

Lect. Ph.D. Dr. Zana Abubakr Ahmed Lak. Forest Ecology

## Ecology

“Oecology” Ernst Haeckel – 1866 Greek: oikos, “**household**,” home or place to live. and logos (meaning 'the study of'). to denote such relationships between the organisms and their environment. Thus, literally, ecology is the study of organisms 'at *home*'.

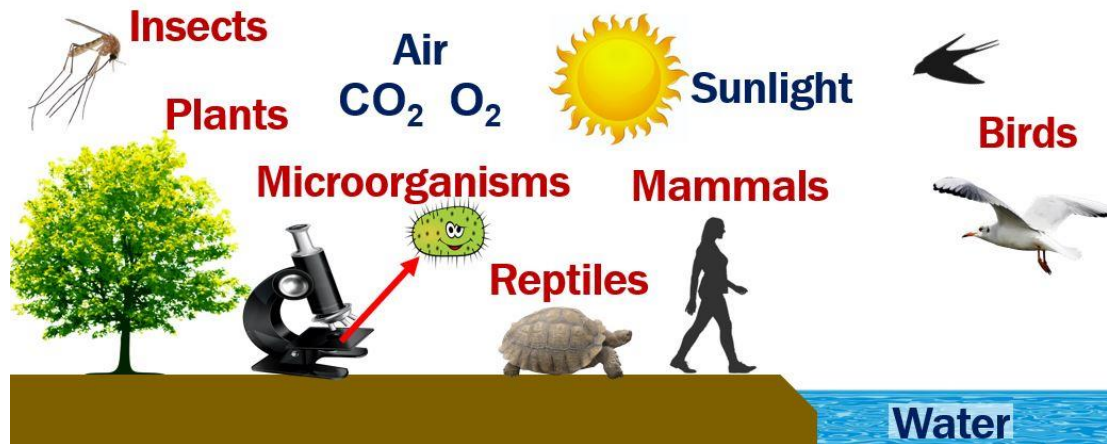
### *Definition*

Research in the field of 'life sciences' which studies the distribution, abundance and productivity of living organisms, the relationships between living organisms and the surrounding (physical) environment (Kimmins 1997). it seeks to understand the vital connections between plants and animals and the world around them.

# Ecology

*The study of the relationships between organisms and their environment, and the balances between these relationships*

Blue Words = Abiotic Factors    Red Words = Biotic Factors



# *Types of Ecology*

**Physiological Ecology**

**Population Ecology**

**Community Ecology**

**Evolutionary Ecology**

**Ecosystem Ecology**

## Ecophysiology

**Environmental physiology** or **physiological ecology** is a biological discipline that studies the adaptation of an organisms physiology to environmental conditions.

The study of the physiology of organisms with respect to their adaptation to the environment

## *Population Ecology*

# POPOULATION ECOLOGY

Population ecology is the study of **populations** in relation to **environment**, including **environmental influences** on **density** and **distribution**, **age structure**, and **population size**.

www.getclipsarts.com

# Population Ecology



# Community Ecology

- **Community**

- ◆ all the organisms that live together in a place
  - interactions

- **Community Ecology**

- ◆ study of interactions among all populations in a common environment

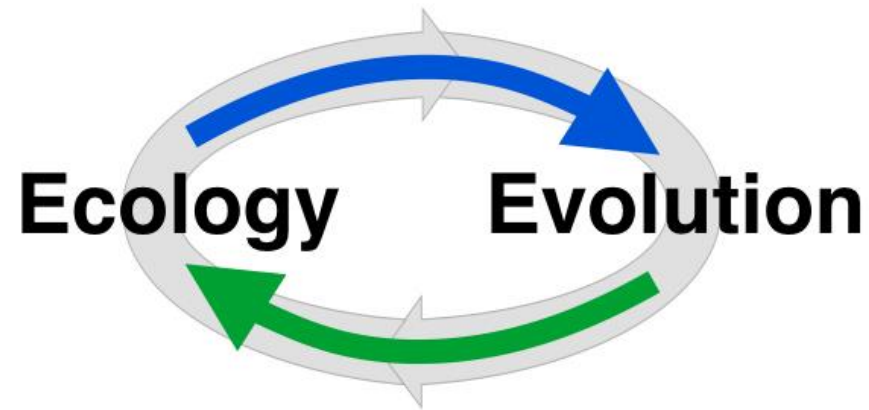
To answer:  
In what way do the  
populations interact?



