

# Land and Water

## Narrative Summary

In this unit, students investigate the interactions between land and water. Using a stream table as their model, students observe how runoff causes stream formation; how ground water forms; how soil is eroded, transported, and deposited; and how water shapes land. Students create hills, build dams, and grow vegetation. Miniature valleys, waterfalls, and canyons form in the stream tables as water flows over the soil. Students also deepen their appreciation for the vastness of stream systems by creating aerial diagrams of their stream table results. The stream table also serves as a basis for investigations of the water cycle. Through observing the model, manipulating certain parts of it, and testing interactions under various conditions, students discover how water changes the shape of land and how land formations, in turn, affect the flow of water. They connect the models to real-world examples and apply the concepts they have learned to photographs of land and water on earth. Through these applications, students are encouraged to observe land and water each day and search for evidence of interactions between land and water in the world around them.

## Science Content

Modeling complex systems in order to investigate the relationships between the life, earth, and physical sciences is at the core of this unit. Stream table models provide students with evidence for land and water interactions. Science in personal and social perspec-



tives—including changes in environments—provides the basis for investigations. The water cycle, natural hazards such as flooding, and dam building are investigated in terms of their effect on society and natural resources. Change, constancy, and measurement are central to this unit. Geological surface features are described and characterized through direct observation. Students observe physical properties of earth materials, collect and measure sediment

moved during erosion, and record the path of streams to determine changes in land and water over time.

## Assessment

Classroom brainstorming in Lesson 1 elicits students' prior knowledge of land and water. Students also examine photographs of local and national landscapes and share their thoughts about the interactions between land and water in each shot. The photos and brainstorming session serve as a pre-unit assessment of students' knowledge of interactions between land and water and are matched to a post-unit assessment following Lesson 16. In an embedded assessment in Lessons 15 and 16, students design their own landscapes and synthesize what they have learned. Additional assessments at the end of the unit include a student self-assessment, an activity that challenges students to apply what they have learned to investigate the path of polluted running water, and a method for observing the interactions between land and water in students' own environments.

## Goals for *Land and Water*

In this unit, students investigate interactions between land and water. Through their experiences, students are introduced to the following concepts, skills, and attitudes.

### Concepts

- Water has an important role in shaping the land on earth.
- Soil is a composite of weathered materials and organic matter at the earth's surface. Soil components include sand, silt, clay, gravel, and humus. Each soil component has unique properties.
- The wearing away and moving of soil and rock is erosion; the settling of eroded materials is deposition.
- The water cycle includes the processes of evaporation, condensation, and precipitation and the passage of water over and through land. These processes affect the shape of the land.
- Both the flow of water and the slope of the land affect erosion and deposition.
- Tributaries are branches of streams that converge to form the trunk of a larger stream, or river. Together, they act as a system that drains the land.
- Land forms, such as canyons and deltas, result from the action of flowing water.
- Humans can affect erosion and deposition in various ways, including clearing the land, planting vegetation, and building dams.
- Hills, rocks, plants, and dams may change the direction and flow of water.
- Aerial photographs are views of land or other surfaces as seen from above.

### Skills

- Using stream table materials to investigate the interactions between water and land.
- Analyzing the materials that make up land and describing these materials on the basis of their properties.
- Testing the porous and adhesive qualities of earth materials.
- Comparing the changes in land created by water flowing over and through soil in a stream table.
- Relating stream table results to natural processes.
- Communicating the results of an investigation through record sheets, oral and written observations, and drawings.
- Investigating the effects of slope, flow, and natural land formations on erosion and deposition.
- Creating and labeling aerial drawings.
- Designing and building models of dams to test the effects of dams on land and water interactions.
- Designing and building models of landscapes, predicting how a landscape will affect the flow of water, and relating these modeled effects to land and water interactions on earth.
- Implementing a planned investigation and making and validating predictions.
- Identifying evidence within a model to support observations and conclusions.

