

ATOMIC ENERGY CENTRAL SCHOOL, INDORE



CLASS XII
BIOLOGY

 **MODULE 1/3**

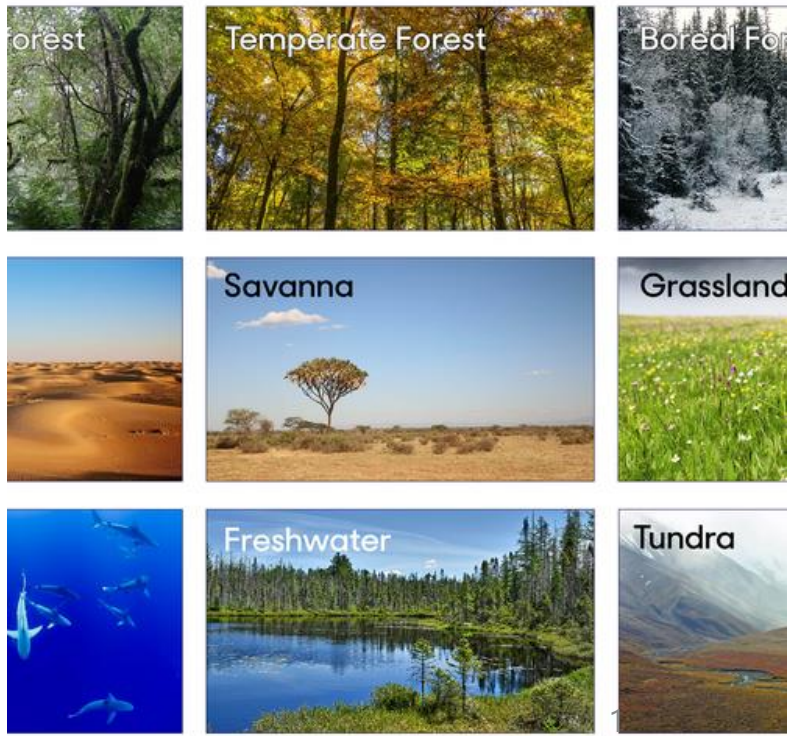
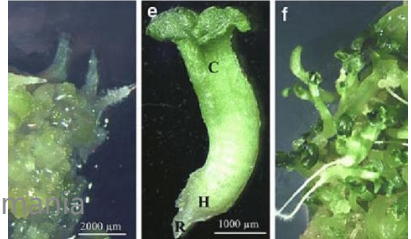
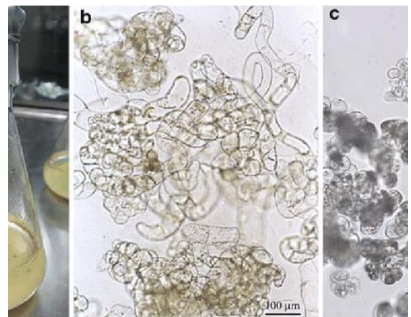
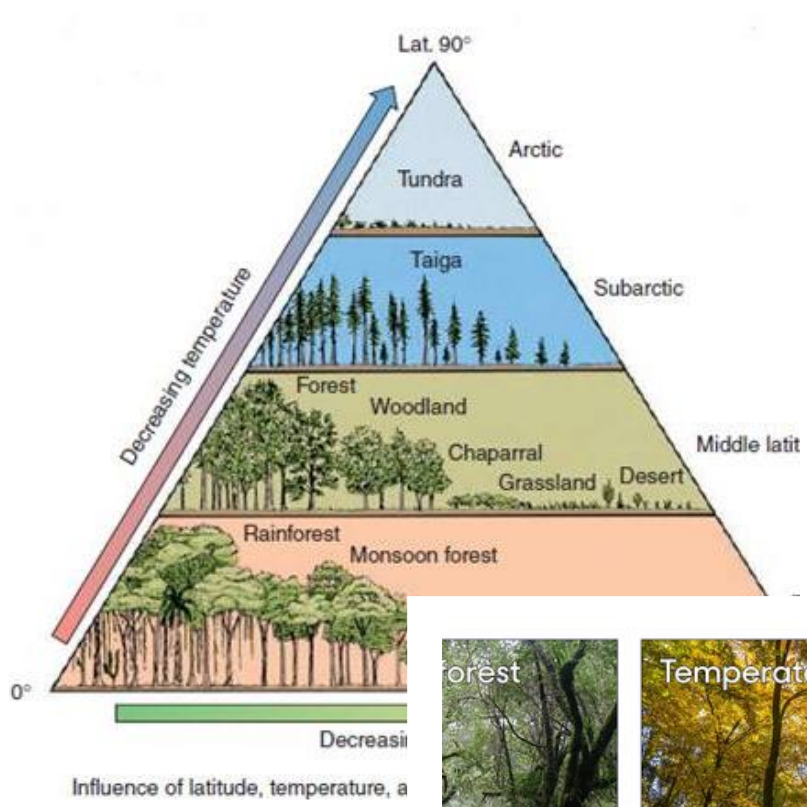
 **CHAPTER 13**