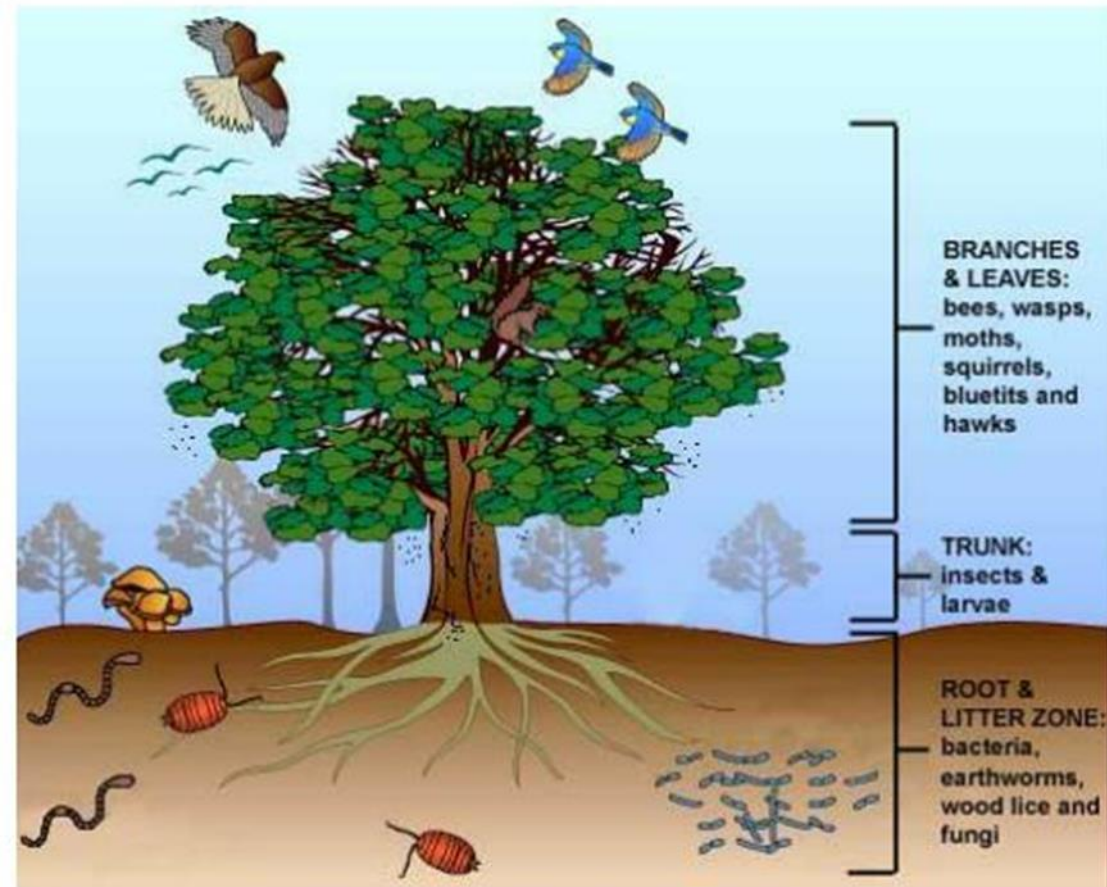
AP Biology



***Evolutionary Ecology*** : is linked closely to population ecology. The physical and biological environment acts as a filter that allows some individuals within a population to pass, and screens out others. Those who pass contribute genes to the next generation; thus, there is a continual inter-play between the environment and the generic composition of populations.



**Ecosystem Ecology** :(e.g. forest, river, ponds...) is to a great extent about mass balances of elements and their interactions. The fluxes of elements are strongly coupled to each other, and often one limiting element regulates the fluxes of the others.



