

## ACTIVITY 15

# Score One for the Estuaries

## Estuary Principle

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 can people act as stewards of the nation's estuaries?

## Introduction

The 2010 oil spill in the Gulf of Mexico is an extreme example of how human mistakes can and have negatively affected the ocean, estuaries, wetlands, and other waterways. It is also a good example of how citizens, including students, have acted as stewards, uniting to try and repair some of the environmental damage. Every citizen has a responsibility to help protect and maintain the health of estuaries, especially if damage to those estuaries has been caused by human activities. The three exercises in this activity focus on how we are all responsible for making decisions to protect and maintain the health of estuaries.

## Climate Extension

We all can take actions to reduce climate change and its impacts. One way humans are able to mitigate climate change or lessen its severity is by reducing greenhouse gas emissions. To be able to reduce greenhouse gas emissions, a combination of short-term to long-term strategies are needed. The most immediate strategy is the conservation of oil, gas, and coal which we rely to fuel or things like transportation, agriculture, and electricity. Building new infrastructure to switch to the use of alternative, renewable energy sources represent short to mid-term strategies. Long-term strategies will require innovative research and a deep fundamental change in the way we use energy.

Students will learn how to mitigate the impacts of climate change through several example projects being implemented at the National Estuarine Research Reserves.

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## TEACHER GUIDE

# Score One for the Estuaries

## Research Question

How can people act as stewards of the nation's estuaries?

## Content Objectives

*Students will understand that:*

- Humans can have both negative and positive impacts on the health of estuaries.
- Stewardship is a way for people, including young people, to care for or maintain something such as the environment, an estuary, or wetlands.
- Many people working together, even if they are young, can have a big impact on the estuaries and the wetlands.
- There are a variety of stewardship activities that they can do to help lessen the impacts of climate change.

## Exercises

### Exercise 1: Student Stewards

Students will read stories about three students from Oregon, Alaska, and Alabama who experienced the 2010 Gulf oil spill either directly or indirectly to identify how these students decided to take action to help protect local waterways or estuaries.

### Exercise 2: Stewardship and NERRS

Students will learn how the National Estuarine Research Reserve System (NERRS) was created to help protect estuaries along the coasts of the United States and Puerto Rico. Students read about different NERRS stewardship projects around the country and choose one project to promote with an original, student-written and designed brochure.

### Climate Extension

Students will learn ways to mitigate the impacts of climate change through an interactive PowerPoint that highlights several Reserves commitment to stewardship and the reduction of greenhouse gas emitted at their sites.

### Exercise 3: What Can You Do?

Students use a planning worksheet to plan (and hopefully carry out) their own stewardship project for a nearby estuary or wetlands.

## Assessment Questions

Assessment questions based on content covered in *Score One for the Estuaries* can be downloaded on the web page for this activity in the Middle School Curriculum section of the Estuary Education website at [estuaries.noaa.gov](http://estuaries.noaa.gov).

## Vocabulary

**Anthropogenic** – arising from human activity.

**Carbon footprint** – A carbon footprint is the amount of carbon dioxide an individual or entity creates. Increasing carbon dioxide, the most plentiful greenhouse gas, traps more of the sun's heat and leads to global climate change.

**Climate change** – a regional change in temperature and weather patterns. Current science indicates a link between climate change over the last century and human activity, specifically the burning of fossil fuels.

**Environmental** – all conditions, living and non-living, in which an organism lives.

**Greenhouse gases** – gases that trap heat in the atmosphere and contribute to the greenhouse effect. The main greenhouse gases that enter the atmosphere because of human activities are Carbon Dioxide (CO<sub>2</sub>), Methane (CH<sub>4</sub>), and Nitrous Oxide (N<sub>2</sub>O).

**Human impact** – impacts arising from human activity; often referring to negative impacts on the environment.

**Mitigation** – to make less severe.

**Pollution** – contamination of natural environment.

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

## National Estuaries Day

Organize or participate in National Estuaries Day activities that celebrate our world estuaries. National Estuaries Day is an annual celebration of the vibrant coastal areas where rivers meet the sea – estuaries. Celebrated on the last Saturday in September, National Estuaries Day is a great opportunity to learn more about these magical ecosystems and how you can help to protect them. Whether you live close enough to visit your local estuary, or you virtually transport yourself to an estuary anywhere in the world via the Internet, take some time to explore these wonderful resources. Check out the Estuary Education website at [estuaries.noaa.gov](http://estuaries.noaa.gov) for more information.