 **ORGANISMS AND POPULATIONS**



NEERAJ KUMAR BAMANIA
PGT(SS) - BIOLOGY
ATOMIC ENERGY CENTRAL
SCHOOL, INDORE

Neeraj Bamania



CHAPTER 13. ORGANISMS AND POPULATIONS

INTRODUCTION

- ❖ **The study of interaction or inter-relationship of living organisms with their environment is called ecology.**
- ❖ **Organisms and environment are always interdependent, interrelated or mutually reactive.**
- ❖ **The term ecology was coined and described by E. Haeckel.**
- ❖ **The term ecology was first authentically used by Reiter (Father of ecology).**
- ❖ **Autecology is the study of the inter-relationship of organisms of a species.**
- ❖ **Synecology is the study of the relation of the group of different species with their environment.**

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Ecology: Ecology is the branch of science that studies the relationship between organisms and their physical & biological environment.

Level of Organization in ecology:

ORGANISM

- Survival and Reproduction ; unit of Natural selection

POPULATION

- Population Dynamics; unit of Evolution

COMMUNITY

- Interactions among populations

ECOSYSTEM

- Energy flux, Nutrient cycle.

BIOSPHERE

- Global process.

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ECOLOGICAL HIERARCHY

➤ The hierarchy in the levels of organisms connected with ecological grouping of organisms is called ecological hierarchy.

➤ An **organism** is the smallest unit of ecological hierarchy and basic unit of ecological study.

➤ It may be microscopic (e.g., Amoeba, Chlorella, bacterium) or macroscopic (e.g., Rose, Mango, Crocodile, Dog, Human being).

➤ An organism can be unicellular (e.g., Amoeba, Euglena, Chlamydomonas), colonial (e.g., Volvox) or multicellular (e.g., Fish, Lizard, Mango tree).

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ECOLOGICAL HIERARCHY

- Each organism is capable of growth, self repair, movement and self regulation of its activities.
- A group of individuals (members) of the same species living at one place (specific geographical area) constitute a population.
- **Biotic community** is a group of organisms of different species that live in common area and which are interrelated and interdependent. It is a natural aggregation of plants and animals in the same environment.

Biotic community = Animal community + Plant community + Microbial community

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13.1 ORGANISM AND ITS ENVIRONMENT

The constituents of the environment which directly or indirectly influence the form and functioning of organisms in any specific way are known as **environmental factors**.

Climate is the characteristic pattern of weather elements in an area over a period of time with regard to temperature, rainfall, pressure, humidity, wind etc.

Habitat is the physical area covered by any organism.

Microclimate and Microhabitat : Sub-division of habitat is called microhabitat. It is an immediate climate (real climate) of an organism which is different from the average climate of the region.

e.g., Forest floor, burrow and surface of desert.

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13.1 ORGANISM AND ITS ENVIRONMENT

Biomes or Terrestrial Ecosystems

- ❖ The terrestrial part of the biosphere is divisible into enormous regions called biomes.
- ❖ No two biomes are alike. They are characterized, by distinct climate (precipitation and temperature mainly), vegetation, animal life and general soil type.
- ❖ The climate determines the boundaries of a biome and abundance of plants and animals found in each one of them.

