



Climate Change in the Inland Pacific Northwest

Week 2 – Day 4

Lesson Overview

The purpose of this lesson is for students to apply and extend their previous knowledge of global climate change to a regional context. Students will gain an understanding of what the impacts of climate change look like in the inland Pacific Northwest and how those impacts will influence wheat farming.

Lesson Vocabulary

temperature, precipitation, climate, seasons, region, and climate change

Standards and Learning Targets for Lessons

Learning Targets

- I can describe how the climate is changing in the inland Pacific Northwest.
- I can explain several ways that climate change is impacting wheat farms in the inland Pacific Northwest.

Next Generation Science Standards

- 5-ESS2-1 – Earth’s Systems
 - Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Idaho Science Standards

- 5.S.1.2.1 – Goal 1.2 Understand Concepts and Processes of Evidence, Models, and Explanations
 - Use observations and data as evidence on which to base scientific explanations and predictions.

Common Core ELA Standards

- RI.5.2 – Reading Informational Text
 - Determine two or more main ideas of a text and explain how they are supported by details; summarize the text.

Materials

- Text “Regional Climate Change and Agriculture in the Inland Pacific Northwest” (Print one copy for each student.)
- “Regional Temperature Data” (Print one copy for each student.)
- “Evidence-Based Reading and Writing: Text Reduction Protocol Recording Form” (Print one copy for each student.)
- Exit ticket (Print one copy per student.)



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Lesson Duration

Approximately 2 hours

Lesson Description

Engage (5 minutes)

- Begin this lesson by accessing prior student knowledge.
- Have students get into partner groups and discuss the following questions: *What is the greenhouse effect?*; and *What is climate change?* (2 minutes)
- Select several students to share their group's thinking. (2 minutes)

Explore (30 minutes)

- Give each student a copy of the regional temperature data (graph) and have them independently grapple with the graph to identify patterns. (5 minutes)
- During this time, write the discussion questions below on the board.
- After the students have independently spent time analyzing the data, have them work in small groups to analyze the data and answer the following discussion questions:
 - *What are three patterns that you notice in the data?*
 - *What differences do you see between the high-temperature spikes in our time right now and those in the 2090s?*
 - *How do you think this warming pattern will impact wheat farmers?*

Note for teacher: this graph was plotted using a model to predict inland Pacific Northwest regional temperature from 2005 to 2099. The major trends to highlight are that the lowest temperatures each year are expected to increase (i.e., winters will get warmer) and the highest temperatures each year are expected to increase (i.e., hotter summers).

Explain (15 minutes)

- Unpack the learning targets: (1) *I can describe how the climate is changing in the inland Pacific Northwest;* and (2) *I can explain several ways that climate change is impacting wheat farms in the inland Pacific Northwest.* Write the learning targets on the board or on chart paper. Discuss the meaning of key words. Discuss the purpose of the lesson in terms of what students will be able to do by the end of the lesson.
 - Clarify the term “climate” and the concept “climate change” for the first learning target.
 - Clarify that the expectation of the second learning target is for students to articulate multiple ways that climate change is impacting wheat farming and that the evidence students use will be based on data and cited directly from the text.

Elaborate (45 minutes)

- Pass out “Evidence-Based Reading and Writing: Text Reduction Protocol Recording Form.” Read instructions together and clarify any questions.
- Have students conduct the text reduction protocol in small groups.



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Evaluate (20 minutes)

- Begin by having a debrief on the text reduction protocol. Have the whole class circle up. Each student will share her/his significant word that addresses the question, *How are changing temperature and precipitation impacting wheat crops in the inland Pacific Northwest?*
- After the students have shared their thinking, ask each student to complete the exit ticket.



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Regional Climate Change and Agriculture in the Inland Pacific Northwest

Scientists at the University of Idaho in Moscow, Idaho study temperature, precipitation (rain and snow), and climate patterns in the inland Pacific Northwest. They have collected data showing that the climate is changing in the region. The average temperature of the region has increased by nearly 1.3°F over the past century. Summers have become warmer in the past ten years. Scientists have also observed changes in precipitation patterns throughout the region. Data show an increase in spring rain and a decrease in summer rain over the past fifty years.

