

RESOURCE LIBRARY | ACTIVITY : 2 HRS 5 MINS

# Precious Freshwater

Students explore maps and diagrams related to freshwater accessibility and relate it to the Ganges (Ganga) River Basin. Then, students read about groundwater, snowpack, and glaciers as sources of freshwater. Students analyze an infographic to note the connection between the population in the Ganges River Basin and the significance of glaciers and snowpack to the rivers.

## GRADES

6, 7, 8

## SUBJECTS

*Biology, Ecology, Conservation, Earth Science, Climatology, Geography, Physical Geography*

## CONTENTS

2 Images, 2 PDFs, 4 Links, 6 Resources

## OVERVIEW

Students explore maps and diagrams related to freshwater accessibility and relate it to the Ganges (Ganga) River Basin. Then, students read about groundwater, snowpack, and glaciers as sources of freshwater. Students analyze an infographic to note the connection between the population in the Ganges River Basin and the significance of glaciers and snowpack to the rivers.

For the complete activity with media resources, visit:

<http://www.nationalgeographic.org/activity/precious-freshwater/>

## In collaboration with

# DIRECTIONS

This activity is part of the Peak Water: Mount Everest and Global Water Supply unit.

**1. Guide students in their exploration of maps and diagrams related to freshwater availability and connect it to the Ganges (Ganga) River Basin, one of the most populated river basins in the world and found at the base of Mount Everest.**

- Distribute or project the Freshwater Availability map. Ask students what they notice about where our readily accessible freshwater is located.
  - Ask students to identify their location on the map.
  - In pairs, have students interpret the map to see if their country is in an area of water scarcity, stress, or vulnerability.
  - Have students work with a partner to find out how much water is available per person in their country, according to the map.
  - Circulate findings to encourage discussion and provide assistance as needed.
- Next, assist students in locating India, where the Ganges River Basin is mostly located, on the map. Explain its source, its connection to the Himalaya, and how it connects to the Peak Water: Mount Everest and Global Water Supply unit.
  - In pairs, have students interpret the map to find out if India is in an area of water scarcity, stress, or vulnerability.
  - Have students work with a partner to find out how much water is available per person in India, according to the map.
- Ask students: *Why do you think freshwater is so scarce globally, despite the fact that the Earth is covered in water?* Show the Water Distribution on Earth diagram.
  - Have students use the diagram to identify what percentage of Earth's water is saltwater (97.5 percent) and the three major sources of freshwater (lake and river storage, groundwater, and glaciers/snowpack).
  - Ask: *Of the three major sources of freshwater, where is the bulk of freshwater stored? What do you find surprising about this information?*
- Connect the discussion to Everest by asking students: *Which of these three major freshwater sources do you think that people living near Everest rely upon?* (Elicit student ideas; no correct response needed at this point.)

## 2. Facilitate student learning of groundwater, snowpack, and glaciers as sources of freshwater.

- Highlight the importance of groundwater, snowpack, and glaciers as sources of freshwater in local watersheds.
  - Show students [this image](#) of Mount Everest and ask if they think there is any freshwater in this picture.
  - Students should recognize that the snow and ice they see is freshwater. If needed, remind students of the three sources of freshwater, as identified in Step 1: lake and river storage, groundwater, and glaciers/snowpack.
  - Use the EarthPulse [Interactive Everest Map](#) to show students how the snowpack on Everest and the surrounding mountains contributes to the surface water storage of the surrounding area.
    - Under “Contextual,” turn off the “Expedition Route, Camps, and Settlements” widget and turn on the “Basin” widget. Under “Supply,” turn on the “Surface Water Storage” widget. Then use the minus sign in the top right corner of the map to zoom out so that multiple peaks and the basin outline are visible.
    - Help students interpret what they are seeing. The bright yellow line indicates the outline of the Ganges-Brahmaputra River Basin. (When the “Expedition Route” widget is turned on, the Nepal-China border is visible in gray, and the expedition route is visible in dark yellow.) Dark blue represents water that is there year-round, whereas light blue is surface water that is there seasonally.
    - Ask students: *What do you notice about surface water in the basin? Are there large reservoirs of surface water?*
- Now use the map to help visualize snow cover along the expedition route to help students see where most of the water is held.
  - To do so, reload the page to reset the map. The “Expedition Route, Camps, and Settlements” widget will now be on. Under “Supply,” turn on the “Snow Covered Area” widget. Use the minus sign in the top right corner of the map to zoom out so that the entire expedition route is visible, and be sure that the legend is also visible.
  - Ask students what they notice about snow cover along the expedition route. How does it compare to coverage by surface water? (Students should see that snow covers more area than surface water.)

