

Non-Point Source Pollution Program Ranger Led Education Program



Overview

In an effort to introduce National Park visitors to the concept of non-point source pollution, a summer program was developed to help explain some Park related management issues. As a portion of this program, and the [New Jersey Marine Sciences Consortium \(NJMSC\)](#) programs that bring students to Sandy Hook, an opportunity arose to introduce this knowledge to a younger audience. The resulting Ranger Led Education Program gives these students the opportunity to interact with Park staff, learn the importance of the National Parks and their concept of Stewardship, and give them the opportunity to learn what they can do about it.

Background for Educators:

Non-point source pollution has no specific source location but is caused by a variety of pollutants that are introduced to our waterways primarily through rainwater runoff. These pollutants include:

- Nutrients (Primarily Nitrogen and Phosphate)
- Pathogens (Bacteria and Viruses)
- Sediment (Sands, Silts and Clays)
- Toxic Contaminants (Including oil)
- Floatable Debris (Styrofoam Cups, Cans, Plastics)
- Thermal Stress (Excessively heated water)

As rain or melted snow travels across the land surfaces, it picks up pollutants that can be health risks to humans and cause serious damage to the water ecosystem. Over 60% of existing water quality problems are the result of non-point source pollution linked to this runoff, also called “Stormwater” runoff.

The activities in this Lesson are divided into three groups:

Pre-Visit: Students will research the concept of bio-degradation and/or Nutrients/Fertilizers. Activities will test biodegradability of easily accessible items, and the effects of over-fertilization on plants and water.

On-Site: Students will see and hear about examples of how non-point source pollution impacts Sandy Hook. They will differentiate between biodegradable and non-biodegradable items that have been found on Sandy Hook, and discuss possible impacts the item can have in the environment. The discussion will include possible solutions to issues at the Park, and solutions for more global problems. Students will participate in an interactive demonstration of non-point source pollution using an Enviro-Scape® model.

Post-Visit: Students will compare non-point source pollution issues at the Park with non-point source pollution issues at their homes and in their schools. They will develop a plan for reducing non-point source pollution on their school grounds.

Essential Questions:

- **What is non-point source pollution?**
- **Why does non-point source pollution matter at Sandy Hook?**
- **Why is Sandy Hook a unique place to study non-point source pollution?**

Estimated Duration

- **Pre-Visit:** 30-60 minutes (plus optional activities spanning up to 2 weeks)
- **On-Site:** 10 minutes
- **Post-Visit:** 30-60 minutes

NJ Core Curriculum State Standard (s) addressed:

Standard 5.10 (Environmental Studies).

All Students will develop an understanding of the environment as a system of interdependent components affected by human activity and natural phenomena.

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Pre-Visit Activity

Synopsis: Students will learn 2 major concepts: Biodegradability and Nutrient Pollution. Using items found in the home and in the classroom, students may conduct up to three activities to investigate these concepts. The activities include developing lists of biodegradable vs. non-biodegradable items and testing their choices, seeing the effects of nutrient pollution on water quality, and seeing the effects of overwhelming an ecosystem with nutrients.

Materials:

- Buckets/Empty Fish tanks
- Flowerpots without holes in the bottom (large cups will suffice)
- Paper/Plastic Plates
- Small Household Plants (approximately 3, likely they will die)
- Small Household/Classroom items (disposable, may vary)
- Miracle grow or similar fertilizer
- Distilled Water

Duration:

- **Activity 1** – 10 minutes
- **Activity 2** – 10 minutes
- **Activity 3** – 10 minutes

Activity 1: Biodegradation

Synopsis:

This activity will teach the students about biodegradation, that is, the ability for an object to break down once disposed of in a natural environment.

Activity:

The teacher should provide a basic background on the concept of biodegradation. This may be a lecture or a pre-activity homework assignment to research the topic.

Students will then break into 2 groups, one for biodegradable and one for non-biodegradable. Each group will go around the room and list as many items as they can find of their assigned type. Lists should include simple items such as apples in a lunch box, a plant, a pen, a book, et cetera; and should include complex items such as a wooden/metal desk, a lunchbox with all its contents, et cetera.

Once the lists are made they should be analyzed to determine if any items are incorrect. After the lists are complete students may continue onto Activity 2.

Activity 2: Biodegradation Continued

Synopsis:

This activity will test the students' ability to determine if an item is biodegradable. It will also allow them to see how long an item takes to biodegrade.

