Exploring and protecting waterways
Lesson 2: Water in our world

Grades	4–5	**Duration**	60 min.
Subjects	Science, English language arts		
Essential question	Why is water *(water ecosystems)* important?		
Content and language objectives	• Students will be able to use a map to explain the distribution of water on Earth, understanding that fresh water is a small portion of available water. • Students will be able to explain the importance of water for plants and animals, including humans.		
Summary	In this lesson, students use a map as an anchor point to understand the distribution of water in the world. They read a comic that outlines why water and water ecosystems are important and share this information with their community.		
Standards	***Next Generation Science Standards:*** **5-ESS2-2 Earth's Systems** **Describe and graph the amounts and percentages of saltwater and fresh water in various reservoirs to provide evidence about the distribution of water on Earth.** 4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.		
	Common Core English Language Arts: **CCSS.ELA-Literacy.W.4.2/5.2** **Write informative/explanatory texts to examine a topic and convey ideas and information clearly.** CCSS.ELA-Literacy.W.4.2.a/5.2.a Introduce a topic clearly and group related information in paragraphs and sections; include formatting (e.g., headings), illustrations, and multimedia when useful to aid comprehension. CCSS.ELA-Literacy.W.4.2.b/5.2.b Develop the topic with facts, definitions, concrete details, quotations, or other information and examples related to the topic. CCSS.ELA-Literacy.W.4.2.d/5.2.d		

	Use precise language and domain-specific vocabulary to inform about or explain the topic. CCSS.ELA-Literacy.W.4.2.e/5.2.e Provide a concluding statement or section related to the information or explanation presented.		
	C3: College, Career and Civic Life Framework *(National Council for the Social Studies)* D2.Eco.3.3-5. Identify examples of the variety of resources (human capital, physical capital, and natural resources) that are used to produce goods and services. **D2.Geo.2.3-5. Use maps, satellite images, photographs, and other representations to explain relationships between the locations of places and regions and their environmental characteristics.** D4.2.3-5. Construct explanations using reasoning, correct sequence, examples, and details with relevant information and data.		
Language frames	_____because ... The percentage of ... is ...	The important thing about _____ is ... I learned ...	I wonder ... ____ is located ...
Vocabulary ***You may use "watershed," "drainage basin," or "catchment" in this lesson; all three vocabulary words refer to the same concept.***	ecosystem habitat waterway watershed*	catchment drainage basin fresh water *(n.)*/ freshwater *(adj.)* permafrost	salt water *(n.)*/ saltwater *(adj.)* groundwater *(n. or adj.)* ice cap/ice sheets glacier
Materials	Pre-lesson activity: What is a watershed? Teacher resource: Bar chart —Where is Earth's water? Teacher resource: Tennessee River food web Handout: World map Handout: Revising checklist Exploring and protecting waterways comic (or low resolution version) Teacher edition: Exploring and protecting waterways comic		

Before the lesson

Complete the activity: "What is a watershed?" before this lesson to ensure students understand the concept. Options for this activity include hands-on engineering, modeling, or a video.

Teacher note: You may use "watershed," "drainage basin," or "catchment" in this lesson; all three vocabulary words refer to the same concept.

Engage and prepare

1. Distribute a map of the world to students. Ask them to fill in any information they know about geography, habitats, etc. Encourage students to start with naming continents/countries/oceans and then move to adding more specific information like "desert" or "Taj Mahal."
2. As a class, label a map with all the information students know. Encourage as much information as possible to be shared, including information about longitude/latitude or the poles.
3. If students do not know the names of all the oceans, teach this and label them.
4. Ask students for information about large lakes and rivers, as well. If they do not know, label:
    a. Amazon River
    b. Lake Baikal
    c. Great Lakes
    d. Mississippi River
    e. Any other large bodies of fresh water near you that you want to label

