their environment as regards the nature of the locality they frequent, the temperatures and the amounts of light which suit them, and their relations to other organisms as enemies, rivals, or accidental and involuntary benefactors". The term ecology is made up of two Greek words, **oikos** (meaning 'house 'or 'dwelling place') and **logos** (meaning 'the study of') to denote such relationships between the organism and their environment. Thus, literally, ecology is the study of organisms 'at home'.

There is some controversy about the author who coined the term ecology and first used it in literature. For instance, Kormondy (1969) tried to give credit for the first use of the term ecology to Henry David Throreau on 1858 (Reiter, 1885; Macmillan, 1897). There are, however, references in literature in favour of German Biologist, H. Reiter also who is said to have used this term for the first time in 1868 (Reiter,1885; Macmillan,1897).

Although, there is uncertainty about the original coining of the term, there is consensus that the German biologist, Ernst Haeckel first gave substance to this term. Haeckel, although appears to have first used the term in 1886 (Sharma, 1996) and he regarded the ecology of an organism as "….the knowledge of the sum of the relations of organism to the surrounding outer world, to organic and inorganic conditions of existence…." Ecology as a distinct discipline grew out of natural history early in this century as natural historians began to collect their observations into a body of theory. In this process, vital was the work of Charles Darwin. Although his book on THE ORIGIN OF SPECIES was published in 1859, before the term was coined it contained many seeds that could grow to dominate modern ecology. Ecology has been defined in various ways by different authors. Warming (1905) who actually employed this science for the study of plants, defined oekology as "the study of organisms in relation to their environment". American ecologist Frederick Clements (1916) considered ecology to be "the science of the community," whereas British Ecologist Charles Elton (1927) defined ecology as "scientific natural history" concerned with the "sociology and economics of animals" (Chase and Leibold, 2003).

Woodbury (1954) treated ecology as "a science which investigates organisms in relation to their environment, and a philosophy in which the world of life is interpreted in terms of natural processes." Taylor (1936) defined ecology as "the science of all the relations of all organisms to their environments." Andrewartha (1961) and Krebs (1972) defined it as "the scientific approach to the study of environmental interactions which control the welfare of living things; regulating their distribution, abundance, reproduction and evolution." (Birch and Browning, 2011)

However, the recent development in the study of ecology has been the recognition of the fact that the biotic (living) and abiotic (non-living) components of nature are not only interrelated but both of these components function in an orderly manner as a definite system. Thus, structure and function should be studied together for fuller understanding of this vast nature.

In Haeckel's definition of ecology, he refers to the "surrounding outer world", which we now call the environment of an organism. His 'organic and inorganic conditions', we call biotic and abiotic environmental factors, respectively. Biotic factors are the other organisms, whether of the same or different species. Abiotic factors are the physical and chemical conditions such as temperature, moisture,

respiratory gases, and substrate. Odum (1963, 1969, 1977) with such an approach put forth a anew definition of ecology, and in his own (1969) words "as you know ecology is often defined as the study of interrelationships between organisms and environment". I feel that this conventional definition is not suitable; it is too vague and too broad. Personally, I prefer to define ecology as 'the study of the structure and function of ecosystems', or we might say in a less technical way 'the study of structure and function of nature'. With more or less similar concept, put about the triangle of nature, Mishra (1967) defined ecology as 'interaction of form, functions and factors.' These three interacting aspects i.e. form, function and factors integrate together to construct the triangle of nature. Krebs (1985) defined ecology in simple modern comprehensive way as 'ecology is the scientific study of the interactions that determine the distribution and abundance of organism.'

1.3 SCOPE OF ECOLOGY

Ecology is the science that need minimum time and labour for its introduction to a layman. Present day problems of varied nature in human life are directly or indirectly very much related to ecology, as their solution needs an ecological knowledge. These days ecology has been contributing very much to social, economic, political, and other similar policies of the world. It is so common to find references of ecology in social and economic writings, magazines, weeklies and daily news papers. There are interdependencies not only between ecology and biological areas of plant and animal sciences, but also between ecology and physical as well as social sciences.

Ecology indeed plays an important role in human welfare. This is primarily a field subject and modern ecology is concerned with the functional interdependencies between living things and their environment. Taylor (1936), in an attempt at define ecology, has very rightly pointed out the scope of ecology by stating that "ecology is the science of all the relations of all organisms to all their environments." Ecology plays an important role in agriculture (crop rotation, weed control etc.) management of grasslands (range management), forestry, biological surveys, pest control, fisher biology, and in the conservation of soil, wildlife, forest, water supplies, etc. the international problem of environmental pollution also needs ecological assistance (Sharma, 1996; Jaiswal, 2013).

In essence, ecologists seek to explain: life processes, interactions, interrelationships, behaviors, and adaptations of organisms, the movement of materials and energy through living communities, the successional development of ecosystems and, the abundance and distribution of organisms and biodiversity in the context of the environment (Jaiswal, 2013).

1.4 ECO-SENSITIVITY

Eco-sensitivity is related to rare of an organism or biological trait: influenced by a particular environment or habitat. It also discuss about Vulnerable to environmental damage or destruction; ecologically fragile. And also about Characterized by awareness of environmental issues; environmentally friendly. The concept of an ecologically sensitivity or eco-sensitivity is appealing but difficult. Consequently, eco-sensitivity is among the most widely used terms with no unequivocally accepted definition. In fact, eco-sensitivity is often

considered synonymous to: environmentally sensitive areas (Saxena, et.al, 2011; Hemkumara, 2009; MacDonald, 2000; Steiner, et.al, 2000; Capuzucca, and Hill, 2001), environmentally sensitive zones (Anon, 2008), ecologically sensitive ecosystem (Lin, 2006), ecologically sensitive sites etc., depending upon the context and the area or location of conservation interest. In most of these situations, the terms used are without any specific definition or with variable meanings (Gadgil et.al, 2011). For this reason, while it is possible only to list a set of criteria that characterise eco-sensitivity, all of them will not be applicable in all situations.

One such criterion is that eco-sensitivity is expected to have low levels of resilience, and hence is difficult to be recovered or restored if perturbed by external influences. Ecology Expert Panel, set up by the Ministry of Environment and Forests, Government of India, 2010, noted that, world over a number of features are being used for identifying ecologically sensitivity or eco-sensitivity in different contexts. In fact, several of these criteria refer more to the significance, either ecological or economic, than to the resilience of the locality (Gadgil et.al, 2011).

Given that the ultimate purpose of identifying ecologically sensitivity or eco-sensitivity is to promote environment-friendly management regimes and conservation of the ecological wealth of the sites, it is evidently necessary to consider features that define ecological and economic values, along with the resilience of the locality while identifying ecologically sensitivity or eco-sensitivity area. Therefore, following a country-wide consultation among experts and interested stakeholders, Ecologist has attempted to re-evaluate the concept of eco-sensitivity area, redefine it for the purpose at hand and develop a consensus protocol for scoring levels of ecological significance and sensitivity, leading eventually to a mapping of eco-sensitivity area (Jaiswal, 2017).

1.5 ADAPTATIONS

Adaptation refers to traits of an organism that increase its fitness to survive and reproduce. The environment is ever changing. It is the evolutionary process whereby an biotic organism becomes better able to live or survive in its habitat or habitats. In order to survive in the rigours of new circumstances, the organisms should either change accordingly or follow the path of extinction. Therefore, a succession of environmental changes is paralleled by the development of adaptive features, morphological and physiological including food and feeding habits, way of living, reproductive and defensive mechanisms and protection against bad weather etc ((Moran, 1979; Jaiswal, 2013, 2015).

1.6 ECO-SENSITIVITY ADAPTATION

Shifting weather patterns as a result of climate change, affecting rainfall and temperature, are likely to impact the ecosystem goods and services such as clean water and food on which people rely. Eco-sensitivity Adaptation or Ecosystem-based Adaptation, involving the conservation, sustainable management and restoration of ecosystems can help people adapt to the impacts of climate change (Moran, 1979).

Eco-sensitivity Adaptation or Ecosystem-based Adaptation is a nature-based solution that harnesses biodiversity and ecosystem services to reduce vulnerability and build resilience to climate change (Moran, 1979).

Check Your Progress

1) What is ecology?

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1.7 ACCLIMATION

Acclimation involves physiological, anatomical, or morphological adjustments within a single organism that improve performance or survival in response to environmental change. The extent of this acclimation is constrained by the genome of the individual. In turn, adaptation involves the acquisition or recombination of genetic traits that improve performance or survival over multiple generations.

Acclimation is the process by which an organism adjusts to a change in its environment .It generally refers to the ability of living things to adjust to changes in climate, and usually occurs in a short time of the change (Ford, 1982).

1.8 ACCLIMATIZATION

Acclimatization is the compensatory adjustment of organism to change in the environment, in nature or natural condition is known as acclimatization. Adjustment to seasonal changes in temperature comes under acclimatization.

Scientists distinguish between acclimation and acclimatization because the latter adjustment is made under natural conditions when the organism is subject to the full range of changing environmental factors. Acclimation, however, refers to a change in only one environmental factor under laboratory conditions.

Acclimatization usually involves a number of interacting physiological processes. For example, in acclimatizing to high altitudes, the first response of human beings is to increase their breathing rate. After about 40 hours, changes have occurred in the oxygen-carrying capacity of the blood, which makes it more efficient in extracting oxygen at high altitudes. As this occurs, the breathing rate returns to normal (Athalye, ý2015).

1.9 CHANGES THAT OCCUR DURING ACCLIMATION AND ACCLIMATIZATION

There are various changes that take place in Acclimation and Acclimatization that include physiological changes like glycolysis, electron transport cycle and Kreb's cycle.

In cold acclimation protein and enzyme secretion is more as compared to hot acclimation. All the changes during acclimation are not understood except the following –

Normally changes occur in –

- Protein and phospholipid synthesis and turnover.
- Synthesis of isozymes suitable for new environment.
- Modification of membrane lipids. Normally membrane lipids become unsaturated fats so that they remain fluid in cold condition.

Likewise animals show behavioural responses

Cold Acclimation: When birds or mammals are kept at low temperature in laboratory, initially their body temperature falls down but then they show rise in metabolic rate, rise in O2 consumption. This change is proportional to change in temperature.

As oxidation is faster, the food intake rises. The enzymes in liver, muscles and mitochondria rise. Glucose, pentose, fatty acid pathways are mobilised. They become faster. Adrenal and thyroid secretion rises. Most important is that the peripheral circulation rises to keep skin warm (Athalye, 2015).

Cold Acclimatization: This is a slow process and is seasonal. The change is prolonged and gradual and hence the compensatory changes are different. In nature when change occurs, the animal shows changes in thickness of fur coat. They reduce the peripheral circulation and both these prevent heat loss.

This is because in environment with approach of winter there is scarcity of food. It is found that the thickness of fur rises in large animals. In them, fat is mobilised and unsaturated fat gets deposited in joints and extremity so that the flexibility is maintained. Their Central Nervous System, tissue, nerves gradually gain resistance to stand the cold. Sensitivity of tissues is increased. There is higher sensitivity of the tissues to neurotransmitter or the transmitter substance. Along with these the animal shows behavioural changes in them (Athalye, 2015).

Check Your Progress

2) Define Acclimatization?

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1.10 ECOSYSTEM

Ecological studies are made at ecosystem level, which is considered as a recent development in ecology. An ecosystem is overall integration of whole mosaics of interacting organisms and their environment. It is normally an open system with a continuous, but variable, influx and loss of material energy. It is a basic functional unit with no limits of boundaries, consisting of both biotic and abiotic components interacting with each other, both necessary for maintenance of life on earth. Thus, an ecosystem represents highest level of ecological integration which is energy based and this functional unit is capable of energy transformations,

accumulation and circulation. Its main function in ecological sense is to emphasize obligatory relationships, interdependence and causal relations (Moran, 1979; Jaiswal, 2015).

An ecosystem is the whole biotic community in a given area along with its abiotic environment. It therefore includes the physical and chemical nature of the sediments, water and gases as well as all the organisms (Barrows, 1923).

The environment factors fall into two categories;

- Abiotic (non living) or Physical factors
- Biotic or living factors

1.10.1 ABIOTIC (Non Living) or Physical factors

The Physical environment includes medium and climate

A) Medium: there are four types of media in which the animal and plants live.

These are: 1. Soil; 2. Water; 3. Air; 4. the bodies of other organisms in case of parasites.