## **Forest ecology?**

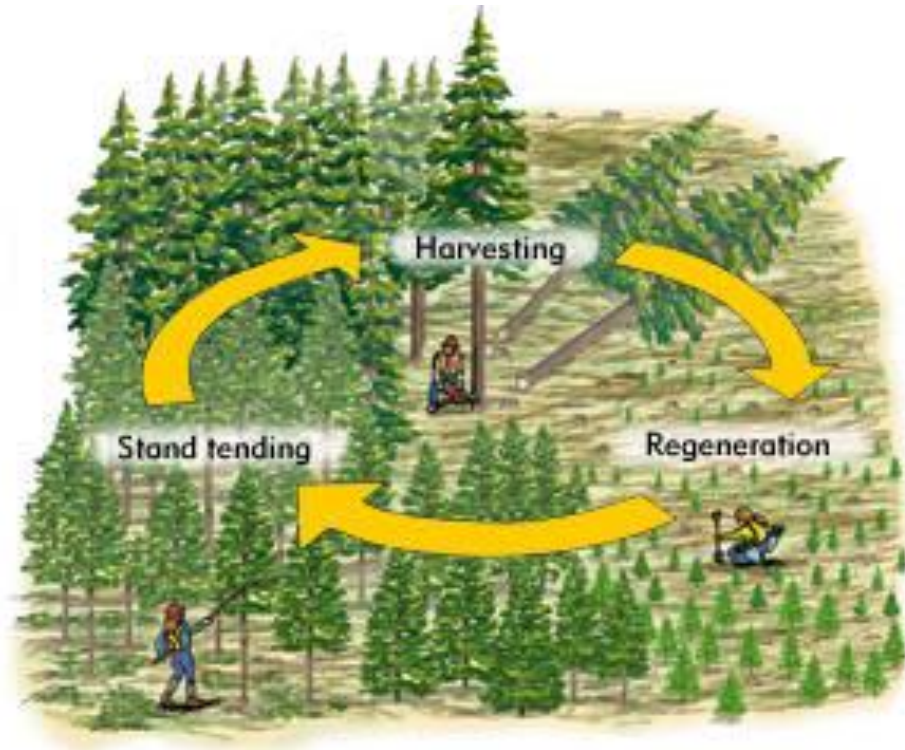
***Forest ecology** is the study of the complex interactions between the organic and inorganic elements of a forest ecosystem .*

***A forest ecosystem is a dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system***

<https://www.nature.com/subjects/forest-ecology>

## Why study forest ecology?

In general: to keep ecosystems healthy and productive.



But we have silviculture?

Source: Introduction to Silvicultural Systems [www.for.gov.bc.ca/hfd/pubs/ssintroworkbook/](http://www.for.gov.bc.ca/hfd/pubs/ssintroworkbook/)

## *Forest ecosystem*

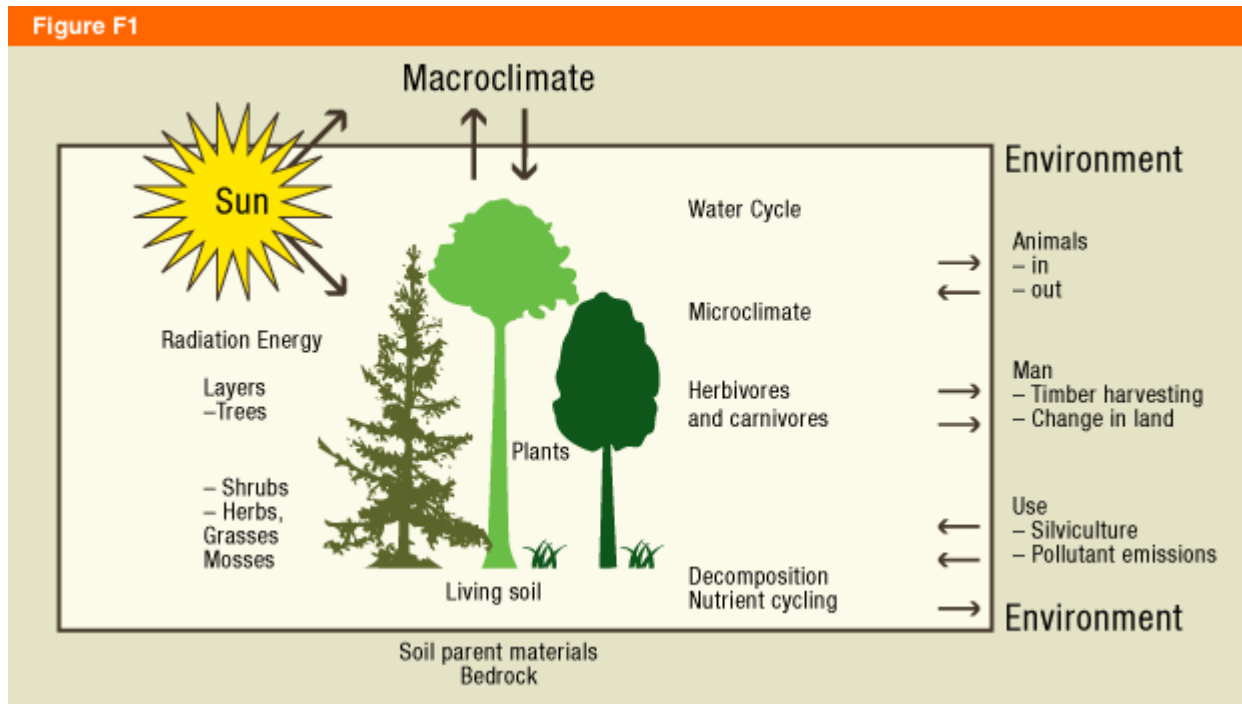
A forest ecosystem is a **dynamic complex of plant, animal and micro-organism communities and their abiotic environment interacting as a functional unit, where trees are a key component of the system**