- Repeat the same steps for “Glaciers.” Reload the page to reset the map. The “Expedition Route, Camps, and Settlements” widget will now be on. Under “Supply,” turn on the “Glaciers” widget. Use the minus sign in the top right corner of the map to zoom out so that the entire expedition route is visible. Make sure that the legend is also visible.
- Next, visit the EarthPulse [Everest Snow Cover Graph](#).
  - Help students toggle between “Yearly Historical” and “Monthly 2018” graphs to visualize trends in snow cover in the Ganges-Brahmaputra River Basin. Ask: *How has snow cover changed over the years in this region? If this trend continues, what might occur?*
- Preview the [Glacier](#) encyclopedic entry by showing the images and providing the definition of a [glacier](#) at the top of the article. Tell students that the [Gangotri Glacier](#) is one of the largest glaciers in the Himalaya and one of the major sources of water for the Ganges River. Use the interactive [Mapping Mount Everest StoryMap](#) to show students the images of the Khumbu Glacier.
- Preview the [Aquifer](#) article by showing students the diagram and providing the definition of an [aquifer](#) at the top of the article.
- Distribute the *Comparing Sources of Freshwater* student worksheet. Direct students to discuss the similarities and differences between a glacier and an aquifer with a partner, and then record their ideas in the first section of the worksheet.
- Follow the steps below to lead students in a jigsaw reading activity.
  - Organize students into groups of four. Assign each student to skim one of the following encyclopedic entries: [Groundwater](#), [Snowpack](#), [Lake](#), and [River](#).
  - Explain to students that to skim an article means they will be looking for key facts and concepts, including:
    - The definition of the freshwater source.
    - What uses humans have for the freshwater source.
    - Answers to the prompts in part two of the [Comparing Sources of Freshwater](#) worksheet.
    - After students skim their article, pair them with others who reviewed the same article to complete the corresponding section in part two of their worksheet, before returning to their original groups.

- In their original groups, students take turns sharing what they learned about their source of freshwater with the other members and work to complete part two.
- Lead a discussion that synthesizes the importance of these sources of freshwater. Remind students that of the three sources of freshwater, the bulk of freshwater comes from glaciers and permanent snowpack.

### 3. Assist students as they analyze an infographic and note the connection between the population in the Ganges-Brahmaputra River Basin and the significance of glaciers and snowpack to the rivers.

- Distribute or have students open the *River Basins and their Hydrological Significance* Infographic (found on page 8). Explain that watersheds and river basins (or drainage basins) are sometimes used interchangeably. Explain that hydrological means related to the study of water. Highlight the challenge of flooding in river basins.
- Distribute the *Project Journal: Precious Freshwater*. Support students in interpreting the map by first having them locate the Ganges River Basin.
  - Ask: *What level of significance do the glaciers and snow have on the rivers there?* Students should see that it has a high significance.
  - Ask: *What level is the population, in millions, of that region?* Students should see that it is about 400 million.
- Then have students locate the Brahmaputra River Basin. Working in pairs or small groups, have students answer these questions in section one of their Project Journal:
  - Ask: *What level of significance do the glaciers and snow have on the rivers there?* Students should see that it has a high significance.
  - Ask: *What level is the population, in millions, of that region?* Students should see that it is about 100 million.
- Ask students to summarize the connection between glaciers/snow and the freshwater available to the combined 500 million people. They should be able to note that the glaciers and snowpack are highly significant to the rivers.
  - Ask: *If something were to happen to the glaciers and snow, what would happen to the rivers (and the people who rely on these rivers) in this watershed?* (Suggested

response: In the short term, there would be more flooding. In the long term, we are unsure, but water resources coming from glaciers would likely not be available during the dry season.)

