

**GHS&T Science Domain 2-ECOLOGY STUDY GUIDE → GPS Standards: SB3.** Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems. **SB4.** Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems. **PLEASE VISIT MR. BAHN IN BHS 610 IF YOU NEED INDIVIDUAL ASSISTANCE WITH THIS STUDY GUIDE!!!! 5<sup>TH</sup> BLOCK ON TUESDAYS, PLEASE MAKE AN APPOINTMENT IN ADVANCE!**  
**→ ECOLOGY → the study of interactions between organisms and their environment.**

**A. Types of Interactions in Ecology → Biotic & Abiotic**

1. Biotic → interactions between an organism & other living organisms. Ex. → 2 animals competing for resources
2. Abiotic → interactions between an organism & non-living items in the environment. Ex. → A tree's roots absorbing nutrients from the soil

**B. Levels of Organization in Ecology**

**1. Species 2. Population 3. Community 4. Ecosystem 5. Biome 6. Biosphere**

1. Species → (The INDIVIDUAL) → Organisms that are similar to each other they can breed & produce *fertile* offspring.  
Ex. → Odocoileus virginianus (white tailed deer); Homo sapien (humans); Canis lupus (gray wolf)
2. Population → (The GROUP) → A *group of individuals* that belong to the *same species* & live in the same area.
3. Community → (Multiple Populations) → Populations that live together in a certain area.
4. Ecosystem → (Multiple Populations & Abiotic factors) → Communities & their physical (abiotic) environment.
5. Biome → A group of Ecosystems with similar Communities & the same climate.
6. Biosphere → (All Biomes combined) → All the portions of the planet where life exists → land, water, air, the atmosphere → The biosphere is *dynamic* → always changing

**C. Energy Flow in an Ecosystem → energy has a 1-way flow and is used up in an ecosystem**

1. There must be a form of ENERGY to power every organism's interaction with its environment.
  2. The primary source of energy for life on Earth is *Sunlight* → less than 1% is used by living organisms on Earth.
  3. "Troph" means FOOD. Organisms get their energy from food.
    - a. **Autotroph or Producer** → Makes its own food by photosynthesis → Examples: Plants, Bacteria, Algae
    - b. **Heterotroph or Consumer** → Consumes other organisms for food → Examples: Humans, mammals, reptiles, insects, fish
  4. Food Chains vs. Food Webs
    - a. A food chain shows the transfer of energy from one organism to another:  
Ex: 1. Sun gives oak tree energy from photosynthesis, grows acorns → 2. Deer eats acorns → 3. Wolf eats deer  
→ Energy from transferred from the sun to the oak tree (1) to the deer (2) and finally to the wolf (3).
    - b. A food web shows all the food chains in an ecosystem linked together → transfer of energy for an entire ecosystem → the different levels in a food chain or web are called Trophic Levels → each level gets its energy from the level BELOW IT
    - c. Organisms use only 10% of the energy they take in for "staying alive", the rest is lost as heat.
- USE THIS INFORMATION TO STUDY ENERGY & BIOMASS PYRAMIDS!!!!
5. Main Types of Heterotrophic Consumers:
    - a. Herbivores: obtain energy by eating (or consuming) autotrophic producers such as plants. Ex: Deer, rabbits, bison
    - b. Carnivores (a predator): obtain energy by consuming other consumers (the prey). Ex: Mountain Lion, Gray Wolf
    - c. Omnivores: obtain energy by consuming a variety of foods including plants and other consumers
    - d. Decomposers: obtain energy by breaking down organic matter

**D. MATTER Flow in an Ecosystem → matter is recycled in an ecosystem (compare to ENERGY) → RECALL: Matter can neither be created nor destroyed.**

1. The main cycles in an ecosystem include: Water, Carbon, Nitrogen, and Phosphorus
2. Matter is recycled through ecosystems, transformed into different states, and then reused again (recycled).

**E. Climate / Weather / Human Impacts on the Earth:**

**a. Pollution b. Global Warming c. Explosive Population d. Pesticide & Herbicide Usage e. Resource Consumption**

1. The Greenhouse Effect → gases in the atmosphere trap in heat to maintain Earth's temperature, makes life on Earth possible → 3 main Greenhouse Gases: a. CO<sub>2</sub> b. Methane c. Water Vapor
2. Global Warming → High levels of CO<sub>2</sub> released from burning fossil fuels (Ex. Coal Power Plants, Automobile Emissions) → The Greenhouse Effect + increased CO<sub>2</sub> leads to Global Warming.
3. Pollutant → a harmful substance that can enter the biosphere through land, air, or water  
Ex: Particulates (ash & dust from burning fossil fuel that get in animal lungs; Nitrates & Sulfates (acid rain); Oil, Sewage, & Chemicals (DDT) in water supplies (Biological Magnification)
4. Acid Rain → a. Nitrogen (N) and sulfur (S) gases are released into the atmosphere from industrial & power plants and automobile emissions. b. The gases combine with water vapor to form nitric & sulfuric acids in the clouds. c. When the clouds precipitate, the rain is very acidic (4.5 pH compared to a normal rainwater pH of 6.0) from the presence of the nitric and sulfur acids. Acid Rain kills plants because it damages their leaves and the soil.

**F. Community Interactions in Ecology**

1. Habitat vs. Niche  
Habitat → Where an organism lives. Ex: White-tailed Deer in Georgia lives in a Temperate Deciduous Forest (Biome)  
Niche → What an organism does. Ex: White-tailed Deer are 1st level consumers & large mammal grazers  
Competitive Exclusion Principle → NO TWO SPECIES CAN OCCUPY THE SAME NICHE!!!
2. Competition → Organisms trying to use the same *resource* at the same time in an ecosystem.  
4 Important Resources in an Ecosystem: a. Water b. Nutrients & Food c. Space d. Light
3. Predation → an interaction where one organism (the predator) captures & feeds on another organism (the prey).
4. Symbiosis → organisms living closely together → this constantly affects both of the organisms' interactions in the ecosystem.  
3 types of Symbiosis: a. Mutualism b. Commensalism c. Parasitism
  - a. Mutualism → both organisms benefit → "Helps both of us" → Insects feed on plants, but also spread their pollen
  - b. Commensalism → one organism benefits, the other is neither helped nor harmed → "Helps me, doesn't hurt you"  
→ Remora rides on a shark, jumps off and gets food when the shark feeds → Doesn't affect the shark at all.
  - c. Parasitism: one organism (the parasite) is on or inside another organism (the host) & harms it. "Helps me, hurts you" → Flea biting a Dog