Human Impacts on Biodiversity: The Piney Point Disaster

Lesson Topic
Human Impacts on Biodiversity

RIEL Biology Element
Sociopolitical Consciousness

Time Required
3 Days

Standards Addressed
- SC.912.L.17.8 Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.

Content Learning Objectives
- Students will be able to analyze the impacts of the 2021 Piney Point discharge on the ecosystem of Tampa Bay and will propose a solution to prevent events like this in the future.

Lesson Summary

This 3 day lesson introduces students to the 2021 discharge of large amounts of wastewater from the Piney Point fertilizer plant site in Manatee County. The first day has students brainstorm their prior knowledge about Tampa Bay and the biodiversity of its ecosystem. They are then introduced through a video clip to the environmental disaster that occurred in March of 2021 when a tear in the wastewater reservoir caused the release of millions of gallons of nutrient-rich wastewater into the bay. They learn more about what occurred by reading an article and completing a graphic organizer. On the second day students analyze data from the Tampa Bay Estuary Program's dashboard in order to explain the environmental effects that occurred in the months after the wastewater release. The third day focused on prevention through social action. Students begin by brainstorming, in their groups, about the various stakeholders who might have the power to prevent further disasters like that at Piney Point. Once student groups identify the stakeholders and their roles, they will design a product that could be used to prevent another disaster like Piney Point from happening in the future.

Summary of RIEL Element in Lesson: Students apply previously learned ecology information (e.g., food webs, factors that affect population size, biodiversity, etc.) to a major ecosystem that they live near, the Tampa Bay ecosystem. Students will also make connections between the Tampa Bay ecosystem and their daily lives. They will have to think about the role of the government, private businesses, and individual citizens in protecting our ecosystems. Through these activities, students will explore the ways in which they can act as individuals to help with this issue.

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Summary of Science and Engineering Practice: Students will be analyzing and interpreting several sources of data. They will examine nitrogen and phosphorus levels at monitoring sites in Tampa Bay near Piney Point, as well as data about the algal blooms that occur during the spring and summer of 2021 (directly after the plant discharge). They will use these data to construct a scientific explanation of the environmental impacts on the Tampa Bay ecosystem. Students will then use their data analysis and explanations to make a plan for how events like this could be prevented in the future by considering the roles of various stakeholders in the prevention of environmental disasters.

Materials

- PowerPoint Slides
- Student Sheets (one per student):
  - Day 1
  - Day 2
  - Day 3
- National Geographic Article "Hazardous spill in Florida highlights environmental threat decades in the making" (one per student)
- Computer access for Day 2 of lesson (laptops, computer lab, etc.)

Before the Activity:

- Make copies of the article ("Hazardous spill in Florida highlights environmental threat decades in the making") and student sheets for Days 1, 2, and 3.
- Ensure students will have access to computers to explore the data dashboard for Day 2 of the lesson.
- Explore the Tampa Bay Estuary Program Data Dashboard and view the tutorial if needed to ensure you understand the multitude of data students can access on it.

Lesson Activities:

Day 1

1. Bellwork/Brainstorming Discussion

- Ensure students each has a copy of the Day 1 Student Sheet.

Science and Engineering Practices

- Analyzing and Interpreting Data
- Constructing Scientific Explanations

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- Allow students to individually brainstorm the bellwork question. A map of the Tampa Bay watershed can be displayed during this time as a visual aid. Once students have had time to think individually, allow them to share their ideas using your preferred class discussion format (whole class or small group).

- Remind students of the definition of biodiversity (or introduce the term if you have not used it during previous lessons). Use your preferred class discussion format to have students answer the next 2 questions on the student sheet about biodiversity. Photos of plant and animal species found in Tampa Bay can be displayed at this time as a visual aid.

2. Video Introduction

- As an introduction to what occurred at Piney Point in the spring of 2021, show the video from the CBS Evening News (Play until 2:48 for an introduction and hook, the rest of the video is an interview with a local reporter about the details of the situation at the plant and can be used later for extension if desired).

- Encourage students to take notes in the space provided on the Student Sheet about what they hear and see during the video. After the video allow students to share their notes with the class or their group.

