

Delaware Science Coalition



Grade 4 Land and Water Unit Template



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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 investigate interactions between land and water. Earth materials have unique properties and are parts of living and nonliving systems. Students will learn that interactions within and among these systems cause changes in matter and energy. Students will investigate how the earth's landscape is a result of the long-term integration of a variety of natural and man-made processes that act on the surface of the earth.

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 and 5 found on the following web site: http://www.doe.k12.de.us/programs/ci/content_areas/science.shtml

Standard 1: 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.
 - Using books, computers, and other resources, search for ways that people use natural resources to supply energy needs for lighting, heating, and electricity. Report your results by making a poster, written report or oral presentation.
 - Observe satellite photos showing change over time of landforms (i.e., Chesapeake Bay, Cape Henlopen, Delaware coastline) and predict future changes that may occur. Describe how these predictions may affect human activities (i.e., locations for building).

Science Standard 5: Earth's Dynamic Systems

Components of Earth

Students should know that:

1. Water exists in three states (solid, liquid and gas) that are dependent upon the surrounding temperature.
2. Rocks and minerals are broken down over time to clay and sand sized particles. These particles combine with plant remains and living organisms to form soil.
3. The ability of water to pass through soil depends on the relative amounts of clay and sand in the soil.

Students should be able to:

- Examine materials that compose soil (i.e., sand, clay, humus, gravel, water) and describe these on the basis of their properties (i.e., color, luster, granularity, texture, mass relative to size, particle size, ability to absorb water, pore space, ability to compact). Describe how certain soil properties affect the way in which soil is eroded and deposited by water.

Interactions Throughout Earth's Systems

Students should know that:

1. Earth is a dynamic system resulting from interactions among the geosphere, hydrosphere, atmosphere and biosphere.

Students should be able to:

- Create a model that can be used to describe how water moves from one place on Earth to another in a continuous cycle through the processes of evaporation, condensation, and precipitation.
2. Water reshapes Earth's land surface by eroding rock and soil in some areas and depositing them in other areas.

Students should be able to:

- Use stream tables to observe the creation of landforms as water flows over and through the land. Describe changes that result from the flowing of water, using correct geographic terminology (i.e., canyon, delta, tributary). Describe changes to the water as it flows over land (i.e., color, transparency).

- Describe how fast-moving water and slow-moving water over the land affect erosion and deposition.

3. The flow of water can be affected by human activities, ground cover and the slope of the land affect

Students should be able to:

- Use stream tables to model and describe the effects of slope. Describe how the flow of water (fast or slow) is affected by the slope of the land, the amount and type of vegetation, and the landforms.
 - Use stream tables to model the effect of human activity on erosion and deposition. Describe how human activity (i.e., building a dam, clear cutting a forest, bulldozing a roadway) affects the amount of erosion and deposition and changes the environment.
4. Water in rivers and streams transports materials. As a general rule, when a stream enters a larger body of water, less massive materials in suspension will travel farther than more massive materials before settling.
5. The surface of Earth changes constantly. Some of these changes happen slowly and are difficult to detect on a daily basis. Other changes happen quickly and result from events (i.e., major storms and volcanoes).

Students should be able to:

- Research and report on a specific landform created by the interaction of land and water (i.e., Cape Henlopen, Delaware Bay, Mississippi Delta, Appalachian Mountains).

Technology and Applications

Students should know that:

1. Some satellites allow scientists to observe, over time, large-scale changes in the geosphere as well as the development of short term weather events.

Students should be able to:

- Observe satellite photos showing change over time of landforms (i.e., Chesapeake Bay, Cape Henlopen, Delaware coastline) and predict future changes that may occur. Describe how these predictions may affect human activities (i.e., locations for building).
- Select and use a variety of appropriate instruments (i.e., graduated cylinders, stream tables, hand lens, ruler, balances) for collecting, recording, and analyzing data obtained from stream table investigations. Communicate the results of stream table investigations through record sheets, oral and written observations, and drawings.

