



# Forest Ecology



# LESSON PLAN FOR FOREST ECOLOGY

<u>Learning Unit</u>	<u>Contents</u>		<u>Sessions</u>
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		Moisture	
		Wind	
	Edaphic Factors	Soil Formation	
		Soil Profile	
		Soil Properties	
		Soil Structure	
		Soil Water, Soil Air, Relationship	
Soil Organic Matter			

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<u>Learning Unit</u>	<u>Contents</u>		<u>Sessions</u>
2- Ecological Factors	Physiographic Factors	Configuration of Land Surface	
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		Slope	
		Aspect and Exposure	
	Biotic Factor	Weeds	
		Parasites	
		Grazing	
		Fire	
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3- Ecosystem	Component of Ecosystem	Concept of Ecosystem	2
		Ecosystem Energetic - Primary & Secondary Production, Food Chains	
		Biogeochemical Cycles	
	Major Ecosystems	Terrestrial	
		Aquatic	

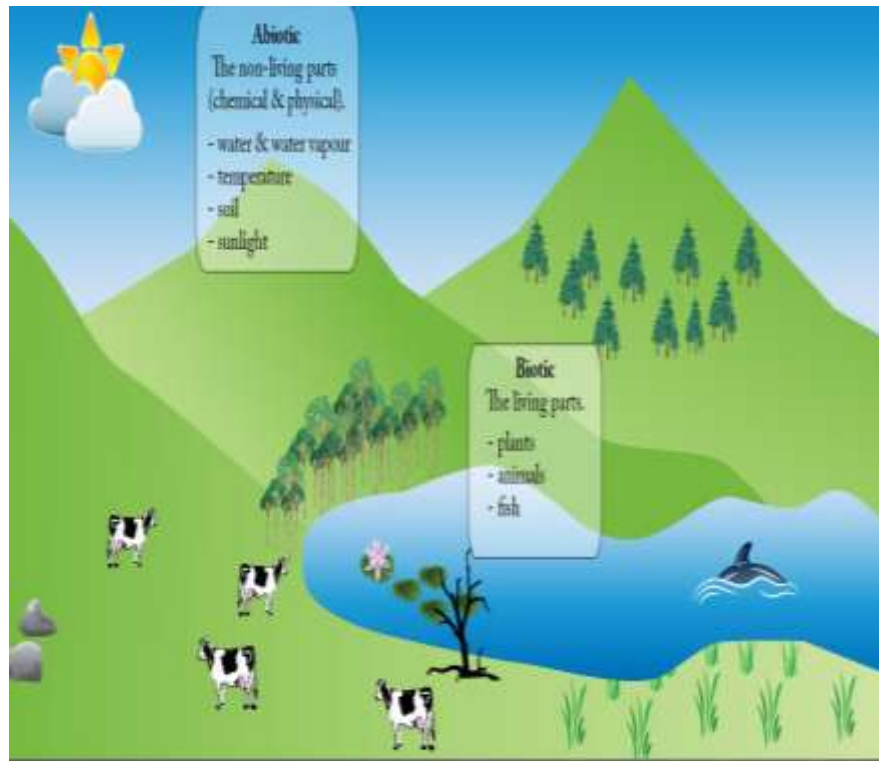
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<u>Learning Unit</u>	<u>Contents</u>		<u>Sessions</u>
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<u>Learning Unit</u>	<u>Contents</u>		<u>Sessions</u>
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		Poly-climax Theory	
		Kinds of Succession	
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	Animals		
8- Ecological Indicators	Ecological Indicators		
9- Invasive Alien Species	Invasive Alien Species		1
10- Phytogeographical Zones	Phytogeographical Zones		1
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12- Classification of Forests	Introduction & Types		4
	Champion & Seth's		

**Ecology** (from Greek: οίκος, *oikos*, "household"; and λόγος, *logos*, "knowledge") is the scientific study of the **distribution** and **abundance** of living **organisms** and the **interactions** among organisms and between organisms and their **environment**. The environment of an organism includes **abiotic** and **biotic** factors.

