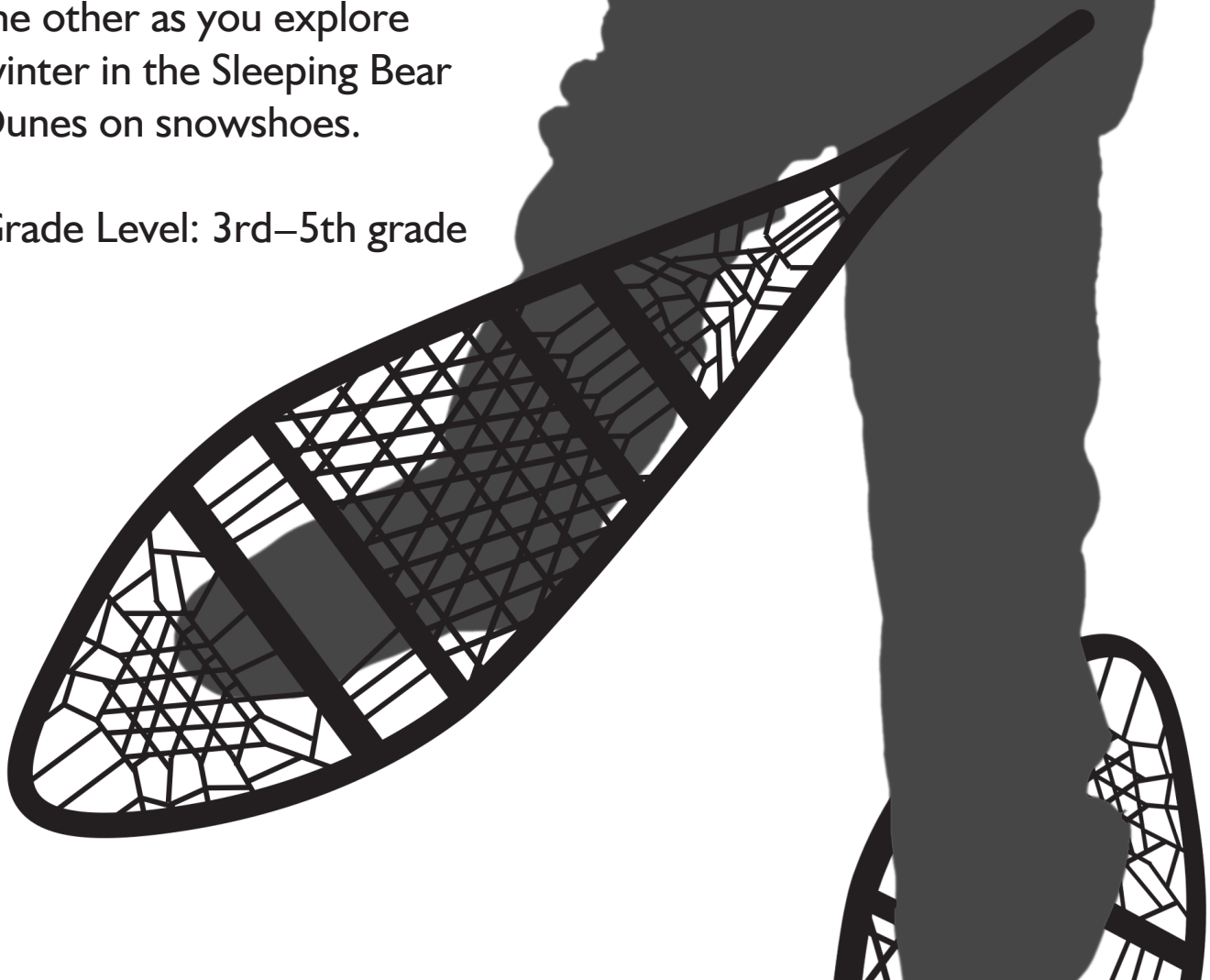
Sleeping Bear Dunes
National Lakeshore

Snowshoe Hike

Put one “shoe” in front of the other as you explore winter in the Sleeping Bear Dunes on snowshoes.

Grade Level: 3rd–5th grade



Snowshoe Hike

Sleeping Bear Dunes National Lakeshore

Overview

The following lessons were designed as pre, during, and post activities for snow shoe hikes to Sleeping Bear Dunes National Lakeshore. The purpose of the pre visit activities is to build background knowledge and to create interest and excitement for the snow shoe hike. The lessons during the hike will allow students to explore concepts in winter ecology and snow-science in a hands-on, experiential format. The post activities are designed to extend learning and to give students the opportunity to be creative and to connect learning to the real world. The lessons are designed to work together, yet can be used in a mix and match way based on student interest and needs.

Grade Level

3 – 5 (with emphasis on 4th grade)

Duration

Each lesson is designed to take about 1 – 2 hours or class periods. However, some lessons can be broken into learning segments that may require less time.

Group size

Up to 36 students

Location

Classroom for pre and post activities
Snowshoe trails in Sleeping Bear Dunes NL

Pre Visit Activities

Snow shoe history and design/Snowshoe Art Extensions
It's Cool to Stay Warm
Tricky Tracks 1
Glacial impact on Sleeping Bear Dunes National Lakeshore (links, questions, experiment)

Suggested Hike Activities from Snowschool

Step In Step Out
Snowshoe Rock-Paper-Scissors
Adaptation Run
Deer's ears
Snow Track Theories
Winter Camouflage

During Hike Resource

file:///C:/Users/meyersjo/Downloads/SnowSchool%20Activity%20and%20Curriculum%20Guide%202015-16%20(1).pdf

Post Visit Activities

Tricky Tracks 2
Super Survivor
Glaciers Then, Now, and in the Future
Mission Ad Campaign
Reflection

Learning Objectives for Pre and Post Lessons

Pre Visit

Lesson 1: Snowshoe history and design
Students will learn the historic significance of snowshoes as it relates to Sleeping Bear Dunes area.

Students will compare and contrast snowshoe models and learn how certain features provide for better movement in different types of terrain and snow and how snowshoe technology has changed over time.

Students will compare snowshoe design with adaptations of animals that winter in the Sleeping Bear Dunes National Lakeshore and create sketches or diagrams comparing similar features.

Students will describe how artwork communicates facts and/or experiences of various cultures.

Lesson 2: It's Cool to Stay Warm
Students will research the physical and behavioral strategies an animal uses to survive the winter.

Students will learn the meaning of the terms hibernation, dormancy, migration, and adaptation.

Students will create a product highlighting what they have learned and present their findings to classmates.

Lesson 3: Tricky Tracks 1
Students will learn how to observe patterns in tracks and to categorize the track pattern as straight-walking, hopping, or waddling.

Lesson 4: Glacial impact on Sleeping Bear Dunes National Lakeshore
Students will learn how glaciers move and how glaciers impacted the land around Sleeping Bear Dunes National Lakeshore.

Post Visit

Lesson 5: Super Survivor
Students will design and create a model of a super survivor species after learning about winter plant and animal adaptations and develop an argument for the viability of the species on a new planet.

Lesson 6: Tricky Tracks 2
Students will learn how to distinguish between observation and inference and they will be introduced to the idea that all ideas are valid unless there is further evidence to suggest otherwise.

Lesson 7: Glaciers: Then, Now and in the Future
Students will learn where the world's glaciers are located, how they are changing, and what the implications of change may be for the future.

Lesson 8: Mission Ad Campaign
Students will create an ad that promotes the Sleeping Bear Dunes mission statement.

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Students will justify how their ad supports the mission statement.

Students will present their ad projects to an audience. In addition, students will ask questions, develop and use models, plan and carry out investigations, write an argument, and communicate information.

Procedure

In lesson plans.

Assessment

In lesson plans where applicable.

Additional resources

http://www.nps.gov/glac/learn/education/upload/Winter%20Ecology%20Teacher%20Guide%202010.pdf Glacier National Park Winter Ecology Teacher Packet

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National Standards/Content Expectations

Based on NGSS and CCSS

Science NGSS	
Use evidence (e.g., measurements, observations, patterns) to construct an explanation. (4-PS3-1) Make observations to produce data to serve as the basis for evidence for an explanation of a phenomenon or test a design solution. (4-PS3-2)	Trick Tracks 1 and 2
ETS1.A: Defining Engineering Problems, Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (secondary to 4-PS3-4)	Super Survivors
Energy can be transferred in various ways and between objects. (4-PS3-1),(4- PS3-2),(4-PS3-3), (4-PS3-4)	It's Cool to Stay Warm
Similarities and differences in patterns can be used to sort and classify designed products. (4- PS4-3)	Snow Shoe Design Tricky Tracks 1 and 2
Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. Plants and animals have both internal and external structures that serve various functions in growth, survival, behavior, and reproduction. (4-LS1-1)	Glacial Impact Glaciers: Then, Now, Future

A system can be described in terms of its components and their interactions. (4- LS1-1),(4-LS1-2)	Glacial Impact Glaciers: Then, Now, Future
Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time. Local, regional, and global patterns of rock formations reveal changes over time due to earth forces, such as earthquakes. The presence and location of certain fossil types indicate the order in which rock layers were formed. (4-ESS1-1)	Glacial Impact
Patterns can be used as evidence to support an explanation. (4-ESS1-1)	Tricky Tracks 1 and 2
4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.	Glacial Impact
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.	Glacial Impact
Make observations and/or measurements to produce data to serve as the basis for evidence for an explanation of a phenomenon. (4-ESS2-1)	Tricky Tracks 1 Glacial Impact
Analyze and interpret data to make sense of phenomena using logical reasoning. (4-ESS2-2)	Tricky Tracks 1 and 2 Glacial Impact
Rainfall helps to shape the land and affects the types of living things found in a region. Water, ice, wind, living organisms, and gravity break rocks, soils, and sediments into smaller particles and move them around. (4-ESS2-1)	Glacial Impact Glaciers: Then, Now, Future
Obtain and combine information from books and other reliable media to explain phenomena. (4-ESS3-1)	Glaciers: Then, Now, Future Tricky Tracks 1
Cause and effect relationships are routinely identified and used to explain change. (4-ESS3-1)	Glaciers: Then, Now, Future

