Delaware Science Coalition

Grade 5 Ecosystems Unit Template

Preface: This unit has been created as a model for teachers in their designing or redesigning of course curricula. It is by no means intended to be inclusive; rather it is meant to be a springboard for teacher thought and creativity. The information we have included represents one possibility for developing a unit based on the Delaware content standards and the Understanding by Design framework and philosophy.

Brief Summary of Unit

In this unit, students understand the web of relationships that links organisms to one another and to their natural environments. By constructing, observing, discussing, and reading about both land and water ecosystems in this unit, students develop a growing sensitivity to living things and what they need to survive. Students learn that organisms in ecosystems have dependent and independent relationships and that natural and human-made events can disturb an ecosystem. They also learn that people bring different perspectives to environmental issues and that they can work together to develop solutions. (STC – Ecosystems)

Stage 1: Desired Results
Delaware Science Content Standards

Delaware Science Content Standards

This course focuses on the Delaware Science Content Standards and Grade Level Expectations in Standards 1, 6, and 8 found on the following web site: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: The Nature and Application of Science and Technology
Understandings and Abilities of Scientific Inquiry
Students should know and be able to:

1. Understand that: Scientific investigations involve asking a focused scientific question. Investigations differ depending upon the question being asked.

- Be able to: Generate focused questions and informed predictions about the natural world.

2. Understand that: Fair test design supports the validity of the investigation. Sometimes it is not possible to know everything that will have an effect on the investigation or control all conditions.
   - Be able to: Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested.
3. Understand that: The purpose of accurate data collection is to provide evidence to compare with the prediction.
   - Be able to: Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and question results with and from others.
4. Understand that: The body of scientific knowledge grows as scientists ask questions, conduct investigations, develop explanations and compare results with what is already known.
   - Be able to: Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation.
5. Understand that: The purpose of communicating is to share and justify results. Scientists communicate their results to others, including the details that allow others to replicate the results.
   - Be able to: Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument.
6. Understand that: The use of mathematics, reading, writing, and technology are important in conducting scientific inquiries.
   - Be able to: Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Science, Technology, and Society
Students should know that:

1. Science and technology are related. Technology provides the tools needed for science to investigate questions and may provide solutions to society's problems, wants, or needs. Not all technological solutions are effective, uniformly beneficial, or equally available to everyone.

History and Context of Science
Students should know that:

1. Contributions by individuals have been essential in advancing the body of scientific knowledge.

Students should be able to:

- Identify natural (i.e., wildfire, flood, and drought) and man-made changes (forest clear cutting, input of pollutants, filling in of marshland) to an ecosystem. Discuss how these changes affect the balance of an ecosystem.

Standard 6: Life Processes

Matter and Energy Transformations

Students should know that:

1. Plants need the Sun's energy to grow and survive.

Students should be able to:

- Explain that all organisms require a form of energy to survive and that humans and other animals obtain energy and materials from food.

Students should know that:

2. Animals need food to provide materials and energy for life which they derive directly or indirectly from plants.

Students should be able to:

- Identify external structures (i.e., legs) and behaviors (i.e., walking) of organisms that enable them to survive in their particular ecosystem and describe how these structures enable the organisms to respond to internal (i.e., hunger) and external (i.e., temperature, danger) cues.
- Research the ways that a variety of organisms respond to internal (i.e., need for food and shelter) and external (i.e., presence of predators) cues. Describe the similarities and differences among the organisms.
- Identify and discuss how short-term and long-term alterations in the environment affect the health of organisms found in that ecosystem.

Students should know that:

3. The digestive system has major structures that function to break down food for use in the body. The major parts of the digestive system include the mouth, esophagus, stomach, small intestine, and large intestine.

Students should be able to:

- Recognize that the digestive system has many parts that work together to perform a function in humans and many other animals.
- Describe how to promote healthy digestion and recognize some symptoms that indicate disturbances associated with the normal functioning of the digestive system (i.e., stomach ache, flatulence).
- Identify, label the parts, and describe the basic functions of the human digestive tract including the mouth, esophagus, stomach, small intestine, large intestine (colon), rectum, and anus.
- Compare and contrast the human body digestive system with that of other animals e.g., earthworm, chicken, fish, crayfish, snail, cow.

