“Solutions-Oriented Learning” Storyline

5 - Wetlands: Ecosystem Benefits

Storyline introduction and overview:

The goal of the fifth grade Wetland: Ecosystem Benefits storyline is to build on students’ previous knowledge of plant/animal needs, habitats, and protection of Earth’s resources. In this storyline students develop an understanding of wetland ecosystems, photosynthesis, what plants need to grow/gain mass and blue carbon wetlands.

NGSS Learning Progression for Wetland Storyline:

The 5th grade storyline is part of a larger learning progression that includes students mastering standards pre-K to 12th grade. Look at how the 5th grade performance expectations fit in a continuum of learning for your students.

Placemaking: To connect students to place, have students participate in a sit spot with the prompt, “How does your spot connect to the wetland? How does water interact in your spot?”	**Anchoring phenomena:** Show students the poster below and ask how humans impact wetlands. Wetland Poster	**Drawdown:** Drawdown: Coastal Wetland Restoration
Indigenous and other relevant cultural connections: Billy Frank Jr. story of the Nisqually Delta Nisqually Story: Water from the Mountain Where the Salmon Run: The Life and Legacy of Billy Frank Jr.	**NGSS Pes (progress towards):** 5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water. 5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.	

Estimated time required to implement this storyline: 3 to 4 weeks

NGSS PEs:

5-LS1-1: Support an argument that plants get the materials they need for growth chiefly from air and water.

5-ESS3-1: Obtain and combine information about ways individual communities use science ideas to protect the Earth’s resources and environment.

Science & Engineering Practice (SEP)	Disciplinary Core Idea (DCI)	Cross Cutting Concept (CCC)
Engaging in Argument from Evidence Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing	**LS1.C: Organization for Matter and Energy Flow in Organisms** • Plants acquire their material for growth chiefly from air and water.	**Energy and Matter** • Matter is transported into, out of, and within systems.

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relevant evidence about the natural and designed world(s). • Support an argument with evidence, data, or a model. **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/or other reliable media to explain phenomena or solutions to a design problem.	**ESS3.C: Human Impacts on Earth Systems** • Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth’s resources and environments.	**Systems and System Models** • A system can be described in terms of its components and their interactions. ***Connections to Nature of Science*** **Science Addresses Questions About the Natural and Material World.** • Science findings are limited to questions that can be answered with empirical evidence.

Materials

Learning Session	Materials
1	• Nisqually Story: Water from the Mountain (Nisqually) • Skunk Cabbage Story (page 19) (Kathlalamet) • Roger Fernandes "Salmon Boy" (Coast Salish)
2	• poster image (color copy or projected)
3	• 5-Wetland: Ecosystem Benefits Pre-Assessment (copies for students) • 5- Wetland: Ecosystem Benefits Rubric (copies for students)
4	• Fabulous Wetlands with Bill Nye the Science Guy • Note Taking Tool (copies for students) • Types of Wetlands (read online or copies for students)
5	• Two long, shallow pans (baking pan or paint roller pan) • Modeling clay • Sponges and/or strips of carpet as wide as the pan • Food coloring • Jar of muddy water • Watering can or pitcher of clean water *Amount of materials dependent on if this is a demo or with small student groups

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6	• Ecosystems: StudyJams! Science | Scholastic.com (read online or copies for students) • What is an Ecosystem Quiz(copies for students)
7	• Ecosystems Episode 5: The Wetland Ecosystem! (4K) - YouTube • Teacher’s Guide to Wetland Activities
8	• Eagle Graphic (copies for students) • Nisqually Story: Water from the Mountain (Nisqually) • Skunk Cabbage Story (page 19) (Kathlalamet) • Roger Fernandes "Salmon Boy" (Coast Salish)
9	• Forest Fact Breaks-Photosynthesis • Nature of Trees- Structure and Function (Photosynthesis) (graphic organizer for each student)

10	• 1 set per four kids
	  ○ 2 plastic baggies
	  ○ handful of beans
	  ○ Tape
	  ○ sharpie marker
	  ○ paper towel
	  ○ Stapler
	• science notebook page-learning session 3 (copies for students)

