

# Glaciers in Indiana

## Key Objectives

Students will understand how glacial ice and melting water shaped and reshaped the Earth's land surface by eroding rocks and soil in some areas and depositing them in other areas in a process that extended over a long period, and will look at how the glaciers affected two Indiana State Parks.

## State Parks Featured

- Pokagon State Park [www.stateparks.IN.gov/2973.htm](http://www.stateparks.IN.gov/2973.htm)
- Chain O'Lakes State Park [www.stateparks.IN.gov/2987.htm](http://www.stateparks.IN.gov/2987.htm)

Activity:	Standards:	Benchmarks:	Assessment Tasks:	Key Concepts:
<b>Time and Motion</b>	SCI.4.2.2 2010	Describe how wind, water and glacial ice shape and reshape earth's land surface by eroding rock and soil in some areas and depositing them in other areas in a process that occurs over a long period of time.	Explain how a glacier is formed and moves along, and what natural features it can leave behind.	Glaciers Glaciers and natural features of IN State Parks Glacial vocabulary
	ELA.4.SL.2.4	Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.	Understand the different glaciers that moved across Indiana and the parts of the state they reached.	
<b>Left Behind: Glacial Parks in Indiana</b>	SS.4.3.1 2007	The World in Spatial Terms: Use latitude and longitude to identify physical and human features of Indiana. Example: Transportation routes and major bodies of water (lakes and rivers)	Identify the location of two Indiana State Parks using latitude and longitude	
	ELA.4.SL.2.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) on grade-appropriate topics and texts, building on others' ideas and expressing personal ideas clearly.	Discuss and understand some the glacial features at Chain O'Lakes and Pokagon.	
	ELA.4.SL.2.4	Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.	Discuss and understand some the glacial features at Chain O'Lakes and Pokagon.	

## Key Resources

- Indiana Geological Survey: Indiana Glacial Boundaries <http://igs.indiana.edu/Surficial/IndBoundries.cfm>
- Indiana Geological Survey: Ice Age in Indiana <http://igs.indiana.edu/Surficial/IceAge.cfm>
- Indiana Geological Survey: After the Thaw—Development of Lake Michigan <http://igs.indiana.edu/FossilsAndTime/LakeMichigan.cfm>
- Post Geology of Pokagon and Geology of Chain O'Lakes online [http://igs.indiana.edu/ReferenceDocs/StateParkGuide\\_Pokagon.pdf](http://igs.indiana.edu/ReferenceDocs/StateParkGuide_Pokagon.pdf)
- Post Geology of Indiana Dunes online [http://igs.indiana.edu/ReferenceDocs/StateParkGuide\\_ChainOlakes.pdf](http://igs.indiana.edu/ReferenceDocs/StateParkGuide_ChainOlakes.pdf)

## Activity 1: Time and Motion

### Activity Summary

During this lesson students will investigate how a glacier moves over time. Students will use a piece of paper and a pencil to make observations and relate what they see to the formation of a glacier.

**Activity Length: 60 minutes**

### Background

The Ice Age started over one million years ago and ended in Indiana about 15,000 years ago. During colder Ice Age periods, the Earth's temperature was lower, and there was a lot of snow. Snow piled up faster than it melted, getting deeper and deeper. As the snow piled up, its weight formed into a **glacier** of solid ice.

If you drop a clump of wet sand on a sidewalk, it spreads out. If you drop a second clump at the same spot, the first clump spreads out further. This is how glaciers moved. As snow continued to fall in the north, the weight pushed the edges of the glacier further south.

The Ice Age shaped Indiana's **landscape**. Glaciers flattened hills, buried rivers, dug out new lakes and pushed piles of rocks into new hills called **moraines**. As the glaciers melted, large amounts of water carved the paths of Indiana's rivers.

Today we see **evidence** of glaciers in Indiana, especially in northeastern Indiana. The many lakes, low hills and **boulders** in northeastern Indiana are signs of our most recent glaciers.

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### Vocabulary

**Glacier:** a large, flowing river of ice that moves very slowly

**Landscape:** a section or expanse of scenery

**Moraines:** a long hill of earth and stones carried and deposited by a glacier

**Deposited:** to put or leave (someone or something) in a particular place

**Evidence:** proof

**Boulders:** a large rounded rock

### Materials Required

- Paper Glaciers: paper, pencils
- A Human Glacier: ID tags for glaciers (10-12), rocks (5-6) and debris (5-6)

### Focus Questions

- What is a glacier?
- How is a glacier formed and how does it move?
- How were natural features like the Ohio River and Lake Michigan formed by the presence of the glaciers?

