

NEH Hudson River Workshop Lesson Plan 2011

Teacher: Eileen La Torre

Subject: Interdisciplinary

Grade Level: 5th Grade

Summary:

This lesson allows students to understand the importance of the Hudson River. Students will work with primary and secondary sources that show the relationship between the Hudson and human interaction. This lesson also shows students the geographic relationship between the location of their school and the Hudson River.

Investigating and Analyzing the Hudson River through Real World Problem Solving

Name: Eileen LaTorre

Course: Integrating Math, Science & Social Studies

Grade Level: 5

Rationale:

The purpose of this lesson:

- Students will gain an understanding of the important role the Hudson River plays in the Northeastern part of the United States through an interdisciplinary approach to problem solving.
- The students will investigate and explore different facets of the Hudson River, located 8 miles from Lincoln School in Hasbrouck Heights, NJ.
- Through various hands on cooperative group activities/learning centers, the students will have the opportunity to sharpen their analytical and interpreting skills.
- Students will see first-hand through primary and secondary sources, the interrelationship between the physical and human environment.

Essential Questions:

- How does living close to the Hudson River impact your life?
- What information does a chart or table give?
- How do charts, tables, and graphs help you interpret data?
- How is this math relevant? Who can use this data in real life?
- Why do boaters use nautical knots and not miles per hour?
- Who needs to know tidal information?
- Do we really need nautical maps if we have a GPS?
- What does a historical map show?

Objectives:

Upon completion of The Hudson River learning stations:

Students will understand how tides move from Battery Park to Albany.

Students will understand current and historical purposes for using maps.
Students will be able to use a GPS for mapping and to identify geographic positions.
Students will learn basic map reading skills including interpreting location and direction (N,S,E,W. Latitude/ Longitude).
Students will create line graphs to show 2011 rainfall records and relate to storm surges and effect on Hudson River.
Students will be able to compare and contrast historical and current maps of the Hudson River area.
Student will be able to estimate nautical knots vs. MPH.

NJ State Standards

Science:

5.1.4.C.3 Present evidence to interpret and/or predict cause-and-effect outcomes of investigations.
5.1.8.C.1 Monitor one's own thinking as understandings of scientific concepts are refined.
5.1.4.A.3 Use scientific facts, measurements, observations, and patterns in nature to build and critique scientific arguments.
5.4.8.A.1 Analyze moon-phase and tidal data to explain how the relative positions and motions of the Sun, Earth, and Moon cause these three phenomena

Math:

4.2.5 D Use measurements and estimates to describe and compare phenomena.
4.5.A 1 Learn mathematics through problem solving, inquiry, and discovery.
4.5.B.2 Communicate their mathematical thinking coherently and clearly to peers, teachers, and others, both orally and in writing.

Social Studies:

6.1.4.B.3 Explain how and when it is important to use digital geographic tools, political maps, and globes to measure distances and to determine time zones and locations using latitude and longitude.
6.4.C.2. Trace the major land and water routes of the explorers (Hudson)

Materials:

Two groups will have wireless Acer laptops available for research, while the other groups will have nautical maps from NOAA.

http://www.ecostudies.org/chp/visuals/hudson_river_counties_complete.pdf
(Hudson map including counties and cities from NY Harbor to Troy)

<http://xtide.ideo.columbia.edu/hudson/tides/predictions.html>
(current high and low tide schedule of Hudson)

http://www.paddlenewyork.com/hudson/currents_and_tides.htm
(Tide lesson)

ScienceText: CPO Science (Earth Science) 2007 ISBN-10 1-58892-476-9

(4) Hand held GPS navigators

Rulers, graph paper, calculators

http://www.grc.nasa.gov/WWW/k-12/WindTunnel/Activities/knots_vs_mph.html

(conversions from knots to MPH)

NOAA Charts/Maps of the Hudson River

http://www.charts.noaa.gov/Catalogs/atlantic_chartside.shtml

http://www.nj.com/news/index.ssf/2011/08/hurricane_irene_nj_rainfall_ma.html

Record rainfalls in NJ for the month of August 2011

Procedure:

Working in groups of four, the students will travel to different 'Hudson River' learning stations within the classroom. Each station will give the students an opportunity to read and analyze charts, tables and maps. The students will stay at each learning station for approximately 25 minutes before moving to the next station. It is expected to take approximately 3 - 4 math class periods to complete these lessons. This lesson will correlate with the Earth Science curriculum as well as integrate 5th grade Math concepts and skills of measurement, distance and problem solving.

Station #1~ Measuring nautical knots/Currents

Background knowledge given to students:

A knot is a nautical mile traveled in one hour.

Knots is how the speed of aircraft and boats is measured. Both miles per hour and knots is a speed which is the number of units of distance that is covered for a certain amount of time.

1 knot = 1 nautical mile per hour = 6076 feet per hour

1 mph = 1 mile per hour = 5280 feet per hour

For example, if a train is moving at 50 mph on a track, how would you represent this speed in knots (even though trains are not usually represented in knots)?