Soil- it is the upper part of the surface layers of the earth. It is formed by the weathering of underlying rocks in association with organic matter4 and with living organisms. Soil contains a variety of inorganic salts and organic compounds in addition to gravels, solid sills of stone, finely divided particles of mineral matter such as sands, silts or clays depending upon the texture. Micro-organisms, plants and burrowing animals are found abundantly in the soil. Bacteria are very useful and the most numerous inhabitant of the soil.

Water- it covers 73% of the earth's surface and provides the most extensive medium for a majority of the animals. It constitutes the major portion of the protoplasm and is a primary controlling factor of the organisms.

Air- Air forms the atmosphere of the earth. It consists mainly of oxygen (20%), nitrogen (79%) and carbon dioxide (0.3%). water and minute traces of inert gases (He, Ne, Kr and Ar) are also present in the atmosphere. Organic matter, dust and micro-organism are also held in suspension. Except the inert gases all the main components of air serve as raw materials and each plays an important role in the life of organisms.

The bodies of other organisms- Certain organisms live as parasites or in the body of other organisms. They derive their nourishment from the body of host without causing its death. The parasites undergo various morphological, anatomical and physiological modifications to suit the conditions of the host.

B. Climate: It is the average of the atmosphere over a given area. The main climatic factors are temperature, humidity, light, wind, rainfall and snow.

C. Chemicals factors: Besides physical factors of the environment certain chemical factors are also of ecological importance. These are gases like oxygen, carbon dioxide, hydrogen, ion concentration, hydrogen sulphide and nutrients etc.

1.10.2 BIOTIC or Living Factors

The living or biotic factors, deals with the interaction among different organism of the same or different species. The interaction among the individuals of the same species is known as intraspecific relationship. This relationship among the members of the same species is for reproduction, assistance and competition for food and space (Levin, 1998).

The interaction among the individuals of different species is known as interspecific relationship. Such relationship may be beneficial or harmful to both the individuals, beneficial to one and harmful to the other or neutral in respect to the other.

The interspecific relationships are of two types. **1) Symbiosis** and **2) Antagonism**. In symbiosis one or both the partners are benefitted, while in antagonism at least one of the species is harmed. Symbiotic relations are divided into two categories- **i) Mutualism and ii) Commensalism**. In mutualism both the partners are benefitted while in commensalism only one of the partners is befitted.

Check Your Progress

3) What do you mean ecosystem?

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1.11 SUMMARY

Ecology, relatively a new science, deals with the various principles which govern such relationships between organisms and their environment. Ecology is the study of organisms 'at home' Ecology is the science that need minimum time and labour for its introduction to a layman. Ecology indeed plays an important role in human welfare. The concept of an ecologically sensitivity or eco-sensitivity is appealing but difficult. The environment is ever changing. In order to survive in the rigours of new circumstances, the organisms should either change accordingly or follow the path of extinction. Eco-sensitivity Adaptation or Ecosystem-based Adaptation, involving the conservation, sustainable management and restoration of ecosystems can help people adapt to the impacts of climate change. Acclimation involves physiological, anatomical, or morphological adjustments within a single organism that improve performance or survival in response to environmental change. Acclimatization is the compensatory adjustment of organism to change in the environment, in nature or natural condition. Ecological studies are made at ecosystem level development in ecology. The Abiotic (non living) includes medium and climate. The living or biotic factors, deals with the interaction among different organism of the same or different species.

1.12 REFERENCES

Andrewartha, H.G. (1961). The Distribution and Abundance of Animals. Chicago: University of Chicago Press.

Anon. P. (2008). Environmentally Sensitive Zones ESZ. Maharashtra Pollution Control Board MPCB, 2008; www.mpcb.gov.on

Athalye, R.P. ý(2015). Acclimation and Acclimatization.

http://dspace.vpmthane.org:8080/jspui/handle/123456789/4750

Encyclopaedia Universalis. (2010). Histoire de l'éthologie,11-15.

http://dspace.vpmthane.org:8080/jspui/bitstream/123456789/4750/1/Acclimation%20and%20acclimatization.pdf

Barrows H. H. (1923). Geography as Human Ecology. Annals of the Association of American Geographers. 1-14.

Birch L. C. and Browning T. O. Herbert George Andrewartha 1907–1992 Archived 2 March 2011 at the Wayback Machine, Biographical Memoirs, Historical Records of Australian Science, vol.9, no.3, 1993. 259–268

Capuzucca, J., Federal Hill. (2001). An Extraordinarily Environmentally Sensitive and Historically Significant Area. Executive Summary, August 2001; www.graphicwitness.com

Chase, J.M. and M.A. Leibold. (2003). Ecological Niches. Chicago: University of Chicago Press.

Clement, F.E. (1916). Plant Succession. Washington, D.C.: Publications of the Carnegic Institute, Reprint 1928. 242-247.

Darwin, C. (1859). The Origin of Species by means of Natural Selection. Reprint, 1998, New York:Modern Library.

Elton, C.S. (1927). Animal Ecology. London: Sidgwick and Jackson. 11-19.

Emilio F. Moran. (1979). Human Adaptability: An Introduction to Ecological Anthropology. Duxbury Press, 104-121.

Ford, M. J. (1982). The Changing Climate: Responses of the Natural Fauna and Flora. Boston: G. Allen and Unwin.

Gadgil Madhav, R. J. Ranjit Daniels, K. N. Ganeshaiah, S. Narendra Prasad, M. S. R. Murthy,C. S. Jha, B. R. Ramesh and K. A. Subramanian. (2011). Mapping ecologically sensitive, significant and salient areas of Western Ghats: proposed protocols and methodology Current science, 100: 2, 175-182.

Gadgil, M. and Meher-Homji, V. M. (1986). Role of protected areas in conservation. In Conservation of Productive Agriculture (eds Chopra,V. L. and Khoshoo, T. N.), Indian Council of Agricultural Research,New Delhi, 1986, . 143–159.

Hemkumara, G. P. T. S. (2009). GIS based analysis on environmental sensitive areas and identification of the potential disaster hazardous locations in southern Sri Lanka. Int. J. Civil Environ. Eng., 2009, 9, 311–315.

Henry David Throreau. (1858). The Journal of Henry David Thoreau. Journal Thoreau's Journals

IUCN International Union for Conservation of Nature. (2017). ISSUES Brief: International Union for Conservation of Nature. Gland Switzerland. 1-3.

Jaiswal, A. (2013). Human Origin and Variation: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Human Genetics and Applied Biophysical Anthropology: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Glossary of Biophysical Anthropology Terms: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2017). Ecosystem and eco-sensitivity: Human Ecology PG e-Pathsala, (An Ministry of Human Resource Development Project under its National Mission on Education through ICT (NME-ICT).

Krebs, C.J. (1972). A Review of the Chitty Hypothesis of Population regulation. Canadian Journal of Zoology. 56: 2463-2480.

Krebs, C.J. (1972). *Ecology: The Experimental Analysis of Distribution and Abundance*. BIOS, 56, No. 4: 236-238.

Kormondy, E.J. (1969). Concept of Ecology. Englewood Cliffs, N.J. : Prentice Hall. 11-15.

Lin, M. (2006). Changing landscapes: monitoring ecologically sensitive ecosystems in a dynamic semi-arid landscape using satellite imagery: a case study in Ejin Oasis, Western China. In Agriculture and Hydrology Applications of Remote Sensing (eds Kuligowski, R. and Parihar, J. S.).

Levin Simon A. (1998). Ecosystems and the Biosphere as Complex Adaptive Systems, Ecosystem Springler, Verlag

MacDonald, A. (2000). Assessment of risk and identification of environmentally sensitive areas. In Interspill Marseille Conference and Exhibition, 2000; www.interspill.com.

Misra, S.B. (1967). "Late Precambrian fossils from southeastern Newfoundland". Geological Society of America Bulletin. 80 (11): 2133–2140.

Mivart, St. George. (1894). Difficulties of the Theory of Natural Selection". The Month. XI. 35–53.

Moran, Emilio F. (1979. Human Adaptability: An Introduction to Ecological Anthropology. Boulder,Colorado: Westview Press.

Odum, E. P. (1963). Primary and Secondary energy flow in relation to ecosystem structure. Washington, D.C.: Proceedings of the Sixteenth International Congress of Zoology. 336-338.

Odum, E. P. (1969). The Strategy of Ecosystem Development. Science 164:242-270.

Odum, E. P. (1977). The Emergence of Ecosystem of Ecology as a new Integrative Discipline. Science 195: 1289-1293.

Saxena, M. R., Kumar, R., Saxena, P. R., Nagaraja, R. and Jayanthi, S. C. (2007). Remote sensing and GIS based approach for environmental sensitivity studies. A case study from Indian Coast. International Society for Photogrammetry and Remote Sensing, 2007; www.ispres.org

Sharma, P.D. (1996). Ecology and Environment, Seventh edition. Rastogi Publication, 220-266.

Steiner, F., Blair, J., McSherry, L., Guhathakurtha, S., Marruffo, J. and Holm, M., (2000). A watershed at watershed: the potential for environmentally sensitive area protection in the upper San Pedro Drainage Basic (Mexico and USA). Landsc. Urban Plann., 2000,49, 129–148.

Taylor, W. P. (1936). What is Ecology and What Good is It? Ecology: Ecological Society of America. 111-128.

Woodbury Angus M. (1954). *Principles of General Ecology*. Blakiston, New York, viii: 503.

1.13 ANSWERS TO CHECK PROGRESS

1) Ecology, relatively a new science, deals with the various principles which govern such relationships between organisms and their environment.

2) Acclimatization is the compensatory adjustment of organism to change in the environment, in nature or natural condition is known as acclimatization. Adjustment to seasonal changes in temperature comes under acclimatization.

3) An ecosystem is overall integration of whole mosaics of interacting organisms and their environment. It is normally an open system with a continuous, but variable, influx and loss of material energy. It is a basic functional unit with no limits of boundaries, consisting of both biotic and abiotic components interacting with each other, both necessary for maintenance of life on earth.

UNIT 2 UNDERSTANDING HUMAN ECOLOGY*

Contents

2.1 Introduction

2.2 Human ecology

2.3 Definition and Interpretations:

- 2.3.1 Autecology and Synecology
- 2.3.2 Ecosystem
- 2.3.3 Principal Steps and Components of an Ecosystem
- 2.3.4 Functional point of view of ecosystem
- 2.3.4 Structural point of view of ecosystem

2.4 Relation to Other Sciences

2.5 Scope of Human Ecology

2.6 Summary

2.7 References

2.8 Answers to Check Your Progress

Learning Objectives

After going through this unit, you would be able to:

- Understand what is Human Ecology and Scope of Human Ecology;
- Describe the Relation of Human Ecology to the Traditional Academic Disciplines; and
- Also able to know the important feature of ecosystem.

2.1 INTRODUCTION

Anthropology is, by its very nature and tradition, a kind of multidisciplinary science. Living organisms are inseparably related with their physical and biological surroundings. This inter-relationship of organisms with their physical and biotic environment is studied under a separate discipline of science, which is known as environmental ecology or ecology.

Ecology has been variously defined by several workers, Ernst Hackel (1869) who is said to coin the word oekologie, has given the following definition: “It is relation of animal to its organic (living) as well as its inorganic (non- living) environment, particularly its friendly or hostile relations to those animals or plants with which it comes into contact” (Jaiswal, 2017).

Ecology has also been defined as “the scientific natural history” by Charles Elton (1927) “the study of biotic communities” or “the science of communities and populations”. The most popular and most comprehensive definition of ecology is “the study of animals and plants in their relations to each other and to their environment”.

* Contributed by Ajeet Jaiswal, Associate Professor, Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruarur

2.2 HUMAN ECOLOGY

Human ecology is the study of the interactions of humans with their environments, or the study of the distribution and abundance of humans. Human ecology is an approach to the study of human behavior marked by two commitments. First, human ecologists think that humans should be studied living systems operating in complex environments. The human sciences are balkanized into several social sciences, humanistic, and human biological disciplines. Ecologists are used to thinking that systemic nature of individual organisms and populations of organisms mean that we typically have to understand how diverse parts of the system operate together to produce behavior. The traditional human science disciplines take people apart; human ecologists endeavor to put us back together. Breaking complex problems down to operationally tractable parts is a great strategy, but only so long as some are committed to putting them back together in the end (Cohen, 1968)

Second, human ecologists think that humans are subject to very similar ecological and evolutionary processes as any other species. Of course, humans are unique, and this fact has important consequences. However, we think that the deep rifts between human biologists and social scientists (and between scientists and humanists for that matter) are a deeply embarrassing scandal that honest scholars are obligated to repair as expeditiously as possible (Richerson and McEvoy, 1976).

