

# 1. Know – Understand – Do Organizer

Teacher: C. Pellegrini

Subject: Honors Biology

Topic: Soil Biology and the Biosphere

**Which standards are students learning in this unit?** **3.6.10. A.** Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting. • Apply knowledge of plant and animal production processes in designing an improvement to existing processes. **4.3.10.C.** Explain biological diversity as an indicator of a healthy environment. • Explain species diversity. • Analyze the effects of species extinction on the health of an ecosystem. **4.4.10. B.** Assess the influence of agricultural science on farming practices. • Compare the practices of no-till farming to traditional soil preparation (e.g., plow, disc). • Analyze and explain the various practices of nutrient management on the farm. • Analyze and explain how farm efficiencies have changed human nutrition. **4.6.10A** Explain the biotic and abiotic components of an ecosystem and their interaction. **4.6.10B** Explain how cycles affect the balance in an ecosystem.

**By the end of this unit, students will be able to . . .**

<b>KNOW:</b>	<b>UNDERSTAND:</b>	<b>DO:</b>
<p>The levels of organization that ecologists study.</p> <p>The source of energy for life processes.</p> <p>The methods used to study ecology.</p>	<p>Within the biosphere, organisms are linked to one another and to the land, water, and air around them by relationships that enable energy to flow and matter to cycle.</p> <p>Why soil health is important and why it matters to human health.</p>	<p>Trace the flow of energy through living systems.</p> <p>Evaluate the efficiency of energy transfer among organisms in an ecosystem.</p> <p>Describe how matter cycles among the living and nonliving parts of an ecosystem.</p> <p>Explain why nutrients are important in living systems.</p> <p>Describe how the availability of nutrients affects the productivity of ecosystems.</p>

## Potential Vocabulary:

Ecology, biosphere, species, population, community, ecosystem, biome, autotroph, producer, photosynthesis, chemosynthesis, heterotroph, consumer, herbivore, carnivore, omnivore, detritivore, decomposer, food chain, food web, trophic level, biomass, nitrogen cycle, carbon cycle, evaporation, transpiration, nutrient, nitrogen fixation, denitrification, primary productivity, limiting nutrient, algal bloom, sand, silt, clay, organic matter, soil texture triangle, NPK, microbe, nitrogen, methane, soil food web, cover crops, mulch, crop rotation, erosion, iLAB

## 2. Assessments

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Teacher: C. Pellegrini

Reading High School

Subject: Honors Biology

Topic: Soil Biology and the Biosphere

### **Common Assessments on what students should know and do in this unit:**

**Pre-test Questions on Soil Carbon/Science**

**Water cycle, Carbon cycle, and Nitrogen cycle worksheets**

**Analyzing Data – Farming in the Rye**

**Food Chain Lab**

**Real-world lab – Identifying a Limiting Nutrient**

**Carbon Sequestration Articles**

**Post-test Questions on Soil Carbon/Science**

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**Culminating Activity:**

**Chapter Test**

**Remember: Check the Know – Understand-Do Organizer.  
Has everything been assessed?**

### 3. Student Learning Map

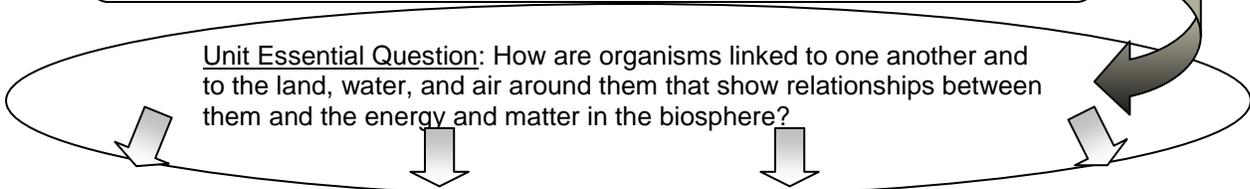
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Reading High School

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Topic: Soil Biology and theBiosphere

**Key Learning:** Within the biosphere, organisms are linked to one another and to the land, water, and air around them by relationships that enable energy to flow and matter to cycle.



