

Tidal Wetlands and Climate Change

Teacher Guide for
High School Lessons



Marie Schneider

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About Marie Schneider



After 17 years in the environmental field, I changed careers and became a high school Biology teacher. Best move ever! Witnessing students explore and engage in science is so rewarding. In addition to Biology, I teach Environmental Science, Aquatic Ecology, Marine Biology, Oceanography, & Meteorology. I earned my Bachelor's degree and Master's degree from West Chester University, both in Biology. I am a self-proclaimed tree hugger, and I'm happiest when I'm experiencing nature. Exposing students to the natural world and having them recognize the importance of the complex interactions is a role I do not take lightly. I find this especially true in aquatic ecosystems like wetlands and estuaries. It's easy to look at these areas and dismiss them as unimportant, but once students begin to explore what is beneath the surface (both literally and figuratively!), they learn to appreciate the many benefits we often take for granted. This leads to environmental stewardship, and what could be more rewarding than that?



PA STEELS Standards

- **3.1.9-12.M:** Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- **3.1.9-12.N:** Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.
- **3.3.9-12.S:** Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.
- **3.4.9-12.D:** Apply research and analytical skills to systematically investigate environmental issues ranging from local issues to those that are regional or global in scope.
- **3.4.9-12.E:** Plan and conduct an investigation utilizing environmental data about a local environmental issue.

Learning Objectives

- Understand the importance and interconnectedness of tidal wetlands and estuaries. Research a problem and offer a solution.
- Analyze the current state of a nearby tidal wetland or estuary (e.g., Stone Harbor, N.J.).
- Predict and then research the impact rising sea levels (due to climate change) will have on tidal wetlands and estuaries, and propose a recovery plan.
- Hands-on investigation of a tidal wetland or estuary (field trip).

Part 1: Introduction to Tidal Wetlands

Standards: *3.4.9-12.D 3.1.9-12.M* (One day)

Question Formulation Technique (QFT) *Source: rightquestion.org*

Materials: Paper and pencil, tidal marsh photo, whiteboards for each group (optional).

Directions

1. Introduce the four essential rules for producing questions:

- *Ask as many questions as you can.*
- *Do not stop to discuss, judge, or answer the questions.*
- *Write down every question exactly as it is stated.*
- *Change any statement into a question.*

2. Display a **picture of a tidal wetland** (choose your own or use the one on the next slide). Tell students they have two minutes to write down as many questions as they can about the picture.

3. When time has lapsed, explain to students that there are two types of questions: open-ended and close-ended. Open-ended: requires an explanation. Closed-ended: can be answered with yes, no, or one word. Have students read through their list of questions and mark each as either open-ended “O” or closed-ended “C.”

4. Have students choose one of their open-ended questions and change it into a closed-ended question, then choose one of their closed-ended questions and change it into an open-ended question.

5. Tell students to choose two of their open-ended questions that they consider most important (science-based).

6. Break students into small groups (three to four students) and have them share their two most important questions with each other and why they chose them. *Optional-* Have them write all of their questions on a whiteboard to share with the class.



Part 1: Introduction to Tidal Wetlands

Continued

7. Have each group choose the one open-ended question from their group that they think is **most important**. If they used a whiteboard, they will circle this question. Each group will share this question with the class, explain why they deemed it most important. (This will be revisited in Part 4).

8. Introduce tidal wetlands: Show these two short videos:

- What is a Tidal Salt Marsh?

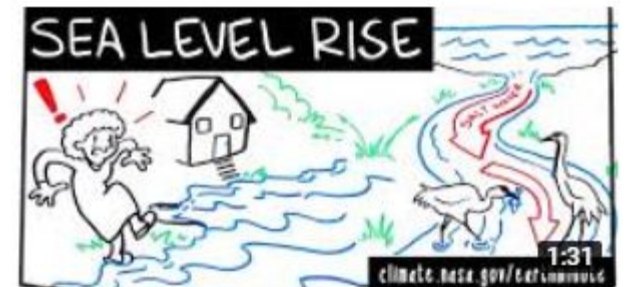
<https://www.youtube.com/watch?v=PhmoxJasIYs>

- Sea Level Rise:

<https://www.youtube.com/watch?v=msnOHuPep9I&list=PL9TFrgFq75552g7qVa-iTOeuo7Fy11o5f>

9. Return to the picture. Ask if any students wrote a question about rising sea levels. Discuss this as a group (Why? Why not?).

10. The video said a child born today should expect a sea level rise from 1-4 feet in their lifetime. Ask students to write a reflection predicting what this area (in the picture) will be like in 50 years. They should include both the geological changes and the impact on the plants and animals that depend on this wetland. Collect this to assess understanding.



Part 2: Tidal Wetlands and Sea level Rise

Standards: *3.4.9-12.D* *3.1.9-12.M* (One day)

1. Show the picture from the previous day and have students brainstorm what they've learned about tidal marshes in the videos.
2. Students will access the NOAA Sea Level Rise Viewer to research a marsh in an area familiar to them (or predetermined by the instructor), and they will investigate the projected sea level rise following the instructions given. They will complete a report with their findings.

NOAA Link: <https://coast.noaa.gov/slr/>

3. [Tidal Marshes and Sea Level Rise Instructions](#)
4. [Tidal Marshes and Sea Level Rise Report](#)



Part 3: Field Investigation: Trip to a Tidal Wetland

Standards: 3.4.9-12.D; 3.4.9-12.E; 3.1.9-12.M (One day)

(Note: Virtual field trip options also exist)

This is an opportunity for students to explore a tidal marsh first hand. They will witness the delicate balance of life in this ecosystem. The Wetlands Institute (Stone Harbor, N.J.) offers programs for water and soil testing and identifying and learning about animals and plants of the wetlands. Below are some example programs from The Wetlands Institute.

Wetlands Ecology (5th – 12th grade)- Two full hours of hands-on, feet-wet activities! Students will test water quality from our dock to understand how environmental factors impact wildlife. Then they'll take soil samples from the marsh and test them to demonstrate the marsh's flood-preventing powers. Next, look at plants that can grow in the salty environment – including one that everyone gets to taste! – and chase after a few fiddler crabs. Finally, it's into the creek with seine nets in search of minnows, shrimp, and crabs.

The **Science Education at Sea (SEAS)** program is conducted entirely on a boat! This science boat excursion sails out of Cape May/Wildwood and educational activities aboard the vessel cover a broad range of subject areas including plankton, specimen collection, animal handling, horseshoe crabs and dolphins. All SEAS programs are aligned to New Jersey Academic Standards and the North American Association for Environmental Education K-12 Guidelines for Learning, and are tailored to the needs of our visiting teachers and schools.



Part 4: Revisiting the Important Question

Standards: 3.1.9-12.N; 3.4.9-12.D; 3.4.9-12.E (Two days)

Have students return to their Day 1 subgroups. Now that they understand tidal wetlands and experienced a field investigation, they will revisit the open-ended question (problem) they chose as **most important**.

As a group they will research to find a possible solution (answer) to their problem using reputable sources. They will create a group poster (suggested format below). Optional: Share their research with the class.

Tidal Marshes Question/Problem	
Background/Intro (explanation of the question)	Research findings (data supporting your answer)
include at least 3 relevant pictures somewhere on the poster	Include one graph or chart, if applicable
Conclusion (answer to question)	
Sources (at least 2)	Authors

