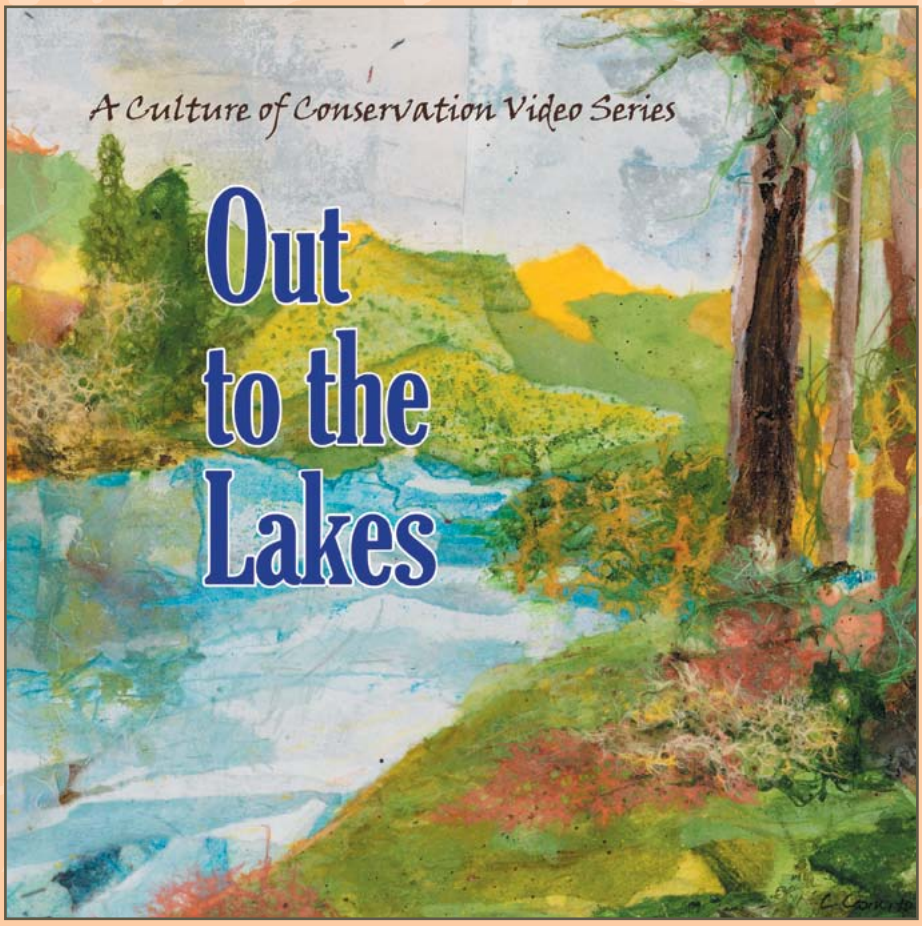
Building a Culture of Conservation – It All Begins with You!

Enhancement activities for middle school, high school/junior college students to accompany the video "Out To The Lakes"



Building a Culture of Conservation –
It All Begins with You!

Enhancement activities for the video "Out to the Lakes"

The enhancement activities in this booklet link students to water bodies and watersheds. The activities are used in conjunction with the "Out to the Lakes" video, approximately 43 minutes in length.

The "Out to the Lakes" video and curriculum enhancement is rooted specifically in Iowa, emphasizing the near environment. This video explores the relationship humans have with water, watersheds and water quality. These activities further develop the themes of the video and deepen the learning experience for your students.

Iowa Learning Farms

Iowa Learning Farms, initiated in 2005, is a unique partnership of farmers, state and federal agencies, conservation groups, the research community and the general public. Iowa Learning Farms is building a Culture of Conservation, taking a grassroots approach to develop innovative ways in which all Iowans have an active role in keeping our natural resources healthy.

For more information about the Iowa Learning Farms, visit our website: www.extension.iastate.edu/ilf

The Culture of Conservation video series was developed for the Soil and Water Conservation Districts of Iowa and is based on ideas expressed by farmers, resource staff and other Iowans during listening sessions conducted across the state by Iowa Learning Farms between 2008 and 2010.

Enhancement activities compiled by Karla Stevens and Dawn Harms.

9/2011

Out to the Lakes!

Have you ever been to an Iowa lake? One out of every six Iowans visits a lake each year, so chances are good that you have. Iowa has over 150 lakes offering a host of recreational activities, such as swimming, skiing, fishing, boating, hiking, and bird-watching. These types of activities can increase the health and quality of life for participating individuals. Additionally, these recreational areas add to the state economy by supporting jobs and through visitor spending. In fact, an estimated $977 million is spent yearly by visitors to Iowa's lakes, with nearly 11,500 jobs being supported.

Lakes are a treasured natural resource and they deserve our care and protection. To be good stewards of our lakes, however, we must understand the context in which lakes exist. We need to look at watersheds.

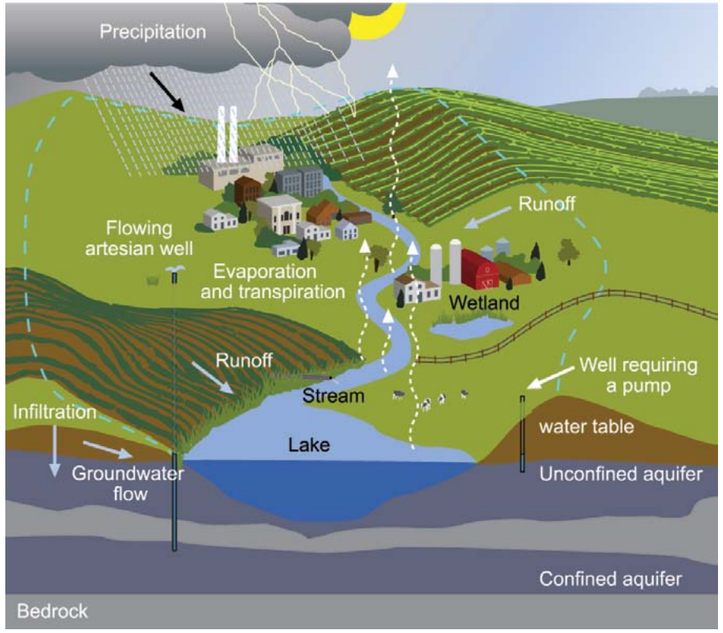
Watersheds

A watershed is the area of land where all of the precipitation flows toward the same place, such as a lake, stream, river, marsh, or groundwater reservoir. All land is divided into watersheds of different shapes and sizes which cross county, state, and national boundaries. They can vary from millions of acres, like the land that drains into the Mississippi River, to a few acres that might drain into a small pond.

