

Principles of Ecology

BSc. Course 2024 – 2025

Lecture - 1

Dr. Adel H. Talib & Dr. Israa Mohsin Jasim

adelht_bio@csw.uobaghdad.edu.iq

Department of Biology

College of Science for Women

University of Baghdad

Principles of Ecology Syllabus (Course Outline)

3rd Class 2024 – 2025

Weeks	Topics
1	Introduction & Relation to Other Science Fields & Divisions.
2	Natural Ecosystems & Components.
3	Microcosms, Incomplete Ecosystems & Homeostasis.
4	Environmental Succession.
5	The Species & Individuals in the Ecosystem.
6	1st Examination
7	The Biogeochemical Cycles.
8	Species Interaction, Competition & Predation.
9	The Limiting Factors.
10	The Basic Habitats : Rivers, Marshes, Marine, Estuarine & Deserts.
11	Productivity, the Energy Flow, Food Chains & Ecological Pyramids.
12	2nd Examination
13	The Biomes
14	Ecological Indicators & Biomonitors

Principles of Ecology

* References

1- Smith, R. L. & Smith, T. H. (2015)
Elements of Ecology, 9th ed.,
Pearson/Benjamin Cummings, Inc.
707pp.

2- Begon, M.; Howarth, R. W &
Twonsend, C. R (2014) **Essentials of
Ecology**, 4th ed. Blackwell Publishing, 483
pp.

Principles of Ecology

- The word **ECOLOGY** is Derived from the Greek **Oikos**, meaning “**household**”, and **logos**, meaning “**study**”.
- Thus, the study of the environmental house includes all the organisms in it and all of the functional processes that make the house habitable.
- Literally, then, **ECOLOGY** is the study of “**life at home**” with emphasis on “**the totality or pattern of relations between organisms and their environment**”
- Ecology was of practical interest early in human history.
- In primitive society, all individuals needed to understand the forces of nature and the plants and animals around them-to survive.
- The beginning of **civilization**, in fact, coincided with the use of fire and other tools to modify the environment.

Principles of Ecology

- The science of ecology has had a gradual development during recorded history.
- The writings of **Hippocrates**, **Aristotle**, and other philosophers of ancient Greece clearly contain references to ecological topics.
- However, the Greeks didn't have a word for ecology.
- The word ecology is of recent origin, having been first proposed by the German biologist **Ernst Haeckel** in 1869.
- **Haeckel** defined Ecology as “**the study of the natural environment including the relations of organisms to one another and to their surroundings**”.
- Even in the eighteenth and nineteenth centuries, many scholars had contributed to the subject, even though the word Ecology was not in use.

Principles of Ecology

- For example, in the early 1700s, **Antoine van Leeuwenhoek**, best known as a premier Microscopist, also pioneered the study of Food Chain and Population Regulation, and the writings of the English Botanist Richard Bradley contributed to the understanding of Biological Productivity.
- All three of these subjects are important areas of modern **Ecology**.
- As a recognized, distinct field of science, **ecology** dates from about 1900, but only.
- In the past few decades has the word **ecology** become part of the general vocabulary.

Principles of Ecology

- At first, the field was rather sharply divided along taxonomic lines (such as plant ecology and animal ecology), but the biotic community concept of Fredericj E. Clements and Victor E. Shelford, the food chain and material cycling concepts of Raymond Lindeman and G. Evelyn Hutchinson, and the whole lake studies of Edward A.
- Birge and Chauncy Juday, among others, helped establish basic theory for a unified of general ecology.
- What can best be described as a worldwide environmental awareness movement burst upon the scene during two years, **1968** to **1970**, as astronauts took the first photographs of **Earth** as seen from outer space.

Principles of Ecology

- For the first time in human history, we were able to see Earth as a whole and to realize how alone and **fragile Earth** hovers in space.
- Suddenly, during the 1970s, almost everyone became concerned about **pollution, natural areas, population growth, food and energy consumption, and biotic diversity**, as indicated by the wide coverage of environmental concerns in the popular press.
- The **1970s** were frequently referred to as the “decade of the environment”, initiated by the first “**Earth Day**” on **22 April 1970**.
- Then, in the **1980s** and **1990s**, environmental issues were pushed into the political background by concerns for human relations-problems such as **crime, the cold war, government budgets, and welfare**.