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### Step-By-Step Directions

Begin with a discussion of what glaciers are, when they were here and how the landscape might have looked during their advancement across portions of what is now Indiana. Use the focus questions and resource links identified. Use one or both of the activities below.

#### Paper Glaciers

1. Ask students, individually or in groups, to fold a piece of paper inward about 1 inch on two sides, and then fold the paper in half. Stand the paper on a desk so the piece of paper looks like a tent.
2. Have them place the pencil in front of the piece of paper. The paper represents a glacier; the pencil represents the land in front of the glacier.
3. Press gently on the paper. This represents the pressure that was being applied by years of falling snow. Have the students record observations. Ask what happens to the pencil? Ask what direction the glacier moves.
4. After recording observations, crumple the paper. Ask what effect might crumpling the paper might have on the glacier movement? Repeat the activity several times with the crumpled paper and record observations. Ask the students what way they think best demonstrates how a glacier moves and why. Note: The crumpled-paper approach better represents the way a glacier might move.
5. Hold a discussion using these questions and others: What best represents how a glacier moves? Where is the pressure

coming from on a glacier? What does the pencil represent?

#### A Human Glacier

1. Move aside desks and tables in the room where possible.
2. Ask 10 students to stand at one end of the classroom and lock elbows. This will represent part of a glacier. Give them ID tags. Ask the other students to scatter throughout the room. They will represent rocks and soil that is picked up by the glacier. Give them ID tags as well.
3. Have the "glacier" move forward. As the glacier moves forward, it adds debris (students) to the glacier. ("Rocks" and "debris" lock their elbows to the glacier.)
4. Stop the "glacier" and ask it to "retreat" to its original location. As the glacier begins to retreat, have the rocks and debris fall to the ground. Some may form a line where the glacier stopped; some may be dropped further along the retreat pathway.
5. Experiment with varying speeds for movement of the glacier. Try having some students move faster than others. Try stopping the glacier after varying periods of time.

Lead a discussion about how this relates to Indiana. Not every student will be picked up by the glacier, depending how far across the room you allow the "glacier" to move. This represents parts of southern Indiana. The rocks and debris left behind can represent glacial gravel and erratics still found today.