## forest ecosystem key-features

1. **Structure**: an ecosystem is composed of biotic and abiotic components arranged in vertical and horizontal patterns
2. **Function**: continuous flow of matter and energy between the living community and the abiotic environment
3. **Complexity**: assemblages of living organisms, connected to dead organic matter and the physical environment
4. **Interactions**: between living organisms, dead organic material and abiotic components: changes in one set of components induces change in almost all others as well > superorganism
5. **No clear boundaries**:
6. **Dynamical**: ecosystems change over time

# Why study forest ecosystem?

*We should know the basics of forest structure and processes !!*



... to better estimate the consequences of change

Source: Hannelius & Kuusela 1995

## ❖ Forest Ecosystem:

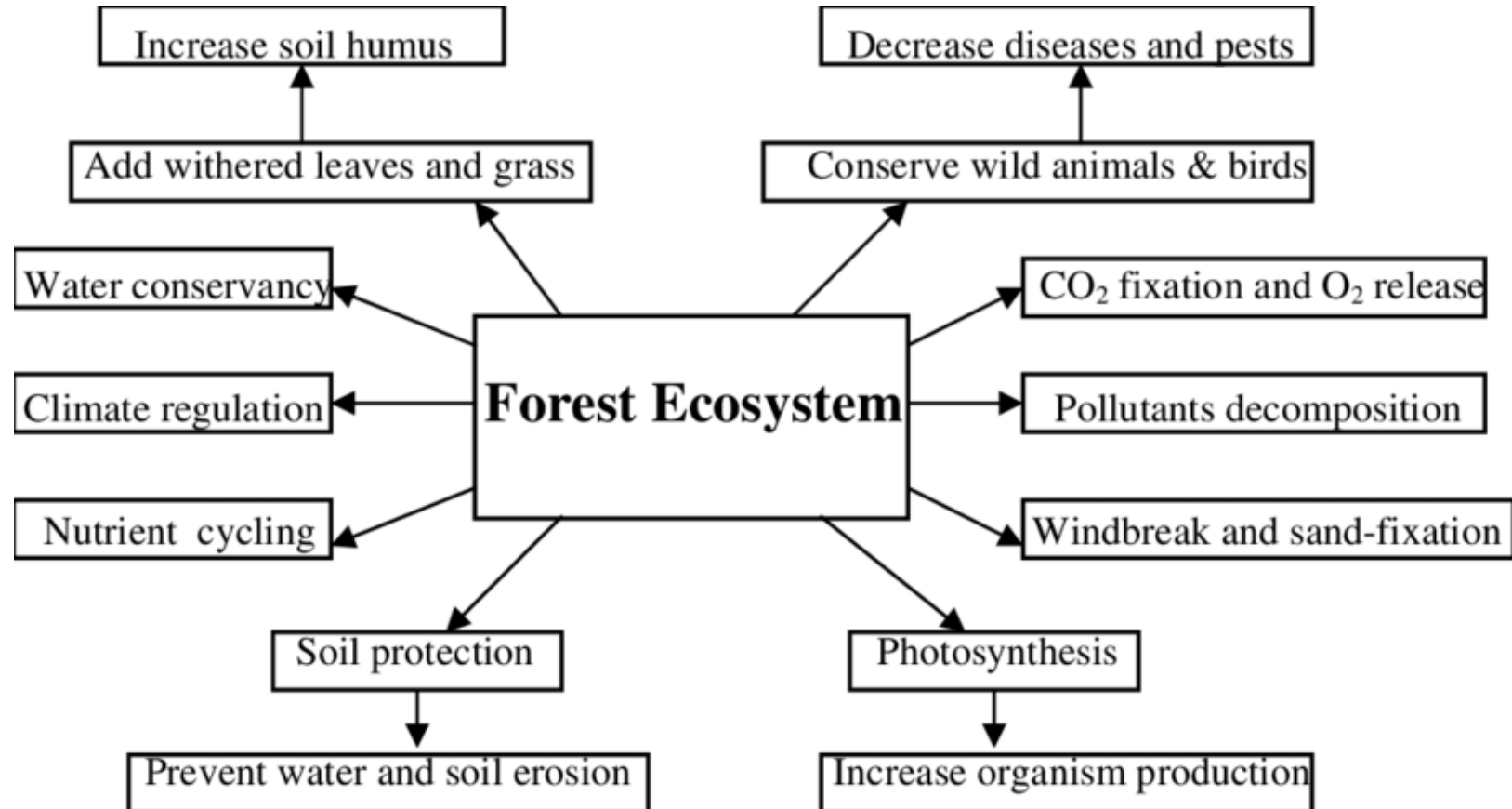
- ❖ A forest is an area with a high density of trees.
- ❖ **World's total land area** is 13,076 million hectares - (Source: FAO; 1989)
- ❖ Of which total forests account for about 31% of the world's land area.
- ❖ **In Iraq** the forest cover is roughly 11% of the total land area.
- ❖ The forest ecosystem are of great concern from the environmental point of view.
- ❖ It provides numerous environmental services like;
  - Nutrient cycling,
  - Maintaining biodiversity
  - Providing wildlife habitat
  - Affecting rainfall patterns
  - Regulating stream flow
  - Storing water
  - Reducing flooding
  - Preventing soil erosion
  - Reclaiming degraded land & many more....