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Over time, people's needs and wants change, as do their demands for new and improved technologies. (4-ESS3-1) Engineers improve existing technologies or develop new ones to increase their benefits, to decrease known risks, and to meet societal demands. (4-ESS3-2)	Glaciers: Then, Now, Future Snow Shoe History and Design
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost. 3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	Snow shoe design Super Survivor
ELA / Literacy CCSS	
RI.4.1 Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text. (4-PS3-1)	It's Cool to stay Warm Snow Shoe History
RI.4.3 Explain events, procedures, ideas, or concepts in a historical, scientific, or technical text, including what happened and why, based on specific information in the text. (4- PS3-1)	Snow Shoe History Glaciers: Then, Now, Future
RI.4.9 Integrate information from two texts on the same topic in order to write or speak about the subject knowledgeably. (4-PS3-1)	Glacial Impact Glaciers: Then, Now, Future Super Survivor
W.4.1 Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (4-LS1-1)	Super Survivor Mission Ad Campaign
W.4.7 Conduct short research projects that build knowledge through investigation of different aspects of a topic. (4-PS3-2),(4-PS3-3),(4-PS3-4)	Tricky Tracks 1 Glaciers: Then, Now, Future

W.4.8 Recall relevant information from experiences or gather relevant information from print and digital sources; take notes and categorize information, and provide a list of sources. (4-PS3-1),(4-PS3-2),(4-PS3-3), (4-PS3-4)	Glaciers: Then, Now, Future Glacial Impact Super Survivor
W.4.9 Draw evidence from literary or informational texts to support analysis, reflection, and research. (4-ESS1-1)	Snow Shoe History and Design Super Survivor It's Cool to be Warm
SL.4.4: Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.	Tricky Tracks 1 Super Survivor Mission Ad Campaign
SL.4.5 Add audio recordings and visual displays to presentations when appropriate to enhance the development of main ideas or themes. (4-PS4-1),(4-PS4-2)	
SL.4.6: Differentiate between contexts that call for formal English (e.g., presenting ideas and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation.	It's Cool to be Warm Super Survivor Mission Ad Campaign
Art	
VA.IV.4.1 Describe how artwork communicates facts and/or experiences of various cultures.	Snow Shoe Art

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Snowshoe Design and History Pre Visit

Overview

Prior to experiencing Sleeping Bear Dunes National Lakeshore snowshoe hikes, expose students to some or all of the activities below.

Focus Questions

How are the four main styles of snowshoes alike and how are they different?

What advantages and disadvantages might each style present?

What animal adaptations are like snowshoes?

Objectives

Students will learn the historic significance of snowshoes as it relates to the Sleeping Bear Dunes area.

Students will compare and contrast snoshoe models and learn how certain features provide for better movement in different types of terrain and snow and how snowshoe technology has changed over time.

Students will compare snowshoe design with adaptations of animals that winter in the Sleeping Bear Dunes National Lakeshore and create sketches or diagrams comparing similar features.

Directions

Cut the pictures of snowshoe styles into sets of four cards. Arrange students into groups of four. Have students spread the four pictures out and work as a group. Ask students to discuss and record responses to the following questions:

Based on key characteristics, what would you name each style of snowshoe? Think of a name that reflects a characteristic and a name that would be memorable.

Describe the physical characteristics of each style of snowshoe. How are the snowshoes alike? How are they different?

Think about how each style might perform in the snow: heavy wet snow, light and fluffy snow, deep snow, shallow snow, groomed trails (wide, flat, little debris), self-blazed path (no trail, trees, lots of debris).

What might be the advantages and disadvantages of each style of snowshoe considering these conditions?

Next, provided that there are about 6 – 8 groups, ask each group to share ideas for one of the questions.

Pass out the snowshoe information sheet. Ask students to compare their ideas with the actual information. Ask if they found anything surprising or confusing about the information.

Have students share one idea by completing the sentence: I used to think ____, now I think ____.

Lastly, have students brainstorm a list of animals that winter in the Sleeping Bear Dunes Lakeshore and the adaptations they might have that are similar to snowshoes? (Use the following link for ideas: ***http://www.nps.gov/slbe/learn/nature/upload/SLBEchecklist_WEB.pdf***) Extend this discussion by having students create drawings of the animal and use labels and diagrams to highlight the similarities between the animal adaptation and the snowshoe.

Follow this up with a shared reading of "The History of Snowshoeing" (see below) and / OR explore modern evolution of the snow shoe: ***http://www.gvsnowshoes.com/en/snowshoe-history***.

Just for fun

Use the link to access a Kahoots quiz that covers basic snowshoe facts and history. Students love Kahoots and it could help you assess what they learned. Students would need to use their Smartphone or computer to access. Use the link below. Once you click on the link you can share an access code with your students. It's that easy! ***https://play.kahoot.it/#/k/b39f05c9-1447-4080-96c9-3c840e9f5e3f***

Everything you EVER wanted to know about the history of snowshoeing if you want more! ***http://www.gvsnowshoes.com/en/snowshoe-history***

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Snowshoe styles

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Snowshoe information

Michigan (Maine or Beaver-tail)

tear-drop shape, up-turned toe, and narrow tailfor use on trails or open woods

advantages: versatility, will work fairly well in most situations

disadvantages: clumsy in thick woods or in very deep, powdery snow

by far the most popular design

Bear Paw

oval in shape, lacking tail - for use in thick woods and hilly areas

advantages: tight maneuverability

disadvantages: slower than other styles and poor for deep snow

Alaskan (Trail, Yukon)

extremely long and narrow, greatly up-turned toe, and narrow tail

for use in open areas and deep snow

best for most racing

advantages: handles deep snow, very fast, and tracks well over long distances

disadvantages: poor maneuverability

Modern snowshoe design

They usually have a lightweight aluminum frame instead of wood and plastic decking instead of webbing. They also have cleats, or crampons, on the underside for increased traction.

For more detail on the technological revolution that brought back thesnowshoe sport see:
http://www.gvsnowshoes.com/en/snowshoe-history

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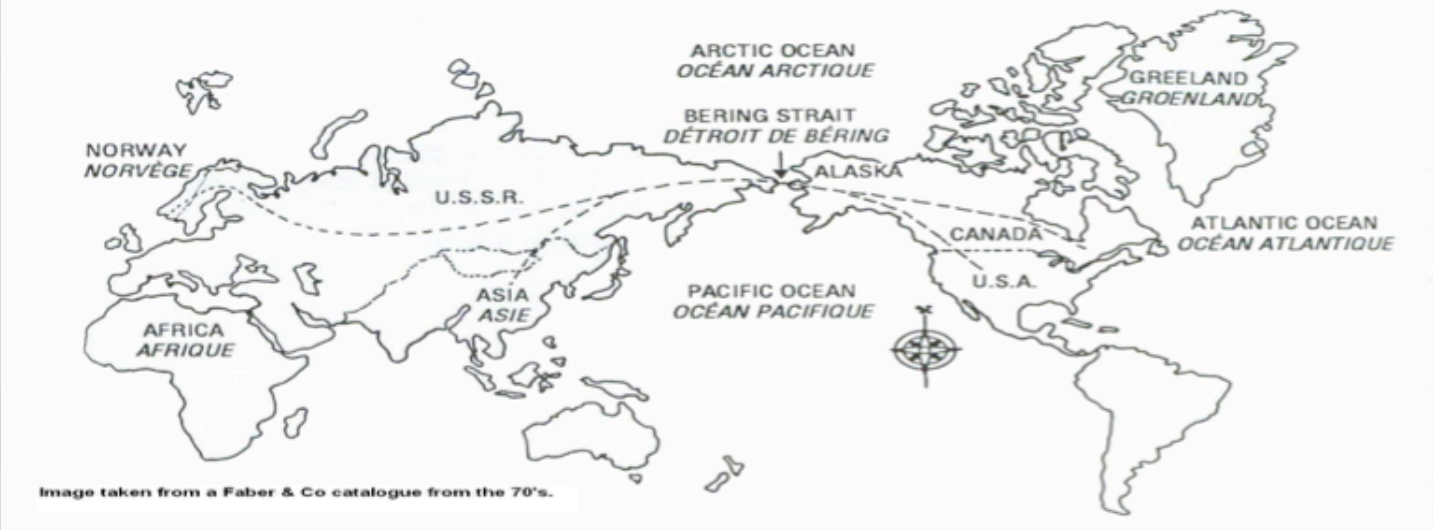
History of Snowshoes

There are two main theories about the origin of the snowshoe. The first theory is that snowshoes were invented by the Asians who first crossed the Bering Strait to inhabit North America. The second theory is that the Norwegians used a form of snowshoes consisting of wooden plates attached to the shoes of their horses to allow easier progress in deep snow.

Regardless of how snowshoes first evolved, it is generally agreed that it was the North American Indians who actually developed and popularized snowshoes as we know them today. Snowshoes were at this time a mean of transportation and a necessity for the first people of Canada and United States.

Early European explorers noted that North American Indian snowshoe design differed from one tribe to the next. The differences are most likely the result of the different conditions the native people were living in thus requiring different design features. For instance, the Iroquois people used shorter and more compact snowshoes that were easier to maneuver in the forested areas they lived in, compared to the snowshoes used by the Cree hunters in the deep snow and open land of northern North America; these were sometimes as long as six feet! Most of these early snowshoes, however, did share some common design features: strong, wooden frame made from a bendable wood, such as ash, with webbing made from animal hide or sinew (connective tissue).

Europeans also had to start using snowshoes to get around; they now all had to survive the same winter. Probably the first white people to make use of the snowshoe were the French who began to move in and colonize the St. Lawrence River area in the 1600's. The French befriended the Indians and they quickly learned how to make best use of the snowshoe in wintertime and canoe in summer. During the long French and Indian War, the struggle between French and English for control in North America was almost swayed to the side of the French by their superior fighting tactics and by the way they, with their Indian allies, used snowshoes as a tactical aid for raiding English settlements.



The Dutch and English, who tended to settle further south along the Atlantic coast, were not as successful as the French in learning from the Indians. These settlers did not learn from the Indians as quickly. One person who did learn well from the Indians was Robert Rogers, who put his knowledge to good use as a scout for the English armies fighting on the borderlands. The famous 1758 "Battle on Snowshoes" near Lake George in the Adirondacks led military leaders to realize how important snowshoes were in waging winter warfare. From that time on the English colonies, later to become the United States, made snowshoes part of their military forces' basic equipment. During the great westward expansion period, snowshoes were equally as important as the axe and flintlock rifle in the places where snow lay deep throughout the winter season. Trappers, hunters, explorers and surveyors in these areas found snowshoes to be a necessity.