## **Attitudes**

- Recognizing the importance of models for investigating processes too large or complex to study firsthand.
- Developing an interest in the interactions between land and water and recognizing these interactions in the real world.
- Accepting that humans can attempt to control and affect the interactions between land and water.
- Appreciating the role that plants play in curbing erosion and runoff.
- Recognizing the role humans play in planning and designing landscapes that take into account the natural interactions of land and water.



# Land and Water

## Fundamental Concepts and Principles Addressed (K–4)

### Science as Inquiry

#### *Abilities necessary to do scientific inquiry*

- Ask a question about objects, organisms, and events in the environment.
- Plan and conduct a simple investigation.
- Employ simple equipment and tools to gather data and extend the senses.
- Use data to construct a reasonable explanation.
- Communicate investigations and explanations.

#### *Understandings about scientific inquiry*

- Scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.
- Scientists use different kinds of investigations, depending on the questions they are trying to answer.
- Simple instruments, like rulers and magnifiers, provide more information than scientists obtain using only their senses.
- Scientists develop explanations using observations and what they already know about the world. Good explanations are based on evidence from investigations.
- Scientists make the results of their investigations public.
- Scientists review and ask questions about the results of other scientists' work.

### Physical Science

#### *Properties of objects and materials*

- Objects have observable properties, including size, weight, shape, and color.
- Objects are made of one or more materials and can be described by the properties from which they are made.
- Materials can exist in different states—solid, liquid, and gas. Some common materials, such as water, can be changed from one state to another.

#### *Position and motion of objects*

- An object's motion can be described by tracing and measuring its position over time.
- The position of an object can be described by locating it relative to another object.

### Life Science

#### *Organisms and their environments*

- When the environment changes, some plants and animals survive, and others die or move.
- All organisms cause changes in the environment where they live. Some changes are detrimental to the organism, others are beneficial.
- Humans depend on both their natural and their constructed environment. Humans change environments in ways that can either be beneficial or detrimental for other organisms.

### Earth and Space Science

#### *Properties of earth materials*

- Earth materials are solid rocks and soils, water, and the gases of the atmosphere; these materials have different physical properties.
- Soils have properties of color and texture, capacity to retain water, and ability to support the growth of many kinds of plants.

#### *Changes in the earth and sky*

- The surface of the earth changes through processes such as erosion, weathering, and landslides.

### Science and Technology

#### *Abilities of technological design*

- Identify a simple problem.
- Propose a solution.
- Implementing proposed solutions.
- Evaluate a product or design.
- Communicate a problem, design, and solution.

### *Understandings about science and technology*

- Science is one way of answering questions and explaining the natural world.
- People have always had problems and invented tools and techniques to solve problems.
- Scientists and engineers often work in teams with different individuals contributing to the results.
- Tools help scientists make better observations.

### *Abilities to distinguish between natural objects and objects made by humans*

- Some objects occur in nature while others have been designed by people to solve human problems.
- Objects can be categorized into two groups, natural and designed.

## **Science in Personal and Social Perspectives**

### *Types of resources*

- Resources are things we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources include basic materials, such as air, water, and soil.
- The supply of many resources is limited. If used, resources can be extended through recycling and decreased use.

### *Changes in environments*

- Changes in environments can be natural or influenced by humans.
- Some environmental changes occur slowly, and others occur rapidly.

### *Science and technology in local challenges*

- People continue inventing new ways of doing things and solving problems.
- Science and technology have greatly improved health. These benefits of science and technology are not available to all of the people of the world.

## **History and Nature of Science**

### *Science as a human endeavor*

- There is still much more to be understood about science.
- Many people choose science as a career. Many people derive great pleasure from doing science.

## **Unifying Concepts and Processes**

### *Systems, order, and organization*

### *Evidence, models, and explanation*

### *Constancy, change, and measurement*

### *Evolution and equilibrium*

### *Form and function*



# Land and Water

## Fundamental Concepts and Principles Addressed (5–8)

### Science as Inquiry

#### *Abilities necessary to do scientific inquiry*

- Identify questions that can be answered through scientific investigations.
- Design and conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze, and interpret data.
- Develop descriptions, explanations, predictions, and models using evidence.
- Think critically and logically to make the relationships between evidence and explanations.
- Recognize and analyze alternative explanations and predictions.
- Communicate scientific procedures and explanations.
- Use mathematics in all aspects of scientific inquiry.