#### 4. Prompt students to reflect on what they have learned in this activity in their Project Journal.

- In the *Project Journal: Precious Freshwater*, have students reflect on global freshwater availability and the connections between freshwater availability and human population in the regions around Everest. Additionally, ask students to record evidence from this activity to support the claim that humans impact Earth's systems.

#### 5. Assess students' understanding of Water Works lesson of the Peak Water: Mount Everest and Global Water Supply unit through an exit ticket.

- Use the questions below to assess students' understanding of the main concepts covered in this lesson. Have students respond individually to the following questions as an exit ticket:
  - You told your older brother that he should turn off the water while he brushes his teeth to conserve water. He said, "Earth is covered in water. Brushing my teeth while I run the water won't hurt anything because water is basically everywhere." Is our supply of freshwater endless? What if everyone on Earth did what he did. Using what you learned in the *Water Works* lesson, write a scientific claim to share with your brother connecting his personal water use to his impact on the environment. Include evidence from the *Water Works* lesson and use reasoning to connect your claim to your evidence.
  - Your neighbor likes to change her car's oil at home and dump it down the storm drain. She also washes her car in the driveway. Your other neighbor puts fertilizer on his grass and runs his sprinklers twice a day. Using what you've learned from the *Water Works* lesson, explain how these actions impact the people, animals, plants, and freshwater sources in your watershed.

## Modification

**Step 2:** For the jigsaw reading activity, you may decide to use this Rivers encyclopedic entry if you prefer a shorter version for students who may require reading support.

# Tip

**Step 3:** The [River Basins and their Hydrological Significance](#) infographic highlights the challenges of floods—of too much freshwater in the near term—as much as a drought. The Ganges, for example, is expected to see an increase in river flows for most months as the climate warms this century.

## Informal Assessment

Students' responses to class discussions provide input on their understanding of freshwater availability. Use the [Comparing Sources of Freshwater](#) worksheet as an opportunity to understand students' ideas about freshwater, as they analyze and compare the different types of freshwater sources. Students also record responses to prompts in the [Project Journal: Precious Freshwater](#) related to their readings and maps. Use the exit ticket in Step 5 to assess students' understanding of the main concepts presented in the [Water Works](#) lesson of the [Peak Water: Mount Everest and Global Water Supply](#) unit.

## Extending the Learning

As time allows, consider leading students through this [Just a Drop in the Bucket](#) demonstration to help them visualize how freshwater is a limited resource.

Step 1: You may want students to read the [Ganges River Basin](#) encyclopedic entry to anchor them in the location before looking at the [Freshwater Availability Map](#).

Step 2: You may decide to use this [Aquifers](#) encyclopedic entry instead of the shorter article provided.

## OBJECTIVES

## Subjects & Disciplines

### Biology

- [Ecology](#)
- Conservation

### Earth Science

- Climatology

### Geography

- Physical Geography

# Learning Objectives

Students will:

- Explain why freshwater is in short supply.
- Identify sources of freshwater.
- Create a cause and effect pathway between the snowpack and glaciers and the population of the Ganges Basin.

# Teaching Approach

- Project-based learning

# Teaching Methods

- Jigsaw
- Reading
- Reflection

# Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills
    - Information Literacy
  - Learning and Innovation Skills
    - Communication and Collaboration
- 21st Century Themes
  - Environmental Literacy
  - Global Awareness
- Critical Thinking Skills
  - Analyzing



- Applying
- Understanding
- Geographic Skills
  - Acquiring Geographic Information
  - Analyzing Geographic Information
  - Answering Geographic Questions
  - Asking Geographic Questions
- Science and Engineering Practices
  - Analyzing and interpreting data
  - Obtaining, evaluating, and communicating information

# National Standards, Principles, and Practices

## COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

- CCSS.ELA-LITERACY.WHST.6-8.9:

Draw evidence from informational texts to support analysis, reflection, and research.&nbsp;

## NEXT GENERATION SCIENCE STANDARDS

- Crosscutting Concept 2:

Cause and Effect&nbsp;

- MS-ESS3-4:

Construct an argument supported by evidence for how increases in human and natural resources impact Earth’s systems.

