

SCHOOL OF THE WILD: EXPLORING WATERSHEDS

If you have questions specific to this curriculum, please contact:

Ellen Carman

Iowa Flood Center | Program Coordinator

ellen-carman@uiowa.edu | (319)467-1181

The Iowa Flood Center develops innovative tools and reliable information that community leaders, home and business owners, educators, and the public depend on to help them understand reduce their flood risks and make better flood-related decisions.

The University of Iowa's School of the Wild and the Iowa Flood Center have partnered to develop these learning activities.

Theme Summary

In this theme, students will explore their local watershed with the objective of understanding how we impact our watershed and how our watershed impacts us. Students will activate their background knowledge by discussing their experiences with waterways, floods, and water in their lives. Where relevant, students will consider a local flood event as an anchoring phenomenon.

This anchor will help students think about how our watershed impacts us, introducing questions about how water moves on land, why floods occur, and how they can be mitigated. Students will then begin exploring the concept of a watershed by examining maps of their local park and watershed. Next, they will hike through the park, identifying landforms and land cover with their maps, practicing observing the natural world as they move across the land. In this section, students will be asked to consider the landforms, land cover, and soils they encounter to help them better understand what makes up their watershed.

Next, students will explore a wetland environment and consider how humans have changed this environment and how the surrounding landscape impacts the wetland. After they have had ample opportunity for exploration, students will create a simple watershed model to help explain what they have learned about their local watershed. Finally, they will return to the anchoring phenomenon and consider how the health of the watershed impacts events like flooding in their community and how communities make decisions about their watershed. As an assessment, you may choose to have students create an interpretive sign demonstrating what they have learned throughout the day.

Lesson Big Questions

- What is a watershed?
- What is in our watershed?
- How do we impact our watershed and how does our watershed impact us?
- How can we help protect our watershed?

Iowa State Standards Alignment

Science - 5-ESS3-1. Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Science and Engineering Practice – Developing and using models.

Cross-Cutting Concepts – Systems and system models.

Social Studies - SS.5.19. Create geographic representations to illustrate how cultural and environmental characteristics of a region impacted a historical event.

Literacy – SL.5.2. Summarize a written text read aloud or information presented in diverse media and formats, including visually, quantitatively, and orally.

Universal Constructs – Critical thinking while examining issues that develop innovative responses – Collaboration toward productive group interactions and respectful disagreement.

Teacher Background Information

What is a Watershed?

A watershed is an area of land that drains into a lake or river. As rainwater and melting snow run downhill, sediment and other materials are carried into our streams, lakes, wetlands and ground water.

Watersheds are organized into different sizes using a classification system called HUC (Hydrologic Unit Code). Smaller watersheds (HUC 8s or HUC 12s) make up larger watersheds (HUC 2s). For example, Iowa City is located in the Ralston Creek (HUC12), Lower Iowa (HUC 8), Upper Mississippi Region (HUC 2). [Click this link to find your watershed](#) (ARC GIS Watershed Locator).

We all live in a watershed. It is important to understand how the decisions of upstream communities impact those downstream when making decisions about water ways, land use, and infrastructure.



Figure 1. Watershed Diagram

Iowa's Watersheds

Land Use

Land use in a watershed can impact the health of the watershed. Iowa is dominated by agricultural land uses including row cropping and raising livestock. Waterways can be impacted by erosion of bare fields transporting sediment into waterways and agricultural chemicals being transported with precipitation into the water. Additionally, people have changed the shape of rivers and streams through a process called stream channelization to create more farmland or safer passageways to transport goods on rivers. This process can disrupt the watershed by changing the rate at which water moves and the habitat around waterways.

Urban areas also impact watersheds where heavily built environments with concrete can cause more water run-off. Concrete can also heat water, causing a disruption to fish and other aquatic wildlife that require colder water in streams.

Management

Water resource professionals work across Iowa to protect and manage the state's watersheds. These professionals monitor water quality, collect data on stream and river levels, engineer and implement flood mitigation practices, and much more. These professionals as well as city and county officials and other local leaders have formed watershed management groups across the state. These groups work together to create management plans for their watershed and secure funding to complete watershed projects such as restoring stream banks that have been eroded, restoring wetlands, building urban stormwater run-off practices such as permeable pavement and bioswales and much more.

