

PROJECT PLANNER

1. Project Overview

Project Title	Using NASA's Global Precipitation Measurement (GPM) Data to Save Precious Freshwater Resources- "Water for Wheaties?" lesson plan	Public Product(s) (Individual and Team)	<ul style="list-style-type: none"> - Teacher's Guide - Water for Wheaties? PowerPoint Presentation - "Growing Wheat" expert group resource - "Weather and Climate in Sargodha, Pakistan" expert group resource - "Weather and Climate in Gypsum, Kansas" expert group resource - Pakistan's Freshwater Resources" expert group resource - Note-taking Organizer - "Global Precipitation Measurement Data" resource - Data literacy cubes (optional) - Assessment Rubric
Driving Question	How can wheat farmers in Pakistan take advantage of technology to reduce their use of freshwater resources?		
Grade Level/ Subject	3 rd grade		
Time Frame	3 to 4 45-minute class periods		
Project Summary	<p>NASA's Global Precipitation Measurement (GPM) mission is an international satellite mission that has been taking measurements of precipitation as it falls to Earth since 2014. It follows the Tropical Rainfall Measurement (TRMM) which launched in 1997 and also used remote sensing to measure global precipitation. The two decades of global precipitation measurements are enabling a variety of "end-users" to take these data and find ways to improve life around the world.</p> <p>In this Problem-Based Learning activity, students will work in "expert" groups to learn how we are able to use technological advances to solve real-world problems. They will focus on the impact of decreasing freshwater resources in Pakistan as they learn about wheat farming, weather and climate conditions, and the impact of decreasing freshwater resources. They will interact with actual NASA satellite data to see the amount of precipitation that has fallen over the past two decades and answer guided questions to help them unpack and analyze this data to determine when wheat farmers might need to irrigate their crops.</p> <p>Once they have this background understanding to guide them, they will be introduced to Faisal Hossein, a Civil & Environmental Engineering professor at University of Washington, to gain an understanding about the work he has been doing to enable farmers in developing countries to gain easy access to cell phone messages which let them know if they need to water their wheat crops or if they can rely on precipitation instead. They will learn more about his STEM-related career and see how the work and others are doing are making a positive difference in the lives of people around the world.</p>		

2. Learning Goals

Standards	<p>3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.</p> <p>3-ESS3-1. Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard</p> <p>3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change</p> <p>3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem</p>
Key Vocabulary	<p>Irrigation</p> <p>Satellites</p> <p>Remote sensing</p> <p>Wheat</p> <p>Freshwater resources</p>

Literacy Skills	<p>Reading informational texts</p> <p>Presentation of ideas with evidence</p> <p>Engaging in collaborative conversation</p> <p>Understanding and analyzing graphs, charts, and data sources</p>
Success Skills	<p>Critical thinking, collaboration, self-management</p> <p>STEM-related career pathways</p>
Rubric(s)	<p>Included in lesson documents</p>