Sources

http://fyi.uwex.edu/uphamwoods/files/2014/10/Snowshoeing-Lesson-Plan.pdf
http://www.totalsnowshoes.com/index.html
https://www.fabersnowshoes.com/history

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Snowshoe Art and Pictures

Overview

Art and images are great to use with Thinking Routines. See art, images, and links below. These images can be cut, pasted, and enlarged for more flexible use.

Objective

Students will describe how artwork communicates facts and/or experiences of various cultures.

Suggested Thinking Routines

Understanding Routines
http://www.visiblethinkingpz.org/VisibleThinking_html_files/03_ThinkingRoutines/03d_UnderstandingRoutines.html

Core Routines
http://www.visiblethinkingpz.org/VisibleThinking_html_files/03_ThinkingRoutines/03c_CoreRoutines.html

Example: Using "What Makes you say that?" routine:
http://www.visiblethinkingpz.org/VisibleThinking_html_files/03_ThinkingRoutines/03d_UnderstandingRoutines/WhatMakes/WhatMakes_Routine.html

What Makes You Say That

Interpretation with Justification Routine (adapted to fit content)

1. What's going on?
2. What do you see that makes you say that?
3. After considering all of the images, write a claim (opinion) that can be supported using evidence from the images.

1884 watercolor. View of a man sliding down a hill with snowshoes on. In the background, three snowshoers are sliding down the hill, one on his back

1884 watercolor . View of a man kneeling down and strapping on his snowshoes while his blue mittens lay on the ground beside him.

Two Women on Snowshoes, Date: 1866 watercolor, brush and black ink, with white gouache over pencil on wove paper.

Indian Hunter on Snowshoes Cornelius Krieghoff collection: 1858-1860 , oil on canvas.

Buffalo Hunt on Snowshoes. Hand colored lithograph. Artist George Catlin 1796-1872

Micmac Indian Family with sleigh and snowshoes. 1840 watercolor over pencil with scraping out on wove paper. Image of four adults and one baby in a landscape. The male adult is standing, holding snowshoes, while the three women are sitting. A sleigh is nearby. Artist Millicent Maryca Chaplin, 1790-1858

Portrait of Canadian Indian Nicolas Vincent wearing snowshoes by Philip J. Bainbrigge 1840. A watercolor drawing of Nicolas Vincent of Indian Lorette, 1840, wearing snowshoes and loading a rifle.

Returning Home on Snowshoes ca 1860-1870. The watercolor depicts in the foreground two figures on snowshoes, one of whom carries a papoose on her back. They are approaching a house with two chimneys and a veranda. To the right of the house is a church (unidentified) and in the background are other buildings.

Hurdle Race on Snowshoes at Montreal watercolor, gouache, pen and ink over pencil on wove paper Item is part of the Arthur Elliot album Subject depicts outdoor winter landscape with 6 figures; four figures are wearing snow shoes and jumping hurdles, two men stand at left margin; architectural structures in background.

Source: Total Snowshoes *http://www.totalsnowshoes.com/snowshoe-pictures.html*

Six girls lifting up their snowshoes, High Park,: Feb 1914 , Toronto

Two trappers and Raymond Thompson's dog team on the old Grande Prairie Trail in midwinter

Bessie Taylor, Adam and Lillie Ballantyne on snowshoes. [Oct] 1890 Ottawa, Ont,

A man with snowshoes (Studio portrait) Part of: The Grant album 1869, Montréal, Quebec,

Junior on snowshoes, Val d'Or, [P.Q.] 1935

Alberta Camp Scene 1948

J. Keele in exploratory outfit 1907-1908 , Gravel River, NWT.

F. Fredette, D.L.S. 1st assit with cook tent in background. 1915

James M. Christie, expert frontiersman 1907-1908

J.B. Tyrrell & Monroe Ferguson (Geological Survey - 1894)

Lumbermen's camp 1870, Nashwaak River, NB.

Relief workers with snowshoes. Jan 1934, Upper Brockway, NB,

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It's Cool to Stay Warm Pre Visit

(Adapted from Central Wisconsin Environmental Station (CWES) Winter Ecology Pre-Visit activities)

Overview

Sleeping Bear Dunes National Lakeshore is home to more than 1,500 plant and animal species that have developed different strategies to survive during the hot months of summer, the freezing temperatures in the winter and everything in between. This activity will highlight migration, hibernation, dormancy and staying active (adaptation). The animals that stay active have physical and behavioral strategies such as huddling, curling, fluffing of fur or feathers, shivering, increasing insulation and tunneling in order to protect themselves from the cold.

Objectives

Students will research the physical and behavioral strategies an animal uses to survive the winter.

Students will learn the meaning of the terms hibernation, dormancy, migration, and adaptation.

Students will create a product highlighting what they have learned and present their findings to classmates.

Subjects

Life Science, Language Arts

Approximate time required

2.5 hours, 1 hour research, 30 minutes to plan, 1 hour to create, 30 minutes to share

Materials

It's Cool to Stay Warm worksheet

Pencils, crayons, markers etc.

Construction paper

Glue

Library and internet access

Cereal boxes, poster paper etc.

OR use digital presentation like Prezi, Google Presentation, Powerpoint, Powtoons etc.

Teaching Suggestions

1. Discuss with the class the season of winter and how it affects people. What changes do the students and their families make in their dress, food, homes, and vehicles?
2. What about animals? How do they adapt to winter? Do they make similar changes in their coats, food, homes, and travel? Using students' ideas, highlight the four winter survival strategies: hibernation, dormancy, migration, or adaptation
3. Pass out the It's Cool to Stay Warm worksheet to each student. Have each student review the list and choose one organism to research for their presentation (cereal box, poster, digital). Students can use the guided questions to help them with their research.
4. Allow students to utilize the internet, library, and other resources to research their organism and answer the questions on the worksheet.
5. If using cereal boxes, have students glue construction paper on all sides to cover it completely.

6. Students will transfer information they collected about their organism in an organized way. For example, if using the cereal box, the front could have the common and scientific name and picture, the sides could have habitat, what it eats, predators, and the back side could have its winter survival strategy and 5 interesting facts. The students can get even more creative by creating games, mazes, crossword puzzles, maps, diagrams etc.
7. All students to present their projects to class, small group, partner, or by gallery walk.
8. Students should feel confident in knowing the survival strategy of their organism when they come to SBDNL snowshoe hike.

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It's Cool to Stay Warm!

Choose one organism that you want to learn more about. The list below includes plants and animals that can be found in the Sleeping Bear Dunes area. Research strategies your organism uses to survive in a winter environment and record you findings on the other side of this worksheet.

Birds

Barred Owl

Black-Capped Chickadee

Blue-Jay

Piping Plover

Dark-eyed Junco

Bald Eagle

Red-tailed Hawk

Great Horned Owl

Wild Turkey

Ruffed grouse

Downy, Hairy, Pileated Woodpecker

Great Horned Owl

Snowy Owl

Mammals

Beaver

Chipmunk

Coyote

White-tailed Deer

Porcupine

Raccoon

Grey and Fox squirrels

Woodland Deer Mouse

Striped Skunk

Black Bear

Snowshoe Hare

Eastern Cottontail

Little Brown Bat

Vole

Reptiles and Amphibians

Bull Frog

Garter Snake

Painted Turtle

Spring Peeper

Salamander

Snapping Turtle

Tree Frog

Water Snake

Box Turtle

Hog Nosed Snake

Guided Research Questions

1. What is the common name of your organism?

2. What is the scientific name?

3. Where does it live? What kind of ecosystem or ecosystems in the Sleeping Bear Dunes National Lakeshore is it found within? (Shoreline, woodland, dunes, wetland etc.)

4. What does it eat? What are its predators?

5. What is its winter survival strategy? Does it migrate, hibernate, go dormant or stay active and adapt? Describe in detail.

6. List 5 interesting facts about your organism:

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Sample Grading Rubric

It's Cool to Stay Warm						
Category	**Explanation of Points**					**Score Received**
	1	**2**	**3**	**4**	**5**	
Research Subject Clear	No name or drawing provided	Only common name of organism is provided	Common name and drawing of organism	Common name and scientific name found	Common name, scientific name, and drawings are clear	
Accurate Information	No information provided; no research questions answered	Little information given; few research questions answered	Adequate information given; some research questions answered	Most research questions answered	All research questions answered	
Organization of Information	No attempt was made to organize information	Attempt to organize information	Mostly organized	Information organized	Information very well organized	
Overall Neatness and Creativity	Project is not neat nor creative	Attempted to be neat and creative	Partially neat and creative	Almost entirely neat and creative	Project is very neat, eye-catching, uniquely or creatively done	
Total						**/20**

Tricky Tracks I Pre Visit

Overview
Students will learn to observe animals by studying their tracks and will understand how animals can be grouped according to the way they move.

Objectives
Students will learn how to observe patterns in tracks and to categorize the track pattern as straight-walking, hopping, or waddling.

Students will measure tracks to produce data to help determine pattern.

Grade: 3 – 5

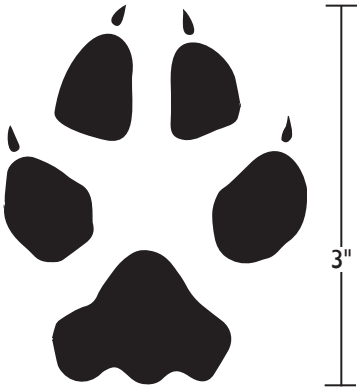
Approximate time required:
45 – 60 minutes

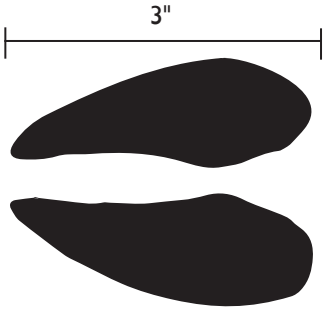
Materials
Laminated animal track sheets (10 sheets per set)

Measurement and track pattern worksheet
(1 per group)

Rulers

Teaching suggestions
1. Tell the class that you are going to teach them how to be track detectives. Detectives look at clues to solve a puzzle and there are three important clues when observing animal tracks and they all start with the letter P: Print, Pattern, Place. The first clue when tracking is to observe the Print. How big is it? What shape is it? Is it the print from the front foot or hind foot? Once a footprint is observed, it is important to determine the design the footprints make. This design keeps repeating itself and is called a track pattern. The last thing they need to be aware of in tracking is where the animal lives, its place, which is the Sleeping Bear Dunes area for this exercise.
2. Instruct students to use their rulers to measure the length of the front and hind prints of the animals on their Tricky Track sheets. Be sure to measure the total length of the print. Measurements should be recorded on the worksheet in inches.





