MIDDLE SCHOOL
CURRICULUM

TRAILING ICE AGE MYSTERIES

ICE AGE TRAIL ALLIANCE

NATIONAL PARK SERVICE

OVERVIEW

ICE AGE TREKKING

THE DRIFTLESS AREA

SEARCHING GLACIAL FEATURES

WHY GLACIAL GEOLOGY MATTERS

TRAILING ICE AGE MYSTERIES TOPIC GUIDES

CONTENTS

Overview:

During the past 2.5 million years, numerous continental glaciers advanced and retreated across much of the upper Midwest. All this glacial activity shaped and deposited both the topography and soil types that we see today. Combined, they greatly influence regional water cycle activity, lakes, rivers, forest cover, and land use. So in the end, what happened during the Ice Age affects how and where we use the land today. That's why understanding the effects of glacial geology helps students better understand a great many things in their state or region, plus how that glacial geology might impact their lives.

I. Enduring Knowledge:

Students will learn how glaciers were formed and the resulting land formations. Students will understand how glaciers have impacted Wisconsin's farming, forests, and water, as well as how to pursue information on the topic.

Learning Targets:

1. Students should learn the process of glacier formation over a very long time period.
2. Students should learn how glaciers move and the resulting land formations.
3. Students should learn glacial features specifically found in Wisconsin.
4. Students should learn how to find glacier information online and specifically about the "Ice Age Trail."

II. Teacher Background:

A glacier is made up of thick layers of compressed ice formed by repeated snowfalls that has the ability to move. It flows like a slow river of putty and physically changes the shape of the land in the process. The size of a glacier can vary from as small as a football field to hundreds of kilometers.

Today's glaciers cover 10% of the earth's surface, compared to 32% at the time of the last ice age, and are found primarily in Antarctica, Greenland, and some mountain ranges. They are receding at an increased rate – many scientists feel this is because of climate change.

A glacier forms when the amount of accumulating snow is greater than the amount that melts. This accumulation remains year-round and compresses the lower layers into ice. The extreme weight of the glacier deforms the lower layers of ice similar to putty; this characteristic, along with the pull of gravity, causes the ice to move through mountain valleys or across plains. It can change speed and at times retreat, altering the land beneath by a combination of forces.

As a glacier moves, it carves away land by erosion and also deposits and sculpts new landforms. Erosion creates u-shaped valleys, fjords, and horns. Sculpting and deposition can form moraines, kettles, drumlins, and eskers. These features are formed with glacial drift that is made up of sand, gravel, rocks, and boulders created and transported by the forces of the moving ice. The melted water creates rivers and lakes.

Recently, scientists have drilled and extracted ice cores to learn more about the earth's history in the layers of ice and to provide clues to climate change. They have also measured an increase in ocean levels as glaciers melt.

Wisconsin's geology has been greatly affected by glaciers in four distinct glacial periods. These glaciations have impacted not only the soil, but also many landforms around the state. These glacial landforms can be seen in Wisconsin as far north as Eau Claire and south in Kettle Moraine Park, west of Milwaukee. There are many jobs associated with glaciers, not only geologists, map makers, and hydrologists, but also park rangers who service the many areas where glacial landforms exist. Ray Zillmer provided the vision and helped develop the Ice Age Trail across Wisconsin in the 1950's.

Online Resources:

- http://nsidc.org/cryosphere/glaciers/questions/what.html - glacial facts
- http://curiosity.discovery.com/question/how-are-glaciers-formed - glacial facts
- http://dnr.wi.gov/org/land/parks/specific/iceagetrail/iceage.html
  - Wisconsin glacial facts & vocabulary
- http://www.iceagetrail.org - Ice Age Trail information
- http://wisconsingeologicalsurvey.org/ice_age.htm
- http://www.untamedscience.com – interactive and video
- http://www.intotheoutdoors.org
- www.nps.gov/iatr

Vocabulary:

1. **Alpine glacier:** glacier that is formed in a mountain valley
2. **continental glacier:** glacier formed as ice fans out across the land
   These are much larger than alpine glaciers.
3. **moraine:** a ridge-like landform consisting of glacial debris that is created along the edges of a glacier
4. **kettle:** a depression formed when glacial ice breaks off and is buried
   Over time the ice melts, creating a small depression

5. **esker:** long ridge of gravel deposited in a tunnel under the glacier by its melt waters
6. **drumlin:** long, teardrop-shaped glacial drift formations that run parallel to the glacier's flow It is unclear whether it forms from dragging sediment or from melt water movement.
7. **dell:** small valley
8. **foot:** the bottom (terminal) edge of the glacier – the edge that creates the terminal moraine
9. **geomorphology:** the study of the physical features of the surface of the Earth and how they formed or change
10. **terminal moraine:** a moraine deposited at the point of furthest advance ("terminus") of a glacier, forming a ridge
11. **cartography:** the design and production of maps
12. **hydrology:** the scientific study of the properties, distribution, and effects of water on the earth's surface and in the soil and underlying rocks

III. Before Viewing the Video:

Demonstration/small groups:

Set up a shallow pan or tray and pour sand in the bottom of the tray. Have the students take turns moving the sand at first with their finger, then with a flat index card. Have students describe the results:

- What kind of path is made?
- What happens to the sand in front?
- What happens to the sand alongside the finger and the card?
- Dampen sand slightly and repeat activity.