## EXERCISE 1

# Student Stewards

### Estuary Concept

Every citizen has a responsibility to help protect and maintain the health of estuaries, especially if that means repairing damage caused by human activities.

### Focus Questions

Who are the stewards who help restore estuaries?

### Performance Task

*Students will:*

Read examples of how students were called to action to be stewards of estuaries and watersheds during the 2010 Gulf oil spill.

### Teacher Background

Students often feel powerless when faced with large problems or with situations that are far away. For many people, the 2010 Gulf oil spill is a good example of one of these large and — for people who don't live on the Gulf coast — far-away problems that are so difficult to approach. In this exercise, students are asked to describe how they felt when they saw the reports of the 2010 Gulf oil spill. They then will read about and explore how three students in different parts of the United States were able to make a difference and help make things better for the environment in different ways in response to the Gulf oil spill.

**Teacher Note:** The stories in this activity are fictional. Health and safety regulations may limit student involvement oil spill clean up activities.

Stories and photos by Tom Gaskill, December, 2010

#### Overview

In this exercise, students explore narratives about how three students from Oregon, Alaska, and Alabama experienced the Gulf oil spill either directly or indirectly to examine how these students decided to become environmental stewards and take action after the Gulf oil spill.

#### Time Required

Two 45-minute class periods

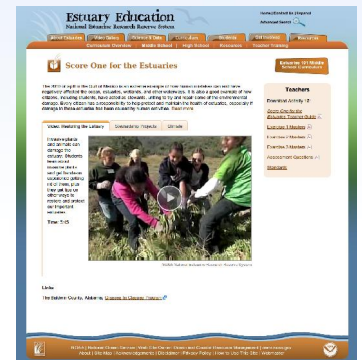
## Teacher Preparation

1. You may want to show (or show again) the video from Activity 14: *The Oil Spill — The Rest of the Story* in the Middle School Curriculum section of the Estuary Education website.
2. Make copies of Student Master: *Student Stewards*. Each student will only need one of the three student stories; every student will need one copy of the Student Master.

## Procedure

1. Show the Gulf oil spill video to your students. Ask students to discuss how they felt about the oil spill after watching the video. Do they remember how they felt about the oil spill back in 2010 when it was happening and in the news? Have their feelings about the oil spill changed over time? How?
2. Tell your students that they are going to read how three students responded to the 2010 Gulf oil spill. Your students should understand that the students in the three different stories reacted to and responded to the Gulf oil spill in different ways.
3. Distribute copies of Student Master: *Student Stewards* to each student. Have students read the opening paragraph about stewardship. Discuss what it means to be an environmental steward with your class. According to the EPA, environmental stewardship is “the responsibility for environmental quality shared by all those whose actions affect the environment.” Have students think about what parts of the environment their own actions affect.
4. Divide the class into three teams. Assign each team one of the three student stories. Distribute copies of the individual student story to each student in the correct, assigned team.
5. Next, have the students on each team read their assigned story. They can either read the story individually or aloud in their group. Once everyone on the team has read the story, the team should discuss the questions on the Student Master: *Student Stewards*.
6. Have the three teams share with the class how their team’s student decided to take action and be an environmental steward. You may suggest that students on each team read their student’s story aloud to the class before presenting their answers to the discussion question.
7. When all three student stories have been presented, discuss how each student was able to make a difference and be a steward for the estuaries and wetlands, either locally, at a distance, or both.

You'll find multimedia and other resources on the web page for this activity in the Middle School Curriculum section of the Estuary Education website: <http://estuaries.noaa.gov>.



## Materials

### Per student

Student Master: *Student Stewards*

## STUDENT MASTER

# Student Stewards

Put simply, environmental stewardship is when a person whose actions affect the environment takes responsibility for maintaining or improving the quality of that environment. It's your Earth. It's your water, your air, your oceans and coasts. It's your responsibility as someone who uses and appreciates these things to act as stewards to take care of these things and leave them for future generations to use and appreciate.