Standard 8: Ecology

Interactions within the Environment

Students should know that:

2. All living organisms interact with the living and nonliving parts of their surroundings to meet their needs for survival. These interactions lead to a constant exchange of matter.

Students should be able to:

- Examine a variety of ecosystems such as marsh, pond, field, forest. Compare how the organisms, the habitat, and the food chains are similar and different in these ecosystems.
- Differentiate between an organism's "habitat" (where an animal lives) and its "territory" (an area claimed as its own space). Select an organism and describe its habitat and territory.

Students should know that:

3. Adaptations in organisms enable them to live and reproduce in certain environments. Those organisms that are best suited for particular environments have adaptations that allow them to compete for available resources and cope with the physical conditions of their immediate surroundings.

Students should be able to:

- Predict and describe how a dramatic increase or decrease in the population size of a single species within an ecosystem affects the entire ecosystem.

Students should know that:

4. Changes in an organism's environment may be either beneficial or harmful. Organisms may be affected by other organisms, by various physical factors (e.g., rainfall, temperature), by physical forces (e.g., storms, earthquakes), and by daily, seasonal, and annual cycles.

Students should be able to:

- Identify environmental factors that affect the growth and reproduction of organisms in an ecosystem (e.g., temperature can affect germination and soil moisture).

Energy Flow and Material Cycles in the Environment

Students should know that:

1. Plants need energy from the Sun, water and nutrients for growth and survival.

Students should be able to:

- Conduct investigations to simulate terrestrial and aquatic ecosystems and their interdependence. Demonstrate and describe how alteration of one part of the ecosystem (i.e., change in pH, over fertilization, addition of salt) may cause changes throughout the entire ecosystem.

Students should know that:

2. Animals eat plants or other animals that have eaten plants. Animals obtain energy and materials for body repair and growth from food.

Students should be able to:

- Identify the Sun as a source of energy that drives an ecosystem. Describe the path of energy from the Sun to the producers then to the consumer in the food chain. Recognize that an organism has dependent and independent relationships in an ecosystem.

Students should know that:

3. Dead plants and animals are broken down by decomposers.

Students should be able to:

- Categorize the organisms within an ecosystem according to the function they serve as producers, consumers, or decomposers. Explain why the organism was categorized this way.

Human Impact

Students should know that:

1. Human activities may cause pollution of air, water and soil.

Student should be able to:

- Identify natural (i.e., wildfire, flood, and drought) and man-made changes (forest clear cutting, input of pollutants, filling in of marshland) to an ecosystem. Discuss how these changes affect the balance of an ecosystem.

Students should know that:

2. Different technologies are used to access resources to meet human wants and needs. In many cases the environment is affected and resources become limited. Some activities may include burning of fossil fuels, logging, building of highways, shopping centers, and dams, introduction of one species to control another species, spraying of insects, as well as some aspects of farming.

Students should be able to:

- Explain why moving organisms from their ecosystem to a new ecosystem may upset the balance of the new ecosystem, for example, by introduction of diseases or depletion of resources.

Big Ideas

- **Models** are used to duplicate, investigate, and analyze aquatic and terrestrial ecosystems
- **Models** are used to **observe interactions** within an ecosystem
- **Models** are used to **investigate** the impact of humans on the environment
- Energy and matter **cycle** through an ecosystem
- **Reasoning and explanations** offers solutions to environmental problems

Unit Enduring Understandings

Students will understand that…

- Organisms and their environments are interconnected.
- Changes in one part of the system will affect other parts of the system.
- Matter needed to sustain life is continually recycled among and between organisms and the environment.
- Humans can alter the living and non-living factors within an ecosystem, thereby creating changes to the overall system.
- The life processes of organisms are affected by their interactions with each other and their environment and may be altered by human manipulation.
- Scientific inquiry involves asking scientifically-oriented questions, collecting evidence, forming explanations, connecting explanations to scientific knowledge and theory, and communicating and justifying the explanation.

Unit Essential Question(s)

1. How can change in one part of an ecosystem affect change in other parts of the ecosystem?

2. How does matter and energy link organisms to each other and their environment? Why is sunlight essential to life on Earth?

