

OVERVIEW OF ECOSYSTEM RESTORATION UNIT



The United Nations Decade on Restoration launches in 2021 in response to the global decline in biodiversity and the threat of climate change. Ecosystem restoration is a tool to increase biodiversity and combat climate change. The UN is calling on everyone to participate. Students take on the role of restoration ecologists to study a healthy (reference) ecosystem and apply their understanding of how a healthy ecosystem functions, to designing a restoration plan for degraded land (the restoration site) in their community. During a full day field trip, students visit the reference ecosystem to find out what an ecosystem is and to take photos of interesting beings and things they find. Back in the classroom they categorize and use the photos to build an initial model of the ecosystem. Classroom investigations and activities in photosynthesis, cellular respiration, food chains, food webs, and the effects of resource availability on populations of organisms help students add to an increasingly complex ecosystem model. Students figure out that native plant

communities are the foundation of the ecosystem: native plants support a complex food web. The more organisms and connections between organisms in the food web, the more biodiverse it is and the healthier it is. They apply their understanding of how the reference ecosystem functions to designing a plan for the restoration site, with the goal of increasing biodiversity. Students present their plans to a Washington Native Plant Society Steward and the land manager of the restoration site. With the expert guidance of the Steward and the support of the land manager, students implement a restoration plan over the remaining school year.

The **reference ecosystem can be any intact, healthy ecosystem in the community, for example a natural park or land trust preserve*

The **restoration site can be any degraded land that is either overgrown with invasives or has no vegetation. The restoration site might be in the schoolyard, it might be an unused and uncared for plot of land in walking distance of the school or it might be adjacent to or in the reference ecosystem (for example, a scotch broom field or ivy desert in the park or preserve)*

NEXT GENERATION SCIENCE STANDARDS

Focal Science and Engineering Practices: Asking Questions and Defining Problems, Developing and Using Models, Planning and Carrying Out Investigations, Analyzing and Interpreting Data, Engaging in Argument from Evidence, Obtaining, Evaluating and Communicating Information

Focal Crosscutting Concepts: Energy and Matter, Systems and System Models, Stability and Change, Cause and Effect

Building Toward NGSS Performance Expectations:

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

TIMELINE for YEER East

<p style="text-align: center;">AUGUST</p> <p><u>Teacher Onboarding Workshop</u> Teachers attend virtual onboarding workshop that prepares them to teach unit</p> <p><u>Restoration Site & Reference Site Meeting</u> YEER Coordinator, Steward, Teacher and Land manager meet at reference site to plan for field trip and restoration site to plan for restoration field days</p>	<p style="text-align: center;">SEPTEMBER</p> <p><u>Teacher begins Ecosystem Restoration unit</u> Unit will take 3-4 weeks of class time</p> <p><u>Field Trip to Reference Ecosystem</u> YEER Coordinator leads field trip to reference ecosystem on second day of unit</p>	<p style="text-align: center;">OCTOBER</p> <p><u>Students present Ecosystem Restoration Proposals</u> On last day of unit, student groups present proposals to site steward & YEER coordinator.</p>	<p style="text-align: center;">NOVEMBER</p> <p><u>3 restoration field days spread over remaining school year</u> YEER Coordinator, Steward, teacher, and land manager will be present at all field days. Exact dates to be determined by each team.</p> <p style="text-align: center;">Best time to Plant</p>
<p style="text-align: center;">DECEMBER</p> <p style="text-align: center;">Best time to Plant</p>	<p style="text-align: center;">JANUARY</p> <p style="text-align: center;">Best time to Plant</p>	<p style="text-align: center;">FEBRUARY</p>	<p style="text-align: center;">MARCH</p>
<p style="text-align: center;">APRIL</p>	<p style="text-align: center;">MAY</p> <p style="text-align: center;">Suggestion: have the last field day in spring to take plant survivorship data, and weed new</p>	<p style="text-align: center;">JUNE</p> <p style="text-align: center;">End of Unit</p>	<p style="text-align: center;">JULY</p>

	young weeds.		
--	--------------	--	--

UNIT AT A GLANCE

Driving Question: *How can we, as student restoration ecologists, restore land in our community to increase biodiversity?*

Lesson 1: *What is the United Nations Decade on Restoration?*

Students define a problem: global decline in biodiversity. They ask questions about how they can restore land in their community to increase biodiversity, thereby participating in the UN Decade on Restoration.

