

## **Lab-1- Ecology**

**Ecology:** is the study of the organism, environment and how the organisms interact with each other and their environment. It was first devised by **Ernst Haeckel**, a German Zoologist.

**Environment:** is defined as the physical, chemical and biological factors that effect on the living organisms or ecological community and ultimately determine its form and survival.

Ecology is studied at various levels, such as **organism, population, community, biosphere** and **ecosystem**.

Ecologists primary goal is to understand life processes, adaptations , habitat interactions and biodiversity of organisms.

## **Types of Ecology**

**1- Organism Ecology:** is the study of an individual organism's behavior, morphology, physiology, etc. in response to environmental challenges.

**2- Population Ecology:** deals with factors that alter and impact the genetic composition and the size of the population of organisms.

**3- Community Ecology:** deals with how community structure is modified by interactions among living organisms occupying the same geographical area. Competition, mutualisms are key interactions to maintaining a community.

**5- Ecosystem Ecology:** deals with the entire ecosystem, including the study of living organisms along with non-living environmental components like air, water, soil .

**6- Landscape Ecology:** throws light on the role of human impacts on the landscape structures and functions.

**7- Global Ecology:** deals with interactions among earth's ecosystems, land, atmosphere and oceans, which helps to understand the large-scale interactions and their influence on the planet.

**7- Habitat ecology:** is the type of natural environment in which a particular species of an organism live, characterized by both physical and biological features.

**8- Molecular Ecology:** is the study of ecology focuses on the production of proteins and how these proteins affect the organisms and their environment.

### **Importance of Ecology :**

- 1- **Environmental protection :** Ecology enables us to understand the impact of our actions on the ecosystem.
- 2- **Resource Distribution :** Ecology enables us to understand which resources are essential for the existence of various organisms.
- 3- **Conservation of Energy :** Energy is necessary for all living things. The overuse of energy sources like light, food, and radiation as a result of a lack of ecological understanding causes the depletion of these resources.
- 4- **Disease and Pest Control :** Microbial creatures play a role in our environment that is equal to that of any other kind of life. Certain bacteria must be thoroughly researched in order to stop the rapid spread of disease in humans.
- 5- **Increases Environmental Awareness :** Ecology research promotes eco-friendliness by striving for ecosystem balance, raising public awareness, and encouraging sustainable living to protect the environment.

**Ecological ( Environmental ) Pollution :** is an effect caused by undesirable changes in the natural environment that have a harmful effect on plants, animals and humans.

### **Types of Environmental Pollution :**

- 1- Air pollution
- 2- Water pollution
- 3- Soil (or land) pollution
- 4- Noise pollution
- 5- Thermal pollution
- 6- Light pollution
- 7- Radiation pollution

## **Lab-2- Ecosystem**

**Ecosystem:** is the ecological unit consisting of biotic factors (living) and abiotic factors (non-living) in a specific area . At any place where the organisms live, there is continuous interaction between the living and non-living components, i.e. between plants, animals and their environment.

Ecosystem basically is of two types : aquatic and terrestrial .

### **Terrestrial ecosystem :**

It is classified into following sub parts:

- 1- Forest ecosystem
- 2- Desert ecosystem
- 3- Grassland ecosystem
- 4- Mountain ecosystem

### **Aquatic ecosystem :**

The main two types are :

- 1- Marine ecosystem ( ex. Coral reefs )
- 2- Freshwater ecosystem ( ex. Rivers , streams , wetlands ).

### **Importance of Ecosystem:**

- 1- It provides habitat to wild plants and animals.
- 2- It promotes various food chains and food webs.
- 3- It controls essential ecological processes and promotes lives.
- 4- Involved in the recycling of nutrients between biotic and abiotic components.
- 5- It helps in maintaining the usual flow of energy in an ecosystem including:  
Carbon Cycle, Energy Cycle, Nitrogen Cycle, Oxygen Cycle, and Water Cycle.