All people live in watersheds and are part of watershed communities. Animals, birds and fish are, too. You influence what happens in your watershed, good or bad, by how you treat the soil, water, air, plants and animals within it. In addition, what happens in your small watershed also affects the larger watersheds downstream.

So, a lake contains fed water from the watershed in which it resides. In addition, other smaller watersheds upstream supply water to the lake. It stands to reason, then, that healthy watersheds are important to maintaining clean and healthy lakes. What features make a watershed healthy?

Healthy watersheds have good soil and healthy land which leads to high water quality in the lakes, streams, rivers and groundwater that they feed. High quality groundwater translates to pure, healthy drinking water. Clean water bodies, such as lakes and rivers, are crucial for the plants and animals that live in and around them, and they are a great place to have fun.



Discover your watershed

Go to http://cfpub.epa.gov/surf/locate/index.cfm to find your local watershed and learn about organizations working to monitor, improve, and maintain it. Perhaps choose an organization in which your class can become involved.

Because we all need and use water, it is everyone's responsibility to care for it as a precious natural resource. Let's take a closer look at this natural resource that we use every day and may take for granted.

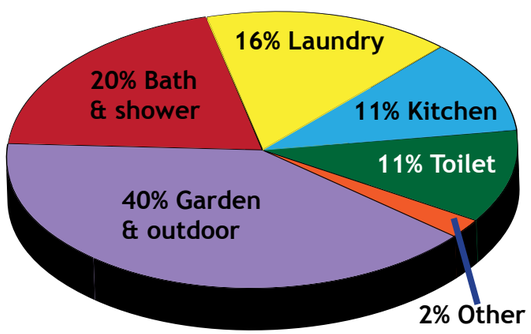
Precious Water

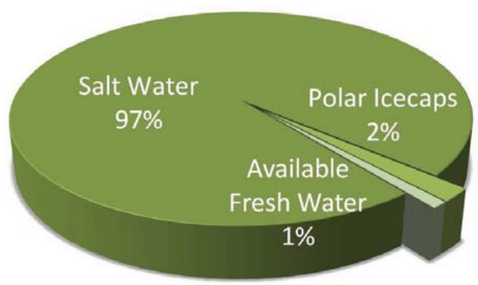
Water is necessary to live. Did you know the human body is made up of 50-75 percent water (depending on your age)? A person can survive about a month without food but only five to seven days without water! Think of all the different ways water is part of our lives: We drink it; we clean with it; we use it to grow and make many things; it provides habitat for fish and other animals and plants; and we have a lot of fun playing in it.

Keeping the water we drink and use clean is important, especially when we consider that about three percent of the Earth's supply of water is fresh (97 percent is salty) and only about one percent is drinkable (the other two percent is frozen).

Consider these other interesting and important water facts:

- The average American uses 140-170 gallons of water per day.
- An average American family of four uses 881 gallons of water per week simply by flushing the toilet.
- Every day in the United States, we drink about 110 million gallons of water.
- A dairy cow must drink four gallons of water to produce one gallon of milk.
- 300 million gallons of water are used to make one day's supply of U.S. newsprint.





With only one percent of Earth's water suitable for drinking, it is wise to protect and use just the amount we need. Water, a precious resource, should never be taken for granted. Life depends on it, and if we all do our part to keep it healthy, it will continue to help sustain our lives and our planet.

Activity Ideas

Personal Water Use Worksheet

Divide students into teams, or lead large-group discussion, to complete the Personal Water Use worksheet (page 5) and discuss results. Encourage students to estimate water used by their whole family for one month and to check their estimates against a utility bill. Brainstorm strategies to reduce the amount of water used in homes and at school. Devise a monitoring system to check efficacy of strategies.

Water Conserving Architecture

Assign an online article for students to read at: http://www.waterconservationusa.org/articles/336-capture-the-rain-skyscraper-marries-water-smarts-with-beauty.html to learn about creative architecture devised to conserve water. Assign a 1-2 page reaction paper, asking students to share opinions on ideas and examples from the article. Students should also brainstorm other creative options for water conservation to include in the paper.

Personal Water Use

For this worksheet, you will calculate the amount of water you use in a 24-hour period of time. First, take a moment to estimate the amount you believe you use:

I think I use about _____ gallons/day and _____ gallons/week of water.

			Total Water Used	
Activity	**Times/day**	**Approximate gal./use**	**Gallons/day**	**Gallons/week**
Bathing		40 gallons		
Showering (5 min)		20 gallons		
Flushing toilet		1.5 gallons		
Washing face/hands		5 gallons		
Drink from tap		.25 gallons		
Brushing teeth (tap is off while brushing)		.25 gallons		
Brushing teeth (tap left on)		2 gallons		
Cooking		10 gallons		
Washing clothes		60 gallons		
Washing dishes by hand		30 gallons		
Automatic dishwasher		10 gallons		
Other				
Totals: (should include things that don't happen every week)				
Multiply weekly total by 52 for annual yearly water use.				

Visit the Water Use Footprint website: http://www.h2oconserve.org/home.php?pd=index for more information about reducing your water use footprint.

Something really special happens during the water cycle: Water is purified through evaporation, transpiration, and condensation. Water is also cleaned as it filters through rocks and soil. So, a natural water purification process is in place that humans do not have to operate or monitor. Does this mean Iowa's lakes and other water forms are always clean? Unfortunately, this is not the case. Due to pollution, some waters are unsafe and unhealthy.