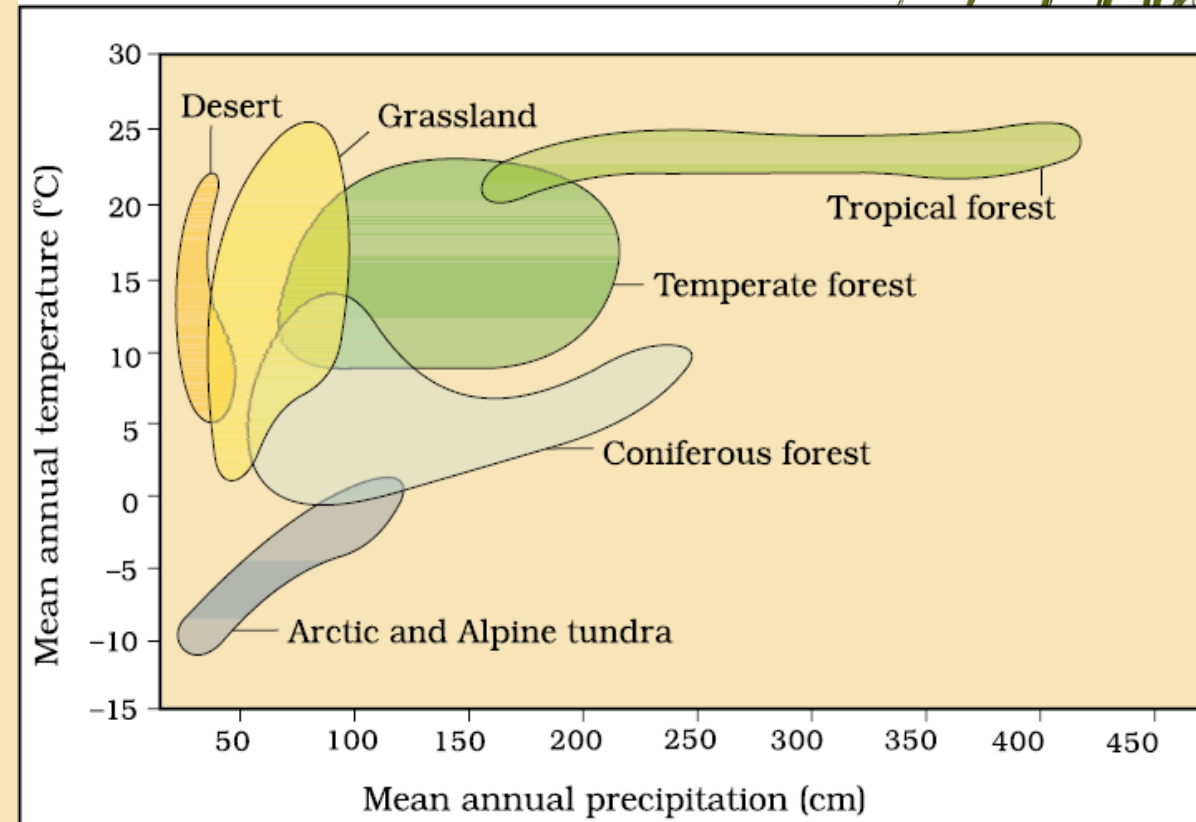


Figure 13.1 Biome distribution with respect to annual temperature and precipitation. (Source NCERT)

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Biomes or Terrestrial Ecosystems

Major biomes of India

Major biomes of India are shown in Figure 13.2. On planet Earth, life exists not just in a few favourable habitats but even in extreme and harsh habitats – scorching Rajasthan desert, perpetually rain-soaked Meghalaya forests, deep ocean trenches, torrential streams, permafrost polar regions, high mountain tops, boiling thermal springs, and stinking compost pits, to name a few. Even our intestine is a unique habitat for hundreds of species of microbes.



