GENERATIONGENIUS
ALWAYS QUESTION. ALWAYS WONDER.

LESSON PLAN

DISTRIBUTION OF NATURAL RESOURCES
GRADES 6-8

SUMMARY

Students engage in analyzing and interpreting data to solve the problem of access to fresh water.

NEXT GENERATION SCIENCE STANDARDS CORRELATION

MS-ESS3-1. Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.

MS-ESS3-4. Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

Science & Engineering Practices	Connections to Classroom Activity
Constructing Explanations and Designing Solutions **Engaging in Argument form Evidence**	• Students use data to explain that Earth has an unequal distribution of natural resources. • Students watch the Generation Genius video to learn about natural resources and how they are distributed across Earth due to plate tectonics. • Students construct an agreement for the best place to erect water collection nets based on water mass data.

Disciplinary Core Ideas	Connections to Classroom Activity
ESS3.A: Natural Resources Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over	• Students learn that fresh water is a non-renewable nature resource and where ground water aquifer are located across Earth. • Students watch the Generation Genius video to learn that natural resources are unequally distributed

human lifetimes. These resources are distributed unevenly around the planet as a result of past geologic processes. **ESS3.C: Human Impacts on Earth Systems** Typically, as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth, unless the activities and technologies involved are engineered otherwise.	across Earth. Natural resources include wind, water, sunlight, precious metals, minerals, fossil fuels, and fresh water. Some natural resources are considered renewable and some are non-renewable. • Humans use Earth's natural resources for many different things. Some of the natural resources humans use are non-renewable and are being used faster than they can be replenished. Students use technology to figure out where to put water collection nets to help mitigate the depletion of the groundwater aquifers.
Cross Cutting Concepts	**Connections to Classroom Activity**
Cause and Effect **Connections to Engineering, Technology, and Applications of Science** **Connections to the Nature of Science**	• Students identify patterns to determine cause and effect relationships in water mass patterns to predict the best place to erect water collecting nets. • Students watch the Generation Genius video to learn how Earth's systems (cause) created an unequal distribution of some of Earth's natural resources (effect). • Students learn that not all resources will last forever, like fossil fuels. They also learn that using some natural resources have a negative impact on Earth. • Students learn that humans know they can use up the fresh water in ground water aquifers and other non-renewable resources but continue to use them anyway.

DURATION

Two 45 min. lessons

MATERIALS

- Computer, tablet or phone with internet connection (per student pair or small group)
- Water bottle with lid for demonstration (optional)

ENGAGE

Begin by showing students a regular water bottle with a lid. Say to students, "What if I told you there was a way to fill this water bottle just by letting it sit here on the counter, what would you think, where would the water come from?"

Ask students to make a prediction about where the water might come from and record it in their science notebook. Next, have them share their ideas in small groups along with their reasoning behind their idea. Instruct students to make a t-chart and label one side "notice" and the other "wonder." Tell students you have a video to share about getting water out of air then play the video, Fog catcher for water. Have students fill out their chart as they watch the video.

Ask students to share out what they noticed. Students may share the following:

- They can get water from fog.
- They use nets to collect water from the air.
- People use this water for drinking.
- The net looks like it is in the desert.

- The nets are placed on a hill where there is wind.

In small groups, have students brainstorm ideas about how this technology could be used to solve a human problem.

