UNIT II

- **FUNDAMENTALS OF ECOLOGY**

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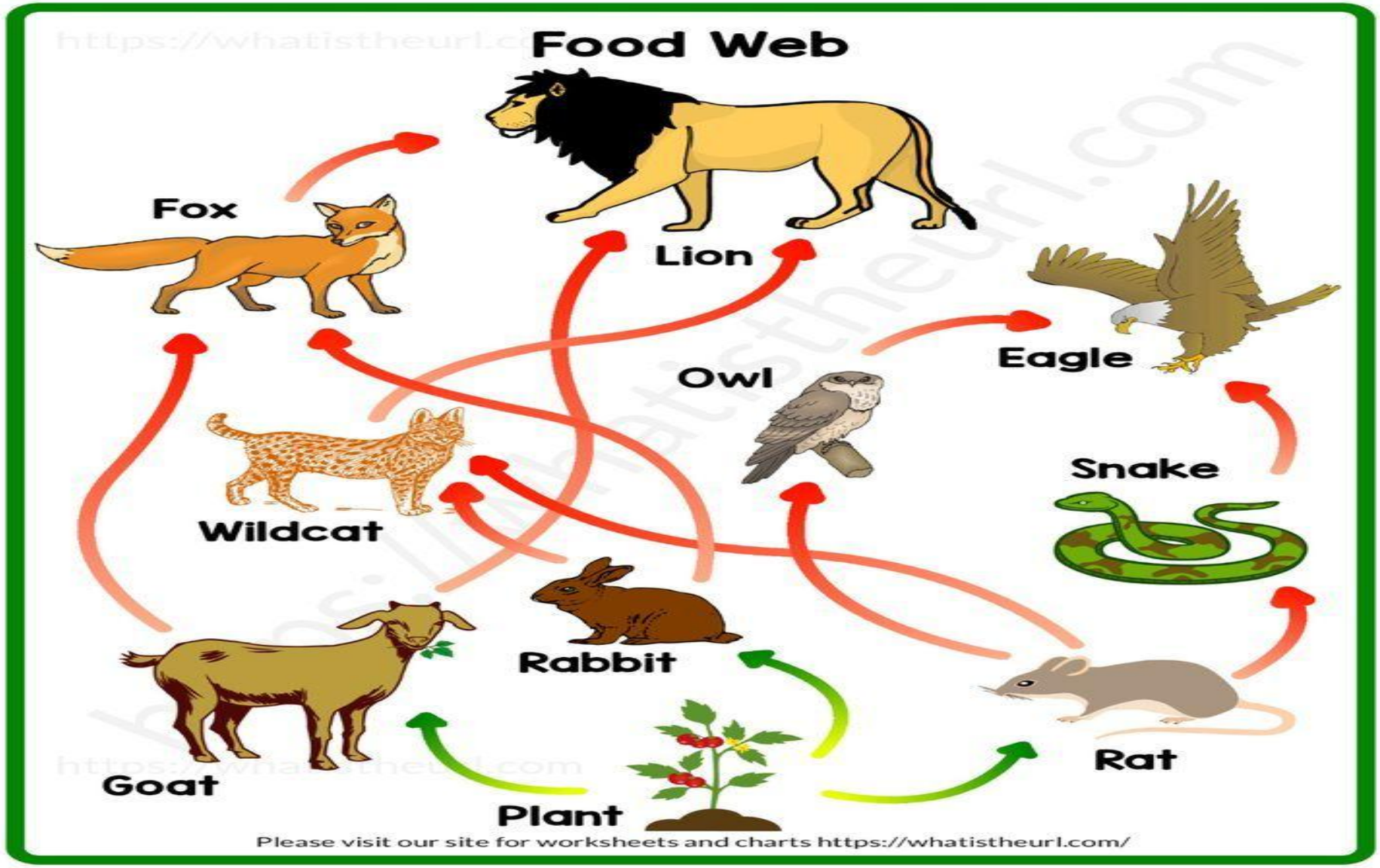
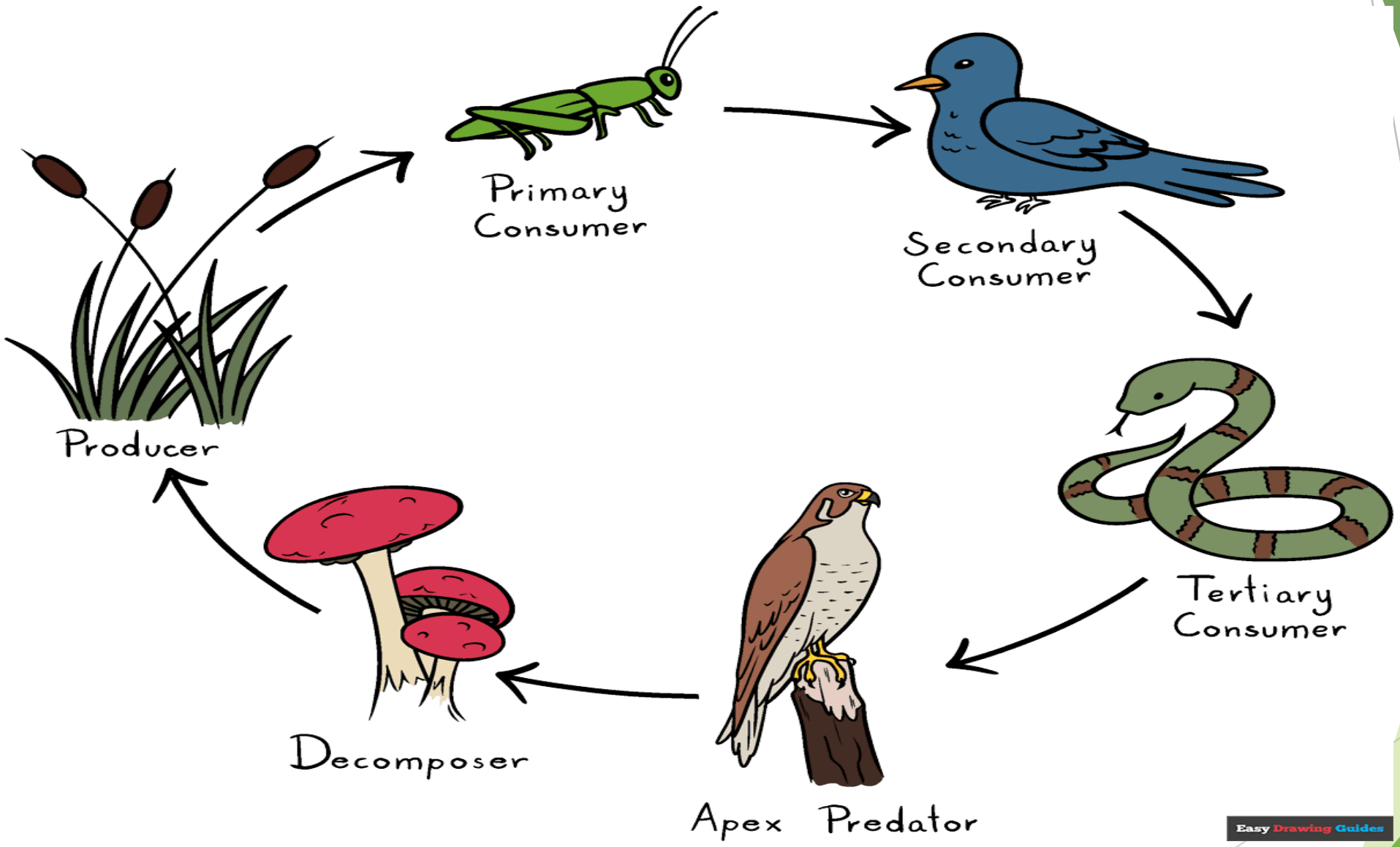
What is Ecology?