The Water Cycle

From the National Weather Service Forecast Office

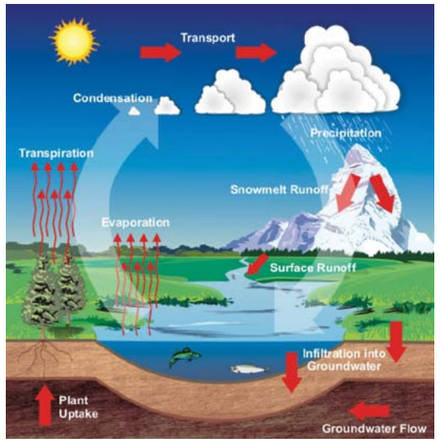
The water cycle, also known as the hydrologic cycle, refers to the continuous movement of water between the earth and the atmosphere. There are many components to the water cycle, but only the most important ones will be discussed here:

Evaporation and Transpiration

Condensation

Precipitation

Runoff and Groundwater



Evaporation and Transpiration

Evaporation is the process by which a substance changes from the liquid phase to the gas phase. On earth, the most important substance is water (liquid water into water vapor). Energy is required for evaporation to occur. Energy can come from the sun (radiation), the atmosphere (conduction) or the earth (conduction). When energy is extracted from the atmosphere to evaporate liquid water, the atmosphere will cool. This is also true if water evaporates off a surface. An example is when you step out of a pool on a warm, sunny day. The water on your skin will evaporate, removing heat from your skin, causing your skin to cool. Evaporation is very important because it is how water vapor, which is needed for clouds and precipitation, enters the atmosphere. Transpiration is simply the evaporation of water through plant membranes. It is another important way in which water vapor enters the atmosphere.

Condensation

Condensation is the process by which a substance changes from the gas phase to the liquid phase. As air containing water vapor rises into the atmosphere, it will expand and cool. If it cools to its dewpoint temperature, the air will become saturated and condensation will occur. Condensation can be observed in the atmosphere as clouds, fog, dew, or frost form. When condensation occurs, the heat required to originally evaporate the water is returned to the atmosphere, causing the atmosphere to warm.

Precipitation

Clouds are composed of millions of water droplets that have condensed. These water droplets grow into larger droplets by colliding and coalescing with one another. Eventually, the droplets can grow large enough that they will not be able to stay suspended in the cloud. When this occurs, they fall out of the cloud as precipitation. If the cloud's temperature is below freezing, it will contain ice crystals. Ice crystals collide and stick to other ice crystals and eventually fall from the cloud as snow. Precipitation is water, either liquid or solid, that falls from the atmosphere to the surface.

Runoff and Groundwater

Runoff and groundwater are both driven by precipitation. When precipitation falls to the surface, it will either be absorbed into the ground (groundwater) or, if the ground cannot absorb any more water, flow into streams. Eventually, even water that is absorbed into the ground will make its way into streams. The water in streams converges into rivers and flows back to the oceans. Finally, some of the runoff will be evaporated and some of the groundwater will be taken in by plants and then transpired.

Middle School Activity Ideas

Share Lake Experiences

Lead students in sharing experiences they've had at Iowa lakes. Which lakes were visited? What kinds of activities occurred (fishing, skiing, swimming, hiking, etc.)? What was the quality of the water and surrounding land? If they saw any problems, what do they think caused them, and how could they be remedied? Discussion could also include other water forms, such as rivers, wetlands, or streams.

Field Trip

Schedule a field trip to a lake or other water body within the local watershed. Remind students to dress appropriately and to bring notebooks to record observations. Divide students into small groups or pairs, instruct them to draw plants/animals they see and to answer the following questions:

1. What types of vegetation do you see? Does vegetation type change in relation to distance from water body?
2. What type of soil is observed? Does soil type change in relation to proximity to water?
3. What wildlife (aquatic and/or land-based) is observed, either directly (via viewing) or indirectly (via tracks, nests, feces, etc.)? Does any wildlife seem absent?
4. Do you note any signs of erosion or other pollution?

Upon return, compare notes and discuss health and vibrancy of the local watershed. Perhaps assign reflection piece.

Create a Terrarium

By creating a terrarium, students will observe how water is continuously cycled between the Earth and the atmosphere. In a terrarium, condensation appears as beads of water on the walls or ceiling (acting as the atmosphere) before falling onto the soil and plants. Discussions can be held on student observations, with references between the terrarium and different stages of the Earth's water cycle.

(adapted from http://www.nwf.org/~/media/PDFs/Be%20Out%20There/Schoolyard%20Habitats/WaterCycle-NWF2011.ashx)

High School & Junior College Activity Ideas

Share Lake Experiences

Lead students in sharing experiences they've had at Iowa lakes. Which lakes were visited? What kinds of activities occurred (fishing, skiing, swimming, hiking, etc.)? What was the quality of the water and surrounding land? If they saw any problems, what do they think caused them, and how could they be remedied?

Go to http://www.card.iastate.edu/lakes/about_project.aspx to learn about the Iowa Lakes Valuation Project. Compare research data collected on the different lakes students visited. Discuss trends in water quality over the years of data collection and the economic value of the different lakes.

Conduct a Water Survey

Work as a class to create a water use survey. Discuss why and how surveys are created. Determine what information the survey will examine and who will be surveyed. Decide how responses will be collected, analyzed, and presented. Then complete the project.

Global Changes in Water Cycle

Investigate scientific knowledge on changing patterns in the hydrologic cycle. Present current research findings and expert opinions on the topic. Share information in the form of a written report, media presentation, or poster.

Supplemental Information

Interactive Water Cycle Sites:

http://www.epa.gov/safewater/kids/flash/flash_watercycle.html

2-3 min. presentation of water cycle stages

http://earthguide.ucsd.edu/earthguide/diagrams/watercycle/index.html

Water cycle diagram with short quiz about different stages.

Water Pollution

Water pollution is the contamination of water forms. It occurs when unwanted materials, known as pollutants, are added to the water.