- Science and Engineering Practice 1:

Asking questions and defining problems

- Science and Engineering Practice 2:

Developing and using models

- Science and Engineering Practice 8:

Obtaining, evaluating, and communicating information

## Preparation

## What You’ll Need

## MATERIALS YOU PROVIDE

- Highlighters

## REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per pair, Monitor/screen, Projector

## PHYSICAL SPACE

- Classroom

## GROUPING

- Heterogeneous grouping
- Jigsaw grouping
- Large-group learning
- Small-group learning

## RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- [Project Journal: Precious Freshwater](#)
- [Comparing Sources of Freshwater](#)

## RESOURCES PROVIDED: REFERENCE

- Ganges River Basin
- Lake
- River
- United Nations Environment Programme: River Basins and their Hydrological Significance
- Groundwater
- Snowpack

## RESOURCES PROVIDED: MAPS

- [Freshwater Availability](#)

## RESOURCES PROVIDED: INTERACTIVES

- National Geographic: EarthPulse Interactive Everest Map

## RESOURCES PROVIDED: IMAGES

- National Geographic: EarthPulse Everest Snow Cover Graph
- [Everest](#)
- Aquifer
- European Space Agency: Gangotri Glacier

## BACKGROUND & VOCABULARY

### Background Information

Freshwater is water that is not salty and could be used for human consumption. Groundwater, snowpack, glaciers, lakes, rivers, and other forms of surface water are sources of freshwater. Mount Everest and nearby glaciers are a source of freshwater in the Everest watershed, otherwise known as the Ganges (Ganga) River Basin, or more expansively, the Ganges, Brahmaputra, Meghna River Basin. The GBM (Ganges, Brahmaputra, Meghna) River Basin serves an approximate 630-700 million inhabitants. Water demand is increasing for these individuals, yet snowpack and glaciers are threatened. For the Ganges, snow/ice melt is currently a minor input compared to precipitation. The Indus (home to the second-highest mountain in the world—K2, and draining through Pakistan) emerges as extremely glacier-dependent.

### Prior Knowledge

["Students will be more successful in this activity if they have a foundational understanding of what freshwater is, what watersheds are, and why freshwater is so scarce."]

### Recommended Prior Activities

- [A Day Without Water](#)
- [Watersheds](#)

### Vocabulary

Term	Part of Speech	Definition
aquifer	<i>noun</i>	an underground layer of rock or earth which holds groundwater.
Ganges River	<i>noun</i>	(2,495 kilometers/1,550 miles) river in South Asia that originates in the Himalaya and empties into the Bay of Bengal. Also called the Ganga.

Term	Part of Speech	Definition
Gangotri Glacier	<i>noun</i>	large glacier in the Himalaya Mountains, the source of the Ganges (Ganga) River.
glacier	<i>noun</i>	mass of ice that moves slowly over land.
groundwater	<i>noun</i>	water found in an aquifer.
hydrological	<i>adjective</i>	having to do with the study of water.
lake	<i>noun</i>	body of water surrounded by land.
river	<i>noun</i>	large stream of flowing fresh water.
snowpack	<i>noun</i>	layers of snow that naturally build up during snowfalls.
water scarcity	<i>noun</i>	situation when the amount of water available does not meet the amount of water needed or wanted by a population.
water stress	<i>noun</i>	situation faced by a nation or community when the amount of available water is less than 1,700 cubic meters per person.
water vulnerability	<i>noun</i>	threats to the supply of freshwater such as aquifer depletion, contamination from human and natural sources, and the effects of climate variability and change.

## For Further Exploration

### Articles & Profiles

- [National Geographic: Life at the Extremes](#)
- [National Geographic: Freshwater Access](#)

### None

- [National Geographic: Freshwater Resources](#)

