

Title: Water You Doing With Your Waste?

Goals:

This lesson will encourage students to take action and be mindful of water pollution in their communities as well as learn how to mitigate pollution in urban environments through teaching them about water pollution and its origins. The takeaways from this lesson for students will be to explain solutions in place to minimize water pollution, identify where they can see solutions to water pollution in students' area, and use key terminology defined in the lesson. Students will be able to see the routes that pollution takes along landscapes and how it ultimately ends up in bodies of water through models that illustrate these pathways.

Objectives:

- Students will list the various types of water pollution (point-source, non-point source) and determine where they come from.
- Students will identify the number one source of water pollution and its origins in the state of Pennsylvania.
- Students will build a model of the potential solutions to water pollution using materials provided.
- Students will model the types of water pollution and how they enter a body of freshwater.
- Students will identify where they see solutions for water pollution in their everyday lives.

Audience ID:

- Adolescence age group
- Age 12-15, Grade 7
- There will be a classroom consisting of about 18 students coming to participate in this activity
- Affiliation: Northwestern PA and New York students involved in the Creek Connections services school program

Duration: 3 hours

- Before: In the week prior Allegheny students will acquire the needed supplies to conduct the lesson.
- Before (Day Of): Allegheny Students will arrive around 7:30am to set up the powerpoint in the classroom, stream table, and enviroscape model. The needed materials should be placed in the back of the room. The Allegheny students will then wait outside for the Middle School students to arrive between 9am to 9:30am.
- During: The lesson will start at 9:30am and will last until 11:30am. Total time: 2 hours.
- Classroom Follow-Up: The students will head back to the classroom and complete a matching activity that will take around 15 minutes. Allegheny Students will then go over

the answers for another additional 5 minutes. Before leaving the classroom students will be asked one thing new that they learn that day as a “ticket out of the door”. Total Time: 30 minutes

- After: Middle school students will then eat lunch at Brooks Dining hall. Total time: 45 minutes.

Location:

Allegheny College, Alden Hall (Basement and upstairs classroom)
475 N Main St
Meadville, PA 16335

We are current Allegheny College students, and are able to conduct this lesson in the Alden Hall basement. The students will be dropped off outside Alden Hall along N. Main St and an Allegheny Student will meet them outside. They will be picked up in the same location at the end of the lesson.

Content:

The lesson will be complemented with supplemental material in the PowerPoint presentation that will be presented at the beginning of the lesson and prior to the activity in order to provide background information on water pollution. A lot of students nowadays are intimidated by the thought of environmental issues and experience **ecophobia**, meaning students become extremely concerned and overwhelmed with the vastness and unsolvability of environmental issues, so they resort to not attempting to help or learn about it at all out of fear (Sobel, 2019). To tackle this, the lesson will focus on **water pollution** close to students’ homes and community, understanding solutions in place to mitigate pollution, and encourage them to take social action as a way to ease ecophobia and engage with the desire to “save the world” that’s often seen in students of the adolescent age group (Sobel, 2019).

In Pennsylvania specifically, **sediment** is the number one water polluter by volume and though it does occur naturally in areas, it is exacerbated greatly by land development and can cause serious problems (Erosion, 2022). Sediment pollution is caused by **erosion**, which is typically a result of the deforestation of natural plants along the **riparian area** of a body of water, and then the runoff of sediment is unable to be filtered by the natural flora of the area prior to entering the body of water (Erosion, 2022). This type of pollution has such harmful effects such as fish kills, drinking water contamination, or increased turbidity (Erosion, 2022). Buffers such as **bioswales** and **rain gardens** are able to help filter this runoff from developed areas (parking lots and large paved areas) through rocks and natural plants as it runs off of the paved area in order to be cooled, filtered, and then slowly released back into the waterbody.

Students will also learn about the different types of pollution, including **point source** and **nonpoint source**, using an **enviroscape model** to demonstrate where pollutants originate and see how they all contribute to water pollution. The enviroscape model will focus on point source pollution, or pollution originating from a single, identifiable source (such as a discharge pipe from a factory or sewage plant), and nonpoint source pollution, which does not originate from a

single source, or point, using different food coloring to simulate different pollutants (Harvey, 2022).

Vocabulary Pertinent to this Lesson

Sedimentation	The settling of solid particles from fluids.
Pollution	The introduction of harmful materials into the environment.
Bioswales	A long, channeled depression or trench that receives rainwater runoff, has vegetation, and organic matter to slow water infiltration and filter out pollutants.
Enviroscape Model	a 3-D self-contained mini watershed model.
Rain Garden	A garden of native shrubs, perennials, and flowers planted in a small depression.
Point Source	any contaminate that enters the environment from an easily identifiable or contained place.
Non-Point Source	pollutants released from a wide area.
Erosion	the process in which the earth is worn away by the action of water, glaciers, winds, etc.
Stream Table	A model showing how streams flow through a watershed and how they behave when the water levels change.

Methods:

Day Breakdown

- **Arrival (9:00-9:30 AM)**
 - Students get off of buses and arrive at Allegheny College at Alden Hall. Students will be directed to sit in Alden Hall classroom where they can get water, use the restroom, or have a snack before the lesson begins at approximately 9:30 AM.
- **Beginning Presentation (9:30-10:00 AM)**
 - Present a questionnaire on PowerPoint in Alden Hall classroom with multiple choice questions on key vocabulary terms to familiarize students and prepare them for hands-on activities. Students can be broken up into groups or can answer individually.
 - **Questions:**
 - What is pollution?
 - What is water pollution?