3. Deepening Understanding of the Problem through Article and Graphic Organizer

- Ensure students each have a copy of the National Geographic article "Hazardous spill in Florida highlights environmental threat decades in the making." Explain that they will read the article to gain more information about the problem that occurred at Piney Point, the background causes, and the possible environmental effects.
- As they read they will use the information in the article to complete the 4 graphic organizer sections on the Student Sheet.

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- *Define the Problem* – what happened at Piney Point?
- *Background on the Problem* – why did this problem occur, what steps led to it happening?
- *Possible Environmental Effects of the Problem* – what do we need to worry about?
- *Data Needed to Monitor Problem* – what kind of data should scientists collect to figure out if the environmental effects are happening?

- While students read and work on the graphic organizer, circulate to provide assistance and scaffolding as needed based on the reading levels of your students. If time permits, you can also have a discussion at the end of class about the main points that students found to answer each of the 4 sections. Their answers to the last 2 sections should serve as a connection to the second day of the lesson where they will focus on the data collected by scientists after the disaster and the environmental effects that were observed.

Day 2

1. Bellwork/Eutrophication Review

- Ensure students have a copy of the Day 2 Student Sheet and allow them time to individually answer the bellwork question. Then allow students to share ideas and review eutrophication and its causes.
- All or part of the video from UF Thompson Earth Systems Institute can be used to supplement this discussion and review.

2. Data Exploration/Analysis

- Explain to students that during the Piney Point disaster the Tampa Bay Estuary Program created an online dashboard where all 12 scientific agencies that were monitoring the bay could share their data in one area.
- Have students navigate to the dashboard and then allow them to spend a few minutes to explore anything they want on the dashboard. (Free exploration time allowed students to have better focus when following step-by-step directions in the next section.)

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Teacher Note

The directions focus on one monitoring site (Piney 3), but can be modified to use a different site or include multiple sites. Based on the technological proficiency and reading levels of your students it may be helpful to model the use of the dashboard with them or provide more visual resources (screenshots or videos of the dashboard in use). Students could also complete this part of the activity in pairs or groups.

- Tell students that they will be focusing on data about total nitrogen and phosphorus levels in the water (can be linked to review of eutrophication). They will also explore possible algal blooms by looking at chlorophyll-a concentration in the water and at data provided about red tide (*Karenia brevis*) levels during update summaries from June and July 2021.
    - Update summaries are not in the dashboard, but can be found at Piney Point Monitoring. Step-by-step directions on how to access these data are found on the Student Sheet.

- As students explore the different data, they will either write about or draw a graph that shows the trend that is occurring. Space is provided on the student sheet for them to do this for total nitrogen, total phosphorus, chlorophyll-a concentration, and algae/red tide levels.

- After they have explored all of the data, they will write a summary of their findings to explain the overall effects of the wastewater release on Tampa Bay, and recommend which data scientists should collect moving forward.

- If time permits, a class discussion could be conducted at the end to allow students to share some of their key findings in their summaries.

Day 3

1. Bellwork/Stakeholder Brainstorming

- Ensure students have a copy of the Day 3 Student Sheet and allow them time to individually answer the bellwork question. This question is designed to get them to think about what different groups of stakeholders play a role in preventing environmental disasters.

- Once they have had time to think individually, allow students to share their answers and create a class list that can be referred to throughout the lesson. Point out how multiple different individuals and teams are responsible for working together to prevent large-scale environmental disasters.

- Direct students to look at the chart on the Student Sheet that shows the three major groups of stakeholders, who each have different roles in preventing a disaster, like Piney Point, from occurring in the future.

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- Allow students time to work in small groups to brainstorm the role(s) of each of these stakeholders in reaching this overall goal. You may also want to have students share their ideas with the whole class, and build on some ideas before switching back to working in groups.

2. Prevention Product Design

- Student groups will now use the information from the brainstorming session and all background gained from Days 1 and 2 to design a product that could be used to help meet the goal of preventing another disaster from happening in the future.

- This product can focus on one group of stakeholders or multiple. Examples of possible products include letters to lawmakers, laws or environmental protections that could be passed by government bodies, rules for corporations who own land used for phosphate mining, plans for corporations to monitor the environment, and social media/informational campaigns led by concerned citizens to bring awareness.

- Products will vary widely from class to class and will be influenced by group discussion and student opinions. Teacher should use knowledge of students to determine any scaffolding or additional parameters needed to allow groups to create their product.

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