2.3 DEFINITION AND INTERPRETATIONS

The word ecology has been derived from the Greek words oikos meaning habitation or home and logos meaning discourse or study (Richerson and McEvoy, 1976). It therefore, implies a study of the habitations of organisms. The term was introduced by Retter in 1868 but it was properly defined by Ernst Hackel that is why he is falsely credited for coining this term (Richerson and McEvoy, 1976, Jaiswal, 2017).

Ecology may be studied with particular references to animals or plants, hence animal ecology and plant ecology. Animal ecology however cannot be properly understood without a considerable knowledge of plant ecology. Therefore, animals and plants are given equal emphasis and the term bioecology is often used. Irrespective of animals or plants under study. Now a days two main subdivisions of ecology are recognized viz. autecology and synecology (Sharma, 1996; Jaiswal, 2013).

Check Your Progress

1) Who coined the word oekologie?

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2.3.1 Autecology And Synecology

i) **Autecology: Autecology** is the study of inter-relationships of the organisms of a species to biotic or abiotic environment. It is also known as species ecology. Autecology deals with nutrition, growth, reproduction, development and life history of the individuals of the individuals of a species in a given environment (Berry, 1976).

ii) **Synecology:** Synecology is the study of inter-relationship of different groups of the organisms living such as populations, biotic communities and ecosystems and their environment, which are associated together as a unit. It can be differentiated into population ecology, community and ecosystem ecology or the ecology of population, ecology of community and ecology of habitat (Berry, 1976).

2.3.2 Ecosystem

The term ecosystem was proposed by a British ecologist A.G.Tansley in the year 1935. The ecosystem represents the basic functional unit of ecology which comprises of the biotic communities mutually related with their abiotic environment. Thus a biotic community and its abiotic environment together represent in ecosystem (Sharma, 1996; Jaiswal, 2017).

Odum has defined "Ecosystem as the basic fundamental unit of ecology which includes both the organisms and the nonliving environment, each influencing the properties of the other and each is necessary for the maintenance of life." (Vadya, 1969; Jaiswal, 2013)

Mathavan (1974) has given another definition of ecosystem according to which "Ecosystem is the sum total of living organisms, the environment and the process of interaction between the various components of the system" (Sharma, 1996; Jaiswal, 2017).

The concept of ecosystem can be best illustrated by the fact that holozoic animals cannot synthesize their food and depend upon plants either directly or indirectly, Even plants which are capable of synthesizing their own food depend upon the abiotic environment from which they receive light, water, carbon dioxide and mineral salts, other inorganic and organic substances of absolute necessity for the synthesis of food. The organic substances and some of the inorganic compounds are accumulated in the soil by the dead decaying organisms and the excreta of living individuals.

2.3.3 Principal Steps and Components of an Ecosystem

The principal steps in the operation of an ecosystem are

i) Reception of energy

ii) Manufacture of organic food by producers

iii) Consumption of organic material by consumers

iv) Decomposition into organic compounds and

v) Transformation of these compounds into suitable compounds for the nutrition of the producers.

In the operation of an ecosystem these steps not only involve the production growth and death of the living components but also influence the non-living environment of the habitat (Orlove, 1980).

2.3.4 Functional Point of View of Ecosystem

From a purely functional point of view Odum has divided ecosystem into two components:

a) **Autotrophic component:** It consists of green plants which bring about the fixation of solar energy (sunlight) and the synthesis of organic compounds (carbohydrates from simple inorganic substances).

b) Heterotrophic component: It consists of the decomposers (micro-organisms such as bacteria and fungi) which are concerned with the utilization, rearrangement and degradation of complex food substances (Orlove, 1980).

1.3.5 Structural Point of View of Ecosystem

But from structural point of view, the ecosystem has been divided into four components:

a) Abiotic substances

b) Producers

c) Consumers

d) Decomposers

a) **Abiotic components:** The non living or abiotic substances of an ecosystem includes basic inorganic materials such as water, carbon dioxide, oxygen, nitrogen, calcium, phosphate etc. And their compounds such as nitrates, carbonates, phosphates etc. These occur either free in nature or in the form of compounds dissolved in water in the soil. Some of them are recycled by the action of micro-organisms on the dead bodies of plants and animals.

b) **Producers:** These are autotrophic members of the ecosystem (the green plants) which are capable of synthesizing food from the non living components. In an ecosystem the producers may be represented by the small microscopic plants (the phytoplankton) and algae or the rooted or the large floating plants generally growing in shallow water only. The phytoplanktons are distributed throughout the pond as deep as light could penetrate the water. These are found in all waters. But the large sized are of different ecosystems. The grasses are found in the grassland, trees in forests, floating plants in pond water and lakes.

c) **Consumers:** These are heterotrophic organisms which are also called as macro consumers or phagotrophs. They consume the producers directly or indirectly.

The herbivores are the primary consumers in the ecosystem. They solely feed upon vegetation or plants. A deer or rabbit is a primary consumer in a forest and a rat in the gardens.

d) **Decomposers:** The micro organisms (bacteria and moulds) are decomposers of the ecosystem. They feed upon dead decaying living organisms (both

plants and animals) and break them into simpler compounds. They are released free in the atmosphere and are utilized by the producers for the synthesis of their food material.

Clarke has recognised a fifth category in the ecosystem which is composed of transformers. These act upon the decomposed substances and transform them into different forms of inorganic and organic substances (Clarke, 2015).

Check Your Progress

2) What is human ecology?

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2.4 RELATION TO OTHER SCIENCES

Human Ecology is one of the three main subdivisions of biological anthropology; the other two being morphology and physiology. Morphology deals with the structure of organisms and physiology with their function. To understand fully the structure of an organ, one needs to know how it functions, and the way it functions is clearly related to environmental conditions. The morphologist is concerned with problems of anatomy, histology, cytology, embryology, evolution and genetics and the physiologist with interpreting functions in terms of chemistry, physics and mathematics; while the ecologist with the distribution and behaviors of organisms, their populations and communities. The evolution of adaptations and of species is of mutual interest to the ecologist and to the geneticist: bioclimatology is a connecting link between ecology and physiology. In fact, all areas are simply different approaches to an understanding of the meaning of life (Sharma, 1996; Jaiswal, 2017).

It is natural to think, and very often asked whether ecology is a science or an art, before we think over the issue, we must attempt first to explain what we mean by science and art. Art is doing, science is understanding. For instance, a painter who paints beautiful picture is an artist. This is doing, without understanding anything of the physics and chemistry of action of the pigments and oils being used in painting.

On the other hand, the scientist aims to understand the glycerides in oils, their chemistry, the degree of unsaturation in the molecules etc. He does not paint the picture that the artist does. The information gathered through understanding of various principles that govern the function of nature (the science of ecology) is then applied in the welfare of mankind that becomes the art of human ecology.

Although, it may appear quite surprising as how can we harmonize in one profession both, a science and an art, but it is true, and ecology, like some other science, have both, its science as well as its art. Indeed, science and art go together, and are studied best together. Advancement in art depends on science, as more we shall learn and understand, newer the art would be. And it would be almost

futile to investigate science unless it is applied in the development of art. Moreover, it would also be not incorrect to say that art inspires science to investigate more. For instance, if a scientist looks at any picture, he might think as how it can be made more attractive by advancement in the chemistry of pigments etc. The art of ecology developed first, which may be traced back to the period of prehistoric man. The science of ecology, like all phases of learning, developed gradually. But at present, we know much of the science of ecology, and it has helped us in the development of its art, as conservation of nature and natural resources, solution of pollution problems, etc. (Young, 1974; Sharma, 1996).

As Regards the relation of ecology to other life sciences, we should know first various divisions of biology. Biology, the science of life has its basic divisions such as morphology, ecology, genetics, evolution, molecular biology and developmental biology. These are basic divisions because they are considered with fundamentals common to all forms of life. The various forms of living organisms are the taxonomic divisions of biology which deal with the morphology, physiology, ecology of specific kinds of organisms.

The three large taxonomic divisions of biology as botany (plants), zoology (animals) and microbiology (microorganisms) other taxonomic divisions are smaller as they deal with limited group of organisms. These are mycology (fungi), phycology (algae), entomology (insects), protozoology. Thus ecology is a basic division of biology and as such is also an integral part of any and all the taxonomic divisions. Biology attempts to define and explain patterns within and among between organisms at each of the following hierarchy of levels of organisation:

Level of organisation	**Basic division of biology**
Organic molecules	Biochemistry
Subcellular organellesCells	Cell Biology
Tissues	Histology
OrgansOrgan systemsOrganisms	Anatomy, Physiology
PopulationsCommunitiesEcosystems	Ecology

Each level of organisation has properties peculiar to it that are not identifiable at the level below. But studies at higher levels must take account of the lower levels. For example, a random collection of tissues-say blood, muscle and connective tissue - do not make a heart. These tissues must interact in particular ways to form that organ. Similarly, a community may be coherent unit (albeit much less tightly organized than a heart), which can be understood only by a consideration of the constituent populations and their interactions. The ecological levels of organisation are somewhat distinct from one another because of the type of questions that are posed by ecologists, or rather what we actually emphasize at each level. Each ecological level and examples of the questions posed each level and the approaches used to answer them are then described (Sharma, 1996; Jaiswal, 2017). A population population is a number of all the organisms of the same group or species who live in a particular geographical area and are capable of interbreeding.

Check Your Progress

3) What are the three large taxonomy of biology?

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A community is a social unit or a group of living things with commonality such as values, norms, customs, or religion. It may include all the populations in that area - all plants, all animals, and microorganisms - or may be defined more narrowly as a particular group such as the fern community, or the seed-eating bird community of that area. A major concern of community ecologists is the question, "Why is this community of a particular diversity'? Diversity is a combination of the number of species and the number of individuals of each species in a community. Another important question is, "Why does a particular community occur at a given location?" Answers are sought in the influences of the abiotic environment, how communities interact, and how communities change through time. From evolutionary biology view point communities are much looser assemblages than are populations and thus answers to problems at community level must be sought among the evolutionary histories of the constituent populations (Moran, 1979; Sharma, 1996).

An ecosystem is the whole biotic community in a given area plus its abiotic environment. It therefore includes the physical and chemical nature of the sediments, water and gases as well as all the organisms. Ecosystem ecology emphasizes the movements of energy and nutrients (chemical elements) among the biotic and abiotic components of ecosystems. A major concern is, "How much and what rates are energy and nutrients being stored and transferred between components of a given ecosystem?" Because the ecosystem is the highest level of biological organisation, all ecological concepts can be set within its framework. The biotic components of any ecosystem are linked as food chains. Food chains are interlinked to form complex food webs. Food webs are the basic unit of ecosystem ecology. Thus ecology begins with populations and culminates in ecosystem.

Food webs are basic units since it is around them that energy and nutrient transfers take place. In Addition to the organisms, there are also exchanges with the abiotic environment. Figure I shows the basic patterns of energy and nutrient transfers in a generalized ecosystem. The patterns of energy and nutrient movements differ significantly in their relationship with the abiotic environment and with the ecosystem boundary. Energy flows through ecosystems, being acquired from outside as light energy from the sun and being intimately lost from the ecosystem as heat dissipated by the respiration of all community members. Nutrients are cycled within ecosystems to a much greater extent.

Is there any relation of ecology with physical sciences, like physics, chemistry, mathematics, and statistics? It is evident that physical sciences, contributing very much to ecology, particularly in the study of population communities, ecosystems.

Physical sciences, these days, are contributing not only to ecology, but to other life sciences also, and it has become very common to find the statements like life sciences are becoming oriented to physical sciences", and physical sciences, now changing their field, and becoming oriented to life sciences". However, it would be proper to conclude that all sciences, physical as well as biological, are pouring at a common pool- the ecology". This interdisciplinary approach may prove to be very fruitful indeed for the solution of many problems ahead. In this way ecology is of all, and all are of ecology, and this provides an opportunity to persons of diverse fields to sit together around a common table and discuss mutual problems in order to secure fuller understanding of nature that would certainly help in the conservation of nature and natural resources and to boost agricultural production. Such mutual discussion should be of much help in the development of the modern art of ecology (Sharma, 1996; Jaiswal, 2017).

Source: Relation of Human Ecology to the Traditional Academic Disciplines (Sharma, 1996; Jaiswal, 2013).

