

## The Hudson River Plume A COOL Classroom Adventure

<http://new.coolclassroom.org/adventures/explore/plume>

*This Human Impact Adventure explores the Hudson River Plume; including what it is, how it is created, and what impact it has on the marine environment. Through this unit students learn about watershed dynamics, density, satellite sea surface temperature data, human impacts on the watershed (non-point source pollution), and eutrophication.*

### Overview

The unit is written so that students progress through it as a class with the teacher facilitating the rate of progress and shifting between student work at the computer to group and whole class discussions. This unit can be done with each student at their own computer, in small teams (preferred), or as an entire class working with a white board.

Journal questions have been strategically placed throughout the unit so students have the opportunity to stop and reflect on their learning. Many of these questions can be utilized as class discussion topics and are a great opportunity for formative assessment. There are also several hands-on activities that can be done (outside of the web-based environment) to further increase student understanding.

The units are designed to allow adaptability and customization to the needs of different groups of students. Core activities of the unit (in a recommended sequence) constitute the main flow of the unit, while discovery activities and readings provide extension opportunities.

The following unit progression is suggested (with timing based on an 8th grade reading level and a 45 minute period). Student

journals can be printed each day for teacher review.

### Unit Plan

**Overarching Question for the Unit:**  
*How does your watershed impact the ocean?*

Note: Lessons 1 and 2 can be reversed, depending on your students' familiarity with watersheds and the computer lab schedule.

### Lesson 1 (Computer Lab)

[1-2 class periods]

#### Introduction to the Hudson River Watershed and the Hudson Plume

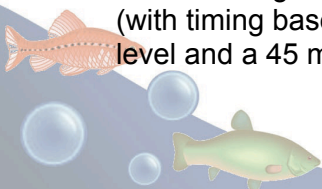
Web Pages: 1-19

#### Topics to Cover

- ✓ Watershed Dynamics
- ✓ Review of the Water Cycle (animation)
- ✓ Watershed Dynamics (how water flows in a watershed)
- ✓ Hudson River Watershed
- ✓ Plume Characteristics
- ✓ Paint the Plume (students print this version to compare to their revised drawing)
- ✓ Smokestack Analogy
- ✓ Plume Characteristics (food coloring dropped into water video)
- ✓ Repaint the Plume
- ✓ Satellite images of Plume
- ✓ Sea Surface Temperature (SST) explanation
- ✓ Plume paths (how wind affects the plume)

#### Optional Homework

Print out "Learn More about Water" from web site page 2



## **Lesson 2 (Classroom Lab)**

[1 class period]

### **Build a Watershed Activity**

## **Lesson 3 (Classroom Lab)**

[1 class period]

### **Create a Plume Activity**

## **Lesson 4 (Computer Lab)**

[1 class period]

### **Explanation of density and plume characteristics**

*Web Pages: 20-30*

*(click on “3 – Why do plumes stay together” in the left navigation bar to jump directly to page 20)*

#### **Topics to Cover**

- ✓ Google Earth file: flyby of the Hudson River
- ✓ Extension: NY SST archive
- ✓ Plume Dynamics (why does it stay together)
- ✓ Extension: Learn More About: How Temperature and Salinity affect the Characteristics of a Plume
- ✓ Video of temperature and salinity layering
- ✓ Explanation of Density
- ✓ Knowledge check (layering river, bay, and ocean water based on temp and salinity)
- ✓ Review of Plume Characteristics
- ✓ How scientists track a plume
- ✓ Meet Brian Gaas, Marine Microbiologist
- ✓ Scuba Hugh interviews Brian Gaas (video clip lasts 2 minutes 45 seconds)

#### **Optional Homework**

(If not done during computer lesson): Learn More About... How temp & salinity affect characteristics of a plume (printed from web site page 28)

## **Lesson 5 (Classroom Lab)**

[2 class periods]

## **Layering Liquids and Jar Density Demo**

[1 class period]

### **Density Currents [1 class period]**

## **Lesson 6 (Computer Lab)**

[1 class period]

### **Human Impacts on the Watershed**

*Web Pages: 31-37*

*(click on “4 – Why are plumes important”)*

#### **Topics to Cover**

- ✓ Why is studying river plumes important?
- ✓ What does the water carry into the ocean? (student ideas)
- ✓ Looking at Land Use
- ✓ Comparing Land Use to Natural Features (rivers)
- ✓ Human Impact graphic
- ✓ Local pollution sources question

## **Lesson 7 (Computer Lab)**

[1 class period]

### **Explanation of Eutrophication**

*Web Pages: 38-40*

*(click on “5 – What is eutrophication”)*

#### **Topics to Cover**

- ✓ Start on page 38~ What is eutrophication
- ✓ Eutrophication animation
- ✓ Students answer overarching question asked in the beginning of the unit: “How does your watershed impact the ocean?”

## **Lesson 8 (Classroom w/ whiteboard or projector)**

[1 class period]

### **Review of Eutrophication**

*Project Web Pages 39-40 on board*

#### **Topics to Cover**

- ✓ Class discussion of Eutrophication

- ✓ Extension: Reading and quiz: The Pollution Solution
- ✓ Extension: Reading and quiz: NJ Dead Zones

### **Lesson 9 (Classroom)**

[2 class periods]

#### **Student Final Project**

*Web Pages 40 (optional)*

Student creates essay, children's book, diorama, informational poster, cartoon strip illustration, etc., to describe what they have learned in this unit, specifically what happens when river water meets the ocean and the impact this has on the marine environment (possibly creating the conditions for eutrophication to occur: delineating the steps and its consequences).

### **Time Planning**

<b>Lesson</b>	<b>Concept</b>	<b>Type of Activity</b>	<b>Class Periods</b>	<b>Extensions</b>
Lesson 1	Intro to Hudson River Watershed and the Hudson Plume	Computer	2	✓ Google Earth Hudson River Tour
Lesson 2	Build a Watershed	LAB in classroom	1	
Lesson 3	Create a Plume	LAB in classroom	1	
Lesson 4	Explanation of density and the Hudson River Plume characteristics	Computer	1	<ul style="list-style-type: none"> <li>✓ Find that Plume</li> <li>✓ Real-time Data: Plumes in SST</li> <li>✓ Reading: About Water</li> </ul>
Lesson 5	Density and density currents	LAB in classroom	2	
Lesson 6	Human Impacts on the Watershed	Computer	1	
Lesson 7	Explanation of Eutrophication	Computer	1	✓ COSEE Eutrophication Tanks
Lesson 8	Review of Eutrophication	Classroom discussion	1	<ul style="list-style-type: none"> <li>✓ Reading: Pollution Solution</li> <li>✓ Reading: Dead Zones</li> <li>✓ Reading: NJ Dead Zone</li> </ul>
Lesson 9	Student Application of Watershed and Eutrophication knowledge	Classroom/ Computer student project	2	✓ Literature connection: "Paddle to the Sea"