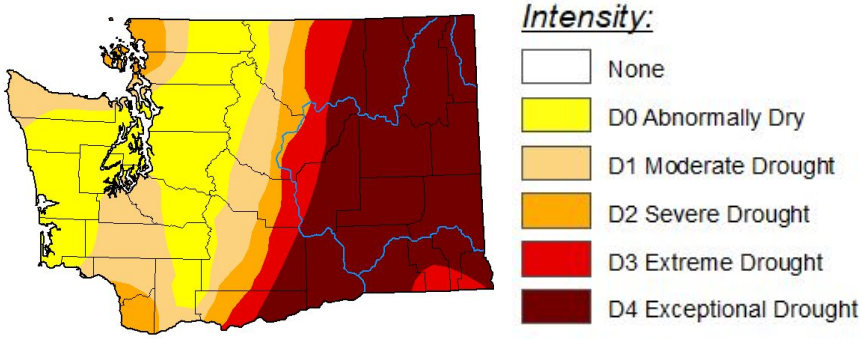
Name:_____ PRD: _____

Essential Question: How does climate change affect Washington wheat farms?

Background



Figures 1-3: [Left] Drought map for Washington state August 2021 from Tinker, Richard. *U.S. Drought Monitor Washington August 3, 2021*, CPC/NOAA/NWS/NCEP, August 2021, droughtmonitor.unl.edu [Right, top] Heat-stressed wheat from Berg, Nicole. *'Early and Fast' wheat harvest due to drought*,Capital Press, June 2021, capitalpress.com/ag_sectors/grains/early-and-fast-wheat-harvest-in-washington-due-to-drought/article_394eed38-d83c-11eb-bd4d-cb0440f58b21.html[Right, bottom] Hessian fly, a wheat plant pest from Bauer, Scott. *Hessian fly, Mayetiola destructo,* Agricultural Research Service USDA, August 2013, en.wikipedia.org/wiki/Hessian_fly#/media/File:Hessian_Fly.jpg

In the 2021 growing season, extreme drought in Washington state means that soils are very dry. Farmers are concerned about sufficient **yield** this year - about harvesting and selling enough wheat to make a profit.

Over much of Washington's wheat fields, farmers rely completely on precipitation (snow and rain) to provide enough moisture for their wheat plants (no sprinklers or irrigation on these fields!). Many, especially in areas where the **climate** is already dry, use a summer fallow rotation, which means that they leave empty, or fallow, half of their acres each year in order to build up moisture before planting more wheat. After a field is harvested (July-August) it will sit fallow until the following September when it will be planted with winter wheat. With enough precipitation the fallow field will accumulate moisture for the next year's crop. It's a long-term commitment that drought can quickly spoil.

In addition, the overall warming of temperatures in Washington state means wheat farms may become more **susceptible** to certain pests, wheat diseases, and even weeds. So, **how does climate change affect Washington wheat farms?**

Vocabulary

climate: weather patterns and average conditions over a long time period.

susceptible: able to be harmed by something.

trend: the overall or average direction over time.

yield: the amount of wheat seeds that can be harvested and sold.

variety: a type of wheat plant or seed that has specific traits.

bushel: volume measure for harvested wheat.

pest: insect that harms the health or growth of the wheat plant.

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1. MARK THE TEXT

Underline claims the author makes and any pieces of information and evidence that are relevant to the Essential Question. A claim is the idea (or ideas) the author will show you or try to convince you of.

Circle the vocabulary words listed in the box above if you find them in the text. These words might clue you into places where there is evidence in the text.

Put a question mark ? above any other word you need to look up to help you best understand what the author is saying.

2. CONNECT AND RESPOND

Use these symbols to mark sentences or paragraphs in the article. Explain your connections or responses in the **margin**. Include at least two of the following:

→ Something you have a connection to (Do you know something else about the point the author is making? Did you learn this information in another place?)

+ Something you agree with

X Something you disagree with or have a counterclaim for

△ Something that changes what you thought at first

~ Something you have a question about or don't understand yet

Name:_____ PRD: _____

Essential Question: How does climate change affect Washington wheat farms?

Sweat the Small Stuff, Like the Hessian Fly *WSU Wheat and Small Grains* July 23, 2019 by Doug Finkelnburg

1 As climate change is occupying more space in public discourse, it is easy to focus on the attention-grabbing headlines about loss of sea ice, warming oceans, and more intense and frequent wildfires. Often overlooked are the seemingly subtle effects a changing climate presents and the ramifications these subtle changes can have. For example, let us discuss a modest pest of Pacific Northwest wheat, the Hessian fly.

2 First observed in the inland Pacific Northwest in the 1930's, the 1/8-inch long Hessian fly causes damage when larva feed on young wheat plants' shoots, leading to increased lodging (bending over of the plant; making it hard to harvest) and reduced yields.

3 Wheat is the preferred food source for Hessian fly, but barley, triticale and rye species are alternate hosts. The larva form pupa or "flax seeds" in the stem which protect them until favorable conditions allow for emergence, egg laying and a repeat of the life cycle.

4 In the inland Pacific Northwest, conditions have typically allowed one to two generation of Hessian fly per season, occurring at a time that mainly threatens spring wheat crops (Castle del Conte et al. 2005). A heavy infestation of Hessian fly in susceptible spring wheat can result in 11-24% loss in grain yields (Smiley et al. 2004).

5 Current mitigation strategies include planting resistant varieties, crop rotation with non-host species to prevent pest population build-up, delayed winter seeding or early spring seeding that avoid the fly's most active season, and insecticide application when necessary.