Glacier



Glacier



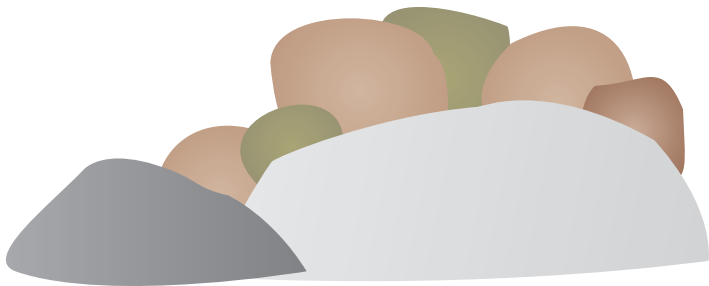
Glacier



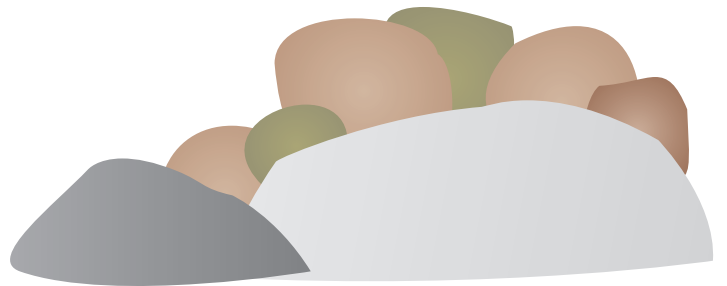
Glacier



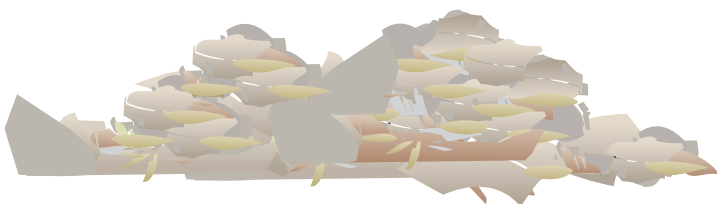
Rocks



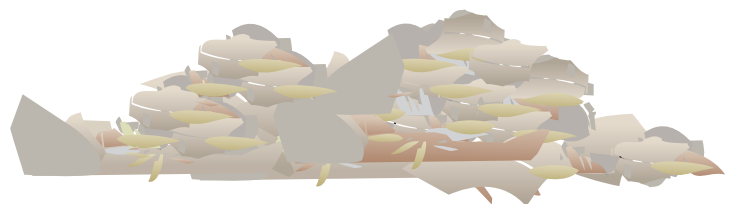
Rocks



Debris



Debris



## Activity 2: Left Behind: Glacial Parks in Indiana

### Activity Summary

This activity will introduce students to the locations of Indiana State Parks and to how glaciers impacted the landscape on which these DNR properties are located using maps and photos of glacial features in two Indiana State Parks.

**Activity Length: 60 minutes**

### Background

Chain O'Lakes State Park and Pokagon State Park are located in northeast Indiana, where evidence of the glaciers that moved across the region can be seen. During an age when the climate was approximately 10 degrees cooler, more snow fell in the winter than melted in the summer. As an accumulation piled up over thousands of years, it formed an ice sheet that flowed from Canada over northern Indiana. The glacier that began melting 10,000 to 15,000 years ago was the

last one of four to cover Indiana and has been named the Wisconsin glacier. The Saginaw lobe of this massive, one-mile thick, ice flow was the last of the "great forces" of Mother Nature to leave a lasting impression on the face of the lands of these two parks. Glacial features that can be seen include **kettle hole lakes, kettle depressions, glacial kames, eskers** and **glacial erratics**.

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### Vocabulary

**Kettle hole lake:** When blocks of ice broke away from the mass of a glacier and wedged into surrounding earth, they melted, and left behind small lakes.

**Kettle depression:** Bodies of water and connecting wetlands formed by the gouging of earth, piling of surrounding debris, and the deposits of sand and stone.

**Glacial Kame:** Kames were created where water from the melting glaciers ran across the glacier's surface and into a large hole in the ice. The water carried sand and rocks, just as modern day rivers do today. When the ice around the holes melted large piles of sand and rock remained.

**Esker:** A long winding ridge of stratified sand and gravel of peculiarly uniform shape that was deposited under a glacier.

**Erratics:** Glacial boulders varying in size from a baseball to a small car that were left behind as glaciers receded.

### Materials Required

- Map identifying glaciers/glacial periods in Indiana [igs.indiana.edu/images/allenCounty/surficialgeology3.jpg](https://igs.indiana.edu/images/allenCounty/surficialgeology3.jpg)
- DNR webmap showing the locations of Indiana State Parks. [dnrmaps.dnr.in.gov/apps/sites\\_spr.htm](https://dnrmaps.dnr.in.gov/apps/sites_spr.htm)
- Handout showing glacial features at Chain O'Lakes State Park and Pokagon State Park

### Focus Questions

- How were natural features like the Ohio River and Lake Michigan formed by the presence of the glaciers?
- Why do northern Indiana and southern Indiana have different natural features?
- What are some of the features that provide evidence that glaciers were here?

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### Step-By-Step Directions

1. Discuss with students the advance and retreat of glaciers in Indiana. Use the map at [igs.indiana.edu/images/allenCounty/surficialgeology3.jpg](https://igs.indiana.edu/images/allenCounty/surficialgeology3.jpg) that identifies the general advance of the Wisconsin glaciation and match the location of each of Indiana's state parks using the DNR web map provided at [dnrmaps.dnr.in.gov/apps/sites\\_spr.htm](https://dnrmaps.dnr.in.gov/apps/sites_spr.htm). Which properties appear to be more or less impacted by the glaciers from what we know today?
2. As a class, locate with latitude and longitude the locations of both Chain O'Lakes and Pokagon State Parks. Should these two parks exhibit evidence of glaciers in Indiana?
3. Talk about several classic features that are evidence of a glacial past as identified in the vocabulary.
4. Match the photos provided of glacial features at Chain O'Lakes and Pokagon state parks on the DNR webmap pdf with the feature names and descriptions provided.

5. Locate these features on the property map for each park. Identify whether they are glacial erratic, kettle lake, glacial till, moraine, or something else.

