# 02 The Living World Biodiversity

Content Area: **Science**
Course(s): **AP Environment**
Time Period: **Semester 1**
Length: **2 weeks**
Status: **Published**

## Standards

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|---|---|
| CCC.1 | Patterns. |
| HS-ETS1-2 | Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. |
| CCC.1.1 | students observe patterns in systems at different scales and cite patterns as empirical evidence for causality in supporting their explanations of phenomena. They recognize classifications or explanations used at one scale may not be useful or need revision using a different scale; thus requiring improved investigations and experiments. They use mathematical representations to identify certain patterns and analyze patterns of performance in order to reengineer and improve a designed system. |
| HS-ETS1-3 | Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. |
| CCC.2 | Cause and effect: Mechanism and explanation. |
| CCC.2.1 | students understand that empirical evidence is required to differentiate between cause and correlation and to make claims about specific causes and effects. They suggest cause and effect relationships to explain and predict behaviors in complex natural and designed systems. They also propose causal relationships by examining what is known about smaller scale mechanisms within the system. They recognize changes in systems may have various causes that may not have equal effects. |
| CCC.4 | Systems and system models. |
| CCC.4.1 | students can investigate or analyze a system by defining its boundaries and initial conditions, as well as its inputs and outputs. They can use models (e.g., physical, mathematical, computer models) to simulate the flow of energy, matter, and interactions within and between systems at different scales. They can also use models and simulations to predict the behavior of a system, and recognize that these predictions have limited precision and reliability due to the assumptions and approximations inherent in the models. They can also design systems to do specific tasks. |
| CCC.7 | Stability and change. |
| CCC.7.1 | students understand much of science deals with constructing explanations of how things change and how they remain stable. They quantify and model changes in systems over very short or very long periods of time. They see some changes are irreversible, and negative feedback can stabilize a system, while positive feedback can destabilize it. They recognize systems can be designed for greater or lesser stability. |
| 9-12.HS-LS2-6 | Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. |
| 9-12.HS-LS2-2 | Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. |
| 9-12.HS-LS2-7 | Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. |

## Essential Questions

How do organisms within ecosystems adapt to the changes created by disruptions?

How does biodiversity relate to the health of an ecosystem?

## Enduring Understandings

Ecosystems are complex, interactive systems that include both biological communities (biotic) and physical (abiotic) components of the environment.

Ecosystems are dynamic, experiencing shifts in population composition and abundance and changes in the physical environment over time, which ultimately affects the stability and resilience of the entire system.

## Knowledge and Skills

**Topic 2.1 Introduction to Biodiversity**

**Knowledge**

- Biodiversity in an ecosystem includes genetic, species, and habitat diversity.
- The more genetically diverse a population is, the better it can respond to environmental stressors. Additionally, a population bottleneck can lead to a loss of genetic diversity.
- Ecosystems that have a larger number of species are more likely to recover from disruptions.
- Loss of habitat leads to a loss of specialist species, followed by a loss of generalist species. It also leads to reduced numbers of species that have large territorial requirements.
- Species richness refers to the number of different species found in an ecosystem.

**Skills**

- Describe environmental concepts and processes.

**Topic 2.2 Ecosystem Services**

**Knowledge**

- There are four categories of ecosystem services: provisioning, regulating, cultural, and supporting.
- Anthropogenic activities can disrupt ecosystem services, potentially resulting in economic and

ecological consequences.

**Skills**

- Explain environmental concepts and processes.

**Topic 2.3 Island Biogeography**

**Knowledge**

- Island biogeography is the study of the ecological relationships and distribution of organisms on islands, and of these organisms' community structures.
- Islands have been colonized in the past by new species arriving from elsewhere
- Many island species have evolved to be specialists versus generalists because of the limited resources, such as food and territory, on most islands. The long-term survival of specialists may be jeopardized if and when invasive species, typically generalists, are introduced and outcompete the specialists.

**Skills**

- Describe environmental concepts and processes.

**Topic 2.4 Ecological Tolerance**

**Knowledge**

- Ecological tolerance refers to the range of conditions, such as temperature, salinity, flow rate, and sunlight that an organism can endure before injury or death results.
- Ecological tolerance can apply to individuals and to species.

**Skills**

- Identify the author's claim.

**Topic 2.5 Natural Disruptions to Ecosystems**

**Knowledge**

- Natural disruptions to ecosystems have environmental consequences that may, for a given occurrence, be as great as, or greater than, many human-made disruptions.
- Earth system processes operate on a range of scales in terms of time. Processes can be periodic, episodic, or random.
- Earth's climate has changed over geological time for many reasons
- Sea level has varied significantly as a result of changes in the amount of glacial ice on Earth over geological time.
- Major environmental change or upheaval commonly results in large swathes of habitat changes.
- Wildlife engages in both short- and long-term migration for a variety of reasons, including natural disruptions.

**Skills**

- Describe patterns or trends in data.

**Topic 2.6 Adaptations**

**Knowledge**

- Organisms adapt to their environment over time, both in short- and long-term scales, via incremental changes at the genetic level.
- Environmental changes, either sudden or gradual, may threaten a species' survival, requiring individuals to alter behaviors, move, or perish.

**Skills**

- Describe relationships among variables in data represented.

**Topic 2.7 Ecological Succession**

**Knowledge**

- There are two main types of ecological succession: primary and secondary succession.
- A keystone species in an ecosystem is a species whose activities have a particularly significant role in determining community structure.
- An indicator species is a plant or animal that, by its presence, abundance, scarcity, or chemical composition, demonstrates that some distinctive aspect of the character or quality of an ecosystem is present.
- 1 Pioneer members of an early successional species commonly move into unoccupied habitat and over time adapt to its particular conditions, which may result in the origin of new species.
- Succession in a disturbed ecosystem will affect the total biomass, species richness, and net productivity over time.

**Skills**

- Explain patterns and trends in data to draw conclusions.

Make connections to other units by considering:

Biodiversity is the key component to sustaining life, and changes over time. The health of a species is closely tied to its ecosystem, and small changes can have a large impact.

Key vocabulary you need to know

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|---|---|---|
| Species | Anthropogenic | Keystone species |
| Biodiversity | Island Biogeography | Indicator species |
| Genetic Diversity | Evolution | Pioneer species |
| Species Richness | Tolerance | Habitat Fragmentation |
| Species Abundance | Succession | Specialist |

| | | |
|---|---|---|
| Ecosystem diversity | Ecosystem services | Generalist |
| Invasive species/biotic pollution | Bottleneck | Natural Selection |

Figures/ Equations to know

Population density = # of individuals/area

## Transfer Goals

Explain levels of biodiversity and their importance to ecosystems.

Describe the results of human disruptions to ecosystem services.

Describe the role of island biogeography in evolution and conservation strategies.

## Modifications

https://docs.google.com/document/d/1ODqaPP69YkcFiyG72fIT8XsUIe3K1VSG7nxuc4CpCec/edit?usp=sharing

## Assessments

https://docs.google.com/document/d/1wR7bQF-8AQoRrt0g4C3hKja0yjwDjC9_BiAmONWbTcI/edit?usp=sharing