(a)



(b)



(c)



(d)

Figure 13.2 Major biomes of India : (a) Tropical rain forest; (b) Deciduous forest; (c) Desert; (d) Sea coast. (NCERT)

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Ecological niche word is given by *Grinnel*.

It is a specific part of habitat occupied by individuals of a species which is circumscribed by its range of tolerance, type of food, range of environment, microclimate, shelter etc.

Organisms that occupy the same or similar ecological niche in different geographical regions are known as ecological equivalents.

e.g., Arctic fox and African Jackal, both are scavengers. Grazers of North America and Kangaroos of Australia.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.1 Major Abiotic Factors:

The environmental factors are divided into two categories on the basis of their nature – abiotic & biotic factors.

TEMPERATURE : A few organisms can tolerate and thrive in a wide range of temperatures (eurythermal) but the vast majority of them are restricted to a narrow range of temperatures (stenothermal).

On the basis of temperature vegetation is divided into four groups:

Megatherms :

- The plants growing in high temperature throughout the year, e.g., tropical rainforest.

Mesotherms :

- The plants growing in alternate high and low temperature, e.g., deciduous tropical forest.

Microtherms :

- Plants growing in low temperature, e.g., coniferous forest.

Hekistotherms :

- Plant growing in very low temperature, e.g., alpine vegetation.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.1 Major Abiotic Factors:

WATER

- Water is an important component of protoplasm.
- Water is a resource, a condition and a habitat in itself.
- The productivity and distribution of plants is dependent on water.
- Some organisms are tolerant of a wide range of salinities (**euryhaline**) but others are restricted to a narrow range (**stenohaline**).

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.1 Major Abiotic Factors:

LIGHT

Light intensity, light direction and light quality control a number of processes of organisms as photosynthesis, growth, movements, photoperiodism, etc.

In deep lake, zonation or stratification may be according to the need of light. The different zones of light in aquatic habitat are-

Littoral zone : shallow coastal region producers occur throughout.

Limnetic zone : open water zone; oxygen and light decreases with depth.

Photic zone : light can penetrate.

Aphotic zone : light does not penetrate

Benthic zone : bottom zone.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.1 Major Abiotic Factors:

SOIL

- **Soil is the upper weathered part of earth's surface having mineral particles (45%), water (25%), air (25%), living organisms and humus (5%) which can sustain terrestrial plant life.**
- **The study of soil is called edaphology.**
- **It is derived from rocks by weathering which is of three types:**
 - **Chemical weathering** caused by oxidation, hydrolysis or carbonation.
 - **Mechanical weathering** caused by living organisms, e.g., lichens, grazing animals or earthworm.
 - **Physical weathering** caused by water, wind, gravity, glaciers, etc.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.1 Major Abiotic Factors:

SOIL

What is a soil profile?

A soil profile consists of several soil horizons.

O horizon

- humus on the ground surface.

A horizon

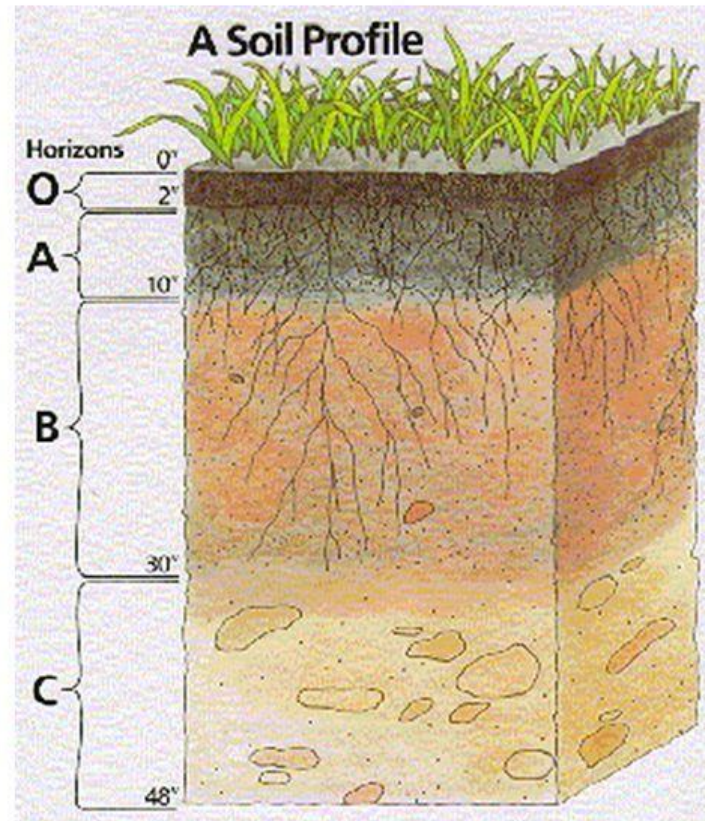
- Top soil.
- Rich in organic matter. Typically dark color.
- Also called zone of **leaching**.

