“Solutions-Oriented Learning” Storyline

3-Fire: Wildfires in Washington

Storyline introduction and overview:

A change in climate over time has contributed to a significant increase of wildfires in our state. In this storyline, students will make the connection between changes in ecosystems and the interconnectedness of all things. Students will gain an understanding of combustion (fire triangle), and observe through data that certain conditions (humidity, temperature, fuel load, etc.) contribute to forest fires (fire environment triangle).

NGSS Learning Progression for this Storyline: The 3rd Grade storyline is part of a larger learning progression that includes students mastering standards pre-K to 12th grade. Take a look at how the 3rd Grade performance expectations fit in a continuum of learning for your students.

Placemaking: Wildfires have become commonplace in Eastern and Western Washington, and around the world. Whether or not they’ve experienced a fire in their communities, all students in Washington have experienced smoke-filled summers. Students living in counties along the Outer Coast of Washington State live in or near thick forests that are becoming more and more vulnerable to wildfire.	**Anchoring phenomena:** Images of the Ecologically Managed Forests from The Nature Conservancy (available in a Google Slide Deck). Facilitate a conversation with your students about the images and their connections to them. Guide students in noticing the similarities and differences in these situations.	**Drawdown:** Indigenous Peoples’ Forest Tenure
Indigenous and other relevant cultural connections: Tree of Life, Stewardship, interconnectedness, duality of fire, Connections can be made through Tribal Nations work mitigating and/or preparing for the impacts of changing ecosystems and climate.	**NGSS PEs(progress towards):** 3-LS4-1: Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago. 3-ESS2-1: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.	

Estimated time required to implement this storyline: 2 to 3 weeks

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NGSS PEs:

3-LS4-1: Analyze and interpret data from fossils to provide evidence of the organisms and the environments in which they lived long ago.

3-ESS2-1: Represent data in tables and graphical displays to describe typical weather conditions expected during a particular season.

Science & Engineering Practice (SEP)	Disciplinary Core Idea (DCI)	Cross Cutting Concept (CCC)
Analyzing and Interpreting Data Analyzing data in 3–5 builds on K–2 experiences and progresses to introducing quantitative approaches to collecting data and conducting multiple trials of qualitative observations. When possible and feasible, digital tools should be used. • Represent data in tables and various graphical displays (bar graphs and pictographs) to reveal patterns that indicate relationships. (3-ESS2-1) • Analyze and interpret data to make sense of phenomena using logical reasoning. **Obtaining, Evaluating, and Communicating Information** Obtaining, evaluating, and communicating information in 3–5 builds on K–2 experiences and progresses to evaluating the merit and accuracy of ideas and methods. • Obtain and combine information from books and other reliable media to explain phenomena. (3-ESS2-2)	**LS4.A: Evidence of Common Ancestry and Diversity** • Some kinds of plants and animals that once lived on Earth are no longer found anywhere. *(Note: moved from K-2)* • Fossils provide evidence about the types of organisms that lived long ago and also about the nature of their environments. **ESS2.D: Weather and Climate** • Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next. (3-ESS2-1) • Climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years. (3-ESS2-2)	**Scale, Proportion, and Quantity** • Observable phenomena exist from very short to very long time periods. **Patterns** • Patterns of change can be used to make predictions. (3-ESS2-1),(3-ESS2-2) ***Connections to Nature of Science*** **Scientific Knowledge Assumes an Order and Consistency in Natural Systems** • Science assumes consistent patterns in natural systems.

Learning Sessions

Materials List

Learning session	Materials
Set Up	2 plants for the whole class or more if you are going to do groups
1.	Regional story of your choice
2.	Google slides, regional connection

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3.	Pre-assessment and rubric
4.	Paleoclimates and Pollen activity materials including pollen picture, 1 large graduated cylinder, 5 different types of sediment (soil, clay, potting mix, play dough, gravel),small plastic bag per group, pie pan per group, tweezers per group, colored paper for making pollen samples, permanent marker.
5.	Climate chart copies per student
6.	Computers to access the simulation
7.	Fire triangle poster, gumdrops, toothpicks, paper, scissors, tape
8.	Computer to show video
9.	Model fire carrier
10.	Grandmother Cedar Tree
11.	
12.	Post assessment and rubric

	Set Up	Estimated time: 15 minutes
	To prepare for learning session 6, students will simulate plant needs and growth by making observations of plants that are or are not having their needs met. You can use any type of small plant or for this activity: ● Plant 1: Place in a spot with sunlight and given adequate water ● Plant 2: Place in a closet/cabinet with no water and no sunlight. You can set up this lab for the whole class or for small groups, whichever you prefer.	