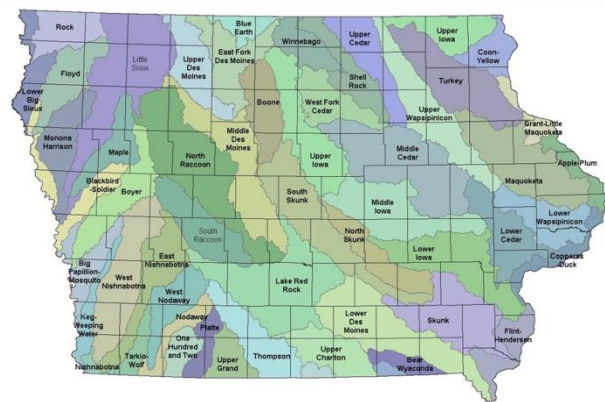


Figure 2: HUC 8 Watersheds in Iowa

Watershed Day – At A Glance

| Activity | Time | Activity Description | Necessary Materials |
|--|-------------------|---|--|
| Our Water Stories <i>Engage</i> | 30 min. | Have students interview each other about what they know about water in their community. Flooding in Iowa – Share with students a story about a local flood and the impact it had on the community. | <ul style="list-style-type: none"> Printed Flood photos and data, as available SOW Journal & Pencil Small Whiteboard and Expo Marker |
| Surveying the Land <i>Explore</i> | 1 hour | Students will hike on a route you have chosen through the local park. Together, students will identify distinct types of land cover and landforms they see along the way. | <ul style="list-style-type: none"> SOW Journal & Pencil Local Park Maps 6 in. Diameter Ductwork connector like this. Full Water Bottle |
| Lunch Break | 30 min. | Identify a comfortable space to enjoy lunch with your group. | *A location near a bathroom is recommended! |
| Exploring Wetland Environment <i>Explore</i> | 1 hour 30 min. | Students will explore a wetland environment looking for evidence of human intervention, non-living and living components of the ecosystem. | <ul style="list-style-type: none"> Buckets Wetland Wildlife Identification Guides or Books Dip Nets Turbidity Tube (optional) Magnifying Glasses (optional) |
| Watershed Modeling <i>Explain</i> | 30 min. | Students will work in pairs or small groups to create a model of watersheds and to better visualize topography. | <ul style="list-style-type: none"> 8.5 by 11 in. Cardstock Blue Markers Spray Bottle w/ water Iowa Watershed Maps |
| Welcome to Your Watershed <i>Evaluate</i> | 30 min. | Students will create an interpretive sign that could be displayed in the park to share with visitors what they have learned about their watershed. | <ul style="list-style-type: none"> SOW Journal & Pencil Colored Pencils or Markers |

This activity is sequenced intentionally for students to build on their knowledge. However, you may choose to change aspects of the activity or rearrange items due to the layout of your park or other logistics. Times will vary depending on your location.

Optional Pre-Teaching: The Water Cycle

An understanding of the Water Cycle will be helpful background knowledge for students before participating in their Watershed Exploration Day. If you feel your students need an introduction to or a refresher on the water cycle, consider these classroom activities before your time at School of the Wild.

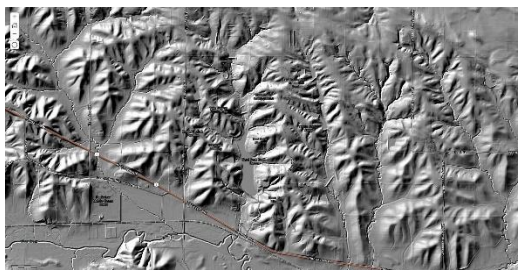
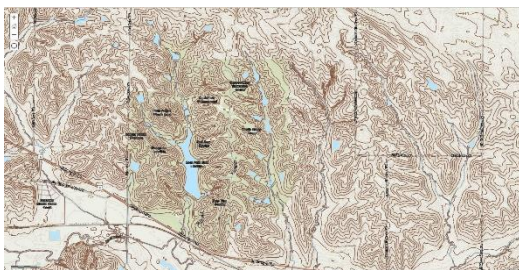
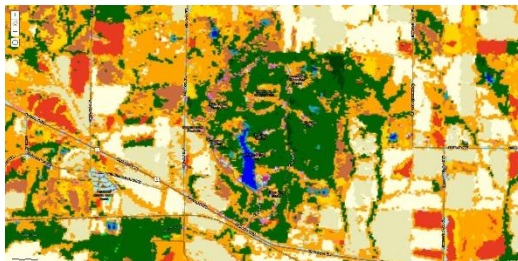
Option 1 – [Water Cycle Classroom Game](#) (UAF Geophysical Institute)

Option 2 – [Water Cycle Model](#)