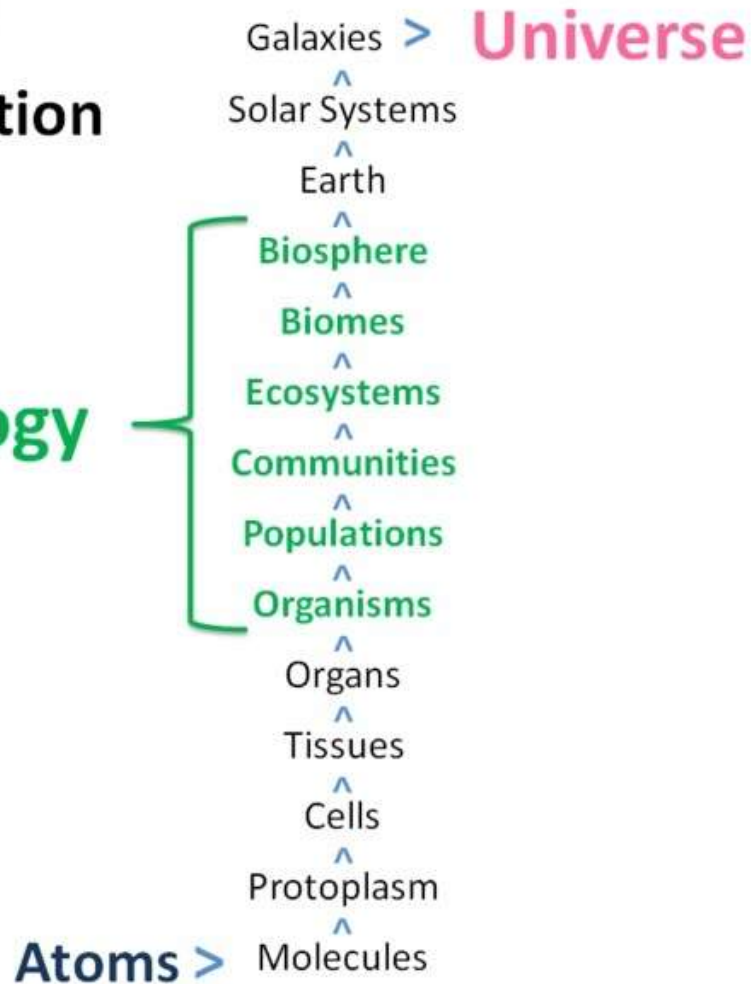


- Ecology is usually considered a branch of biology.
- Ecology is a multi-disciplinary science. Because of its focus on the higher levels of the organization of life on earth and on the interrelations between organisms and their environment, ecology draws heavily on many other branches of science, especially geology, geography, meteorology, pedology, genetics, chemistry, and physics. Thus, ecology is considered by some to be a holistic science.

# Biological organizations

Levels of  
Organization

Ecology





# LEVELS OF BIOLOGICAL ORGANISATION

Living (Bio) + Component	NON	(=) Resultant Bio-system	Discipline Concerned with the enquiry
Genes Cells Tissues Organs	L I V I N G	Genetic Systems Cell System Tissue System Organ System	Genetics Cytology Histology Anatomy, Physiology
Organisms Populations Communities	E N V I R O N M E N T	Organismic System Population System Ecosystems	} Ecology

S. No.	Level	Description
1	Organism	An individual plant or animal
2	Population	A group of individuals of one species
3	Community	The sum of populations of different species within a given area
4	Ecosystem	The sum of the communities and the non-living environment in an area
5	Biosphere	The sum of all ecosystem

The interaction between biological units of various levels with their non-living surroundings or environment result in a hierarchy of bio-system. The situation is elaborated in the next table. The table also indicates various disciplines concerned with scientific enquiries at various levels of biological organization.

# Sub-Divisions:

The science of ecology has many sub-divisions and each sub-division is related to a different level of biological organization:

Autecology

Study of an **individual** organism; life history of the organism and its response to the environment.

Population ecology

Study of abundance, distribution and /or dynamics of a **group of organisms** of same kind