Modeled and shared instruction

1. Remind students of the activity: "What is a watershed?" completed before the lesson.
2. Review the definition of a watershed/catchment/drainage basin.
3. Tell students today we are going to talk about watersheds, they hold the world's land-based water. Students think about watersheds and predict how much water is held in rivers/lakes vs. groundwater vs. locked up in glaciers/ice caps .
4. Read pages 1–3 of the "Exploring and protecting waterways comic" (or low resolution version). You may choose to use stopping points and discussion questions that are a good fit for your class using the "Teacher edition."
5. Review the concept of a food web, explaining that the arrows show energy flow and point from the organism being eaten (e.g., prey) to the organism that eats it (e.g., predator/consumer).
    a. To reinforce this idea, play a round of "I eat ..., Who eats me?"
    b. Project the "Tennessee River food web." Students secretly choose an animal to represent

in the game.

   c. Start the game by acting as an animal on the bottom of the food web (mussel, etc.). Say "I am a ____. I eat microscopic plants, algae, and animal matter."
   d. If students have chosen to be any of the animals to whom the arrow points to from where you started, they can shout out "I am a _____. I eat (name animal)." Alternatively students can raise hands or use a buzzer. Their goal is to be the first one.
   e. The game continues until the top of the food web is reached, the top predator.
   f. Repeat and play again!

6. Read pages 4–6 of the Exploring and protecting waterways comic (or low resolution version). You may choose to use stopping points and discussion questions that are a good fit for your class using the "Teacher edition."
7. Review student predictions about the amount of water that is available for drinking water. Students confirm or revise their predictions based on the information in the comic.
8. Project the USGS's bar chart: "Where is Earth's water?" and discuss what it means using the definitions and information provided.
   a. What is the difference between fresh water and salt water? Why is fresh water important?
   b. Where is most of the fresh water? Why is it important to think about where it is stored?
   c. What surprises you about this graph? What do you want to know more about?
9. Return to the world map from the warm-up and point out:
   a. Ocean water = salt water
   b. Glaciers and ice caps/ice sheets (use this map to add general areas to your class map)
   c. Groundwater *(tell students groundwater is under us in most places, it is being affected by human use, natural changes to precipitation, and climate change)*
10. Read pages 7–8 of the "Exploring and protecting waterways comic" (or low resolution version). You may choose to use stopping points and discussion questions that are a good fit for your class using the "Teacher edition."
11. Tell students your class is going to share your learning with the school (or beyond, if desired).
12. Review the parts of an informative paragraph (introduction, details, evidence, conclusion).
13. Write the topic sentence together. Review the comic's message and record this as your introduction.
   a. What is the author trying to tell us about water? What are the main ideas?
   b. What can we learn from this? What message is important to share?
   c. Main idea will be related to water connecting us all and being important for survival.

Collaborative and independent practice

1. Partner students to review the comic together and choose one fact or reason that supports the class' topic. Examples include:
    a. Animals/ecosystems depend on water (pgs. 2–3).
    b. People and animals share a water source (pg. 4)
    c. Water moves downstream, what we do upstream affects those below us (pg. 5).
    d. There is not a lot of fresh water in the world. It is mostly in groundwater and glaciers/ice caps/ice sheets (pg. 6).
    e. Saving water is important for our survival and the animals and plants in our community's ecosystems (pgs. 7–8).
2. Partners write a detailed sentence using evidence from the text, the graph, or their own experiences.
3. Partners switch sentences with another group. They review each other's sentences for accuracy and scientific word choice using the handout: "Revising checklist."
4. Partners revise their sentences based on the feedback.
5. Partners write their sentences on a blank sheet of paper and create an illustration, graph, or other visual to support their writing.

Evaluate and close
Call to action

1. Students share their writing with the class.
2. Review the introduction and write a concluding sentence together.
3. Choose several groups to write the introduction and conclusion on sentence strips or print them out in larger font.
4. Post the introduction with the students' writing below it and the conclusion at the bottom. This can be posted in the school classroom, hallway, office, or another location for visibility. You may choose to post the class' map with the paragraph.