1.	**Grounding Native Ways of Knowing:**	Estimated time: 45 minutes
	To connect to native ways of knowing consider exploring the following ideas in connection with your local tribal nation: ● Tree of Life ● Interconnectedness of all things ● Fire duality (good/bad)	

- Stewardship

To access information on how to reach out and build relationships with local tribes, visit the OSPI Office of Native Education: Partnering with Tribes webpage.

For example in Southeast and Southwestern Washington, an appropriate reach out is to the Yakama for a story and/or teachings on Fire/Prescribed Burns.

- Yakama Nation Fire Management
- What did the story teach us about our relationship between Cedar Tree and the interconnectedness of all things (fire, pollen) and changing landscape as it relates to climate change?
- What are the impacts of changing ecosystems (as impacted by changes in climate over time) and connectedness of all things as fires become bigger and more constant in our communities?

Another example of a relevant connection for the North Puget Sound area is the Samish Story of Grandmother Cedar Tree.

- The Grandmother Cedar Tree Story
- The Story of Cedar
- Roger Fernandes Storytelling

In addition to stories of the past, research and connect with tribal nations close to your community and their actions to mitigate and adapt to a changing climate.

2.	**Examine Phenomenon: Wildfire affects the landscape in Washington.**	Estimated time: 45 minutes

1. A story of two forests: In this learning session, students will view images of two different forests. They will make observations and connections to these spaces. The teacher will write down the student comments to use later.

Have the students discuss the images in these Google Slides.

After eliciting student responses to the images about the forest, fires, and aftermath, show students more images from one of these regionally specific resources:

- Cascade Mountains, Central and Eastern Washington: Osborne Panoramas
  - More on William B. Osborne: Profile
- Coastal Washington: Olympia Mountain Images page 3 of the PDF
- Northern Idaho: Fires of 1910
- Southcentral Washington (smoke impacts for all of Washington state): Eagle Creek Fire
  - Eagle Creek Fire videos- During and After

	Students will write in their journal or science notebook what they notice about the forest and its changes over time based on the regional images.

3.	**Pre Assessment:**	Estimated time: 45 minutes
	3-Fire: Wildfires in Washington Pre- Assessment **3-Fire: Wildfires in Washington Assessment Rubric**	

4.	**Guiding question:** **What can the mud at the bottom of a lake tell us about changes in climate over time in our area?**	Estimated time: 45-60 minutes

NOTE: Activity requires considerable prep by the teacher - approximately 90 minutes.

Use the ADAPTED Paleoclimates and Pollen Lab Activity.

NOTE: The adapted version has been simplified to make the information more accessible to 3rd graders. It is formatted to meet the goal of understanding that different species of plants have needs. For more information on the actual climate of those time periods, please read the background material included in the activity.

The activity is adapted from a UCAR Center for Science Education exercise written for 7th-9th grade students. Y**ou will need to support younger students by**:

1. Having a class discussion about what plants grow in what different kinds of climates. You can use very general descriptions of climate types.
    - For example, ask students how the plants and trees in the Hoh rainforest might be different than the trees and plants we have in Eastern Washington. Or use more extreme examples of tropical rainforest and desert. Make sure to talk about temperature and precipitation differences between the two climates, and the adaptations the plants must have to survive in those climates.
2. Having a discussion with students that plants have different needs. Some plants need more water and higher temperatures, while others need cooler, drier climates. Ask students what would happen if those needs aren't met (the plants could die).
3. Showing students the model sediment column from the activity. Explain that paleobotanists (special plant scientists) study ancient plants by looking at the mud in the bottom of the lake. When mud settles at the bottom of the lake, pollen gets trapped. We can find the pollen and figure out what plants were nearby. The different layers in the column are from different times in history. Ask the students which layer happened first (the bottom layer). This is the oldest layer. Ask students how they know (you have to put the bottom down first, and the next layer on top).
4. Explaining that they will be paleobotanists looking at model mud samples. They have

	to find the pollen grains in the sample and then the class will work together to figure out what the climate was like. **NOTE**: There is ability to differentiate this activity built in to the adapted exercise. Students should work in teams; each team will get a sample to analyze. Some samples have more "pollen" types to find and record while others have less.

