

## AP ENVIRONMENTAL SCIENCE

# UNIT 2

# The Living World: Biodiversity



**6–8%**

AP EXAM WEIGHTING



**~11–12**

CLASS PERIODS

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# The Living World: Biodiversity



## Developing Understanding

### BIG IDEA 2

#### *Interactions Between Earth Systems* **ERT**

- Can an invasive species be considered a native species if it occupies a place for a long time?

Biodiversity, which includes genetic, species, and habitat diversity, is critically important to ecosystems. Biodiversity in ecosystems is a key component to sustaining life within the living world. Natural and human disruptions have short- and long-term impacts on ecosystems. Ecological succession can occur in terrestrial and aquatic ecosystems in both developed and developing areas. Organisms within ecosystems must adapt to the changes created by these disruptions. In subsequent units, students will examine in greater detail how populations change over time.

## Building the Science Practices

1.A 1.B 5.A 5.B 5.C

Data analysis is an important skill to begin developing at this point in the course. Quantitative information about changes in populations or the environment due to human activities is often represented in tables and graphs. Students should understand that tables and graphs are important tools of communication used to identify patterns and trends that indicate environmental problems. Students will then learn to describe the characteristics of data in tables or graphs and identify patterns or trends.

In this unit, students should also be able to describe and explain the environmental concepts and processes of biodiversity. It is important that they understand the differences between similar concepts and clearly articulate those differences in their written and verbal explanations. For example, they should be able to articulate the differences among species, genetic, and habitat diversity; between keystone and indicator species; and between ecosystem services and ecological services.

## Preparing for the AP Exam

On the AP Exam, students must be able to explain environmental science concepts that are represented using tables, charts, and graphs. They must also be able to explain patterns and trends related to data. Additionally, they must be able to give several examples of ecosystems and ecological services. Students often confuse environmental science terminology, like ecological service and ecological function of an ecosystem, and biodiversity and genetic diversity. To combat this, students can explain environmental concepts in context, rather than memorizing textbook definitions without a full understanding of the context. Students can benefit from practice providing ecological services for different ecosystems. They should be able to indicate the direction of change to a species as a result of disruptions to the ecosystem based on data. Students should also be able to describe whether or not a species can adapt to an environmental change.

**SUGGESTED SKILL**

 *Concept Explanation*

**1.A**

Describe environmental concepts and processes.



**AVAILABLE RESOURCES**

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > [Chief Reader Report 2017, Q3 & Q4](#)
- The Exam > Samples and Commentary ([2017, Q3, 2017, Q4](#))
- Collaborations with AP > [Loss of Biodiversity](#)

**TOPIC 2.1**

# Introduction to Biodiversity

## Required Course Content

### ENDURING UNDERSTANDING

**ERT-2**

Ecosystems have structure and diversity that change over time.

### LEARNING OBJECTIVE

**ERT-2.A**

Explain levels of biodiversity and their importance to ecosystems.

### ESSENTIAL KNOWLEDGE

**ERT-2.A.1**

Biodiversity in an ecosystem includes genetic, species, and habitat diversity.

**ERT-2.A.2**

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.

**ERT-2.A.3**

Ecosystems that have a larger number of species are more likely to recover from disruptions.

**ERT-2.A.4**

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.

**ERT-2.A.5**

Species richness refers to the number of different species found in an ecosystem.

## TOPIC 2.2

# Ecosystem Services

## Required Course Content

### ENDURING UNDERSTANDING

**ERT-2**

Ecosystems have structure and diversity that change over time.

### LEARNING OBJECTIVE

**ERT-2.B**

Describe ecosystem services.

**ERT-2.C**

Describe the results of human disruptions to ecosystem services.

### ESSENTIAL KNOWLEDGE

**ERT-2.B.1**

There are four categories of ecosystem services: provisioning, regulating, cultural, and supporting.

**ERT-2.C.1**

Anthropogenic activities can disrupt ecosystem services, potentially resulting in economic and ecological consequences.

**SUGGESTED SKILL**

 *Concept Explanation*

**1.B**

Explain environmental concepts and processes.

**AVAILABLE RESOURCES**

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > Chief Reader Report ([2018, Q1](#), [2017, Q1](#))
- The Exam > [Student Performance Q&A 2016, Q1](#)
- The Exam > Samples and Commentary ([2018 Q1](#), [2017, Q1](#), [2016, Q1](#))

## SUGGESTED SKILL

 *Concept Explanation***1.A**

Describe environmental concepts and processes.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- The Exam > Chief Reader Report ([2018, Q1](#), [2017, Q1](#))
- The Exam > [Student Performance Q&A 2016, Q1](#)
- The Exam > Samples and Commentary ([2018, Q1](#), [2017, Q1](#), [2016, Q1](#))

## TOPIC 2.3

# Island Biogeography

## Required Course Content

### ENDURING UNDERSTANDING

**ERT-2**

Ecosystems have structure and diversity that change over time.