Principles of Ecology

- As we enter the early stages of the twenty-first century, environmental concerns are again coming to the forefront because human abuse of Earth continues to escalate.
- Systems containing living (**Biotic**) and nonliving (**Abiotic**) components constitute **Biosystems**, ranging from genetics systems to ecological systems.
- This spectrum may be conceived of or studied at any level, or at any intermediate position convenient or practical for analysis.
- For example, host-parasite systems or a two-species systems of mutually linked organisms (such as the **fungi-algae** partnership that constitutes the **lichen**) are intermediate levels between **population** and **community**.

Principles of Ecology

- **Ecology** is largely, but not entirely, concerned with the system levels beyond that of the organism.
- In ecology, the term **population**, originally coined to denote a group of people, is broadened to include groups of individuals of anyone kind of organism.
- Likewise, community in the ecological sense (sometimes designated as “**biotic community**”), includes all the populations occupying a given area.
- The community and the nonliving environment function together as an ecological system or Ecosystem.

Principles of Ecology

Organism-Populations-Community

- **Bio-Systems** below the level of the individual are not concerns of **Ecology**, but they fall within other sciences such as **Genetics**, **Cell Biology** or **Physiology**.

Biotic Factors	+	Abiotic Factors	=	Bio-systems
Genes	+	Abiotic Factors	=	Genetic System
Cells	+	Abiotic Factors	=	Cellular System
Organs	+	Abiotic Factors	=	Organs System
Organisms	+	Abiotic Factors	=	Organism System
Population	+	Abiotic Factors	=	Population System
Community	+	Abiotic Factors	=	Ecosystem
All Communities	+	Abiotic Factors	=	Biosphere

INTRODUCTION TO ECOLOGY

LEVELS OF ORGANIZATION

BIOSPHERE



ECOSYSTEM



COMMUNITY



POPULATION



ORGANISM



Principles of Ecology

- The Biosphere

- The broadest, most inclusive level of organization is the **Biosphere**, the volume of Earth and its atmosphere that supports life. The highest level of organization.

- Ecosystems

- The biosphere is composed of smaller units called **Ecosystems**.
- An Ecosystem includes all of the organisms and the nonliving environment found in a particular place.

- Community

- A community is all the interacting organisms living in an area.
- Below the community level of organization is the **population** level, where the focus is on the individual organisms of a single species.

Principles of Ecology

- Population

- A group of organisms of one species living in the same place at the same time that interbreed.
- Produce fertile offspring.
- Complete with each other for resources (food, mates, shelter, etc.)



Principles of Ecology

- Organism

- Any unicellular or multicellular form exhibiting all of the characteristics of life, an individual.
- The lowest level of organization.



Principles of Ecology

Divisions of Ecology for the purpose of study and research

- Due to the breath and comprehensiveness of this science, interested scientists and researchers cannot practically cover all aspects in depth and accuracy.
- Therefore, the studies in this area divided into several aspects to qualify the process of handling and research.
- Based on that, Ecology divides for the purposes of study and research into following sections:

Principles of Ecology

- Divisions of Ecology for the purpose of study and research

- First:

- The division according to the type of living environment.
- This division includes:
 - 1- Aquatic Ecology.
 - 2- Terrestrial Ecology.
 - 3- Marine Ecology (salinity up to **35‰**).
 - 4- Estuarine Ecology (salinity up to **19‰**).
 - 5- Limnology (inland waters, salinity less than **0.5‰**).
- The latter is divided into stagnant water environment = (**Lentic Water**), and running water environment = (**Lotic Water**).

Divisions of Ecology for the purpose of study and research

- Second:

- **A - Autecology.**
- A study that include a specific type of organisms living in the vicinity and may include life cycle, the behavioral aspects of nutrition, breeding, migration and other phenomena of life and its relationship to environmental factors of the area (ex. A study of birds species to observe the food, the egg-laying date, reproductive habits ... etc.).
- **B- Synecology.**
- A study of a group of individuals joined by certain qualities as one unit within region (ex. The study of birds species in a wooded area, or the study of fish in a lake or the study of insects within a specific area and so on).
- **C- The study of the Ecosystem.**
- A study of all organisms in an ecosystem (ex. The study of desert area, or the study of organisms in a lake and so on).