To do this problem, you can multiply the number of miles per hour that the train is moving by the number of feet per hour that = 1 mph. this converts the speed to a

distance traveled in one hour.

$$(50 \text{ mph})(5280 \text{ feet/ mph})=264,000 \text{ feet}$$

Now, divide that distance by the number of feet in a nautical mile (6076).

$$(264,000 \text{ feet})/(6076 \text{ feet/ knot}) = 43.4 \text{ knots}$$

Students will complete this chart using their calculators:

Knots	MPH
2	
	10
58	
	64
110	
	250

answers	
Knots	MPH
2	2.3
8.7	10
58	66.7
55.6	64
110	126.6
217.2	250

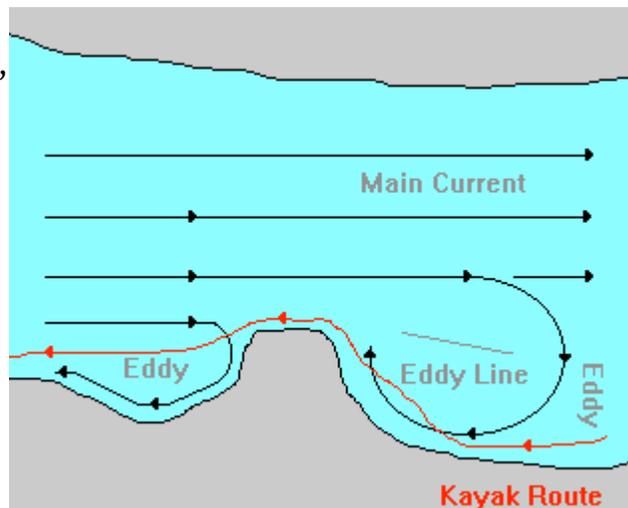
Adapted from: http://www.grc.nasa.gov/WWW/k-12/WindTunnel/Activities/knots_vs_mph.html

Students will read below to discuss the problem.

At its maximum, a current moves at about 2.44 knots. This is almost 3 miles per hour

An eddy is an area of current that forms behind an obstruction in which the current flows in the opposite direction from the main channel. Eddies may form behind any obstruction. If you stay close to shore, more often than not you can use small obstructions to steer your way against even tough currents with far less effort than you would fighting the main current.

The line that separates the main current from the eddy is an important one to recognize in any body of water. Knowing this small detail can help you find your way opposite most, but not all, currents in



the Hudson River. Fair warning: as a general rule areas where the shoreline has been developed tend to have fewer natural points jutting out into the water and so have fewer eddies.

Group Problem:

If Janis and her friends were deciding to kayak around the island of Manhattan, and the tide was with them the entire distance, estimate how long it would take them to travel the approximate 30 miles. Would their timing change if they stayed close to the shore where there were fewer eddies?

Station #2 ~ Understanding Tides (How rainfall and flooding effect high and low tides)

Background knowledge given to students:

An understanding of the currents and tides on this unique body of water is crucial to those who travel in small boats.

On the Hudson River, the tide comes in from the sea like a giant wave. It moves up the river as far as Albany over the course of the day. On one particular day, high tide at the Battery in lower Manhattan was at 5:45 AM. The high tide rode up the river as follows:

Battery Park, Manhattan	5:45 AM
George Washington Bridge	6:46 AM
Haverstraw	8:05 AM
Newburgh	9:29 AM
Poughkeepsie	10:17 AM
Hudson	12:41 PM
Albany	2:43 PM

By the time the high tide reached Albany, low tide had come through the battery, the G. W. Bridge and up as far as Haverstraw. Low tide moves UP the river just like high tide does. If you have trouble visualizing how low tide can move up the river, just remember that the trough between two ocean waves moves towards the shore just as fast as the peaks of those waves, even though the current in the trough pushes out towards the sea. The low tide in the Hudson is just like the trough between two massive ocean waves.

In August 2011, NJ received a record rainfall of 18.79 inches. The previous rainfall for August was 11.84 set in 1955. Students will collect data and choose 4-5 cities from

the interactive rainfall NJ map to compare and contrast.

http://www.nj.com/news/index.ssf/2011/08/hurricane_irene_nj_rainfall_ma.html

Students will make a line graph showing record rainfall data correctly labeling x and y axis.

Using the Hudson River map #12327 of the NY Harbor, students will follow the Hackensack River and have a group discussion.

Questions to discuss: Where did all that rainfall go from the line graph above? What if it was high tide and it rained 5 inches in one day?

If the tide came into Battery Park in Manhattan at 2 PM in the afternoon, at approximately what time will it be high tide in Albany, NY?

Station #3 ~ Latitude, Longitude & Distance (Reading map scales and keys and using rulers for measurement)

Students will compare a map of Hudson's trip down the river to current nautical maps # 12327 to 12348 to find how many miles he traveled before turning back.

http://upload.wikimedia.org/wikipedia/commons/1/12/Henry_Hudson_Map_26.png

Map of Hudson's journey up the Hudson

Students will compare longitude and latitudinal locations while answering questions from a worksheet.

