



# Ferry Beach Ecology School

## Helping Students Meet the Goals of the Massachusetts PreK-8 Science and Technology/Engineering Curriculum Framework

Below you will find a list correlating lessons taught at FBES with Massachusetts' Science Frameworks. There is a short description of each lesson taught during a typical week-long program at FBES followed by frameworks met by that particular lesson. While many of the frameworks pervade the FBES curriculum, the following is a list of lessons where the frameworks are most heavily focused on.

### **ABCs of Ecology**

Students are introduced to the "ABCs of Ecology": *Abiotic, Biotic, Cycles and Change*. Understanding these four basic ecology terms gives students the tools they need to compare the ecosystems they will be visiting during the course of their visit as well as ecosystems they encounter during their daily life at home. They also learn to use their own senses as well as tools such as soil corers, hand lenses and field guides to better observe the world around them.

#### *Earth and Space Science PreK-2*

4. Recognize that the sun supplies heat and light to the earth and is necessary for life.
5. Identify some events around us that have repeating patterns, including the seasons of the year, day and night.

#### *Earth and Space Science 3-5*

10. Describe how water on earth cycles in different forms and in different locations, including underground and in the atmosphere.

#### *Life Science PreK-2*

2. Differentiate between living and nonliving things. Group both living and nonliving things according to the characteristics that they share.
3. Recognize that plants and animals have life cycles, and that life cycles vary for different living things.
7. Recognize changes in appearance that animals and plants go through as the seasons change.

#### *Life Science 3-5*

3. Recognize that plants and animals go through predictable life cycles that include birth, growth, development, reproduction, and death.

### **Climate and Geology**

The *Climate and Geology* lesson focuses on abiotic (non-living) factors affecting ecosystems. Students compare the climatic and geologic make-up of several ecosystems and also learn about soil formation, climate change and the recent geologic history of New England.

#### *Earth and Space Science PreK-2*

2. Understand that air is a mixture of gases that is all around us and that wind is moving air.
3. Describe the weather changes from day to day and over the seasons.

#### *Earth and Space Science 3-5*

3. Identify the three categories of rocks (metamorphic, igneous, and sedimentary) based on how they are formed, and explain the natural and physical processes that create these rocks.

## **Climate and Geology (continued)**

### *Earth and Space Science 3-5*

4. Explain and give examples of the ways in which soil is formed (the weathering of rock by water and wind and from the decomposition of plant and animal remains).
5. Recognize and discuss the different properties of soil, including color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.
6. Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.
7. Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.
9. Differentiate between weather and climate.
11. Give examples of how the cycling of water, both in and out of the atmosphere, has an effect on climate.
12. Give examples of how the surface of the earth changes due to slow processes such as erosion and weathering, and rapid processes such as landslides, volcanic eruptions, and earthquakes.

### *Earth and Space Science 6-8*

4. Explain the relationship among the energy provided by the sun, the global patterns of atmospheric movement, and the temperature differences among water, land, and atmosphere.
5. Describe how the movement of the earth's crustal plates causes both slow changes in the earth's surface (e.g., formation of mountains and ocean basins) and rapid ones (e.g., volcanic eruptions and earthquakes).
6. Describe and give examples of ways in which the earth's surface is built up and torn down by natural processes, including deposition of sediments, rock formation, erosion, and weathering.
7. Explain and give examples of how physical evidence, such as fossils and surface features of glaciation, supports theories that the earth has evolved over geologic time.

### *Life Science 6-8*

17. Identify ways in which ecosystems have changed throughout geologic time in response to physical conditions, interactions among organisms, and the actions of humans. Describe how changes may be catastrophes such as volcanic eruptions or ice storms.

## **Ecosystem Lessons**

Students compare and contrast six ecosystems: sand beach, primary and secondary dunes, forest, tide pools and salt marsh through 4 different lessons. They compare diversity, nutrient levels, succession, disturbance, animal interactions and animal adaptations in ecosystems as well as how the water, carbon, and nitrogen cycles connect and transport living and non-living things within and between ecosystems. Since one of the main purposes of each of these four lessons is to compare these ecosystems, many of the curriculum goals apply to all of these lessons: **Forest, Beach and Dunes, Tide Pools and Coastal Watersheds**.

### *Earth and Space Science PreK-2*

1. Recognize that water, rocks, soil, and living organisms are found on the earth's surface.

### *Life Science PreK-2*

1. Recognize that animals (including humans) and plants are living things that grow, reproduce, and need food, air, and water.
8. Identify the ways in which an organism's habitat provides for its basic needs (plants require air, water, nutrients, and light; animals require food, water, air, and shelter).