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3. Students will also need to identify the track pattern of each animal. We will focus on three track patterns for this activity: Straight-Walking, Hopping, Waddling. Invite students to imitate each walking pattern.

   Straight-Walking: To walk this pattern, the students will move their right hand and left foot at the same time and likewise for their left hand and right foot. Canines, felines, and many hoofed animals walk this way.

   Hopping: The hopper's pattern is interesting because the larger hind feet land in front of the smaller front feet. The arms swing ahead first to take the body's weight and the back feet follow, swinging around to the outside of the hands and landing slightly in front of them. Rabbits, frogs, and squirrels are hoppers.

   Waddling: This is one of the more difficult patterns to imitate. The animal's weight shifts to the right as both the left hand and foot move forward at the same time, then shifts to the left as the right hand and foot move in their turn. When done, slowly and with some exaggeration, waddling can give a clear impression of an animal slowly lumbering along. Bears, raccoon, and penguins waddle.

4. After reviewing, break students up into groups and pass out the Tricky Track sheets. Each sheet includes a picture and the name of an animal along with its front and hind footprints (actual size) and track pattern. The students will work together to measure the print and determine whether the track pattern is straight-walking, hopping, or waddling. They will write their findings on the Tricky Tracks worksheet.

5. Review the answers with the class and close the activity with reading the story "The Mystery of the Tricky Tracks." Or you can have students write their own words to the illustrations linked below.

   https://www.behance.net/gallery/8020871/The-Mystery-of-the-Tricky-Tracks

6. Variation: Cut and laminate front and hind tracks, track pattern, animal name and information box, and image separately (4 smaller cards per animal instead of one sheet per animal). Have students first match all pieces that go together based on prior knowledge and comparing and contrasting features of the tracks. Check for accuracy as a class and then proceed to measurements and pattern identification steps.

Snowshoe Hike

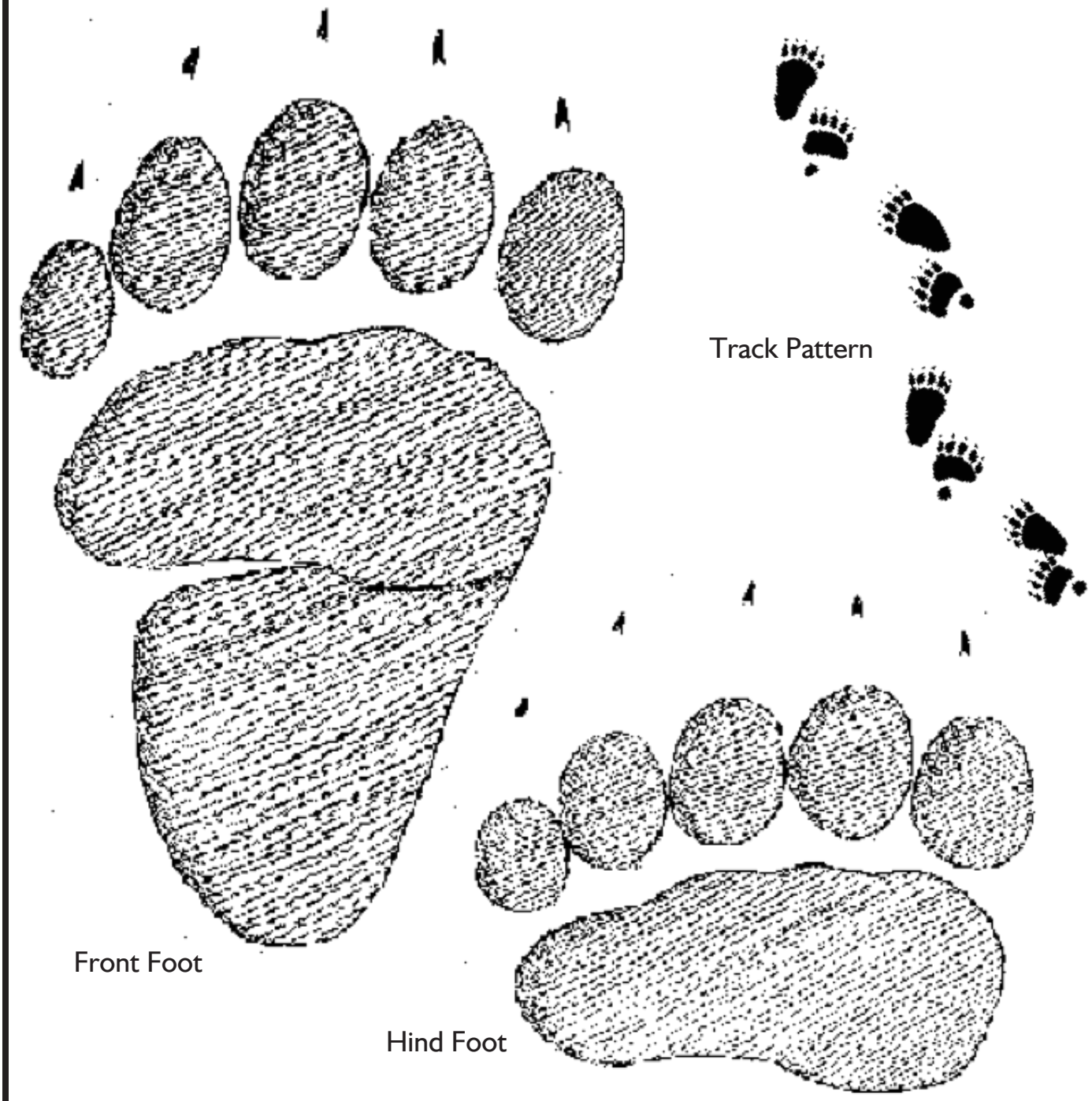
Sleeping Bear Dunes National Lakeshore

Tricky Tracks I Worksheet

Using the Track Cards, measure the length of the track and identify the track pattern for mammals that call the Sleeping Bear Dunes home.

Measurements and Track Pattern										
	Black Bear	Raccoon	Coyote	Skunk	Beaver	White-tailed deer	Porcupine	Gray Squirrel	Red Fox	Cottontail
Front Length										
Hind Length										
Track Pattern Type										

- Straight-walking animals move their right hand and left foot at the same time then the left hand and right foot
- Waddling animals move the left hand and foot forward
- Hopping animals are interesting because the larger hind feet land in front of the smaller front feet



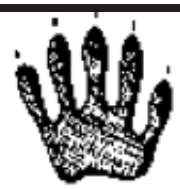
Black Bear

Ursus americanus

Black Bear are present in SBDNL but are considered rare.

Front Foot

Hind Foot

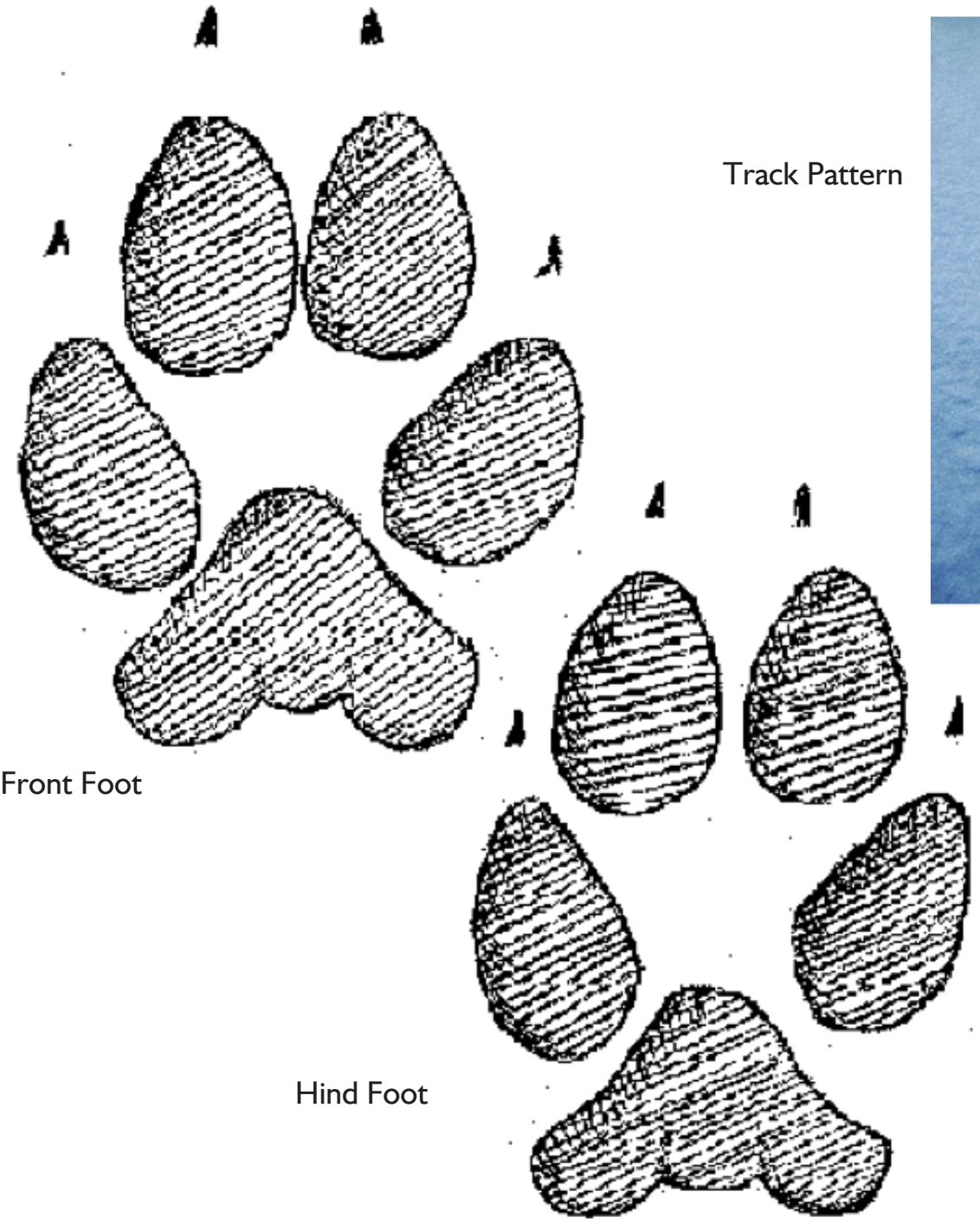


Track Pattern

Raccoon

Procyon lotor

Racoons are present in SBDNL and are considered common.