Preparing for Your Watershed Day

The following tasks will help you familiarize yourself with the activity and your local park and ensure for a successful week of watershed exploration:

1. Prepare your local park maps. Follow the directions below to get maps for this lesson. Also, consider obtaining a trail map of the park you will be visiting from the park website or naturalist.
 - a. Go to the [Iowa Geographic Map Server \(Click Here\)](#).
 - b. Search for your local park.
 - c. Take screenshots of the map with the following specifications:
 - i. **Basemap:** Hybrid Imagery **Content:** none
 - ii. **Basemap:** Hybrid Imagery **Content:** Iowa – 2002 DNR Land Cover
 - iii. **Basemap:** Hybrid Imagery **Content:** Iowa - 2020 – LiDAR Hillshade
 - iv. **Basemap:** Topographic **Content:** Iowa - 2020 – LiDAR Countours
2. Identify landforms and a hiking route for Part 1
3. Identify a body of water in your local park that you can explore with students in Part 4.
4. Collect and prepare necessary materials (listed in overview).



Sample images of maps.

- i. Top Left
- ii. Top Right
- iii. Bottom Left
- iv. Bottom Right

Figure 3: Sample Maps

Part 1: Our Water Stories

Eliciting Background Knowledge

Begin by activating student background information by asking students to interview a partner, asking the following questions. Encourage students to take notes in their SOW journals to share with the group.

Student Interview Questions:

1. Have you ever seen or explored a lake, pond, river or stream? Tell me what you noticed.
2. Where have you seen water go when it rains?
3. Have you ever heard of or seen a flood happen? What happened?

Once each student has had a chance to interview and be interviewed. Ask students to share out about what their partners said. Highlight any similarities or differences you notice in students' ideas and experiences.

Anchoring Phenomenon – A Local Flood Event

Next, share with students about a local flood event you have discovered. Have student pairs take time to read about, look at photos of and consider data about this flood event. Ask to discuss what they notice about what happened and what they wonder about the flood event.

Weather and Flood Data Resources:

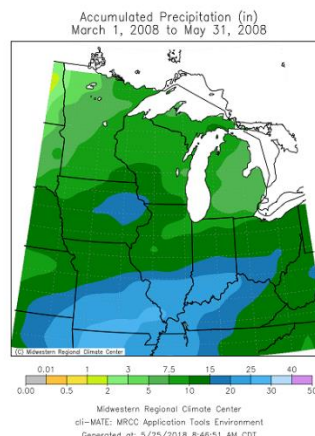
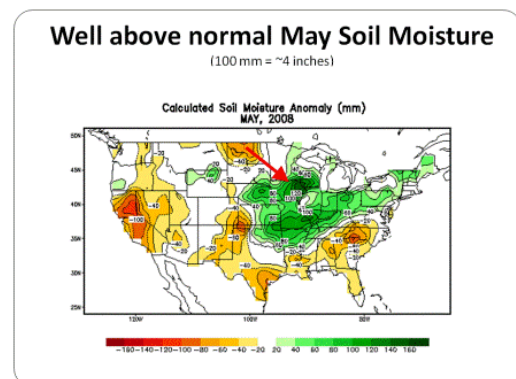
[Past Weather Data – National Weather Service](#)

[Iowa Flood Center's Iowa Flood Information System Historic Data](#)

For assistance finding data from a local event, please contact Ellen Carman at ellen-carman@uiowa.edu.

After students have looked at data and photos, ask them to share what they think caused the flood event to happen. Encourage students to refer to the data to support their thinking.

After students have looked at data, tell them they are going to explore the park more to better understand how water moves through the park and our communities.



PLACE BASED CONNECTIONS

Activities with symbol are place-based, meaning you must be in a local environment to do the learning activity. School of the Wild is a unique opportunity to learn in local natural environments, so we recommend prioritizing these sections of the lesson.

Data examples from the Iowa River leading up to the historic flooding in June 2008.

Data Source: National Weather Service.



Part 2: Surveying the Land and Exploring Soils

Examining Park Maps

Distribute all maps and ask students to share what they are noticing about each map by writing observations in their journal. Ask students what maps would help them identify where they are.

Topographic Map – Help students understand the topographic map using your hand or a willing student's hand to draw topographic lines. By making a fist and then flattening your hand, you can demonstrate how each line on the maps represents different elevations on the land.

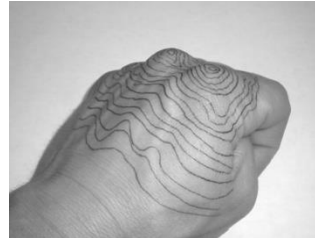


Figure 4: Image of topographic map hand demonstration.

