Cary Institute of Ecosystem Studies — Changing Hudson Project

Name _____ Date _____

How much water is in that river?

The rate of flow in a stream or river has a big impact on what kinds of organisms can live there, whether nutrients and sediments accumulate or are removed from a system, and ultimately how the stream/river and its floodplain change through time. In this activity, you will calculate the volume of water flowing past you every second in a stream and compare this to the volume of your classroom and the volume of water in the Hudson River. You will then look at historic data from the Hudson and think about the future implications of changing flow with a changing climate.

Part 1: Your best guess

Calculate the volume of your classroom in cubic feet:

_____

Estimate the volume of water moving past a point each second in the stream you will visit in cubic feet per second (cfs):

_____

Estimate the volume of water moving in the Hudson River in cfs:

_____

Part 2: Measuring your stream's flow

Step 1: Stream segment length

Measure out a specific length of your stream (if it is a small stream that is moving very slowly, you will probably want to use a shorter length).

Stream segment length: _____ ft

Step 2: Stream segment width

Find the average width of your stream segment at the top, middle, and bottom end of your segment.

Width top: _____
Width middle: _____
Width bottom: _____
Average: _____ ft

Step 3: Stream segment velocity

Using your segment, drop a ping pong ball or a tennis ball (depending on the perceived velocity of your stream-a ping pong ball works better in slower moving water) and record the speed at which the object travels the length of the segment. You should do this at the left, middle, and right side of the stream, and then average your measurements.

Left side (sec)	Middle (sec)	Right side (sec)	Average

Average of all three segments (time in seconds)			

Step 4: Stream depth. Stretch a tape measure across the stream at the mid-point of your stream segment. At 1 foot intervals across the stream, measure the depth (in feet) and record it in the table below.

Distance (ft)	Depth		Distance (ft)	Depth
0	0		6	
1			7	
2			8	
3			9	
4			10	
5			11	

Sum of depths: _____ / number of samples taken = _____ average depth of stream

Step 5: Flow calculation
Now that you have all your measurements, simply plug in the numbers in the equation:

[____ft (length) x _____ft (width) x _____ft (depth)**]** ÷ _____time (secs) =_____ cubic feet / sec (cfs)

Part 3: How good were your estimates?

How does your calculated flow compare with your original guess of flow in your stream?

A. Download the historical flow data (cubic feet per second) in the Hudson River at Poughkeepsie: Go to the following USGS website: http://on.doi.gov/117BoHv Scroll down. Below "Historical Event Information," you will see "Historical monthly freshwater flow data for the Hudson River." Choose the Poughkeepsie 'MS-Excel' file for use with Excel, or click on 'Poughkeepsie…' to copy and paste the data.

B. Plot a graph of the monthly mean flow over time. Add a trend line.

How does your stream's flow compare with the Hudson's?

How does the actual flow at Poughkeepsie compare with your estimate?

Part 4: Comparing Historic and Future Flow Rates

What does this data set show?

_____

_____

_____

Which year had the highest annual discharge? _____ the lowest? _____

What is the average annual discharge from 1947 to 2005? _____

C. Plot the discharge for the months of April and September from 1947 to 2005.

Which month has the *highest* discharge levels? _____

Which month has the *most variable* discharge levels? _____

Read the following and answer the question below:

Streams and rivers have a natural variability in their flow rates. Spring snow melt and storms cause high flow levels. By late summer, the snow has long since melted, summer heat has caused surface water levels to drop, and groundwater levels have lowered, dropping flow levels substantially.

Scientists have found that plants and animals struggle to survive when their native stream or river experiences flow rates above or below the ecosystem's natural range of variability. Why do you think this happens? Consider different types or sizes of plants and animals that may prefer slow- or fast-moving waters, and whether they may move in response to changing flow rates.

_____

_____

_____

_____

_____

_____

Read the following and answer the question on the back of this page:

> Under climate change scenarios from the IPCC report (A2 and B2, which estimate an increase between 2°C and 4°C), estimates are that the Hudson River will experience a 20% increase in flow rate by 2050, from 20,400 cfs to 24,500 cfs. The average historic freshwater flow rate of the Hudson over the last sixty years is 20,350 cfs.

What types of impact would this increased flow rate have on the Hudson River? How might this affect a river like the Mississippi? What impact will an increase in flow together with rising sea level have on the Hudson?

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