Cerebrum Biology Academy

Ecology & Environment

Quick Notes for NEET Success

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Organisms and Populations

- Population: Group of organisms of same species in defined area
- Population interactions: Competition, predation, parasitism, commensalism, mutualism
- Exponential growth: J-shaped curve (unlimited resources)
- Logistic growth: S-shaped curve (limited resources, carrying capacity)
- Density-dependent factors: Disease, food scarcity, waste accumulation
- Density-independent factors: Weather, natural disasters, human activities

■ REMEMBER

Population interactions shape ecosystem structure. Know the +/- effects of each interaction type!

Ecosystem Structure & Function

- Biotic components: Producers, consumers (primary/secondary/tertiary), decomposers
- Abiotic components: Sunlight, temperature, water, soil, atmospheric gases
- Producers: Autotrophs (plants, photosynthetic bacteria)
- Consumers: Heterotrophs (animals feeding on other organisms)
- Decomposers: Bacteria and fungi breaking down dead organic matter
- Ecological niche: Role and position of organism in ecosystem

■ KEY CONCEPT

Ecosystems have both structure (components) and function (energy flow). Both equally important!

Energy Flow in Ecosystems

- Food chain: Linear pathway of energy transfer (Producer → Consumer → Consumer)
- Food web: Multiple interlinked food chains
- 10% law: Only 10% energy transferred to next trophic level
- Reason for 10% loss: Respiration, heat, growth, reproduction
- Ecological efficiency: Varies by organism (typically 10-20%)
- Pyramid of energy: Always upright (decreasing energy at higher levels)

■ NEET TIP

The 10% law explains why food chains are usually 3-4 levels long. Calculate energy at each level!

Ecological Pyramids: Numbers, Biomass, Energy

- Pyramid of numbers: Organisms at each trophic level (can be inverted)
- Pyramid of biomass: Total dry weight of organisms (usually upright)
- Pyramid of energy: Total energy at each trophic level (always upright)
- Inverted pyramids: Possible for numbers/biomass with large producers/small consumers
- Energy pyramid: Never inverted because energy always flows downward
- Use: Understand energy distribution and organism relationships

■ REMEMBER

Only energy pyramid is always upright. Understand why numbers and biomass can be inverted!

Nutrient Cycling: Carbon, Nitrogen, Phosphorus

- Carbon cycle: CO2 ↔ atmosphere ↔ organisms ↔ soil (combustion, photosynthesis)
- Nitrogen cycle: N2 ↔ soil ↔ organisms (fixation, nitrification, denitrification)
- Nitrogen fixation: Bacteria (Rhizobium, Azotobacter) convert N2 to NH3
- Phosphorus cycle: Weathering ↔ soil ↔ organisms (no gaseous phase)
- Nutrient availability: Limits primary productivity
- Human impact: Eutrophication from excess nutrients

■ CONCEPT

Carbon and nitrogen have gaseous phases, phosphorus does not. Key difference for cycling!

Ecological Succession: Primary & Secondary

- Succession: Gradual change in community composition over time
- Primary succession: On barren land (no soil) - very slow (centuries)
- Pioneer species: Lichens and mosses in primary succession
- Secondary succession: After disturbance (land exists) - faster (years to decades)
- Climax community: Stable final stage (no further change)
- Factors: Environmental resistance, species interactions, resource availability

■ NEET TIP

Primary = no soil, Secondary = soil exists. Remember pioneer species for primary succession!

Biodiversity: Types, Patterns, Importance

- Genetic diversity: Variation within species (alleles)
- Species diversity: Number of different species (richness and evenness)
- Ecological diversity: Variety of ecosystems and habitats
- Biodiversity hotspots: High species richness in limited area
- Importance: Ecosystem stability, productivity, human resources (medicines, food)
- Patterns: Latitude (higher near equator), altitude (decreases with elevation)

■ KEY CONCEPT

Biodiversity at three levels: genetic, species, ecological. All three vital for ecosystem health!

Biodiversity Conservation: In-situ & Ex-situ

- In-situ conservation: Protecting species in natural habitat (national parks, sanctuaries)
- Biosphere reserves: Multiple-use zones (core, buffer, transition)
- Protected areas: Habitats preserved from human destruction
- Ex-situ conservation: Outside natural habitat (zoos, botanical gardens, seed banks)
- Advantages & disadvantages: Both approaches complement each other
- Community participation: Essential for long-term conservation success

■ REMEMBER

In-situ is better (prevents adaptation loss) but ex-situ helps with critically endangered species!

Environmental Issues: Pollution & Climate

- Air pollution: Smog, acid rain, particulate matter (health hazard)
- Water pollution: Eutrophication, biomagnification of toxins
- Soil pollution: Heavy metals, pesticides, industrial waste
- Ozone depletion: CFCs break down stratospheric O3
- Global warming: Greenhouse gases (CO2, CH4, N2O) trap heat
- Bioaccumulation: Toxins increase in concentration up food chain

■ NEET TIP

Understand the difference between biodegradable and non-biodegradable pollutants and their effects!

Wildlife Protection Act & Biosphere Reserves

- Wildlife Protection Act 1972: Indian legislation protecting fauna and flora
- Schedule I: Highest protection (tiger, rhinoceros, elephant)
- Schedule II-VI: Varying levels of protection based on risk
- National Parks: Strict protection, no human activity allowed
- Sanctuaries: Protection with regulated human activities
- Biosphere Reserves: UNESCO designation for biodiversity conservation

■ REMEMBER

National Parks > Sanctuaries > Reserved Forests in terms of protection level. Know Indian examples!