ICE AGE TRAIL UNIT

Rahr Memorial School Forest – Fourth Grade

ENDURING UNDERSTANDINGS

Wisconsin's geography and people are linked to the past by the impact of the Great Wisconsin Glacier. This unique geological and environmental event led to the creation of the Ice Age Trail. The creation of the trail and the study of the glacier's path provide exceptional educational opportunities.

ASSESSMENT

Students will demonstrate an understanding of the Wisconsin glaciations by participating in activities planned for the classroom and hands-on activities developed for the Rahr Memorial School Forest.

WISCONSIN MODEL ACADEMIC STANDARDS

Social Studies: A.4.2
Math: A.4.3, A.4.4, B.4.3, B.4.5
Science: A.4.5, B.4.1, C.4.1, E.4.1, E.4.5

LESSON PLAN OUTLINE

I. Introduction
II. Pre-visit activities
    a. Vocabulary Activities
    b. Web Quest
    c. PowerPoint slideshow
III. Animals and Extinction – Fossils Hike
IV. Glaciations and Lake Nippissing – Maps and Ridges Hike
V. Walking Math
VI. Hiking the Ice Age Trail
VII. Wrap-up
VIII. Post-visit activities

- Cool Math
- Gliding glaciers
- Mammal Adaptations Game
- Topographic map hands
- Meet a Paleontologist

Teacher Information

- A Brief History of the Ice Age Trail
    - Information about the ridges topography
    - Buried forest
- Glossary
- Wild Edibles/ Medicinal Plants
- Animal Extinctions
- Resources
- Maps
- PowerPoint DVD

MATERIALS

Pre-visit classroom activities:

- Vocabulary activities
- Web Quest sheets
- Web Quest certificates
- Computers with internet access
- Pencils
- BINGO cards, marker chips, caller cards

School Forest activities (four stations):

Animals and Extinction
- Fossil examples
- Fossil identification books
- Fossil recording sheets
- Pencils
- Clipboards

Glaciations and Lake Nippissing
- Paper
- Pencils
- Clipboards
- Topographic maps
- Wet-erase markers

Walking Math
- Walking Math worksheets
- Pencils
- Clipboards
- String
- Markers
- Tape
- Highlighters
- School Forest maps
- Measuring tape
- Gym cones
- Calculators

Hiking the Ice Age Trail
- Hiking backpack with supplies
- Maps
- Bus*

Post-visit classroom activities:

There are many post-visit activities to choose from. Look through the section to see what materials are needed for each activity.

LESSON

I. Introduction

This lesson plan is to be used in the classroom and at the Rahr Memorial School Forest. After setting up a date with the School Forest secretary, teachers are also responsible for filling out and turning in a field trip request form. Teachers may schedule a time when the School Forest coordinator can meet with them at school to discuss the visit. Teachers will be asked to teach or co-teach one of the activities while the student groups rotate through the activities during the day. The School Forest coordinator may be available to teach at one of the stations during the day. Preparation time will be needed to review, plan, and execute the pre- & post-visit activities at school. Students should come prepared to be outside for most of the day. Proper walking shoes are needed.

* When the group first arrives at the School Forest, inform the bus driver that you will be needing rides to the other side of the property throughout the day.

Student Introduction:

Through the dedication of many people in Wisconsin, we have an incredible trail that spans the entire state. The Ice Age Trail is a National Scenic Trail that travels through some of the most beautiful places in our state. Along the trail, hikers can experience amazing geologic features that the glaciers left behind. Our School Forest has a segment of this trail. During these activities, students will learn more about geologic features, the past, plants, and animals.

II. Pre-visit activities

These activities can be done before the School Forest visit.

a. Vocabulary Activities – see "Pre-visit activities" section of this binder
   - Word list and definitions
   - Fill in the blank
   - Sentence writing
   - Crossword puzzle
   - Word Search
   - BINGO
   - Matching, multiple choice, fill in the sentence (assessment)

b. Web Quest – the included web quest will help the students to learn background information about the Ice Age Trail and vocabulary words. The handout and certificate can be found in the "Pre-visit" section of this binder.

c. PowerPoint slideshow – the photos in this slideshow depict geographical features in Wisconsin and points of interest along the Ice Age Trail. Teacher note: the "notes" sections of the slides have details about the photos. The PowerPoint DVD can be found in the "Teacher Information" sections of this binder.

III. Animals and Extinction – Fossils Hike

Many different types of animals lived in this area before and during the glacial time period. Geologists have determined that most of Wisconsin was covered by an ocean at one time. This sea was occupied by small and large animals. After the sea receded, wet forests grew and were full of different animals. Then, the glaciers came and as they covered half of Wisconsin, the animals either died or moved south where it was warmer.

Brainstorm with the class some of the prehistoric animals that they know. Examples of Ice Age animals include: mammoths, mastodons, and saber-toothed cats. Other animals that were here before the Ice Age: trilobites, dragonflies (with 2 foot wingspan), and locusts.