5.	**Guiding question:** **How can we use graphing and mapping to visualize weather pattern changes to understand how the climate has changed over time in our region?**	Estimated time: two 30-minute segments

After students complete the Paleoclimates and Pollen lab, students are going to collaboratively write the story of changes in climate over time by recording the Paleoclimate data starting with the oldest layer. There are two ways students could engage in this activity:

- Option 1: Write the story (layer by layer) on an anchor chart and have the students write in their journal along with you. Make sure to include what happens to the species that exist in one layer, but not in the one that follows.
- Option 2: Write the story (layer by layer) on the board, and have students create a comic strip with two frames for each layer. Include the "death" or what happens to the species that exist in one layer, but not in the one that follows.

Here is an example of prompts you might use with your students (with the anticipated answer in italics):

Which layer is the oldest layer? *Layer 5*.
How do you know this? *It is at the bottom.*
What was the climate like when that mud settled to the bottom of the lake? *It was very cold, and there were plants that didn't need much water.*
How do you know this? *There are mostly grasses and sedges that grow in cool climates and some other plants that also don't need much water.*

Which layer came next? *Layer 4*
How do you know this? *It is on top of Layer 5.*
What was the climate like when that mud settled to the bottom of the lake? *It was warmer than during Layer 5, and there are still plants that don't need a lot of water.*
How do you know this? *There are many of the same species, but some new ones that need warmer climates.*

Which layer came next? *Layer 3*
How do you know this? *It is on top of Layer 4.*
What was the climate like when that mud settled to the bottom of the lake? *It was warmer and wetter than during Layer 4.*

How do you know this? *There are a lot of alder and Douglas fir trees that need lots of water, and Douglas fir that needs a warmer climate.*

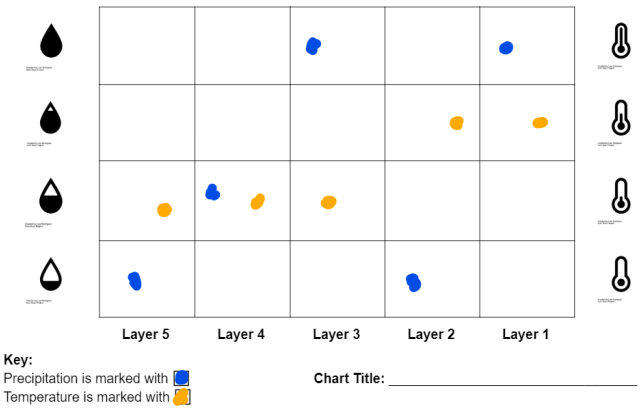
Which layer came next? *Layer 2*
How do you know this? *It is on top of Layer 3.*
What was the climate like when that mud settled to the bottom of the lake? *It was warm and wet.*
How do you know this? *The Douglas fir and mixed meadow species need water and warm temperatures.*

Which layer came next? *Layer 1*
How do you know this? *It is on top of Layer 2.*
What was the climate like when that mud settled to the bottom of the lake? *Cooler and wetter than before.*
How do you know this? *There are cedar trees and alder trees that need more water.*

While writing, ask students what happens to the plants that don’t appear in subsequent layers (i.e. lodgepole pine was in Layer 4, but not in Layer 3).

Where did the lodgepole pine go? *It died because it didn’t have what it needed / the climate changed. It became dead logs on the ground.*

Students will complete the Climate Chart for Battle Ground Lake, Washington after looking at the data.. This is a chart with two variables on the y-axis, and students will need support to complete it.



Example outcome. Students will have two dots in each column - one for temperature and one for precipitation for each layer.

Show students the charts at NOAA’s Climate.gov website. Prior to introducing it to students, first scroll to the Global Climate Dashboard.

- On this dashboard, you can see three different variables at one time. We only want to look at the data for temperature and snow cover. To make it more clear for students,

	first click the labels, "Suns Energy," "Glaciers," and "Heat-Trapping Gases." Next, click the label for "Snow" and then the label for "Temperature". This puts the Global Average Temperature at the top, and Spring Snow Cover just below it. Facilitate a conversation with students about these very complicated charts. • What do the bars show? • Do you notice any trends in the data? • What can we say about the temperature changes over time? • Look at the Spring Snow Cover graph. What do taller bars mean? Does the snow cover stay the same or change?