In this exercise, you and your classmates are going to meet three students: Tia, Will, and Kylie. These three kids are a lot like you. They live in different parts of the country, but share something in common. In 2010, all three of them were very upset with the tragic events surrounding the Gulf oil spill and were inspired to become stewards of their local estuaries and wetlands.

### Procedure

1. Read your team's assigned story of one of the student's reaction to the 2010 Gulf oil spill and that student's response.
2. Answer the following questions as a team and be prepared to present your answers to your class.

### Questions

Q1. What is your student's name? Where does your student live?

Q2. How did your student react to the 2010 Gulf oil spill? Give specific examples.

Q3. What other events or interests in the student's life inspired the student to care about the oil spill and its impact on the Gulf?

Q4. How is your student a steward of the estuaries or wetlands?





## STUDENT MASTER

# Student Stewards

## Tia Smith

### Oregon - April 2010

The morning that news of the Gulf oil spill first reached Tia, she was making breakfast while her little sister Tess pranced around the room in a ballerina costume. Outside, a cold rain fell on the green blanket of fir and spruce trees that covered the hills around her house. Just another Oregon spring day! In Oregon, liquid April sunshine brings May moss.

Tia was watching a news report on the family laptop. She saw a blazing fire that had erupted from a wrecked offshore drilling platform in the Gulf of Mexico. She couldn't believe her eyes. Several boats worked furiously to quell the flames, but as the water spouts arced into the sky and landed on the fire, they seemed ridiculously inadequate to the task. Beyond the ring of vessels, Tia could see bizarre brown streaks snaking their way across the surface of the sea. Oil was escaping from the broken well and was beginning to spread across the Gulf.

Tia's family had visited the Gulf of Mexico two summers ago. Tia had raced with Tess along the beaches near Gulfport, Mississippi on their family vacation. The family had rented a place in Ocean Springs where they could walk to the beach. Man, what a great trip that had been! White sands and beach time every day with warm winds and plenty of time to hang out and watch boys. What's not to like? Now, Tia realized that the whole scene she remembered could change very quickly.

Over the next couple of weeks, as the daily news reports began to show fouled Gulf beaches and oil-covered birds, Tia became sad and frustrated. She found herself looking over her family's Gulf vacation photos. One photo in particular caught her attention. A beautiful brown pelican perched atop a piling gazed knowingly at her with one big dark eye. Tia remembered how she and her family had drifted quietly along the waters of the inlet past a flock of these graceful but awkward looking creatures. The one in the picture had stayed in place the longest and then gently swooped down off the post and glided out across the glassy surface towards the bay.

Tia loved birds. Her heart was breaking as she watched the news from the Gulf. Night after night, she saw the images of oiled pelicans and egrets, and of other wildlife being rescued or simply counted as casualties of the spill. "I wish I could do something to help. But what?" she wondered.

Tia had an idea! What if she created a blog where kids from all over the country could share their thoughts and feelings about what was happening in the Gulf and let kids down there know they weren't alone and that lots of people cared? She often got frustrated at school when she heard her classmates complaining all of the time, but never willing to jump in and do something to make a difference. This time she wasn't going to sit back and do nothing! She was going to take action!



## STUDENT MASTER

# Student Stewards

### Will Ferris

#### Alaska - April 2010

Far to the north, in the tiny town of Homer, Alaska, along the shores of Kachemak Bay, Will Ferris was walking the beach after school. The snow had just barely disappeared from the ground around his house. Will was headed off to meet some buddies to see if they could persuade some spring Chinook to take a hand-tied fly along the bay near Catching Creek.

Will felt proud about the work he and his class had done along the banks of the creek. They had planted willows and hemlock to provide shade for young salmon moving downstream and out to sea. Some of the kids had worked through the summer to put some large logs in place along the creek to create deep, dark pools for the young salmon to hide from predators. Now Will was ready to go back and try his hand at landing a fish or two for the dinner table.

As he walked, Will recalled some bad news he had read that morning. A friend of his from Alabama had posted some pictures and first-hand descriptions on Facebook about the crazy scene unfolding in the Gulf of Mexico. Oil was spreading like a plague through the waters around an exploded oil rig. It sounded too familiar.