Preserved remains or prints of some of the animals that lived here can be found throughout Wisconsin. Show fossil examples to the students. As a class, hike to the Lake Michigan beach to search for fossils. After awhile of searching, gather the class to examine what was found. Use the identification books to help (the teacher is NOT expected to be able to identify the fossils by name). The students can fill out their data sheets. They may work in groups. You can decide to take a few of the fossils back to school is you would like.

IV. Glaciations and Lake Nippissing – Maps and Ridges Hike

The Laurentide Ice Sheet covered northern and eastern Wisconsin about 25,000 to 10,000 years ago. When the ice began to melt, it created a glacial lake. You may have noticed ridges that run through the School Forest property, parallel to Lake Michigan. These ridges were formed under water during the later post-glacial stages of Lake Nippissing. This glacial lake existed thousands of years ago where Lake Michigan currently sits. Lake Nippissing reached much farther inland than Lake Michigan does today.

As giant waves washed in toward the shore the leading edge of the waves curled over and dug an underwater trench. As the wave curled under it pulled sand from the trench back toward the lake and dropped it, thus creating an underwater ridge. A fairly rapid drop in the lake level allowed the ridges to exist without being leveled off through erosion. This is what created the swales (trenches) and ridges at the School Forest. (See the Teacher Background section for more details.)

Reading topographic maps – Use the topographic maps of the School Forest area to locate where you are. Discuss what topographic lines are and why they are important. Show the students how

to read elevation lines on a map. Ask the students to list jobs where people use topographic maps.

Hike away from the buildings towards the lake (Red Oak Trail). As you go, notice the ridges that run parallel to the beach. Count how many ridges there are on the way to the beach. Examine these features on the topographic map. Does the map match the land? The last tall ridge before the beach (before the intersection with Coho Lane) extends for quite a ways to the north. If there is time, you can leave the trail and walk along the top of the ridge into the forest. Notice how the forest on top of the ridge looks different than the forest to the east, down the hill.

Hike back to the building. Discuss the topics that were covered during this class. The students should be able to explain why it is important to know the topography of an area. They should also understand terms like "swale" and "ridge."

V. Walking Math

In this activity, the students will use School Forest maps to determine the length of the Ice Age Trail through the forest. Then, they will walk a certain distance and figure out their hiking pace. After they know their pace, they will use the worksheet to do the math to figure out how many steps it will take them to travel the segment of the Ice Age Trail through the School Forest.

Pass out the supplies. The worksheet has the directions for the activity. You may choose to do step-by-step as a class or have small groups work together.

If you have time at the end of the lesson, you may choose to take a short hike on the IAT.

VI. Hiking the Ice Age Trail

We have a fantastic stretch of the Ice Age Trail that travels through the School Forest. Start this activity with a brief talk about important things to keep in mind before you go hiking:

- Always tell someone where you are going and when you will be back
- Bring a backpack with water, map, compass, cell phone, a snack, first aid kit, extra clothes (socks)
- Watch where you are going – for roots, branches, any obstacles
- You may also choose to bring a camera, journal, field guides.

Ask a bus driver to take the group to the western edge of the School Forest where the IAT starts (just north of the little bridge on Lakeshore Road on the east side of the street). The IAT is marked with yellow signs. Follow the trail signs through the forest all the way back to Hemlock Trail. Stop along the way to enjoy nature and rest. Take turns carrying the backpack (if desired). Talk about good things to include in a "hiking backpack." If you have time, continue south through part of the South 80. Head back to the buildings and discuss what students enjoyed about the hike and what they found challenging. Would they want to hike more of the IAT?

VII. Wrap-up

Our School Forest is a really amazing place. When the Ice Age Trail was incorporated into the facility in 2007, we gained an incredible resource. This trail provides us with a way to connect to the past (educationally) and also with other parts of the state (literally). We must continue to protect special places like the School Forest and get outside to enjoy the beauties that the glaciers left behind within Wisconsin.

VIII. Post-visit activities - These activities can be done after the trip to the School Forest.

Cool Math

Materials needed: worksheets, pencils, calculators

Use the provided worksheet to make math calculations using the Ice Age Trail as the framework

Gliding glaciers

See attached lesson plan

Mammal Adaptations Game

See attached lesson plan

Topographic map hands

Materials needed: washable markers

One optional activity is for the student to create topographic maps of their knuckles. Have the students draw circles around their knuckles at certain intervals. Now, when they lay their hand flat, palm down, they will have a topographic map of their hand.

Meet a Paleontologist

Materials needed: computer lab

Go to http://www.nationalgeographic.com/education/invitation/novacek.html to learn more about being a paleontologist.

