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**MSU Coastal Research & Extension Center**

**Lesson 6: Ecosystem Services and Wetland Management**

**Theme**

* Environmental Science/Ecology

**Grade Level**

* 9th – 12th

**Class Size**

* 10-30 Students

**Length**

* 1.5 hours

**Materials**

* Tragedy of the Commons Results Fishing Log for each student
* One bowl per group
* One cup per person
* M&Ms (or goldfish crackers)
* One spoon per person

**Instructional Method**

* Lecture inside, Tragedy of the Commons Activity inside

**Evaluation Method**

* Discussion, In Class Activity or Optional Homework Material

**Date Prepared / Modified:**

* August 10th, 2022

## Goal: In this lesson, students explore a variety of ecosystem services that coastal wetlands provide, the variability in magnitude of those ecoservices, factors that influence those magnitudes, and important considerations when aiming to engineer these ecosystems to suit our demands.

## Learning Objectives:

## Distinguish the Tragedy of the Commons in the context of natural resource use

## Assess the notion of sustainable management (and to not see humans as simply a plague upon the land)

## Recognize ecosystems are not constant over time

## Infer that science is a slow process and there will always be uncertainty

## Defend decisions made with limited certainty

**Mississippi College and Career-Readiness Standards:**

ENV.2 Students will relate the impact of human activities on the environment, conservation activities, and efforts to maintain and restore ecosystems

ENV.3 Students will discuss the direct and indirect impacts of certain types of human activities on the Earth's climate

ENV.4 Students will demonstrate an understanding of the interdependence of human sustainability and the environment.

* Aligns with ENV.3.3, ENV.4.1, ENV.4.2

**INTRODUCTION**

**Ecosystem Services and Wetland Management Lesson Overview:**

Engage with students prior to the lecture to start a discussion about ecosystem management

* Conduct the Tragedy of the Commons activity
* Have students share and explain what happened during the activity
* Review provided PPT slides and investigate key concepts further
* Evaluate students understanding of concepts by facilitating a group discussion at the end of class, or by assigning essay questions for homework

**LECTURE**

**Engage with students to start a discussion on ecosystem management (5 min)**

* Optional script: “Clean up your room!” is probably a phrase you’re all familiar with, but if it was really ***your*** room, should you not be able to do as you please with your space? We learned in the last lesson ecosystems are inherently connected to each other: actions in one system impact adjacent ones…so that smell permeating from ‘your’ area of the house might be of interest to your fellow housemates, or if it’s your parent telling you, they might be interested in you developing management habits to promote a healthy lifestyle.
* Ask the students:
* What about shared spaces? Like the bathroom? Or the kitchen? Do you enjoy cleaning up others’ messes?

* What about issues that are no one’s fault? Who takes responsibility when the microwave breaks down or the A/C needs repair?
* Sometimes these matters are managed well and in an agreeable fashion, and at other times, it can be very controversial because of conflicting interests. Space and services like A/C are resources commonly shared, where the interests of the individual may conflict with the interests of the community.

**Conduct Tragedy of the Commons Activity (30 mins)**

* Use provided materials below to conduct ~ 2 rounds of the activity

[**Tragedy of the Commons activity**](https://docs.google.com/document/d/1Sd0qxVnLQaeWGHUhhku14TLnfFfAkI_ihtXy8plfnHQ/edit?usp=sharing) **\*In person sheets\***

[**Tragedy of the Commons Fishing Log**](https://docs.google.com/document/d/1YwvayGi3a_He2T3T8E0wxzbeeCr_BVvC5HWdWtuaKyk/edit?usp=sharing) **\*Virtual Log for use with Jamboard app\***

**Explore and Explain Key Concepts (15 min)**

1. Review provided PPT slides to further explore and explain ecosystem services and management.

[**Marsh Conservation and Restoration**](https://docs.google.com/presentation/d/1hYr-OPV9v_AXgLRIxbg9X8yunq1uApD_bTw-Rpsa6yc/edit?usp=sharing) **\*PPT SLIDES PROVIDED\***

* The tragedy of the commons concept applies to many scenarios in natural resource management because natural resources are often claimed by communities.

* Private interests within a community may knowingly or unknowingly overextend some use of a natural resource to the detriment of the community.

2. Clarify student understanding of the use of “tragedy” and challenge students to question the validity of using that word.

* Ask:
  + Are common resources doomed to overuse and depletion?
  + What practices can be employed to solve the “tragedy” of the commons?

3. Let’s address a philosophical matter.

* Ask:  What is a “healthy” ecosystem?
  + We’ve come to define a “healthy” ecosystem as one that generally exists in a stable state and functions to sustain its biological inhabitants. As humans, we have discovered a large capacity to engineer our environments to better suit us.

4. Touch upon carbon sequestration / climate change:

* What about carbon? Wetlands are exceptional at storing carbon.
* Burning fossil fuels releases CO2 into the atmosphere and the ocean, with varying degrees of impacts, but impacts that affect all of us.
* If we agree to release only so much CO2 into the atmosphere (ie, the Kyoto Protocol), what actions related to wetlands could we employ to help reach our target? How could we implement it?

**Elaborate on Key Concepts (35 minutes)**

1. Present students with an environmental dilemma.

2. Assign 2-3 stakeholders’ points of view, the same for any number of groups. Each group will discuss interests of each and hypothesize how different decisions will affect them.

* Who should make sacrifices?
* Is there a better solution where everybody wins?

3. Roam around and facilitate discussion for 20 minutes. Then have each group present their conclusions from deliberation.

Example Topics to discuss:

* The Mississippi River’s hydrology has varied substantially over time. The potential for flooding substantiates levee development for folks that live down there, but it leads to chronic debilitation of the extant wetlands. Lacking sediment supply and slower water flows, wetlands are often unable to keep pace with natural and anthropogenic stressors to being drowned.
* Oil and gas harvested domestically has historically provided economical means of power (extension: get into the energy debate), and southern Louisiana is primely positioned to harvest those nonrenewable resources but by means of dredging to maintain navigation channels, exacerbating the wetland loss but breathing life into Louisiana’s and associated economies.

**EVALUATION**

**Gauge Students Retention of Knowledge (10 minutes or leave for homework)**

1. Ask students as a group to propose several environmental situations that would fall under the “Tragedy of the Commons”.

2. For homework, students that proposed ideas can claim a unique one from the group list. Others will have to come up with their own. Have them identify 2-3 stakeholder interests that conflict, 2-3 defensible solutions, 2 major uncertainties within each of those, and which solution they feel is best and why.