Written by Emily Townsend in collaboration with Mongabay Kids.

About Wild Guardians

Mongabay Kids is the Kids Desk of Mongabay, a nonprofit environmental science and conservation news platform.

Wild Guardians is a multimedia educational series that uses videos, comics, and hands-on activities to engage grade 4–5 students in community-based interdisciplinary learning about how to be stewards of wild things and wild places in their community.

Website: kids.mongabay.com

Special thanks

This project was supported by a grant from The CEK Foundation Earth Focus Initiative.

Activity: What is a watershed?

Duration: 30 min.

*This activity can be stand-alone or used before teaching either of the **exploring and protecting waterways lessons** to introduce the concept of a watershed.*

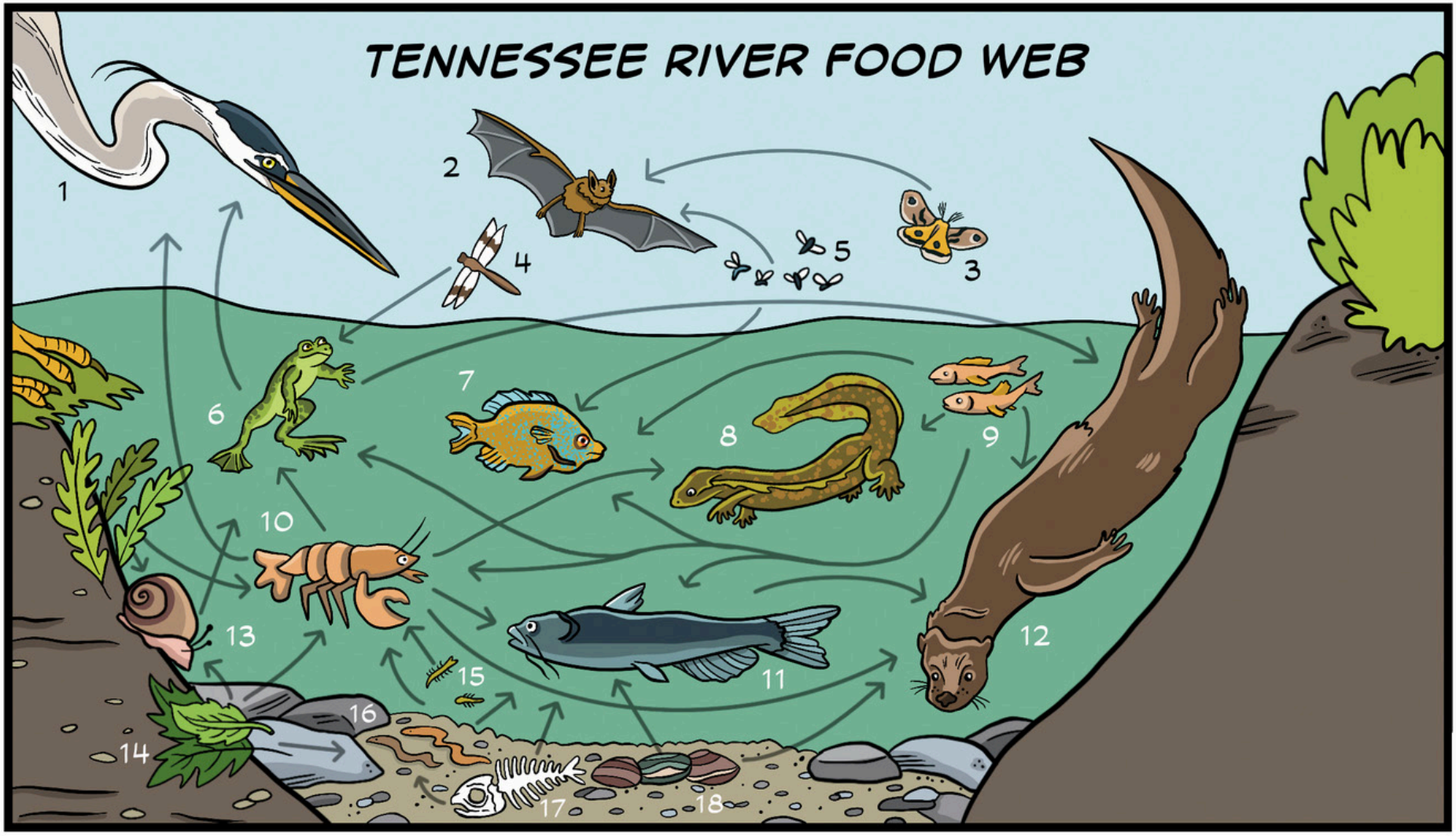
Science and Engineering Practices: Developing and Using Models