### Extension Ideas

- Take a field trip to Pokagon or Chain O'Lakes state park to learn about the impact of the glaciers in northeast Indiana.
- Take a field trip to Indiana Dunes State Park to learn about the impact of the glaciers on the formation of Lake Michigan.

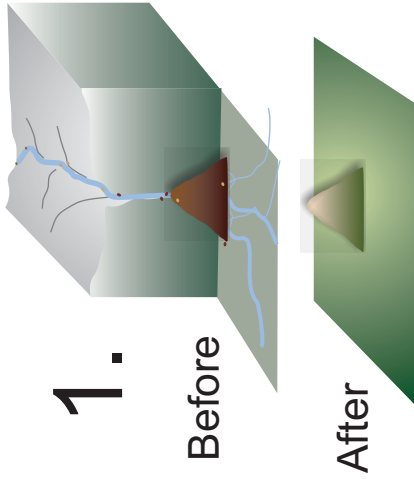
### Resources

- These brochures were developed by the Indiana Geological Survey.
- Fossils at Brookville Lake [www.in.gov/dnr/kids/files/ed-BrookvilleWhitewaterFossils.pdf](https://www.in.gov/dnr/kids/files/ed-BrookvilleWhitewaterFossils.pdf)

Name: \_\_\_\_\_

Draw a line from the description of the glacial feature to its diagram.

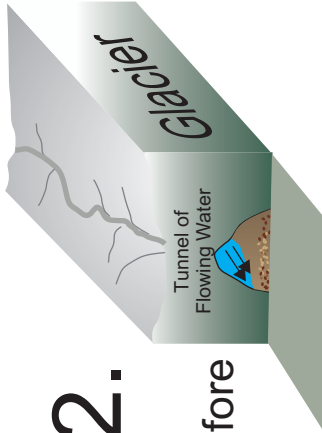
1.



Before

After

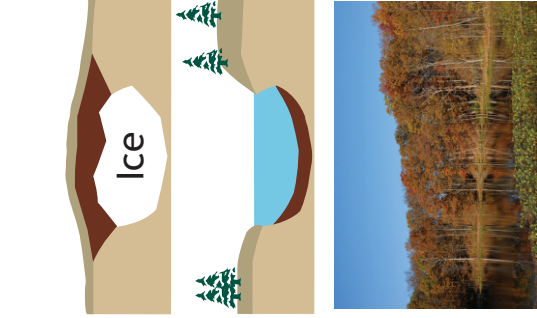
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Before

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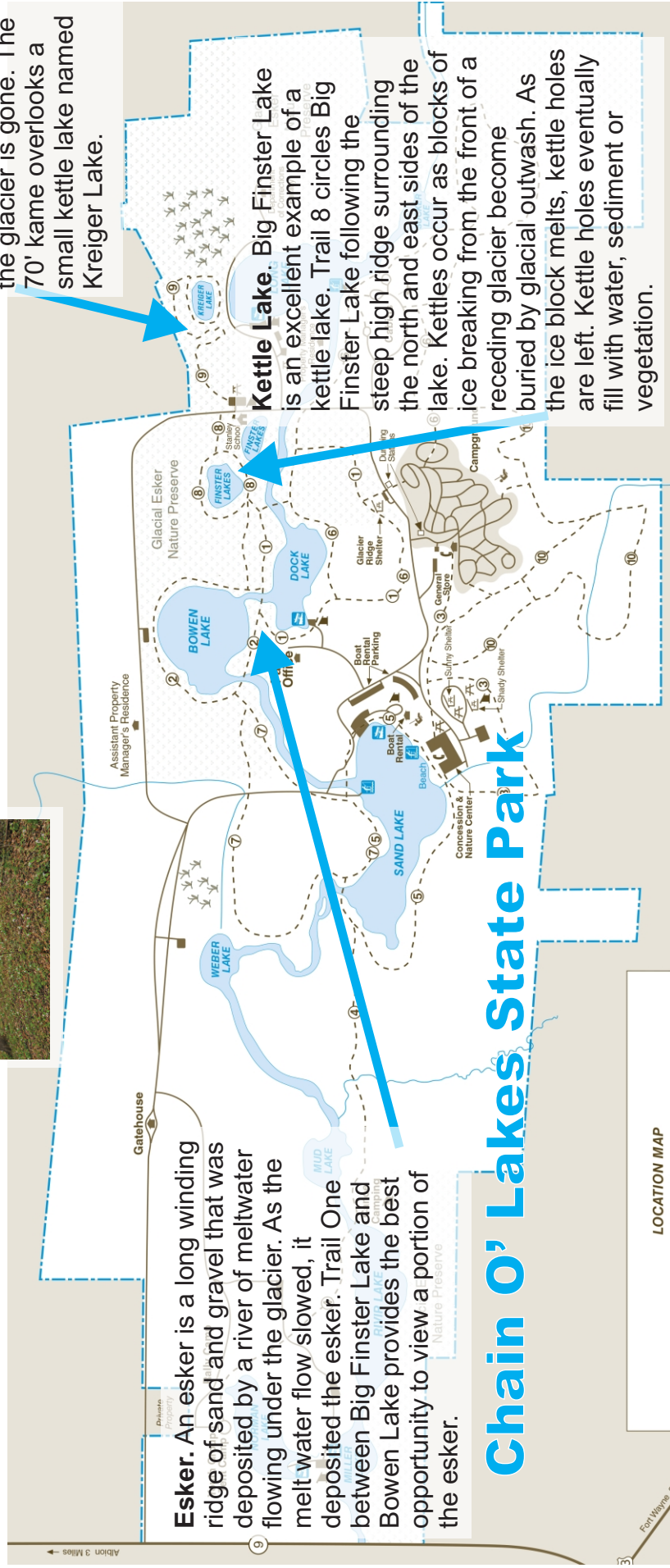
Before

