EXTREME WEATHER

Flooding, Rainfall, & Hurricanes

ABOUT THE LESSON

In this lesson students will learn about extreme weather events that take place because of increased evaporation and water vapor in the atmosphere, namely flooding, precipitation, and hurricanes. This lesson includes cross curricular connections to subjects like language arts, geography, and social science.

ESSENTIAL QUESTIONS:

- What is an extreme weather event?
- Why have extreme weather events been increasing with
- climate change?
  How are different ecosystems, including humans, impacted by flooding, rainfall and hurricanes?

LEARNING OBJECTIVES:

- Explore stability and change in natural systems over time.
- Draw evidence from informational articles.
- Interpret data and answer questions based on graphs and
- models.
  Understand how human activity draws on natural resources.

Patterns; Cause & Effect; Scale, Proportion & Quantity; Stability & Change
NOAA Guidelines: 3.3, 7.1, 7.2 & 7.3

Have your students read the two news articles below and discuss the following questions as a group. You can choose any other relevant or latest news articles using the SEARCH feature to anchor your classroom discussion on heatwaves and wildfires.

FLOODING IN EUROPE

Find Germany on a map and the Rhine and Ahr rivers that flow through the country.

According to the article, what caused the flooding and were the people prepared?

Why do you think there is more precipitation happening now in Europe?

How have humans adapted to areas with higher chances of flooding in the past - near rivers, wetlands, marshes?

What kinds of precautions do you think a town that is close to a river should take in the future?

ARE HURRICANES/TYPHOONS GETTING STRONGER?

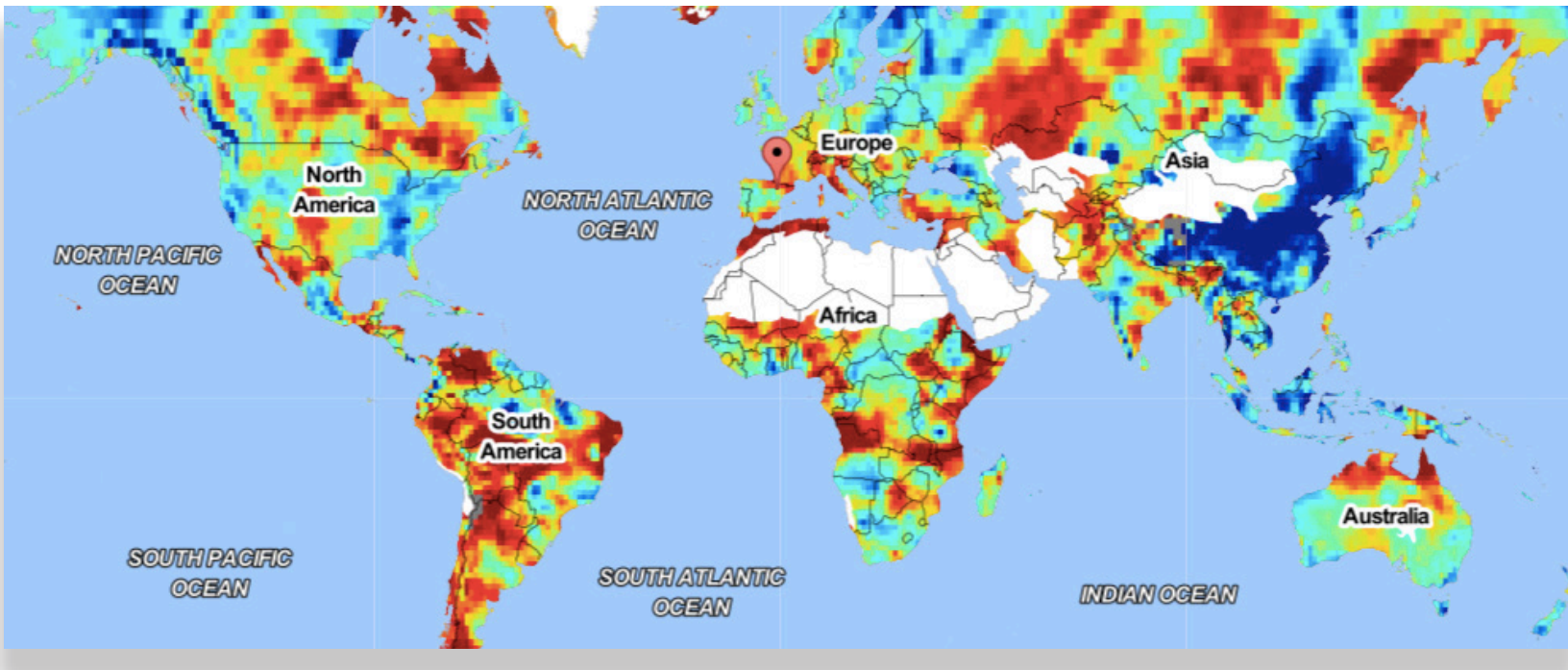
What is the difference between a hurricane and a typhoon?