Before class, compile materials for groups of 3–4 to engage in hands-on exploration with a watershed. Several options are described below:

a. Each group needs a baking tray (or something of a similar size) with several large scoops of sand or dirt and a spray bottle or eye dropper with water. Sand or dirt may be dry or slightly damp to allow students to work with it more easily.
b. Alternatively, this activity may be done outside on the playground and only water and spray bottles/eye droppers will be needed.
c. The class may instead observe one example, facilitated by the teacher.
d. A video of a similar simulation can be used to show students the concept of a watershed.

Activity:

1. Distribute materials to student groups. Instruct groups to build a landscape with at least one hill/mountain, including high and low areas. *You may instruct students to build the landscape of your community, if desired. You may ask students to sketch their landscape after building.*
2. Ask students to locate the highest points in their landscape and predict, “If it rains here, where will the water go?”
3. Students discuss their predictions of how the water will move from the highest places around their landscape. *If students have sketched their landscape, they may mark their predictions on their sketch.*
4. Next, students use the eye dropper or spray bottle to simulate rain and observe the movement of water.
5. Students discuss and revise or confirm their predictions and why the water may have moved differently than they anticipated. *If students have sketched their landscape, they may mark the true path of the water on their sketch.*
6. Student groups share their observations with the class.
7. Label the place where all the water drained downhill as the “watershed.” Alternatively, if may be referred to a drainage basin or a catchment.
8. Student groups clean up their materials.