After

**Kame.** Trail 9 in the Glacial Esker Nature Preserve traverses a kame. A kame is an irregularly shaped hill or mound composed of sand and gravel that fills a depression on a melting glacier. The debris is deposited on the land surface once the glacier is gone. The 70' kame overlooks a small kettle lake named Kreiger Lake.



**Esker.** An esker is a long winding ridge of sand and gravel that was deposited by a river of meltwater flowing under the glacier. As the melt water flow slowed, it deposited the esker. Trail One between Big Finster Lake and Bowen Lake provides the best opportunity to view a portion of the esker.



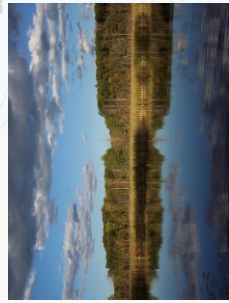
**Kettle Lake.** Big Finster Lake is an excellent example of a kettle lake. Trail 8 circles Big Finster Lake following the steep high ridge surrounding the north and east sides of the lake. Kettles occur as blocks of ice breaking from the front of a receding glacier become buried by glacial outwash. As the ice block melts, kettle holes are left. Kettle holes eventually fill with water, sediment or vegetation.

# Chain O' Lakes State Park

Name: \_\_\_\_\_

Draw a line from the description of the glacial feature to its diagram.

Kettle Hole Lake. Lake Lonidaw is an example of a kettle hole lake. When the most recent glacier melted and receded, blocks of ice broke away from the glacier. Some wedged into surrounding earth, melted, and left behind small lakes. Standing along the shore of a kettle hole lake, you get the impression of a bowl.



Kettle Hole Lake. Lake Lonidaw is an example of a kettle hole lake. When the most recent glacier melted and receded, blocks of ice broke away from the glacier. Some wedged into surrounding earth, melted, and left behind small lakes. Standing along the shore of a kettle hole lake, you get the impression of a bowl.

Kame. Hell's Point is a perfect example of a glacial kame. Kames were created when water from the melting glaciers ran across the glacier's surface and into a large hole in the ice. The water carried sand and rocks. The water carrying this debris poured into holes and when the ice around the holes melted, large piles of sand and rock remained.



Glacial Esker. As melt water flowed across the ice, it cut into the ice, forming a river. The water carried sand and gravel and as surrounding ice melted, the winding, twisting river, left behind a high ridge of this debris. Trail three on the south side of Lake Lonidaw is a winding ridge with the lake to the north and an oak-hickory valley to the south.

Glacial Esker. As melt water flowed across the ice, it cut into the ice, forming a river. The water carried sand and gravel and as surrounding ice melted, the winding, twisting river, left behind a high ridge of this debris. Trail three on the south side of Lake Lonidaw is a winding ridge with the lake to the north and an oak-hickory valley to the south.

# Pokagon State Park