6.	**Guiding question:** **What if the needs of the plants are not met?**	Estimated time: 30-45 minutes
	In this activity, we are reviewing what happens to the plant if its needs are not met. Students will simulate plant needs and growth by making observations of plants that are or are not having their needs met. **You will need to set this experiment up in session before starting the learning sessions.** You can use any type of small plant or for this activity: • Plant 1: Place in a spot with sunlight and given adequate water • Plant 2: Place in a closet/cabinet with no water and no sunlight. Ask students to discuss what they noticed about the two plants. Ask students what other things plants and trees need to survive and grow. *For this next activity, the most appropriate course of action would be to connect with your local tribal leaders or representatives to learn about sustainability practices and interrelationships with the native species in your region. It is important that the connections be appropriate for your students in your place. Here are some resources to get you started: the OSPI Office of Native Education and Since Time Immemorial.* What follows is a traditional Samish story and dialogue you could use to support this storyline. Listen to the story, "Grandmother Cedar Tree." Before playing the story, explain that this is a traditional story of the Samish people. The storyteller will be telling the story in both English and Samish - a language of the peoples of the Northern Puget Sound who have lived in that area since time immemorial. Traditionally, most stories are only told in winter (with exceptions). It is important for students to be respectful and listen to the story quietly, thinking about the words and teachings in the story. *NOTE: The Cedar Bentwood Box Teaching Toolkit is an excellent resource for background information and a written version of this particular story.* After the story, ask students to think about the ways that Grandmother Cedar Tree was able to care for Little Cedar Tree. Have students help to make a list of the ways Grandmother Cedar	

Tree cared for the needs of Little Cedar Tree. (Later the students will think about how Little Cedar Tree helped Grandmother Cedar Tree.)

Example responses: *Protection from animals*
Protection from strong wind
Shade from hot sun
Calling animals to sing to him

NOTE: If students get a little silly about the tree "calling" the birds to sing to Little Cedar Tree, ask them if they think trees can actually do this. Explain that in fact, trees can send out smells that are attractive to birds, just like freshly baked cookies to us, to bring the birds to their branches to remove pests or distribute seeds.

Can the students picture themselves as Little Cedar Tree? How have trees provided for people? Make a list of the ways trees have provided for people.

Example responses: *Wood for homes*
Food and medicines
Shade from hot sun
Paper for books
etc.

Later, students will be asked to remember this story and how the roles became reversed. Post this quote for reflection and connection to the story: "Grandmother, you took care of me. Now I will take care of you."

7.	**Guiding question:** **What do plants / trees have to do with fire?**	Estimated time: 30-45 minutes

Facilitate a discussion about what happens to plants when their needs are not met. Remind students of the Paleobotany exercise (Learning Session 4). Were there any trees that existed in an older layer, but not a younger layer? *Lodgepole pine, grasses and sedges, alpine sagebrush, Engelmann spruce, grand fir, alder, etc.* What happened to those trees and plants when they didn't have their needs met? *They died. Their material became litter.*

In these two learning sessions, we'll learn how that plant material can become fuel for fires.

The Fire Triangle - Activity #1 (adapted from FireWorks)

Procedure:

1. Explain: Students will share what they already know about fire and then organize this knowledge to better understand what makes fires burn and what makes them go out.
2. Ask students what is needed to make a fire. List their responses on the board (they may include matches, paper, cardboard etc. as well as wildland fuels). Try to write

them in three loose clusters (fuel, heat, and oxygen), which you'll label later. If students don't include plant material (i.e. logs, sticks, pine needles, etc.), guide them to include some in their list.

3. Ask students to come up with a word that describes each category. Guide them to the concepts of fuel, heat, and oxygen, and then label the categories. These are the 3 parts of the Fire Triangle. You may need to explain what oxygen is: an invisible gas, one of several "ingredients" in the air we breathe.
4. Display the Fire Triangle poster (Fire Triangle Poster) and/or label the sides of your drawing. Explain: you can use a triangle to illustrate what makes fires burn and what makes them go out.

Adapted from: Making Fires Burn or Go Out 1: Introduction to the Fire Triangle

8.	**Guiding question:** **What do plants / trees have to do with fire?**	Estimated time: 45 minutes

The Fire Triangle - Activity #2

Procedure:
After introduction to the fire triangle, it is time to think about those three needs for fire, and what would happen if we were to disrupt the triangle. Students will either:

A. Watch a video as a class and contribute to class discussion, or
B. Watch several demonstrations by the teacher and contribute to class discussion.