Types of water pollution include:

- **Toxic Substances**–A toxic substance is a chemical pollutant that does not naturally occur in aquatic ecosystems. The greatest contributors to toxic pollution are herbicides, pesticides, and industrial compounds.
- **Organic Substances**–Organic pollution occurs when an excess of organic matter, such as manure or sewage, enters the water. When organic matter increases in a body of water, the number of decomposers will increase. These decomposers grow rapidly and use a great deal of oxygen during their growth. This leads to a depletion of oxygen which can kill aquatic organisms.

  Another type of organic pollution can occur when inorganic pollutants, such as nitrogen and phosphates, accumulate in aquatic ecosystems. High levels of these nutrients, which are found in fertilizers, cause an overgrowth of plants and algae. As the plants and algae die, they become organic material in the water. The enormous decay of this plant matter, in turn, lowers the oxygen level. The process of rapid plant growth, followed by increased activity of decomposers and depletion of the oxygen level, is called eutrophication.

Algae in East Okoboji Lake, Dickinson County.

- **Thermal Pollution**–This can occur when water is used as a coolant near a power or industrial plant and then is returned to the aquatic environment at a higher temperature than it was originally. Thermal pollution can lead to a decrease in the dissolved oxygen level in the water.
- **Ecological Pollution**–This takes place when chemical pollution, organic pollution, or thermal pollution is caused by nature rather than by human activity. An example of ecological pollution would be an increased rate of siltation of a waterway after a landslide, which would increase the amount of sediments in runoff water. Another example would be when a large animal, such as a deer, drowns in a flood and a large amount of organic material is added to the water as a result.

Sources of water pollution are generally grouped into two categories based on their origin:
- point source
- non-point source.

Point source pollution can be traced to its original source and occurs when the polluting substance is dumped directly into the waterway.

Examples of point source water pollutants include:
- A pipe dumping toxic chemicals directly into a river
- Livestock defecating in streams
- River or oceanic oil spills.

Non-point source (NPS) pollution cannot be traced to a specific original source. It happens when rainfall, snow melt, or irrigation water runs over land or through the ground, picks up pollutants, and deposits them into a water form. According to the Iowa Department of Natural Resources, major non-point source pollutants in Iowa include:

- Sediment–soil that is broken down into fine particles, known as silt, through weathering and erosion, which collects in water forms. This is the leading NPS pollutant. Most sediment in Iowa comes from farming practices such as cropland tillage and livestock in pastures and feedlots. High levels of eroded sediment also come from construction sites, stream banks and lake shorelines.
- Nutrients–especially nitrogen and phosphorus. Nutrients can come from fertilizers used on residential lawns, golf courses, and farmland, as well as from organic sources such as manure and human sewage.
- Pesticides–chemicals used on farms and in urban areas to kill unwanted insects.
- Pathogens–bacteria and viruses.
- Auto oil and grease–leaked onto pavement or improperly dumped.

Soil as a NPS Pollutant

When soil erosion occurs at an accelerated rate the excess soil particles, known as silt, collect in the lakes, streams, and rivers. This is the number one water quality problem in Iowa.

Silt decreases the amount of light entering water, which has a negative effect on aquatic animals and plants. Silt particles clog fish gills, smother fish eggs and make it difficult for aquatic animals to see their food. When large amounts of soil particles are deposited into lakes, rivers, and streams (a process called sedimentation), habitat of aquatic life is destroyed and the ecosystem changed. Sedimentation reduces the holding capacity of lakes and rivers, which leads to changing water temperatures, widening river channels, and increased flood potential. Many Iowa lakes have lost several feet of depth due to sedimentation. Damage from erosion exceeds $54 million annually in Iowa.

Soil can also carry nutrients from fertilizers it picks up as it is eroded from city lawns and treated crop fields. When these nutrients collect in a water body, such as a lake, they increase the production of algae (plant-like organisms living in water). The algae reduce the oxygen level, which creates problems for other aquatic life, and can interfere with human enjoyment of water. The water is unappealing to swim in and there are fewer fish to catch.

Although soil plays a role in NPS pollution it is also a valuable resource which performs many important functions including helping to filter our water and keep it clean. Taking care of our soil can reduce NPS issues, while at the same time helping to preserve a precious resource.

Middle School Activity Ideas

Storm Drains and NPS Pollution

This exercise demonstrates what a storm drain may collect and how water from storm drains can impact water quality and health of watersheds.

Materials needed for "Waterway": aquarium, rectangular box, watering can, spray bottle, & water.

Materials needed for "Pollutants": green food coloring (pesticides, fertilizer); vegetable oil (motor oil); soil/sand (silt); grass clippings & twigs; cafeteria waste & trash.

Preparation: Fill aquarium half full. Cut hole in bottom of box and place on top of aquarium. The box represents the storm drain and the aquarium is the water body in the storm drain's watershed.

Procedure:

1. Discuss storm drain systems and purpose of storm drains. Discuss where water goes after entering a storm drain. Have students list things that might find their way down a storm drain.
2. Assign a group of students to each pollutant. Discuss each pollutant, including its use or origin and how it could enter the storm drain.
3. Have each group place their pollutant into the "storm drain." Use watering can to produce rain to wash pollutants into waterway.
   Discuss the following questions:

   How does each pollutant damage the waterway, local watershed, and watersheds downstream?
   Do the people responsible for the pollutant want to hurt the watershed? Why do they do what they do? How can this type of pollution be reduced?
4. After adding all of the pollutants, examine contents of the waterway. Discuss how it has changed and how viewing this change makes the students feel.

(Adapted from: http://water.epa.gov/learn/kids/drinkingwater/upload/2005_03_10_kids_activity_grades_4-8_nonpoint_pollution.pdf)

Silt and Sedimentation

Students will investigate the sediment load in local water sources. It is most effective to collect the water samples after a rain if at all possible.

1. As a class, discuss and decide how to get consistent results from sampling methods. Discuss the variables that must be controlled in order to have results that can be compared fairly (e.g. same size and shape of containers, same volume). Determine the volume of water to be collected, and collect similarly sized and shaped clear containers.
2. Students then collect the water samples in the containers from a variety of local water sources such as streams, lakes, rivers and ditches. The best time to collect samples is following a rainy period. Be sure that students identify the location sampled and collect water from the water body itself, not from bottom material.
3. After students bring samples to school, they gently shake each jar and compare the color and clarity of the samples, predicting how much sediment will settle out of each. After the particles settle overnight, students compare the amount of sedimentation to their predictions.
4. Discuss the area water bodies that seem to be receiving the most eroded soil particles. As the class discusses, have students share their ideas why those particular water bodies may contain the most sedimentation and ideas for reducing the amount of sediment.