2.5 SCOPE OF HUMAN ECOLOGY

Human societies can often be understood very clearly from an ecological perspective as we study, for example, the population dynamics (demography) of our own species, the food and fossil energy flowing through our society. Humans appear to be changing aspects of the global environment in many ways. Thus, human ecology can be very useful to help us understand what these changes are, what the implications might be for various ecosystems, and how we might intervene in either human economies or in nature to try to mitigate or otherwise alter these changes. There are many professional ecologists, who believe that these apparent changes from human activities have the potential to generate enormous harm to both natural ecosystems and human economies. Understanding, predicting and adapting to these issues could be the most important of all possible issue for humans to deal with. In this case ecology and environmentalism can be the same (Kaur, 2019)

Man is as much a part of environment as any other animal. The problems of varied nature, whether socioeconomic, political or similar other policies are all in some way correlated with ecology. For example, production of grains, livestock,

timber, fiber, fish, flower, control of pest species, conservation of wild life etc. are all basically ecological problems. Ecology plays an important role in agriculture. The problems of crop rotation, weed control, management of grassland, forestry and biological surveys are nicely solved under ecology. The problems and effects of disposal of wastes, pollution of air, water and land, deterioration of habitat, productivity and contamination of sea, radioactive pollution (Sharma, 1996; Jaiswal, 2013).

2.6 SUMMARY

Anthropology is, by its very nature and tradition, a kind of multidisciplinary science. Ecology has been variously defined by several workers. Hackel who is said to coin the word oekologie. Ecology has also been defined as "the scientific natural history" by Charles Elton (1927). Human ecology is the study of the interactions of humans with their environments, or the study of the distribution and abundance of humans. Human ecology is an approach to the study of human behavior marked by two commitments. The word ecology has been derived from the Greek words oikos meaning habitation or home and logos meaning discourse or study. Ecology may be studied with particular references to animals or plants, hence animal ecology and plant ecology. Autecology is the study of inter-relationships of the organisms of a species to biotic or abiotic environment. Synecology is the study of inter-relationship of different groups of the organisms. The term ecosystem was proposed by a British ecologist A.G.Tansley 1935. Odum has defined "Ecosystem as the basic fundamental unit of ecology. The concept of ecosystem can be best illustrated by the fact that holozoic animals cannot synthesize their food. From a purely functional point of view Odum has divided ecosystem into two components, from structural point of view, the ecosystem has been divided into four components. The herbivores are the primary consumers in the ecosystem. Clarke has recognised a fifth category in the ecosystem which is composed of transformers. Human Ecology is one of the three main subdivisions of biological anthropology. Ecology is a basic division of biology. A population population is a number of all the organisms of the same group or species who live in a particular geographical area and are capable of interbreeding. A community is a social unit or a group of living things with commonality such as values, norms, customs, or religion. An ecosystem is the whole biotic community in a given area plus its abiotic environment. Food webs are basic units since it is around them that energy and nutrient transfers take place. Man is as much a part of environment as any other animal

2.7 REFERENCES

Berry, J.W. (1976). Human Ecology and Cognitive Style: Comparative Studies in Cultural and Psychological Style. New York: John Wiley. See also the Journal of Cross-cultural Psychology.

Clark, G.F., Raymond, B., Riddle, M.J., Stark, J.S. and Johnston, E.L. (2015). 'Vulnerability of Antarctic shallow invertebrate-dominated ecosystems'. Austral Ecology 40:482– 491.

Cohen, Y.I. (ed.) (1968). Man in Adaptation. (Two Volumes). Chicago: Aldine.

Elton C. S. (1927). Animal Ecology. London: Sidgwick and Jackson. 12-22.

Hackel, E. (1869). History of Ecological Sciences, Part 47: Ernst Haeckel's Ecology. Bulletin, Ecological Society of America. 5:353-370.

Jaiswal, A. (2013). Human Genetics and Applied Biophysical Anthropology: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Glossary of Biophysical Anthropology Terms: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2017). The distinctive interdisciplinary nature of ecological anthropology: Human Ecology PG e-Pathsala, (An Ministry of Human Resource Development Project under its National Mission on Education through ICT (NME-ICT).

Jaiswal, A. (2017). Concept of human ecology: Human Ecology PG e-Pathsala, (An Ministry of Human Resource Development Project under its National Mission on Education through ICT (NME-ICT).

Kaur S. (2019). Ecology: Definition, Scope and Relationship with other sciences.

Mathavan, S. (1974). Ecophysiological studies in chosen insects (Odonata: Anisoptera). Ph. D. thesis, Madurai University, Madurai.

Moran, E.F. (1979). Human Adaptability: An introduction to ecological anthropology. North

Scituate, Mass.: Duxbury Press. Emphasizes the ecosystem concept as an organizing principle. Early historical chapters excellent.

Odum, E. P. (1963). Primary and Secondary energy flow in relation to ecosystem structure. Washington, D.C.: Proceedings of the Sixteenth International Congress of Zoology. 336-338.

Orlove, B.S. (1980). Ecological anthropology. Ann. Rev. Anthropol. 9:235-73. Good modern review.

Richerson Peter J. and McEvoy James. (1976). Human Ecology: An Environmental Approach. Duxbury Press, 22-38.

Reiter Hanns. (1868). "Evolution into ecology? The strategy of Warming's ecological plant geography". Journal of the History of Biology. 19 (2): 181–196

Sharma, P.D. (1996). Ecology and Environment, Seventh edition. Rastogi Publication, 220-266.

Tansley, A.G. (1935). The Use And Abuse Of Vegetational Concepts And Terms. Ecology 16:284-307.

Vayda, A.P. (ed.) (1969). Environment and Cultural Behavior. Garden City NY: The Natural History Press.

Young, G. (1974). Human ecology as an interdisciplinary concept: a critical inquiry. Advances in Ecological Research 8: 8-105.

2.8 ANSWERS TO CHECK YOUR PROGRESS

1. Ernst Hackel (1869) who is said to coin the word oekologie
2. Human ecology is the study of the interactions of humans with their environments, or the study of the distribution and abundance of humans.

3) The three large taxonomic divisions of biology as botany (plants), zoology (animals) and microbiology (microorganisms) other taxonomic divisions are smaller as they deal with limited group of organisms.

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UNIT 3 ANTHROPOLOGY AND HUMAN ECOLOGY*

Contents

3.1 Introduction
3.2 Concept of Human Ecology in Anthropology
3.3 Basic Concepts Ecology
3.4 Cultural Ecology
3.5 Cultural Ecology and Anthropology
3.6 Ecological Approaches in Anthropology
3.7 Summary
3.8 References
3.9 Answers to Check Your Progress

Learning Objectives

After going through this unit, you would be able to:

- Understand the Concept of Human Ecology in Anthropology;
- Describe the Cultural Ecology and Anthropology; and
- Also able to know the important feature of Human ecology.

3.1 INTRODUCTION

Human ecology, and all of anthropology, is an empirical science. It generally adheres to the procedures and rules of modern Western science, including the scientific method. All cultures have some form of science; human ecologists often draw on other cultures' ways of knowing as well as on modern science (Sutton and Anderson, 2010). Human Ecology is the study of the mutual interconnections between people and their environments at multiple scales and multiple time frames. The subject is informed by ecological and evolutionary theory in biology and by the concepts of landscape and spatial relationships in geography; but recognizes that humans have gradually achieved partial ecological and geographical dominance through their culturally given but continually changing technology and social, economic, and political arrangements. Human ecology subsumes such specialized approaches to these relationships as cultural ecology, political ecology, geography, ecological anthropology, environmental sociology, environmental economics, environmental psychology, and environmental history (Robbins, 2007).

Ecological anthropologists who view themselves as human ecologists generally see ecology as providing a testable framework for examining both human and non human social behavior within a unified theoretical perspective. Those who view themselves as cultural ecologists, on the other hand, are more likely to reject a strict application of ecological principles to the study of the human condition on the grounds that culture acts as a mediating force which renders

*Contributed by Ajeet Jaiswal, Associate Professor, Department of Epidemiology and Public Health, Central University of Tamil Nadu, Thiruarur

human adaptation to the environment analytically distinct from that of all other species. For cultural ecologists, ecology serves more as an orientation for the study of human environmental relations than as an operational set of theoretical principles which can be used to explain specific human social behaviors.

3.2 CONCEPT OF HUMAN ECOLOGY IN ANTHROPOLOGY

Human ecology, much like the rest of anthropology, is an eclectic science. As scientists, we want to learn, understand, and apply the knowledge about how people interact with their environment. We will utilize any theory or idea that might help us learn about how people adapt and why they might do things in a particular way. As such, many approaches can be employed in the study of human ecology.

For a significant number of human ecologists, including many cultural ecologists, people are seen as animals much like any other animal (Park, 1936), concerned solely or mainly with obtaining food and mates by the most efficient means possible. This general approach, embodied in evolutionary ecology, directs our attention toward serious studies of food getting, among other things, and has produced much useful research (Sutton and Anderson, 2010). It also directs our attention toward serious consideration of the environment: what resources it offers, how difficult it is to obtain those resources, and any other problems it may present (Jaiswal, 2017). Most human ecologists find above information inadequate because it predicts neither the wide variety of cultures observed in the world nor the existence of art, music, poetry, and all the other things people have and do that other animals do not.

A second approach regards humans as rational choosers. In this approach, humans set various goals, not solely the pursuit of necessities. They then seek, methodically and rationally, to reach those goals. This model directs our attention to individual choice. It assumes that people choose carefully and seriously on the basis of good information. This above information has been shown to be very useful in many situations. However, people do not always have good information about their environment.

More importantly, human choice is greatly affected by emotion, by social pressures, by cultural traditions, and by plain, ordinary mistakes. Thus, this above information alone is also inadequate (Sutton and Anderson, 2010).

A third approach looks at political processes, from individual negotiation to worldwide political forces. This above information directs our attention most especially to power differentials, from the power of village authorities to the far greater power of multinational agencies and corporations. This above information has a number of major empirical successes to its credit, but it does not adequately deal with human long-term goals.

Anthropologist take something of a flexible position toward all these above information's, suggest at the outset that understanding will come only from combining models, both existing and new. People have biological needs, and they have to fulfill them. People choose, and they make the best choices they can—and mistakes cannot be ignored or denied. They have to negotiate with

others; they cannot do what they please in a social vacuum. Cooperation and competition are the common lot of social life.

To comprehend ecological practices, we must understand the history of those practices. We must look at the whole chain of specific events, including pure chance, that actually caused the behavior to become established (Vayda, 1996). For example, could any rational choice theorist, in the absence of previous knowledge, predict that most Americans would celebrate December 25 by piling gifts around an evergreen tree? December 25 was not the actual birthday of Jesus Christ; the date and tree were originally part of a pagan Yule festival of northern Europe that was taken over by Christianity as it expanded northward. If we want to explain why Americans cut down millions of trees every year for a holiday, we must look at history. The individual choices that brought us to this ecological adjustment may have been rational, but no rational choice theorist could ever have predicted the present situation on the basis of existing theory (Sutton and Anderson, 2010).

Check Your Progress

1) What is human ecology?

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3.3 BASIC CONCEPTS ECOLOGY

Like other sciences ecology too has its own principles and basic concepts, which are follows:

1) All living organisms and their environment are mutually reactive, affecting each other in various ways. Animal population, flora, and vegetation are interdependent through the environment and are mutually reactive (Sharma, 1996; Jaiswal, 2013).

2) Environment, which actually is a complex of several inter-related factors and much dynamic (i.e. varying with time and space), as its one or the other factor becomes critical at critical stages of the life cycle of the species.

3) The species puts each effort to maintain its uniformity in structure, function, reproduction, growth and development by preservation of its genetic pool. However, species is also plastic and reacts to the varying environment to get itself adjusted structurally and physiologically in the changing environment. This is achieved by the degree of plasticity set by the genetic constitution of the species. The various forms of species, in order to meet the challenge of changed environment, may arise by virtue of somatic

plasticity, the ecads, or by the reorganization of their genes during sexual reproduction, the ecotypes. Thus species may increase their capacity of tolerance towards changing environment by developing ecads and ecotypes (Sharma, 1996; Jaiswal, 2013).

4) It is not only the environment which influences the life of organisms, but organisms also modify their environment as result of their growth, dispersal, reproduction, death, decay, etc. Thus, the environment is caused to change due to organisms' activities. The dynamic environment and organisms make way for the development of different kinds of organisms through a process known as succession. The process continues till the development of community which is now more or less stable and is now able to keep itself adjusted in equilibrium with the environment. This final stage of community is called a climax (Sharma, 1996; Jaiswal, 2013).

5) Clements and Shelford (1939), however, put forth a concept of bio wherein all plants and animals are related each other by their coaction and reaction on the environment. According to their view, under similar climatic conditions, there may simultaneously develop more than one communities, some reaching to climax stage, others under different stages of succession. This complex of several communities in any area, represented by an assemblage of different kinds of plants, animals etc., sharing common climate, is called a biome (Sharma, 1996; Jaiswal, 2017).