Big Ideas

1. Observation and Evidence: Observe the factors (*human and natural*) that affect erosion and deposition of sediments.
2. Use a model to observe the water cycle including evaporation, condensation, and precipitation that affects the shape of the land.

3. Interaction of science and technology through the design, modeling and construction of dams in a stream table.
4. Interaction of (land and water can change the landscape) different elements of earth that characterize the land and water landscape.
5. Change: Observe how water brings about change to the Earth's surface.
6. Investigate the properties of soils and the flow characteristics of water that determine the nature of erosion and deposition.
7. Investigate the affect of land formations on erosion and erosion on land formations (e.g., canyons and deltas).
8. Flow of water and slope of land shapes and affects amount of erosion.

Unit Enduring Understandings

Students will understand that...

1. Soil can be broken down into individual components that have observable measurable properties.
2. Earth's components form systems. These systems continually interact at different rates of time, affecting the Earth locally and globally.
3. Technology enables us to better understand Earth's systems. It also allows us to analyze the impact of human activities on Earth's systems and the impact of Earth's systems on human activity
4. Models can be used to investigate and predict larger interactions (erosion, deposition, and water cycle)
5. Humans must take into account natural interactions between land and water when designing landscapes.
6. The water cycle causes changes to the land

Unit Essential Question(s)

1. How does understanding the properties of Earth materials and the physical laws that govern their behavior lead to prediction of Earth events?

2. How do changes in one part of Earth systems affect other parts of the system?
3. In what ways can Earth's processes be explained as interactions among cycles?
4. How do the systems interact and allow us to explain observations or events and make predictions?
5. How does human interaction affect changes in the landscape?
6. How can we use a model to predict nature?
7. How does the water cycle affect the land?
8. How would land shape and soil composition affect how the land can be used?
9. How would land shape and soil composition affect erosion?

Knowledge & Skills

Students will know....

- That water has an important role in shaping the 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 and have unique properties
- The wearing away of soil and rock is called weathering.
- The moving of weathered Earth materials is called erosion.
- The settling of eroded materials is called deposition.
- The water cycle includes the processes of evaporation, condensation, and precipitation and the passage of water over and through land.
- The water cycle 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, rivers and streams act as a system that drains the land.
- Landforms 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.

Students will be able to (Grade Level Expectations)...

- Observe photographs and describe the land and water interactions.
- Build a model stream table.
- Investigate the water cycle through use of a stream table.
- Record observations and collect data.
- Analyze data.
- Communicate results to others.
- Explain how the water cycles on earth.
- Model the effects of rain on the land through the use of a stream table.
- Model a small flowing stream through the use of a stream table.
- Identify landforms and discuss similarities and differences in results of stream table investigations.
- Explain how weathering, erosion, and deposition affect earth materials differently.
- Compare soil components.
- Investigate how pore space and particle size of different soil components affect porosity and permeability.
- Investigate how the speed of flowing water affects the amount of weathering, erosion and deposition.
- Investigate how the shape of the land affects erosion and deposition.
- Model stream tributaries through the use of a stream table.
- Model a fast-flowing stream on the land and discuss the results.
- Investigate how dams influence the direction and flow of water.
- Investigate how the slope of the land affects the weathering, erosion, and deposition.
- Investigate how plants can assist in preventing erosion.

Stage 2: Assessment Evidence

(Design Assessments To Guide Instruction)

Suggested Performance Task(s)

The Land and Water 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. Water cycles on Earth.
2. Water is important to the geosphere, hydrosphere, biosphere, and atmosphere.
3. Water can exist as a solid, liquid, or water vapor in the air.
4. Soil is formed from the breakup of rock and minerals over time, combined with organic matter.
5. The ability of water to pass through soil depends upon the pore space between the particles.
6. The greater the force of the stream, the greater the mass of particles that the stream can carry.
7. Water reshapes Earth's land surface by eroding rock and soil in some areas and depositing them in other areas.