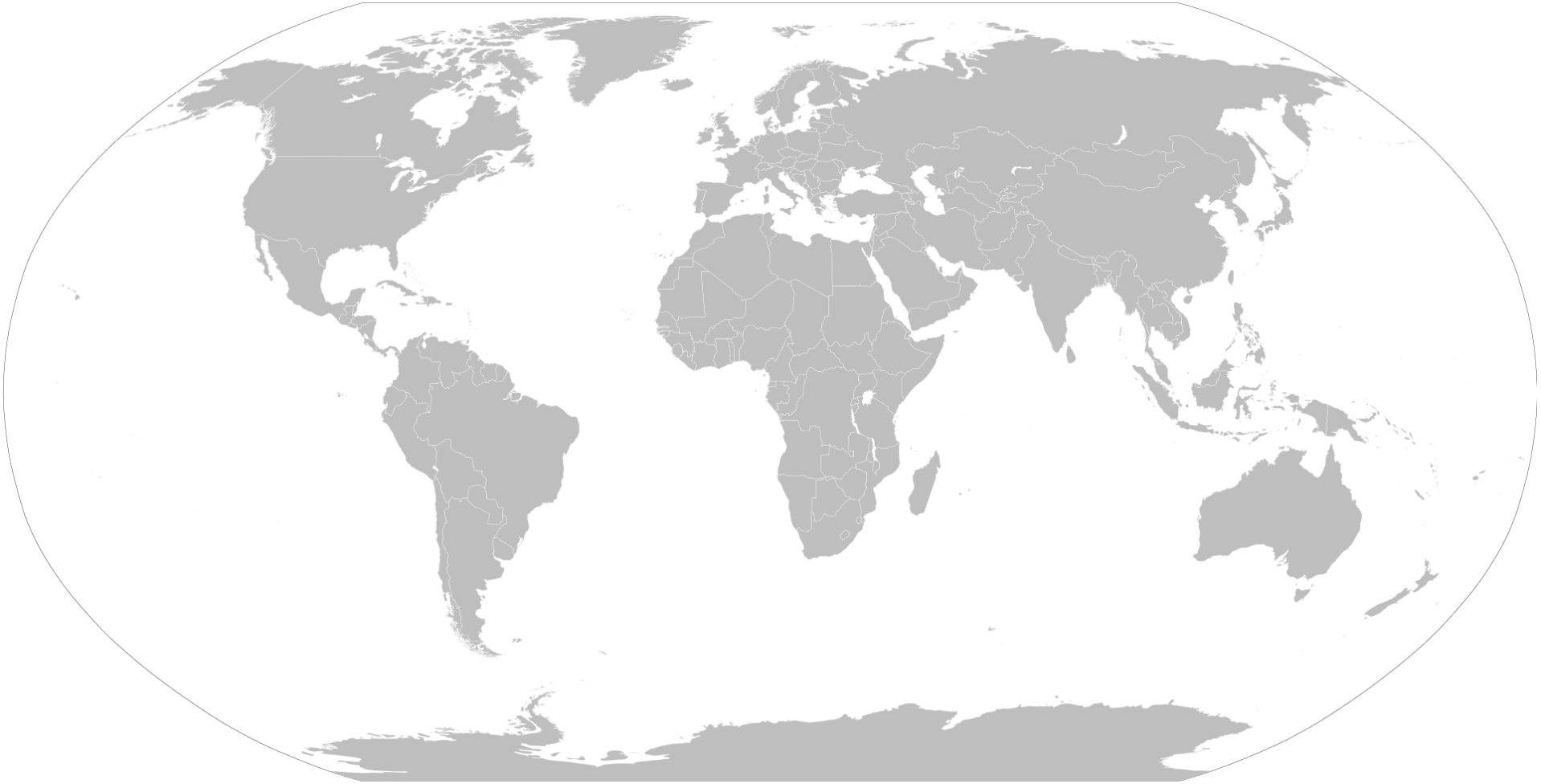


1. great blue heron
2. bat
3. moth
4. dragonfly
5. gnats/small insects
6. bullfrog
7. longear sunfish
8. hellbender
9. madtoms (small catfish)
10. crayfish/crawfish
11. catfish
12. river otter
13. aquatic snail
14. decaying leaves
15. caddisfly larvae
16. aquatic worms
17. fish skeleton
18. freshwater mussels

