ECOSYSTEMS, BIOMES AND BIOLOGICAL COMMUNITIES

An ecosystem is a community of interdependent organisms along with the inorganic components of their environment, including water, soil, and air. Earth is the largest ecosystem, divided into biomes, large areas with similar climate and vegetation. A biome is a large ecosystem, extending over a wide geographic region, characterized by certain dominant life forms—most notably, trees or the lack thereof. There are two basic varieties of biomes: terrestrial, or land-based and aquatic (marine and freshwater).

Within a biome or ecosystem, the sum of all living organisms is referred to as the biological community. Sometimes the term biota, which refers to all flora and fauna (plants and animals) in a region, is used instead. Thus, biological community is a larger concept, since it includes microorganisms, which are vital to the functioning of the food web. The food web, which may be thought of an interconnected network of food chains, is the means by which energy is transferred through a biological community. Without microorganisms known as decomposers, a key link in the food web would be missing.

SUCCESSION

Over the course of time, ecosystems experience a process known as succession, the progressive replacement of one biological community by another. This is rather like the series of changes one might witness if one were to record the activity on a major city block over the space of a few decades, as stores come in and shut down and buildings are built and demolished. In the case of biological succession, a process like natural selection is happening: the ecosystem becomes home to a number of different biological communities until (in the absence of outside interference) the one that is most suited or adapted to local conditions finally takes root. (That is, until it is replaced, and the process of succession continues.)

This most suited or adapted biological community is described as a climax community, one that has reached a stable point as a result of ongoing succession. In such a situation, the community is at equilibrium with environmental conditions, and conditions are stable, such that the biota experiences little change thereafter. The most significant forms of climax vegetation are often the defining characteristics of terrestrial biomes.
**KEY IDEAS/ ENDURING UNDERSTANDING**

**Biodiversity:**
A greater variety of species in an ecosystem leads to **sustainable** ecosystems.

**Homeostasis:**
Balance depends on the stimulus and response cycle of organism and the system as a whole.

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**KEY ABILITIES FOR WHOLE UNIT:**
- Describe the effect on an ecosystem if it received no sunlight for a year.
- Differentiate between the levels of ecological succession.
- What is evidence of biodiversity?
- How do different types of catastrophic events impact ecosystems?
- Compare and contrast ecosystem and biome, climate and weather
- Make a circle map of the characteristics of a stable ecosystem
- Create a full-page illustration that describes how biodiversity contributes to the sustainability of an ecosystem.
- List the organisms you might find in a grassland biome and a desert biome.
- Compare and contrast the producers, consumers and decomposers

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**STUDENT EXPECTATION---I CAN:**
- **Illustrate and describe the impact of a catastrophic event like:**
  - flood on a forest ecosystem.
  - hurricane on a coastal ecosystem.
  - tornado on a prairie ecosystem.
- **Recognize the names and characteristics of Earth’s major biomes.**
  - Recognize ecosystems with low biodiversity and those with high biodiversity.
  - Describe an example of where human actions have decreased biodiversity.
  - Describe the characteristics of a stable ecosystem.
  - Explain the relationship between organisms and environment using real world examples.
- **Define ecological succession in my own words and give several real world examples of situations where it would occur.**
  - Recognize a microhabitat when I observe one (like a garden with weeds).
  - Explain how ecological succession affects microhabitats.
  - Record accurate and appropriate data about an identified microhabitat.
- **Define external and internal stimulus.**
  - Explain how response to stimuli allows a living thing to maintain balance.
  - Give examples of real world situations where organisms react to external and internal stimuli.
- **Recognize the importance of the ground water and surface water quality to the organisms in an ecosystem.**
  - Recognize a watershed and the direction of its’ flow on a map.
  - Identify groundwater on a diagram and explain the flow into and out of the system.
  - Identify human activities that affect ground water and surface water quality.
Summary of our story so far—Energy is the source of all life on earth. And it all begins on a star that is 93 million miles away. This star provides all the energy we need on Earth. Light takes about 8 seconds to reach us from the sun.

After a sun dies, many elements are released in the universe.

Gravity pulls the elements into a planet.

Over many years, these elements lead to all living and non-living matter.

That means there are a limited number of elements on earth.