Front Foot

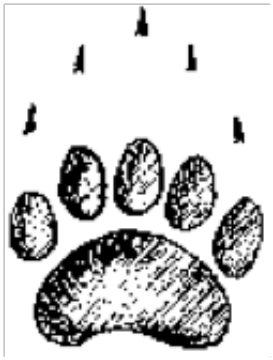
Hind Foot

Track Pattern

Coyote

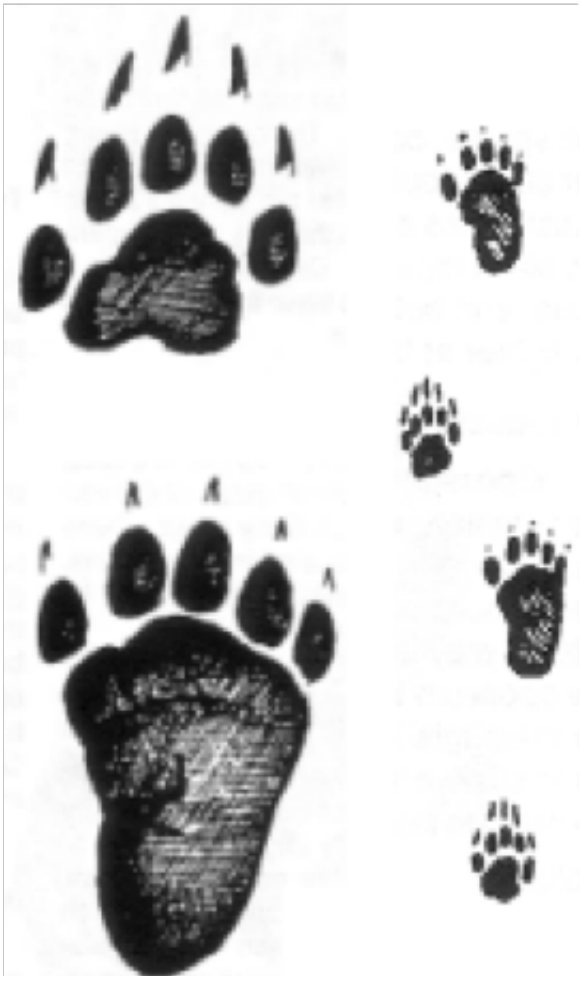
Canis latrans

Coyotes are present in SBDNL and are considered common.



Front Foot

Hind Foot



Track Pattern

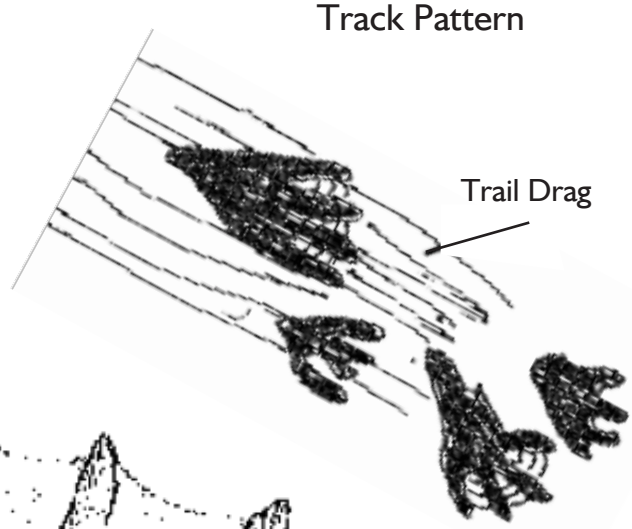
Striped Skunk

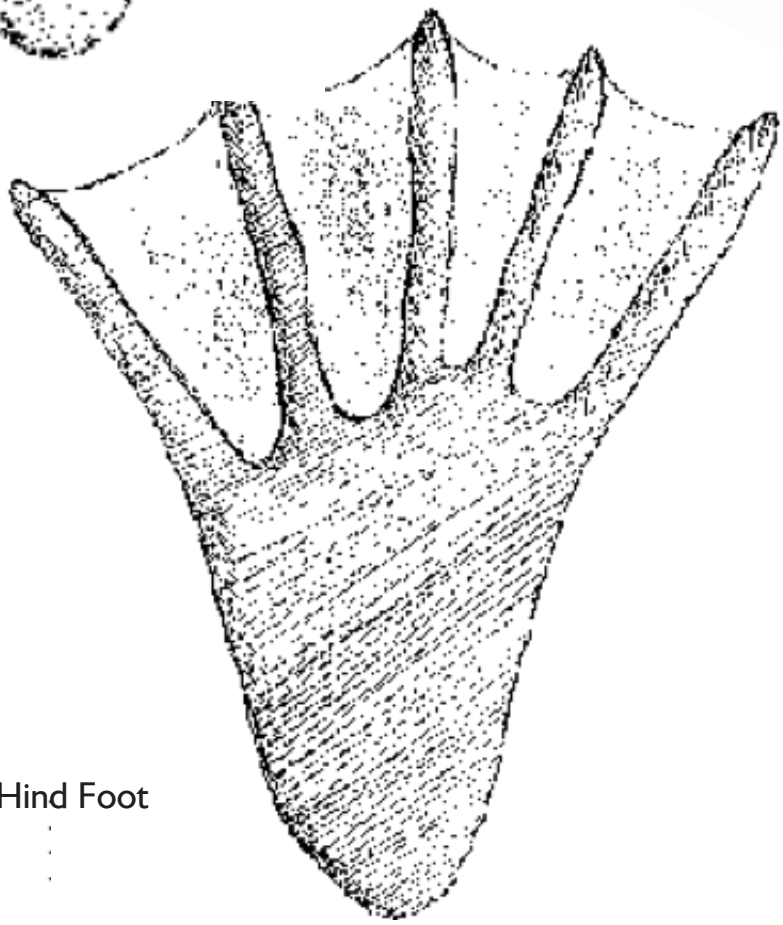
Mephitis mephitis

Striped skunks are present in SBDNL and are considered common.

Front Foot

Track Pattern



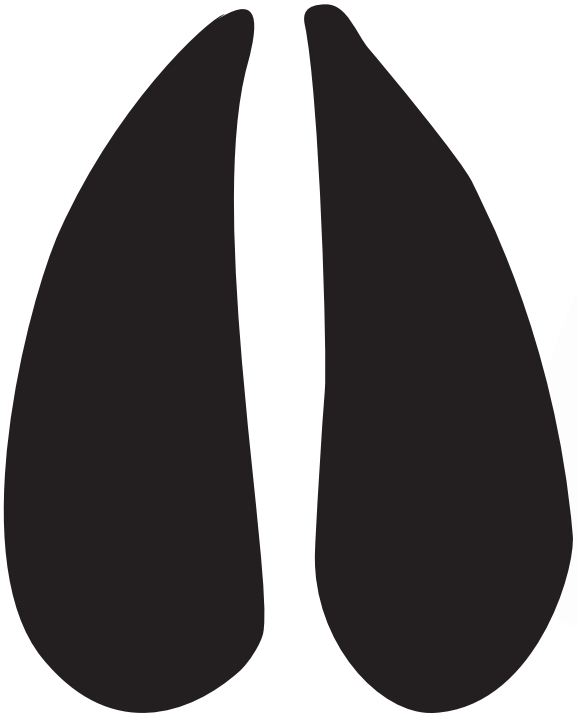


Hind Foot

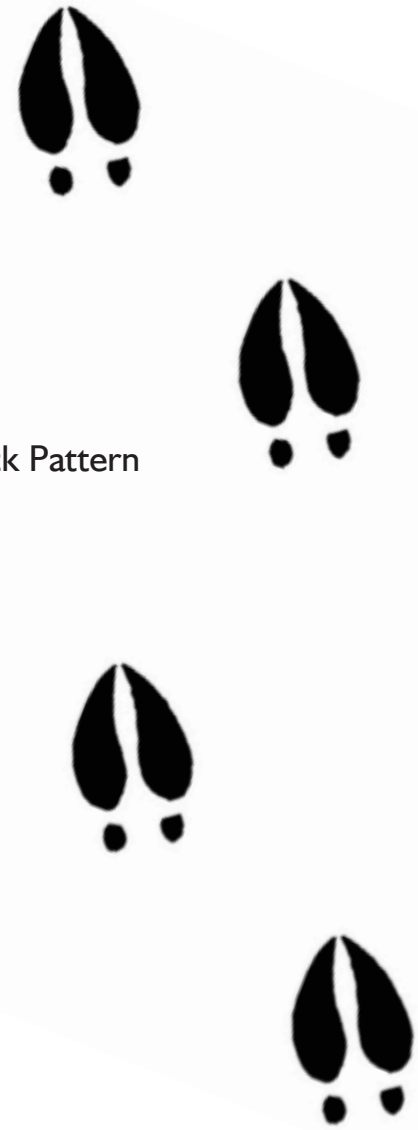
Beaver

Castor canadensis

Beavers are present in SBDNL and are considered common.



Hind foot and front foot look alike



Track Pattern

White-tailed Deer

Odocoileus virginianus

White-tailed deer are present in the SBDNL and are considered common.

Front Foot

Hind Foot

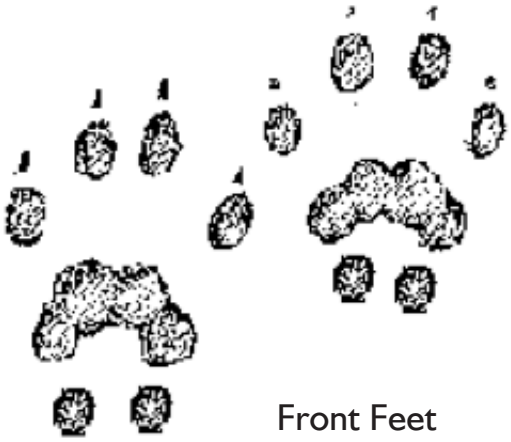
Track Pattern

Porcupine

Erethizon dorsatum

Porcupines are present in SBDNL and are considered common.