In the above account, basic concepts of ecology have been explained mainly upon structural basis. However, with the introduction of ecosystem concept in ecology, functional aspects along with the structural ones are also to be strongly emphasized. Tansley (1935) thus emphasized the role of environment, with its various factors interacting with each other in his comprehensive term ecosystem which involves all the non-living and living factors working in a complex (Sharma, 1996; Jaiswal, 2013).

Within this new concept in modern ecology, following are the basic concepts:

1) When both, biotic and abiotic components are considered, the basic structural and functional units of nature are ecosystems. Discrete biological units consist of populations and communities, including biomes. Each population occupies a specific niche, a unique functional position with respect to other organisms with which it interacts.

2) There exist varying degrees of +, - or even neutral interactions among organisms, at both, inter- and intraspecific levels, which determine along with abiotic parameters, the degree of success a particular population has within a given habitat. Population ecologists study interactions at population as well as community levels. They study competition, usually between population from the same trophic level (such as herbivores competing for the same grass i.e. population ecology involving individuals of same species) and prey - predator interactions between members of adjacent trophic levels (i.e. population ecology involving interactions between individuals of different species, at community level) (Sharma, 1996; Jaiswal, 2013).

3) Also there are involved energetics of ecosystem, as energy is the driving force of this system. The radiant energy is trapped by the autotrophic organisms (producers) and is transferred as organic molecules to the

heterotrophic organisms (consumers). This energy flow is unidirectional or non-cyclic.

4) The chemical components of the ecosystem move in defined cycles - biogeochemical cycles. Within the ecosphere, biological systems frequently regulate the rate of movement of cycling of the chemicals. Role of water as the universal solvent for biological systems is much relevant here.

5) Successful growth of the organism is governed by limiting factors. For success in growth and reproduction with a particular habitat, an organism requires various essential factors from its environment. The success of an organism is limited not only by deficiencies in substances or conditions but also by excesses. The minimal and maximal levels of tolerance for all ecological factors of a species vary seasonally, geographically and according to the age of the population (Sharma, 1996; Jaiswal, 2013).

6) Under natural conditions, different kinds of population undergo succession. Ecosystems undergo an orderly process of change with time, passing from a less complex to a more complex state. This process involves not only changes in species composition but also changes in the physical environment of a community. The terminal or stabilized state is known as the climax.

   According to Evans (1956), the ecosystem involves the circulation, transformation and accumulation of energy and matter through the medium of living things and their activities. Thus, the dynamic abiotic components of the environment and the assemblage of plants and animals there, as a result of interactions between themselves keep modifying and changing each other, and this leads to the development of ecosystem.

7) Then come the probabilities of disruption and exploitation of ecosphere. As a result of natural condition or activities of man, species diversity in an ecosystem is reduced. It leads to a set back to the state of development and reduction in the stability of the ecosystem. Man's exploitation of ecosystems is directed toward channeling productivity to his needs. Applied ecology or human ecology is the use of ecological concepts to describe human activities and the determination of ways in which people can best obtain their needs from ecosystems. Ecosystems which are substantially altered by human activities are called managed, whereas those free from such disturbances are referred to as natural (Sharma, 1996; Jaiswal, 2017).

Check Your Progress

2) Write short notes on climax?

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3.4 CULTURAL ECOLOGY

Cultural ecology is the study of human adaptations to social and physical environments. Human adaptation refers to both biological and cultural processes that enable a population to survive and reproduce within a given or changing environment. Ecology is the study of the interaction between living things and their environment. Human ecology is the study of the relationships and interactions among humans, their biology, their cultures, and their physical environments. The term provides the title of Human Ecology, a leading journal in the field. Human ecology includes ecological anthropology (which includes a great deal of biological anthropology) and environmental anthropology (a more "cultural" or humanistic side of the field) (Sutton and Anderson, 2010).

A number of comprehensive treatments of the field are available. Most impressive is Human Adaptive Strategies: Ecology, Culture, and Politics (Bates, 2005). The title suggests the grounding in the new knowledge and also the way Bates integrated the field around the concepts of adaptation and strategizing. Patricia Townsend brought out a brief but extremely well-targeted overview, Environmental Anthropology (2000), that covered basically the same ground from a very similar point of view, but at an entry level. In addition, Bates and Susan Lees, longtime editors of Human Ecology, have produced a collection of articles from that journal, Case Studies in Human Ecology (1996). Among several other readers, particularly noteworthy are Environmental Anthropology: A Historical Reader, edited by Michael Dove and Carol Carpenter (2008), and The Environment in Anthropology, edited by Nora Haenn and Richard Wilk (2006). The former includes important articles from the entire history of cultural ecology and environmental anthropology; the latter focuses more on the newer work (Sutton and Anderson, 2010).

Human ecologists study many aspects of culture and environment, including how and why cultures do what they do to solve their subsistence problems, how groups of people understand their environment, and how they share their knowledge of the environment. The broad field of human ecology includes two major subdivisions. Human biological ecology is the study of the biological aspect of the human/environment relationship, and cultural ecology is the study of the ways in which culture is used by people to adapt to their environment (Sutton and Anderson, 2010).

Check Your Progress

3) What is cultural ecology?

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3.5 CULTURAL ECOLOGY AND ANTHROPOLOGY

Cultural ecology is generally included within the discipline of anthropology, the study of human beings. Anthropology includes the study of human biology, language, prehistory, religion, social structure, economics, evolution, and anything else that applies to people. Thus, anthropology is a very broad discipline, holistic in its approach, and comparative, or cross-cultural, in its analyses. Anthropologists generally concentrate their work on small-scale cultures and tend to have considerable personal contact with the people of those cultures.

Culture, learned and shared behavior, is the fundamental element that sets humans apart from other animals. (Many animals learn some of their behavior socially, but only humans make an enormous project of it.) The vast complexities of human behavior derive from culture, based to be sure on biology. Culture is largely transmitted through language, which, as far as we know, is unique to humans. In addition, every person belongs to a culture, a group of people who share the same basic pattern of learned behavior, the same values, views, language, and identity. Each culture's bearers hold an identity unto themselves, such as the Cheyenne, the Germans, or the Yanomamo, and recognize that they are different from other cultures (Sutton and Anderson, 2010).

On the other hand, cultures interact and learn from one another, and people (especially young ones) easily shift from one to another. The idea of cultures or ethnic groups as steel-walled, separate universes are currently popular in the mass media but is utterly wrong. Cultures may remain separate while learning a great deal from their neighbors, or they may merge totally.

Anthropologists traditionally hold a set of basic beliefs in their study of other cultures. First, it is recognized that all cultures are at least a bit ethnocentric—that people believe their culture is superior to others (although many envy the richer or powerful). Americans tend to view non-Americans as being inferior, less cultured, or backward. Germans have the same view of non-Germans, as do the Chinese of non-Chinese. In fact, every culture seems to include this view; it is a normal part of the self-identification process. Yet ethnocentrism has often been used to rationalize mistreatment of peoples. Virtually all colonial powers exploited native populations on the belief that they were inferior, which was used to justify their enslavement or murder. In North America, the natives were considered "savages" who were "in the way" of "civilization." The Native Americans were thus moved, incarcerated, or killed with government approval.

A similar situation currently exists in a number of countries attempting to "develop." Anthropologists are usually—though far from always—from a culture other than the one being studied. Thus, the researcher views the culture through the lens of his or her own culture, in essence an outsider's view. The other perspective is that of the insider. One's perspective, whatever it is, influences what is observed and ultimately what can be learned. Anthropologists deal with this problem as best they can. Perhaps the best way is to draw on both outsider and insider views, comparing them with each other and (hopefully) respecting both (Sutton and Anderson, 2010).

A basic conviction in anthropology is cultural relativism, that cultures and cultural practices should not be judged. This term has been misunderstood to imply that anthropologists approve of anything practiced in any culture. More correctly, it means that anthropologists study cultures to understand them with-out trying to show that one is "better" than another and without trying to impose their culture or standards on other people. This relativity is methodological and not moral. Indeed, anthropologists have traditionally taken a very strong stand against genocide and "culturocide," or forcing people to give up their culture against their will. Anthropologists attempt to avoid being ethnocentric and believe that all people and cultures are valid, that they have the rights to exist, to have their own culture and practices, and to speak their own language, and that individuals have fundamental human rights (Nagengast and Turner, 1997; Merry, 2003). These are moral positions and conflict with moral relativism.

Anthropology can be divided into many sub-disciplines—perhaps dozens, depending on how they are defined and who is defining them. Here, we follow the traditional basic division of the field into four sub-disciplines: cultural anthropology, biological (or physical) anthropology, anthropological linguistics, and archaeology.

Check Your Progress

4) Define ecological anthropology?

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3.6 ECOLOGICAL APPROACHES IN ANTHROPOLOGY,

Within anthropology, ecological approaches have been employed in a variety of ways. Cultural ecology has been applied in sociocultural studies as an alternative to a deterministic application of "culture" as the primary causal agent leading to new "culture." In other words, culture, as ideas and behavior, can arise from the environmental circumstances (both social and physical) of people's lives or culture can arise sui generis, that is, in and of itself! Historical processes play an important role in this latter scenario. These two fundamental approaches to anthropological inquiry have characterized the science for many years. The functionalist school of anthropological theory, in which cultural attributes were identified as part of an interrelated system, was heavily criticized because it neglected historical explanation and human agency, that is human actions contributing to culture (Michael, 2007).

Environmental determinism and possibilism, functionalism, culture-area approaches, racism, evolutionism, and historicism were conceptual and theoretical perspectives that were all mixed in complex ways during the late 19th and early 20th centuries in anthropology. Franz Boas, the founder of American anthropology, demonstrated the influence of the environment on body size and form in migrants in the first decade of the 20th century, yet he rejected evolutionary explanations and identified human behavior and culture as arising from historical forces not environmental forces (Michael, 2007).

Early social studies of humans and their environment moved from the "environmental determinism" of the anthropogeographers (Ratzel, 1889-91; Semple, 1911), to the "environmental possibilism" of the ethnographers (Forde,1934; Evans-Pritchard, 1940), and to the "cultural ecology" of Julian Steward (1938, 1955). In the 1930s, Steward moved cultural ecology a step forward by rejecting the "...fruitless assumption that culture comes from culture..." (Steward, 1955). He also developed the concept of culture core as the behavior patterns most closely linked to the environment (e.g., subsistence and food acquisition). He advocated a three-fold analysis of relationships between (1) the environment and subsistence, (2) subsistence and behavior patterns, and (3) behavior patterns and other components of the culture, and his view of ecology was closely linked to the concept of "adaptation to the environment" (Vayda and Rappaport, 1968).

Later studies criticized Steward's "culture core" concept as too narrowly conceived. This form of criticism is quite characteristic of anthropology: rather than building on previous ideas and data, ideas are rejected sequentially as new theoretical approaches appear and rise in popularity.

Anthropology is the holistic and scientific study of man in space and time. Anthropological progress over the past century has been constrained because the pattern of exploration has been: first, limited application of scientific design and hypothesis testing; second, a continual succession of new theoretical frameworks and approaches without full exploration; and third, little validation of research results and limited development of a tested body of fundamental principles (Michael, 2007).

3.7 SUMMARY

Human ecology, and all of anthropology, is an empirical science. It generally adheres to the procedures and rules of modern Western science, including the scientific method. Ecological anthropologists who view themselves as human ecologists generally see ecology as providing a testable framework for examining both human and non-human social behavior within a unified theoretical perspective. Human ecology, much like the rest of anthropology, is an eclectic science. As scientists, we want to learn, understand, and apply the knowledge about how people interact with their environment. For a significant number of human ecologists, including many cultural ecologists, people are seen as animals much like any other animal (Park, 1936), concerned solely or mainly with obtaining food and mates by the most efficient means possible. Humans are rational choosers as humans set various goals, not solely the pursuit of necessities. More importantly, human choice is greatly affected by emotion, by social

pressures, by cultural traditions, and by plain, ordinary mistakes. Anthropologist take something of a flexible position and we must look at the whole chain of specific events, including pure chance, that actually caused the behavior to become established. Like other sciences ecology too has its own principles and basic concepts. It is not only the environment which influences the life of organisms, but organisms also modify their environment as result of their growth, dispersal, reproduction, death, decay, etc. Thus, the environment is caused to change due to organisms' activities. the ecosystem involves the circulation, transformation and accumulation of energy and matter through the medium of living things and their activities. Cultural ecology is the study of human adaptations to social and physical environments. Human adaptation refers to both biological and cultural processes that enable a population to survive and reproduce within a given or changing environment. Cultural ecology is generally included within the discipline of anthropology, the study of human beings.