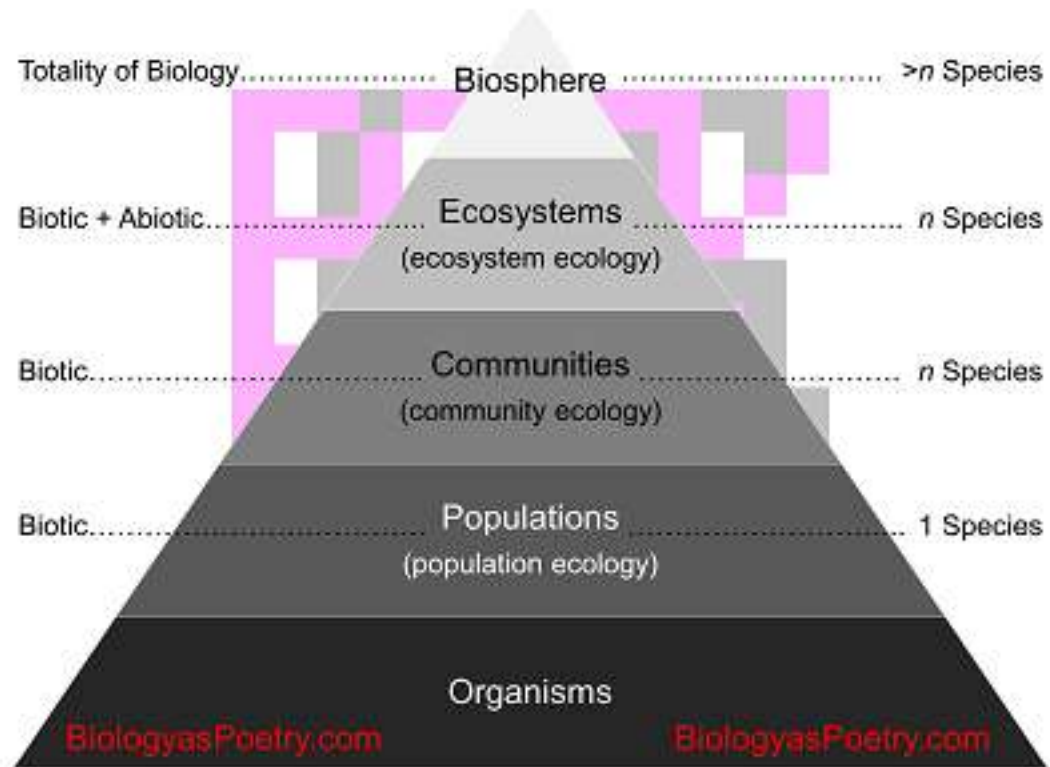
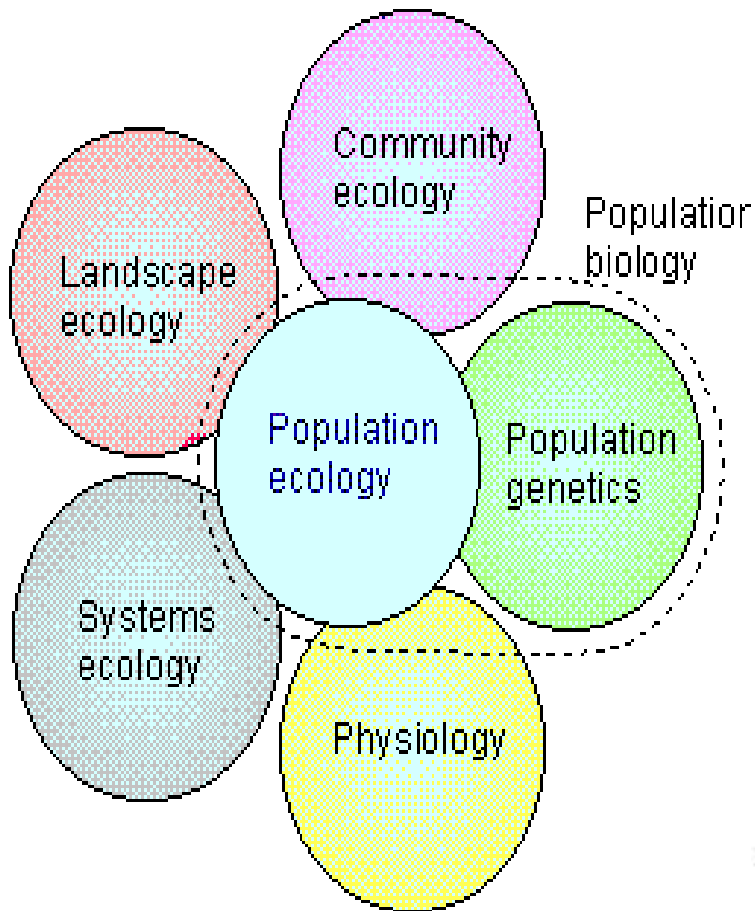
Synecology  
(community ecology)

Study of **properties of a community**, i.e. a natural assemblage of different species of organisms