Hind Feet



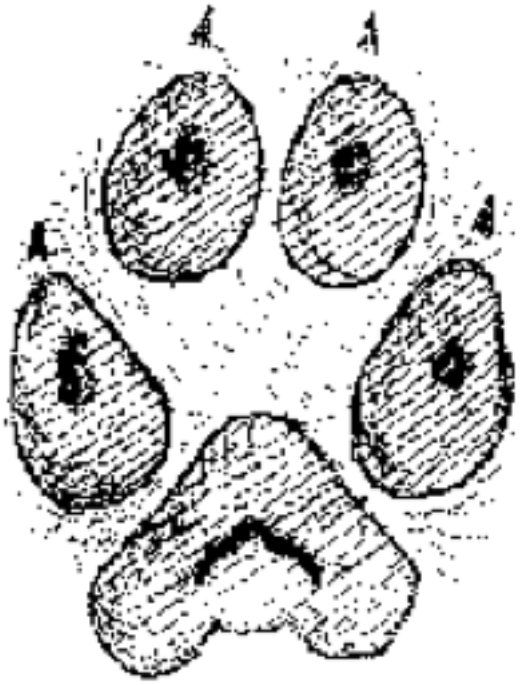
Front Feet

Track Pattern

Grey Squirrel

Sciurus carolinensis

Gray Squirrels are present in
the SBDNL and are considered common.



Hind foot and front foot look alike

Track Pattern

Red Fox

Vulpes vulpes

Red Foxes are present in SBDNL and are considered common.

Track Pattern

Front and Hind feet

Cottontail

Sciurus carolinensis

Sylvilagus floridanus

Eastern Cottontails are present in the SBDNL and are considered common.

Snowshoe Hike

Sleeping Bear Dunes National Lakeshore

Glaciers and the Impact on the Sleeping Bear Dunes Pre Visit

Overview

Step one and two are designed to help students gain a basic understanding of how glaciers are formed and how glaciers impacted the land of the Sleeping Bear Dunes National Lakeshore. Step three is a hands-on investigation where students create a model of a glacier and observe how a glacier is formed, how it moves, and how it shapes the land.

Objective

Students will learn how glaciers move and how glaciers impacted the land around Sleeping Bear Dunes National Lakeshore.

Grade Level: 3 – 5

Subject: Earth Science

Duration: 50-60 minutes or one class period.

Step One

Introduction

Introduce students to background about the Sleeping Bear Dunes using this brief video:

On the Shores of Lake Michigan: ***https://www.youtube.com/watch?v=gagnnGKprBE*** (2:20)

Prior to showing video, generate a discussion with the question: **What is unique about our Sleeping Bear Dunes National Lakeshore and why should we care?**

Step Two

Where it all began Glacier Exploration

The following step includes big idea questions, brief tutorial on how the Great Lakes were formed, and comprehension questions.

What is a Glacier? How has glacier movement shaped the Sleeping Bear Dunes National Lakeshore?

Follow up with a simple explanation via interactive slideshow. Students can watch as a class or explore individually.

How the Great Lakes were formed: ***http://www.asu.edu/courses/gph111/Glaciers/GreatLakesMovie5.swf***

Have students answer the following questions: See student worksheet on next page with link. This can be set up as a Google doc so all students can access using their one to one computers.

What is the term for the period of Earth's geological history where much of the Northern Hemisphere was covered by ice? (slide 1 and 2) Ice Age

According to the geological time scale in what era did the last ice age occur? (slide 3, replay if necessary) Cenozoic

Was Michigan covered by the Laurentide glacier at its peak around 18,000 years ago? How do you know? (slide 4) Yes, the glacier extended as far South as Chicago, Illinois and the map shows Michigan is covered by the glacier.

What effect can glacial erosion have on the land? (slide 5) It can level mountains and carve out massive valleys.

What caused the formation of the Great Lakes? (slide 6 - 10) The glacier began retreating and melt water filled the holes the glacier left behind.

What is another word for "glacial boulder"? (slide 7, hint: see changing picture and caption) erratic

Without the great weight of the glaciers land began to rebound. What does rebound probably mean? (slide 12) The land in the Great Lakes Basin continues to rise.

What is one other force that continues to change the size and shape of the Great Lakes? (slide 13) Rebounding of the Earth's crust, erosion, climate change

What prediction might you make for the state of the Great Lakes hundreds of years into the future? Explain your prediction. Answers will vary.

Step Three

Have students complete the "How does Glacier Movement Affect Earth?" model building activity

Snowshoe Hike

Sleeping Bear Dunes National Lakeshore

How Were the Great Lakes formed?

Student Worksheet

Answer the following questions using the following presentation. You can replay each page as many times as you need.

http://www.asu.edu/courses/gph111/Glaciers/GreatLakesMovie5.swf

1. What is the term for the period of Earth's geological history where much of the Northern Hemisphere was covered by ice? (slide 1 and 2)

   _____

2. According to the geological time scale in what era did the last ice age occur? (slide 3)

   _____

3. Was Michigan covered by the Laurentide glacier at its peak around 18,000 years ago? How do you know? (slide 4)

   _____

   _____

4. What affect can glacial erosion have on the land? (slide 5)

   _____

   _____

5. What caused the formation of the Great Lakes? (slide 6 - 10)

   _____

   _____

6. What is another word for "glacial boulder"? (slide 7, hint: see changing picture and caption)

   _____

7. Without the great weight of the glaciers land began to rebound. What does that probably mean? (slide 12) What is one other force that continues to change the size and shape of the Great Lakes? (slide 13) What prediction might you make for the state of the Great Lakes hundreds of years into the future? Explain your prediction.

   _____

   _____

How Does Glacier Movement Affect Earth?

Overview
Glaciers are massive bodies of ice that move across the surface of the Earth like rivers. As glaciers move, they change the surface of the Earth by wearing away loose rocks and soil and depositing them somewhere else.

Objective
Students will create a glacier model to observe what happens to the Earth's surface when ice moves over land.

Research Questions
How is glacial ice formed?
How do glaciers move?
What happens to the Earth's surface when a glacier moves?

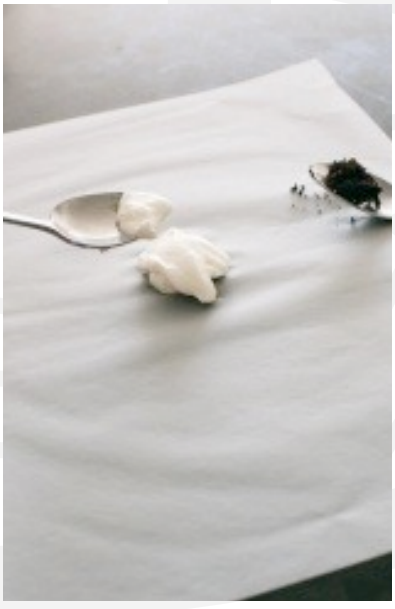
Grade Level: 3 – 5

Subject: Earth Science

Duration: 50-60 minutes or one class period

Materials
Cornstarch
Waxed paper
Spoon
Graduated cylinder
Water
Large bowl
Gravel
Sand
Soil

Experimental Procedure
1. Mix 1 ½ cups of water and 1 pound box of corn-starch in large bowl. Mix to where very little water is left standing on the surface.
2. Place a golf-ball sized spoonful of the mixture in the center of a piece of waxed paper.
3. Observe how the material behaves. Does it flow? This is much like the way ice deep in a glacier flows.
4. Draw a diagram of what your glacier model looks like.
5. On top of the glacier, place another spoonful of the mixture in the center. This is a "new snow" over the ice cap during the winter. What do you observe about the perimeter of the glacier?
6. Sprinkle sand, gravel, and soil in a 1 ½ inch band around the edges of the glacier. Use a marker to mark the perimeter of the band on the waxed paper.



7. Sprinkle a little soil on top of the glacier. This represents loose rocks and soil from the Earth's surface.
8. Place one spoonful of

Snowshoe Hike

Sleeping Bear Dunes National Lakeshore

the mixture at a time on top of the center of the glacier. After each spoonful, measure how far the ice cap moved. Observe what happens when the glacier reaches the sand. Stop adding "new snow" when the glacier is 1 ½ inches from the paper's edge.

9. Draw a diagram of your glacier. Compare the thickness at its edges and center.
10. Place a second piece of waxed paper on top of the glacier. Carefully turn it over so you can see the bottom of the glacier. Observe and draw a diagram of the bottom. What do you notice about the position of the sand and soil particles?

Terms / Concepts

Weathering; glacial movement; continental glaciers; valley glaciers; moraines; erratics

References

http://42explore.com/glaciers.htm
https://nsidc.org/cryosphere/glaciers

Other resources

For more advanced students: This resource could challenge higher level readers to understand information in print, diagrams, and pictures.

http://www.awesomemitten.com/how-the-great-lakes-were-formed/

A very simplified diagram explaining the formation of the Great Lakes:

http://greatlakesstlawrencelowlands.weebly.com/how-the-area-was-formed.html

Most comprehensive website about glaciers–good for further exploration:

http://42explore.com/glaciers.htm

Super Survivor! Post Visit

Objective
Students will design and create a model of a super survivor species after learning about winter plant and animal adaptations and develop an argument for the viability of the species on a new planet.

Scenario
(For students) You and a select group of scientists have been given the opportunity to colonize a new planet. As biologists and geneticists, it is your team's job to create a new species that will survive and thrive on this new planet. Winter is the primary season of this planet. The animals that make the journey must be super survivors in the winter. Only 10 animals will be chosen to make the journey so they must be survivors! Will it be your creation?

Grade: 3 – 5

Subject: Life science, Art

Duration: 1 – 2 class periods

Questions to guide research and thinking
What size? Big or small? Does size matter for survival?

What does it eat? What might eat it?

What is the species main purpose on the new planet?

How might adaptations work together to be more effective?

When choosing the top 10 consider how each species would interact with the others.