IV. Viewing Guide:

Hand out the following questions for students to answer during video:

1. Name three steps in the formation of a glacier (snow falls year around, top snow compresses to thin ice below, snow compresses to ice under pressure, moves down by the force of gravity)
2. Name two land features created by a glacier (drumlin, moraine, kettle lake)
3. Name two jobs associated with glaciers (geologists, map makers, hydrologists, park rangers)
4. Who is Ray Zillmer? (helped develop the Ice Age Trail in Wisconsin)

V. Discussion Guide:

Review film questions as a whole class or in small groups. The following activities can also be added as a class or in small groups:

1. Make a 3-D model of a glacier.
2. Ask the students for ideas of how to demonstrate glacier movement; let students develop their own experiments.
3. Ask students to select a glacial feature and find photos on Internet. Develop and present a slide show and explain how it was formed.

VI. Evaluation:

Ask students to give a presentation on their group activities; evaluation will be based on the following:

1. Quality of information on glaciers including formation, how movement caused the shape, how feature is recognized
2. Ability to work together (informal assessment)
3. All members helped in the preparation and presentation (each must speak and be able to show his/her individual work)

Suggestions for extended learning:

1. Look up Wisconsin Ice Age Trail with maps and plan a day hike. Consider supplies, background information, length of hike, and sites along the way.
2. Take a field trip to an Ice Age National Scientific Reserve Unit or walk on the Ice Age Trail. Summarize what you learned.
3. Research careers associated with glaciers and/or nature parks.
4. Research climate warming and glaciers in Greenland or Antarctica. Write a short paper describing what is happening to glaciers today and why.
5. Research one glacier feature. Describe the formation and the resulting effect on the land and land uses. Or, develop a 3-D model or a series of pictures.
6. Research Ray Zillmer and write a report about his accomplishments.
7. Put together a slide show presenting glaciers and glacier features from around the world.

The following Wisconsin Student Proficiency Standards can be met by teaching **Trailing Ice Age Mysteries**:

SCIENCE

1. **Connections**: How evidence explains phenomena
2. **Inquiry**: Understanding how questions direct research
3. **Earth Science**: Earth history & structure of Earth
4. **Physical Science**: Motion & Forces
5. **Science Application**: Interdependence of science and technology

SOCIAL STUDIES

A. **Geography:** "Students in Wisconsin will learn about geography through the study of the relationships among people, places, and environments."

- **8th grade**: A.8.6, A.8.8

B. **History:** "Students in Wisconsin will learn about the history of Wisconsin through the study of geology. They will examine change and continuity over time in order to develop historical perspective, to explain historical relationships, and analyze issues that affect the present and the future."

- **8th grade:** B.8.3, B.8.12

LANGUAGE ARTS

Reading—Informational Text

- **Key Ideas and Details** • 8.RIT.1, 8.RIT.2, 8.RIT.3
- **Craft and Structure** • 8.Rit.4
- **Integration of Knowledge and Ideas** • 8.Rit.7, 8.Rit.9

Writing

- **Text Types and Purposes** • 8.W.2, 8.W.3
- **Production and Distribution of Writing** • 8.W.4, 8.W.5, 8.W.6
- **Research to Build and Present Knowledge** • 8.W.7, 8.W.8, 8.W.9

Speaking and Listening

- **Comprehension and Collaboration** • 8.Sl.1, 8.Sl.2
- **Presentation of Knowledge and Ideas** • 8.Sl.4, 8.Sl.6

Listening

- **Conventions of Standard English** • 8.L.1, 8.L.2
- **Knowledge of Language** • 8.L.3
- **Vocabulary Acquisition and Use** • 8.L.4, 8.L.5, 8.L.6

Wisconsin Teacher Standards which can be met with this curriculum

Standard 1: Subject matter
This curriculum provides information not readily available in other forms. A teacher using this material will be well-informed about the subject matter.

Standard 2: Broad range of ability
This curriculum provides instruction that supports their intellectual, social, and personal development.

Standard 3: Adapt instruction
This curriculum provides suggestions for learners with a variety of intelligences and levels of ability.

Standard 4: Instructional strategies
This curriculum includes the use of technology to gain information and suggestion for using research in extending learning.

Standard 5: Individual and group motivation
Both prior knowledge and carefully designed group projects promote motivation for students to learn.

Standard 6: Verbal and nonverbal communications
Instructional media and technology that promotes active learning are key parts of this curriculum.

Standard 7: Organizes and plans systematic instruction
This curriculum is organized to support teacher knowledge, to draw on and motivate students to engage in active learning, and promotes active inquiry, collaboration, and supportive interaction in the classroom.

Standard 8: Formal and informal assessments
Suggestions for a variety of assessments, both formal and informal, are offered in the curriculum.

Standard 10: Fosters relationships
This curriculum provides information regarding ways in which to actively interact with native communities, both face-to-face events and in using distance learning or technology (e.g. email) methods.