(Adapted from: http://www.baylink.org/lessons/3fr_topsoil.html)

Supplemental Information

Interactive NPS Activity
http://www.epa.gov/owow/NPS/kids/whatwrng.html

High School & Junior College Activity Ideas

Iowa's Impaired Waters

Go to http://www.igsb.uiowa.edu/wqm/ImpairedWaters/Year2010/ImpairedWaters2010Maps.html for a map of impaired waters in Iowa,

and

http://www.igsb.uiowa.edu/wqm/Beaches/BeachMapState.htm for a listing of state beach recommendations. How are water bodies and beaches within the local watershed rated? If impaired, how can these waters and beaches be improved? What obstacles might be encountered on the "road to recovery" for impaired waters?

Water Test Demonstration

First collect water samples from one or two water bodies within the local watershed. Go to http://www.chicagoriver.org/upload/Water%20Quality%20Tests%20Explained.pdf for a demonstration to explain eight water quality tests (pH, turbidity, nitrates, phosphates, total solids, dissolved oxygen, biological oxygen demand, and fecal coliform). This presentation is based on the Chicago River, but it is applicable to any water body. Following the demonstration, test the local water samples and discuss results.

Silt Observation

Students will investigate erosion and the sediment load of a local water body and determine ways to reduce sediment loads. The best time to conduct this activity is following a rainy period.

1. As a class, discuss the variables that will need to be controlled in order to have consistent and comparable results between water samples (e.g. determining clear container size and volume requirements for the samples).
2. Students select a local water body such as a stream, lake, river or ditch for water sampling. The best time to collect samples is following a rainy period if possible. Be sure that students identify the location sampled and collect water from the water body itself, not from bottom material. When students are collecting their samples they should also investigate along the water body for signs of erosion and/or possible sources of sediment.
3. Water samples should be shared with classmates so that turbidity can be compared between the various water bodies.
4. Students submit a proposal for reducing the sedimentation of their investigated water body.

(adapted from: http://www.baylink.org/lessons/3fr_topsoil.html)

Supplemental Information

World Water Facts

Students may study world water sanitation and global water facts at
http://www.who.int/water_sanitation_health/publications/factsfigures04/en/

and

http://gamapserver.who.int/gho/interactive_charts/phe/total_percentage/atlas.html
(interactive map). They can further study the state of global water concerns and share information learned via written report, multimedia presentation, pamphlet, or poster.

Precious Soil

Soil is an important natural resource. While you may be tempted to think "it's just dirt," pause and consider that all life is dependent on soil in some way. Green plants are at the beginning of the food chain and those plants rely on soil to grow and survive. As a member of the food chain, your food consists of items grown in soil or items that eat something grown in soil. Soil's ability to grow food is probably the function of soil with which you are most familiar; however, this natural resource can affect you in other ways as well.

Soil helps to control the flow of water during a rainstorm and acts as a storage bin for the water. During a storm, rain is absorbed into the soil, and healthy soil will hold moisture for plants to use for many days following. This means it doesn't need to rain every day in order for plants to thrive. Soil also acts as a filter–removing chemicals and excess nutrients from the water it absorbs, preventing them from entering groundwater. This helps to keep our waters clean for drinking and recreation.

Soil Formation

Soil is formed as rocks and minerals are weathered by wind and water and broken into smaller pieces. These pieces then mix with material from rotting animals and plants, known as organic material. The process of creating a single inch of soil can take 500 to 1,000 years depending on weather conditions and amount of organic material available. Iowa was once a vast prairie and over the years experienced the prairie life cycle: Prairie fires leaving behind dead, organic material followed by regeneration of new growth. This life cycle helped to develop the rich black earth known as topsoil. Unfortunately, this wonderful soil can be lost or destroyed at a much faster rate than it can be created.

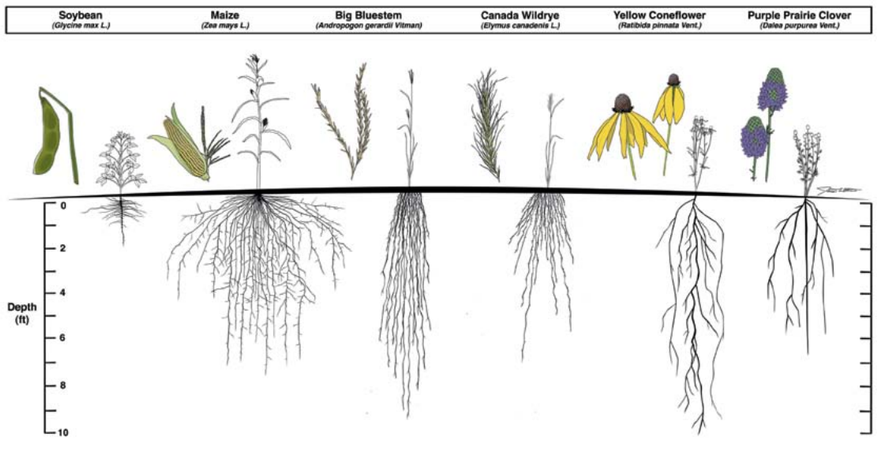
Soil Erosion

Soil erosion is the physical wearing of the Earth's surface resulting in surface soil material being removed. Wind and water are weathering elements that cause basic amounts of soil erosion to naturally occur. Changes to landscape and water flow can greatly increase the rate of erosion. As plants are removed for farming and city construction, more soil is carried into our watersheds with wind and rain.

People have changed the Earth in many ways. Unfortunately, some of these changes can cause soil to be eroded more quickly than it naturally would.

Changing Landscape

In the past, Iowa's prairie landscape was covered with a variety of plants which also had a variety of root systems. Some were shallow, some very deep, some chunky like a ball, others matted and knotted together. The varying root types increased the soil's ability to absorb and retain water and minimized erosion by helping to hold the soil in place.