B horizon

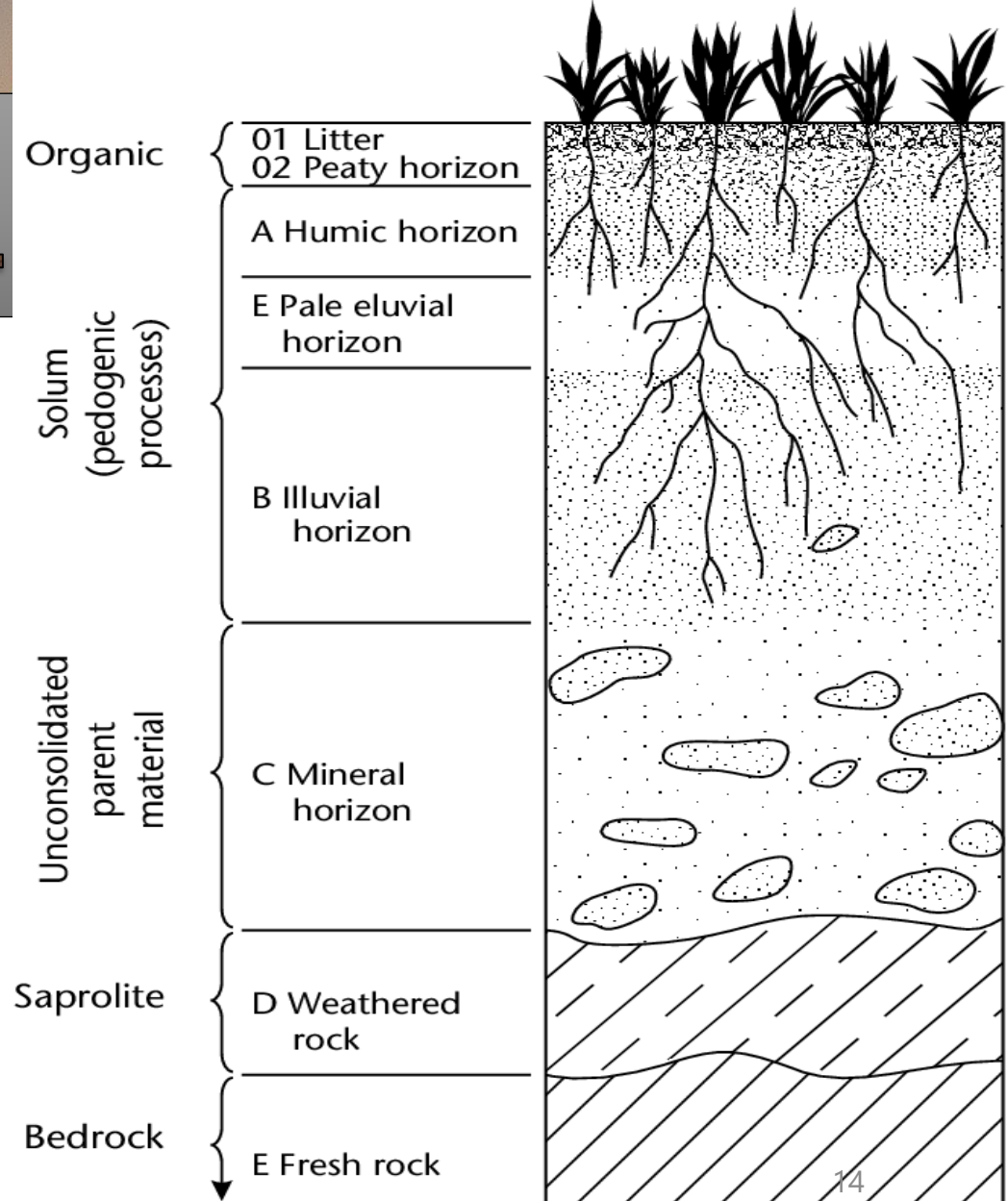
- Subsoil.
- Also called zone of accumulation.
- May contain soluble minerals such as calcite in arid climates (caliche).