Principles of Ecology

Divisions of Ecology for the purpose of study and research

- Third:

- Dealing with environmental studies for a full taxonomic groups.
- **1- Insect Ecology.**
- **2- Plant Ecology.**
- **3- Animal Ecology.**
- **4- Microbial Ecology.**

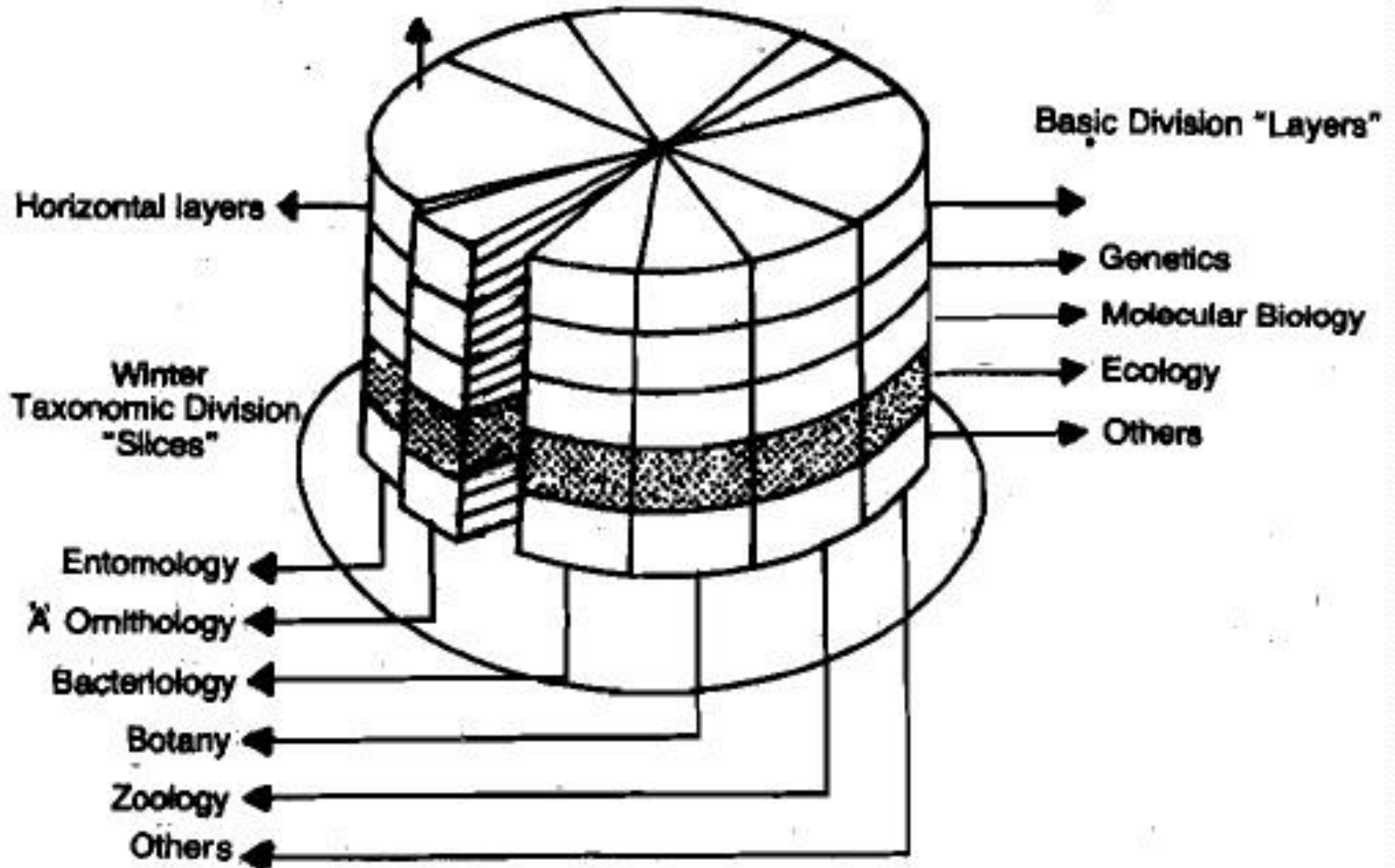
Principles of Ecology

Divisions of Ecology for the purpose of study and research - Fourth:

- Addressing environmental studies in the application or (practical) interest (studying the problems and solutions to them), such as:-
- **A-** the study of natural resources to identify and preserve wealth and rationalization of consumption.
- **B-** the study of environmental pollution such as identifying specific pollution problems such as air pollution or Water Pollution or Soil Pollution.
- **C-** the study of Human Ecology which include the development of human environment, and eradication of environmental diseases.