Will remembered hearing how hard things were for his family when the Exxon Valdez oil tanker dumped tons of oil nearby in 1989. His Uncle Frank worked in the oil industry, designing drilling rigs. His cousins and older brother had spent most of that summer over in Prince William Sound, working to scrub the rocky shores clean. The pay was good, but later people figured out that the cleanup had done more harm than good. Will imagined that this spill in the gulf was hitting oil workers and their families hard, too.

Now it looked like this new Gulf oil spill was going to be even bigger than the Exxon Valdez spill had been. Will wondered, "What can I do to help people in the Gulf?" He couldn't stop the huge amounts of oil gushing up from the broken oil rig, but maybe he could give some kids down there an idea of how to keep more oil from draining off the land and making things worse. Will remembered the oil he and his friends had found in the water when they were doing bank restoration work at Catching Creek. They figured out that the oil was coming from storm runoff at a huge parking lot, several blocks away. Will and his class decided to organize a native planting project around the storm drains leading into Catching Creek. The plants could help filter out some of the oil before it went down the drains and into the creek. What if people upstream from the Gulf of Mexico, all along the Mississippi River drainage basin, did their own native planting projects? Could that keep additional oil out of the hard-hit Gulf waters?





## STUDENT MASTER

# Student Stewards

### Kylie Simmons

#### Alabama - April 2010

“What can I do to help?” That question never really occurred to Kylie Simmons. There wasn’t time. Almost as soon as the Deepwater Horizon oil spill happened, Kylie and her classmates went to work along the beaches near Gulf Shores, Alabama deploying an oil boom to protect the precious young marsh plants from the fast approaching spill. So far the oil had only hit the shore in a few places, but wildlife on the barrier islands off of Louisiana was showing up oiled and it seemed only a matter of time before Mississippi, Alabama, and Florida were hit with it too.

These weren’t just any marsh plants Kylie was protecting. These were her marsh plants. Kylie and her classmates from Jubilee Middle School had spent many hours working on the “Grasses in Classes” program to seed and grow saltmarsh spartina seedlings at her school.

Then they helped plant the seedlings along an eroding shoreline nearby. Now, the threat of oily, black tar balls slowly making their way to shore was threatening to ruin all of their hard work. Kylie and her classmates had to leap into action once again.

Today, Kylie and her classmates had a plan. But what would happen in the weeks to come? The oil spill had already been spreading for days and the end wasn’t in sight. In fact, the oil company was telling the government that the soonest they would be able to stop oil from pouring into the Gulf would probably be August, three months from now! In the meantime, her class had a new crop of seedlings ready to transplant, but they had no idea where to plant them. How would they protect the seedlings they and others had already planted or were about to plant from being overcome by the oil that was moving out across the Gulf?



## EXERCISE 2

# Stewardship and NERRS

## Estuary Concept

Actions that will improve and maintain estuary health include energy conservation, water conservation, habitat protection, and restoration, proper wastewater treatment, and education about estuaries.

## Focus Question

How does the National Estuarine Research Reserve System act as a steward of the nation's estuaries?

## Performance Tasks

*Students will:*

- Explore examples of real stewardship projects undertaken by people within the National Estuarine Research Reserve System.
- Create a promotional brochure for an existing NERR stewardship project.

## Teacher Background

The National Estuarine Research Reserve System (NERRS) was created to help protect and conserve more than 1.3 million acres of coastal and estuarine habitat along the coasts of the United States and Puerto Rico. Beyond the work it does for areas within the Reserves, NERRS seeks to improve the stewardship of coastal habitats outside Reserve boundaries as well. This “stewardship approach uses the best available science to maintain and restore healthy, productive and resilient ecosystems, and disseminates information to regional and national stakeholders. Site-based stewardship strategies assess and respond to threats from coastal development, human use of reserve resources, climate change, and invasive species.” Stewardship translates to everyone working together to preserve the estuary environments for everyone to use and enjoy, now and in future generations.