Hybrid Imagery Map – Ask students to share what type of land uses they are seeing on this map. How is the park different from areas around the park? How is it different from their school and neighborhood?

Landcover Map – Share with students that each color on the map represents a different type of landcover but there is a problem with this map, it does not have a legend. Ask students how they might create their own legend for this map.

LiDAR Map – Explain to students that LiDAR is a technology that helps us map the surface of Earth. This map helps show us topography throughout the park

Park Trail Map – If you have one, show students a park trail map and show them the hiking route you will be taking. Ask students to use their other maps to predict what they might see and experience on the hike (*Will it be flat? Hill? What types of habitats might they move through or past? Are there any notable landmarks on the hike?*).

Land Survey Hike

Note: that an ideal hike for this lesson will include different types of landcover or habitat and varying topography. Ask your park naturalist or environmental educator to help you identify a suitable route.

In this section you will lead students on the hike you have planned. As your group hikes stop along the way to ask students to discuss and/or document in their journals the following:

- Describe the land here.
 - What landcover are we hiking through? Prairie, wetland, woodland? Can we see other types of landcover around us? Ask students to compare what they are seeing to their maps.
 - If it were raining right now where might raindrops accumulating here end up? (*water could infiltrate into the ground, run-off across the land, or might be used by plants in the area*). Use the LiDAR map and Topographic map for students to explain their thinking.
 - What does the soil look like here? Take a few minutes to test water infiltration on an area (see below).



Hiking Tips:

Before beginning your hike discuss with students how they will have a successful hike. Some things you might want to consider saying include:

I will lead the way on this hike so that we can keep our group together, so I can watch for any obstacles on the trail and because I have planned some places along the way for us to stop and explore.

Hiking is a great time to talk with each other. As you hike, you can chat with the people around you. Let's be mindful to speak quietly so we can also be watching and listening for any wildlife. Remember if we are too loud, we will likely scare wildlife away and I know we want to see as much as we can while we are here.

For our safety, we will walk during our hike and stay on the trail. We will stop to take breaks and drink water.

- What else are we observing in this location? If students find wildlife they want to observe, that is great! Take the time to stop and allow students to discuss all observations.

Water Infiltration Test Procedure

| Location | Prairie | Forest | Mowed Grass Field | Dirt Trail |
|----------|---------|--------|-------------------|------------|
| Time | | | | |

Figure 5: Sample water infiltration table for student journals



Figure 6: Consider putting duct tape along the top edge of the ductwork connector as the edge can be sharp. These can be purchased at many home improvement stores.

- Place your 6-inch ductwork connector into the ground firmly.
- Pour about 8 ounces of water on the ground inside the space you have created with the cylinder.
- Use a watch or cellphone to time how long it takes the water to “infiltrate” or soak into the ground.
- Consider conducting this test in a woodland area, in a prairies area, on mowed grass, and on compacted soil (such as a trail).



Part 3: Investigating a Wetland Area

After lunch, your group will visit the local pond, river, stream, or lake you have identified to explore.

Tell students that they will explore the environment three times, looking for evidence of something new each time they go back to explore the space.

1. Evidence of Humans

What do you notice about this environment that might have been created by people? Did people leave anything here?

Give students 10 minutes to observe the area and record what they find in their journals. Then, bring everyone together to discuss.

Note: In some places the wetland itself might have been created by people. If you can, find out the history of the wetland you are exploring ahead of time and share this with students after this section.

2. Nonliving Elements of the Environment

What nonliving things make up this environment?

| Human Evidence | Non-Living Things | Living Things |
|--|--|--|
| <ul style="list-style-type: none"> -Rocks place on shoreline -Culvert (metal pipe) going into lake -Trail -Bridge -Dock across lake | <ul style="list-style-type: none"> -Rocks -Soil around water -Water -Air -Sun | <ul style="list-style-type: none"> -Frogs -Fish -Turtle -Duck -Geese -Smaller Critters -Algae -Coon Tail Plant |

Figure 7: Sample Student Journal

Give students 10-15 minutes to look for nonliving components of the environment. They might identify the water, rocks and soils, etc. Ask students to be specific about what they are finding. Are all the rocks the same? Are there different types of dirt/soil/sediment? Encourage students to record what they are finding in their journal.

Once students have explored come back together and ask them to consider how they might learn more about these non-living things. If you have them, introduce tools such as a turbidity tube, thermometer, and magnifying glasses to help students collect more information about each component they identified. Also consider conducting another water infiltration test near the water.