As Iowa's land transitioned to row-crop production, more and more areas contain only one root type at a time (the planted crop). Today, less than 0.1 percent of Iowa's natural prairie remains. Water's flow over the land has been further changed by farming practices, such as channelization and tiling, and landscape changes due to spreading city limits.

Changing Waterways

Streams and rivers naturally wind through the landscape. As farmers and urban developers seek to utilize more of their land, they manually straighten these waterways. This is a process known as channelization.

Channelized waterway; original stream bed is still visible.

Water in channelized streams flows faster; after all, it is faster to run in a straight line rather than around obstacles. This faster water flow increases erosion and deepens the stream channel. Natural plant life around the stream is changed, further increasing erosion and affecting wildlife. The changed flow of water can damage bridges and increase the amount of flooding. Most of Iowa's rivers and streams have channelized stretches, and over the years approximately 3,000 miles of Iowa's rivers have been lost to channelization.

Tiling involves installing a drainage system underground to remove excess water. This drainage system changes the pathways of water flow by reducing the flow of water over the land surface. Water and nutrients moving through the tile are short-circuited in their movement to streams. With the installation of subsurface drainage systems, most of Iowa's wetlands have been drained.

With altered water flow pathways, rivers and streams move faster, leading to higher levels of soil erosion and less-stable stream and river banks. More erosion means more NPS pollution in our lakes and other water bodies.

Middle School Activity Ideas

Defining Soil Erosion

Students research and then use words and pictures to describe in detail the following:

- Erosion
- Sedimentation
- Soil
- Three types of erosion
- Three forces that cause different forms of erosion
- Three negative effects of erosion on the environment

(adapted from http://www.cas.muohio.edu/scienceforohio/Erosion/images/Ts3All.pdf)

Erosion Observation

Have students make observations of their own neighborhoods looking for signs of erosion. Students should answer the following questions and share their answers via presentation, report, etc.

1. What is the example of erosion happening around your neighborhood or local area?
2. What agent or force is causing the erosion to happen?
3. Where is the eroded material going?
4. What can be done in order to reduce the amount of erosion?
5. Can you think of another example of erosion and describe it?

(adapted from: http://teacher.scholastic.com/dirtrep/erosion/observe.htm)

High School & Community College Activity Ideas

Soil Functions

Divide the class into five groups. Assign one of the five soil functions to each group to research and prepare a 5-10 minute persuasive argument as to why their assigned function is the most important function that soil performs. After arguments have been presented, discuss what stood out as the most valid points of importance. What points were most surprising?

Healthy Soil Discussion Questions:

1. Do you have a personal responsibility to keep our soils healthy? If not, whose responsibility is it?
2. Do you think our local environment is healthy? What parts of our environment do you think we could study to try to find the answer? (Clues to the health of an environment can be found in its air, water, plant and animal ecosystems, and soil. Highlight the fact that although all of these factors are very important to a healthy planet, soil pollution heavily influences the health of every other part of the environment.)
3. Make a list on the board of the ways unhealthy soil affects plants, animals and humans.

Farming Practices to Reduce Erosion

There are many farm practices that can reduce soil erosion by controlling where rainwater and snow melt flows or slowing down the water so that more can be absorbed into the soil. These include:

- Planting cover crops—small grain or legume "green" crops seeded in early fall to protect and improve water quality during the "brown" winter months when cash crops are not grown. The roots of these plants grow closely together and are left in the soil over the winter, helping to keep soil in place.

Rye cover crop growing before corn is harvested.

- Leaving above-ground crop residue–stalks and leaves–covering the ground after harvesting. This cover helps keep soil in place by absorbing impact of raindrops on the soil surface and lessens the amount of soil that can be removed by the wind blowing over the surface of the field.
- Reducing the number of times a field is plowed or "tilled," or not tilling the field at all. This is referred to as conservation tillage or no-till farming, respectively. This leaves plant residue cover on the ground to help minimize the soil erosion.

No-till corn field with a grassed waterway.

- Keeping grassy areas in valleys and other low areas. These grassed waterways catch soil that may be eroded from the hillside during a rainstorm.
- Creating terraces on steeper slopes of land, which resemble stair steps on the slope of the hill. This changes water flow down the slope from a straight line to the bottom to a slower flow pattern.
- Planting crop rows along hills rather than up and down them. Planting rows which follow the curves of the land is called contour farming.
- If a field is next to a lake, river, or stream do not plant crops right up to the water bank; instead establish grassed buffers at the field edge. Grassed buffers help keep the water's banks strong and catch soil that may be flowing with rainwater to the water body.

It is estimated that these types of farming practices save the erosion of 52.5 million tons of soil per year in Iowa.

Contour farming combined with terraces.

Supplemental Information

Interactive Soil Activity

http://urbanext.illinois.edu/gpe/case2/index.html
Help solve a mystery while learning more about soil and its connection to plant life.

Understanding Timeframe

http://soil.gsfc.nasa.gov/inch/soiltime.htm

See how long it takes for one inch of soil to form compared to a listing of world history events for the same timeframe.

Middle School Activity Ideas

Farming Soil Management Practices

1. Divide the class into groups of four or five students. Distribute two aluminum foil roasting pans to each group. The groups cut a V-notch about 2-4 cm. deep in the middle of one short side for a water spout. Prepare one extra set of pans for teacher demonstrations.
2. Discuss the soil management practices that can be used to reduce farming runoff.
3. After discussing the practice of establishing cover crops to reduce erosion, solicit suggestions of ways to model the procedure using the set of teacher demonstration pans. One way to carry out the procedure is to fill both pans with soil, cover one with sod cut from grass, elevate one end, pour water simultaneously over both pans and collect the runoff in a cup at the notched spout.
4. Discuss variables in the experiment and how to control them. Students may suggest that the pans must be tilted equally, equal amounts of water must be poured on both pans, water must be poured from the same height, and water should be poured at the same rate of flow.
5. As a class, conduct the experiment [comparing the two pans–one representing a bare (tilled) field and the other a cover crop]. Discuss the results by comparing the amount and clarity of the water that flows off each pan.
6. Once everyone understands how to control for variables, each group chooses one soil management practice to model using their pans. Groups should discuss their plans with the teacher before actually conducting their tests. Practices that are easiest to model include terracing, plant residue cover, contour farming, and establishing a buffer area. Small pieces of sod will be needed to model crops and plantings. Each team could bring in their own materials or the teacher may furnish them.
7. After the groups prepare their models, have them conduct their experiment in front of the whole class. Once all experiments have been observed, discuss the following:

- Which pans showed the most erosion? The least?
- Why do farmers need to understand this problem?
- If you were a farmer, what factors would you consider when deciding which practices to use?