## Climate Extension

We all can take actions to reduce climate change and its impacts. One way humans are able to mitigate climate change or lessen its severity is by reducing greenhouse gas emissions. To be able to reduce greenhouse gas emissions, a combination of short-term to long-term strategies are needed. The most immediate strategy is the conservation of oil, gas, and coal which we rely to fuel or things like transportation, agriculture, and electricity. Building new infrastructure to switch to the use of alternative, renewable energy sources represent short to mid-term strategies. Long-term strategies will require innovate research and a deep fundamental change in the way we use energy.

As a system, the NERRS are particularly concerned with atmospheric gases that contribute to climate change and endeavor to reduce their impacts. The NERRS strive to reduce greenhouse gas emissions in all program aspects including: how

### Overview

In this exercise, students look at examples of stewardship projects that are working under the direction of the National Estuarine Research Reserve System. The primary project example used in this exercise is the Grasses in the Classes project, where students from Baldwin County, Alabama and the Weeks Bay NERR are helping to restore coastal areas after the Gulf oil spill by growing and planting native grasses. Students then choose a stewardship project from a different NERR site and create a promotional brochure for the project.

### Time Required

One 45-minute class session

facilities are developed, renovated, and operated; the selection and use of boats and vehicles; and how we conduct programs and meetings. The NERRS strongly believe that practices and policies followed at the Reserves as well as homes, schools, businesses and governments can affect climate. Additionally, actions taken by students and other individuals, schools, communities, states and countries all influence climate. We need to start taking actions today to make sure that we have healthy estuaries and coastal communities of the future.

## Teacher Preparation

1. Visit the web page for this activity in the Middle School Curriculum section of the Estuary Education website. Click on the Stewardship Projects tab to explore stewardship projects at different NERRS sites.
2. Read about the Grasses in the Classes project. Download and view the Grasses in the Classes brochure and save to share with your students.
3. Decide if there are any that you want to share with your students as part of a teacher demonstration. Here are example projects:

### Examples of coastal habitats projects

- Sapelo Island NERR, GA: Marsh Bird Monitoring Program
- Apalachicola NERR, FL: Habitat-Species Monitoring

### Examples of invasive species projects

- Narragansett Bay NERR, RI: Prudence Island Cooperative Weed
- Weeks Bay NERR, AL: Swift Tract Invasives Removal Project

### Examples of water quality projects

- Padilla Bay NERR, WA: Storm Team and Stream Team
- Elkhorn Slough NERR, CA: Volunteer Water Quality Program

4. Make copies of Student Master: *Stewardship and NERRS*.
5. Decide whether to let students use computers to explore individual NERRS stewardship projects on their own or in teams. You should also decide whether you want to have students create promotional brochures for the projects they research.
6. You may choose to simplify the brochure project a little by having students only do a one-sided brochure. That is, if they are creating a tri-fold brochure, they would only need to fill three panels, not six.

Find links to NERRS stewardship projects on the web page for this activity in the Middle School Curriculum section of the Estuary Education website:  
<http://estuaries.noaa.gov>.



## Materials

### Per student

- Student Master: *Stewardship and NERRS*
- Computers with Internet connection
- Assorted materials for creating a brochure (e.g., computer and software or paper, ruler, colored pencils, etc.)

## Procedure

1. Use a computer with a projector to display the NERRS interactive map in the Middle School Curriculum section of the Estuary Education website. Find the Weeks Bay NERR in Alabama. Discuss the location of Weeks Bay and how hurricanes and then the 2010 Gulf oil spill would have had an impact on local coastal habitats.
2. Distribute copies of Student Master: *Stewardship and NERRS*.
3. Now discuss the NERRS stewardship project, Grasses in the Classes. Students will find a short description of the project on their Student Master. Open up the Grasses in the Classes brochure from the web page for this activity. Discuss the brochure with your students. First discuss the nature of the project. There are “Grasses in Classes” programs at several NERRS sites around the country. In these programs, students grow native sea grasses at school nurseries and then plant their sea grass along coastal waterways, helping restore and protect coastal habitats. What can your students tell about the Weeks Bay project from the brochure?
4. Tell your students that they are going to go online and explore stewardship programs at different NERRS sites around the country. As they read about different programs, they should remember to think about not only what the project is trying to accomplish, but also how the project is getting accomplished, how volunteers are used, and other great ideas on how to make a stewardship project work.
5. Direct students to the web page for this activity on the Estuary Education website. Students will find links to descriptions of stewardship projects.
6. If there is time, have students or teams of students choose a NERRS stewardship project to research as a team. Then the students should design simple promotional brochures for that stewardship project. Use the Grasses in the Classes brochure from the web page for this activity as an example.