<p><u>Concept:</u> What is ecology?</p>	<p><u>Concept:</u> Energy Flow</p>	<p><u>Concept:</u> Cycles of Matter</p>	<p><u>Concept:</u> Soil Biology</p>
<p><u>Lesson Essential Questions:</u> What different levels of organization do ecologists study?  What methods are used to study ecology?</p>	<p><u>Lesson Essential Questions:</u> Where does the energy for life processes come from?  How does energy flow through living systems?  How efficient is the transfer of energy among organisms in an ecosystem?</p>	<p><u>Lesson Essential Questions:</u> How does matter move among the living and nonliving parts of an ecosystem?  How are nutrients important in living systems?</p>	<p><u>Lesson Essential Questions:</u> What is soil? What does soil do? Why are carbon and nitrogen vital for plants? How can humans improve the quality of the soil?</p>
<p><u>Vocabulary:</u> Ecology, biosphere, species, population, community, ecosystem, biome</p>	<p><u>Vocabulary:</u> autotroph, producer, photosynthesis, chemosynthesis, heterotroph, consumer, herbivore, carnivore, omnivore, detritivore, decomposer, food chain, food web, trophic level, ecological pyramid, biomass</p>	<p><u>Vocabulary:</u> biogeochemical cycle, evaporation, transpiration, nutrient, nitrogen fixation, denitrification, primary productivity, limiting nutrient, algal bloom</p>	<p><u>Vocabulary:</u> sand, silt, clay, organic matter, soil texture triangle, NPK, microbe, nitrogen, methane, soil food web, cover crops, mulch, crop rotation, erosion, iLAB</p>

Additional Information/Resources:

# Acquisition Lesson Plan

Course: Honors Biology

Plan for the Concept, Topic, or Skill --- Not for the Day    Topic: What is Ecology

## Essential Question:

How do ecologists study the biosphere?

What do students need to learn to be able to answer the Essential Question?

Assessment Prompt \_1\_: How are living things dependent on living and non living things?

Assessment Prompt \_2\_: What are the six levels of organization in ecological study?

Assessment Prompt \_3\_: What are the three methods ecologists use to study ecology?

Assessment Prompt \_\_\_:

## Activating Strategy:

Sitting in the outside, list all the living things you see (be specific). Then list all the nonliving things you see. How do these living things interact with the other living things and the nonliving things?

- Which organisms on your list provide energy or nutrients to the others?
- What would you expect to happen if all the plants on your list died? Explain.
- Why is it difficult to make accurate predictions about changes in communities of organisms?

## Teaching Strategies:

Graphic Organizer: Section outline

Instruction: Discuss Activating Strategy. Discuss vocabulary in class. Powerpoint presentation on Ecology.

**AP #1: How are living things dependent on living and non living things?**

Discuss levels of organization in ecological study. Create a table that shows examples of ecological levels where you live. Use illustrations and color.

**AP #2: What are the six levels of organization in ecological study?**

Discuss Ecological Methods.

**AP #3: What are the three methods ecologists use to study ecology?**

**AP #4:**

**AP #5:**

Assignments: vocabulary, table of ecological levels

## Summarizing Strategy: Table of ecological levels created

Course: Honors Biology

## Acquisition Lesson Plan

Plan for the Concept, Topic, or Skill --- Not for the Day    Topic: Energy Flow

### Essential Question:

How does energy flow through living systems?

What do students need to learn to be able to answer the Essential Question?

Assessment Prompt \_1\_: What is the main difference between producers and consumers?

Assessment Prompt \_2\_: How do the four subgroups of consumers differ from each other?

Assessment Prompt \_3\_: What is the difference between a food chain and a food web?

Assessment Prompt \_4\_: At what level is the largest amount of energy found on the ecological pyramid?

### Activating Strategy:

Vocabulary preview: photo-, chemo-, synthesis, herb-, carn-, omni-, detritus, -vore: What do these words and word parts mean? How can they help you understand the vocabulary words for this section?