(adapted from: http://www.baylink.org/lessons/3fr_topsoil.html)

Field Trip

Take a class trip to look for area examples of agriculture soil management practices, both good and bad. Discuss what was most commonly seen.

High School & Community College Activity Ideas

Human Connection to Healthy Soil

1. Separate students into groups of five to eight. Explain that each group is going to present a persuasive argument about the cause-and-effect relationship between humans and soil health. Students will develop a hypothesis, conduct an investigation to discover the facts and then inspire others to act.
2. Instruct each group to choose a specific human action that could lead to soil contamination. Each group should then decide what it thinks the primary effect of that action will be and write a hypothesis (e.g. human actions such as poor waste management, deforestation or the use of pesticides can lead to effects such as soil erosion, animal and plant extinction, and food shortages).
3. Groups then do investigative research and determine effects both locally and globally of the chosen human action.
4. Students present their findings through a posterboard or PowerPoint presentation. The presentation should include the facts that were uncovered during research regarding local and global effects and also recommended local and global action plans. Additionally, students should present their answers to the following questions:

   a. If their plans are enacted what do they hope will happen?

   b. What challenges do they see in persuading others to take action?
5. Take a class poll to find out which group had the most compelling argument for action! Discuss what was most persuasive about each presentation.

(adapted from: http://www2.scholastic.com/browse/article.jsp?id=3747551)

Agriculture Soil Management Practices

Have students research best soil management practices for agriculture, including investigating fields in their local area for the use of such practices. Written submission by students should include whether these practices are, or are not, currently being used by local farmers and to what extent, potential reasons why they are not being used more frequently or by all, and suggestions for increasing the usage of such practices.

Spreading City Limits

As cities grow, an increasing number of roads, parking lots, and buildings cover the ground. These surfaces do not absorb water, and they prevent rain and snow melt from soaking into the ground. Water moves along these surfaces to lower areas, gutters, and storm sewers often times very quickly. This is referred to as runoff.

Because of the amount of these non-absorbing surfaces, runoff in cities can be quite high. In fact, a typical city block generates more than five times more runoff than a woodland area of the same size.

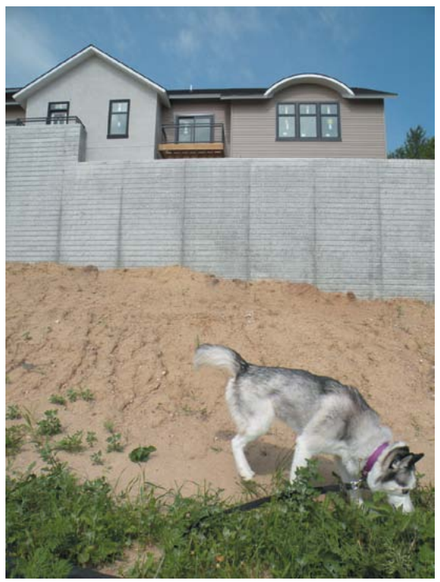
Water that flows through gutters and sewers reaches streams, rivers and lakes much faster than if that water soaked into the ground and passed through layers of soil. When this faster moving water reaches the waterways it damages bank landscape and plant life which increases the erosion of these areas. Additionally, if too much water enters the waterway at one time, the banks overflow and floods result.

With growing cities there are also lots of construction sites. These areas temporarily tear up the ground and plant life, leaving larger areas of bare soil while construction is taking place. Any time soil is left uncovered it is at risk of being more easily eroded by wind and precipitation.

Reducing City Related Runoff and Erosion

Farmers should not be the only ones concerned with reducing soil erosion and runoff. City runoff, containing soil particles and pollutants, also ends up in our lakes and rivers. Just as farmers are becoming educated on
using soil management practices, construction companies and city planners are adopting methods to control city erosion and runoff. These include:

- Conserving natural areas such as buffers and absorbing soils with good plant life
- Leaving trees in place, if possible, because they have large root systems and the canopy of leaves slows the fall of rainwater
- Keeping soil surfaces rough at construction sites
- Covering exposed soil at construction sites with straw
- Maximizing areas of water-absorbing landscape in the midst of concrete
- Observing flow paths to break up and slow down water flow



Personal Responsibility

Water and soil are important to all of us. These natural resources have very important connections to the foods we eat and staying healthy, but they also perform many crucial functions which keep our planet healthy and strong. Additionally, soil is the base for beautiful landscapes and water in our lakes and rivers provides a great place for fun and recreation.

The quality of these resources directly affects the functions these resources perform. Therefore, it is important for us to do our part to keep our water and soil clean and healthy in order to continue to enjoy what they do for us.

We all can be a part of reducing water pollution and soil erosion, and improving water quality in the lakes and other water forms within our watershed. Small changes by many people can add up to big results.

Some basic steps to follow include:

- Reduce fertilizer and pesticide use.
- Store and dispose of chemicals properly.
- Watch for and promptly repair auto leaks. Dispose of auto fluids properly.
- Use materials that allow water to pass through on driveways and sidewalks
- Use native plants and wildflowers which have better root systems instead of grass lawns
- Sweep driveways, sidewalks, and roads instead of cleaning with a hose
- Use a variety of plants and root types in flower beds and mulch them
- Do not connect rain spouts directly to the city's storm drain. Direct the water into the lawn or garden instead
- Do not flush medicines down the drain.
- Pick up and properly dispose of pet waste.
- Beautify a lake, river, or stream near you by removing trash or planting trees. Invite others to get involved too!
- Support state, national, and international organizations aimed at improving and protecting natural resources.