### Take Note

Make sure to review the procedures and materials related to the Climate Extension before proceeding with this activity.

## Climate Extension

7. After the presentation on Grasses in the Classes and the student online exploration of NERRS stewardship projects ask the students if they have ideas of stewardship activities that could help minimize the impacts of climate change on estuaries. Explain that the NERRS are particularly concerned with atmospheric gases that contribute to climate change and endeavor to reduce their impacts. The NERRS strive to reduce greenhouse gas emissions in all program aspects including: how facilities are developed, renovated, and operated; the selection and use of boats and vehicles; and how we conduct programs and meetings.
8. Discuss the terms carbon footprint, greenhouse gases, and mitigate with students. Show the PowerPoint “National Estuarine Research Reserves: taking steps to reduce their carbon footprint”. With each slide ask the students if they can figure out ways the Reserves are reducing their greenhouse gas emissions and how they are stewards of the estuary.
9. Distribute copies of Student Master: *Stewardship and NERRS* and have students complete the worksheet.

For resources and links related to this Climate Extension, look for the Climate tab on the web page for this activity in the Middle School Curriculum section of the Estuary Education website:  
<http://estuaries.noaa.gov>.



## Question for Discussion

**How are the Reserves, working with local volunteers, to “score one for the estuaries?”**

Students may mention that the National Estuary Research Reserve System (NERRS) has been put into place to be stewards of estuaries. That means that it is part of NERRS mission to maintain and protect estuaries for future generations. NERRS sites have multiple stewardship projects and programs, all designed to combat threats by invasive species or prevent damage to coastal habitats or limit the impact of poor water quality.



## STUDENT MASTER

# Stewardship and NERRS

Did you know the National Estuarine Research Reserve System (NERRS) was created to help protect estuaries along the coasts of the United States and Puerto Rico? The mission of these Reserves is to help protect coastal wetlands by doing such things as removing non-native plants from public lands, monitoring water quality, restoring oyster beds, and preserving these environments for everyone to enjoy.

Like the students you read about in Exercise 1: *Student Stewards*, the Reserves serve as stewards for the estuaries and nearby wetlands. In this case, stewardship translates to everyone associated with each NERR working together to preserve the estuary environments for everyone to use and enjoy, now and in future generations.

**Using the information below and from your online research, choose a NERRS stewardship project. Write down how individuals worked on the project and how they ‘Scored One for the Estuaries’.**

These stewardship projects fall into four general categories:

### 1. Change to Coastal Habitats

Coastal habitats are the parts of the coastal estuaries where plants and animals are living. These habitats can be negatively affected by changes in land use, pollution, erosion, and sea-level changes due to climate change. Restoration efforts within the Reserves allow people to explore the science behind restoration. Efforts include dam removal projects, restoration of sea grass along channels, beach grass on dunes, and widening of openings to allow more salt water flow into marshes.

**Example:** The Grand Bay Reserve serves as a “NERR” perfect restoration example. Recently, the stewardship coordinator designed a project to prevent the shoreline adjacent to their boat launch from eroding. Black Needlerush marsh was planted/restored with the help of local elementary students and is protected with a manmade “log” of shredded coconut hulls. This log keeps the waves from eroding away the new marsh and will eventually decompose and disappear after the root systems of the plants have had a chance to develop. Today the restored marsh is successfully growing and helping protect the shoreline from erosion. The runoff from the parking lot has been minimized, and the Reserve’s visitors and staff have a useful boat launch and fishing dock.

### 2. Invasive Species

Invasive species are species not native to an ecosystem although not all non-native species are invasive. An invasive species can either be animals, plants or other organisms. Invasive species are bad for the native ecosystem because they often “out compete” the native species, in effect starving or displacing the native plants or animals. Invasive species may constitute the largest single threat to coastal ecosystems. All four coasts — East, West, Gulf, and Great Lakes — as well as many waterways in the interior of this country have been severely affected by invasive aquatic species.