Activity:

The activity will demonstrate biodegradation and test the students' ability to assess items they listed in Activity 1. It will also demonstrate the timeframe necessary for an item to degrade given certain conditions. At least 3 items should be chosen off the 2 lists generated in Activity 1. The items should include:

- 1 item easily biodegradable (like an apple, bread, etc...)
- 1 item non-biodegradable (polystyrene cup, plastic cup)
- 1 item slowly biodegradable (paper juice box, etc...)
- Any items that were incorrect on the lists or seem counterintuitive (such as a metal paperclip)

The items should then be placed either on a plate or in a cup of water and allowed to sit for a few days. A desk lamp may be placed overtop the items to accelerate the degradation. Students may make guesses to determine which will degrade fastest and how long it will take items to become unrecognizable.

A discussion over the course of the activity (make take days to a week depending on the items chosen) should include what happens to the items when they are improperly disposed of. If an item is thrown directly into the bay or river the biodegradation activity will show what happens to the water.

As a follow-up, students should be encouraged to determine how much trash is disposed of by their families, or school, each week. Talk about what would happen if these items went directly into a local river or bay.

Activity 3: Nutrient Pollution (over fertilization)

Synopsis:

This activity will demonstrate the consequences of introducing excessive nutrients into the environment. It will show what happens to the water when there is a surplus of nutrients and what happens to plants if too many nutrients reach them.

Activity:

Four flower pots should be set up, two with only water, two with plants.

The pots with only water should be filled with distilled water for two reasons. First, it will eliminate nutrients already in tap water. Second, tap water contains chlorine which inhibits bacteria and algal growth. Label one pot "Control". Label the second pot "Nutrients". In the nutrient pot add miracle grow or a similar fertilizer. Allow the pots to sit near a window. The pot with nutrients should develop an algal (scum-like) surface within a few days. This demonstrates the effect nutrients have on our bays and rivers. Nutrients like the fertilizers enter the waterways directly as non-point source pollution runoff from residential, agricultural and commercial yards.

The pots with plants should also be labeled "Control" and "Nutrients". The control plant should be watered and fertilized as normal. The plant labeled nutrients should be fertilized at 3-4x the advised level (obviously excessive). This high level of nutrients will kill the plant, and will demonstrate the effect excessive nutrients from non-source pollution have on the plants in our rivers and bays.

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On-site Activity

Synopsis:

The Ranger will introduce and review the concept of Non-Point Source pollution. They will show examples of items found on Sandy Hook and discuss the damage that occurs locally due to the pollution. Finally, they will introduce ideas of minimizing and eliminating non-point source pollution both on Sandy Hook and at home. Students will participate in a demonstration of non-point source pollution using an Enviro-Scape® model.

Interactive Discussion Activity:

1. Introduce the concept of Non-point Source Pollution
2. Ask for examples from the students
 - a. Discuss solid examples (polystyrene cups, etc...)
 - b. Discuss chemical examples (nutrients, etc...)
 - c. Demonstrate Enviro-Scape® model
3. Show Examples
 - a. Biodegradation Time Line – This is a take home 11”x15” poster that will be provided one copy per class to the instructor.
 - b. Trash found on Sandy Hook
 - c. Chemical examples
 - i. Fertilizer
 - ii. Oil
 - d. Items students saw in the Enviro-Scape® model
4. Cause and Effect
 - a. Examples of Harm to Environment by Garbage
 - i. Local to Sandy Hook
 - ii. Regional/Global
 - b. Harm to Water by Chemicals
 - i. Damage to cycle of life (estuaries)
 - ii. Damage to living organisms
5. Possible Solutions
 - a. Reduce/Reuse/Recycle
 - b. Pet Waste Pickup
 - c. Don't feed Wildlife
 - d. Proper Disposal of Household items (carry in/carry out)
6. Conclusions
 - a. Everyone is responsible
 - b. Starts at home
 - c. Spread the word

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Post-Visit Activity

Synopsis:

As a take home message from the on-site activity, the Ranger has encouraged the students to think about what they could do to reduce and eliminate Non-Point Source Pollution. This discussion should continue back in the classroom.

Activity:

The students have seen the effects of the pollution on Sandy Hook. Every day they are presented with opportunities to reduce non-point source pollution. Students should develop plans to reduce floatable garbage (Styrofoam cups and aluminum cans) and non-recyclable trash, both at home and at school.

These plans may include cleanup activities to prevent trash from entering storm drains, plans to ensure proper recycling, and plans to reduce the total amount of non-recyclable items.

Supplemental:

Students and instructors may also use the “[Salt Marsh in a Pan](#)” lesson plan available through the NJ Marine Sciences Consortium (<http://www.njmsc.org> under Education, [NJMSC Lesson Plans](#)) as a follow up activity.

For more information about Gateway NRA-Sandy Hook, contact the Sandy Hook Visitor Center at 732-872-5970

<http://www.nps.gov/gate> click on Discover Sandy Hook Unit!