My NASA Data - Lesson Plans

GLOBE Local Connections: Earth Systems in the Local Study Site

Overview

To help students articulate and integrate their existing knowledge about the air, water, soil, and living things by viewing them as interacting parts of a system

Learning Objectives

Students will be able to:

- identify the major components of the Earth system, and give examples from their local study site;

- infer connections among the atmosphere, hydrosphere, biosphere, and pedosphere by describing connections among examples at the study site; and

- predict some ways that changes in one component of the study site might affect the changes in other components.

Essential Questions

Atmosphere–Hydrosphere Interconnection

- How does the presence of a stream, pond, lake, or ocean affect the air temperature nearby? (hydrosphere – atmosphere)
- How does a rainstorm affect rivers and streams?

Atmosphere–Lithosphere (Pedosphere) Interconnection

- Does the amount of moisture in the soil change? How? (atmosphere – pedosphere)
- How does the presence of large areas of rocks or asphalt affect the air temperature nearby? (Rocks are part of the lithosphere which is distinct from the soil, which is the pedosphere. Asphalt is man-made but is made up of natural materials. You can call this lithosphere – atmosphere interaction or more simply surface – atmosphere interaction)

Atmosphere–Biosphere Interconnection

- What do plants, animals, and other organisms obtain from the air? What is transported from each of those groups of organisms into the air? (biosphere –atmosphere)
- Where does heat in the soil and in the air come from? Did you know that the sun mainly warms the air only indirectly? (The soil is warmed by the sun, which heats the air, and not the other way around.) (pedosphere – atmosphere)

Hydrosphere–Lithosphere Interconnection

- Is moisture present in the soil? How does it get there? (hydrosphere – pedosphere)

Hydrosphere–Biosphere Interconnection

- How does water get from the stream (or pond, lake, canal, or ocean) to the trees? (hydrosphere – biosphere)
- How does the presence of a stream (or pond, lake, canal, or ocean) affect plants and animals? What are differences among species that live in it, species that live adjacent to it, and species that live 20 meters or more away from it? (hydrosphere – biosphere)

Biosphere–Lithosphere (Pedosphere) Interconnection

- How do leaves become part of the soil? (biosphere – pedosphere)
- Does water carry soil? When and how? (biosphere – pedosphere)
- How do plants affect the soil? (biosphere – pedosphere)
- How do animals affect the soil? Remember, there are animals living in the soil as well as on its surface. (biosphere – pedosphere)
- How do bacteria and other microorganisms affect the soil? How are they affected by the soil? (biosphere – pedosphere)

Materials Required

- Pencils
- pads of paper with stiff backing

Optional:

- magnifying glasses
- trowels
- gloves

Preparation

- Select and visit a Phenology study site (see the Biosphere Investigation).

- Prepare students for a trip to study site.
- Make copies of Learning Activity Work Sheets:
    - Recording Interconnections
    - Effect of One Component on Another
    - Identifying Sources for Ideas
    - Understanding Earth System Concepts
- Assessment rubrics for this activity (if you wish to share them with your students)

Technology Requirements

- Standalone Lesson (no technology required)

Teacher Background Information

General Earth As a System Documents

Earth as a System Introduction (pdf)

Earth as a System Appendix (pdf)

Procedure

See the PDF here to access the full lesson plan and student worksheets.

LC1: Connecting the Parts of the Study Site

Purpose

To help students articulate and integrate their existing knowledge about the air, water, soil, and living things by viewing them as interacting parts of a system

Overview

Students visit a study site, where they observe and recall their existing knowledge of air, water, soil, and living things to make a list of interconnections among the four Earth system components. They make predictions about the effects of a change in a system, inferring ways these changes affect the characteristics of other related components.

Student Outcomes

Students will be able to,

- identify the major components of the Earth system, and give examples from their local study site;
- infer connections among the atmosphere, hydrosphere, biosphere, and pedosphere by describing connections among examples at the study site; and
- predict some ways that changes in one component of the study site might affect the changes in other components.

Science Concepts

Earth and Space Sciences

Weather changes from day to day and over the seasons.
The sun is the major source of energy at Earth's surface.
Solar insolation drives atmospheric and ocean circulation
Each element moves among different reservoirs (biosphere, lithosphere, atmosphere, hydrosphere).

Physical Sciences

Heat is transferred by conduction, convection and radiation.
Heat moves from warmer to colder objects.
Sun is a major source of energy for changes on the Earth's surface.
Energy is conserved.

Life Sciences

Organisms can only survive in environments where their needs are met.
Earth has many different environments that support different combinations of organisms.
Organisms' functions relate to their environment.
Organisms change the environment in which they live.
Humans can change natural environments.
Plants and animals have life cycles.
Ecosystems demonstrate the complementary nature of structure and function.
All organisms must be able to obtain and use resources while living in a constantly changing environment.
All populations living together and the physical factors with which they interact constitute an ecosystem.
Populations of organisms can be categorized by the function they serve in the ecosystem.
Sunlight is the major source of energy for ecosystems.
The number of animals, plants and microorganisms an ecosystem can support depends on the available resources.
Atoms and molecules cycle among the living and non-living components of the ecosystem.
Energy flows through ecosystems in one direction (photosynthesis-herbivores-carnivores-decomposers).