Principles of Ecology

Relationship Between Biology Divisions and Ecology



Modern Branches of ECOLOGY

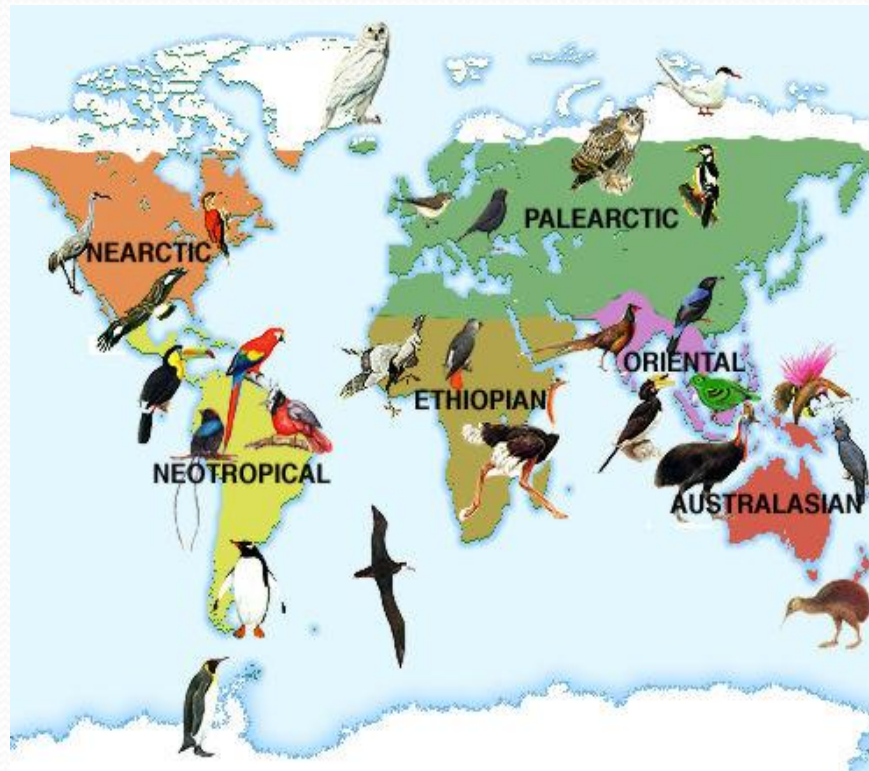
- The science of **Ecology**, like the rest of modern sciences has in recent decades branched off to many disciplines.
- New scientific departments in universities interested in subspecialty of **ECOLOGY** have emerged and specialized scientific journals issued and societies formed.
- Some of these new scientific branches of **ECOLOGY** are:-
- 1- **Oceanography**: the science of seas and oceans.



Principles of Ecology

Modern Branches of ECOLOGY

- 2- Zoogeography: the geographic distribution of animals.



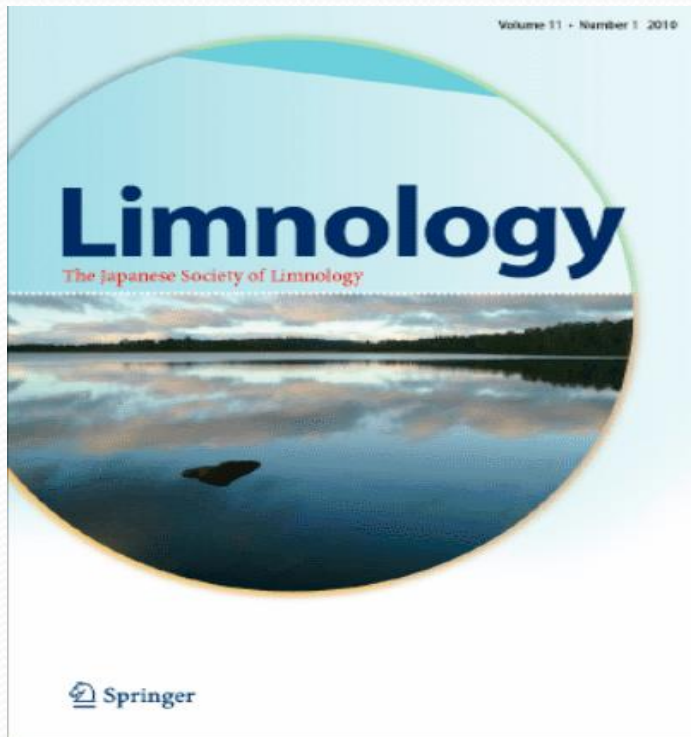
Zoogeographic regions and some characteristic animals



Principles of Ecology

Modern Branches of ECOLOGY

- 3- Limnology: the science of Inland Waters.