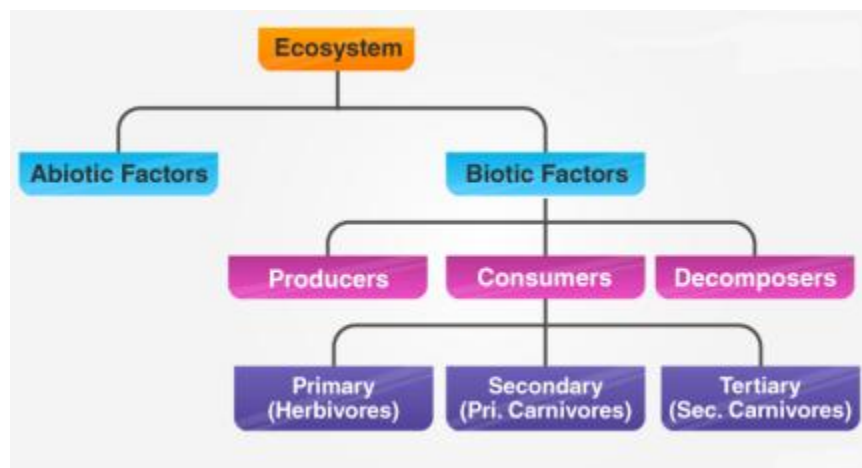
## Ecosystem Components

### 1- Biotic Components :

**A- Producers:** are organisms which prepare organic compounds from inorganic raw materials, through the processes of photosynthesis e.g. all green plants.

**B- Consumer:** are organisms which depend on the energy, produced by the producer. Different categories of consumer are herbivores, carnivores and omnivores.

**C- Decomposers:** are organisms that attack on dead animals and plants, and convert the complex organic compounds in to simpler compounds (by the process of decomposition) and then recycle all the nutrients back. For example bacteria and fungi.



**2- Abiotic component includes:** physical and chemical factors

#### (A) Physical Factors

- 1- Sunlight (for photosynthesis)
- 2- Water (essential for living beings)
- 3- Temperature (necessary to survive)
- 4- Soil (provide base and nutrients)

## Lab-3- Abiotic Factors

**Abiotic factors:** are nonliving (physical and chemical) factors in an ecosystem. As part of the ecosystem, these factors do affect the living organisms.

### Examples of Abiotic Factors:

**1- Winds:** is defined as the movement of air from the high-pressure area to low pressure area, and measured by units' **m/s** or **Km/ hr.** or **Knot**

The instrument used to measure wind direction is called **Anemometer**.



There are many types of wind such as **permanent, seasonal and local winds.** These main types divided into:

**A- Trade Winds:** These are permanent winds flowing from east to west.

**B- Easterlies winds:** is a prevailing wind blowing from the east.

**C- Westerlies:** are prevailing winds that flow from the west towards the east.

**D- Land Breeze winds:** is a wind that flows from the land towards the sea. It flows often at night.

**E- Sea Breeze winds:** is a wind that blows towards land from the direction of a large water body. Sea breeze develops due to differences in air pressure created by the differing heat capacities of water and dry land.

**F- Anabatic Winds:** These Winds are upslope winds driven by warmer surface temperatures on a mountain slope than the surrounding air column.

**G- Katabatic Winds:** are downslope winds created when the mountain surface is colder than the surrounding air and creates a downslope wind.

### **Importance of winds:**

- 1- Pollinating & Seed dispersal for plants
- 2- Generating renewable electricity using wind turbines
- 3- Environmental purification by cleaning the air of pollution
- 4- Weather and climate regulation by distributing heat & moisture
- 5- Winds impact flight routes, sailing & shipping

**2- Rainfall:** is the amount of rain that falls in a location over a period of time. Its measured by **ml.** unit. Also called liquid **precipitation.**

The instrument used to measure precipitation is called **Rain Gauge.**



**3- Humidity:** is the amount of water vapor in the air.

The instrument used to measure humidity is a **Hygrometer**.



There are three main measurements of humidity:

**a- Absolute humidity:** is the mass of water vapor per unit volume of air and is expressed in **g/m<sup>3</sup> or g/kg**.

**b- Relative humidity:** is the ratio of current water vapor content of the air to its content at saturation and measured by **percentage %**.

**c- Specific Humidity:** the mass of water vapor per unit mass of air and measured by **g/kg**.

**4-Atmospheric pressure:** is defined as the force per unit area exerted against a surface by the weight of the air above that surface it's measured by units: **Dyne / cm<sup>2</sup> or Newton / m<sup>2</sup> and Millibar**. The instrument which is used to measure atmospheric pressure is called **Barometer**.



### **Factors that effect on atmospheric pressure:**

- 1- Rise and fall above sea level
- 2- Temperature
- 3- Water vapor
- 4- Distribution of land and water

**5-Evaporation:** The transition of a substance from a liquid to a gaseous state due to an increase in temperature. It's measured by **ml. unit.**

**Evapotranspiration:** is the sum of water loss of any region as result of the combined effect of evaporation from the soil and water surface and transpiration from plants.