Elements in our Food can include:
- Hydrogen (H)
- Carbon (C)
- Oxygen (O)
- Calcium (Ca)
- Iron (Fe)
- Nitrogen (N)

Elements form all the layers (“sphere”) of matter, including our water (H and O), soil (mostly Si and O), living matter like animals and people (C, H, and O), and our air (which is mostly Nitrogen, not Oxygen).

**Draw an icon for each sphere showing the key elem.**
Living (Biotic) + Nonliving (Abiotic) factors are considered part of the ecosystem.

Biodiversity (the variety of species) helps maintain balance (HOMEOSTASIS) within the system and leads to sustainability (long lasting).

The largest ecosystems (biomes) are classified by similar climate and vegetation species (usually trees or lack of trees).

For each biome, there are key ideas to know:

**TUNDRA:**
- Plants and animals have unique adaptations to live in extreme cold
- Permafrost (permanently frozen ground)
- Short growing time (supports limited species)

**DESERT:**
- Sparse vegetation and plants have waxy coatings and deep roots
- Animals are able to conserve water
- Low precipitation (low rainfall)

Ecosystems are also changed and affected by ecological succession—which can change the food webs and energy use within the ecosystem.
**Food Webs** show us how the energy that arrives on earth from the sun and is used by producers to create available energy for consumers. As the energy travels through the food web and energy pyramids, we see a reduction of available energy.

Living organisms like plants and animals respond to stimuli:

- Plants wilt (response) without enough water (stimulus).
- People develop fevers (response) when ill (stimulus) trying to cool the body.
- Fear (stimulus) leads to the fight or flight (response) when adrenaline is released.
- Sunflowers follow the sun as a way to maximize energy to create food (phototropism).

**Biodiversity = sustainable ecosystem**

A variety of organisms in the ecosystem’s food web will lead to great diversity and greater levels of balance—which is a sign of a healthy ecosystem. An older, more diverse ecosystem will have higher levels of biodiversity and be more sustainable.

Ecosystems are also constantly undergoing changes and adaptations through succession. Succession happens over MANY years (often millions of years).
Succession affects both large (biomes) and small (micro) ecosystems, but is only visible over many years.

**Primary Succession**
(no life already existed here)

- Bare rock
  - Mosses and lichens grow and form soil when they die
  - Soil develops and then grasses and small plants grow
  - Soil thickens and smaller shrubs grow
  - Trees start to grow

**Secondary Succession**
(there was already life)

Microhabitats (life already exists) are areas like gardens— which grows weeds.

Eventually the weeds are replaced by larger plants, which in turn are replaced by small trees. Over many years, the once bare garden becomes a forest.
Catastrophic Events

Tornados, volcanoes and more lead to long-term changes in ecosystem. Organisms move back in slowly after habitat damage.

**Hurricanes** affect coastal areas – destroy habitats

**Tornadoes** affect grasslands -- high winds damage habitats

**Fires** affect rain forests.

**Floods** affect forests and freshwater – makes water muddy and unclear.

**Volcanoes** – habitat destruction means that the organisms will move back in slowly
So now that we know there are just a few elements that make up the life that we know, how does matter move within the spheres (in a cycle)? For example, the water that we drink today is the same water that dinosaurs used or once all the gold is mined, there will be no more gold made. We must be aware of the movement of elements and that they are “finite” or limited. The elements are recycled by natural processes that take YEARS (millions usually) to move the matter from place to place.

**Draw each cycle.**

Water cycle

Water cycle can be affected by pollution --- for example, fertilizer from farms

All living and non-living things are part of systems that maintain balance – **HOMEOSTASIS**
Use as many vocabulary words as possible to label the diagram and demonstrate your knowledge of the interdependence of ecosystems.

The levels of organization for living matter are already done for you, so get creative.

**Stimulus - Response Cycle**
A deer being hunted-----
Stimulus – fear triggers adrenaline
Response – fight or flight

**Geotropism:**
Stimulus = ______________________
Response = ______________________

**Phototropism:**
Stimulus = ______________________
Response = ______________________

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3. Input: Information sent along afferent pathway to

4. Output: Information sent along efferent pathway to

2. Change detected by receptor

1. Stimulus: Produces change in variable

5. Response of effector feeds back to influence magnitude of stimulus and returns variable to homeostasis

Variable (in homeostasis)

Imbalance

Control center

Receptor (sensor)

Effector