C horizon

- Weathered bedrock (rotten rock).
- Bedrock lies below the soil profile.



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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.2 Responses to Abiotic Factors

Homeostasis is the maintenance of a constant internal environment in response to changes in –

- ✓ the changing conditions of the external environment.
- ✓ the changing conditions of the internal environment.

The various responses to abiotic factors are regulated, conform, migrate & suspend.

A. Bergman rule - Birds and mammals attain greater body size in colder regions and lesser in warmer regions.

B. Allen's rule - Animals from colder climate generally have shorter ears and limbs to minimise heat loss.

C. Jordan's rule - Fishes occurring in cold water have more vertebra than those found in warmer water.

D. Gloger's rule - Animals of tropic region are more darker in colour and heavily pigmented than those in arctic region.

E. Rensch's rule - Birds of colder region have narrow wings than those found in warmer region.

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13.1 ORGANISM AND ITS ENVIRONMENT

— 13.1.2 Responses to Abiotic Factors

1. Regulators :

Some organisms are able to maintain homeostasis by physiological (Some times behavioral) means which ensures body temperature, constant osmotic concentration.

All birds and mammals, a very few lower vertebrates and invertebrates are regulators (Thermoregulation and osmoregulation).

For example, human beings maintain their body temperature by sweating in summer and shivering during winter season. Plants do not have such mechanisms to maintain internal temperatures.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.2 Responses to Abiotic Factors

2. Conformers :

Majority of animals and nearly all plants cannot maintain a constant internal environment.

Their body temperature changes with the ambient temperature. In aquatic animals the osmotic concentration of the body fluids change with that of the ambient water and osmotic concentration.

Some species have evolved the ability to regulate, but only over a limited range of environmental conditions, beyond which they simply conform.

Thermoregulation is energy-expensive process. Heat loss or gain is a function of surface area. Therefore small animals are not found in polar region.