3.8 REFERENCES

Bates, Daniel G., and Susan H. Lees (eds.) (1996) Case Studies in Human Ecology. New York: Plenum Press.

Bates, Daniel G. (2005). Human Adaptive Strategies: Ecology, Culture, and Politics. 2nd ed. Boston: Allyn & Bacon.

Clements, Frederic, and Victor E. Shelford. (1939). Bio-Ecology. New York: John Wiley & Sons.

Evans-Pritchard, E. (1940). The Nuer: A Description of the Modes of Livelihood and Political Institutions of a Nilotic People. Clarendon Press, Oxford.

Evans E.C. (1956). Ecosystem as the basic unit in Ecology. Science 123:1127-1128.

Forde, C.D. (1934). Habitat, Economy and Society. Methuen, London

Jaiswal, A. (2013). Human Origin and Variation: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Human Genetics and Applied Biophysical Anthropology: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Glossary of Biophysical Anthropology Terms: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2017). Ecosystem and eco-sensitivity: Human Ecology PG e-Pathsala, (An Ministry of Human Resource Development Project under its National Mission on Education through ICT (NME-ICT).

Merry, Sally. (2003). Human Rights Law and the Demonization of Culture. Anthropology News 44(3):4–5.

Michael D., Carol Carpenter (eds.) (2008). Environmental Anthropology: A Historical Reader. Oxford: Blackwell.

Michael A. Little. (2007). Human Ecology in Anthropology: Past, Present, and Prospects, Anthropologist Special Volume No. 3: 25-38

Nagengast, Carole, and Terence Turner. (1997). Introduction: Universal Human Rights versus Cultural Relativity. Journal of Anthropological Research 53(3):269–272.

Nora Haenn, Richard Wilk (eds.) (2006). The Environment in Anthropology: A Reader in Ecology, Culture and Sustainable Living. New York: New York University Press.

Park, Robert Ezra. (1936). Human Ecology. American Journal of Sociology 42:1–15.

Patricia Townsend, K. (2000). Environmental Anthropology: From Pigs to Policies. Prospect Heights, IL: Waveland Press.

Paul Robbins (2007) Human Ecology: Encyclopedia of Environment and Society, Sage Publications

Ratzel, F. (1882-1891). Anthropogeographie. J. Engelhorns, Stuttgart.

Sharma, P.D. 1996. Ecology and Environment, Seventh edition. Rastogi Publication, 220-266.

Sutton Mark Q., Anderson E. N. (2010). Introduction to Cultural Ecology Second Edition, AltaMira Press 23-28.

Semple, E.C. (1911). Influences of the Geographic Environment: on the Basis of Ratzel's Anthropogeography. Holt, New York.

Steward, J.H.: (1938). Basin-Plateau Aboriginal Sociopolitical Groups. Bureau of American Ethnology, Bulletin 120. Smithsonian Institution, Washington, D.C.

Steward, J.H.: (1955). Theory of Culture Change. University of Illinois Press, Urbana

Vayda, A.P. and Rappaport, R.A. (1968). Ecology, cultural and non-cultural, pp. 476-498. In: Introduction to Cultural Anthropology, J.A. Clifton (Ed.). Houghton.

Vayda, Andrew P. (1996). Methods and Explanations in the Study of Human Actions and Their Environmental Effects. Jakarta, Indonesia: Center for International Forestry Research-World Wildlife Fund.

3.9 ANSWERS TO CHECK YOUR PROGRESS

1. Human Ecology is the study of the mutual interconnections between people and their environments at multiple scales and multiple time frames.

2) Under natural conditions, different kinds of population undergo succession. Ecosystems undergo an orderly process of change with time, passing from a less complex to a more complex state. This process involves not only changes in species composition but also changes in the physical environment of a community. The terminal or stabilized state is known as the climax.

3) Cultural ecology is the study of human adaptations to social and physical environments. Human adaptation refers to both biological and cultural processes that enable a population to survive and reproduce within a given or changing environment.

4) Ecological Anthropology is broadly concerned with people's perceptions of and interactions with their physical and biological surroundings, and the various linkages between biological, cultural, and linguistic diversity.

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UNIT 4 METHODS OF STUDYING HUMAN ECOLOGY*

Contents

4.1 Introduction
4.2 Population
4.3 Population ecology
4.4 Basic Concepts of Population Ecology
4.5 Describing a Population (Population Characteristics)
4.6 Dispersion
4.7 Age structure
4.8 Natality (birth rate)
4.9 Mortality (death rate)
4.10 Life tables
4.11 Population Dynamics
4.12 Regulation of Population Density
4.13 Human Ecology and Climate Change
4.14 Human Ecology and Infectious Diseases
4.15 Human Ecology and effect of Environment
4.16 Summary
4.17 References
4.18 Answers to Check Your Progress

Learning Objectives

After going through this unit, you would be able to:

- understand the basic concept of Population Human;
- describe the Population Characteristics; and
- also able to know the important feature of human ecology and climate change, infectious diseases and effect of environment.

4.1 INTRODUCTION

The foregoing unit provides a background of the various ecological factors as they might govern the distribution of organisms, and details of the requirements and reactions of an individual species (autecology). However, organisms in nature rarely grow as separated from each other. Invariably, organisms grow organized as populations (A population population is a number of all the organisms of the same group or species who live in a particular geographical area and are capable of interbreeding), communities (A community is a social unit or a group of living things with commonality such as values, norms, customs, or religion) and ecosystems. We would consider the basic concepts applicable at each of these

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three levels of organ isolation. And we begin with population level. In this unit, we would consider properties of populations as though largely isolated from populations of other species (Sharma, 1996).

4.2 POPULATION

A population is generally a group of individuals of a particular species occupying a particular area at a specific time. Some of the ecologists, however, recognize two types of population.

i) **Monospecific population**: It is the population of individuals of only one species, and

ii) **Mixed or Polyspecific population:** It is the population of individuals of more than one species. However, in ecology polyspecific population is generally referred to as a **community**, and the term population is used for group of individuals of any kind of organism (Sharma, 1996; Jaiswal, 2017).

4.3 POPULATION ECOLOGY

Population ecology is the study of individuals of the same species where the processes as aggregation, interdependencies between individuals etc. and the various factors governing such processes are emphasized. This has been an important development in modern ecology. The foundations of population ecology were laid by animal ecologists in the first half of this century. It is only relatively recently that detailed studies of plant populations have been made. The increasing population of the world could attract the attention of not only of ecologists but also of behaviourial scientists and it led to the development of such new facets in ecology. Population ecology, thus has to play a vital role in a number of socio-economic problems both at national as well as international levels (Sharma, 1996; Jaiswal, 2017).

4.4 BASIC CONCEPTS OF POPULATION ECOLOGY

Populations arc characterized with such characteristics as dispersion, fluctuation in numbers (density), sex ratio, birth rate and death rate. The population of a species generally arises as a result of reproduction, active transport of individuals, or their passive transport by such agencies as wind, water etc. All the three means of population growth are influenced by several factors of the environment as well as by the characteristics of the individuals of the species itself. Under favourable conditions, the group of individuals increases in numbers However, environment is never static and keeps on changing from time to time i.e., is dynamic. Thus, environment acts as a natural check on population. An increase in the number of individuals of a species results in the consequences of concern to the species itself and also to other interdependent species growing in the area.

Such an increase brings about harmful as well as beneficial effects (interactions) on the species. The former type of effects is mainly due to increased competition. particularly intraspecific for nutrition and space etc. The beneficial effects (interactions) include the protection, influences on reproduction, and division of labour (Sharma, 1996; Turchin, 2001, Jaiswal, 2013).

The subject of population ecology may be discussed as:

4.5 DESCRIBING A POPULATION (POPULATION CHARACTERISTICS)

The various characteristics which are unique to the group (population) as a whole and not to an individual in the group are described including some of their numerical patterns (Sharma, 1996; Jaiswal, 2017).

The population-a collective group of organisms of the same species occupying a particular space, has the following characteristics:

1) Population size and density
2) Dispersion
3) Age structure
4) Natality (Birth rate)
5) Mortality (Death rate), and
6) Life tables

Size and density

Total size is generally expressed as the number of individuals in a population. More informative are estimates of density, the number per unit area (or volume of environment. Larger organisms as trees may be expressed as 500 trees per hectare, whereas smaller ones like phytoplanktons (as algae) as 2 million cells per cubic meter of water. In terms of weight, it may be 100 pounds of fish per hectare of water surface. Since, the patterns of dispersion of organisms in nature are different it becomes important to distinguish between crude density and specific (ecological density) (Vandermeer and Goldberg, 2003).

Crude density: It is the density (number or biomass) per unit total space.

Specific or ecological or economic density. It is the density (number or biomass) per unit of habitat space i.e. available area or volume that can actually be colonized by the population. This distinction becomes important due to the fact that organisms in nature grow generally clumped into groups and rarely as uniformly distributed.

Concepts of growth rates:

Before dealing with other characteristics of a population, it is necessary to have idea of growth rates. Since population is a changing entity, we are interested not only in its size and composition but also in nature of its change. As varying from place to place, population density also varies in time. Population may remain constant, they may fluctuate, or they may steadily increase or decrease. Such charges are the main focus of population ecology. They are brought about by the interplay between four factors (Sharma, 1996).

Natality (production of offspring) and immigration (individuals entering a population from elsewhere) lead to an increase in density, while mortality (death of individuals) and emigration (moving out of population) lead to a decrease in density.

A rate is generally obtained by dividing the change by the period of time elapsed during the change. Thus, growth rate of a population is the number of organisms added to the population per time. It is customary to abbreviate in a change in something' by writing the symbol A (delta) in front of the letter representing the thing changing.

Thus, if N represents the number of organisms and / the time, then

ΔN = the change in number of organisms.

ΔN / Δt = the average rate of change in the number of organisms per time. This is growth rate.

ΔN / NΔt = the average rate of change in the number of organisms per time, per organisms (the growth rate divided by the number of organisms initially present, or alternately by the average number of organisms during the period of time.) This is often called **specific growth rate**.

If multiplied by 100 i.e.

ΔN/(NΔt) X100, it becomes the percent growth rate.

Suppose a population of 50 in a pool increased to 150 after an hour.

Then

N (the initial number) = **50**

ΔN (change in number) = **150-50=100**

ΔN / Δt (average rate of change per time i.e. growth rate) = **100 per hour**

ΔN / NΔt (average rate of change per time per individual i.e. specific growth rate) = **2 perhour** ——————————————————(a 200% increase per hour)

Check Your Progress

1) Define a population and its type?

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2) What are characteristics of Population?

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4.6 DISPERSION

Dispersion is the spatial pattern of individuals in a population relative to one another. Figure 3 shows the three basic patterns that occur.

1) **Regular dispersion**: Here the individuals are more or less spaced at equal distance from one another. This is rare in nature but is common in naged systems (cropland), Animals with territorial behaviour tend toward this dispersion.

2) **Random dispersion:** Here the position of one individual is unrelated to the positions of its neighbours. This is also relatively rare in nature.

3) **Clumped dispersion:** Most populations exhibit this dispersion to some extent, with individuals aggregated into patches interspersed with no of few individuals. Such aggregations may result from social aggregations, such as family groups or may be due to certain patches of the environment being more favourable for the population concerned. The relative frequency of these three pattern is well shown by trees in a semi deciduous forest. Of sixteen species, 12 were clumped, 3 were random and 1 was regular in dispersion (Forman and Hahn, 1980).

4.7 AGE STRUCTURE

The age structure of a population is an important factor in population dynamics. In most populations, individuals are of different ages. The proportions of individuals in each age group is called age structure of that population. **Age structure** is the proportion of a population in different age classes (http://www.opentextbooks.org.hk/ditatopic/35696#:~:text).

Age distribution is important, as it influences both, natality and mortality of the population. The ratio of the various age groups in a population determines the current reproductive status of the population, thus anticipating its future. From an ecological view point there are three major ecological ages (age groups) in any population. These are, pre-reproductive, reproductive and post-reproductive. The relative duration of these age groups in proportion to the life span varies greatly with different organisms. In man, the three 'ages' are relatively equal in length, about a third of his life falling in each class. Many plants and animals have a very long pre-reproductive period. Some animals, particularly insects, have extremely long pre-reproductive periods, a very short reproductive period and no post-reproductive period (Sharma, 1996; Jaiswal, 2017).