Resources

GeoNote 3: Quaternary Glaciation in Illinois. Champaign, IL: Illinois State Geological Survey. Ordering information can be found at http://www.isgs.uiuc.edu/servs/pubs/edshome.htm

"Governor Doyle Approves Purchase of Six Stewardship Land Parcels" Office of Governor Jim Doyle. Home page Media Room. November, 8, 2004 Available: http://www.wisgove.state.wi.us. February, 4, 2007

Holiday, Diane Young. Digging and Discovery: Wisconsin Archaeology. State Historical Society of Wisconsin, Madison, WI. 1997. (Badger History Series)

Kiley, M. 1998. Illinois' ice age legacy, GeoScience Education Series 14. Champaign, IL: Illinois State Geological Survey. Ordering information can be found at http://www.isgs.uiuc.edu/servs/pubs/edshome.htm

"Knowles-Nelson Stewardship Program" and "The State Trails Program" The Wisconsin Department of Natural Resources. Home page. Revised December 14, 2006. Available: http://www.dnr.state.wi.us.

Leichtle, Kurt. The Wisconsin Journey. Gibbs Smith Publisher, Salt Lake City. 2004. (text book)

Reuss, Henry S. *On the Trail of the ICE AGE*. Sheboygan, Wisconsin. Ice Age Park and Trail Foundation, Inc. 1990.

Town and Country Garden Club project. Sheboygan Indian Mound Park History and Nature Trail Guide.

Wisconsin Department of Natural Resources. *Two Creeks Buried Forest Sate Natural Area*. Revised: September 1, 2004. http://www.dnr.state.wi.us/org/land/er/sna/sna50.htm

Web Resources

U.S. Geological Survey Education - Learning web
Paper Model of Glaciers http://www.usgs.gov/education/learnweb/ice.html

GLACIER Web Site http://www.glacier.rice.edu/

Maine Department Of Conservation - Geological Survey - Glacial Geology Photo Gallery
http://www.state.me.us/doc/nrimc/pubedinf/photogal/surfical/surfphot.htm

Illinois State Museum Geology Online – http://geologyonline.museum.state.il.us

Satellite Images of Glaciers - http://pubs.usgs.gov/factsheet/fs133-99//index.html

Illinois State Museum - Glaciers in Illinois http://www.museum.state.il.us/exhibits/larson/glaciers.html

All About Glaciers [Excellent site with great photos]
http://www-nsidc.colorado.edu/glaciers/questions/what.html

Background information can be found at:
http://www-nsidc.colorado.edu/glaciers/questions/land.html

Illinois State Museum Geology Online – http://geologyonline.museum.state.il.us

Ice Age Trail Website: http://www.iceagetrail.org.

Additional Information / Teacher Background Knowledge

A Brief History of the Ice Age Trail

Ray Zillmer was the man with the vision and dream to preserve evidence of the Great Wisconsin Glacier by creating a 1,000 mile long national park. In 1957 Ray Zillmer with the support of state politicians, approached the National Park Service with the idea for the park. A team from the National Park Service was sent to Wisconsin to evaluate the proposal. With a favorable report from the NPS, The Ice Age National Scientific Reserve Act was signed into law on October 13, 1964. "The act's stated purpose was 'to assure protection, preservation, and interpretation of the nationally significant features of the Wisconsin glaciations, including moraines, eskers, kames, kettle holes, swamps, lakes, and other reminders of the Ice Age.' (Reuss 10)

Originally considered a reserve in 1968, the Department of the Interior and the Wisconsin Department of Natural Resources set aside nine areas with a total of 32,500 acres. At the time, it was considered not feasible to create a 1,000 mile trail because it would be unmanageable. A second Ice Age act on October 21, 1970 provided federal funds for the nine areas. The reserve was officially dedicated on August, 1973 and became part of the National Park System. However, it wasn't until October 3, 1980 that an act of Congress gave the reserve National Scenic Trail status.

In 1983 the NPS and the Advisory Counsel created a plan for the trail that included this guideline, "the trail should follow the terminal and interlobate moraines as nearly as possible." (Reuss 12) During this period most of the trail was on public lands with little money to purchase parcels from private landowners; therefore, the trail on private land relied on informal landowner agreements. Eventually, the informal agreements created problems in the 1980's because without renewed agreements or permanent protection the trail on private land began to disappear.

The state of Wisconsin took the trail under its wing by law on November 25, 1987 stating that the Ice Age National Scenic Trail should also be the Ice Age State Scenic Trail. Funding to purchase land became available through the Knowles-Nelson Stewardship Program enacted on August 3, 1989. This program provides three million dollars annually with the stated purpose to "preserve valuable natural areas and wildlife habitat, protect water quality, and fisheries and expand opportunities for outdoor recreation." ("Knowles-Nelson") In addition, Governor Jim Doyle has supported the Ice Age Trail since his election. "In his State of the State Address, the Governor set the goal of permanently protecting the next 400 miles of the Ice Age Trail within the next decade." ("Governor")

Information about the ridges topography

The north-south sand ridges formed under water during the later post-glacial stages of Lake Nippissing. A fairly rapid fall in lake level permitted the ridges to exist without going through the leveling erosion processes. Similar ridges are still being formed offshore in Lake Michigan's breaker zone. The 66-foot wide north-south transect follows a ridge wooded with red and white pines, hemlock, sugar maple, red maple, and yellow birch. Common ground layer species along the ridge include yellow blue bead-lily, wintergreen, American starflower, Canada mayflower, three-leaved goldthread, and trailing arbutus.