11	• Blue Carbon: A Story from the Snohomish Estuary • graphic organizer (copies for students)
12	• Wetlands of High Conservation Value Map Viewer | WA - DNR ○ Regional resources are linked in the learning session
13	• Threats to Wetlands - Wetlands (U.S. National Park Service) (nps.gov)
14	Resources dependent on extensions chosen
15	• 5- Wetland: Ecosystem Benefits Post Assessment (copies for students) • 5- Wetland: Ecosystem Benefits Rubric (copies for students)

Learning Sessions

1.	**Ground Native Ways of Knowing**	Estimated time: 30 minutes
	To connect to native ways of knowing, consider exploring the following ideas in connection	

with your local tribal nation by researching stories of the past and learn about current work and actions the Tribe is taking to mitigate, adapt to, and find solutions to a changing climate.

- Traditional plants found in wetlands
- Management of estuaries and wetlands
- Wetland ecosystem changes

Below are some stories connected with water, the land and wetlands that might be useful to connect students to native ways of knowing. Select one of these stories to share with students or find a more local story to your region.

- Nisqually Story: Water from the Mountain (Nisqually)
- Skunk Cabbage Story (page 19) (Kathalamet)
- Roger Fernandes "Salmon Boy" (Coast Salish)

Another connection between Indigenous peoples' and wetlands are using wetland plants for textile and engineering purposes:

- Tule Mat Lodge (Wanapum)
- Cattail (Coast Salish)

Suggested activity for teachers and students: 3-2-1 research process

- Three new learnings about the Tribe most local to you
- Two questions that you still have about the Tribe most local to you
- One action you can commit to begin a partnership with the Tribe most local to you

Below are some examples of tribal science connections to wetlands.

- Western Washington
  - Squaxin Island Tribe Resolution 15- Skookum Watershed Fish and Wildlife/Riparian Habitat Acquisition and Protection Action Plan (Squaxin)
  - Squaxin Island Tribe, Capitol Land Trust and LOTT Acquire Wetland Property (Squaxin)
  - Floating Wetlands in an Urban Estuary (Duwamish)
  - Reservation Wetlands Ranked by Culturally Important Plants (Swinomish)
  - Wetland and Habitat Mitigation Bank (Lummi)
  - Water Quality (Puyallup Tribe of Indians)
  - Port of Tacoma's Restoration Project on Lower Wapato Creek to Move Forward (Puyallup Tribe of Indians)
  - Where the Salmon Run (Nisqually)
- Olympic Peninsula/Coast
  - Skokomish Estuary (Skokomish)
  - Skokomish Community Center Wetland Report (Skokomish)
  - Suquamish Tribe Wins Land Use Case (Suquamish)
  - Suquamish News: Tribe Purchases Kitsap Parks Property (Suquamish)
- Central and Eastern Washington
  - Restored Wetland Brings Wapato Back to Yakama Nation (Yakama)
  - Return of the Wapato (Yakama)

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	To access information on how to reach out and build relationships with local tribes, visit the OSPI Office of Native Education: Partnering with Tribes, and contact your district's tribal liaison/Title VI coordinator. To learn more about respecting and building upon Indigenous Peoples' Rights visit the Learning in Places website, a project led by Dr. Megan Bang then read Practice Brief #10: Teaching STEM In Ways that Respect and Build Upon Indigenous Peoples' Rights and Practice Brief #11: Implementing Meaningful STEM Education with Indigenous Students & Families published on the University of Washington's STEM Teaching Tools website .

2.	**Examine Phenomena: Humans impact wetland ecosystems.**	Estimated time: 30 minutes
	Have students observe the poster image independently and write down ways that humans impact the wetlands. As a whole group, complete a Wetland OWL (observation, want to learn, learn) chart focusing on observation and want to learn columns. Their observations can include any previous knowledge about wetlands.	