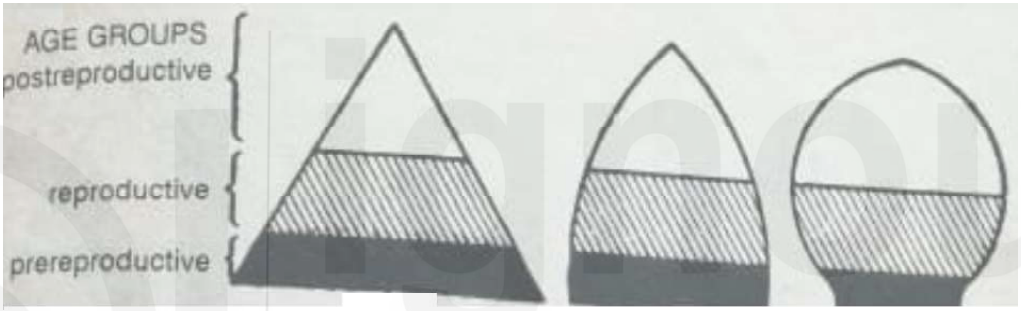
Age pyramids: The model representing geometrically the proportions of different age groups in the population of any organism is called age pyramid (Sharma, 1996). The three hypothetical pyramid types are shown in Figure 1 and 2 which are:

a) **A pyramid with broad base**. It indicates a high percentage of young individuals. In rapidly growing young populations birth rate is high and population growth may be exponential. Under such conditions, such successive generation will be more numerous than the preceding one, and thus a pyramid-with broad base would result (Fig. 1).

b) **A bell-shaped polygon**. It indicates a moderate proportion of young to old. As the rate of growth becomes slow and stable, i.e., the pre-reproductive and reproductive age groups become more or less equal in size, post-reproductive group remaining as the smallest, there results a bell-shaped structure (Fig. 1).

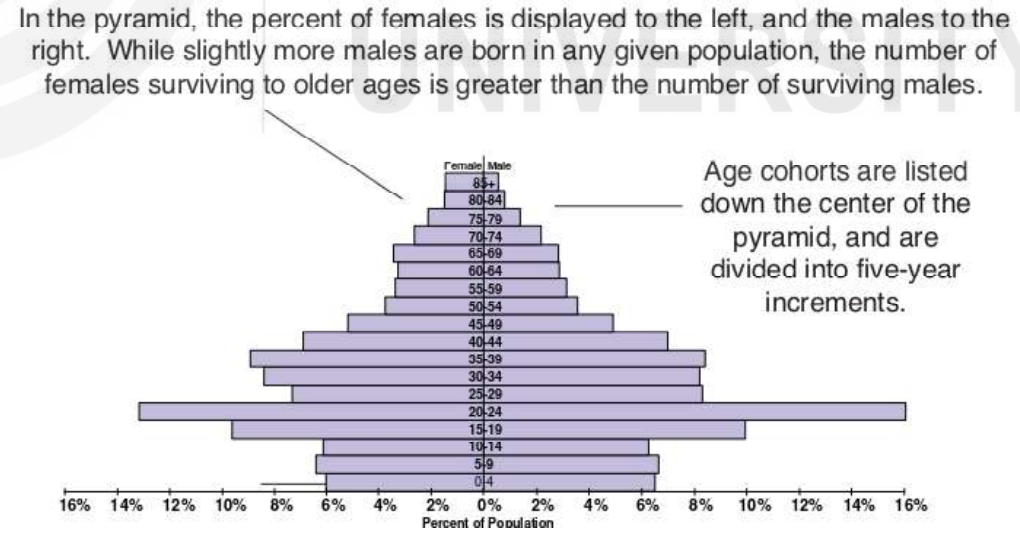
c) **An urn-shaped figure**. It indicates a low percentage of young individuals. If the birth rate is drastically reduced the pre-reproductive group dwindles inproportion to the other two groups and it results in an urn-shaped figure (Fig. 1), which indicates that population is dying off.

While density reveals little about differences between populations in developed and developing countries, age structure highlights some of the causes of rapid population growth in the latter. Developing countries have a much greater preponderance of young people, and the side of pyramids become concave. Such a shape means high population growth, not only at present but also likely in future.



Source: Fig 1: Types of Age Pyramids. 1- Young Population; 2. Stable Population; 3. Declining Population (Sharma, 1996).

Population Pyramid



Source: Fig 2: Population pyramid. (Richmond, 2019)

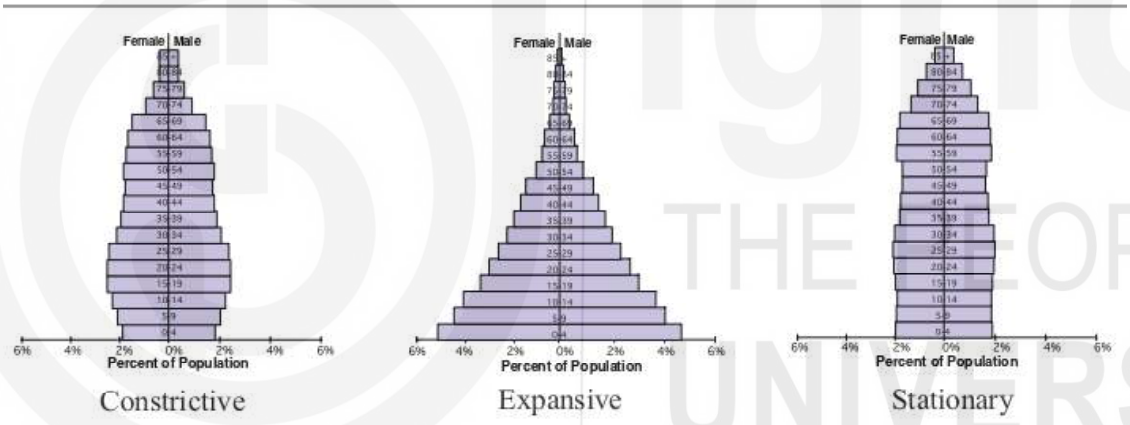
The percent of population is calculated by the number of people of one gender in one age cohort relative to the total number of people of that gender in the population. Summing the bars on both sides of the graph would yield the percent of one age cohort (Fig. 2)

Each country will have different or unique population pyramids. However, population pyramids will be defined as the following: stationary, expansive, or constrictive. These types have been identified by the fertility and mortality rates of a country (Richmond, 2019).

Stationary pyramid: A pyramid can be described as stationary if the percentages of population (age and sex) remains constant over time. Stationary population is when a population contains equal birth rates and death rates.

Expansive pyramid: A population pyramid that is very wide at the younger ages, characteristic of countries with high birth rate and low life expectancy. The population is said to be fast-growing, and the size of each birth cohort gets larger than the size of the previous year.

Constrictive pyramid: A population pyramid that is narrowed at the bottom. The population is generally older on average, as the country has long life expectancy, a low death rate, but also a low birth rate. However, the percentage of younger population are extremely low, this can cause issues with dependency ratio of the population. This pyramid is more common when immigrants are factored out. This is a typical pattern for a very developed country, a high level of education, easy access to and incentive to use birth control, good health care, and few negative environmental factors.



Source: Fig 3: Population Dynamic Types. (Richmond, 2019).

4.8 NATALITY (BIRTH RATE)

It is simply a broader term covering the production of new individuals of any organism, these new individuals are born, hatched, germinated, arise by division etc. In human population, however, the natality rate is equivalent to the 'birth rate".

Along with mortality rate, natality rate is used to calculate the dynamics of a population. They are the key factors in determining whether a population is increasing, decreasing or staying the same in size. Natality rate is the total number of birth per 1000 population during one calendar year (Sharma, 1996).

There are distinguished two types of natality.

1) **Maximum (absolute or potential or physiological) natality:** It is the theoretical maximum production of new individuals under ideal conditions (i.e. no ecological limiting factors, reproduction being limited only by physiological factors) and is a constant for a given population.

2) **Ecological or realized natality:** Ecological or realized natality refers to population increase under an actual, existing specific environmental condition. It is a constant for a population but may vary with the size and age composition of the population and with the physical environmental conditions

Natality is generally expressed as a rate determining by dividing the number of new individuals produced by a specific unit of time (the absolute or crude natality rate) or by dividing the number of new individuals per unit time by a unit of population (the specific natality rate).

In human demography, it is customary to express specific birth rates in terms of the number of women of reproductive age rather than in terms of total population.

4.9 MORTALITY (DEATH RATE)

Mortality quantify death of individuals in the population. It is more or less the antithesis of natality. Mortality is equivalent to death rate in human demography. Like natality. Mortality may be expressed as the number of individuals dying in a given period (deaths per unit time), or as a specific rate in terms of units of the total populations or any part thereof.

Like natality, mortality may be:

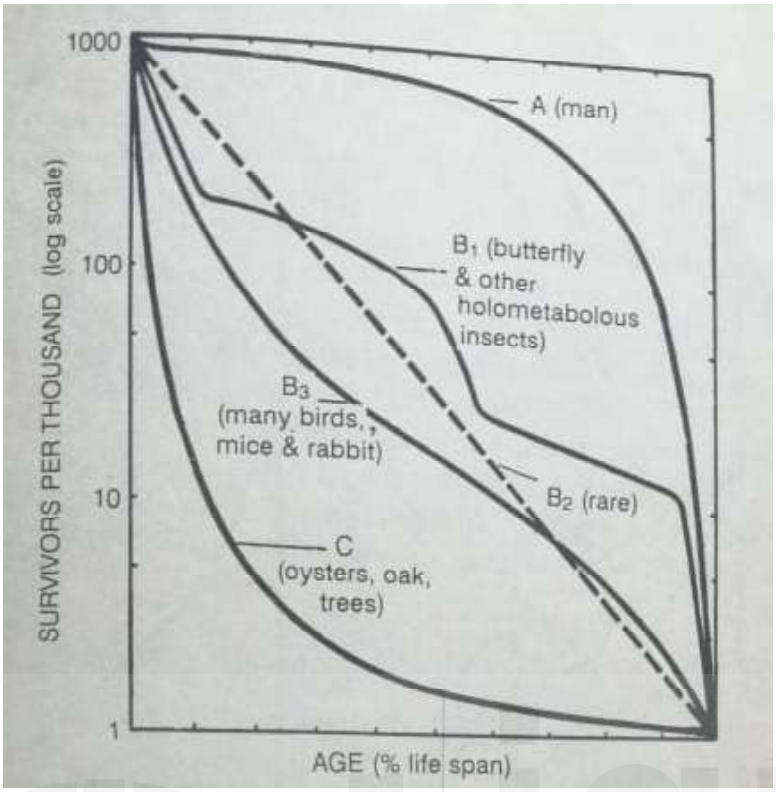
1. **Ecological or realised mortality:** It is the actual loss of individuals under a given environmental condition. It is, like ecological natality, not a constant and varies with population and environmental conditions. Like natality, mortality may be expressed as the number of individuals dying in a given period (deaths per time), or as specific rate in terms of units of the total population or any part thereof. A birth-death ratio (100 x births / deaths) is called vital index.
2. **Minimum mortality:** A theoretical minimum mortality is the constant for a population, represents the minimum loss under ideal or non-limiting conditions. Even under the best conditions, individuals would die of "old age' determined by their physiological longevity. Which, of course, is often far greater than the average ecological longevity.

For a population, the important thing is not which members die but which members survive. Thus survival rates are of much interest than the death rates. If the death rate is expressed as a fraction (M), then the survival rate is 1-M. Survival rates are generally expressed by survivorship curves (Reece, et.al, 2011)

Survivorship curves: The pattern of mortality with age is best illustrated by survivorship curves which plot the numbers surviving to a particular age. There are three general types of survivorship curves (Fig. 4) which represent the different nature of survivors in different types of populations (Sharma, 1996). These are as follows:

a) **Highly convex curves:** Curve A in the figure, is characteristic of the Species in which the population mortality rate is low until near the end of the life Span. Thus, such species tend to live throughout their life span, with low mortality. For example man show such curves.

b) **Highly concave curve:** This curve (C in figure) is characteristic of such species where mortality rate is high during the young stages.



***Source*: Fig 4. Survivorship curves (Sharma, 1996)**

c) **Diagonal curves:** If age-specific survival is more nearly constant, the curve approaches a diagonal straight line (curve B, in the figure). It thus shows a constant proportion of organisms dying per unit time. Probably, no population in the real world has a constant age-specific survival rate throughout the whole life span.

