



Iowa - The Rivers
of Her Valleys 4.0



Title - Using Maps to Predict Stream Erosion to Reduce Property Damage (precursor would be stream table exploration of erosion with different soil types, volumes of water, and varied amounts of slope)

Audience - 4- grade (Focus on Blackhawk County)

Lesson Description -

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

- How does the lay of the land and waterways affect erosion? How can people use maps to protect property from erosion?

Time Needed to Complete - 4-5 periods (30-45 minutes)

Iowa Science Standards -

1. 4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.

Background knowledge of the following is helpful

2. 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.

Supporting Iowa Core Social Studies Standards -

1. SS.4.17 Create a geographic representation to illustrate how the natural resources in an area affect the decisions people make.

Science & Engineering Practices

Asking Questions and Defining Problems
Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used.

- Analyze and interpret data to make sense

Disciplinary Core Ideas

ESS2.B: Plate Tectonics and Large-Scale System Interactions

- The locations of mountain ranges, deep ocean trenches, ocean floor structures, earthquakes, and volcanoes occur in patterns. Most earthquakes and volcanoes occur in bands that are often along the boundaries between continents and

Crosscutting Concepts

Patterns

- Patterns can be used as evidence to support an explanation.

Sustainability Implications & Practices

Human changes to the environment drive changes in populations and landscapes.

of phenomena using logical reasoning.	oceans. Major mountain chains form inside continents or near their edges. Maps can help locate the different land and water features areas of Earth.		
Students will... Identify the big idea and big questions.	Students will Observe how the Earth's rivers change over time cause changes in human habitation.	Students will Identify the changes they observe when comparing historic and current transportation, geophysical , and population maps.	Students will Apply knowledge to understand that unsustainable human practices lead to changes in the populations and the landscape.

Student Objectives

I-can statements

- I can identify patterns in the location of Earth features, including the locations of rivers and why rivers formed in specific ways
- I can organize data using graphical displays from maps of Earth's features
- I can use the organized data to make sense of and describe the most likely places to find stream erosion based on land use and topography
- I can create a geographic representation (map or 3D model) to illustrate the watersheds sites most likely in need of erosion mitigation (reduce erosion.)

Resources (variety of map resources listed to find local maps or create your own.)

- USGS <https://www.usgs.gov/products/maps/overview>
- <http://extension.agron.iastate.edu/soilmgmt/GallerySoil.html> (photo gallery of erosion in multiple land use areas)
- <https://modelmywatershed.org/> (great for resting your own layers)
- <https://geodata.iowa.gov/dataset/topographic-maps>
- <https://www.anyplaceamerica.com/directory/ia/black-hawk-county-19013/> relief elevation map of Blackhawk county
- <https://www.anyplaceamerica.com/directory/ia/> (relief maps for other Iowa counties - lots of useful layers)
- Iowa DOT maps <https://iowadot.gov/maps/msp/pdf/current/stmapmain.pdf> or contact DOT for free hardcopy maps*

A possible social studies related connected resource - [Futility Closet Episode #168](#) - The Destruction of the Doves Type. The story about how "the most beautiful font of all time" was destroyed by dropping it over London's Hammersmith Bridge over several months. Now there is an area on the river where sediment of this time in history is deposited and now exposed and people go to try to find pieces of the type. The earth science part of the story begins at about minute 16. After 100 years, they found over 100 pieces of the type on the shore! and now people occasionally find more.

- Model My Watershed Blackhawk County Map with Waterways <https://modelmywatershed.org/analyze#>

Evidence of Learning

- I can create a geographic representation (map or 3d model) to illustrate the most likely watershed sites (places near rivers) in need of erosion mitigation (fixing) and back up with claims and evidence? (sites should be near school or home.)

Goal: Student teams create a map or 3D model of the most erosive areas with reasonable scale and clear map symbolism to show erodible sites.

5-E Format (3 - 4 30 minute sessions)