Group worksheet (adapted from Stephen Stanne, *The Hudson An Illustrated Guide to the Living River* workshop)

Station #3 Worksheet

1. What is the longitude and latitude of Pollepel Island?
2. What is the longitude and latitude of West Point Military Academy?
3. Looking at the map, why do you think the above site was chosen as a fort?
4. Is Dunderberg Mountain located North or South of the Bear Mountain Bridge?
5. Besides swimming or boating, is there a way to cross from one side of the Hudson to the other between Beacon and the George Washington Bridge?
6. Which part of the river is the shortest distance across between the Newburgh-Beacon Bridge and Bear Mountain?

Students will read the excerpt below from "*Henry Hudson Explores the Hudson River*" by Henry Cleveland

In this excerpt students will read from the diary of Robert Juet who was on board the Half Moon with Henry Hudson in 1609

At night the mate returned in the boat, having been sent again to explore the river. He reported that he had ascended eight or nine leagues, and found but seven feet of water and irregular soundings.

It was evidently useless to attempt to ascend the river any farther with the ship, and Hudson therefore determined to return. We may well imagine that he was satisfied already with the result of the voyage, even supposing him to have been disappointed in not finding here a passage to the Indies. He had explored a great and navigable river to the distance of nearly a hundred forty miles; he had found the country along the banks extremely fertile, the climate delightful, and the scenery displaying every variety of beauty and grandeur; and he knew that he had opened the way for his patrons to possessions which might prove of inestimable value.

It is supposed that the highest place which the Half Moon reached in the river was the neighborhood of the present site of Albany, and that the boats being sent out to explore ascended as high as Waterford, and probably some distance beyond. The voyage down the river was not more expeditious than it had been in ascending; the prevalent winds were southerly, and for several days the ship could advance but very slowly. The time, however, passed agreeably in making excursions on the shore, where they found "good ground for corn and other garden herbs, with a great store of goodly oaks and walnut-trees, and chestnut-trees, ewe-trees and trees of sweetwood in great abundance, and great store of slate for houses, and other good stones"; or in receiving visits from the natives, who came on the ship in numbers. While Hudson was at anchor near the spot where the city bearing his name now stands, two canoes came from the place where the scene of the intoxication had occurred, and in one of them was the old man who had been the sufferer under the strange experiment. He brought another old man with him, who presented Hudson with a string of beads, and "showed all the country there about, as though it were at his command." Hudson entertained them at dinner, with four of their women, and in the afternoon dismissed them with presents.

He continued the voyage down the river, taking advantage of wind and tide as he could, and employing the time when at anchor in fishing or in trading with the natives, who came to the ship nearly every day, till on October 1st he anchored near Stony Point.

http://upload.wikimedia.org/wikipedia/commons/1/12/Henry_Hudson_Map_26.png
Map of Hudson's journey up the Hudson

Additional reading (<http://halfmoon.mus.ny.us/Juets-modified.pdf>)

Using the above passage written by Juet and a yellow highlighter, students will follow the path of the Half Moon as it traveled in 1609.

Using the map scale and rulers, how many miles did Hudson travel in 1609?

Station #4 ~ Global Positioning Satellites – Historical Maps

In this station, each student is given a GPS. Students will compare a Hudson River location on their GPS with the historical map found at the site below.

<http://historical.mytopo.com/index.cfm?CFID=14989853&CFTOKEN=44368626y>

Each student in the group is given a hand held GPS. The group will also have map number #12348 (Coxsackie to Troy).

Comparing a historical map of the area around Newburgh and Cornwall to the present day. Student will engage in 'gps mapping' and draw what they see on the GPS screen.

<http://historical.mytopo.com/index.cfm?CFID=14989853&CFTOKEN=44368626>
(Site for historical maps of NJ and NY)

Assessment: To assess what the students have learned by applying it to current events to check for understanding and higher level thinking.

Whole class #6 ~ Relating Current Events and Hudson River

After students have a turn at each station, the group will join together as a class for discussion. Each group will review one station and tell the class what concept or skill was learned or practiced at that station assessing students understanding of the lessons.

Questions open for discussion using the Hudson River maps from NOAA and other information learned in the Hudson River Stations:

- Explain why you think the Mayor of New York closed the *subways* just prior to Hurricane Irene?
- As the Hurricane approached NYC, discuss why Battery Park could have been one of the first area to be evacuated *prior* to Irene. Why would it have mattered if it was high or low tide at impact of the storm?

<http://www.stripersonline.com/t/815276/hudson-river-morning-high-tide-irene-storm-surge-pics>

- Now that you understand how the tides move up and down the Hudson River, what effect do you think Hurricane Irene may have had on the shellfish population due to excessive storm water?

Bivalves such as clams, oysters and mussels are filter feeders that can accumulate harmful bacteria carried into waterways by storm water. The DEP advises residents and visitors to avoid consuming clams, oysters and mussels taken from state waters until further notice. The Department of Health and Senior Services (DHSS) urges commercial and recreational harvesters, certified shellfish dealers, and the

public to observe all harvesting restrictions because ingesting shellfish from closed beds could potentially cause illness.

http://nj.gov/dep/newsrel/2011/11_0107.htm