**Example:** At North Inlet-Winyah Bay NERR in South Carolina, local stewards continue to work hard monitoring and controlling the spread of beach vitex. This woody shrub, native to Pacific Rim countries, became a problem on Carolina beaches in the mid 1980’s when it was imported for beach stabilization. Beach vitex makes a dense mat of vegetation over dunes posing a direct threat to animals, like sea turtles, that depend upon the dunes in their natural state. Volunteers that monitor sea turtle nesting have documented turtles returning to the sea without laying their eggs when they have encounter beach vitex covered dunes. Luckily the hard work of volunteers within the NERR and along the whole coast of Carolinas has resulted in a location, treatment and replanting of roughly 250 beach vitex sites.

### 3. Water Quality

Water quality directly affects the quality of coastal habitats. Water quality in estuaries, for example, affects spawning and nursery habitats for fisheries, as well as influencing biodiversity. Human communities that live along the coasts and that rely on estuaries for recreation and livelihoods are also affected by water quality. Water quality is a fundamental indicator of the negative impacts from coastal watersheds and is used to measure the health of estuary ecosystems. The quality and quantity of ground water is also important.

**Example:** At Elkhorn Slough NERR in California, staff and volunteers collect monthly data from 24 recording stations (data loggers) within the watershed and associated waterways. Data gathered includes water temperature, salinity, dissolved oxygen, pH, turbidity, nitrate, ammonium, and dissolved inorganic phosphate. The data gathered reveals extremely high nutrient enrichment in the estuary, indicative of non-point source pollution.

### 4. Climate Change

Climate change and the associated impacts are being increasingly felt in coastal areas. A changing climate will have significant impacts on estuaries by likely causing local extinction of some species, dramatic changes in habitats, and changes in how nutrients cycle through the ecosystem. While climate change impacts vary regionally, coastal communities and estuaries are clearly on the front lines of climate change.

**Example:** The Climate Stewards Program at Padilla Bay NERR in Washington, trains staff and volunteers to work with their local communities to educate their neighbors about climate change and show how simple changes in our lives can make huge differences. The volunteers first participate in a training program that provides them with a background in the science of climate change and its impacts, discussions on wise choices to live more sustainably, and how to communicate accurately and confidently about climate change. After completing the training program volunteers develop and engage in climate education projects within their community to teach ways that we individually and collectively can reduce our carbon footprint.

## STUDENT MASTER

# Stewardship and NERRS

Q1. What issue did the stewardship project you picked address?

Q2. How did the NERR staff and volunteers work together to address the issue?

Q3. What might be some next steps the NERR staff and volunteers could do to further help the estuary?

## EXERCISE 3

# What Can You Do?

### Estuary Concept

Students can “score one for the estuaries” by coming up with a stewardship project that will help protect waterways and wetlands in their area.

### Focus Question

How can students “score one for the estuaries?”

### Performance Task

*Students will:*

Create a plan for a class stewardship project.

### Teacher Background

This exercise helps students plan a new stewardship project aimed at resolving a problem or improving environmental quality at a local estuary, wetland, or waterway. Having students design their own action plan will enhance student involvement. Students will come to realize that they are stakeholders in their local environment and therefore should be stewards charged with maintaining or improving the quality of that environment. Suitable sites in your area may be a river, lake, or wetland or, if you live near the ocean, possibly a saltwater marsh or a shoreline. Student work builds on best practices your students identified in Exercise 1: *Student Stewards* and Exercise 2: *Stewardship and NERRS* of this activity. With this final exercise, it is time for your students to think about what they can do for estuaries and wetlands in your own community

### Teacher Preparation

By this point, if your students have done one or both of the other exercises in this activity, your students will be familiar with the concept of environmental stewardship and have some ideas about the types of projects other students and adults have done around the country to improve or maintain the environmental quality of their local estuaries, wetlands, or waterways.

Decide if you really want to do a class stewardship project. You may not have time or it may simply not be practical. There is educational value in going through the process of brainstorming a project plan and trying to figure out how that plan could be implemented. Consider having students complete plans, even if the plans never get carried out.

