ECOSYSTEMS

Connecting Learning and Standards

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Ecosystems: Connecting Common Core and Instructional Practice

Common Core State Standards in both ELA and Math require that students engage in an "inquiry" method of learning. Inquiry is not merely 'having students do projects' but rather strives to nurture deep, discipline-based ways of thinking and doing with students. Inquiry learning is defined as "an investigative process" in which students:

- Acquire and analyze information
- Demonstrate their thinking
- Make their learning visible

Inquiry includes the diverse ways scientists study the natural world and propose explanations based on evidence. It reflects how scientists come to understand the world, and it is at the heart of how students learn. From a very early age, children interact with their environment, ask questions, and seek ways to answer those questions. Understanding science content is significantly enhanced when ideas are anchored to inquiry experiences.

Shifts in existing lessons increase the level of inquiry learning, resulting in lessons or units that strengthen investigative processes and increase inquiry based lessons. Students participate in activities to develop knowledge and understanding of scientific ideas, as well as an understanding of how scientists study the natural world.

Scientific inquiry is a powerful way of understanding science content. Students learn how to ask questions and use evidence to answer them. In the process of learning the strategies of scientific inquiry, students learn to conduct an investigation and collect evidence from a variety of sources, develop an explanation from the data, and communicate and defend their conclusions[1].

ELA Shift #1	Regular practice with complex texts and their academic language
ELA Shift #2	Reading, writing, and speaking grounded in evidence from texts, both literary and informational
ELA Shift #3	Building knowledge through content-rich non-fiction

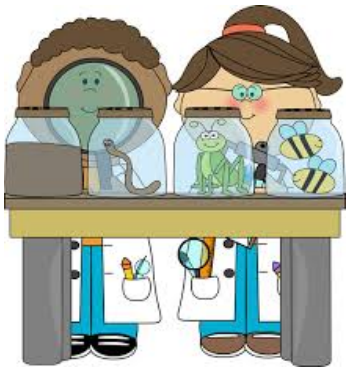
[1] http://www.nsta.org/about/positions/inquiry.aspx
(Accessed August, 2015)

Ecosystems Investigation

In this investigation, students create their own terrestrial and aquatic ecosystems and gain an understanding of ecological systems and their interdependence. Live material is introduced in phases before joining the aquarium and terrarium.

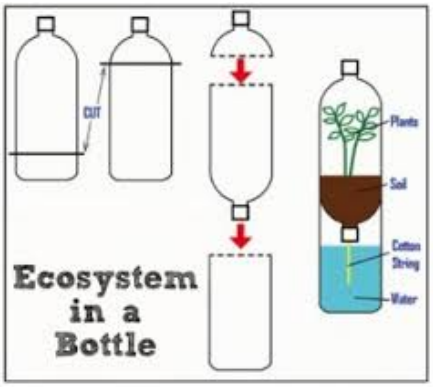
As students create their own terrestrial and aquatic ecosystems, they gain an understanding of ecological systems and their interdependence. The BOCES #1 Science and Technology (BoSAT) kit provides a "hands-on, minds-on" interdisciplinary science curriculum that emphasizes the process skills of:

- Observing
- Classifying
- Measuring
- Collecting and Processing Data
- Predicting and Inferring
- Experimenting
- Creating Models
- Making Decisions
- Replicating



An inquiry approach provides opportunities for active involvement in learning. Teachers and students interact using academic language, talking about their observations and evidence, and building knowledge through content-rich activities.

The web of relationships that link organisms to each other and to their natural environment emphasizes the following concepts:



- An ecosystem is a community of organisms
- Organisms can be classified by their functions: producers, consumers, decomposers
- Organisms in and ecosystem have dependent and interdependent relationships
- Light, water, temperature and soil are factors that affect organism growth and reproduction
- Natural and human events can disturb an ecosystem
- Pollutants can affect the stability of an ecosystem
- Model ecosystems approximate the complex relationships in our environment

Common Core State Standards Connections

ELA/Literacy		ECOSYSTEMS
RI.5.1	Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. *(5-LS1-1)*	Observing Collecting and Processing
RI.5.7	Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. *(5-PS3-1),(5-LS2-1)*	Collecting and Processing Data Classifying
RI.5.9	Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1)	Predicting and Inferring
W.5.1	Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1)	Making Decisions
SL.5.5	Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. *(5-PS3-1),(5-LS2-1)*	Creating Models Experimenting Replicating Measuring

New York State Standards Connections
Intermediate Science Core Curriculum

Key Idea 5: Plants and animals depend on each other and their physical environment.

An environmentally aware citizen should have an understanding of the natural world. All organisms interact with one another and are dependent upon their physical environment. Energy and matter flow from one organism to another. Matter is recycled in ecosystems. Energy enters ecosystems as sunlight, and is eventually lost from the community to the environment, mostly as heat.