Read THIS article about Hurricane Ida. On a map, find the U.S Gulf coast, and the countries of Philippines and Guatemala? What can you tell about their geography? Are they closer to the Equator or to the Poles?

Based on the article, why do you think we are seeing stronger hurricanes since 2006? What are some impacts you can imagine or have read in this article that are attributed to a hurricane (or typhoon)?

INFORMATION	YOUNGZINE CONTENT
IMPACT ON GLOBAL TEMPERATURES Data shows that precipitation patterns are changing with some regions getting wetter, and more winter precipitation falling as rain instead of snow. Changes in precipitation are not uniform with some areas getting wetter and others getting drier. Read these two articles to learn how precipitation is measured by scientists, and the observed trends in precipitation, droughts, flooding, and hurricanes.	Read Module 2.2: Changes in Precipitation and take the quiz: Examine Graph 2.2.3. What does the upward trend tell us about the water vapor in the atmosphere? Read THIS article to understand the data on precipitation, droughts, flooding and hurricanes.
IMPACT ON WEATHER Rising temps —> Increased evaporation —> Atmosphere is able to hold more moisture —> Increased yet uneven precipitation —> Increased frequency, intensity, and duration of hurricanes As the world warms, the rate of evaporation increases and the atmosphere starts to retain more water vapor (7% for every 1C rise), which eventually leads to heavier rainfall and stronger hurricanes.	Read Module 4.2: Impact on Extreme Weather and take the quiz: Examine Graph 4.2.3. What can we conclude about the precipitation patterns by the end of the century? Which areas are projected to get drier and which areas wetter?
IMPACT ON ECOSYSTEMS & COMMUNITIES Warm temperatures and uneven rainfall have negative impacts on snowpack and glaciers—an important source of freshwater—and can promote the growth of toxic algal blooms.	Read the Depleting Freshwater section of Module 4.3: Impact on the Hydrosphere. Optionally take the quiz. Examine Graph 4.3.8. Which areas of the U.S. will experience the most water shortages? Which areas will be the least impacted?

Data Dive!



SPEI Global Drought Monitor

Go to the following website to observe global precipitation patterns over the last 60 years. Play around with the slider to observe drought conditions in different regions of the world.

1. **Zoom into where you live and observe climate patterns for every 5 years starting from the beginning.**

   How have precipitation patterns changed in your region since 1960? What is the typical rainy season for your region? Has that changed over the last 60 years?

2. **Compare and contrast drought conditions in 1998, an El Niño year where temperatures warmed, to conditions in 2001, a La Niña year where temperatures cooled.** What do you notice?
3. **Around the globe, which areas of the world are generally getting wetter? Which are getting drier?**
4. **What are some factors that might contribute to a region's water footprint and drought severity?**

This picture shows what a healthy amount of precipitation looks like.

What do you notice about the snowpack?

Can you describe in your own words how a healthy amount of precipitation on the mountains will affect the living organisms downriver?

What if the amount of precipitation changed?
Let's try it!

What if...

SCENARIO 1

What will happen to the aquatic ecosystems (i.e. ponds, rivers) if there is a very small amount of rain and snowfall one year? *Consider both plants and animals in your answer.*

How does the community need to adapt to the change in precipitation? *Thinkabout how theyuse the water for a variety of purposes such as drinking water, recreation, and food.*

How will the apple orchard be affected with a smaller supply of water? *Considertheirrigation for crops.*

SCENARIO 2

Now that you've thought about what could happen with a small amount of precipitation, let's think about the opposite scenario:

What will happen to the aquatic ecosystems if there is an excessive amount of rain and snowfall?

How will the town and its people be affected by the change in precipitation? What would be some pros and cons to experiencing heavier precipitation?

How will the orchard be affected with a much larger supply of water? Could too much water be detrimental to the farm?

Challenge Question: How can the people in the town adapt or prepare for these large precipitation events?

Mountains: *The mountains have snow peaks which will store water throughout the year;* ***Snow Clouds:*** *The snow will melt and trickle down throughout the year, adding to the ground water supply under the orchard;* ***Rain Clouds:*** *Release water all at once, adding to the surface water sources as well as the groundwater sources;* ***Lake:*** *Many critters and plants live here and thrive on the water that comes from the rain and snowpack;* ***River:*** *Home to freshwater wildlife and is used by the town for outdoor activities like kayaking and fishing;* ***Orchard:*** *Replenished by ground water from snowpack throughout the season.*