3. How do humans have an impact on the diversity and stability of ecosystems?

4. **How is matter and energy transferred/transformed in living systems?**

Knowledge & Skills

Students will know….

- How to conduct simple experiments
- How to set up a model
- How to collect, record, analyze data using simple tools
- How to care for and maintain living organisms
- How to measure the pH of soil and water
- Understand the effects of pollutants on the environment
- Understand that interactions within and among living systems causes changes in matter and energy
- Understand that organisms are linked to each other and to their environments in a web of relationships
- Understand that an ecosystem is a community of organisms that interact with each other and the environment.
- Understand that humans can affect ecosystems in many ways

Students will be able to…..

Examine a variety of ecosystems such as marsh, pond, field, forest. Compare how the organisms, the habitat, and the food chains are similar and different in these ecosystems.

Differentiate between an organism's "habitat" (where an animal lives) and its "territory" (an area claimed as its own space). Select an organism and describe its habitat and territory.

Predict and describe how a dramatic increase or decrease in the population size of a single species within an ecosystem affects the entire ecosystem.

Identify environmental factors that affect the growth and reproduction of organisms in an ecosystem (e.g., temperature can affect germination and soil moisture).

Conduct investigations to simulate terrestrial and aquatic ecosystems and their interdependence. Demonstrate and describe how alteration of one part of the ecosystem (i.e., change in pH, over fertilization, addition of salt) may cause changes throughout the entire ecosystem.

Categorize the organisms within an ecosystem according to the function they serve as producers, consumers, or decomposers. Explain why the organism was categorized this way.

Identify the Sun as a source of energy that drives an ecosystem. Describe the path of energy from the Sun to the producers then to the consumer in the food chain. Recognize that an organism has dependent and independent relationships in an ecosystem.

Identify natural (i.e., wildfire, flood, and drought) and man-made changes (forest clear cutting, input of pollutants, filling in of marshland) to an ecosystem. Discuss how these changes affect the balance of an ecosystem.

Explain why moving organisms from their ecosystem to a new ecosystem may upset the balance of the new ecosystem, for example, by introduction of diseases or depletion of resources.

Explain that all organisms require a form of energy to survive and that humans and other animals obtain energy and materials from food.

Identify and discuss how short-term and long-term alterations in the environment affect the health of organisms found in that ecosystem.

Generate focused questions and informed predictions about the natural world.

Design and conduct simple to multi-step investigations in order to test predictions. Keep constant all but the condition being tested.

Accurately collect data using observations, simple tools and equipment. Display and organize data in tables, charts, diagrams, and bar graphs or plots over time. Compare and question results with and from others.

Construct a reasonable explanation by analyzing evidence from the data. Revise the explanation after comparing results with other sources or after further investigation.

Communicate procedures, data, and explanations to a variety of audiences. Justify the results by using evidence to form an argument.

Use mathematics, reading, writing, and technology when conducting scientific inquiries.

Note: Digestive System lessons need to be developed – possibly with FOOD Chains or other activities that the teacher has.

Stage 2: Assessment Evidence
(Design Assessments To Guide Instruction)

Suggested Performance Task(s)

The Ecosystems unit is assessed through the use of an end-of-unit summative assessment. This assessment is intended to uncover student misconceptions, which will then inform instruction. Both the student guide and teacher rubrics are included. To access the end-of-unit summative assessment, go to the web site listed below. Click on the Delaware Science Comprehensive Assessment Program.

http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Key Transfer Ideas:

1. Understand that organisms within an ecosystem interact with each other and their environment.
2. Understand that organisms within an ecosystem can be categorized as producers, consumers, or decomposers and can be sequenced in simple food chains.
3. Understand that food webs are diagrams that illustrate the dependent and inter-dependent relationships within ecosystems.
4. Understand that the growth and reproduction of organisms within an ecosystem are affected by factors such as food, light, water, temperature, and acidity (pH).
5. Understand that natural events and human activities can cause a disturbance to or imbalance of an ecosystem.
6. Understand the requirements for the survival of organisms.