Option A:
View "The Fire Triangle (Mr. Wizard)" on YouTube. Facilitate discussions at the following timestamps:

Time	*Discussion Prompt*
1:45	Why did the fire go out?
3:04	Why did the fire go out this time?
4:20	How could they take away the fuel?

Option B:
Reproduce the demonstrations from "The Fire Triangle (Mr. Wizard)" YouTube video. Make sure to take safety precautions when working with fire.

To follow-up from this activity, remind students about the images they saw in Learning Session 2 (the Two Different Forests and the Osborne Panoramas). What could they add to their observations of these images? *Potentially looking to connect those close-together matches with the over-crowded forests, while the forests with trees that are spread have natural "fire*

	breaks." Also looking for any connections students have made from the story of Grandmother Cedar Tree.

9.	**Guiding Question: Digging Deeper - Is fire bad?**	Estimated time: 1.5 hours
	Students may develop a misconception that fire is bad. In fact, smaller fires and prescribed burns are an important part of a healthy forest. Suppression of these smaller fires is building a real challenge and making Megafires a major issue in the Western United States. This would be a good time to talk to students about the difference between Megafires and smaller fires, and dig deeper into fire as a healthy ingredient in forest health. "Carrying Fire from FireWorks Curriculum" After students learn about fire as a means to a healthy forest, have students explore possible careers that work in forestry or in fire sciences. These are some suggestions: ● PEI Career Card: Assistant Forester ● Careers in Forestry ● Natural Inquirer: Fire Scientist Careers To extend the career connections in this storyline, reach out to your local Department of Natural Resources office or fire station to invite a person with a career related to fire into your classroom to share about their job with your class.	

10.	**Guiding question:** **What could happen in the future to the climate and what could we do to mitigate the negative impacts of these changes?**	Estimated time: minimum 45 minutes
	Remind students about the warming trends and drier summers we are seeing compared to historical evidence. Use graphs, maps, or other methods as a visual reminder. ● Central and Eastern Washington example: Show students the New York Times interactive "How Much Hotter Is Your Hometown Than When You Were Born?" If you are unable to access the interactive webpage, you may distribute these printouts of the data. ● Puget Sound region example: Show students the temperature change graph on the first page. Students should be able to see how the trend line is increasing over time. Future Scenarios for Climate Change in the Puget Sound In this learning session, students will be bringing together all of the prior experiences with the	

teacher as the facilitator. A discussion might look like the following (example responses in italics):

1. On the board or anchor chart, write: “If ___, then ___, because ___.”
2. Today we want to think about the impacts of the changing climate, and what we can do to make the impacts less severe. What do you think will happen to the temperature in the future? *It might get hotter.* What do you think will happen with precipitation in the future? *It might get drier.*
3. Write, “If the climate gets hotter and drier,” and ask, What will happen to the plants or trees if it gets hotter or drier? *They might die.*
4. Write, “then the plants and trees might die,” and ask, Why might the plants and trees die? *Because they don’t have enough water. Because it is too hot for them to grow.*
5. Write, “because their needs aren’t being met.”

This is the problem statement to guide students in the final product. Direct students back to the quote from Grandmother Cedar Tree, or even listen to the story again. During this listen, students should focus on the ways that Little Cedar Tree was going to help Grandmother Cedar Tree. In the final product, students should take on the point of view of Little Cedar Tree and how they would help the forest trees and plants in this era of warming climate and increased fire danger.

“Grandmother, you took care of me. Now I will take care of you.” (From Grandmother Cedar Tree, as read by Johnny Moses for the Turtle Island Storytellers.)

Final product: As a culminating product, students will show their learning from the point of view of Little Cedar Tree. This can be in the form of a narrative, comic strip, poster, movie, etc. Choose one modality or give the students a choice or list to choose from.

Criterion for the final product:
- Include the problem statement
- Include at least one solution for protection or care of the plants and trees from fire

11.	**Possible next steps/off-ramps/actions:**	
	• What assumptions can we make about plants/species and their adaptability/resilience to fire over time as it relates to climate variables? • Can we map/model future predictions? • Does fire have a direct impact on erosion and mudslides?	

12.	**Post Assessment:**	Estimated time: 45 minutes

3-Fire: Wildfires in Washington

	3-Fire: Wildfires in Washington Post- Assessment **3-Fire: Wildfires in Washington Assessment Rubric**

OER Tracker - 3-Fire: Wildfire in Washington

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