



## Glacial Detectives

**OVERVIEW:** Students will learn basic glacial concepts in preparation for a trip to Exit Glacier or deeper exploration of the site online.

**OBJECTIVE:** Students will learn about glacial features by examining real photographs from Kenai Fjords National Park. In small groups, students will study photos and learn how glaciers move, how they affect the lands around them, and what clues they leave when they have been in an area.

**BACKGROUND:** Teachers need to read the Glaciers and Harding Icefield sections of this manual. Together as a class, read chapters 3, 4 and 5 of Frozen in Motion.

**VOCABULARY:** Braided Stream, Calving, Cirque Glacier, Crevasse, Fjord, Glacial Advance, Glacial Recession, Glacier, Iceberg, Icefield, Moraine, Morphology, Outwash Plain, Serac, Striation, Tidewater Glacier, Valley Glacier.

**PROCEDURE:** Set up 7 stations and place pictures from each of the above groups at each station. Divide the class into 7 "Investigative Teams." Tell them they will be working as a group to unravel clues about glaciers.

Give each team a Glacial Detective Form and let them know they will have about 5 minutes at each station. Their job is to look at the pictures and try to answer the questions for each station in as much detail as they can.

Keep time and let groups know when they should move on to the next station.

**GRADE LEVEL:** 3-5

**SUBJECT:** Glaciers

**KEYWORDS:** Glacial Advance, Moraine, Outwash Plain, Striations

**DURATION:** 45-60 minutes

**GROUP SIZE:** 7 groups

**SETTING:** Classroom

**NATIONAL STANDARDS:** Science D 1, F 4, G 1

### MATERIALS

You will need to go online and print out the photographs and worksheet found in this lesson plan. To enlarge photos and manipulate spacing on worksheet go to <http://www.nps.gov/kefj/forteachers/index.htm>

Print and laminate (only include station numbers on student copies):

Station 1 - Exit Glacier 1950 and 2007

Station 2 - Outwash Plain and Braided Streams

Station 3 - Striations and Moraines

Station 4 - Crevasses and Seracs

Station 5 - Holgate Glacier Calving

Station 6 - The Harding Icefield and aerial view of fjords

Station 7 - Two pictures of park rangers: one with an audience in front of a glacier; one banding a bird or taking a hair sample from an animal.

Print enough copies of the Glacial Detectives form for each student group.

**ASSESSMENT:** At the end of 30 minutes gather the groups together and discuss each of the stations. Students should be able to grasp these concepts in the group discussion:

- ✓ How are glaciers formed?
- ✓ Do glaciers move? If so, what causes them to move?
- ✓ What are some signs of movement you may have seen in the photographs?
- ✓ Do glaciers affect the land around them? In what ways?
- ✓ Does the land or do people affect glaciers? In what ways?
- ✓ Are there different kinds of glaciers? Can you say what makes them different?
- ✓ Why do we have a national park with glaciers in it?
- ✓ Do you think there are any history lessons in Kenai Fjords National Park?

**PARK CONNECTIONS:** To help students understand the concept of national parks spend some discussion time on station 7 and the bonus question.

The four reasons we have national parks are:

1. Conservation—Parks help preserve the animals and the ecosystem that supports them.
2. Education—So that anyone can visit parks and learn more about the geology, biology, and cultural history that are a part of the park.
3. Enjoyment—So people can come and just appreciate the beauty and wonders.
4. Inspiration—Hopefully, once you've seen a national park you'll leave feeling different, perhaps wanting to draw or paint or write. Inspiration is the feeling that drives many artists to create.

**EXTENSIONS:** For older groups, spend some time talking about the Harding Icefield.

What is an icefield?  
How does it form?  
When did this one form?  
What conditions make Seward a place where icefields and glaciers can exist?

Plan a field trip to Kenai Fjords National Park. Visit the "For Teachers" page at <http://www.nps.gov/kefj/> to reserve a date.

## BONUS

Ask learners to decide what makes Kenai Fjords National Park so special?

The answer to the bonus question is the United States was the first nation to recognize the value of setting lands aside so future generations could enjoy undisturbed, the wildness, beauty and history preserved in each site.

It is also empowering to remind students that these lands belong to them.

## TIPS

For younger groups, you might develop Hint Cards for each station. Have them attempt to complete the station without a hint card but allow them to check the hint if they need to.

### HINTS:

Station 1 - Is Exit Glacier growing or shrinking?

Station 2 - Do you see any plants? What do you mostly see in this picture?

Station 3 - Look at the rocks in the first picture; are there marks on these rocks? In the second picture look at the piles of rocks; how did they get here?

Station 4 - The mountain that this glacier comes down is not smooth.

Station 5 - Seawater is warmer than glacial ice.

Station 6 - Picture one feeds all of the glaciers in the park, picture two is a little like the footprint of a glacier.

Station 7 - The rangers are helping a bird; the ranger is teaching students.

## ADDITIONAL RESOURCES

Alaska's Glaciers: Frozen in Motion by Katherine Hocker, Alaska Geographic, Anchorage, 2005.

[www.nps.gov/kefj/forteachers/index.htm](http://www.nps.gov/kefj/forteachers/index.htm)

## STATION 1



Exit Glacier in 1950

Historical Society



Exit Glacier in 2007

USGS photograph by Bruce Molnia

## STATION 2



An aerial image of Exit Glacier and the immediate surroundings.

NPS photograph



Exit Glacier and its surroundings.

NPS photograph

### STATION 3



USGS photograph by Bruce Molnia

This boulder has been altered by the passage of glacial ice.



NPS photograph by Doug Capra

Exit Glacier and surrounding area.

### STATION 4



© Ron Niebrugge courtesy of NPS

This photo shows the face and upper edge of Exit Glacier.



NPS photograph by Lisa Gordon

This photo shows the surface of Aialik Glacier.

### STATION 5



Holgate Glacier.

NPS photograph by CJ Rea

## STATION 6



The Harding Icefield.

NPS photograph by Jim Pheiffenberger



USGS photograph by Bruce Molnia  
The coastline of Kenai Fjords National Park.

## STATION 7



A park ranger working at Exit Glacier.

NPS photograph by Doug Capra



A park ranger working in the field.

NPS photograph

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## GLACIAL DETECTIVES WORKSHEET

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

### STATION 1

These two pictures were taken at Exit Glacier 57 years apart.  
What do they tell you about how Exit Glacier is changing?

### STATION 2

These two pictures were taken of the land in front of Exit Glacier.  
How is this area different from other wild and unpopulated places you know of?

Describe the area:

### STATION 3

These two photographs show clues that glaciers were once here.  
What are the clues?

How were the clues formed?

### STATION 4

These two pictures show features found on a glacier.  
Describe what you see and if you know the names of these features write them down.

Can you guess how they may have been created?

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### STATION 5

This is a picture of Holgate Glacier. Holgate is a glacier that ends in the water. What is happening in this picture?

Can you guess why we don't see this occurring in the pictures of Exit Glacier?

### STATION 6

These pictures are of large features found in Kenai Fjords National Park. Describe what you see in the pictures. If you can, name the features.

Can you guess how these features were formed?

### STATION 7

These are pictures of park rangers at work. What are the rangers in these pictures doing?

Can you list 2-3 reasons why we have park rangers and national parks?

Bonus Question: What was the first country to come up with the idea of setting aside national lands to create parks?