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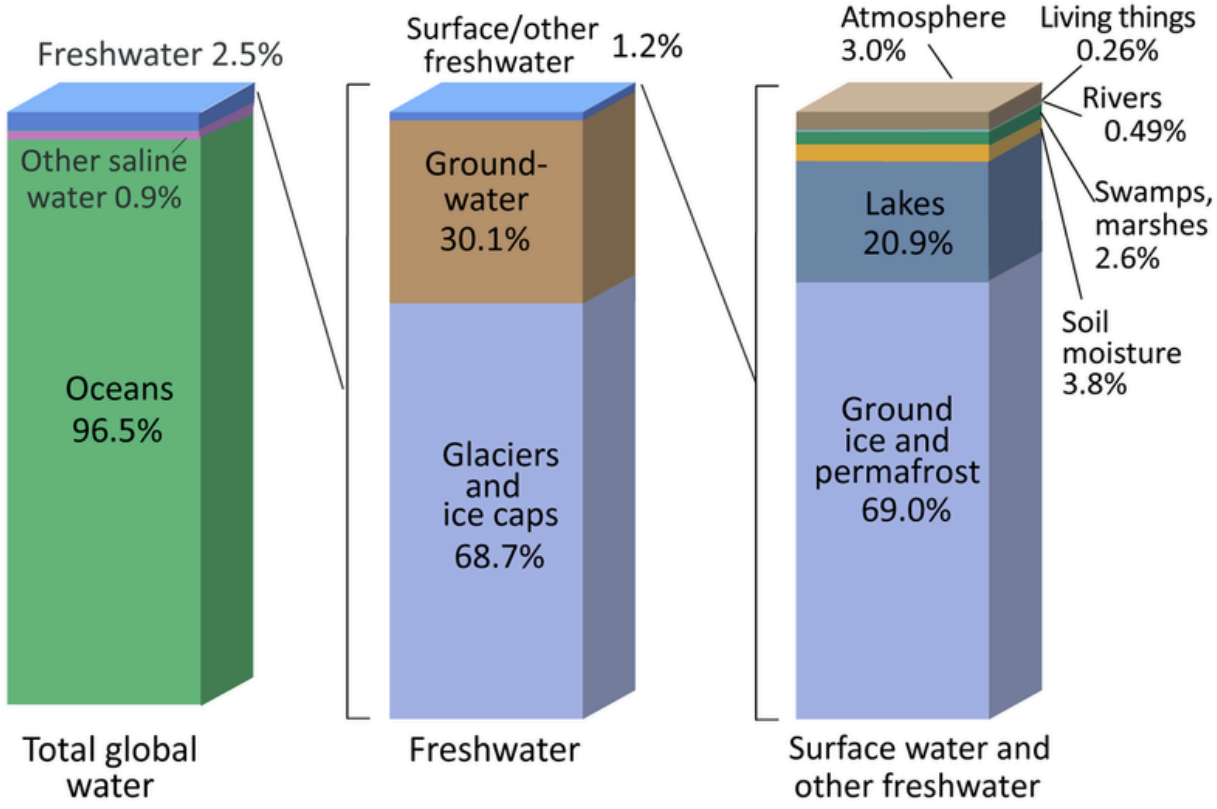
Name _____ Date_____

World map



https://commons.wikimedia.org/wiki/File:BlankMap-World.svg

Where is Earth's Water?



Credit: U.S. Geological Survey, Water Science School. https://www.usgs.gov/special-topic/water-science-school
Data source: Igor Shiklomanov's chapter "World fresh water resources" in Peter H. Gleick (editor), 1993, Water in Crisis: A Guide to the World's Fresh Water Resources. (Numbers are rounded).

The distribution of water on, in, and above the Earth, from USGS; https://www.usgs.gov/media/images/distribution-water-and-above-earth

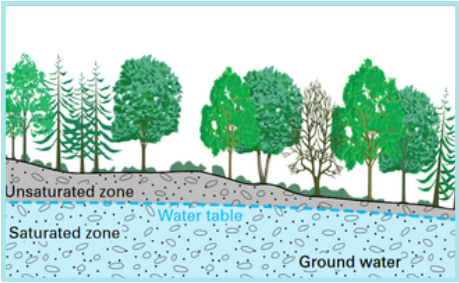


Image: USGS, Public domain





Groundwater is water below the ground's surface that fills small spaces or cracks in soil and rocks.

Glaciers are frozen rivers of ice flowing downhill.

Ice caps and ***ice sheets*** are large masses of ice covering areas of land.

Permafrost is any ground that remains completely frozen for at least two years.

Permafrost is found in cold regions. These include high mountains and also near the North and South poles.

Definition adapted from nasa.gov

Name _____ Date_____

Revising checklist

1. Is the sentence scientifically accurate? How do you know?

_____

_____

2. Underline one word or phrase that helped you understand the sentence.

3. Look at the list of vocabulary from today, are there any words the group could use to make their sentences more scientific? Rewrite the sentence using the word or words.

_____

_____

Name _____ Date_____

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_____

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