Photo = light, chemo = chemical, synthesis = together, carnae = flesh, omin = all, herb = plant, vorare = devour

### Teaching Strategies:

Graphic Organizer: Concept map on energy flow in the ecosystem

Instruction: Powerpoint presentation on producers and consumers.

**AP #1: What is the main difference between producers and consumers?**

Divide the class into groups of 3 or 4. Give each group a variety of pictures of organisms for them to classify into groups, first producers and consumers, then classify the consumers into four subgroups or herbivores, carnivores, omnivores, and decomposers. Present your pictures to class and explain your classification method. Food Web Lab.

**AP #2: How do the four subgroups of consumers differ from each other?**

Powerpoint presentation on Feeding Relationships. Discuss food chains, food webs, and trophic levels. Complete Ecosystem and Communities Lab.

**AP #3: What is the difference between a food chain and a food web?**

Powerpoint presentation on Ecological Pyramids. Draw the three types of ecological pyramids. Use personal examples for biomass and numbers.

**AP #4: At what level is the largest amount of energy found on the ecological pyramid?**

**AP #5:**

Assignments: vocabulary, drawings, ecosystem & communities lab

**Summarizing Strategy: Name 3 trophic levels in order, what are 2 ways to model feeding relationships, describe one of the ecological pyramids.**

Course: Honors Biology

## Acquisition Lesson Plan

Plan for the Concept, Topic, or Skill --- Not for the Day    Topic: Cycles of Matter

### Essential Question:

How does matter move among the living and nonliving parts of an ecosystem?

What do students need to learn to be able to answer the Essential Question?

Assessment Prompt \_1\_: What is a biogeochemical cycle?

Assessment Prompt \_2\_: Why isn't water considered a nutrient cycle?

Assessment Prompt \_3\_: What are the main nitrogen-containing nutrients in the biosphere?

Assessment Prompt \_4\_: What is a limiting nutrient?

### Activating Strategy:

Water Cycle Diagram: Have students draw simplified diagrams of the water cycle from prior knowledge. Ask them to explain how they think other substances (Carbon, nitrogen, etc.) could cycle through an ecosystem? Have them show it on their drawings.

### Teaching Strategies:

Graphic Organizer: Flow charts of the water, carbon, nitrogen, & phosphorus cycles.

Instruction: Powerpoint presentation on Cycles of Matter

AP #1: What is a biogeochemical cycle?

Complete Active Art Water cycle activity (click on hyperlink in power point presentation).

AP #2: Why is water not considered a nutrient cycle?

Use powerpoint presentation on nutrient cycles to discuss cycles. View video clips for each cycle in the power point presentation. Complete the diagram of each cycle.

AP #3: What are the main nitrogen-containing nutrients in the biosphere?

Discuss nutrient limitation. Complete set up for Identifying a Limiting Nutrient lab. Formulate the hypothesis and predict the outcome of the lab. Set up data sheet to record data for the week.

AP #4: What is a limiting nutrient?

AP #5:

Assignments: vocabulary, skeletal outline, active art activity, drawings, limiting nutrient lab write-up

### Summarizing Strategy: Drawings of the water and nutrient cycles.

# Acquisition Lesson Plan

Plan for the Concept, Topic, or Skill --- Not for the Day    **Topic: Soil Biology**

## Essential Question:

What vital role does soil play for humans and other living things?

What do students need to learn to be able to answer the Essential Question?

Assessment Prompt 1: Why is soil important?

Assessment Prompt 2: What does the iLab measure?

Assessment Prompt 3: What role does soil and plant life play in carbon sequestration?

Assessment Prompt 4: Why is soil protected better using organic methods of growing and harvesting than when using conventional methods of farming and gardening?

## Activating Strategy:

Take four columns of soil from four different areas, organic field, organic garden, organic compost, and conventional field. Have students predict which type of soil will absorb water the fastest and which will absorb the water the slowest. Ask why they think what they do. Pour water in each and time how long it takes each column to absorb the water. Observe what the unabsorbed water at the top of the column looks like. Were the students predictions correct? Ask the students to explain why they think the water is absorbed by some of the soils and not the other soils.