- Defining key terms with photos: point source, non-point source, bioswale, enviroscape, rain garden, erosion, stream table, pollution, sedimentation
 - Where does pollution come from? Is all pollution man-made?
 - What kind of pollution is most common in PA?
- **Stream Table Demonstration (10:30-11 AM)**
 - Students will move down to the Alden Hall basement to the stream table for a hands-on lesson in sedimentation pollution. Instructors will ask for a volunteer to construct a “parking lot” on the stream table using plexiglass slats next to the stream to indicate land use and land alterations (compare the alterations to a supermarket parking lot, a mall parking lot, a church lot, etc.).
 - Have the students pour water (**NO** food coloring) over the parking lot to indicate precipitation and watch it go into the stream. Explain to/ask the students if they think that the water going over the parking lot will heat up or cool down, explain how it may then carry potential pollutants that are on the parking lot surface and particulate matter that will run into the stream. Show/have the students demonstrate how the sides of the stream get eroded and carry sediments into the stream. (have the students explore and model that more sediment=more erosion along the banks)
 - Then have a teacher put a few drops of food coloring on the parking lot to indicate sedimentation/pollutants and have the students pour water over the parking lot again to see the “pollutants” directly enter the water, as opposed to being filtered through the soil and plants in that area.
 - Break students into 6 groups (3 or so students in each group). Instruct the students to construct a bioswale/rain garden with sponges and trees in order to “cool” and “decontaminate” the water before it enters the waterway. Students will then take turns pouring the decontaminated water and watching how the bioswales reduce sedimentation and pollution.
- **Enviroscape Demonstration (11-11:30 AM)**
 - The students will be divided up by the instructors into three groups of 6, and one group will move back up to the classroom and circle around the enviroscape model while the other two groups will remain by the stream table to explore the inner workings of a stream in more depth **The other two groups will rotate up to the enviroscape table after each group has 10 minutes with the enviroscape**
 - When the students arrive to the enviroscape table, we will utilize different colored food coloring drops to indicate different types of pollutants that are being produced from different locations on the table (oil from cars, oil from factories, erosion from development and land use and deforestation) and drip the food coloring in the locations on the model that those types of pollution typically occur.
 - Students will then take turns “make it rain” by pouring water or squirting water out of a squirt bottle over the enviroscape model in order to demonstrate precipitation in the area and show how water carries the pollutants to the main body of water

in the area, typically a lake, which can usually be a source of drinking water for that residential area.

- This model is used to provide students a hands on example of the different locations that pollutants come from in their lives and how they can end up in people's drinking water
- Ask them questions, such as: "Where do you think pollution comes from in your everyday life?" and "From what parts of this enviroscape do you predict pollution to water can occur from?"--and have them put the drops on those parts of the model
- **Classroom Activity (11:30-11:45 AM)**
 - The students will head back to the Alden Hall classroom and complete a matching activity using terms they learned today. Allegheny Students will then go over the answers for another additional 5 minutes and encourage students to look for bioswales and rain gardens in their own communities. Before leaving the classroom, students will be asked one thing new that they learn that day as a "ticket out of the door".
- **Lunch (11:45-12:30 PM)**
 - The students will be directed to Brooks Dining Hall, where they will eat lunch on campus before returning to school.

Management and Safety: Safety concerns for this lesson plan includes keeping the students' hands and bodies out of the stream table, and using hands within the stream only when instructed to do so. Important management aspects of bringing the students to Allegheny College includes the absence of any wheelchair ramps down to the basement of the building that we are teaching in. This would mean that a trusted adult may have to stay upstairs on the main floor with the student in a wheelchair, and if possible, they could virtually call in so that they may be a part of the experience and in order to accommodate them. There are no major risks with our site and lesson plan, we would just ask that all students follow the rules instructed by the educator- such as no messing with the stream table when not asked to do so, no handling or touching the other materials and models in the room, no taking apart the enviroscape model and disturbing it, and remaining seated during the powerpoint instruction portion of the lesson.

Equipment:

- Stream table
- EnviroScape Model
- Sponges (Amount: 6)
- Food coloring (1 pack of 4 bottles)

Foul Weather Alternative: N/A, the activity and lesson will take place indoors, so no alternative foul weather location is necessary.

Evaluation:

The students will be evaluated with a matching vocabulary quiz to take home in order to recall the definitions that they have learned during the introduction to freshwater pollution period in the classroom. There will also be an activity on the bus where key vocab terms that were taught that day will be held up on large pieces of paper, and the students will be asked to combine these words in no more than 2 sentences (Present 3 words at a time, and run through all 9 words).

Follow-Up:

Students will be encouraged to show their families their matching vocabulary quiz that they filled out in class as well as explain to their families the one thing that they had learned that day to assess the student's content comprehension regarding water pollution. The instructors will be in contact with the school teacher to understand if the students took away the intended objectives and if there are any adjustments that may need to be made in order to create more memorable information or portray it in a more understandable way.

Connection to PA standards: Grade 7

4.5.7.C

- Explain how human actions affect the health of the environment.
- Identify residential and industrial sources of pollution and their effects on environmental health.

4.2.7.B

Explain the primary functions of a wetland within a watershed.

4.2.7.A

Explain how water enters, moves through, and leaves a watershed.

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