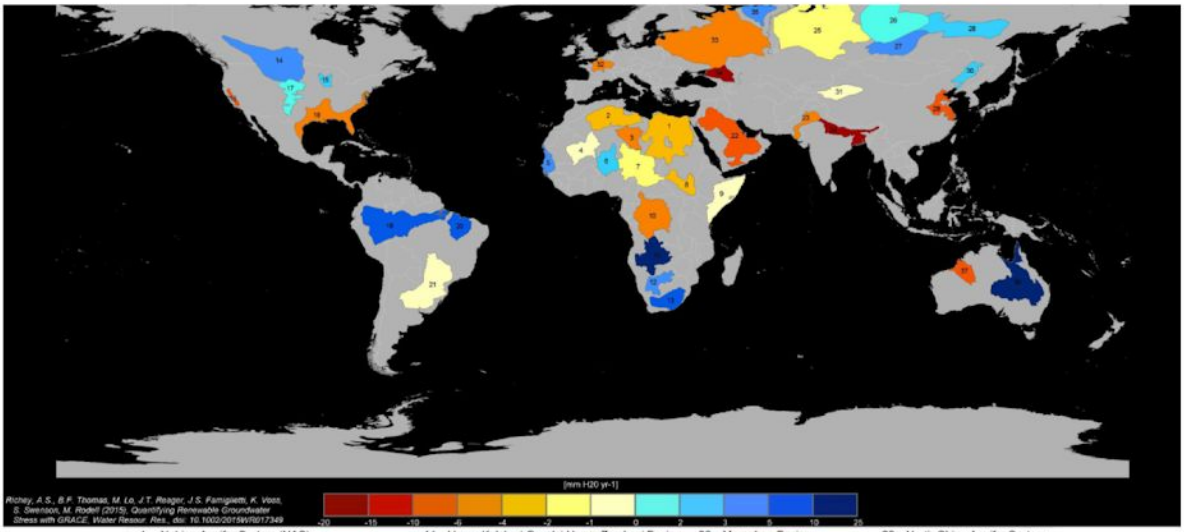
Have a whole-group discussion to share student ideas. A common idea that students surface is that this technology could be used to provide clean drinking water and water to crops to people in undeveloped/underdeveloped countries. Prompt students to think about if this technology would be beneficial to people in the United States and have them share their thoughts. Ideas that surface here usually have to do with watering crops during a drought. Explain that there are still several parts of the United States where people live that do not have access to clean drinking water. Again, prompt students to think about if this technology could help solve that problem and share ideas.

Ask students what other questions they have about the video, common questions could include:
- How do the nets work?
- Why would people need to pull water out of the air?
- How do they know where to put the nets?
- Why don't all people have fresh water?
- Could they put the nets anywhere to pull water from the air?

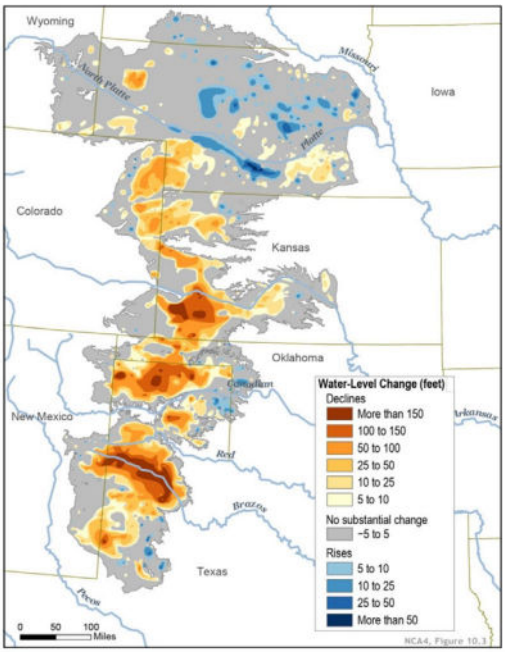
Discuss what to figure out next to help solve the problem of clean water access. If students don't conclude that they would need to figure out where to put the collection nets, use prompts such as:
- We know water is in the atmosphere (prior learning) so can you put these anywhere?
- We have evidence that these collection systems work, so what would be our next step? What information would we need?

EXPLORE

Tell students that before we can figure out where to put the nets, we need to know where the fresh water is and where it is needed. Drawing on prior knowledge, ask students where they can find fresh water. Focus students on ground water as the major source for fresh water. Show students the Map of Groundwater Trends for Earth's Largest 37 Aquifers and ask them what they notice.



Draw attention to where groundwater is located (or not) and remind students that these aquifers are used by billions of people around the world. Ask students, “What do you think would happen to the aquifer if humans used more water than what was added each year?” Agree that if we use more fresh water than is put back each year the aquifer could eventually run out. Tell students that is what is happening to parts of the Ogallala Aquifer in the United States and show the map Changes in the Ogallala Water Levels, 1911-2015.