As you hike to the beach at the School Forest, you will hike up and down 3 large ridges. You can also see them on a topographic map. The ridges extend north of the School Forest and south all the way to Two Rivers this is best seen on aerial photos of the area. Contact the School Forest Coordinator if you have questions or would like aerial photos available for your class to study.

Two Creeks Buried Forest Natural Area

Did you know that right here in Manitowoc County we have a buried forest? It is located at the Two Creeks Buried Forest State Natural Area. This area is north of the School Forest along Lake Michigan. According to the DNR website, "Two Creeks Buried Forest provides a unique, precise record of the multiple glacial advances and retreats in this area during the Wisconsinan stage of glaciation. The historic forest became established between the Cary and Valders glacial substages. After temperatures warmed

and the Cary glacier retreated northward, a mature boreal-like forest of black and white spruce, hemlock, pine, various mosses and other plants developed in the Two Creeks area near Lake Michigan. Shortly afterwards, the advancing Valders glacier blocked off the northern Lake Michigan drainage way, raising lake levels, flooding the forest and covering the ground with silt and clay, preventing decomposition. Later, when the southern end of the Valders glacier reached the area, it flattened the forest leaving behind another clay layer imbedded with logs and other debris. These layers of clay, silt, sand and the buried forest are visible on a steep bluff along the lakeshore where wave action and erosion have exposed the layers which contain long-buried branches, logs, and stumps of spruce, pine and hemlock trees. Conifer needles, cones, mosses, and terrestrial snails are also present within the layers. Unearthed wood, radiocarbon-dated at 11,850 before present, provides an absolute date on late-glacial sequences in the Lake Michigan Basin, and evidence that periods between substage glacial advances were long enough for forests to develop. Two Creeks Buried Forest is a unit of the Ice Age National Scientific Reserve and has been a popular study site for North American geologists, botanists, glacial ecologists and climatologists. Removal of any material is strictly prohibited. Two Creeks Buried Forest is owned by the DNR and was designated a State Natural Area in 1967."

Glossary of Glacial Terms and Formations
And Where They Are Found on the Ice Age Trail

(Photos of many of these terms can be found in the Power Point presentation)

Continental Glaciation

The formation, movement, recession and related effects of colossal, nearly continent-sized ice sheets. Though common during the last Ice Age, the only ice sheet that today approaches the enormity of those existing during the Ice Age is on Antarctica. Continental glaciation had far-reaching effects during the Ice Age, from sculpting a quarter of the Earth's landmass to dramatically changing the Earth's climate, oceans, plants and animals.

Dells/Dalles

A gorge cut by the torrents of melt-water released by the melting glacier or draining glacial lakes. Some dramatic examples: the Dells of the Eau Claire, the Wisconsin Dells, and the Dalles of the St. Croix.

Driftless Area

The southwestern quarter of Wisconsin shows no evidence of glaciers, i.e. "unglaciated". It is a landscape deeply cut by ancient streams into narrow, twisting valleys and several hundred million year old ridges. The best place along the Ice Age Trail to witness the Driftless Area is in Dane County between Mineral Point road and Table Bluff, west of the end moraine.

Drumlin

An elongated, teardrop-shaped hill. These streamlined hills were sculpted in the direction of glacial ice movement. They often occur in groups, known as swarms. Because drumlins generally form miles behind (or "up-ice" from) an end moraine, they are rare along the Ice Age Trail. The Farmington Drumlins, in Waupaca County, is the largest swarm of drumlins along existing segments of the Ice Age Trail. State highway 60, between Columbus and Harford, and interstate highway 94 between Madison and Sussex, cross one of the largest drumlin swarms in the world.

End Moraine/Terminal Moraine

A type of moraine formed at the outer edge of the maximum extent of a glacier or glacial lobe. Prominent end moraines along the Ice Age Trail can be witnessed at Prairie Moraine County Park in Dane county, Devils Lake State Park in Sauk County and the range of hills north and east of Antigo in Langlade County.

Erratics

Boulders carried long distances by the glaciers and deposited when the glacier melted. They tend to be smooth and rounded. Erratics can be found along the entire Ice Age Trail, except where it traverses parts of the Driftless area. Some of the famous and largest ones along the Trail are in Waukesha, Waupaca, and Langlade counties.