Principles of Ecology

Modern Branches of ECOLOGY

- 4- Paleoecology: the science of fossils ecology.



Principles of Ecology

Modern Branches of ECOLOGY

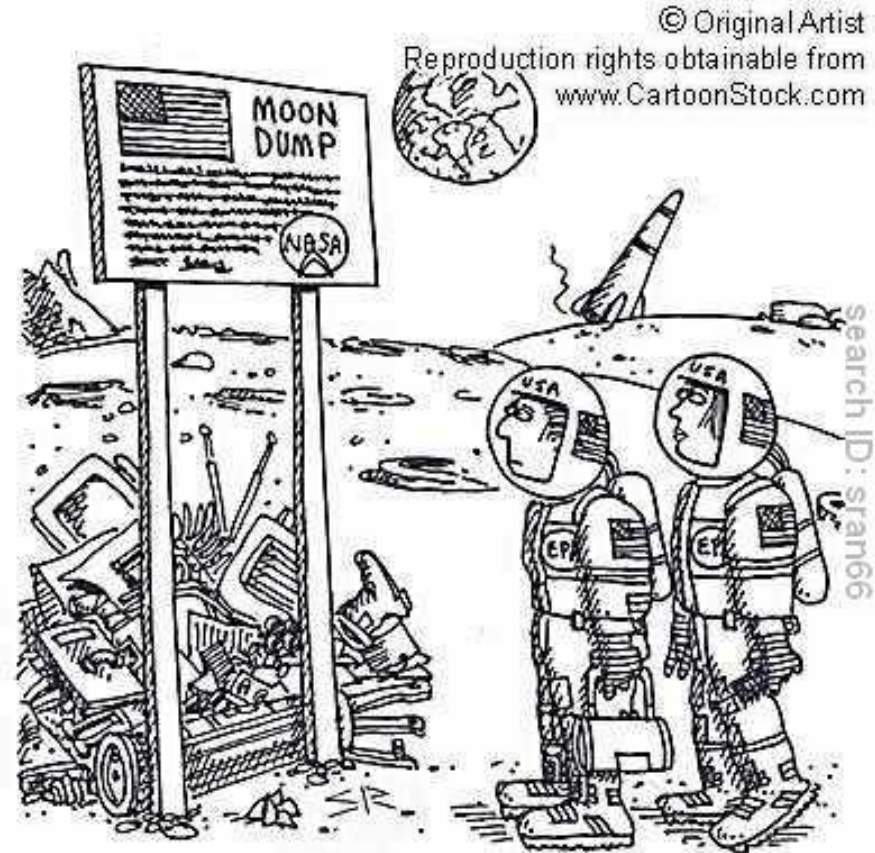
- 5- Wildlife Management: Wildlife managing practices.



Principles of Ecology

Modern Branches of ECOLOGY

- 6- Outer Space Ecology: the ecology of space outside the Biosphere.



Environmental Concerns in IRAQ

- Iraq is one of the leading countries in this region of the world, which has given excellent care of attention to the development and protection of the natural environment over the years.
- **1-** Iraq is one of the countries, which focused a long time ago on the delivery of drinking water to the population, in a scientific and orderly way where it commissioned the first project for the delivery of fresh drinking water to the inhabitants of Baghdad in 1838, in the area Governor Daoud Pasha.
- **2-** Establishment of communities in the areas of appropriate environmental conditions isolated from the industrial activities to maintain the environment, cities and towns from industrial pollution problems.
- **3-** Created national parks to preserve the natural wealth of organisms such as: Deer protection project (the Arabian Oryx and the Ostrich and some birds species like Houbara).

Environmental Concerns in IRAQ

- **4-** Issuing legislation and legal instructions that will protect the environment, such as laws regulating fishing to prevent overfishing, and the Rivers Protection Act and legislation of the allowable limits of contaminants.
- **5-** Created green belts around cities and towns to mitigate climate and increase green areas.
- **6-** Proper dumping of liquid and solid wastes and the establishment of (sewage closed systems) rather than (open sewers).
- **7-** Set up of associations interested in scientific forums on the environment, and environmental studies on environmental protection, such as (Iraq Biological Association), the (Association of Iraqi fishermen) and the (Iraqi Council of Environmental Protection).