Ecosystem ecology

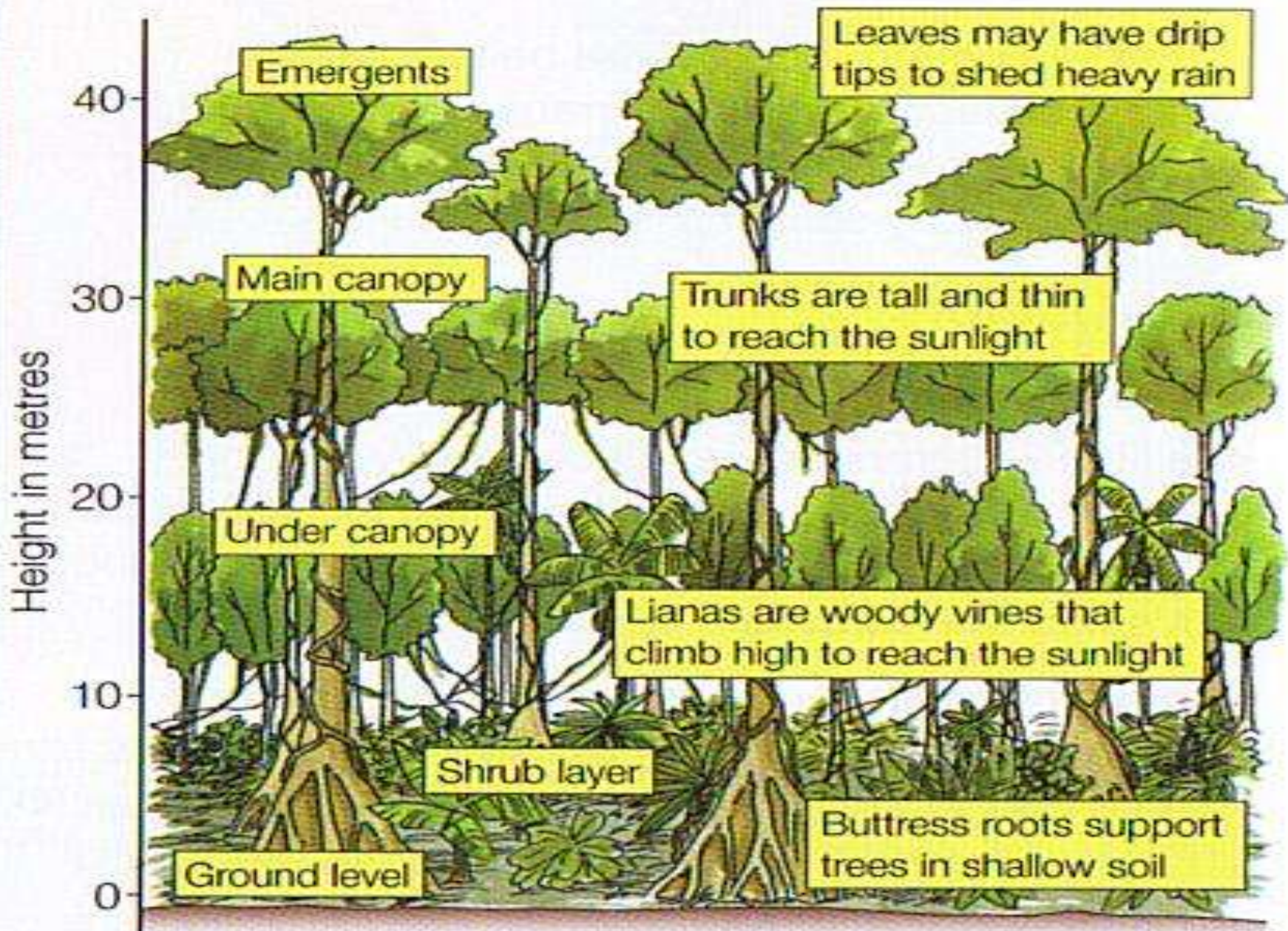
Study of an **ecosystem, biotic community and its abiotic environment.**