7. Identify the sun as a source of energy.
8. Describe the path of energy from the sun to the producers and then to the consumers.
9. Perform a critical analysis of evidence; distinguish opinion from scientific evidence.

Expectations of Students:

- Identify living things in an eco-column.
- Identify non-living things in an eco-column.
- Identify basic needs of fish to survive in an ecosystem and why these needs are essential.
- Identify basic needs of plants to survive in an ecosystem and why these needs are essential.
- Describe plausible consequences to overcrowding of fish in an ecosystem.
- Identify the Sun as the source of energy in an ecosystem.
- Describe the path of energy from the Sun to producers to composers.
- Given a picture, complete a simple food chain.
- Describe how populations within a wetland ecosystem may be affected if an organism is removed.
- Identify changes in population data over time.
- Identify a cause for changes in population data over time.
- Read a graph and identify a trend.
- Observe a water sample and record observations.
- Measure pH.
- Interpret a pH test.
- Relate data from several sources to a water sample.
- Justify a position using evidence.

Lesson 14 students report on their pollutants use lesson format as guide, students can use their own format for their group

presentations.
Lesson 15 can also be used as a performance tasks as they do their presentations, use lesson format as a guide.

See http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Rubrics/checklists for Performance Tasks

Lesson 14 presentation: make sure each group discusses and reports on the following.

- The effects of their pollutant on the terrarium
- The effects of their pollutant on the aquarium
- What the group predicted about the effects of their pollutant on the animals in an ecosystem polluted with their pollutant.

Lesson 15 presentation: make sure each group meets the following requirements.

- States the problem
- Lists proposed solutions
- Describes the advantages of each solution
- Describes the disadvantages of each solution

See http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Other Evidence

Teacher can design their own pre/post unit test for this unit.
Drawings students make in their science journal can be an excellent, quick assessment format.
Teacher observation.
An entire lesson can be used as an embedded assessment.

Student Self-Assessment and Reflection

Self –assessment Lesson 8.
Two environmental problems pgs. 24-26. "Diapers: An environmental Problem" "An Environmental Decision: Oil Fields or a Natural Refuge?"

- The problem begins with three questions intended to help students focus on the main issues as they read.
- A reading selection describes the problem from different points of view.
- Two questions at the end ask students to take a stand on the issue and then back up their choice with reason.

From STC kit Ecosystems pgs. 23-26 Student Assessment

Stage 3: Learning Plan
(Design Learning Activities To Align with Goals and Assessments)

Key learning events needed to achieve unit goals

National Science Resource Center. *STC Ecosystems.*

Lesson 1
Students focus on the topic of ecosystems and serves as a pre-unit assessment of their knowledge and questions related to ecosystems. A discussion is prompted by an illustration of a riverbank that provides additional information about ideas regarding relationships between living and non living things.

Lesson 2
This lesson introduces students to the process of using a model for making scientific observations. By constructing model terrariums and beginning a written record of the components, students begin to think about the relationships among the living and non living things.

Lesson 3
In this lesson students set up their model aquaria and discuss the needs of organisms in an aquatic environment. After carefully observing the aquatic plants students use a series of reading selections to discover more about these organisms and the roles they play in maintaining the ecosystem.

Lesson 4
Students build on the understandings that green plants make their own food and shift their focus from plants as producers of food to

animals as consumers of food. Students add and observe aquatic animals and read to learn more about their animals in the aquaria.

Lesson 5
Through a class webbing activity students synthesize what they have read and observed about aquatic ecosystems. In writing, students then focus on the dependent and interdependent relationships in their ecosystems to identify observable evidence that these relationships really do exist.

Lesson 6
Students record initial observations of the terrarium animals they have added and analyze the role organisms play in a stable ecosystem. This analysis prepares students to make further predictions about how living things affect each other.

Lesson 7
Using a terrestrial food chain wheel and a webbing activity, students learn more about the concepts of food chains, dependence, and interdependence. They compare land and aquatic ecosystems and reflect on how the two systems are interdependently related after physically joining their aquaria and terrarium to make an ecocolumn.

Lesson 8
Using their model ecosystems, students observe describe and compare stable and disturbed ecosystems. Students identify and discuss natural and human made causes that can disturb an ecosystem.