*Forest Ecosystem*



## Forest Ecosystem Functions



## ❖ Forest Ecosystem:

- ❖ Apart from environmental values, forest ecosystems have some traditional values as well.
- ❖ Examples are:
  - Fire Wood & Timber.
  - Fruits.
  - Gums.
  - Herbs & drugs.
- ❖ The various components of a Forest Ecosystem are:
- ❖ Biotic components: The various biotic components, representatives from the three functional groups, of a forest ecosystem are:
  - 1) Producer Organisms:
    - ❖ In a forest, the producers are mainly trees.
    - ❖ Trees are of different kinds depending upon the type of forest developed in that climate.

- ❖ Apart from trees, climbers, epiphytes, shrubs and ground vegetation.
- ❖ Dominant species of trees in major types of forest ecosystems are:
  - ❖ *Tectona grandis*, Acer, Betula, Picea, Pine, Cedrus.

## 2) Consumers:

- ❖ In a forest, consumers are of three main types;

### a) Primary Consumers:

- ❖ These are Herbivores which feed directly on producers. E.g.
  - ❖ Ants, Beetles, Bugs, spiders etc. feeding on tree leaves.
  - ❖ Larger animals such as Elephants, Deer, giraffe etc. grazing on shoots and/or fruits of trees.

### b) Secondary Consumers:

- ❖ These are carnivores and feed on primary consumers.
  - ❖ These include Birds, Lizards, Frogs, Snakes, Foxes, etc.

### c) Tertiary Consumers:

- ❖ These are secondary carnivores and feed on secondary consumers
  - ❖ These include top carnivores like Lion, Tiger, etc.

### 3) Decomposers:

- ❖ These include wide variety of saprotrophic micro-organism like;
  - ❖ Bacteria (*Bacillus Sp.*, *Clostridium sp.*, *pseudomonas*, etc.)
  - ❖ Fungi (*Aspergillus sp.*, *Ganoderma sp.*, *Fusarium*, etc.)
  - ❖ Actinomycetes (*Streptomyces*, etc).
- ❖ They attract the dead or decayed bodies of organisms & thus decomposition takes place.
- ❖ Therefore, nutrients are released for reuse.

### ❖ Abiotic components:

- ❖ These include basic inorganic & organic compounds present in the soil & atmosphere.
- ❖ In addition dead organic debris is also found littered in forests.

## Components of Forest Ecosystem:



### ▪ Producers: Different tree species



### ▪ Consumers in a Forest Ecosystem



### ▪ Decomposers in a Forest ecosystem