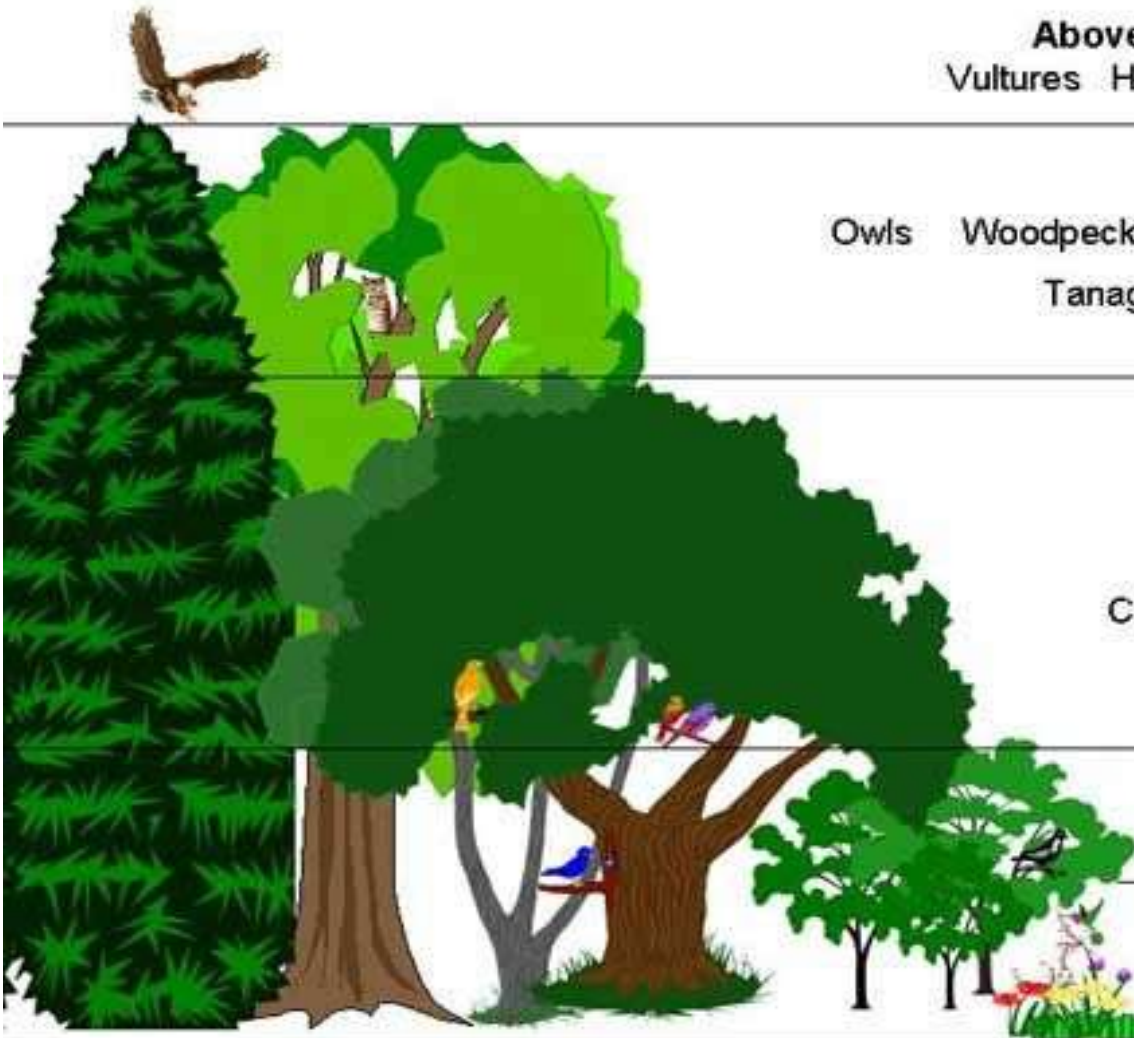
# Disciplines of ecology



# Forest Ecology

- **Forest ecology** is the **scientific study of patterns and processes in forests**.
- Historical background
- Scope of Forest Ecology-Forest ecology is one branch of a biotically-oriented classification of types of ecological study (as opposed to a classification based on organizational level or complexity (e.g population or community ecology)). Thus, **forests can be, and are, studied at any number of organizational levels**, from the individual organism to the ecosystem. However, as the term forest connotes an area inhabited by more than one organism, forest ecology most often concentrates on the level of the population, community or ecosystem. Logically, trees are an important component of forest research, but the wide variety of other life forms and abiotic components in most forests means that other elements, such as wildlife or soil nutrients, are often the focal point.