1. Research animal adaptations in the winter here on earth.
   How do animal survive the winter? Science Made Simple
   http://www.sciencemadesimple.com/animals.html

   Winter adaptations of animals: MSU Extension
   http://mff.dsisd.net/Environment/WinterAnimals.htm

   Physical and behavioral adaptations: video, Schoolmedia
   http://schoolmediainteractive.com/view/object/clip/F8583B4F33BC26EEBD7FE41BB739DA04/03
2. Brainstorm the special adaptations you will include in your new species: (More than 3, less than 6)
3. Make several sketches to find the perfect design. Choose your best idea, make a final drawing of your species. Label each adaptation.
4. Animal's common name

   _____

   Animal's scientific name

   _____
5. Write an argument paragraph that persuades the decision makers to choose your species as one of the top 10! Include a claim, reasons, detailed explanation of your reasons with examples or evidence, and a closing. You will present your sketch and ideas to your classmates.

Snowshoe Hike

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Tricky Tracks 2 Post Visit

Adapted from Nature of Science for grades 3 - 5

Objectives

To help the students distinguish between observation and inference.

To introduce the concept that all ideas are valid unless there is further evidence to suggest otherwise.

Teaching topics

This activity has been adapted for grades 3 – 5 and fits into a scheme of work anywhere where observations are made.

Background information

This activity assumes the following definitions:

An **observation** is what is actually seen.

An **inference** is interpreting what you see.

Teaching tips

This activity could be carried out as a whole class exercise, with individual students recording their own answers or in groups of 3–4 students.

The lesson could be introduced as follows:

Scientists are always putting forward ideas or theories to try and explain the things they see happening in the world.

Scientists often test their ideas and theories by carrying out some experiments. Sometimes new ideas come along which do not fit the old ideas. So more experiments have to be carried out to see if the new idea is correct.

Resources

OHP – if the activity is carried out as a whole class exercise. Photocopiable worksheets Tricky tracks A–C will need to be transferred onto OHT slides.

Class sets of student worksheets if the activity is to be carried out in groups

- Tricky tracks A
- Tricky tracks B
- Tricky tracks C
- Questions

Timing

60–70 minutes. Approximately half the time should be used to carry out the worksheet tasks and the rest of the time discussing the answers.

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Possible Lesson Plan

1. Give out the student worksheet Tricky tracks A and questions. The class starts the worksheets either individually or in groups and collects Tricky tracks B and C as required.

   Or if using an OHP, put up Tricky tracks A and give the class 10 minutes to do question 1, before putting up Tricky tracks B and Tricky tracks C.

2. Get feedback to the whole class by having some students read their answers to question 1. Try and get as many different explanations as you can. It is important to accept all explanations equally.

3. Go through the rest of the questions, pointing out the difference between observation and inference.

4. Finally, link this exercise to scientists, saying that scientists often make similar inferences as they try to interpret their observations. There may be several equally valid theories until new evidence comes along to change it.

Answers

1. All answers to question 1 should be accepted. Possible answers to question 1 could include:

   a) Two animals or birds were out hunting in the forest. On meeting each other at the clearing, they had a fight.

   b) Two animals or birds had a fight in the forest and then went off home to different places.

   c) The tracks lead down to the place where birds meet before going for a swim.

   During the day many different birds will come and go, that is why you can see so many tracks. The big birds and little birds live in different places and that is why the big tracks go off in a different direction to the small tracks. Most of the birds arrive and leave by air, so you cannot see their tracks on the ground. Usually the small birds and the large birds go to the ponds at different times because the little birds try to avoid the big birds, which often chase them.

   d) One day a large male dinosaur was out looking for food. As he was searching a small area he noticed a beautiful female dinosaur coming towards him. It was love at first sight. Being a little shy, he hid behind a rock and when she got closer he jumped out and introduced himself. At first she was afraid, she thought that he was going to attack her and she tried to escape. But when he spoke and told her not to be afraid, they sat down on the rock and had a good chat.

2. In Tricky tracks 2 we see two sets of marks. The marks on the left side of the page are bigger than on the right side of the page. Each big mark has three points coming out of a small black blob. The marks form a diagonal line. Each mark is pointing in the same direction. The marks on the right hand side of the page have three points coming

out of an elongated blob. There are two rows of marks going along the side of the page. There are 14 big marks and 34 small marks. The marks on the right hand side of the page have three points coming out of an elongated blob. There are two rows of marks going along the side of the page.

Only accept answers that describe what is actually seen on the page. Do not accept any answers that try to interpret what the marks are. A typical student answer might be:

'I can see two sets of bird tracks on the page. One bird is bigger than the other bird.'

Challenge the student: How do you know they are bird tracks? Could the tracks belong to anything else?

Explanation: You should now explain that an observation is what you see on the page, not what you think you see on the page.

The typical student answer given above, had been interpreted by using some other knowledge. The student reasoning could be as follows:

'From previous knowledge, I know that these marks resemble birds tracks. I know that big birds have bigger feet than small birds, therefore I have used bird tracks in my answer.'

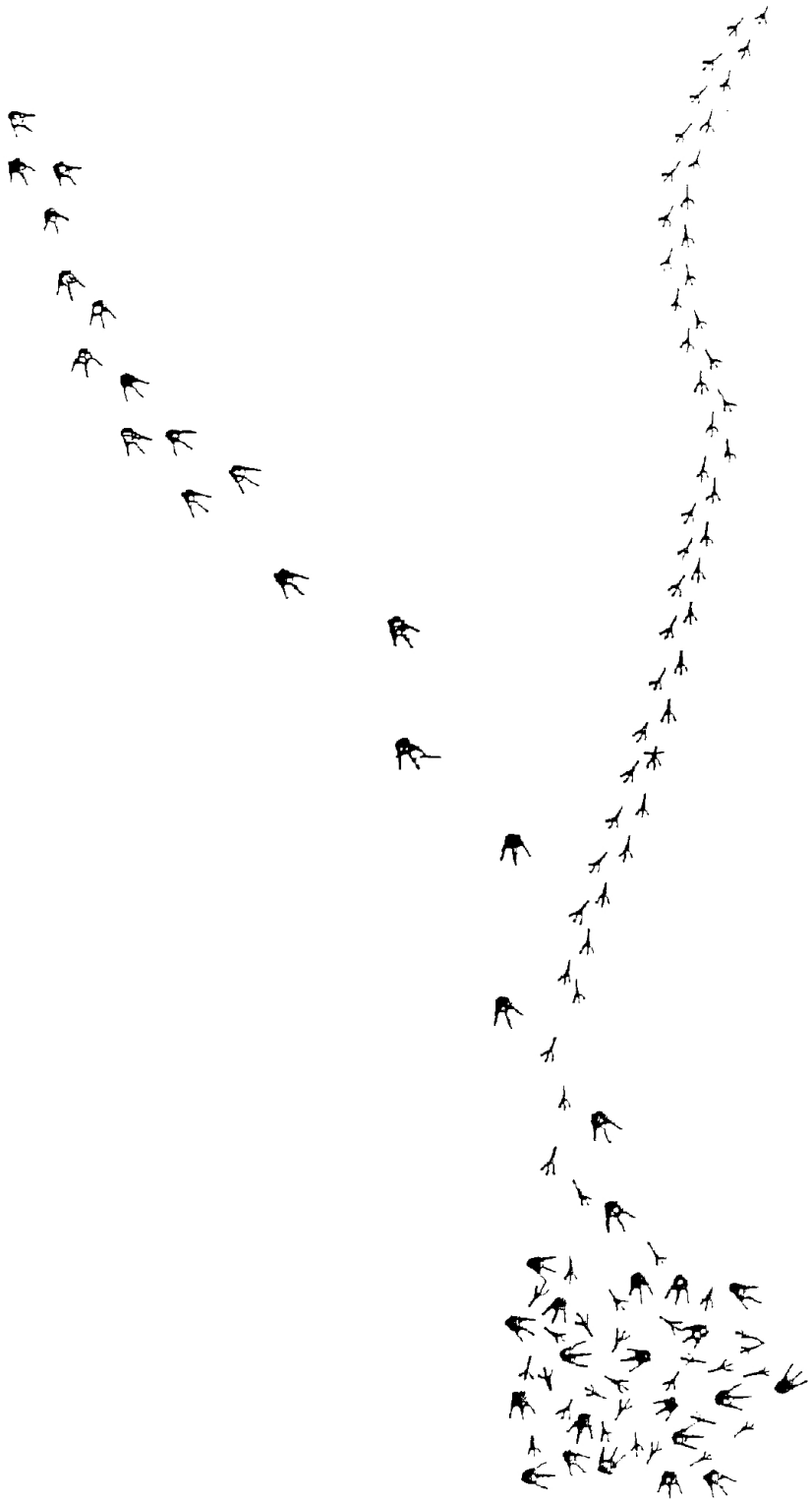
Remind the class of the question, 'What do you **observe** in **Tricky tracks B**?'

3 & 4. These should be treated in the same manner as question 2. You may wish to give the class time to change the answer to their questions, in the light of the answer to question 2.