## Teaching Strategies:

Graphic Organizer: Outline

Instruction: Students fill out Pre-test Questions regarding soil biology. Power point presentation "Soil Biology" by Rodale Institute researchers. Students fill in outline during presentation.

**AP #1: Why is soil important?**

Rodale researchers present iLab technology to students and give them an opportunity to use it on soils collected at the school and at the Rodale Institute.

**AP #2: What does the iLab measure?**

Students read two articles about carbon sequestration, "Could Dirt Help Heal the Climate?", Discover Magazine, May 2011 and "Hot Commodities", National Wildlife, October/ November 2011. Conduct class discussions and have students complete answers to questions about each article, in pairs or individually.

**AP #3: What role does soil and plant life play in carbon sequestration?**

Students visit the Rodale Institute and participate in a tour of the farm, soil core analysis, soil food web workshop, greenhouse work, introduction to organic gardening and farming methods, and food production growing.

**AP #4: Why does soil benefit more by using organic methods of farming and gardening than when using conventional methods of farming and gardening?**

Students complete post-visit questions on Soil Carbon/Science.

**AP #5:**

Assignments: Articles, pre-test and post-test answers

## Summarizing Strategy: Post-visit Questions on Soil Carbon/Science

# Acquisition Lesson Plan

Plan for the Concept, Topic, or Skill --- Not for the Day    **Topic: The Biosphere (review)**

## Essential Question:

How are organisms linked to one another and to the land, water, and air that show relationships between them and the energy and matter in the biosphere?

What do students need to learn to be able to answer the Essential Question?

Assessment Prompt 1: How do ecologists study the biosphere?

Assessment Prompt 2: How does energy flow through living systems?

Assessment Prompt 3: How does matter move among the living and nonliving parts of an ecosystem?

Assessment Prompt 4: What vital role does soil play for humans and other living things?

## Activating Strategy:

Answer the unit essential question in essay form. Use your vocabulary and include all topics covered in this unit including ecology, energy flow and cycles of matter.

## Teaching Strategies:

**Graphic Organizer: (review days: see previous lessons for these items)**

**Instruction: Groups of 3 or 4 students use their completed review sheets and come up with one that is the best. Revise each so they are as correct as possible and be prepared to present to the class.**

Present review sheet for Ecology

**AP #1: How do ecologists study the biosphere?**

Present review sheet for Energy Flow

**AP #2: How does energy flow through living systems?**

Present review sheet for Cycles of Matter

**AP #3: How does matter move among the living and nonliving parts of an ecosystem?**

Present review sheet for Soil Biology

**AP #4: What vital role does soil play for humans and other living things?**

Take chapter test.

**AP #5:**

**Assignments: Essential Question Essay, review sheets**

## Summarizing Strategy: chapter test

Course:

# Acquisition Lesson Plan

Plan for the Concept, Topic, or Skill --- Not for the Day    Topic:

<p><b><u>E</u>ssential Question:</b></p> <p>-----</p> <p>What do students need to learn to be able to answer the Essential Question?</p> <p>Assessment Prompt ____:</p> <p>Assessment Prompt ____:</p> <p>Assessment Prompt ____:</p> <p>Assessment Prompt ____:</p>
<p><b><u>A</u>ctivating Strategy:</b></p> <p>-----</p>
<p><b><u>T</u>eaching Strategies:</b></p> <p>Graphic Organizer:</p> <p>-----</p> <p>Instruction:</p> <p>-----</p> <p>AP #1:</p> <p>-----</p> <p>AP #2:</p> <p>-----</p> <p>AP #3:</p> <p>-----</p> <p>AP #4:</p> <p>-----</p> <p>AP #5:</p> <p>-----</p> <p>Assignments:</p>
<p><b><u>S</u>ummarizing Strategy:</b></p>