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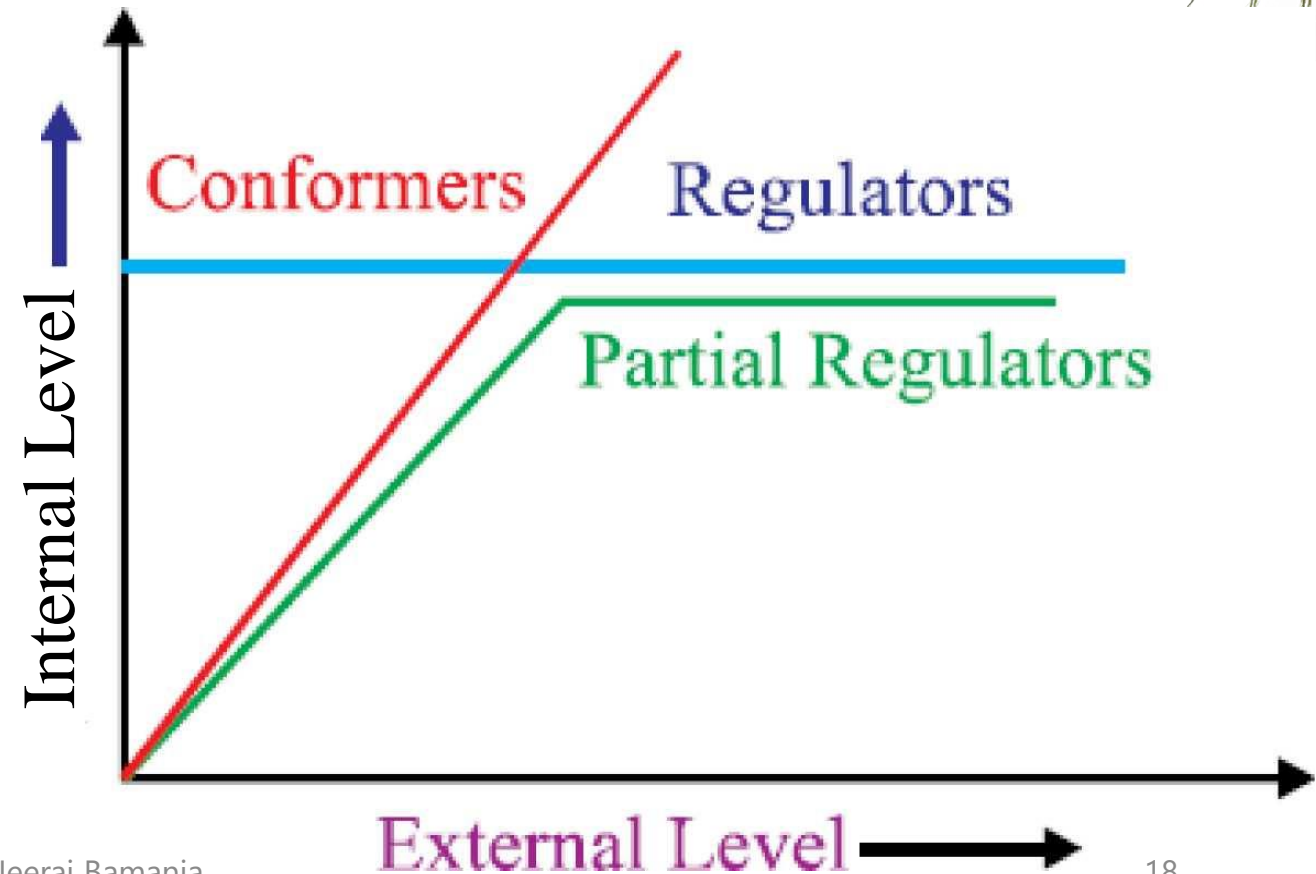
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13.1.2 Responses to Abiotic Factors

3. Partial Regulators :

Hairs on the body acts as heat insulator.

In smaller organisms the surface area is large as compared to the volume. But in large animal this ratio is small. So, the larger animals effectively controls the body temperature.



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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.2 Responses to Abiotic Factors



4. Migration :

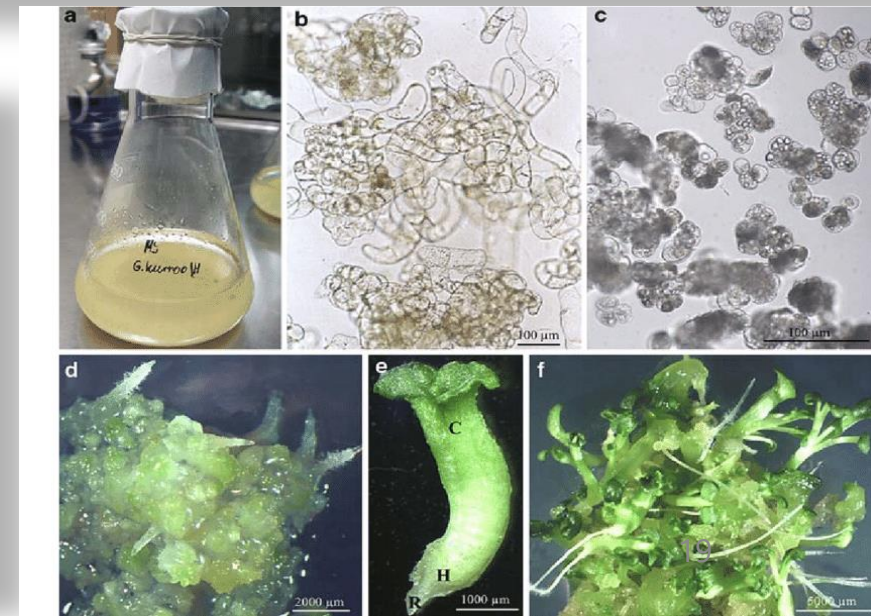
The organisms can move away temporarily from the stressful habitat to a more comfortable area and return when stressful period is over.