Esker

A sinuous ridge formed of rounded sand and gravel deposited by the streams that flowed through tunnels at the base of the glacier. The Parnell Esker in the Northern Kettle Moraine is the most famous. Other notable eskers are in Polk and Taylor counties.

Ice Sheet
A large, continental glacier that is not confined by the underlying topography. The northeastern quarter of North America was covered about a dozen times by the Laurentide Ice sheet during the Ice Age, between 2.5 million and 10,000 years ago. Today, ice sheets are found only in polar regions such as Greenland and Antarctica.

Ice-Walled Lake Plains
Mesa-like hills that were once lakes on a melting glacier. Streams flowing on the glacier deposited loads of sediment into these lakes. When the surrounding glacier had completely melted, the lake-bottoms became the hilltops. Ice-walled lake plains are showcased at the Chippewa Moraine Recreation area in Chippewa County.

Kame
A conical hill composed primarily of water-rounded sand and cobbles, these deposits were left by streams that flowed downward through cracks in the glacial ice. The Kettle Moraine contains the largest and most important kame field in the world. Holy Hill in Washington County is a kame.

Kettle
A surface depression formed by large, detached blocks of melting ice that were buried with sand and gravel. As the ice melted, the other material collapsed, leaving a crater-like depression. Some kettles are more than 100 feet deep. Kettles can be found in many areas along the Trail.

Kettle Moraine
A series of ridges, 120 miles long and only a few miles wide, in eastern Wisconsin. The kettle Moraine was formed by the combined action and deposits of two immense lobes of the cont9nental ice sheet; the Green bay and Lake Michigan loves. The kettle Moraine is the birthplace of the Ice Age Trail and first published study of interlobate glaciation (1887).

Lobe
A tongue-like extension of an ice sheet. Portions of Wisconsin were covered by six major lobes during the late Wisconsin Glaciation. (Lake Michigan, Green Bay, Langlake, Wisconsin Valley, Chippewa, Superior)

Moraine
A ridge formed by the unsorted gravel, sand and boulders carried along by the glacier and deposited at the outer edge, or front, of the glacier. Some are only 10 feet high while others rise 250 feet to 300 feet. Moraines define the basic route of the Trail, so they can be found in many places.

Outwash Plain
A sandy plain formed when glacial melt-water streams in front of the glaciers spread over a very wide, flat area. The sand was swept along into both a glaciated and unglaciated areas by the water. Between Hancock and Plover, interstate highway 39 crosses part of a vast outwash plain. Visible along the Ice Age Trail from the Harrison Hills of Lincoln County, the Antigo flats of Langlade County is a large outwash plain.

Pothole

A smooth bowl carved into bedrock by the grinding action of stones whirling around an eddy in a river, such as at rapids. Many potholes were formed by torrents of glacial melt-water during the Ice Age. The best place to see these along the Ice Age Trail is near the western terminus in Interstate Park formed when the St. Croix river was much deeper than today.

Tunnel Channel

Created by a fast-moving river at the base of a glacier that carves a valley. After the glacier has melted, the valley often contains a series of lakes. Prominent tunnel channels can be seen along the IAT on the New Hop segment in Portage County and the Straight River Segment in Polk County.

Animal Extinction in North America

The Late Pleistocene Extinctions:
Approximately 11,000 years ago a variety of animals went extinct across North America. These were mostly mammals larger than approximately 44 kg (about 100 pounds). Some of the animals that went extinct are well known (like saber-toothed cats, mammoths, and mastodons). Others were less well known animals (like the short-faced skunk and the giant beaver). Some animals went extinct in North America but survived elsewhere, for example, horses and tapirs.

Before this extinction the diversity of large mammals in North America was similar to that of modern Africa. As a result of the extinction, relatively few large mammals are now found in North America.

Why did these animals go extinct?
The real answer is that scientists do now know for sure. This is an active area of research for several paleontologists at the Illinois State Museum (ISM) and for many scientists at other institutions.

Scientists who study the extinction have identified three major mechanisms that may have caused the extinction. These three causes are:

Human Hunting
Just after 14,000 years ago human migrants from Asia entered the New World. They may have been the first people to set foot in North America. They are known as the Clovis people. Their sites and artifacts, including distinctive projectile points, are found over much of North America.

These people hunted and gathered wild animals and plants. The animals they hunted included many that became extinct. However, they also hunted numerous animals that survived.

Many scientists think that these people caused the extinction in North America at the end of the Pleistocene. Researchers who support this view generally favor one of these two explanations. The first is that human over-hunting directly caused the extinction. The second is that over-hunting eliminated a "keystone species" (usually the mammoths or mastodon) and this led to environmental collapse and an amore general extinction.

Environmental Causes Related to Climate Change
Between about 18,000 and 11,500 years ago the climate and environments of North America were changing rapidly. Temperatures were warming. Rainfall patterns wee changing. The glaciers were melting. The seasonal difference in temperatures was increasing.