3.	**Pre-Assessment**	Estimated time: 30 minutes
	5-Wetland: Ecosystem Benefits Pre-Assessment **5- Wetland: Ecosystem Benefits Rubric**	

4.	**Guiding question: What is a wetland?**	Estimated time: 60 minutes
	In this learning session, students will learn about wetlands, including what a wetland is and the different types of wetlands. They will take notes on a video, annotate an article, and create a tri fold brochure about wetlands. Begin by showing the following video and have students use the attached template to take notes: Fabulous Wetlands with Bill Nye the Science Guy (six and a half minutes) Note Taking Tool Next, have students read and highlight the important information in the wetlands flier: Types of Wetlands	

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	Discuss the notes from the video and types of wetlands. Students will then create a trifold brochure using the information learned. It should include what a wetland is, what it's ecological significance is, and the types of wetlands with descriptions. They should also create at least one small illustration within the brochure. **Students can create a brochure using paper and pencil or with a computer. This is teacher discretion.* How to Fold Paper for a Trifold Brochure

5.	**Guiding question: What does a wetland do?**	Estimated time: 90 minutes (dependent on demo or small group)
	Complete the activity: Wetland in a Pan (as a demo or in small student groups) Wetland in a Pan Activity* In this activity, students will create a model of a wetland and demonstrate some of the ecosystem services wetlands provide. Materials: ● Two long, shallow pans (baking pan or paint roller pan) ● Modeling clay ● Sponges and/or strips of carpet as wide as the pan ● Food coloring ● Jar of muddy water ● Watering can or pitcher of clean water Setup: ● Place a sloping layer of clay over about half of the pan to represent land. ● In one pan, place sponges or carpet along the edge of clay to represent a wetland. Be sure the wetland material covers the width of the pan. Leave the other pan without a wetland for comparison. Activity: ● Review ecosystem services of wetlands. It's not possible to demonstrate carbon sequestration with this model, but flood prevention and water purification will be demonstrated. ● Begin by pouring clean water on the clay on both models to represent rainfall. The sponge/carpet should slow and capture some of the flow, resulting in less water getting through compared to the pan with no wetland. Ask for student observations and discuss why this is important. Prompt students to think about wetland removal and what might happen if the sponge/carpet were replaced with homes, development, etc. ● Add some food coloring to the pitcher of clear water, explaining that the food coloring represents pollutants we can't necessarily see, such as chemical pollutants. Pour the water on the clay on both models. The sponge/carpet should capture some of the food coloring and water, resulting in lighter colored water coming through compared to the	

	pan with no wetland. Discuss student observations. • Pour muddy water on the clay on both models, explaining that the muddy water with dirt in it represents pollution we can see, such as farm animal waste. The sponge/carpet should capture some of the dirt in the water, resulting in clearer water coming through compared to the pan with no wetland. Discuss student observations. *In an online setting, teachers may demonstrate this activity virtually for students. Alternatively, if students have access to the materials needed, they could complete the activity themselves either synchronously or asynchronously and provide pictures or videos. Source: WONDERFUL, WATERFUL WETLAND

6.	**Guiding question: What is an ecosystem?**	Estimated time: 45 minutes
	In learning session 5, students will watch a short video that explains what an ecosystem is and what factors, abiotic and biotic, create an ecosystem. They will then answer some questions in their science journals based on the video. Make sure to discuss their responses when completed, remembering to go into detail as to why certain responses cannot be true. Ecosystems: StudyJams! Science | Scholastic.com What is an Ecosystem Questions Technology adaptation or home to school extension: iBiome-Wetland Game (app with a cost) Make A Mangrove ecosystem game (website, no login required, free but not Washington specific)	

7.	**Guiding question: What is a wetland ecosystem?**	Estimated time: 45 minutes
	Ecosystems Episode 5: The Wetland Ecosystem! (4K) - YouTube Discuss: What living things did you see in the video? Using the Teacher's Guide to Wetland Activities from Duck's Unlimited have students create a food chain using the student "Wetland Food Chains" (page 33 of PDF) and "Wetland Plant and Animal" (page 35 of PDF) pages. For the full lesson read page 15 of the PDF.	