5. Suspension:

Organisms that cannot migrate , suspend their metabolic functions during stressful period. It is called suspension.

E.g. Hibernation, aestivation, Diapause

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13.1 ORGANISM AND ITS ENVIRONMENT

— 13.1.2 Responses to Abiotic Factors

- **Hibernation:** Hibernation is a process by which the animals avoid the stress and become inactive during winter.

Ex: Polar bear, Frogs, Lizards.

- **Aestivation:** Aestivation is a process by which the animals avoid the stress and summer related problems and become inactive during summer.

Ex: snails and fishes.

- **Diapause:** It is a stage of suspended development seen in many zooplanktons to avoid unfavorable conditions.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.3 Adaptations

Plants and animals undergo special characteristic changes in order to live and adjust under prevailing environmental conditions which is called adaptation.

PLANT ADAPTATION

According to various modes of adaptations, plants are grouped into the following major types:

- **Hydrophytes, water plants (aquatic plants).**
- **Xerophytes or plants growing in xeric (dry) conditions.**
- **Mesophytes or plants growing in mesic (normal water) conditions.**

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.3 Adaptations

Hydrophytes are divided into **five main types**:

Free floating : They are not rooted in soil, and float freely on the surface of water.

E.g., Wolffia - (Smallest Angiosperm, 1mm) - root less

Suspended hydrophytes : It remains underwater, and are not rooted in mud.

E.g., (i) Utricularia - Bladderwort.

Submerged and Rooted hydrophytes remain underwater, and are rooted in mud.

E.g., Hydrilla, Vallisneria, Potamogeton, Elodea.

Fixed floating hydrophytes : These have fixed roots in mud but the leaves keep floating on the water surface.

E.g., Trapa, Nymphaea, Victoria (water lily), Nelumbium.

Emergent hydrophytes/Amphibious plants : In these plants, the root is fixed in soil and the stem remains partly or completely exposed to air.

E.g., Jussaea, Juncus, Typha, Sagittaria.

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.3 Adaptations

• **Plants grow in dry or xeric conditions are called xerophytes.**

• **Dryness is of two types :**

- **Physical dryness :** Physically low water quantity in plant habitat. E.g., Psammophytes, Lithophytes, Chasmophytes.
- **Physiological dryness :** Optimum water is present in plant habitat but due to some reason, plants can not absorb water. E.g. High salinity, low temperature.

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• **Xerophytes is divided into different types :**

Name	Character	Example
Psammophyte	It grows in dry sandy soil near the river bank mesophytes.	<i>Prosopis, Acacia</i>
Lithophytes	They grow on rock soil, slope of Aravali hills.	<i>Aloe, Agave, Opuntia</i>
Chasmophyte	Grow in rock slit.	<i>Aloe, Agave, Poa, Aristida</i>
Halophyte	Grow in salty soil.	<i>Rhizophora, Avicennia, Sonneratia</i>
Epiphytes	They grow on other plant.	<i>Orchids</i>
Psychrophyte	They grow in cold soil.	<i>Rhododendron</i>

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13.1 ORGANISM AND ITS ENVIRONMENT

13.1.3 Adaptations

ANIMAL ADAPTATION

- **Animals adapt themselves for protection from predators, feeding habits, camouflage, mating, adjust to environmental stress conditions.**
- **Desert lizard keep their body temperature fairly constant by behavioural means. They bask in the sun and absorb heat when their body temperature drops below the comfort zone, but move into shade when the ambient temperature starts increasing.**
- **Kangaroo rat excretes solid urine & can live from birth to death without drinking water thereby, conserving water.**

WHAT IS AN ANIMAL ADAPTATION?