EXPLAIN

Explain that water is a natural resource and fresh water is now considered a non-renewable resource. Tell students you have a video that will help them learn more about natural resources and why they are not distributed equally across the world.

WATCH THE GENERATION GENIUS DISTRIBUTION OF NATURAL RESOURCES VIDEO AS A GROUP

After viewing the video, focus students back to the water collecting nets and say, “Now that you know more about natural and non-renewable resource, what problem do you think these nets could solve?” Have students share their ideas, then say, “So we all think these nets could solve a number of problems, but do you think the nets would work anywhere or is there certain criteria to consider?” Tell them to think about what information they would need to place the nets in areas where they would have the best chance at collecting the most water. Have small groups come up with a list of criteria to consider when determining where to place the nets.

Have groups share the criteria they came up with and have other groups weigh in on agreement. Criteria should include:

- They would have to be placed where it is humid (water in the air) or foggy.
- Probably somewhere not too hot, because the air gets dry and the water that is collected could evaporate.
- Where there is wind (this is from the video).
- Cost (optional and would need to include more research)

Students decide that the most important criteria would be placement. Nets would have to be placed where there is water in the air. Ask students what data they would need to figure out where those places are. Common student responses

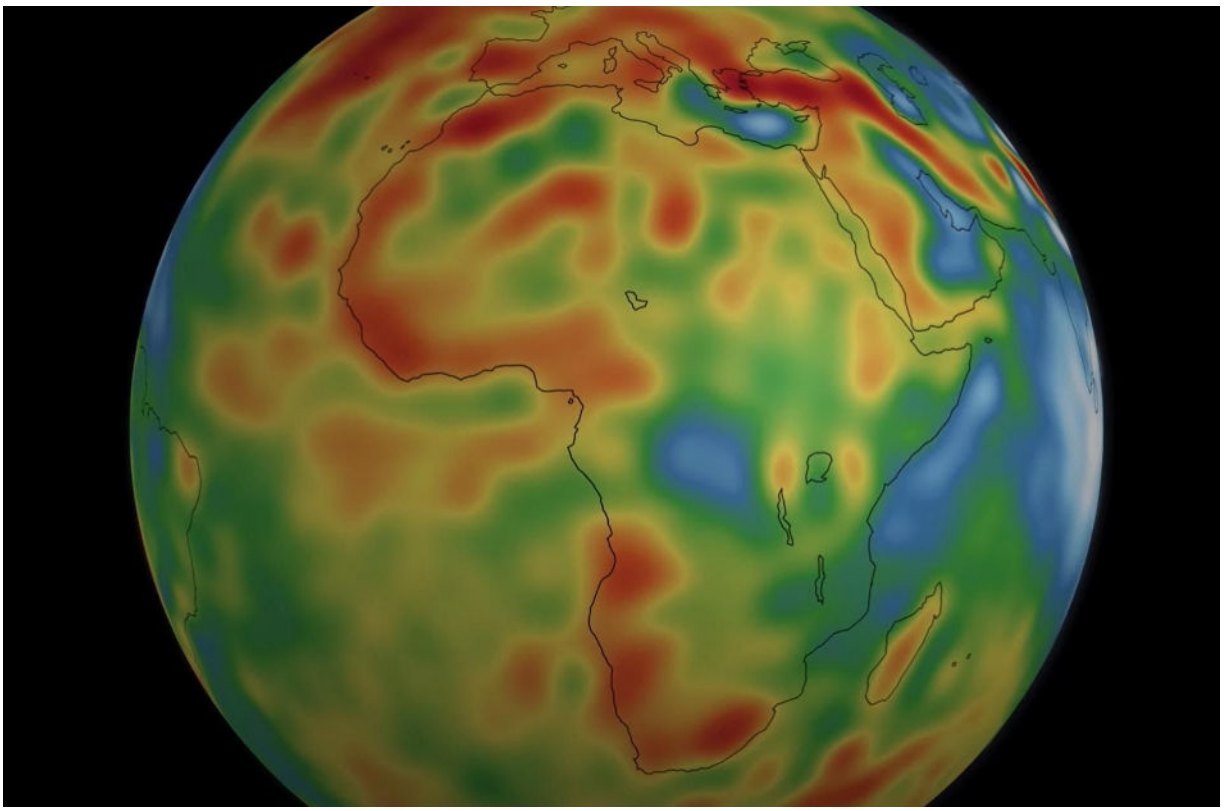
include gathering data on the aquifers, fog, humidity, and temperature.
Ask students how scientists keep track of water in the air then ask students if they have seen a picture like this before (show heat map) and have them explain what they think it is. Agree that this is a ”heat map”, but this heat map is not measuring temperature, it is measuring variations in Earth’s gravity field, which indicates water mass changes. Ask students, “How could knowing where water masses are and how they change help inform our decisions about where to put the water collection nets?” Conclude that knowing the pattern of water mass change would allow them to place the nets in places that indicate there is a high potential for water in the atmosphere.