3. Project Milestones

Milestone #1: Use of freshwater to irrigate crops	Milestone #2: Expert Groups research	Milestone #3: Project Teams Collaboration	Milestone #4: Meet Faisal Hossain	Milestone #5: Communicating to Others	Milestone #6: Saving Freshwater Resources
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<p>Engage:</p> <p><i>Need for agriculture to have freshwater:</i></p> <p>Make a list of the things that you had to eat yesterday. Put a star by the things that needed to be grown by farmers. Share your list with a partner and see if there are items on your list that include ingredients that originally came from farms.</p> <p>Think about what farmers need to have in order to grow their crops. As a class, make a list of the different things that are essential to growing food to meet the needs of people around the world.</p> <p><i>Freshwater versus salt water:</i> Look at a globe and discuss how much of Earth's surface is covered by water. Do <i>Globe activity</i> (hyperlink to hands on globe activity) to predict how much of Earth is covered by water.</p> <p>Do the pouring water into a cup activity to demonstrate how little of Earth's water is freshwater.</p> <p>Explore: Watch the video, "Show Me the Water".</p> <p>Compare and contrast how much water is used by developing countries and the US (developing countries- about 70%</p>	<p>Explore:</p> <p>What happens when there isn't enough precipitation to water farmer's crops? How do they make sure they can water their crops, especially in countries where freshwater resources are not plentiful?</p> <p>With a partner, talk about what farmers might do if they don't have enough water for their crops.</p> <p>Students get into small "expert" groups and read over the resource sheets for their topic.</p> <p>"Expert groups" include:</p> <ol style="list-style-type: none"> 1. Growing Wheat 2. Growing Wheat in Sargodha, Pakistan 3. Growing Wheat in Kansas 4. Pakistan's Freshwater Resources 5. Irrigating Wheat Crops <p>They complete the graphic organizer for their topic to help them communicate their findings to their Project Team.</p>	<p>Explain:</p> <p>Students get together in collaborative "Project Teams" which include an expert from each breakout group. Each expert share their information and all Project Team members complete their capture sheets to reflect the group discussion and findings.</p> <p>Each group gets a copy of the "Global Precipitation Measurement Data" resource. This resource gives them two decades of precipitation data for two different wheat growing regions: Gypsum, Kansas and Sargodha, Pakistan.</p> <p>Teachers may want to consider using these data analysis resources from <i>My NASA Data</i> with students to help them unpack what they are looking at with the interannual time series data graphs.</p> <p>Students use guided questions and capture sheet to help them understand and analyze the line graphs and determine when wheat farmers might need to rely on other sources than precipitation to water their crops.</p> <p>The class meets again as a whole group, and as a</p>	<p>Explain:</p> <p>Show student the slides that show farmers in Pakistan using text messages on their cell phones to know if they should water their wheat crops that day. Have them talk about what is happening in the pictures, and talk about how the farmers might have access to these messages.</p> <p>Introduce Faisal Hossain to the class by watching the short video clip about his work, and reading his interview questions.</p> <p>Make a class list of questions that students would like to ask Faisal Hossain if they could talk to him.</p> <p>Check the FAQ resource to see if he has answered the questions that the students had.</p>	<p>Evaluate:</p> <p>This is an interesting real-world application of technology to help make things better across our globe. Students can now pick a way that they would like to communicate when they have learned with others.</p> <p>These communication methods could include:</p> <ul style="list-style-type: none"> - Make posters - Make a short video - Make a PPT presentation <p>There is a rubric to use to evaluate these projects. Consider having students communicate their findings to other classes, parents and community members during a STEM Family event, and share the results around the school if they've created visual aids.</p>	<p>Extend:</p> <p>Read "Earth's Water Delivery: No Passport Required"</p> <p>Learn more about how and why NASA satellites study Earth's systems: Water Falls- Getting the Big Picture, Why Does NASA Study Earth</p> <p>Figure out how much freshwater their family uses each day. Learn more about how we can reduce the use of freshwater resources. EPA website</p>
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<p>compared to US about 31 %)</p> <p>Read the article, "Precious Freshness"</p>		<p>group they share in their findings. They look at when during the year, based on the GPM satellite data, they think farmers may need to water their wheat crops.</p> <p>They proposed some possible solutions to help farmers to reduce their use of valuable freshwater resources.</p>			
Key Student Questions	Key Student Questions	Key Student Questions	Key Student Question	Key Student Question	Key Student Question
<p>Why are freshwater resources limited?</p> <p>Why don't all regions of the world have equal access to freshwater resources?</p> <p>How are freshwater resources used around the world?</p>	<p>How much freshwater does growing wheat need?</p> <p>How long is the wheat growing season?</p> <p>What is the weather and climate like in Pakistan?</p> <p>What happens when there isn't enough precipitation to water farmer's crops?</p> <p>How do they make sure they can water their crops, especially in countries where freshwater resources are not plentiful?</p> <p>Why are freshwater resources limited in Pakistan?</p>	<p>What information can you get from the "Interannual Time Series" data set?</p> <p>What does this line graph show?</p> <p>What units are being measured?</p> <p>What are the time periods for this data?</p> <p>How does the precipitation data compare between wheat growing regions in Pakistan and Kansas?</p> <p>How does the amount of precipitation that falls during the wheat growing season in each of these locations impact the usage of freshwater resources?</p>	<p>What does Faisal Hossain do?</p> <p>How does he help the wheat farmers know when to use freshwater to irrigate their wheat crops?</p> <p>How does one get a job like Faisal Hossain's job?</p> <p>How does he use NASA data to help him do his work?</p>	<p>How can we communicate our findings to others?</p>	<p>What can you do to reduce how much freshwater you use each day?</p> <p>How can your community try to reduce the amount of freshwater they receive?</p>