<p>Engagement/ Excitement</p> <p>Time 10-15 minutes</p> <p>Introduction Materials: Student copies of discussion diamond</p>	<p>Day 1:</p> <p>Intro Phenomenon: <i>How are these pictures connected? How do these places go together?</i> (The pictures are of the Cedar River, small stream, and eroded surfaces (If possible, substitute pictures with a trip to an actual stream or river)</p> <p>Students (groups of 2-4) brainstorm how these places and objects are connected. (remind students that all ideas are accepted.)</p> <p>Teacher asks the following to guide groups or in whole class debriefing.</p> <ol style="list-style-type: none"> 1. What do you see in each picture? 2. Have you ever been to places like these? 3. What is pictured in the third picture? 4. Using what you know about such places, how would you describe changes that have happened to these places over time? <p>Guide students to share their ideas by completing a Making Connections discussion diamond.</p> <p>Thinking questions:</p> <p><i>How are these pictures connected? How do these places go together?</i></p> <ol style="list-style-type: none"> 1. What are the 'parts' of each place? (varied - plants, soil, rocks, trees, roots, logs, water, soil, etc) 2. What were some changes you think have happened in these places? (<i>varied may include</i> movement of rocks, logs, soil, or water...may use vocabulary such as erosion or flooding or landslides) 3. What earth forces or processes move the materials in each picture? (will vary with experience by should include gravity and erosion)
<p>Exploration Time: 60 -90 minutes Over two -three days (2 -3 sessions of 30 minutes)</p> <p>Task 1 & 2 Materials: Computer w/Internet Access or Print Out for</p>	<p>Day 1 & Day 2 (Maybe 3 days): Why Are Rivers So Important and How Rivers Form (teams of 4 continue)</p> <p>USGS Rivers, Creeks, and Streams teams complete jigsaw discussion diamond (15 minutes)</p> <ul style="list-style-type: none"> • I can identify patterns in the location of Earth features, including the locations of rivers and why rivers formed in specific ways <p>Task 1: Jigsaw reading the article at USGS site (each student reads one section - listed below - and writes a two sentence summary on a team discussion diamond.)</p> <ul style="list-style-type: none"> • Rivers, Streams, and Creeks • What is a river? and Rivers serve many uses • Where does the water in rivers come from? • Where does the water in rivers go?

[USGS article & Student copies of jigsaw discussion diamond](#)

Task 3
Materials:

Computer w/Internet Access

(As reference from Task 1 jigsaw discussion diamond)

Task 4
Materials:
Student copies of resource maps and highlighter or colors or other writing utensils to mark up maps.

Can be done digitally with site provided and use of annotating tools.

Task 2: Teammates share what they learned about rivers, and the team completes the discussion diamond summary.

Teacher: Redirect students to avoid any misconceptions observed. Develop class consensus for what a river is and how it forms.

Potential exit discussion: A final product could be a class definition of a river and description of how it forms.

Task 3: Connecting Water and Erosion (10-15 minutes)

- Watch Video of Erosion & Water <https://www.youtube.com/watch?v=qqsTS67BKmA>
- Have casual [popcorn discussion](#) of observations from video.
 - What is erosion?
 - How does water create erosion?
 - What other factors or forces affect erosion? (amount of water, steepness of land, type of land cover, type of soil)

Teacher: Conduct a guided discussion using the images on the [jigsaw discussion diamond](#) from the previous task regarding the images or maps presented. Be sure to include: Topography - the lay of the land with examples as flat, hilly, mountainous, high, low, etc... (and use to predict erosion prone areas.)

(This activity could be completed digitally at the Iowa GeographicData Server: <http://ortho.gis.iastate.edu/>)

Day 2 (or day 3)

Task 4: Map Study - Analysis of Local Relief Map, Water Drainage, and State Transportation Map: **(15-20 Minutes)**

- Students work in teams to find direction of water movement using Iowa River Map (and County map of rivers); slope using Iowa and County Relief maps (steepness of land); amount of human development using Iowa Dot Map and County Transportation maps to determine possible erosion sites.
- Guiding questions:
 - What direction do the rivers and streams flow?
 - Where is the land the highest and the lowest?
 - Where is the land steepest (has the most slope?)
 - Where are the waterways the biggest?
 - **Where would the land erode the most?**
 - Where are the plant covered areas (trees, grass, crops) and where are the man made surfaces (roads, parking lots, buildings, sidewalks, bare land)?
- Provide [resource maps](#) for students to mark up as they 'answer' the guiding questions. Use data on day 3 to create a map demonstrating response to guiding questions. **There are a variety of maps supplied to give varying levels of difficulty.**
- Additional maps can be created with [Model My Watershed](#) noted in the resources.
- Digital maps may also be used: <https://www.anyplaceamerica.com/directory/ia/black-hawk-county-19013/>