Student Expectations:

- Label the processes of evaporation, condensation, and precipitation on a drawing of the water cycle.
- Explain path water might travel in the water cycle.
- Describe how water is important to the geosphere, hydrosphere, biosphere, and atmosphere.
- Describe the properties of water as a solid, liquid and water vapor.
- Describe how minerals break down over time to form parts of soil.
- Describe the components of soil and how they are different.
- Describe how water interacts with different soil components differently.
- Explain how particle size and pore space affect water permeability.
- Describe how a stream deposits its load in terms of the mass of the different earth components.
- Hypothesize on the causes of muddy run-off.

Other Evidence

Note: Use of student journals will help to formatively assess concepts and decrease the use of copy paper.

Lesson #1: This is a pre-assessment of student knowledge and will serve as information to guide instruction. Teacher notes can be taken using a chart or notebook. Determine what students know or think they know about land and water and the processes that change the surface of the Earth. Look at student notebooks or journals to examine the detail of notes.

Lesson #2: the Water Cycle. In their journals, have students draw a model of the water cycle and label the parts. This should include the water in lakes or ponds, groundwater, surface water, water vapor in the air as clouds, and the processes that move water to include evaporation from lakes/ponds/surface, condensation of water vapor into clouds, and precipitation of the rain onto the surface. Note: transpiration is not taught until 7th grade. Note: Condensation is commonly misunderstood to be the actual liquid water. Be sure to stress condensation as a process of water vapor in the air becoming liquid water that we see as clouds.

Lesson #3: In the student journals, have students draw and describe the changes that happened to the land and water as it rained on the land. This should include the soil particles weathering, the lighter (in mass) particles such as humus being transported away (eroded) and deposited at the base of the hill. The description should include sheeting effect of rain as it runs over the land.

Lesson #4: In the student journals, draw the stream table and label the landforms (gully, stream, source, tributary, mouth). Describe how the stream changed the land. Look for students to use the terms weathering (of soil particles), erosion of the particles and depositing elsewhere. Stress the lighter (in mass) materials being carried further than those of greater mass. Have students describe the run-off in terms of color and amount.

Lesson #5: In their journals, have students draw each earth material (gravel, sand, clay, and humus) and describe each. The description should include words such as color, particle size, and texture.

Lesson #6: In their journals, have students draw and label each graduated cylinder and describe the changes to the earth materials as water was added. This should include the ability of the water to permeate through the material and the rate of permeability.

Lesson #7: In their journals, have students draw their stream table and describe how the speed of the water affects the amount of erosion and deposition. Words to describe this should include velocity. Labels on the stream table should refer to the landforms (delta, mouth, source, canyon).

Lesson #8: In their journals, have students make a T-chart to record the similarities and differences their stream table landforms and other stream table landforms. In the journal, have students draw their aerial map. Look to see if the landforms are labeled correctly (head, valley, canyon, tributary, stream channel, delta, floodplain, mouth).

Lesson #9: In the journal, have students draw and label the stream table and describe how multiple streams changed the landforms.

Lesson #10: Again, in the journals draw and label the stream table and describe how rushing water affects the land. Use the words weathering, erosion and deposition to describe the way the land changed.

Lesson #11: In the journal, draw the before and after picture of the stream table as landforms are added and water poured through. Describe how the land affected the flow of water and water affected the land.

Lesson #12: In the journal, draw a before and after picture of the dam. Describe how the dam affected the flow of water on the land and how the land was affected by the dam. Have students discuss the placement of their town and results of the investigation.

Lesson #13: In the journal, draw the stream table and label the landforms. Discuss how a steep slope versus little slope affect the flow of water, the weather , erosion, and deposition of materials. Discuss how the run off was affected by slope.

Lesson #14: In the journal, draw the stream table. Describe how plants affect the erosion and deposition of soil.

Lesson #15-16; draw the before and after pictures of the stream table with the new landscape. Discuss how water affected the land and the land affected the water.

Student Self-Assessment and Reflection

Students self-assessment A: This self-assessment helps the student clarify the concepts being learned, the tasks in group work, and their attitudes and feelings towards the investigations.