3. Living Things in this Environment

Students can next work together to explore the environment looking for living things and evidence of living things. Some examples of evidence of living things in a wetland might include trees or tree stumps that beavers have chewed on, bubbles on the surface of the water, animal scat, etc. Use wetland field guides, nets, and buckets to aid exploration if possible.

Give students about 30 minutes to look for living things and evidence of living things in the environment. Encourage students to record what they are finding in their journal.

Once students have explored come back together and ask students to share what they found while exploring and discuss whether they think this is a healthy wetland. Ask student to use evidence from their exploration to support their ideas about the health of the wetland.

Reflecting on Explorations

Ask students to begin to make connections between their land survey and wetlands exploration.

Consider asking the following questions:

- Where might the water go if it didn't soak (infiltrate) into the ground?
- What might the water carry with it? Did we find any evidence of this while exploring this wetland?
- What might happen to the land and to this wetland if we get lots of rain?

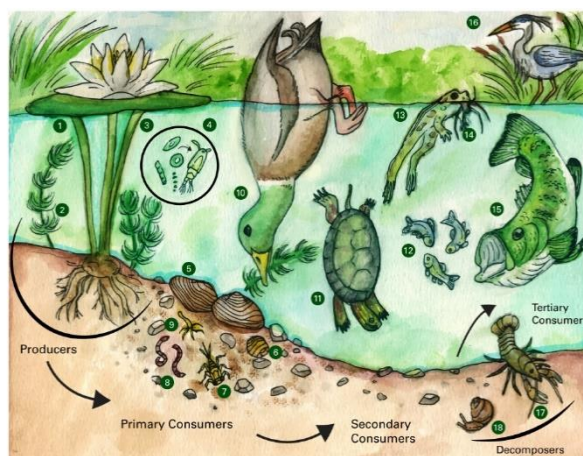


Figure 8: Aquatic food web showing examples of producers, primary consumers, secondary consumers, tertiary consumers, and detritivores that are part of the aquatic ecosystem. Illustration by Madeline Schill.

Part 4: Modeling a Watershed

Keep students in pairs, or for larger groups (more than 12) have students work in groups of 3 or 4.

Each group will need a piece of paper or cardstock and a blue marker. Instruct each group to:

1. Crumple their paper into a ball.
2. Gently partly uncrumple their paper. Do not completely smooth the paper out.
3. Tell students that their paper represents a landscape, and they can image they are looking down at this landscape as if they are a bird flying above it. Ask students to identify different landforms. If needed, introduce the terms: **ridgeline** and **ravine**.
4. Instruct students to use their blue marker to trace all the ridgelines or the highest parts of their paper landscape.

5. Tell the students that it is going to rain on their landscapes. Walk to each group and spray their landscape with your spray bottle so that the blue begins to run across the paper. *Do not spray so much that the paper is soaked through and cannot hold its shape!*
6. Ask students to make observations about how the water is running across the paper landscape. Use the following questions to discuss:
 - a. Where is the water going? What types of waterways are you seeing begin to form?
 - b. Is all the water ending up in the same place or is it going to separate places?
 - c. Can you define areas where all the water is going to the same low point? ***These are your watersheds!***
 - d. Explain to students that this is a model of a watershed. We use models to better understand large systems that can be hard to see all at once. Ask students to think about how the model is similar to the land and water they explored and how it is different (what are the limitations of the model?).



Part 5: Welcome to Your Watershed!

Note: If you don't have time for this section at School of the Wild, you may consider this as a classroom activity after all students have participated in the Watershed Exploration Day.

Assessment

Create an "interpretive sign" for the park that explains to visitors what a watershed is and why it is important to protect.

Provide students with examples of local interpretive signs on other topics. Note them if you pass any while exploring your local park.

Suggest that students might include:

- A diagrammatic model (drawn picture) of the watershed, identifying the name of the watershed if possible.
- A description of the watershed:
 - What is the topography like?
 - What streams, pond, lakes, or rivers are in the watershed?
 - What is the land cover made of in the watershed?
- Why do we need to protect this watershed? What can people do to help protect this watershed?

Additional Classroom Resources:

- Watershed Maps
 - Using the [Iowa Geographic Map Server](#) create maps like the park maps you created, but include the entire HUC 12 watershed your school and/or park is located in.
- Notes from the Watershed Exploration Day at School of the Wild
- Online Resources
 - [Model My Watershed Tool](#)
 - [Iowa Flood Information System – Flood Inundation Map Tool](#)