Lesson 9
Through research students make a classroom presentation about three pollutants and the trade offs involved when humans release pollutants into the environment. Students observe their stable ecosystems and record observations.

Lesson 10
In this lesson students apply what they learned about pollutants in lessons 8 and 9 in preparation of designing their own pollution experiment on their ecocolumns. Students use a planning worksheet to formulate a specific experimental question and make predictions about the results. Through this experience students gain additional insight into the use of modeling to test and observe cause and effect.

Lesson 11

In this lesson students implement their pollution experiment to test their hypotheses. This gives students experience in using simulations, recording results, and verifying predictions. Students also discover the usefulness of varying results. Student's mix and measure chemicals as outlined in their pollution planning worksheet.

Lesson 12
Students observe and record the effects of pollutants have had on the classroom ecosystems used in the experiments. Students observe and discuss the control ecocolumn. Then, by testing each aquariums pH, students discover that one system has affected the other- a concept related to real world land and water systems.

Lesson 13
Reflecting on their experiences as experimenters in lesson 12, students now focus on how scientists use models to answer questions. By comparing the results of their experiments, students also learn the importance of using controls and averaging data.

Lesson 14
Students report on their teams pollution experiments and analyze the data and the effects of each pollutant. By reading about a real ecosystem in danger, the Chesapeake Bay, they start exploring ways to solve real life environmental problems.

Lesson 15
Students now use role playing to examine the Chesapeake Bay from different points of view, the ordinary citizen, dairy farmer, waterman, land developer and recreational boater. By completing a problem solving sheet, student groups analyze the Bays problems from one of these perspectives, propose solutions, and identify trade-offs.

Lesson 16
Students present an environmental problem from a particular point of view and propose solutions. Students examine their own lives and how they can find solutions to some of the world's environmental problems.

Resources & Teaching Tips

- **What text/print/media/kit/web resources best support this unit?**

Moore, Eva. *The Story of George Washington Carver*. 1971. Scholastic Inc. ISBN 0-590-42660-5. This is a great book for reading

while teaching Ecosystems. It is an easy biography to read with actual photographs. I use to have the students make a timeline of important events in George's life as they read the book. I usually had the students read this book during February (Black History Month) or while studying the Civil War. It would also work well while teaching Mixtures and Solutions (Linda Mosley- Red Clay Lead Teacher)

Populations and Ecosystems. 1996. Silver Burdett Ginn Inc. ISBN 0-382-33479-5 *Populations and Ecosystems* has great activities that teachers can do in and out of the classroom. (Linda Mosley- Red Clay Led Teacher)

Walker, Colin. *Ecology*. 1992. The Wright Group. ISBN 0-7802-0451. Contains lots of colorful illustrations of plants and animals that can be used as a reference for writing reports. (Linda Mosley- Red clay Lead Teacher)

Walker, Colin. *The Environment*. The Wright Group. ISBN 0-7802-0465-4. This is full of activities, black and white photographs and charts/diagrams that can be used as a reference for writing reports. (Linda Mosley- Red clay Lead Teacher)

Walker, Colin. *Forest Forever*. 1992. The Wright Group. ISBN 0-7802-0455-7. This has colorful photographs that can be used for reference. (Linda Mosley- Red Clay Lead Teacher)

Lorax – Dr. Suess

A River Ran Wild

Come Back Salmon

Ecology Mystery Stories – Jean Craighead George

Trouble at Marsh Harbor

<u>Video / Websites</u>

Bill Nye Video – Ecosystems

Freddy the Fish – on-line great for text-based LA assessment

Field Trips
Bombay Hook/ Abbott's Mill – covers the digestive system of the fish
Smyrna Aquatic Center – Eco-explorers Program
Ashland Nature Center

- **What tips to teachers of the unit can you offer about likely rough spots/student misunderstandings and performance weaknesses, and how to troubleshoot those issues?**

Emphasize the sun as the source of energy.

Accommodation/Differentiation ideas and tips

WIDA English Language Proficiency Standards for English language Learners. http://www.wida.us/Resources/standards/

Flexible grouping for reading assessments.

Read Aloud.

Provide students with scribes.

Use assistive technology.

Use bilingual tests.