A convex pattern is shown by some large mammals, particularly primates and humans. Approximately diagonal curves are found in some rodents and birds while many plants and insects tend 1o concave patterns. Survivorship may vary in the same species in different environments.

Biotic potential

Each population has the inherent power to grow. When the environment is unlimited (space, food, other organisms not exerting a limiting effect), the specific growth rate (i.e. the population growth rate per individual) becomes constant and maximum for the existing conditions. The value of the growth rate under these favourable conditions is maximal, is characteristic of a particular population age structure, and is a single index of the inherent power of a population to grow. It may be designated by the symbol r, which is the exponent in the differential equation for population growth in an unlimited environment under specific physical conditions (Odum, 1959; Sharma,1996).

The overall population growth rate under unlimited environmental conditions (r) depends on the age composition and the specific growth rates due to reproduction of component age groups. Thus, there may be several values of r for a species depending upon population structure. When a stationary and stable age distribution exists, the specific growth rate is called the intrinsic rate of natural increase or r max. The maximum value of r is often called by the less specific but widely used expression biotic potential or reproductive potential. Thus with this term, one is able to put together natality, mortality and age distribution.

4.10 LIFE TABLES

A life table is a table which shows, for a person at each age, what the probability is that they die before their next birthday. It summarizes birth and death rates of organism at different stages of life. Information on natality and mortality in different ages and sexes can be combined in the form of life tables. From these it is possible to estimate the growth or decline of a population. As with survivorship curves, life tables are standardised to follow the progress of a cohort. In each table there are columns for age of individuals; number surviving to each age; the number dying in each age group the proportion dying from the previous age category; fertility rate; and the number of young born by each age group; The information obtained from these figure provides the net reproductive rate of the population i.e., offspring left by each individual.

Similarly, from life table, mortality in a logarithmic form is also obtained these are then used to calculate the rate of population growth (Sharma, 1996, Jaiswal, 2013).

4.11 POPULATION DYNAMICS

After having studied the various characteristics of a population, we attempt to follow the change in it. Population have characteristic patterns of increase which are-called population growth forms. Such growth forms represent the interaction of biotic potential and environmental resistance (Smith, 1952). What are the theoretical bases that attempt to account for such changes?

Approaches to study of population dynamics are (i) mathematical models (ii) laboratory studies and (iii) field studies.

Mathematical models are of two types: theoretical models and simulation models. The former derive equations that may describe population changes; and the behaviour of such models can be tested by comparing these with real populations. The latter (simulation models) use detailed data from real populations and try to predict future behaviour of these populations under specific environmental conditions.

Models are of use only if they explain facets of population dynamics of real populations. Their predictions are often tested experimentally using laboratory populations. Mathematical and laboratory studies are of value only if they help to explain the behaviour of natural populations. Field studies are made, though these are complex (Smith, 1952).

4.12 REGULATION OF POPULATION DENSITY

The logistic model and its derivatives assume that a population will level off at its carrying capacity, that there is an upper limit to population density set by the environment and that the population is regulated at or around that level. The significance of regulation in population has been a subject of controversy among ecologists for last more than 50 years. What regulates population? Krebs (1972) presented an account of this subject (Smith, 1952).

1) **Nature of factors that influence population density:** Population density can only be increased by natality or immigration and decreased by mortality

or emigration. These factors may be density dependent or density independent in their effects.

Density-dependent factors increase in their proportional effect as a population increases. Density-dependent factors include competition and predation. for example, rate of population growth is increasingly depressed by intraspecific petition as density is increased. Inverse density dependence also occurs if intensity of the factor decreases proportionately as density increases. Density independent factors do not vary systematically in their effects as density changes. Abiotic environmental factors arc often density independent but not always so Floods or fires may damage all populations regardless of their densities. Cold weather in tropics is also a factor of this type. Both density-dependent and density- independent factors may interact in most populations to determine observed densities. For example, in tsetse flies (Glossimia morsiotans), both types are involved. These factors play important role in population dynamics also.

2) **Key factor analysis:** This is the method to analyse mortality factors, to find out which may be regulatory. The k-values for each mortality factor together with total k(the sum of all factors), are plotted for several **successive** generations. The k-factor that most closely follows the pattern of k is called the key factor, in insect population, loss of adults through migration or death is the key factor.

3) **Self-regulation of populations:** Intraspecific density-dependent interactions regulate many populations in the laboratory, and in that sense these are self-regulating. Accumulation of waste products may depress population growth. This is also self-regulation. Social behaviour may also be self-regulatory. Many species have individuals or groups of individuals that defend food or breeding partners in a territory. Death or failures to mate are density-dependent and can regulate population density.

4) **Immigration, emigration and population dynamics:** Besides natality and mortality, immigration and emigration also affect population density. These both are features of disposal. Whereby individuals (singly or in groups) move from one population and die if no suitable environment is found; establish a new population, or join an existing one at a new locale.

4.13 HUMAN ECOLOGY AND CLIMATE CHANGE

Complex problems of landscape change, environmental and social impacts and responses, cannot be understood from a single, disciplinary perspective. Human ecological approach aims at understanding human-environment interactions in an inter-disciplinary way. This allows integrating physical environmental effects with their impacts on livelihoods, culture, health, and perception, to mention just these aspects. To this end human ecology uses methods which combine and integrate scientific data. These methods stem from geosciences (GIS, remote sensing, spatial models), human sciences (Delphi survey, perception studies, interviews, local knowledge analysis, indicators), and applied sciences (environmental health and technology). A range of methods is applied in the studies. This allows coming up with outcomes which go beyond the disciplinary thinking about climate change and its associated effects (Nguyen and Hens, 2019).

4.14 HUMAN ECOLOGY AND INFECTIOUS DISEASES

Human Ecology and Infectious Diseases investigates the interrelationships among human behavior, ecology, and infectious diseases, with emphasis on parasitic and zoonotic diseases. The cultural, behavioral, anthropological, and social factors in the transmission of infectious diseases are discussed, along with methods used to make human ecology a more quantitative predictive science in the global challenge of such diseases. Behavioral patterns that place humans at risk to infections and the nature of risk factors are also analyzed (Neil and John, 1983).

Human Ecology method and Infectious Diseases discuss about the research into those aspects of human behavior that determine risk of helminth, Filarial diseases and hookworm infection, an analysis of human behavior and religions that affect transmission of the parasitoses. Human behavior and transmission of zoonotic diseases are documented as are the habits, customs, and superstitions associated with the epidemic of intestinal capillariasis, along with the changing patterns of parasitic infections and the cooperation of government and the private sector to lower infection rates and an assessment of the importance of behavioral and socio-lcultural factors in determining regional and national patterns in disease incidence and transmission (Neil and John, 1983).

4.15 HUMAN ECOLOGY AND EFFECT OF ENVIRONMENT

Humans and their societies have an absolute dependence on environmental resources to provide energy, food, and materials. Some resources, such as metals and fossil fuels, can only be mined because they are present in a finite supply that is diminished as they are used. Other resources, such as forests, hunted animals, agricultural soil capability, and clean air and water, are potentially renewable, and if sensibly used they could support sustainable economies and societies over the longer term. However, humans commonly overexploit potentially renewable natural resources, that is, they are mined as if they were nonrenewable resources. This common syndrome of resource degradation is one of the most important aspects of the environmental crisis, and it is a formidable obstacle to the achievement of a sustainable human economy (Bates, 1997).

An important activity of human ecologists is to discover the reasons for this habitual overexploitation, so that potentially renewable resources could be utilized in more sensible ways. Human ecologists are also concerned with other environmental effects of human activities, such as pollution, extinction of species, losses of natural ecosystems, and other important problems. These damages are critical because they indirectly affect the availability of resources to humans, while degrading the quality of life in various other ways. Just as important is the damage caused to other species and ecological values, which have intrinsic (or existence) value regardless of any perceived value that they may have to humans.

Human ecologists are attempting to understand the various linkages between humans and the ecosystems that sustain them. This is being done in order to understand the causes of damage caused by human activities to the environment and resources, and to find ways to mitigate or prevent this degradation before

the scale and intensity of the environmental crisis becomes truly catastrophic (Bates, 1997).

Check Your Progress Exercise

3) Explain Age structure?

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4) What is life tables method?

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4.16 SUMMARY

A population is generally a group of individuals of a particular species occupying a particular area at a specific time. Populations are characterized with such characteristics as dispersion, fluctuation in numbers (density), sex ratio, birth rate and death rate etc. Total size is generally expressed as the number of individuals in a population. It is the density (number or biomass) per unit of habitat space i.e. available area or volume that can actually be colonized by the population. Before dealing with other characteristics of a population, it is necessary to have idea of growth rates. Dispersion is the spatial pattern of individuals in a population relative to one another. In most populations, individuals are of different ages. The proportions of individuals in each age group by sex is called age structure of that population. In human population, however, the natality rate is equivalent to the 'birth rate". Mortality refers to death of individuals in the population. The pattern of mortality with age is best illustrated by survivorship curves which plot the numbers surviving to a particular age. Each population has the inherent power to grow. Information on natality and mortality in different ages and sexes can be combined in the form of life tables. Complex problems of landscape change, environmental and social impacts and responses, cannot be understood from a single, disciplinary perspective. Humans and their societies have an absolute dependence on environmental resources to provide energy, food, and materials.

4.17 REFERENCES

http://www.opentextbooks.org.hk/ditatopic/35696#:~:text

Bates, D.G. (1997). Human Adaptive Strategies: Ecology, Culture, and Politics. Allyn and Bacon, 1997.

Forman, R.T.T., Hahn D.C., (1980). Spatial Pattern of Trees in a Caribbean Semi evergreen Forest. Ecology, 61. 1267-1274.

Jaiswal, A. (2013). Human Origin and Variation: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Human Genetics and Applied Biophysical Anthropology: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2013). Glossary of Biophysical Anthropology Terms: A Comparative Treatment of Biophysical Anthropology, Heritage Publishers, New Delhi, India.

Jaiswal, A. (2017). Ecosystem and eco-sensitivity: Human Ecology PG e-Pathsala, (An Ministry of Human Resource Development Project under its National Mission on Education through ICT (NME-ICT).

Kahl's M. P., (1964). Food Ecology of Wood Stork in Florida. Ecol. Monogr. 34:97-147.

Kareiva, Peter (1989). "Renewing the Dialogue between Theory and Experiments in Population Ecology". In Roughgarden J., R.M. May and S. A. Levin (ed.). Perspectives in ecological theory.

New Jersey: Princeton University Press. p. 394 p.

Krebs, C.J. (1972). A Review of the Chitty Hypothesis of Population regulation. Canadian Journal of Zoology. 56: 2463-2480.

Neil A. Croll, John H. Cross. (eds.) (1983). Human Ecology and Infectious Diseases Environment, Academic Press

Nguyen A.T., Hens L. (2019) Human Ecology of Climate Change Hazards: Concepts, Literature Review, and Methodology. In: Human Ecology of Climate Change Hazards in Vietnam. Springer Climate. Springer, Cham

Odum, Eugene P. (1959). Fundamentals of Ecology (Second ed.). Philadelphia and London: W. B. Saunders Co. p. 546 .

Richmond M. (2019). Population Pyramids - Oregon State University; Willamette River Basin Atlas

Reece, J. B., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., and Jackson, R. B. (2011). The exponential model describes population growth in an idealized, unlimited environment. In Campbell biology (10th ed., pp. 1190-1192). San Francisco, CA: Pearson

Sharma, P.D. (1996). Ecology and Environment, Seventh edition. Rastogi Publication, 220-266.

Sarukhan, J., Harper, J.L. (1973). Studies on Plant Demography. Ranunculus repens, Journal of Ecology 61, 675-716.

Smith, Frederick E. (1952). "Experimental methods in population dynamics: a critique". Ecology. 33 (4): 441–450.

Turchin, P. (2001). "Does Population Ecology Have General Laws?". Oikos. 94 (1): 17–26.

Vandermeer, J. H.; Goldberg, D. E. (2003). Population ecology: First principles. Woodstock, Oxfordshire: Princeton University Press.

4.18 ANSWERS TO CHECK YOUR PROGRESS

1) A population is generally a group of individuals of a particular species occupying a particular area at a specific time. Some of the ecologists, however, recognize two types of population monospecific population and mixed or polyspecific population.

2) Populations arc characterized with such characteristics as dispersion, fluctuation in numbers (density), sex ratio, birth rate and death rate etc.

3) In most populations, individuals are of different ages. The proportions of individuals in each age group is called age structure of that population.

4) Information on natality and mortality in different ages and sexes can be combined in the form of life tables. From these it is possible to estimate the growth or decline of a population.

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