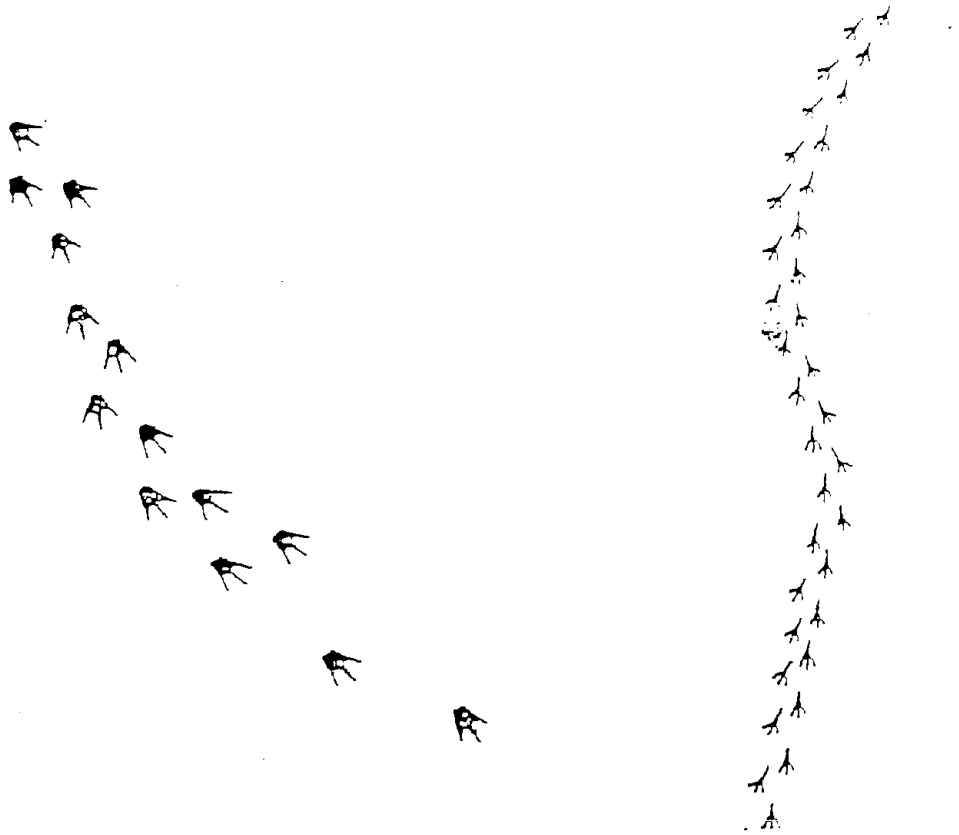
5. Based on the current evidence, we can never know what has really happened. We can only imagine what has happened. Therefore, at each stage all the theories put forward in question 1 are equally valid.

6. To find out more about the situation we could look try and identify the tracks using a key. Once the tracks were identified, more could be found out about the behavior of the animals, which may offer support to some theories and not to others.

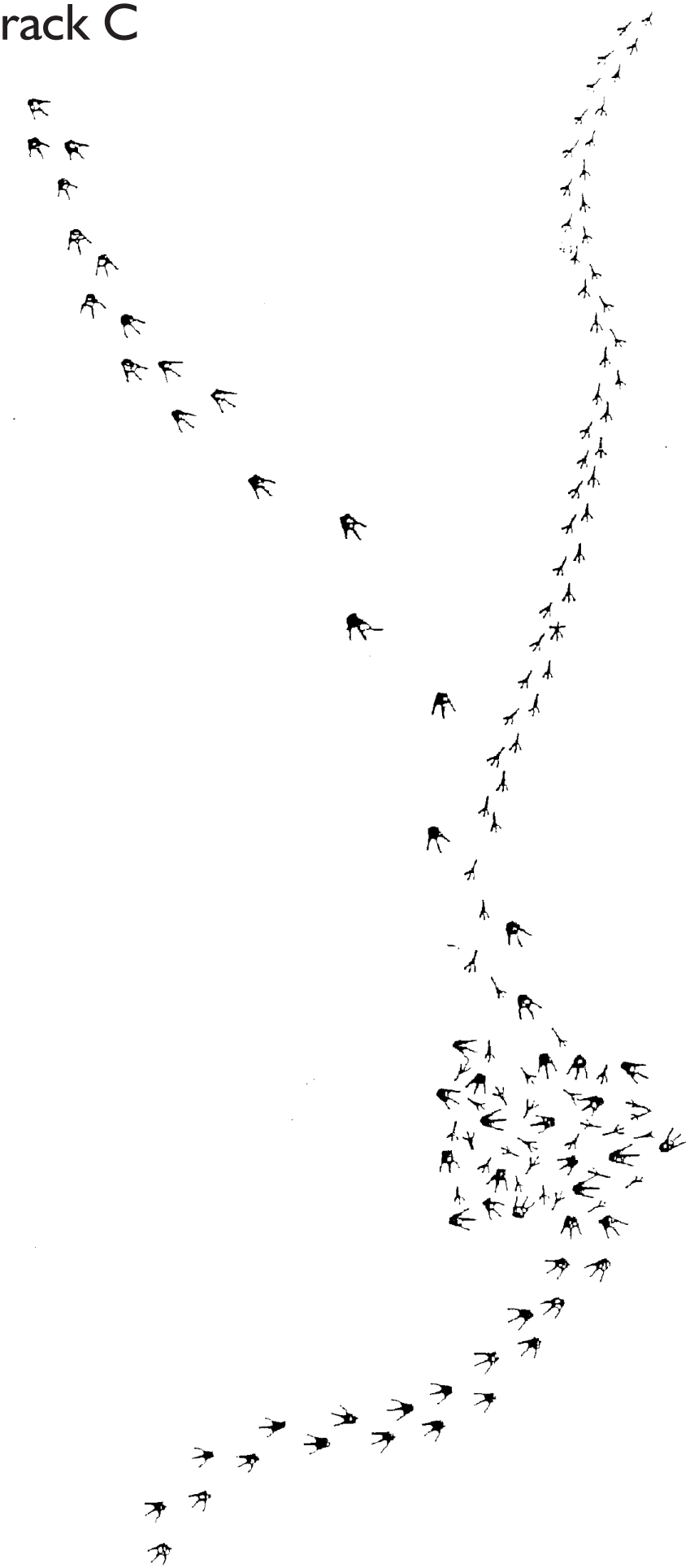
Tricky Track A



Tricky Track B



Tricky Track C



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Tricky Track 2 Questions

1. Carefully study Tricky Tracks A and write a short account (story) of what you think has happened.

Now collect Tricky tracks B from your teacher.

2. What do you **observe** in Tricky tracks B?

Now collect Tricky tracks C from your teacher

3. What do you **observe** in Tricky tracks C?

4. Now go back to Tricky Tracks A. What do you **observe**?

5. Based on what you have found out so far, do you think we can ever know what has really happened?

6. What could you do to find out more about the situation?

Glaciers: Then, Now, and in the Future Post Visit

Objectives
Students will learn where the world's glaciers are located, how they are changing, and what the implications of change may be for the future.

Glaciers: Then and Now
Students compare photographs of glaciers to observe how Alaskan glaciers have changed over the last century.

http://www.windows2universe.org/teacher_resources/teach_glacier.html

Glaciers: Impact on the future
Student friendly interactive website designed to explain the impact of melting glaciers on the future. Students can explore many related topics that may interest them.

http://www.epa.gov/climatechange/kids/impacts/signs/glaciers.html

Activity:
Climate Change Card Games
A series of cards are provided that can be used to play card games based around climate change. They offer an opportunity to practice literacy skills in reading, speaking and listening.

The cards
There are a total of 32 cards.
The cards cover 8 different countries. Each country card shows one of:

- The effects of climate change in the country
- A solution to help the people tackle the effects of climate change
- A personal story
- A map of the world with the country marked on it

There is also a sheet showing the Practical Action logo that can be copied onto the back of the cards.

Subjects
English – speaking, listening, reading.

Activities
A range of games can be played using the cards. A few are suggested below. Be creative!

Resources
Photocopies of cards (preferably on card stock)
See link: http://www.nationalstemcentre.org.uk/dl/53ea4f43c37fb2d14b6b1b415f5d1b598bf5e-aed/4074-card_games_cards.pdf

Snowshoe Hike

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Suggested Games

Collect the countries

The object of the game is to collect all the cards for two countries (4 players max). Use all the cards.

1. Deal out the cards. If 3 players, leave last two face down on table.
2. In turn place one card down on the table and pick up one card.
3. Winner is first person to collect two complete countries. i.e. the problem card, solution card, personal story and map.
4. At the end of the game, all children read out the problem, solution and personal story information for the countries they have completed.

Match the pairs

Object is to match the pairs of problem and solution cards for each country. The game uses just the problem and solution cards.

1. Spread the climate change problem cards (sad smiley) face down on the table
2. Spread the solution cards (happy smiley) face down next to the problem cards
3. Players pick up one of the problem cards and read out loud, the country and the problem that is described
4. Same player then tries to pick solution card for the same country
5. If successful, they read out the solution and keep the pair
6. If not successful, replace both cards face down in original position
7. Winner is one with the most pairs when all cards have been collected

This could be made more difficult by including the personal story card so that a 'set' consists of all three cards.

Sleeping Bear Dunes Mission Ad Campaign

Overview
After completing the pre, during, and post lessons surrounding the 4th grade snowshoe field trip, students will have a better appreciation and understanding of the importance of preserving and protecting Sleeping Bear Dunes historical, cultural, and natural treasures. For this lesson, students will design an ad for the Sleeping Bear Dunes National Lakeshore that promotes the park in a way that supports the park's mission statement.

Objectives
- Students will create an ad that promotes the Sleeping Bear Dunes mission statement.
- Students will justify how their ad supports the mission statement.
- Students will present their ad projects to an audience.

Grades: 3 – 5

Duration: 2 – 3 class periods

Sleeping Bear Dunes National Lakeshore Mission Statement
The mission of the Sleeping Bear Dunes National Lakeshore is to **preserve** the outstanding natural features along 65 miles of Lake Michigan shoreline, in order to perpetuate the natural setting for the benefit and **enjoyment** of the public, and to **protect** the natural and historic features from developments and inappropriate uses that would destroy their scenic, scientific, historic, and **recreational** value.

Steps
First have students read through the mission statement and pick out key terms that will become the focus of their ads.

Next have students brainstorm different forms of advertisements that they have seen in the real world. Responses might be: short video, brochure, poster, radio announcement, bumper sticker, buttons, T-shirt design, song or jingle, slogan

Analyze model ads. Use actual magazines or this link to explore advertisements.

Interactive exploration of advertisements:
http://pbskids.org/dontbuyit/advertisingtricks/

Ads that Made a Difference:
http://www.adcouncil.org/Our-Campaigns/The-Classics

Questions that students may use to notice important elements in the advertisement:
- What is being advertised?
- What is the message?
- Who is the intended audience?
- How are images, words, colors used to capture attention?
- How does the advertisement tap into emotions?

Have students create a list of criteria for their advertisements based on what they see in the models: These could include:
- Create an interesting character
- Introduce a human touch using personification
- Take it over the top using exaggeration
- Say it symbolically using metaphor, similes, images

Snowshoe Hike

Sleeping Bear Dunes National Lakeshore

- Tug at heart strings using emotion
- Make it simple, visually appealing, memorable

After students review model advertisements and create a list of criteria (rubric) for their advertisements, students should begin using the above questions to plan their own message and advertisement.

Snowshoe Hike

Sleeping Bear Dunes National Lakeshore

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