### **Factors effect on evaporation**

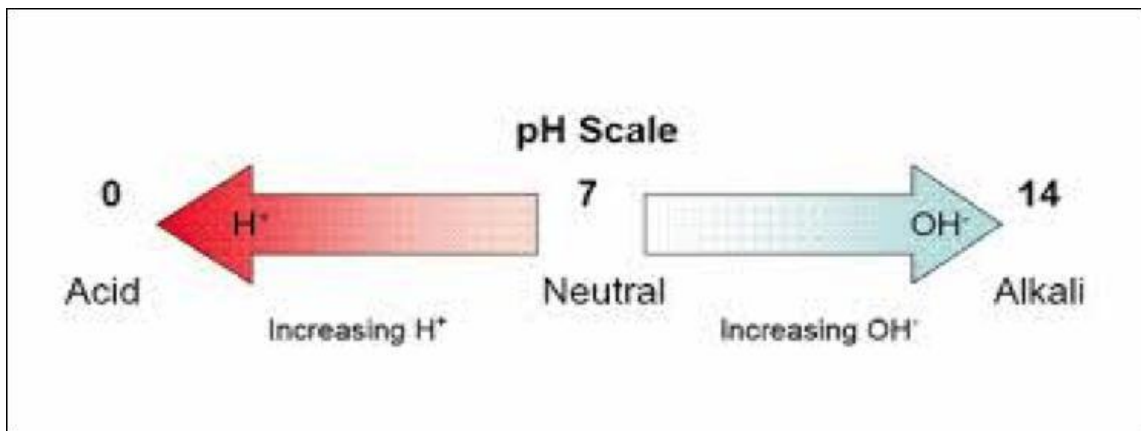
- 1- Climactic factors: water, temperature, wind, humidity and atmospheric pressure.
- 2- Water state: salinity, water depth and water surface area.
- 3- Soil state: soil humidity, soil color and vegetation.

## Lab-4- Chemical Factors

**Chemical factors:** are the non-living chemical components of an environment that influence organisms, such as nutrients, gases, water, and soil chemistry like pH and salinity. These abiotic factors are essential for an organism's survival, growth, and reproduction and play a crucial role in shaping ecosystems.

### Examples of chemical factors:

**1-pH:** it is a measure of the relative amount of free hydrogen ( $H^+$ ) and hydroxyl ions ( $OH^-$ ). It tells degree to which something such as soil, water, or any solution is basic or acidic. pH of less than 7 indicates acidity whereas a pH of greater than 7 indicates alkalinity.



Human activities such as sewage overflows or runoff, can cause significant short-term fluctuations in pH and long-term impacts can be extremely harmful to plants and animals, as it affects metabolic processes and the availability of resources and it affects the solubility and toxicity of chemicals, the availability of nutrients, and the survival, growth and reproduction of organisms in aquatic and terrestrial ecosystems. Extreme changes in pH, can stress local organisms and may ultimately lead many species to leave the area or die. It is measured by:

- A- Colorimetric method
- B- pH meter



**2-Salinity:** refers to the concentration of salt dissolved in water or soil. Salinity is usually expressed in parts per thousand (ppt) or (%).

High salinity in water and soil negatively impacts living organisms by creating osmotic stress, causing ion toxicity, and altering the physical properties of soil, which affects plants, microorganisms, and aquatic animals. For plants, this can lead to reduced water absorption, inhibited growth, and nutrient deficiencies, while soil microorganisms face dehydration and decreased metabolic activity. Aquatic life struggles with increased salt concentrations that can lead to death or displacement, and the soil structure is degraded, which can harm both plants and animals. The instruments used to measure salinity are:

**Conductivity meters (or salinometers):** These are the most common type and measure the electrical conductivity of a sample. They are ideal for both water and soil, as salts in water increase its electrical conductivity.



**Electrical conductivity (EC)** in both water and soil is a measure of their ability to conduct an electrical current, which is directly related to the concentration of dissolved ions or salts. In water, EC indicates the total concentration of dissolved salts like calcium, potassium, and chloride, while in soil, it signifies the concentration of salts in the soil water and can also estimate salinity, soil moisture, and texture. Measure units include deciSiemens per meter (dS/m) for soil and agriculture, and microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) or millisiemens per centimeter (mS/cm) for water quality.