



Title - Iowa Rivers and the Water Cycle

Audience - Middle school, Formal to Informal Education, Teachers to Naturalists, students and their families, Iowa citizens

Lesson Description -

**Big Ideas / Big Questions** - Iowa Core, NGSS and Earth Science Literacy <http://www.earthscienceliteracy.org/document.html>

1. Earth is a complex system of interacting rock, water, air, and life.
2. Earth is continuously changing.
3. Earth is the water planet.

Time Needed to Complete - 3-4 hours of instruction and work time

Iowa Science Standards -

MS-ESS2-1 **Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.**

MS-ESS2-2 **Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.**

MS-ESS2.4 **Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.**

## Science & Engineering Practices

### Developing and Using Models

Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems.

Develop and use a model to describe phenomena.

### Constructing Explanations and Designing Solutions

Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.

Construct a scientific explanation based on valid and reliable evidence obtained from sources (including the students' own experiments) and the assumption that theories and laws that describe nature operate today as they did in the past and will continue to do so in the future.

## Disciplinary Core Ideas

### ESS2.A: Earth's Materials and Systems

All Earth processes are the result of energy flowing and matter cycling within and among the planet's systems. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.

### ESS2.A: Earth's Materials and Systems

The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.

### ESS2.C: The Roles of Water in Earth's Surface Processes

Water's movements—both on the land and underground—cause weathering and erosion, which change the land's surface features and create underground formations.

### ESS2.C: The Roles of Water in Earth's Surface Processes

Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.

Global movements of water and its changes in form are propelled by sunlight and gravity.

## Crosscutting Concepts

### Stability and Change

Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and processes at different scales, including the atomic scale.

### Scale Proportion and Quantity

Time, space, and energy phenomena can be observed at various scales using models to study systems that are too large or too small.

### Energy and Matter

Within a natural or designed system, the transfer of energy drives the motion and/or cycling of matter.

## Sustainability Implications & Practices

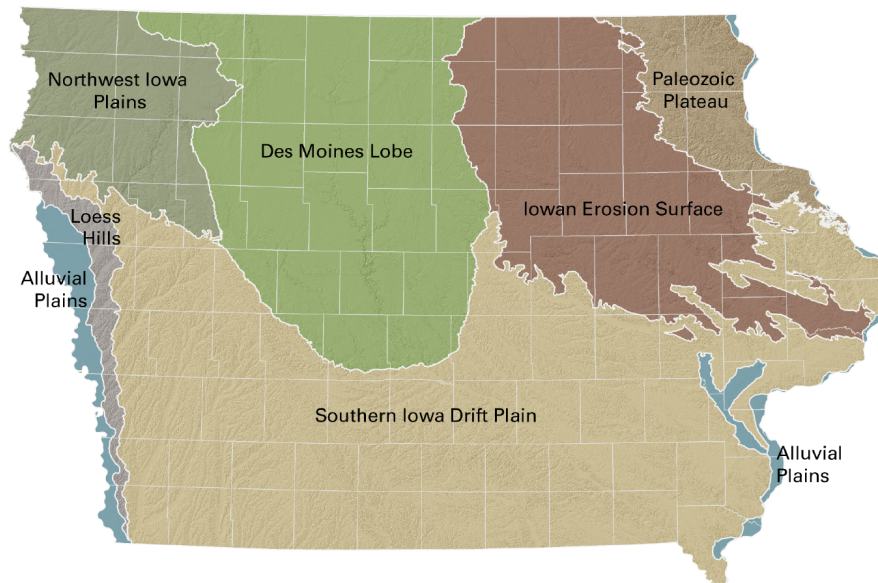
All water on Earth is recycled water.

<b>Students will...</b> Identify the big idea and big questions. Model the water cycle for their location.	<b>Students will</b> Observe how the Earth changes over time.	<b>Students will</b> Identify the changes in the water cycle at the local level.	<b>Students will</b> Apply knowledge to create sustainable practices
<u>Student Objectives</u> Students can model the water cycle in Iowa. Students can discuss how water has formed the different parts of the Iowan Surface.			
<u>Resources</u> Internet access to watch videos and for enrichment activity; <a href="#">map of Iowan Surface for students to study</a> *If you have students that have difficulty with the colors. Please contact <a href="mailto:chad.heinzel@uni.edu">chad.heinzel@uni.edu</a> , to consult for new maps. Other helpful digital resources include: USGS Water Cycle - <a href="https://www.usgs.gov/special-topic/water-science-school/science/water-cycle?qt-science_center_objects=0#qt-science_center_objects">https://www.usgs.gov/special-topic/water-science-school/science/water-cycle?qt-science_center_objects=0#qt-science_center_objects</a> Iowa Geological Survey Landscapes - <a href="https://www.ihr.uiowa.edu/igs/publications/map/landscapes.html">https://www.ihr.uiowa.edu/igs/publications/map/landscapes.html</a>			
<u>Evidence of Learning</u> Students will be able to create a model of the water cycle. Students will be able to discuss how different surfaces can be created over time.			

