

Bringing Wetlands to Market Part 4 Introduction

Riches at Risk: Pressures on Wetlands and Stewardship Activities

Estuary Principle

Principle 6: Human activities can impact estuaries by degrading water quality or altering habitats; therefore, we are responsible for making decisions to protect and maintain the health of estuaries.



Research Question

How do human activities affect the ecological processes of wetlands and how can negative impacts be reduced?

Introduction

Like pirates burying treasure, coastal wetlands are fast and efficient at removing carbon dioxide from the atmosphere and storing it in their wet soils. The carbon sequestered in coastal wetlands could represent a real source of treasure – or at least income – for local communities through the carbon trading market. However, this treasure is only valuable if it stays in the ground, and that is a challenge.

Today, wetlands are being lost or degraded by cumulative impacts occurring every day and carrying large and small effects. Three important factors currently impacting coastal wetlands are **sea level rise, habitat loss or degradation, and nitrogen loading**. Each of these pressures can degrade the healthy functioning of the ecosystem, and can reduce the ability of a wetland to hold on to carbon in the soil. Those effects are increased when several pressures are at work. Because these and other pressures are incremental and gradual, but persistent over a long time, it can be difficult to show and highlight their effects in order to stop them.

To better protect and restore wetlands, the public needs to become more aware of its community's wetlands: where they are, their functions and value, how they are threatened, and how citizens can play a role in protecting them. A few individuals (your students) acting on behalf of the wetlands in your community can do a lot to protect wetlands and prevent losses and degradation. This section has information and ideas to help your students become **wetland stewards**.

By establishing the economic value of coastal wetlands as carbon sinks, the Bringing Wetlands to Market project can provide information and incentives to protect and restore wetlands. Your students can encourage everyone to help sustain these important ecosystems and guard their buried treasure!

Climate Extension

Many of the pressures on wetlands are related to rapidly changing climate, including warming temperatures, changing rainfall patterns, and for coastal wetlands, rising sea level. These lessons will help students learn more about the connections between climate change and pressures on wetlands, and students may choose stewardship activities that are directly related to mitigating impacts of climate change on wetlands.

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Riches at Risk: Pressures on Wetlands and Stewardship Activities

Research Question

How do human activities affect the ecological processes of wetlands, and how can negative impacts be mitigated?

Content Objectives

Students will be able to describe three factors resulting from human activity that can impair or damage coastal wetlands

Students will be able to explain factors that influence sea level



A restored wetland in New Bedford, MA

Students will be able to describe three actions that could help protect or restore coastal wetlands

Exercises

Students will learn that natural systems are subject to cumulative pressure from many factors. Three important factors affecting coastal wetlands are sea level rise, nitrogen loading, and habitat loss or degradation due to both of these and other factors. Stewardship activities can help protect and restore local wetlands.

Exercise 1 Coastal wetlands, development, and sea level rise

Students will investigate how sea level rise and development can impact marsh area and functioning.

Optional exercise: land use change and habitat loss

Students learn to use GIS maps to track land use change and how it affects wetland areas.

Exercise 2 Nitrogen and coastal wetlands

Students will examine the impact of excess nitrogen on the ability of a salt marsh to store carbon.

Exercise 3 Stewardship projects

Students will carry out a stewardship project related to local wetlands. The stewardship project can serve as a culminating project or can be carried out throughout the unit, and can include field studies as well as communication components.



Excess nitrogen can impair the carbon storage capacity of a salt marsh Photo by Melissa Fellet

If you only have time for one activity: Support your students in carrying out a stewardship project. It can be simple or complex, school-based or community wide. The project will enhance students' understanding of science and foster creativity, collaboration, and communication.

Grade level: 9 – 12 Biology, Earth Science, Service Learning

Next Generation Science Frameworks

PS1: Matter and Its Interactions

PS1.B: Chemical Reactions

LS1: From Molecules to Organisms: Structures and Processes

LS2.A: Interdependent Relationships in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

Core Idea ESS3: Earth and Human Activity

ESS3.A: Natural Resources

ESS2.D: Weather and Climate

ESS3.C: Human Impacts on Earth Systems

ESS3.D: Global Climate Change

Obtaining, evaluating, and communicating information

ETS2: Links Among Engineering, Technology, Science, and Society

ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World

Assessment Questions

Questions for assessing students' understanding are included with the exercises. The stewardship project incorporates performance-based assessment.

Glossary

Anthropogenic – arising from human activity.

Coastal erosion The wearing away of land or the removal of beach or dune sediments by wave action, tidal currents, wave currents, or drainage. A combination of storm events and relative sea level rise may accelerate coastal erosion.

Contour line: A line on a map joining points of equal elevation above a given level, usually mean sea level.

Global sea level rise Caused by a change in the volume of the world's oceans due to temperature increase, and melting of land based glaciers and ice.

Inundation: Water covering land or areas that are normally above water level.

Land cover Refers to the vegetation, structures, or other features that cover the land. For example, is the land covered by grass, by trees, by water, or by large buildings surrounded by a lawn?

Nitrogen loading or nutrient loading: High rates of nitrogen or other nutrients to estuaries and the coast from sources such as synthetic fertilizer use in agriculture, wastewater, and nitrogen compounds in precipitation. Nitrogen loading can result in severe problems such as massive algal growth followed by oxygen depletion

Relative Sea Level Rise Occurs where there is a local increase in the level of the ocean relative to the land, which might be due to ocean rise or land subsidence.

Sea level trend: The average rate of change of sea level over at least 30 years.

Stewardship: a way for people, including young people, to care for or maintain something such as the environment, an estuary, or wetlands.

Storm surge Water that is pushed toward the shore by the force of the winds swirling around the storm. This advancing surge combines with the normal tides to create the hurricane storm tide, which can increase the mean water level 15 feet or more.

Thermal expansion: The increase in volume of a material as it gets warmer. For example, water takes up more space as it warms. In the ocean, thermal expansion is one cause of rising sea level.