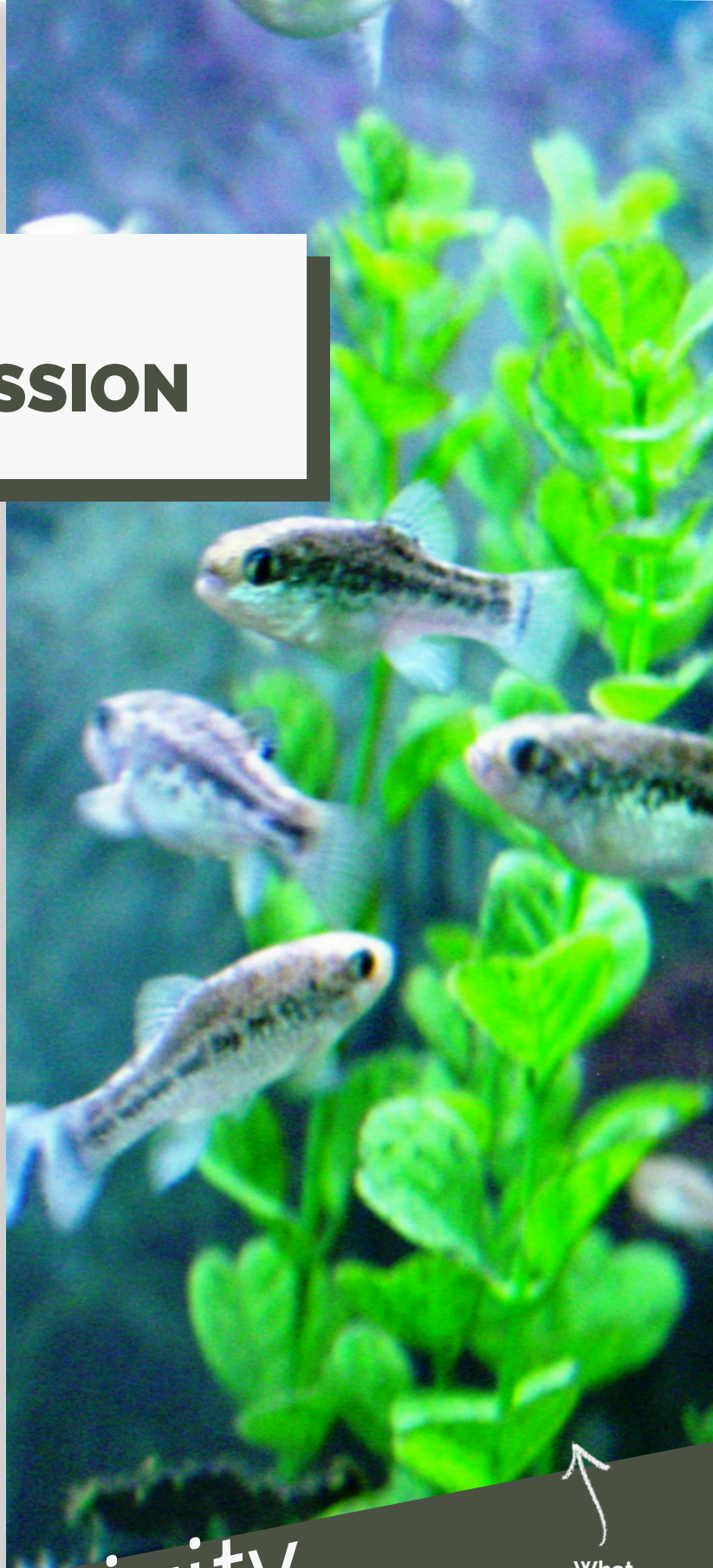
WRAP UP & CLOSING DISCUSSION

Why is it important for regions to have a balanced amount of precipitation?

How are people, plants, and animals affected by our water sources? What happens if we start polluting our water sources?

How are you personally affected by extreme weather events? What can we do to help prepare for extreme weather in the future?

Students can either discuss as a group or do a quickwrite based on the following questions.



Journal Activity

What impact might toxic runoff have on freshwater fish? How does that impact humans?

Extend Your Thinking

1. Imagine the following people and their livelihoods, and explain what kinds of extreme scenarios they would need to plan for:

b. A factory owner in a coastal region that is prone to increasingly stronger hurricane impact.

[Ans: flooding, disruption of power lines, roads and infrastructure damage, polluted runoff, etc]

2. How well do you know freshwater?

a. Where do humans get freshwater from and what do we use it for?

[Ans: reservoir, lakes, underground aquifers, rivers etc.; household use, agriculture, factories, etc.]

c. How is freshwater replenished? (Hint: Think of the different roles of rain and snow)

[Ans: Rain replenishes reservoirs and lakes and underground aquifers. It can be stored and transported. Snow forms snowpacks on mountains that feed river and streams]

d. How does climate change affect our freshwater sources and cycles?

[Ans: dried up reservoirs, rivers, lakes, and underground water; increased water use and scarcity; polluted runoff poisoning freshwater ecosystems]

3. Research your Region!

Learn about the rainfall and precipitation in your community! First, ask a parent/guardian about the rainfall when they were younger versus now. Next, ask your teacher about their experience. Finally, interview a friend or trusted community member. Once you have completed your interviews, answer the following questions: *Howhas therainfall inyour region changed over time? Did you learn something unexpected about the rainfall in your community?*

Connection to Extreme Weather pt. 1

Given what you know about droughts, wildfire, precipitation, and flooding, use examples to summarize in 250 words how climate change leads to more extreme weather events.