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 Kit: Land and Water. Washington D.C. 1997.

Lesson 1: Pre-Unit Assessment - Thinking about Land and Water

Students will record and discuss what they already know about land and water.

Students will observe and describe photographs showing the interaction of land and water. (Gather a bank of local pictures for students to reflect on)

Lesson 2: The Water Cycle

Students discuss the concept of modeling. Students will build a model of land and water that will be used in the investigation of the water cycle.

Lesson 3: Modeling Rain on Land

Students will simulate the effects of rain on land and investigate what happens to the land, and to the water on land, after it rains.

Lesson 4: Investigating Streams

Students will investigate and summarize what happens when water from a single source flows over and through land. Students will also

discuss similarities and differences among different streams.

Lesson 5: Examining Earth Materials

Students will observe and compare different soil components as they record and discuss the properties of each soil component. Students will investigate how soil properties affect the ways in which soil is eroded and deposited by water in their stream tables.

Lesson 6: Where Does the Water Go?

Students will investigate where water goes when it meets land and how soil holds water. They will also observe how water seeps into soil and runs off of different soil components to make connections among ground water, runoff, and stream formation.

Lesson 7: Where Does the Soil Go?

Students explore how runoff wears away and moves earth material and changes the shape of the land. Students also will observe where soil is eroded and deposited in their stream table discovering a correlation between the speed of runoff and the amount of erosion and deposition.

Lesson 8: Looking at the Parts of a Stream

Students create aerial drawings of their stream table to compare results with the rest of the class. Common vocabulary is established for the parts of a stream system as observations are created.

Lesson 9: When Streams Join - Modeling Tributaries

Students use a multiple stream source to model the simultaneous formation of three streams (tributaries). Students make observations the land formations that result when several streams join to form a larger stream or river.

Lesson 10: Rushing Rivers - Exploring Flow

By increasing the rate at which water flows over land, students model the formation of canyons. Students will compare the load of sediment carried by a faster-flowing river and begin to understand the relationship between the flow of water and erosion and deposition.

Lesson 11: Hills and Rocks - How Nature Changes the Direction and Flow of Water

Students conduct a stream table investigation to explore how natural land features affect the direction and flow of water. Students will brainstorm other ways that land affects flowing water including human activity.

Lesson 12: Dams - How Humans Change the Direction and Flow of Water

Students brainstorm why and how humans build dams for their benefit. Students will then predict the effects of dams on the direction and flow of water in their stream tables. Students will design and construct dams in their stream tables and test the effects of these dams on the direction and flow of water in their stream tables.

Lesson 13: Exploring Slope

Using their stream tables, students will look at the effects of slope on erosion and deposition by increasing and decreasing the amount of slope. Students will begin to look at how other factors can affect the rate of runoff and erosion.

Lesson 14: Plants - Protecting Sloped Land from Erosion

Students brainstorm and conduct experiments on what role plants/vegetation has on water runoff and erosion. Students will then apply their understanding of the role of plants on the land to real-world situations.

Lesson 15: Planning Our Home sites – Designing and Building a Landscape

Students will plan and create different landscapes on their stream tables to predict and implement how these landscapes will be affected by water runoff. Based on their creations and predictions, students will select home sites to build.

Lesson 16: Protecting Our Home sites – Testing the Interactions of Land and Water

Students will test their predictions of where to build their home sites on the stream tables based on the effects of flowing water over and through their landscapes. Based on the evidence presented from their testing, students will analyze the effects and make adjustments to either their home sites or landscapes.

Lesson 17: Post-Unit Assessment**Resources & Teaching Tips**

- **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?**

1. Clay/Humus needs to be remixed in every three table runs
2. Be aware of stoppers and bucket
3. Bulldozers break easily
4. Earth mixture is 1500 ml sand, 500 ml humus, 500 ml gravel, 250 ml of clay-more clay may be needed
5. Have students mix sand, humus, gravel, and clay

Accommodation/Differentiation ideas and tips

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