These climate changes wee causing fundamental changes in the ecosystems of North America. Plants and animals were moving out of areas they had lived in and into new areas. Communities were coming apart and reorganizing.

Many scientists think that these climatic and ecosystem changes caused the extinctions at the end of the Pleistocene. The environmental changes might have caused extinction by eliminating food sources, disrupting birth schedules, or exposing animals to climatic conditions to which they were not adapted.

Hyper disease
The third hypothesis to account for large scale extinctions at the end of the Pleistocene is based on the idea of hyper diseases, which are highly infectious diseases.

This theory was most recently proposed by Dr. Ross MacPhee of the American Museum of Natural History and Dr. Preston Marx of the Aaron diamond AIDS Research Center. It supposes that as human populations expanded into new areas during the Pleistocene, for example, into North America approximately 14,000 years ago they brought with them one or more disease-causing agents. These

diseases, new to the New World, jumped from human or animal carriers (for example, their dogs) to the highly susceptible large native fauna. These diseases, according to this theory, were sufficiently lethal to wipe out the native animals.

Almost all scientists working on this problem agree that the extinction was caused by one of these two mechanisms or by some combination of them.

Where Else did these Extinctions Occur?

North America is not the only continent which experienced an extinction of this kind near the end of the Pleistocene. In South America most of the species of medium to large mammals also went extinct approximately 11,500 years ago.

In Australia a major extinction also occurred. The timing of this extinction is much more poorly known; however, it appears to date to between 40,000 and 24,000 years ago.

Europe, Asia, and Africa also experienced some extinction toward the end of the Pleistocene. However, on all of these continents the extinction was less severe.

Illinois State Museum. Homepage. http://www.museum.state.il.us

Gliding Glaciers Lesson Plan

From the Illinois State Museum Geology Online – http://geologyonline.museum.state.il.us

Purpose: To introduce glaciers to students and to allow students to make the connection between glaciers and landforms.

Suggested Goals: Students will gain an understanding of how glaciers are formed, how they move, and the landforms they create.

Targeted Objectives:
As a result of this lesson students will:
1. Gain an understanding of how glaciers move
2. Understand what types of landforms are created from glacial movement

Background:
Glaciers are made up of fallen snow that, over many years, compresses into large, thickened ice masses. Glaciers form when snow remains in one location long enough to transform into ice. What makes glaciers unique is their ability to move. Due to sheer mass, glaciers flow like very slow rivers. Some glaciers are as small as football fields, while others grow to be over a hundred kilometers long. Glaciers made up most of the landforms that we have in Illinois including glacial lakes, kettle lakes, till, and moraines.

Till is material that is deposited as glaciers retreat, leaving behind mounds of gravel, small rocks, sand, and mud. It is made from the rock and soil ground up beneath the glacier as it moves. Glacial till can form excellent soil for farmland. Material a glacier picks up or pushes as it moves forms moraines along the surface and sides of the glacier. As a glacier retreats, the ice literally melts away from underneath the moraines, so they leave long, narrow ridges that show where the glacier used to be. Glaciers don't always leave moraines behind, because sometimes the glacier's own melt water carries the material away.

Streams flowing from glaciers often carry some of the rock and soil debris out with them. These streams deposit the debris as they flow. Consequently, after many years, small steep-sided mounds of soil and gravel begin to form adjacent to the glacier. These mounds are called kames.

Kettle lakes form when a piece of glacier ice breaks off and becomes buried by glacial till or moraine deposits. Over time the ice melts, leaving a small depression in the land, filled with water. Kettle lakes are usually very small and are more like ponds than lakes. Glaciers leave behind anything they pick up along the way, and sometimes this includes huge rocks. Called erratic boulders, these rocks might seem a little out of place, which is true, because glaciers have literally moved them far away from their source before melting away.

Materials/Preparation: Access to a freezer, water, cups, dirt, plastic tub or sink, pictures of landforms made my glaciers, plaster of Paris, pictures of glaciers and landforms created by glaciers, and maps of Illinois.

NOTE: Alternatives to plaster of Paris, although more expensive, include: Activa Art Plaster, Crayola Model Magic, and Direct's Sculptamold.

Procedure:
1. Have a discussion about what glaciers are, how they are formed, glacial movement within Wisconsin, and what landforms glaciers create. Introduce and discuss the terms kettle, moraine, lateral moraine, terminal moraine, glacial lake, till, melt water, kames, cirque, outwash stream, and crevasse.

2. Conduct an activity in which students build a glacier and observe the effects of glacial movement. To do this, create a miniature glacier by freezing gravel, sand or small rocks in a cup of water. Have the students place the cup into the freezer over night. The next day they should be able to tear the paper cup away and use the glacier to simulate its movement over dirt, wood or other material. At the same time

they should be melting a pile of ice cubes on a mound of dirt so that they can see the result of the melting glaciers on the land. It is important to show actual photographs of what occurs so that students can make connects to the larger life-size version of what they are seeing.