8.	**Guiding question: How do living and nonliving things interact with each other in a wetland?**	Estimated time: 30 minutes

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	Revisit the Native Ways of Knowing by listening to one of the stories connected with water, the land and wetlands. Select one of these stories to share with students or find a more local story to your region. ● Nisqually Story: Water from the Mountain (Nisqually) ● Skunk Cabbage Story (page 19) (Kathalamet) ● Roger Fernandes "Salmon Boy" (Coast Salish) Discuss with students about the relationship between living things (including humans) in the wetlands referencing the last learning session's "Wetland Food Chains" activity. Students will further explore the living (biotic) and nonliving (abiotic) factors in a wetland ecosystem. They will then create a diagram and flowchart of how these factors work together to create a healthy ecosystem. Eagle Graphic for Wetlands.docx

9.	**Guiding question: How do beavers impact wetland ecosystems?**	Estimated time: 30 minutes
	Beavers are a critical species in freshwater ponds/lakes and wetlands throughout the state. Beavers are great engineers who can alter ecosystems with the creation of their dams. Activity: Beavers, Natures Engineers ● Supplemental Resources can be found here: WA WDFW 3rd-5th grade winter lessons	

10.	**Guiding question: What is photosynthesis?**	Estimated time: 30 minutes
	**This lesson can be skipped if you have already taught your students photosynthesis. ** Watch the video Forest Fact Breaks-Photosynthesis Lesson: Nature of Trees- Structure and Function (Photosynthesis) This lesson includes the photosynthesis "equation" but also includes a nice graphic organizer to describe the process. Outside opportunity: Ask students to do a sit spot and observe a tree. Have the students focus on scientific illustration and label the structures/functions.	

11.	**Guiding question: How do plants gain mass?**	Estimated time: 45 minutes

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	**This lesson can be skipped if you have already taught your students plant mass is gained from air and water. ** Brainstorm and discuss: *What do plants need to grow?* In this investigation, students create models of growing environments with or without soil to determine what plants need to grow. This investigation will be ongoing for about 1.5 weeks. Investigation Set Up- Learning Session 3 Have students use this science notebook page-learning session 3 to guide them through setting up the investigation and recording their observations (try to observe every three days). Supplies needed are listed at the beginning of the lesson sessions. Teacher Tip: Some students or classes may need more guidance in designing their investigation depending on their past experiences with investigations. After students finish their observations complete a class Claim, Evidence, Reasoning (CER) poster chart (see CER example).

12.	**Guiding question: What is the importance of carbon in a wetland?**	Estimated time: 40 minutes
	Brainstorm and discuss: "What is carbon?" Show the students the below graphic from Salish Magazine: Blue Carbon and discuss how carbon interacts with a wetland:	

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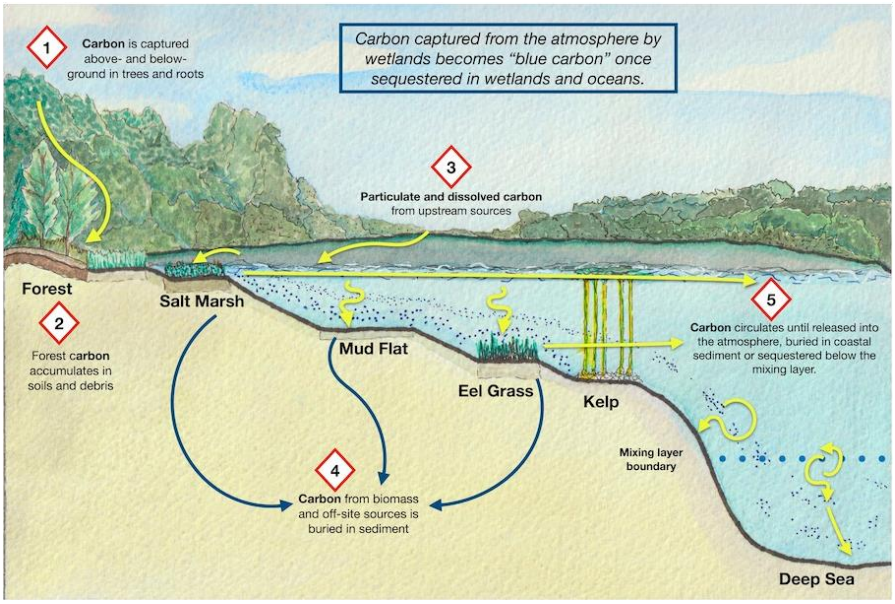