6 The warmer falls and wetter springs expected as the climate changes are likely to result in more than two generations of Hessian fly in a growing season (Eigenbrode et al. 2017). This could lead to some of these mitigation strategies—like timing of seeding—losing effectiveness and could potentially allow the pest to infest winter wheat more frequently as well.

7 If the Hessian fly could survive to infest both spring and winter wheat in the inland Pacific Northwest, that would present two significant challenges.

8 The first challenge is scale. Winter wheat occupies roughly ten times more acreage than spring wheat in any given year. If Hessian flies started to affect winter wheat, as well as spring, there could be 10 times the loss of yield, and profit, for Washington's wheat farmers.

9 The second challenge is the lack of resistance to Hessian fly in available winter wheat varieties. A recent examination of winter wheat varieties adapted to the Pacific Northwest showed that over 96% of them are fully susceptible to Hessian fly (N. Bosque-Perez, University of Idaho Entomologist, personnel communication).

10 An increase in winter wheat infested with Hessian fly would necessitate more frequent insecticide applications to a crop that rarely needs any. Insecticides are a cost to farmers, so increased applications would also erode profitability. Further, such an occurrence would result in an increase in insecticide use each year.

11 The good news is this issue is being addressed by regional experts in entomology and winter wheat variety development. The bad news is that until resistance can be introduced widely to well-adapted commercially-available winter wheat varieties, we are left with crop rotation and the hope for cool falls and dry springs as the best mitigation practices.

12 Climate change's threat to our agricultural systems is not all about droughts and severe weather. Sometimes it's as subtle as a 1/8-inch fly getting one more shot at reproduction per season.

Adapted from Finkelnburg, Doug. "Sweat the Small Stuff, Like the Hessian Fly." *WSU Wheat and Small Grains*, 23 July, 2019, smallgrains.wsu.edu/sweat-the-small-stuff-like-the-hessian-fly/.

Summary: Review the essential question and your annotations. Answer at least two of the following questions in the space below. What claim(s) does the author make about the essential question? Do you agree with the claims? Are they well supported by evidence from the article? What connections did you make that help you evaluate the author's claim?

Name:_____ PRD: _____

Essential Question: How does climate change affect Washington wheat farms?

Discussion Use the information on this page to help guide your discussion to answer the essential question. Remember to say just enough to make your point while leaving **room for others to speak**. It is okay for there to be **periods of silence** while you and your classmates think. (If it's quiet - **go back to your article** annotations and try a sentence starter below!) Make sure you respond to or question each other's ideas while you talk. Look out for times when you can clarify with evidence, ask questions about relevancy or accuracy of information, or identify a counterclaim.

Near the beginning
Give (and analyze) claims and evidence

My author claims…

My article says…but I think…

My article says...and I think...

In the middle
Evaluate information and look for connections and/or counterclaims

From what I know...because...

What does your article say about...

A counterclaim would be that…

Does anyone have more information about...

Does…depend on having...point of view?

Near the end
Answer the essential question

When you said…I thought…

Does the group agree that…?

Even though my article claims...I now think…

My article claims...and I think it is right because…

After listening to everyone's thoughts, I think...

Discussion Checklist

→ Share information by stating (at least 1)
- ❑ **My article's claim, quoted directly from article**
- ❑ My analysis of the claim
- ❑ **Relevant connection or background information**
- ❑ Evidence, quotes directly from article

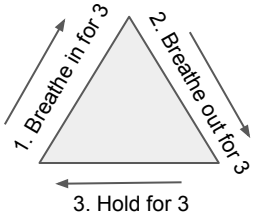
→ Respond to others ideas by (at least 1)
- ❑ Pointing out a counterclaim
- ❑ Asking for examples
- ❑ Asking for evidence
- ❑ **Saying more about others' ideas**
- ❑ Prompting someone else to respond

→ Show respect for others' ideas by (at least 1)
- ❑ **Paying attention to people who are talking**
- ❑ Staying on-topic
- ❑ Re-engaging the group after a period of silence or if you go off-topic
- ❑ Monitoring time

→ Answer the essential question by (at least 2)
- ❑ **Saying my ideas about the essential question**
- ❑ **Using evidence to back up my ideas**
- ❑ Providing a different answer or idea
- ❑ Giving OR asking for a summary

Nervous about speaking? It's normal.
Here are some things that might help:

Breathe. Use a triangle breath to regulate your nerves and prepare yourself to speak.



Go back to your article and look for where you noted **personal connections** to the text. Speaking about something you have experience with may be easier in the group discussion.

Look at the sentence starters above. Write out what you are going to say by filling in the blanks and be on the lookout for when to add your thoughts.

Name:_____ PRD: _____

Essential Question: How does climate change affect Washington wheat farms?

Reflection Think about what you read and what others said in the group discussion to answer the following questions.

1. What did you get out of this activity?

I learned	□ a lot	□ a little	□ nothing
I participated	□ a lot	□ a little	□ not at all
My thinking changed	□ a lot	□ a little	□ not at all
I enjoyed it	□ a lot	□ a little	□ not at all

2. Choose a stem from above and say more. For example, *I participated a lot because the article I read had good evidence for the essential question* or *My thinking changed not at all because I agreed with the article's claim and we did not find any credible counterclaims during our discussion.*

3. How would you answer the essential question in 3-5 sentences? Consider the claims and evidence from your article, along with connections, background information, and counterclaims and evidence brought up during the discussion.