<p>Explanation Time: 30minutes</p> <p>Materials: Poster or Grid Paper Coloring and Drawing Utensils (or materials for a 3D model.)</p>	<p>Day 3 (or day 4): Next Steps: Students pick the area they determine as most erodible to create a map poster to demonstrate responses to guiding questions. Students may ask you for grid paper or poster board (or 3 D model.) Any map is acceptable.</p> <p>Defending your ideas:</p> <ul style="list-style-type: none"> ○ Share answers to guiding questions by creating a map poster which show the these features of your given location: <ul style="list-style-type: none"> ■ What main direction do the rivers and streams flow? ■ Where is the land the highest and the lowest? ■ Where is the land steepest (has the most slope?) ■ Where do the waterways carry the most water? ■ Where would the land erode the most? ■ Where are the plant covered areas (trees, grass, crops) and where are the human made surfaces (roads, parking lots, buildings, sidewalks, bare land)? ■ How does the land cover affect the amount of possible erosion? How?
<p>Evaluation</p>	<p>GOAL: I can create a geographic representation (map or 3D model) to illustrate the most likely watershed sites in need of erosion mitigation (sites should be near school or home).</p> <ul style="list-style-type: none"> ● Student teams create a map or 3D model of the most erosive areas with reasonable scale and clear map symbolism to show erodible sites.
<p>Enrichment/Elaboration/Extension</p>	<p>Extension Ideas:</p> <ul style="list-style-type: none"> ● How could the erodible area be improved? ● What changes to land cover or use could be made to reduce erosion? ● Take action to reduce erosion near your home or at school.

Rubric

'Criteria'	Emerging	Developing	Proficient
<p>content Student teams analyze and organize data to make sense of map features as related to erosion</p>	<ul style="list-style-type: none"> ● Students do not organize data using graphical displays (e.g., table, chart, graph) from maps of Earth's features. ● Students cannot identify patterns in the location of Earth features. (focus on erosion) 	<ul style="list-style-type: none"> ● Students mostly organize data using graphical displays (e.g., table, chart, graph) from maps of Earth's features. ● Students identify most patterns in the location of Earth features.(focus on erosion) 	<ul style="list-style-type: none"> ● Students organize data using graphical displays (e.g., table, chart, graph) from maps of Earth's features. ● Students identify patterns in the location of Earth features.(focus on erosion)
<p>application Student teams create a map of the most erosive areas with reasonable</p>	<ul style="list-style-type: none"> ● Students do not use logical reasoning based on the organized data to make sense of and describe* a phenomenon (<i>river erosion</i>). ● In their mapped description*, students 	<ul style="list-style-type: none"> ● Students use some logical reasoning based on the organized data to make sense of and describe* a phenomenon (<i>river erosion</i>). ● In their mapped description*, students basically include that Earth features occur in 	<ul style="list-style-type: none"> ● Students use logical reasoning based on the organized data to make sense of and describe* a phenomenon (<i>river erosion</i>). ● In their mapped description*, students

scale and clear map symbolism to show erodible sites.	do not include that Earth features occur in patterns that reflect information about how the <i>rivers</i> are formed or occur.	patterns that reflect information about how the <i>rivers</i> are formed or occur.	clearly include that Earth features occur in patterns that reflect information about how the <i>rivers</i> are formed or occur.
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Potential Misconceptions

- Water moves by cardinal direction and not by gravity taking the easiest path
- Only soft material erodes.
- Land covered with a hard surface cannot erode.

Linkages to Standard Specifics

Maps can include topographic maps of Earth's land.

Maps can help locate the different land and water feature areas of Earth.

2. Earth Systems : Processes that Shape the Earth
4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.
The performance expectations above were developed using the following elements from the NRC document for K-2 Science Education

Connections to other DCIs in 4th grade

Connections to other DCIs in 4th grade 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
Articulation of DCIs across grade levels
Iowa Common Core Standards Connections SS.4.17 Create a geographic representation to illustrate how the natural resources in an area affect the decisions people make.

Local to Virtual Options

Possible Test Questions

How does the lay of the land affect erosion?

How does land cover/land use affect erosion?

Potential online resources

<https://modelmywatershed.org/draw> interactive to see actual land features and proposed changes with impacts to water runoff, infiltration, and water contamination.

“Explore mapped layers, such as streams, land cover, soils, boundaries and observations, using the layer selector in the lower left of the map. See [our documentation on layers](#).

Select an [Area of Interest](#) in the continental United States, using the suite of tools below, to analyze the factors that impact water in your area and to begin to model different scenarios of human impacts. Different modeling options for using these tools are described in the [technical documentation](#).”

<https://www.anyplaceamerica.com/directory/ia/> Anyplace America provides topo maps, points of interests and places to visit.

AnyPlaceAmerica.com offers topographic maps and photos of over 1.25 million water, land and man-made landmarks in the United States

Discussion Diamonds from <https://ambitiousscience Teaching.org/discussion-diamond/>