Lesson 2- Field Trip to Reference Ecosystem: *What is an ecosystem?*

Students visit a (reference) ecosystem in order to:

- 1) find out what an ecosystem is
- 2) take photos that they will use back in the classroom to catalog and categorize things in the ecosystem and build an ecosystem model that they will revise and add to as they learn more.

Lesson 3: *How do scientists categorize beings and things in an ecosystem?*

Students categorize their ecosystem photos into abiotic and biotic. Then they categorize the biotic beings into plants, animals and fungi in order to begin to make sense of the photos from the ecosystem.

Lesson 4: *How can we use the photos to make an initial model of the ecosystem?*

Students develop an initial model of the ecosystem in order to represent their initial ideas about matter and energy and relationships between plants, animals, air and soil in an ecosystem. They will revise and add to their model as they learn more

about how a healthy ecosystem functions. In lesson 10 they will use their reference ecosystem models to design a plan for the restoration site to increase biodiversity.

Lesson 5: *What do plants need to grow and survive in an ecosystem?*

Students analyze and interpret evidence in order to find out what plants need to grow and survive in an ecosystem.

Lesson 6: *What do animals need to grow and survive in an ecosystem?*

Students plan and carry out an investigation in order to find out how animals use food to grow and survive in an ecosystem.

Lesson 7: *How does matter and energy move between plants, animals and fungi?*

Students use their photos to build food chains and an example of a food web in the ecosystem in order to find out that:

- 1) the food of all animals can be traced back to plants
- 2) organisms interact with one another and depend on one another in the ecosystem

Lesson 8: *How does the availability of native plants affect other populations?*

Students use a model (a running game) in order to generate data on the effects of resource availability (native plants) on populations of organisms (insects and birds).

Lesson 9: *What makes an ecosystem healthy and stable?*

Students develop the most healthy and stable ecosystem model possible and test how changes/threats to the ecosystem affect organisms.

Lesson 10: *How can we design the restoration site to make it more like the reference ecosystem?*

(How can we restore land in our community to increase biodiversity?)

Students use their Reference Ecosystem model and apply their understanding of how a healthy ecosystem functions to design an Ecosystem Restoration Plan for the restoration site, using the Engineering Design Process.

Lesson 11: *Present Ecosystem Restoration Plan Proposals to Stakeholders*

Students present their Ecosystem Restoration Plan Proposals to stakeholders in order to get feedback and support for a restoration project.

Implement a Restoration Project

Three restoration field days spread over remaining school year: *students complete a restoration project with the support of the land manager and the guidance of the steward*

UNIT STORYLINE

Driving Question:

How can we, as student restoration ecologists, restore land in our community to increase biodiversity?

<p>Lesson Question</p> <p>1 day: 45-60 min class period</p> <p>Total length of unit: 3-4 weeks</p>	<p>What We Do</p>	<p>What We Figure Out</p> <p><i>Language taken from Disciplinary Core Ideas</i></p>	<p>How We Represent it in our Reference Ecosystem Model</p> <p><i>examples coming soon....</i></p>
<p>Lesson 1</p> <p>1 day</p> <p>What is the United Nations Decade on Restoration?</p>	<ul style="list-style-type: none"> • We learn about the UN Decade on Restoration: what is it? Why is the UN devoting a decade to restoration? • We define a problem: global biodiversity loss and ask questions about how we can restore land in our community to increase biodiversity. • We develop a working definition of 'ecosystem' and 'ecosystem restoration.' • We read a letter from a land manager in our community tasking us with a project to restore land to increase biodiversity. • We record initial ideas about the driving question. • We develop a Driving Question Board to guide future investigations. 	<ul style="list-style-type: none"> • The UN is calling on everyone to play a part in restoring ecosystems. • Ecosystem restoration is the process of assisting the recovery of an ecosystem that has been damaged. • A land manager in our community is asking us to write an Ecosystem Restoration Plan Proposal for their degraded land. • We are taking on the role of restoration ecologists to study a healthy ecosystem in order to apply our understanding to design a restoration proposal for a degraded ecosystem. • A reference ecosystem is a healthy ecosystem that restoration ecologists study to guide restoration of a degraded ecosystem. 	
<p>Lesson 2</p> <p>1 Full Day Field Trip</p> <p>What is an ecosystem?</p>	<p>We visit a reference (healthy) ecosystem to:</p> <ul style="list-style-type: none"> • observe and explore an ecosystem, using our 5 senses, to find out what an ecosystem is. • take photos of beings and things in the ecosystem that interest us. • revise our definition of what an ecosystem is based on our 	<ul style="list-style-type: none"> • There are many interesting beings and things in an ecosystem that can be explored using the 5 senses. 	