- Ecology is the scientific study of the interactions among organisms and their environment.

- **Key Focus Areas:**
  Organisms
  Environment
  Interactions


Food Web
Fox
Lion
Eagle
Owl
Snake
Wildcat
Rabbit
Goat
Plant
Rat
Please visit our site for worksheets and charts https://whatistheurl.com/


Primary Consumer
Secondary Consumer
Tertiary Consumer
Apex Predator
Decomposer
Producer
Easy Drawing Guides

Levels of Ecological Organization

- **Individual** – One organism
- **Population** – Group of same species
- **Community** – Different species living together
- **Ecosystem** – Community + physical environment
- **Biome** – Group of ecosystems with similar climate
- **Biosphere** – Earth's life-supporting layer

Ecosystem – Definition

- An **ecosystem** is a complex, dynamic system formed by the interaction of living organisms (biotic components) with their non-living physical environment (abiotic components) within a specific area. These components work together as a unit to maintain balance and support life. The term was first coined by British ecologist **Arthur Tansley** in 1935.

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In an ecosystem, **biotic components** include plants, animals, microorganisms, and decomposers. These are organized into **producers**, **consumers**, and **decomposers**. Producers (like green plants) use sunlight to make food through photosynthesis. Consumers (like herbivores, carnivores, and omnivores) depend on producers or other consumers for energy. Decomposers (such as bacteria and fungi) break down dead organisms, recycling nutrients back into the environment.

- The **abiotic components** include sunlight, temperature, air, water, soil, and minerals. These factors directly influence the survival, reproduction, and distribution of living organisms.

Example: Pond Ecosystem

A **pond** is a classic example of a simple, self-sustaining ecosystem. In a pond:

- **Producers**: Algae, phytoplankton, and aquatic plants produce food using sunlight.
- **Primary Consumers**: Small fish, insects, and zooplankton feed on producers.
- **Secondary Consumers**: Larger fish feed on smaller fish and insects.
- **Decomposers**: Bacteria and fungi break down dead plants and animals, enriching the pond with nutrients.

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The pond's **abiotic factors** like water temperature, sunlight, dissolved oxygen, and pH level affect all life within it.

- Thus, an ecosystem is a balanced and interconnected web where each component plays a vital role. Disturbance to one part can affect the entire system. Understanding ecosystems is essential for conservation and sustainable development.

Components of an Ecosystem

- **Biotic Components (Living):**
  - Producers (plants)
  - Consumers (animals)
  - Decomposers (fungi, bacteria)
- **Abiotic Components (Non-living):**
  - Sunlight
  - Air
  - Water
  - Soil
  - Temperature

Types of Ecosystems

- **Natural Ecosystems:**
  - Terrestrial: Forest, Desert, Grassland
  - Aquatic: Freshwater (lakes, rivers), Marine (oceans)
- **Artificial Ecosystems:**
  - Urban areas
  - Croplands
  - Aquariums

Terrestrial Ecosystems

Forest Ecosystem – High biodiversity, dense trees

Desert Ecosystem – Dry, extreme temperatures

Grassland Ecosystem – Dominated by grasses, large herbivores

Tundra- Arctic and Alphine

Aquatic Ecosystems

Freshwater Ecosystem – Rivers, lakes, ponds

Marine Ecosystem – Oceans, coral reefs, estuaries

Importance:

- Oxygen production
- Climate regulation
- Biodiversity hotspots

Interrelationships in Ecosystems

- **Types of Interactions:**
  - **Predation** – One benefits, one harmed
  - **Mutualism** – Both benefit
  - **Commensalism** – One benefits, other unaffected
  - **Parasitism** – One benefits, one harmed
  - **Competition** – Both are harmed due to shared resources

Food Chains and Food Webs

Food Chain: Linear flow of energy

Food Web: Network of interconnected food chains

- **Trophic Levels:** Producers → Primary Consumers → Secondary Consumers → Decomposers

Artificial Ecosystems

Farmlands, Urban gardens, Aquaculture ponds

- Created and maintained by humans

Threats to Ecosystems

Deforestation

Pollution (air, water, soil)

Climate Change

Overexploitation

Urbanization & Industrialization

What is Ecosystem Restoration?

Process of reversing ecosystem degradation

Goal: Recover biodiversity and ecosystem functions

UN Decade on Ecosystem Restoration (2021–2030)

Methods of Ecosystem Restoration

Reforestation & Afforestation

Wetland Restoration

Coral Reef Restoration

Soil Conservation & Pollution Cleanup

Community-based Conservation

Developmental Needs & Sustainable Goals

Balancing ecological restoration with human development

Sustainable agriculture, green infrastructure, renewable energy

Role of SDGs (especially SDG 13, 14 & 15)

Government & Global Initiatives

National Mission for Green India

Namami Gange Programme

Ramsar Convention on Wetlands

UN Environment Programme

Role of Citizens & Communities

Awareness and education

Waste reduction and afforestation drives

Local waterbody and forest conservation

Conclusion

Ecosystems are life-supporting systems

Restoration is essential for a sustainable future

Collective effort is the key to success