

Ashfall Lesson 1
Wildfire Dynamics
Instructional Guide
(Do not share with students)

Instructions for Lesson 2 - Wildfires and Weather - can be found [here](#).

Grade Level	7 th grade
Instructional Time	60 minutes Time for each task is estimated. <i>Consider extending this lesson across multiple class periods if your students need more direct instruction in finding averages, graphing, or in making claims using evidence.</i>
Standards Alignment	NGSS: MS-ESS3-2
Driving Question	How can we construct a model to make predictions about fire behavior?
Learning Objective	Students will understand the relationship between tree density and acres burned in a wildfire.
Materials	Computer/tablet and internet access
Preparation	- o Prior to class, decide how students will complete the science journal (online or on paper). If needed, print copies of the science journal - o Project the google site at the front of the class, or share it with students for them to view individually - o Have devices for students to use NetLogo (could work in pairs/groups or project at the front of the room, as needed)
Vocabulary	Fuel Independent Variable Dependent Variable Average Claim Evidence
Trauma-Informed Practices	Students may have experienced trauma, first-hand or second-hand, related to wildfires and smoke. Here are some trauma-informed practices to keep in mind: • Tell students a few days ahead of time that you will be doing a lesson on wildfires. • Consider having them reflect on their experience (Task 1) the day before the lesson so that you can discuss specifics with students and encourage them to express their feelings about wildfires, without a time constraint • Consider informing parents that you will be learning about wildfires before the lesson. This could be via a homework assignment for students. • Make it clear that students can take a break during the lesson

	• Make objectives clear to students and approach the lesson from a solution-focused lens - we have to learn how fires spread so that we can stop that spread
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Task 1: Phenomenon and Anchoring Question (7 minutes)

Have students open the [science journal](#) (if digital, have them make a copy to record their work)

Prompts:

- What is your experience with wildfire?
- What do you know about wildfire?

Time permitting, you can allow students to share their answers aloud, or use a program like [padlet](#) to share their answers online.

Note: Use this time to consider trauma-informed practices. Are there any students who may be uncomfortable with this topic, based on their experiences? Make it clear to students that they can take a break during the lesson, if they are feeling uncomfortable.

Task 2: Engage - Fire Behavior (6 minutes)

Project the [google site](#) on the board and play a minute or so of the two videos. As they watch, ask students to think about similarities and differences. Then, have them fill out a see, think, wonder.

- See: What are your factual observations? What are similarities or differences between the two fires?
- Think: What do you think is happening here that you can't see? Why do you think there might be similarities or differences?
- Wonder: What questions do you have? What are some things you see that you aren't able to explain?

Consider having students share out loud or with neighbors.

Task 3: Explore - Modeling Fire (10 minutes)

Students will now investigate the question: How does fuel density affect fire. Students will complete an online simulation using [NetLogo](#) and collect their data in their science journal.

Consider asking the following discussion questions aloud to guide students to make connections:

- *In a real wildfire, what is the fuel?*
- *Why might the fuel density be higher or lower, in real life?*

- *Think back to the videos from Task 2. Which of the videos had higher fuel density? Did they both have the same type of fuel?*
- *What other things do you think might affect a fire?*
- *What were some things that you found surprising during the simulation?*

The educator may need to review how to find averages.

Task 4: Explain - Graphing as Scientific Modeling (7 minutes)

Students consider the purpose of models, as well as their limitations. Students will look at the two models and answer the following questions in their science journal.

Prompts:

- What does the model tell us (its purpose)?
- What does the model leave out?

Students will then learn about independent and dependent variables and how to graph them.

This may take more or less time, depending on their prior knowledge.

Task 5: Elaborate - Graphing Fire (15 minutes)

Students will graph their data using NetLogo.

Students may require some modeling from the instructor to explain how to graph their data. One suggestion is to have students graph the first 2 data points, then project the work of an exemplar. Consider how you can support students in their math curriculum on graphing.

Task 6: Evaluate Your Learning (15 mins)

Students will answer question prompts as a summative assessment of their learning. Prompts:

1. Make a claim about how fuel density affects fire. Use evidence from the simulation.
2. What are the limitations of your model? What does your model leave out?
3. What variables do you see that are the same in all the fire models we've seen?
4. How could you use what we learned to predict wildfires?
5. What have you learned about wildfire behavior that you did not know before?

Students may require some further instruction to answer the first prompt, depending on their experience with CER (Claim, Evidence, Reasoning)

Introduce Citizen Science (time permitting)

The #Ashfall project allows students to participate in real-world science by taking photos of falling ash. Consider introducing this project to students at the end of the lesson. If ash does fall, students can participate at home or you can take them outside to photograph the ash. (Note: For safety, have students wear N95 masks when going outdoors if smoke is at an unhealthy level)

Extension Activities:

Place-Based/Career Connection to DRI Scientists: The link below contains an article and a video about a model that scientists are making at DRI to predict fire. Have students consider how this model differs from the NetLogo simulation that they used during class.

<https://www.dri.edu/new-nv-energy-foundation-grant-will-support-wildfire-preparedness-in-nevada/>

Simulation of Camp Fire:

https://drive.google.com/file/d/1S9zi3ERVUyld-_qtxGdZ05gRehmdvfqk/view?usp=sharing

Hands-On Fire Simulation (requires that things are set on fire - recommended to be completed outdoors by instructor with proper safety equipment - or just watch the video). Have students compare this to the videos from the start of class and the models that they created:

<https://www.youtube.com/watch?v=Mg2nFpEEbow>

- Fire suppression = extra cotton balls and toothpicks
- Climate change = left under heat lamp

<https://youtu.be/HeOI2N6iLy0> Video that explains the problem with fire suppression → how fires can be useful

Instructors, after completing the lesson, please fill out this short survey about your experience.

<https://forms.gle/ugy3iQGJCmKhrfLY6>