## 5-E Format

<b>Engagement/ Excitement</b>	United Emirates trying to get more rain by building a mountain <a href="https://www.youtube.com/watch?time_continue=61&amp;v=O69OA2a8qnk&amp;feature=emb_logo">https://www.youtube.com/watch?time_continue=61&amp;v=O69OA2a8qnk&amp;feature=emb_logo</a> United Emirates towing glacier to get more freshwater <a href="https://www.youtube.com/watch?time_continue=56&amp;v=EnBArsrwnuE&amp;feature=emb_logo">https://www.youtube.com/watch?time_continue=56&amp;v=EnBArsrwnuE&amp;feature=emb_logo</a> (not in English) Discuss why the United Emirates is trying to bring water in. Make sure to point out that the amount of water is consistent on the planet so where does it go.
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<b>Exploration</b>	<p>Students will discover properties of water that are important in the weathering of the land.  Lab activity to show how water changes state and the energy changes that make that happen.  Students will heat water up from ice form until it is boiling. During that time they will take data which will later be graphed. The second part of the lab compares the density of water and ice and how ice can change the material around it as it expands.</p> <p>+How does water go through phase changes? <a href="#">Worksheet</a>  Discuss how these phase changes happen on Earth's surface.</p>
<b>Explanation</b>	<p>Students will create a personalized water cycle.  +Introduce terms needed for the completed cycle. Include condensation, evaporation, precipitation, and run off. Additional terms can be added such as transportation, transpiration, percolation, sublimation, deposition, etc.  +Discuss reservoirs where water can be collected. Iowa reservoirs include lakes, rivers, ponds, streams, snow (in winter), groundwater and springs.</p> <p>After students have been introduced to all of these terms and reservoirs, draw a water cycle for Iowa. Students need to make sure that the arrows are in the direction of the changes. Here is a great example to help students get started.  <a href="https://www.noaa.gov/education/resource-collections/freshwater/water-cycle">https://www.noaa.gov/education/resource-collections/freshwater/water-cycle</a></p> <p>How does the water cycle affect the landforms of Iowa.  Watch <a href="https://www.ihr.uiowa.edu/igs/files/2017/06/LandMap1.jpg">https://www.ihr.uiowa.edu/igs/files/2017/06/LandMap1.jpg</a></p> <p>Use this activity above to start discussion of how water changes the landforms around us. Make sure to reference the water cycle as it is very important for students to make connections to the cycle itself and how they interact with it.</p>



Use this picture above to discuss how the parts of Iowa have different features. [Iowa's Nature Series Educational Graphics](#)

+Jigsaw the different landform areas in small groups. Have each group give a short presentation of how their area is different then others in the state.

+Discuss how the different landforms formed differently.

+What affected the different landforms?

+Lead the discussion to get to the fact that water/ice formed the landforms.

After the discussion about how the water cycle affects the landforms and changes the surface of the land, have students revisit their water cycles and make changes and revisions. Peer review could also be used to have students look at other students work and help them make corrections as needed.

### ***Evaluation***

Students water cycle - Should include at least 8-10 parts including different reservoirs and how the water changes between them.

Test Question

Discuss how the surface of the Earth has changed over time. Include how water has been a part of these changes.

**Rubric**

'Criteria'	Almost never 1	Rarely 2	Occasionally 3	Frequently 5	Almost Always 6
content	Student do not understand that water can change form in the environment.	Student cannot discuss the four phase changes that are essential for the water cycle. (Evaporation, condensation, melting and freezing.)	Student are not able to connect phase changes to the water cycle.	Student are not able to identify all phase changes in the natural environment.	Student are able to identify the processes of phase change within the water cycle. Students will be able to show how water is recycled through the environment around them.
application	Student can not construct a water cycle of their environment.	Student only constructed two or three reservoirs for their personal water cycle.	Student constructed a water cycle, but it is missing major connections between phase changes of water and how water interacts in the environment.	Student constructed water cycles are missing more than one major reservoir, such as rivers, streams or ground water.	Student constructed a water cycle with many different processes involved. Students are also able to distinguish many reservoirs for water to be stored in around them in the environment. Students understand that these changes affect the land that they live on.