A suggested alternative is, rather than using individual ice cubes, freeze water in a rectangular gallon container. Set up a stream table with sand and start the "glacier" at one end by pushing it into the sand. Set a lamp at the "south" end to simulate global warming. As the day goes by, check the regress of the melting "glacier." River systems, lateral moraines, terminal moraines, and glacial lakes should all develop. You can show the depression of the Earth's crust by putting a piece of play dough under the stream table and allowing it to flatten. As the "glacier" melts, the bottom of the stream table should rebound creating a gap in the play dough.

3. Have students build a plaster model of landforms created by glaciers.

4. Have students label a Wisconsin map with glacial landforms.

Questions:
What types of landforms do glaciers create?
How do glaciers change the shape of the land?
What effect have glaciers had in Illinois other than landform changes?

Extensions:
Students can develop a presentation of the various landforms discussed in this lesson.

Assessment:
Assessment of glacial models with labels and the maps

Lesson Specifics:
• Skills-Observation, data collection, computer skills needed to access the internet information.
• Duration - 1 to 2 days
• Group size - Project may be completed individually or in groups of 3 or 4
• Setting - Classroom and computer lab with Internet access

Mammal Adaptation Game

Objective: Students will show in game activities how Ice Age mammals were adapted to their environment until the climate changed, and as this change was occurring, the animals had to move or adapt to survive. Students will analyze environments in terms of the animals' adaptations to determine whether the animals could adapt or would die out.

Time required: one to two class periods

Materials:
Cards of mammals (cut out)
Blank cards of the same size

Motivation: Why did some animals go extinct but other animals survive the Late Pleistocene? Adaptation is a key to survival. What is an adaptation? It is a physical characteristic, trait, or behavior that allows an animal to survive and reproduce. What happens to animals when their environment changes? How can we understand what happens to them? We can pretend we are the animals, act as the animals did, and then try to maintain the same behaviors in a new climate or environment. Will it work? This game is an adaptation of some activities on the Berkeley Web site about fossils and adaptations.

Procedure: Students will talk about and act out the physical adaptations of the animals that they choose to represent in a whole class discussion as they read the ISM Web site on Ice Age Mammals and study a unit on the subject.
• The teacher will show poster or other visual representation of two environments and images of the some mammals. As an example, a mammal's image will be attached to its environment. Students will point out what physical characteristics or behaviors adapt the animal to its environment (size, fur, strength, teeth, legs, speed, and diet).
• Then the teacher will physically move the image to attach it to the new environment and ask students how the animal would fare there (unable to find food, become too hot or cold, could not traverse the terrain).
• The teacher will ask the students if the animals can do anything to adapt (change diet, move to another area) or has other characteristics (adaptations) that could help it adapt. The ultimate answers are found in the fossil record. Some animals did not adapt, became extinct, and exist only in fossil remains. Other animals were able to adapt and are living today.

Environment Images: calendar pictures, or other large images of environments such as rain forests, tundra, prairies, swamps, and temperate deciduous forests.

Cards: Images of mammals: mammoth, mastodon, jaguar, saber-tooth cat, flat-headed peccary, snowshoe hare, beautiful armadillo, ground sloth, dire wolf, wolf, etc. The students attach the cards they are given to the mammals' original environment seen on the poster or large picture of an environment.

Blank Adaptation cards: students will write down each chosen animals' adaptations. This will clarify for students exactly what their animal can do, eat, how it can move, tolerate temperatures, etc. Use 4x6 inch card stock.

Climate Change Switch: At a signal, students will move their animal to another environmental image and attach it there. By reading their Adaptation card again as they analyze visually the new environment, students will decide whether or not their animal can adapt. Students will finally move their animal images to a picture of an environment in which they think the animal would survive. Is it the original environment that no longer exists, or did the animal find a new environment? Help the students remember that extinct animals never found the environment they needed or did not adapt to changes.

Extension: Play this game with modern day counterparts or endangered species of your state. Explain that adaptation plays a part today in the survival of species during global and local climate change and human-caused environmental changes.

Animal Cards: see following pages

Name_____

Ice Age Trail Web Quest

www.iceagetrail.org

Let's go on a fact finding mission to find out about the Ice Age Trail

Go to the internet address above.

What does the acronym IAT stand for (look at the logo)?

_____ _____ _____

Great! You have answered your first question.

Now that you have arrived at the home page, click The Ice Age Trail box at the top and select **FAQs**. This stands for _____ _____ _____.

O.K. Here we go!

1. **What is the Ice Age Trail?**
   The Ice Age National Scenic Trail is a _____ footpath located entirely in _____.

2. **What activities are suitable for the Ice Age Trail?**
   a. c. e.
   b. d.