You may want to choose a site and environmental need or issue before students start their project planning, or you may want choosing a site and an issue to be part of your students’ planning. Either way, it would be good for you to know as much about potential site choices as possible. You may want to contact a local nature center, a NERR site near your school, your state’s Department of Natural Resources, etc., for advice. Other important considerations in choosing a site include distance from your school and safety factors. Visit potential sites before

#### Overview

In this exercise, you and your students can help the Reserves and wetlands “score one for the estuaries” by coming up with a stewardship project that will help protect waterways and wetlands in your area.

#### Time Required

Two or more 45-minute class sessions

starting any stewardship project.

If your class does not start its own stewardship project, perhaps your students can join an existing stewardship project, such as Grasses in the Classes or local efforts to fight non-point source pollution.

## Procedure

1. Divide your class into several teams. Distribute copies of Student Master: *Planning Your Stewardship Project*.
2. Student teams follow the Student Master: *Planning Your Stewardship Project* to design a stewardship project. Allow time for in-class team discussions, research, etc.
3. Student teams should then present their project ideas to the entire class. If you have more than one class, you may want to have each class vote on that class's best project idea and then find a way to have all of your classes hear presentations by the "finalists" before voting on one project that all of your classes can implement together. Focus pre-vote discussions on what makes for a good stewardship project. What considerations of time and money might make one project better, or perhaps simply more feasible, than another?
4. If possible, help your students implement their stewardship project.
5. Get in touch with someone at your local NERR to see if they are interested in sharing some of your students' other stewardship project ideas with the public via their learning centers or web sites.

### Materials

#### Per student

Student Master: *Planning Your Stewardship Project*



**STUDENT MASTER****Planning Your Stewardship Project**

Stewardship = to care for or maintain something (in this case, the environment)

Team name: \_\_\_\_\_

Participants: \_\_\_\_\_

Project Title: \_\_\_\_\_

**Thinking It Through**

What do you plan to do for your estuary, wetland, or waterway? Describe your stewardship project idea in one or two paragraphs.

What do you hope to accomplish by doing this project? How does your project help protect waterways and/or the estuaries?

How will this project make a difference and for whom?

**Planning**

When do you plan to begin (now, next month, next semester, etc.)?

How much time will you need to complete the project?

To your knowledge, has this type of project been done before? If so, what were the results? How will your project be different?

List any community members, community organizations, state or national organizations (such as your local NERR) that might be able to help you with your project. Include names of individual contacts and how to contact them (email address, phone numbers, etc.):

List any special services you might need to complete your project. (This might include things like transportation, garbage disposal, etc.)

Will there be any costs associated with your project? If so, how do you plan to pay the costs? (List costs and possible sources of funding.) Are there any ways you can lower the costs?

List any other resources, materials, or supplies that you will need for the project (gloves, trash bags, tarps, etc.):

If your project requires group work, where and when can you and the other group members get together to work on the project?

Place:

When:

## Actions

Now outline the specific steps or actions your group will take to accomplish the project. Assign specific tasks to each person with clear instructions and completion times. (Use additional sheets of paper as needed.)

Action Item 1: \_\_\_\_\_

Lead Student: \_\_\_\_\_ Completion Date: \_\_\_\_\_

Action Item 2: \_\_\_\_\_

Lead Student: \_\_\_\_\_ Completion Date: \_\_\_\_\_

Action Item 3: \_\_\_\_\_

Lead Student: \_\_\_\_\_ Completion Date: \_\_\_\_\_

Action Item 4: \_\_\_\_\_

Lead Student: \_\_\_\_\_ Completion Date: \_\_\_\_\_

Action Item 5: \_\_\_\_\_

Lead Student: \_\_\_\_\_ Completion Date: \_\_\_\_\_

## Reviewing & Reporting

Did you complete your project and meet your goal?

Did you learn anything that surprised you during your project?

Were there any unexpected things you had to overcome in order to complete your project?

How can you share the information you learned and results with others?

Did your project bring up any other questions or issues that could become future project ideas?

What is the most important thing you learned from doing this project?