#### *Understandings about scientific inquiry*

- Scientists use different kinds of investigations, depending on the questions they are trying to answer.
- Mathematics is important in all aspects of scientific inquiry.
- Scientific explanations emphasize evidence.
- Asking questions and querying others' explanations is part of scientific inquiry.
- Scientific investigations sometimes result in new ideas for study or generate new methods for investigation.

### Physical Science

#### *Properties and changes of properties in matter*

- A mixture of substances (such as soil and water) can often be separated into the original substances using one or more of the characteristic properties—such as density.

#### *Motions and forces*

- The motion of an object can be described by its position, direction of motion, and speed over time.

### Life Science

#### *Regulation and behavior*

- All organisms must be able to obtain and use resources and grow.

### Earth and Space Science

#### *Structure of the earth system*

- Land forms are the result of a combination of constructive and destructive forces, including deposition of sediment, weathering, and erosion.
- Soil consists of weathered rocks and decomposed organic material. Soils are often found in layers, each having a different composition and texture.
- Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates, rises and cools, condenses, and falls to the earth where it collects in lakes, oceans, soil, and in rocks underground.
- Clouds form by the condensation of water vapor.
- Living organisms have played many roles in the earth's system, including contributing to the weathering of rock.

#### *Earth's history*

- The earth processes we see today, including erosion, are similar to those that occurred in the past.

#### *Earth in the solar system*

- The sun is the major source of energy for phenomena on the earth's surface, such as growth of plants and the water cycle.

### Science and Technology

#### *Abilities of technological design*

- Identify appropriate problems for technological design.
- Design a solution or product.
- Implement a proposed design.

- Evaluate completed technological designs or products.
- Communicate the process of technological design.

#### *Understandings about science and technology*

- Scientific inquiry and technological design have similarities and differences. Scientists propose explanations for questions; engineers propose solutions to problems and needs.
- Science and technology are reciprocal. Technology also provides tools for investigation, inquiry, and analysis.
- Perfectly designed solutions do not exist. All solutions have trade-offs, such as cost, efficiency, and appearance.
- Technological designs have constraints, such as properties of materials. Other constraints limit choice in design.

### **Science in Personal and Social Perspectives**

#### *Populations, resources, and environments*

- Causes of resource depletion vary from region to region and from country to country.

#### *Natural hazards*

- External processes of the earth system cause natural hazards, such as floods, that can destroy human and wildlife habitats.
- Human activities also can induce hazards through resource acquisition and land-use decisions. Such activities can accelerate many natural changes.

#### *Risks and benefits*

- Risk analysis considers the type of hazard and estimates the number of people that might suffer consequences.
- Risks are associated with natural hazards, such as floods.
- Important personal and social decisions are made based on perceptions of benefits and risks.

#### *Science and technology in society*

- Science and technology have advanced through contributions of many different people.
- Scientists and engineers work in many different settings.
- Science cannot answer all questions and technology cannot solve all problems or meet all needs.

### **History and Nature of Science**

#### *Science as a human endeavor*

- Women and men of various backgrounds engage in the activities of science. Some scientists work in teams and some work alone, but all communicate extensively with others.
- Science requires different abilities.

#### *Nature of science*

- Scientists formulate and test their explanations using observations, experiments, and mathematical models.
- It is part of scientific inquiry to evaluate the results of scientific investigations.

#### *History of science*

- Many individuals have contributed to the traditions of science.

### **Unifying Concepts and Processes**

#### *Systems, order, and organization*

#### *Evidence, models, and explanation*

#### *Constancy, change, and measurement*

#### *Evolution and equilibrium*

#### *Form and function*