3. **What glacier? When?**
   Wisconsin's most recent large glacier flowed into the state about _____ years ago.
   The last stage of glaciations is called "_____ _____".

4. **How did the Ice Age Trail get started?**
   It began in the 1950s as the dream of _____ _____.

In 1980, Congress recognized the national significance of the Ice Age Trail by designating it a NST_____ _____ _____.

I hope you aren't too tired because there are more interesting facts to find.

Return to the homepage. Click The Ice Age Trail box again, but this time click **glossary**. Great! Now we are going to learn some ice age terms.

Erratics
Boulders carried long distances by glaciers and deposited when the glacier _____.

Esker
A sinuous (winding) rounded ridge of _____ and _____ deposited by _____that flowed through _____ at the base of the glacier.

Kettle
A surface depression formed by large, detached _____ of melting ice that were _____ with sand and gravel.

Moraine
A ridge formed by unsorted gravel, sand, and boulders carried by the glacier and deposited at the _____ _____ or front, of the glacier.

Bonus Question
The Ice Age Trail mascot is a _____.

If you answered all the questions, you are eligible to receive the Ice Age Trail Fact Finders Certificate.

Cool Math

Let's take a "Walk on the Wild Side" and hike the Ice Age Trail. The Ice Age Trail currently has 620.2 miles of trail miles and 479.3 miles of connecting route miles.

Let's add those numbers together and find out just how far we would have to hike in order to hike the entire Ice Age Trail.

$$\begin{array}{r} 620.2 \\ +\ 479.3 \\ \hline \text{miles} \end{array}$$

1. If you wanted to hike the Ice Age Trail from the east end to the west end and you hiked 20 miles a day, how many days would it take to hike the entire trail? Please round up to the nearest whole number.

$$20 \overline{)\ \_\_\_\_.\_ \text{ miles}} \quad \text{days}$$

2. How many weeks will it take?

$$\_ \overline{)\ \_\_ \text{ days}}$$

3. Well, I don't know about you, but I think that I would rather hike the trail in segments, or short stretches over a period of time. O.K. Let's say that I want to hike the trail through Manitowoc County.

Starting at the Kewaunee border at the Kohnle segment and through Weber's Woods is 1.5 miles.

Next, I would take the segment from County highway B to Rockledge Rd. 7.1 miles.

I would take Rockledge Rd. to Lake Shore Rd, 9 miles.

Then I would continue through the School Forest and Point Beach State Forest to Park Rd in Two Rivers, 9.1 miles

From Two Rivers through the city of Manitowoc is 13.1 miles.

Finally, I would hike from Manitowoc to State highway 32 to County highway P, 26.3 miles.

Add all the segments to get the total number of miles I would need to hike in order to hike Manitowoc County.

5. If I hiked ten miles a day, how many days will it take to hike Manitowoc County?

Let's pick a weekend and hike a segment of the Ice Age Trail! See you on the trail!

Name_____

Walking Math

In this activity, you will learn the length of the segment of the Ice Age Trail that goes through the School Forest and how many steps it would take you to walk that distance.

Supplies needed: School Forest map, string, a few pieces of tape, marker, calculator, and pencil.

1. Find the Ice Age Trail on the School Forest map.
2. Take the string and tape an end to the western start of the trail on the map.
3. Now, you want to lay the string down along the route of the trail. You may use the pieces of tape to hold it in place.
4. Once you have the length laid out, mark the end of the trail on the string by using a marker.
5. Now you can carefully remove the string.
6. Use the key on the map to figure out the *length of the trail* and write down your answer here: _____ miles

Wait until your fellow classmates are done with step #6.

7. Go outside and measure a distance of 50 feet with a tape measure. Mark the ends of the 50-foot distance.
8. Now, walk the 50 feet and count how many steps it takes you. If you lose count, try it again.
9. How many steps did it take you? _____ steps

Good work!!!!

We need to figure out how many steps it would take you to walk the entire length of the School Forest segment of the Ice Age Trail. Let's do some math!!!

First, we need to figure out how many 50-foot sections are in the Ice Age Trail.

_____ miles (*length of the trail*)
x 105.6
= 50-foot sections

Now, multiply your number of steps by your last answer.

_____ steps (50-foot distance)
x _____ (50 foot sections)
=

That is how many steps it would take you to walk the School Forest Section of the Ice Age Trail!!! WOW!!!!

Fossil Hunt
Data

Name:_____

Find a fossil on the beach. You may work with a partner to search.

Draw your fossil:

Observations (color, shape, size):

_____

_____

_____

Type of fossil (if you are not sure, you can research it back at school):

_____

Fossil Hunt
Data

Name:_____

Find a fossil on the beach. You may work with a partner to search.

Draw your fossil:

Observations (color, shape, size):

_____

_____

_____

Type of fossil (if you are not sure, you can research it back at school):

_____