*Teachers can replicate this chart and fill it out with students so students can utilize it as an anchor chart for the rest of the storyline.

Watch Blue Carbon: A Story from the Snohomish Estuary and fill out the graphic organizer.

13.	**Guiding question: Where are the wetlands in Washington and your community?**	Estimated time: 2-3 hours

Research opportunity: explore different Washington wetlands and have students write a brochure/presentation/prezi and/or create a community map about wetlands in their area. Have students think about the problems or issues the wetlands might be facing. This work could be done individually, in pairs or small groups.

**This would be a great time to do an outdoor field experience to a local wetland or do a virtual field trip to a wetland.*

Use Wetlands of High Conservation Value Map Viewer | WA - DNR to help locate wetlands in your area. This is a good place to start. When you find a wetland near you then research that specific wetland.

Western/Coastal Washington resources:

- Skagit County Wetland Finder Map: Hydric Soils Map of Skagit County depicting double township sections
- Pierce County Wetland Finder Map: PublicGIS (pierce.wa.us)
- King County Wetlands: King County wetlands - King County
- Critical Wetlands in Snohomish County: Snohomish County Wetlands
- National Wetland Inventory- Pacific County: Pacific County Wetland Map
- Kitsap County Critical Areas: Critical Areas Map

	• Critical Wetlands in Shelton, WA: Potential Wetland Maps • Billy Frank JR. Nisqually Refuge in Nisqually, WA: Wetland Map **Central/Eastern Washington resources:** • Chamna Preserve(Richland, WA): Chamna Natural Preserve • Walla Walla County, WA: Wetland Map • Spokane County Wetlands: Wetland Map • Kittitas County Wetlands: Wetland Map

14.	**Guiding question: How do humans impact the wetlands?**	Estimated time: 1 to 2 hours
	Before reading the articles below, have students discuss how humans impact wetlands. Create a two-column chart with the words “positive” and “negative” at the top of each column. Collect ideas from students that would fall into the two columns; ex: pollution would go into the “negative” column. Have students read the below article and discuss with a partner/small group/whole class the threats to wetlands and those threats that are caused by humans. Make sure to add any new thoughts, or detail, to your chart. Threats to Wetlands - Wetlands (U.S. National Park Service) (nps.gov) Watch the below video on how humans are bringing back wetlands and have students discuss the positive impacts humans can have on wetlands. Restoring Tidal Wetlands at Winter Lake - YouTube Have students complete this learning session by creating an action plan/statement on how they can have a positive impact on their local wetlands (they should know these from the last learning session).	

15.	**Possible next steps/off-ramps/actions/career connections:**	

	• Career Connections
	  ○ Aquatic Plant Specialist
	  ○ Land Steward
	  ○ Watershed Coordinator
	  ○ Owner and Founder of Kayak Nisqually
	• Wetland Art and Poetry
	• Drawing Wild Washington: Puget Sound Wetlands	

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16.	**Post Assessment**	Estimated time: 30 minutes
	5- Wetland: Ecosystem Benefits Post Assessment 5- Wetland: Ecosystem Benefits Rubric	

OER Tracker - 5: Wetland: Ecosystem Benefits

Pacific Education Institute would like to acknowledge and thank the writing team for their work. The team included Chad Mullen, Molly Griffiths, Hattie Osborne and Shelley Stromholt. In you have comments or questions please contact info@pacificeducationinstitute.org