NYS Science Standard		Ecosystems
Performance Indicator 6.1 Describe the flow of energy and matter through food chains and food webs.	6.1a Energy flows through ecosystems in one direction, usually from the Sun, through producers to consumers and then to decomposers. This process may be visualized with food chains or energy pyramids. 6.1b Food webs identify feeding relationships among producers, consumers, and decomposers in an ecosystem. 6.1c Matter is transferred from one organism to another and between organisms and their physical environment. Water, nitrogen, carbon dioxide, and oxygen are examples of substances cycled between the living and nonliving environment.	Collecting Data Processing Data Classifying Making Decisions Measuring Observing
Performance Indicator 6.2 Provide evidence that green plants make food and explain the significance of this process to other organisms.	6.2a Photosynthesis is carried on by green plants and other organisms containing chlorophyll. In this process, the Sun's energy is converted into and stored as chemical energy in the form of a sugar. The quantity of sugar molecules increases in green plants during photosynthesis in the presence of sunlight. 6.2b The major source of atmospheric oxygen is photosynthesis. Carbon dioxide is removed from the atmosphere and oxygen is released during photosynthesis. 6.2c Green plants are the producers of food which is used directly or indirectly by consumers.	Creating Models Experimenting Predicting Inferring Replicating

Energy, Organisms, and Ecosystems

PS3.D: Energy in Chemical Processes and Everyday Life
LS1.C: Organization for Matter and Energy Flow in Organisms
LS2.A: Interdependent Relationships in Ecosystems
LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

Next Generation Science Standards		Ecosystems
5-PS3-1.	Students who demonstrate understanding can: Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. [Clarification Statement: Examples of models could include diagrams, and flow charts.]	Creating Models Collecting Data Processing Analysis Evaluating Information
5-LS1-1.	Support an argument that plants get the materials they need for growth chiefly from air and water. [Clarification Statement: Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.]	Explaining Making Decisions Measuring Observing
5-LS2-1.	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. [Clarification Statement: Emphasis is on the idea that matter that is not food, (air, water, decomposed materials in soil), is changed by plants into matter that is food. Examples of systems could include organisms, ecosystems, and the Earth.] [Assessment Boundary: Assessment does not include molecular explanations.]	Creating Models Experimenting Predicting Inferring Replicating

The eight practices of science and engineering that the *Framework* identifies as essential for all students to learn and describes in detail are listed below:

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 3–5 builds on K–2 experiences and progresses to building and revising simple models and using models to represent events and design solutions. • Use models to describe phenomena. (5-PS3-1) • Develop a model to describe phenomena. (5-LS2-1) **Engaging in Argument from Evidence** Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Support an argument with evidence, data, or a model. (5-LS1-1) - ***Connections to the Nature of Science*** **Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena** • Science explanations describe the mechanisms for natural events. (5-LS2-1)	**PS3.D: Energy in Chemical Processes and Everyday Life** • The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1) **LS1.C: Organization for Matter and Energy Flow in Organisms** • Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. *(secondary to 5-PS3-1)* • Plants acquire their material for growth chiefly from air and water. (5-LS1-1) **LS2.A: Interdependent Relationships in Ecosystems** • The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1) **LS2.B: Cycles of Matter and Energy Transfer in Ecosystems** • Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)	**Systems and System Models** • A system can be described in terms of its components and their interactions. (5-LS2-1) **Energy and Matter** • Matter is transported into, out of, and within systems. (5-LS1-1) • Energy can be transferred in various ways and between objects. (5-PS3-1)

Connections to other DCIs in fifth grade: **5.PS1.A** (5-LS1-1),(5-LS2-1); **5.ESS2.A** (5-LS2-1)

*Articulation of DCIs across grade-levels:***K.LS1.C** (5-PS3-1),(5- LS1-1); **2.PS1.A** (5-LS2-1); **2.LS2.A** (5-PS3-1),(5-LS1-1); **2.LS4.D** (5-LS2-1); **4.PS3.A** (5-PS3-1); **4.PS3.B** (5-PS3-1); **4.PS3.D** (5-PS3-1); **4.ESS2.E** (5-LS2-1); **MS.PS3.D** (5-PS3-1),(5-LS2-1); **MS.PS4.B** (5-PS3-1); **MS.LS1.C** (5- PS3-1),(5-LS1-1),(5-LS2-1); **MS.LS2.A** (5-LS2-1); **MS.LS2.B** (5-PS3-1),(5-LS2-1)

The performance expectations were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Scheduling and Contact Information

BoSAT Elementary Science is a resource for the classroom teacher to aid in the implementation of a “hands on” approach to teaching elementary science. BoSAT provides staff development, classroom support, science kits and materials for grades K-6. Kits are available in the areas of life, earth and physical science.

The BOCES #1 Science and Technology (BoSAT) Center provides subscribing districts with an interdisciplinary science curriculum that emphasizes the process skills of:

- Observing
- Classifying
- Measuring
- Collecting and Processing Data
- Predicting and Inferring
- Experimenting
- Creating Models
- Making Decisions
- Replicating
- Manipulating Materials

In addition, our resources include

- teacher in-service programs where teachers are provided learning theory, teaching strategies, classroom management and assessment
- flexible program for elementary science where each school district selects the science kits and programs that best fit their curriculum, including science kits, video conferencing, and mobile science lab.
- student centered programs where students are active learners and are provided opportunities to design experiments of their own choosing

Give us a call for further information or to ship a kit of hand-on experiments to you.

To view kit descriptions and order go to: http://www.bosat.org/

Please contact Debra Croce at debra_croce@boces.monroe.edu or 585-249-7063 for pricing and scheduling information.

Contact Steve Orcutt at steve_orcutt@boces.monroe.edu or (585) 249-7890 for more information about programs and curriculum.

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