Rain barrels collect rainwater from eaves and holds it for lawn or garden watering when needed.

Staying connected to nature and all it has to offer can help to remind us in personal ways that our resources affect our lives, and our lives affect our resources. So, get out to our lakes: Enjoy them, care for them, and pass them on healthy to future generations!

Permeable pavers allow water to seep through instead of running off into storm sewers.

High School and Community College student Activity Ideas

What Should We Do?

Have students write an opinion paper which includes the following topics: Have soil erosion and destruction problems occurred only in the last 100 years? Is it something we need to be concerned about? What, if anything, do you feel should be done in our country regarding soil conservation and why?

Environmental Surveys

http://thinkearth.org/cgi-bin/surveys.cgi

As a class, complete the school survey and assign students to complete the home survey individually. After survey results are entered at the site and environmental improvement recommendations are given, have students write a reflection piece including how they individually compared to the school and what most surprised them about their own life practices.

Final Class Project Ideas

Middle School Class Projects

1. Write a short play on watershed issues. Perform the play for others in school or elsewhere.
2. Create an educational game about watersheds, lakes, or other information from this curriculum, and share it with other classes within the school or at a school carnival.
3. Create a public service announcement from knowledge learned about watershed issues.
4. Develop an environmental education booth for your school's carnival or other event.
5. Create an educational pamphlet to share with area citizens.
6. Find a soil erosion issue at your school, or in your community, and develop an action plan that could lessen the erosion problem.
7. Determine a water or soil fact to study. Develop and administer a survey to collect measurable data. Calculate and share results. Additionally, create a fact sheet on water and/or soil quality issues to share with survey participants.
8. Create a composting pile.
9. Plant a natural prairie. It may be helpful to take a class trip to a natural prairie in your area. A listing of Iowa natural prairies to visit can be found at www.iowaprairienetwork.org

Individual Projects

1. Make a personal change that benefits your watershed and share what that change is with others in the class. Additionally, encourage others around you (family members and friends) to make personal changes as well.
2. Share what you have learned from this curriculum using new vocabulary terms and environmental facts through one of the following:

   a. Report

   b. Song

   c. Poem

   d. PowerPoint presentation

   e. Diorama

   f. Educational poster

   g. Pamphlet

3. Write a short story about the future of our lakes if no changes are made from current practices.
4. Create a board game, video game, or Jeopardy style game on lakes, watershed, or water and soil quality.
5. Create a crossword puzzle of environmental terms
6. Conduct an experiment related to healthy watersheds and share your results.

Web Resources

National Oceanic and Atmospheric Administration
http://www.education.noaa.gov/noaa_educ.html

Environmental Protection Agency: http://www.epa.gov/students/water.html

Project WET for teachers
http://projectwet.org/water-education-project-wet/water-education-project-wet/

Iowa Department of Natural Resources: http://www.iowadnr.gov/education

Iowa State University Extension publication "Iowa Agricultural Practices and the Environment": http://www.extension.iastate.edu/Publications/IAN104.pdf

Iowa Lakes Valuation Project: www.card.iastate.edu/lakes/about_project.aspx

High School & Community College Group Projects

1. Write a short play about watersheds, lakes, or other information from this curriculum. Perform the play at a local library or elementary school.
2. Create an educational game to teach about watersheds, water quality, soil, and/or other related topics, and share the game with other students (same age or younger).
3. Create a public service announcement from knowledge learned about watershed issues.
4. Develop a watershed education booth for a community event.
5. Create an educational pamphlet to share with area citizens. Each student individually creates one; then the class votes on the best to share. Also determine as a class how to share this brochure with others.
6. Find a soil erosion or water conservation issue at your school or in your community; develop and implement an action plan that could help remedy the problem.
7. Develop and administer a survey to collect measurable data on watersheds, lakes, etc. Calculate and share results. Additionally, create a fact sheet on the topic to share with survey participants.
8. Create a rain garden, wildlife habitat, or natural prairie area at your school or in your community. Capture "before," "during," and "after" photographs to put together on a poster. Display the poster in a common school area for other students, instructors, and visitors to view.
9. Create a composting pile near school kitchen and talk to kitchen staff about using it. Make a poster to display near pile, and a pamphlet to give to staff, with guidelines in "feeding" the pile. Devise and implement a schedule for pile care (adding water and regular stirring).
10. Choose a local water body to adopt for a day. As a class, clean up litter and garbage from around and in the water. Consider doing 2-4 times per school year.

Individual Projects

1. Share what personal changes you will adopt to benefit your watershed with others. Include why these particular changes have been chosen and how you feel these changes will help.
2. Encourage someone outside the class to make a personal change to benefit the watershed. Share this experience, including the following issues: What was the hardest thing about influencing change? Prior to your interaction, how educated was this person on environmental issues related to watersheds? What do you feel was the key element in invoking the change? How do you feel personally after the experience?
3. Write a short story about what the future holds for our lakes if no changes are made from current practices.
4. Create a board game, video game, or Jeopardy style game on lakes, watersheds, etc. Share game with other students
5. Conduct an experiment related to healthy lakes, watersheds, etc. and share your results.

Web Resources

Economic Value of Iowa's Natural Resources
www.card.iastate.edu/environment/items/DNR-Amenity.pdf

Environmental Protection Agency
http://www.epa.gov/students/water.html and http://www.epa.gov/epawaste/education/teens/index.htm

Iowa Department of Natural Resources
http://www.iowadnr.gov/education

National Oceanic and Atmospheric Administration
http://www.education.noaa.gov/noaa_educ.html

Project WET for teachers
http://projectwet.org/water-education-project-wet/water-education-project-wet/

USDA Natural Resources Conservation Service
http://nrcspad.sc.egov.usda.gov/DistributionCenter/

Access to brochure and tip sheet for implementing conservation practices around your home. Enter keywords "Backyard Conservation" into the search box to see options for accessing these publications.

http://www.learningtogive.org/lessons/unit387/lesson2.html contains a lesson plan using this publication

Iowa Watersheds