**Above Canopy Species**  
 Vultures Hawks Swallows Swifts



**Canopy**

Owls Woodpeckers Vireos Thrushes Nuthatches  
 Tanagers Warblers Creepers

**Midstory**

Warblers Jays Vireos  
 Chickadees Cardinals Kinglets

**Understory**

Mockingbird Bluebirds  
 Wrens Doves

**Ground Cover**

Sparrows Shorebirds  
 Waterfowl Wadingbirds



**Canopy**

Junipers Hickories  
 Pines Oaks  
 Cedars Elms  
 Maples Pecans

**Midstory**

Ash  
 Maples  
 Sweetgum  
 Hackberries

**Understory**

**Tall Shrubs** **Low Shrubs**  
 Dogwoods Agaritas  
 Viburnums Yaupons  
 Hawthorne Wax Myrtles

**Ground Cover**

**Prairie** **Wetland**  
 Gramas Sedges  
 Bluestems Rushes  
 Paspalums Cattails

# Ecological Study of forests

- Enumeration of plant species
- Classification of species into groups
- Distribution of species in forest, both in space and time (Management practice)
- Plantations need ecological studies
- Wildlife habitat management
- Population regulation – carrying capacity



# Application aspects of Forest Ecology

- Forests provide **livelihood** to local communities
- **Production** forestry vs. **Protected** areas
- **Secondary** forests
- Forest management- **regeneration, silvicultural** systems
- Ecology vs. economics
- The presence of trees makes forest ecosystems and their study unique in at least four ways.
  - Community diversity & complexity
  - Energy potential
  - Death in the forest ecosystem
  - Water

# Forest ecology and silviculture

- Forest ecology is related to silvics and silviculture.
- Silvics-the **study of the life history and general characteristics of forest trees** and crops, with particular reference to environmental factors, as the basis for the practice of silviculture.

- An **ecological crisis** is a situation when the environment of a species or a population changes in a way that destabilizes its continued survival. There are many possible causes of such crisis:
- It may be that the environment quality degrades compared to the species' needs, after a change of abiotic ecological factor (for example, an increase of temperature, less significant rainfalls).
- It may be that the **environment becomes unfavourable** for the survival of a species (or a population) due to an increased pressure of predation.
- Lastly, it may be that the situation becomes unfavourable to the quality of life of the species (or the population) due to raise in the number of individuals (overpopulation).

# Ecological crisis

Generally, an ecological crisis occurs with the loss of adaptive capacity when the resilience of an environment or of a species or a population evolves in a way unfavourable to coping with perturbations that interfere with that ecosystem, landscape or species survival. It may be that the environment quality degrades compared to the species needs, after a change in an abiotic ecological factor (for example, an increase of temperature, less significant rainfalls). It may be that the environment becomes unfavourable for the survival of a species (or a population) due to an increased pressure of predation (for example **overfishing**). It may be that the situation becomes unfavourable to the quality of life of the species (or the population) due to a rise in the number of individuals (overpopulation).



# Ecological crisis

- Ecological crises vary in length and severity, occurring within a few months or taking as long as a few million years. They can also be of natural or anthropic origin. They may relate to one unique species or to many species, as in an Extinction event.
- An ecological crisis may be local (as an oil spill) or global (a rise in the sea level due to global warming).

# Ecological crisis

- According to its degree of endemism, a local crisis will have more or less significant consequences, from the death of many individuals to the total extinction of a species. Whatever its origin, disappearance of one or several species often will involve a rupture in the food chain, further impacting the survival of other species.
  - Gharial mortality in Chambal
- In the case of a global crisis, the consequences can be much more significant; some extinction events showed the disappearance of more than 90% of existing species at that time. However, it should be noted that the disappearance of certain species, such as the dinosaurs, by freeing an ecological niche, allowed the development and the diversification of the mammals. An ecological crisis thus paradoxically favored biodiversity.
  - Decline in Tiger population

# Challenges-

## Development vs conservation

- Advocating actions and policies for nature conservation.
- Reduction and clean up of pollution, (Green house gases) : **Green India Mission**
- Reducing societal consumption of non-renewable fuels; development of alternative, green, low-carbon or renewable energy sources;
- Conservation and sustainable use of scarce resources such as water, land, and air;
- Protection of representative or unique or pristine ecosystems;
- Preservation of threatened and endangered species;



# Challenges

- Establishment of [nature](#) and biosphere reserves;
- Man animal conflicts
- Protection of [biodiversity](#) and ecosystems upon which all human and other life on earth depends
- Very large development projects - also called [megaprojects](#) - pose special challenges and risks to the natural environment
- [Disaster management](#) – drought, flood, fire, land slides, avalanches
- Weed eradication and invasive alien species
- [Climate change](#) and migration of species

# Challenges

- National Forest Policy
  - Forest area : 33%
- Increase in productivity
- Contribution of forestry sector to GDP
- Sustainable harvesting of NTFP

Thank you