Have groups share their ideas with another group to compare ideas, then have a building consensus discussion. Have groups share the criteria they came up with and have other groups weigh in on agreement. Criteria should include:

- They would have to be placed where it is humid (water in the air) or foggy.
- Probably somewhere not too hot, because the air gets dry and the water that is collected could evaporate.
- Where there is wind (this is from the video).
- Cost (optional and would need to include more research)

Decide that the most important criteria would be placement. Nets would have to be placed where there is water in the air. Ask students what data they would need to figure out where those places are. Common student responses include gathering data on the aquifers, fog, humidity, and temperature.

Explain that scientists have studied and tracked aquifers for many years as it is a main source of fresh water. Now ask them how they think scientists keep track of water stored in snow, soil, and surface water (rivers and lakes)? Have students share their ideas, then ask students if they have seen a picture like this before (show the heat map picture) and have them explain what they think it is. Agree that this is a “heat map” but this heat map is not measuring temperature, it is measuring variations in Earth’s gravity field, which indicates water mass changes. Ask students, “How could knowing where water masses are and how they change help inform our decisions about where to put the water collection nets?” Students should conclude that knowing the pattern of water mass change would allow them to place the nets in places that indicate there is a high potential for water in the atmosphere.



https://gracefo.jpl.nasa.gov/resources/52/grace-fo-gravity-data-over-africa/

ELABORATE

Tell students you are going to watch a video on how scientists have tracked water mass changes in the United States. Have students watch the GRACE Data Over the United States, 2003-2012 video, then lead a discussion for students to share what they noticed.

Next have students break into partners or small groups and assign each group a year from the video in order to analyze the data more in depth.

Have students look for patterns in the data that would help them determine the best places to put water collection nets. After they have analyzed the data for their year, have them share the patterns they noticed with the class. As students share the data trends on the board. Patterns that should have surfaced are:

- Water masses fluctuate throughout the year.
- Water masses fluctuate from year to year.
- Some parts of the United States show little increase in water storage.
- Some parts of the United States show a lot of increase in water storage.
- Many places in the United States have similar patterns of increase and decrease of water storage.

Next, have each group make an argument for where they would build their system. Students should cite evidence and use reasoning in their argument. Have each group present their argument.

EVALUATE

There are multiple ways to assess your students' understanding of this topic. The exit ticket is an opportunity for students to use the science ideas they built in the lesson in a new context. Alternatively, you can use the Kahoot! quiz (which provides downloadable scores at the end of the game) and/or the paper quiz. All these resources are located right below the video in the assessment section.

EXTENSION

Go back to the original questions from the first video and focus on figuring out answers to these questions:

- How do the nets work?
- What are the nets made of?
- Does taking the water out of the air hurt the atmosphere?

Have students figure out more about how the technology works by investigating the water cycle (see *Generation Genius* Water Cycle lesson).

Students could also investigate other ways water can be harvested. Using the clip Teen's Invention Makes Water Out of Thin Air, students could compare the teens' invention with the nets. What similarities and differences do they have? Do you think they could both work?