### *Life Science 3-5*

6. Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beak or feet, placement of eyes on head, length of neck, shape of teeth, color.
8. Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment. Recognize that some animal behaviors are instinctive (e.g., turtles burying their eggs), and others are learned (e.g., humans building fires for warmth, chimpanzees learning how to use tools).
9. Recognize plant behaviors, such as the way seedlings' stems grow toward light and their roots grow downward in response to gravity. Recognize that many plants and animals can survive harsh environments because of seasonal behaviors, e.g., in winter, some trees shed leaves, some animals hibernate, and other animals migrate.

## **Ecosystem Lessons (continued)**

### *Life Science 3-5*

11. Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.

### *Life Science 6-8*

10. Give examples of ways in which genetic variation and environmental factors are causes of evolution and the diversity of organisms.

13. Give examples of ways in which organisms interact and have different functions within an ecosystem that enable the ecosystem to survive.

14. Explain the roles and relationships among producers, consumers, and decomposers in the process of energy transfer in a food web.

15. Explain how dead plants and animals are broken down by other living organisms and how this process contributes to the system as a whole.

16. Recognize that producers (plants that contain chlorophyll) use the energy from sunlight to make sugars from carbon dioxide and water through a process called photosynthesis. This food can be used immediately, stored for later use, or used by other organisms.

## **Astronomy and Nature at Night**

These two lessons concentrate on getting students comfortable with being out-of-doors at night as well as nocturnal animal adaptations, sensory awareness, planets and stars. During **Nature at Night** students will have a chance to explore the woods at dusk and learn about the animals that come out at that time.

During **Astronomy**, students get to tour the solar system and learn about different components of the universe, all the while discovering how unique Earth is.

### *Life Science PreK-2*

6. Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell, and taste.

### *Earth and Space Science 3-5*

1. Recognize that the earth is part of a system called the “solar system” that includes the sun (a star), planets, and many moons. The earth is the third planet from the sun in our solar system.

2. Recognize that the earth revolves around (orbits) the sun in a year’s time and that the earth rotates on its axis once approximately every 24 hours. Make connections between the rotation of the earth and day/night, and the apparent movement of the sun, moon, and stars across the sky.

3. Describe the changes that occur in the observable shape of the moon over the course of a month.

### *Earth and Space Science 6-8*

8. Recognize that gravity is a force that pulls all things on and near the earth toward the center of the earth. Gravity plays a major role in the formation of the planets, stars, and solar system and in determining their motions.

9. Describe lunar and solar eclipses, the observed moon phases, and tides. Relate them to the relative positions of the earth, moon, and sun.

10. Compare and contrast properties and conditions of objects in the solar system (i.e., sun, planets, and moons) to those on Earth (i.e., gravitational force, distance from the sun, speed, movement, temperature, and atmospheric conditions).

11. Explain how the tilt of the earth and its revolution around the sun result in an uneven heating of the earth, which in turn causes the seasons.

12. Recognize that the universe contains many billions of galaxies, and that each galaxy contains many billions of stars.

## **Connections**

This lesson expands upon and reviews the connections between the many ecosystems that the students have studied over the course of the week but also emphasizes the role humans play in ecosystems and explores how humans impact and alter the natural functioning of ecosystems.

### *Life Science 3-5*

7. Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration).

10. Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.

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## **Overall FBES Experience**

Because the FBES experience is so unique, much of the philosophy and vision of the frameworks are met throughout the week students spend here—not only on various lessons, but also through the experience of living in a dorm with peers, eating family style and being away from home. The sections below are taken from the Philosophy and Vision section of the Framework.

### *Inquiry Based Instruction*

Engaging students in inquiry-based instruction is one way of developing conceptual understanding, content knowledge, and scientific skills. Scientific inquiry as a means to understand the natural and human-made worlds requires the application of content knowledge through the use of scientific skills. Students should have curricular opportunities to learn about and understand science and technology/engineering through participatory activities, particularly laboratory, fieldwork, and design challenges.

### *Skills of inquiry, experimentation & design:*

All students need to achieve a sufficient level of scientific literacy to enable them to succeed in post-secondary education, in careers, and as contributing members of a democratic society. To achieve this, students need to develop skills that allow them to search out, describe, and explain natural phenomena and designed artifacts. Scientific inquiry, experimentation, and design involve practice (skills) in direct relationship to knowledge; content knowledge *and* skills are necessary to inquire about the natural and human-made worlds.