### LEARNING OBJECTIVE

**ERT-2.D**

Describe island biogeography.

**ERT-2.E**

Describe the role of island biogeography in evolution.

### ESSENTIAL KNOWLEDGE

**ERT-2.D.1**

Island biogeography is the study of the ecological relationships and distribution of organisms on islands, and of these organisms' community structures.

**ERT-2.D.2**

Islands have been colonized in the past by new species arriving from elsewhere.


**ERT-2.E.1**

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.

## TOPIC 2.4

# Ecological Tolerance

## SUGGESTED SKILL

 Text Analysis**3.A**

Identify the author's claim.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)

## Required Course Content

### ENDURING UNDERSTANDING

**ERT-2**

Ecosystems have structure and diversity that change over time.

### LEARNING OBJECTIVE

**ERT-2.F**

Describe ecological tolerance.

### ESSENTIAL KNOWLEDGE

**ERT-2.F.1**

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.

**ERT-2.F.2**

Ecological tolerance can apply to individuals and to species.

## SUGGESTED SKILL

 Data Analysis

## 5.A

Describe patterns or trends in data.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- External Resource > [Environmental Literacy Council's AP Environmental Science Course Material](#)

## TOPIC 2.5

# Natural Disruptions to Ecosystems

## Required Course Content

### ENDURING UNDERSTANDING

**ERT-2**

Ecosystems have structure and diversity that change over time.

### LEARNING OBJECTIVE

**ERT-2.G**

Explain how natural disruptions, both short- and long-term, impact an ecosystem.

### ESSENTIAL KNOWLEDGE

**ERT-2.G.1**

Natural disruptions to ecosystems have environmental consequences that may, for a given occurrence, be as great as, or greater than, many human-made disruptions.

**ERT-2.G.2**

Earth system processes operate on a range of scales in terms of time. Processes can be periodic, episodic, or random.

**ERT-2.G.3**

Earth's climate has changed over geological time for many reasons.

**ERT-2.G.4**

Sea level has varied significantly as a result of changes in the amount of glacial ice on Earth over geological time.

**ERT-2.G.5**

Major environmental change or upheaval commonly results in large swathes of habitat changes.

**ERT-2.G.6**

Wildlife engages in both short- and long-term migration for a variety of reasons, including natural disruptions.

## TOPIC 2.6

## Adaptations

## SUGGESTED SKILL

 Data Analysis

## 5.B

Describe relationships among variables in data represented.



## AVAILABLE RESOURCES

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- Collaborations with AP > [Loss of Biodiversity](#)
- The Exam > Chief Reader Report (2018, Q1 & Q4, 2017, Q2)
- The Exam > Samples and Commentary (2018, Q1, 2018, Q4, 2017, Q2)
- External Resource > [Environmental Literacy Council's AP Environmental Science Course Material](#)

## Required Course Content

## ENDURING UNDERSTANDING

## ERT-2

Ecosystems have structure and diversity that change over time.

## LEARNING OBJECTIVE

## ERT-2.H

Describe how organisms adapt to their environment.

## ESSENTIAL KNOWLEDGE

## ERT-2.H.1

Organisms adapt to their environment over time, both in short- and long-term scales, via incremental changes at the genetic level.

## ERT-2.H.2

Environmental changes, either sudden or gradual, may threaten a species' survival, requiring individuals to alter behaviors, move, or perish.



**SUGGESTED SKILL**

 *Data Analysis*

**5.C**

Explain patterns and trends in data to draw conclusions.



**AVAILABLE RESOURCES**

- Classroom Resource > [AP Environmental Science Teacher's Guide](#)
- External Resource > [Environmental Literacy Council's AP Environmental Science Course Material](#)
- The Exam > [Student Performance Q&A 2014, Q3](#)
- The Exam > [Samples and Commentary 2014, Q3](#)

**TOPIC 2.7**

# Ecological Succession

## Required Course Content

### ENDURING UNDERSTANDING

**ERT-2**

Ecosystems have structure and diversity that change over time.

### LEARNING OBJECTIVE

**ERT-2.I**

Describe ecological succession.

**ERT-2.J**

Describe the effect of ecological succession on ecosystems.

### ESSENTIAL KNOWLEDGE

**ERT-2.I.1**

There are two main types of ecological succession: primary and secondary succession.

**ERT-2.I.2**

A keystone species in an ecosystem is a species whose activities have a particularly significant role in determining community structure.

**ERT-2.I.3**

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.

**ERT-2.J.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.

**ERT-2.J.2**

Succession in a disturbed ecosystem will affect the total biomass, species richness, and net productivity over time.