Scientists also study how these changes in the region will continue into the future. They have gathered data showing that the regional climate will very likely change even more over the next one hundred years. Summers will become hotter and drier. Summer temperatures will increase about 9°F over the next one hundred years. High temperatures that used to be considered heat extremes will become more usual and eventually considered “normal.” Summer precipitation is expected to decrease a lot. In addition, winters will become warmer and wetter. Warmer winter temperatures will result in less snowfall and more precipitation falling as rain. Winter rain is expected to increase by 1.5 to 3 inches over the next fifty to eighty years.

Scientists also study how these changes in climate will affect people living in the region. Warming temperatures present both opportunities and challenges for agriculture in the region. Warmer temperatures throughout the year are likely to increase the length of the growing season and/or the part of the year in which temperature and rainfall allow plants to grow. This could increase crop yield. However, warming of summer temperatures and less summer rain can also increase stress for crops. First, increased summer heat will result in increased transpiration and plants will lose more water through their stomata. Second, less summer rain will result in drier soils making it more difficult for plants to get the water they need. Both of these conditions will impact many agricultural crops.

Wheat is a main crop of the inland Pacific Northwest. Climate change is expected to have both positive and negative impacts on the region’s wheat. Some wheat farmers will see higher yields with climate change. As atmospheric carbon dioxide (CO₂) increases from greenhouse gas emissions, plants will get more CO₂ in their leaves. Like many plants wheat will use this additional CO₂ to photosynthesize more, which means each plant will make more food and grow more. Another benefit of increasing CO₂ in the atmosphere is that plants will close their stomata more and lose less water. These responses to climate change have been well documented in the scientific literature and could increase wheat yield in the region.

In addition to these positive impacts climate change will have negative impacts on wheat in the region. High temperature during the flowering stage of plant growth can damage wheat.



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For example, a few days with temperatures above 88°F can significantly reduce crop yield. In addition, increased winter rain can result in excess water for wheat crops. Plants need soil moisture for growth, but when soils have too much water their roots become damaged and the plants can die. Climate change can also increase weeds, insect pests, and diseases. All these pests cause decreased wheat yield. Farmers will also lose money as they spend more money on chemicals they will need to kill weeds and insects.

Farmers in the inland Pacific Northwest will continue to see changes in climate and the crops they grow. Wheat farmers are sensitive to the impacts of regional climate change. It is impossible to predict the exact impacts climate change will have on wheat farming. Scientists and farmers throughout the region are working together to help farmers be successful in a changing climate. They are constantly searching for new ways to adapt or adjust to climate changes so they can continue to produce wheat to feed people all over the world.

Text adapted from REACCH Annual Reports: <https://www.reacchpna.org/reports>



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Evidence-Based Reading and Writing: Text Reduction Protocol Recording Form

Directions: Today you will collaborate with a group to read a text, annotate it, and capture evidence and reflections on the recording form on the next page.

Part 1: The protocol begins with a silent reading of “Regional Climate Change and Agriculture in the Inland Pacific Northwest.”

Part 2: As a group reread the text out loud to answer the following questions, underlining or highlighting the information needed to support your answers.

How are temperature and precipitation changing in the inland Pacific Northwest?

How are changing temperature and precipitation impacting agriculture in the inland Pacific Northwest?

How are changing temperature and precipitation impacting wheat crops in the inland Pacific Northwest?



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Evidence-Based Reading and Writing: Text Reduction Protocol Recording Form

PART 3: Independently (silently) organize your thinking in the table below.

Question	Significant sentence	Significant phrase	Significant word
How are temperature and precipitation changing in the inland Pacific Northwest?			
How are changing temperature and precipitation impacting agriculture in the inland Pacific Northwest?			
How are temperature and precipitation impacting wheat crops in the inland Pacific Northwest?			



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Exit Ticket

Name: _____

What do you think are several (three or four) challenges that wheat farmers will face in the future?

Note: use evidence from the text reduction protocol recording form from today and your prior knowledge around plants, photosynthesis, and the inputs and outputs of a wheat farm.



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Regional Temperature Data

