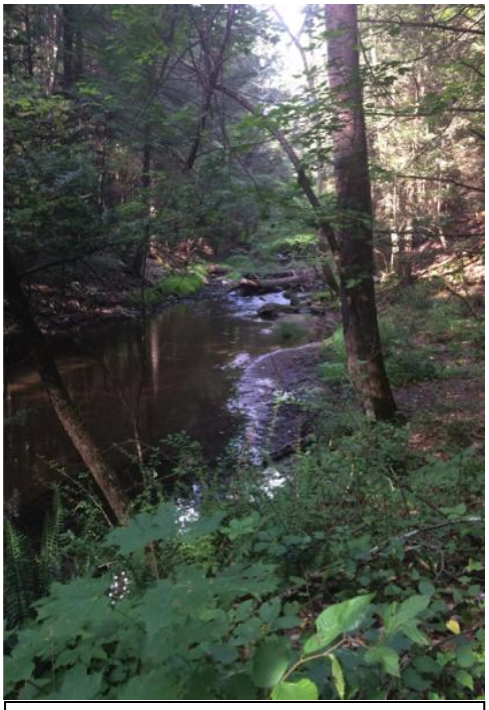
Level 2: Hydrology Data for Wappinger Creek 1994-2016

Written by Jessica Genter (Marymount School of New York)
& Miriam Straus (Oakwood Friends School)

❖ **Background Information:**

The living and non-living things we find in our streams tell a story about what humans are doing on the land surrounding them. Streams reflect what comes out of the watershed, which is defined as the land and water that drain into a body of water. This means that streams are an influential indicator of the local environment's overall health. Looking at abiotic factors such as stream temperature, stream depth and conductivity can indicate the health of the stream as well as the surrounding land. This is extremely valuable when researching human impact on certain ecosystems.



Wappinger Creek in August

Vicky Kelly is the principal scientist involved in stream monitoring at the Cary Institute. She manages Cary's Environmental Monitoring Program, which includes climate; air, precipitation and streamwater quality; solar radiation; phenology and the behavior of water in the landscape. Data from the program have been used to understand the dynamics of road salt and the effects of climate change on precipitation chemistry.

In the research described here, Ms. Kelly looked at four factors in Wappinger Creek: **temperature**, **discharge**, **stream depth**, and **conductivity**.

Vicky Kelly, Cary Institute

- **Temperature** can affect whether organisms can survive, as many organisms such as fish can tolerate only a small change in temperature level. Temperature also impacts dissolved oxygen levels.
- **Discharge** measures the amount of water that flows through the stream, which affects dissolved oxygen (D.O.) and turbidity, or cloudiness. Underwater vegetation and phytoplankton need sunlight in order to photosynthesize, so if the stream is too turbid, the sunlight will not reach them. Aquatic animals such as stonefly larvae need high levels of oxygen dissolved in

the water in order to respire, so if the level of DO is too low, they will not be able to breathe. Discharge increases during precipitation and snowmelt events.

- **Stream depth** can affect the overall ecosystem, as shallower waters tend to be warmer, and deeper waters might indicate a recent storm.
- **Stream conductivity** is a way to measure how much salt is in the water. This has enormous impact on aquatic organisms and can indicate human activity in the area, such as using road salts to clear roads in winter. Salting roads is one of the leading causes of water pollution in the Northeast.

❖ **Dataset Variables:**

- **Conductivity (mS):** the ability of a given substance to conduct electric current. Salts in water conduct electricity, so conductivity can be used to approximate salt levels. The unit used in this research is milliSiemens (mS).
- **Water temp °C:** water temperature in Celsius.
- **Water depth (cm):** measurement of water from the bottom of stream bed to the surface in centimeters.
- **Discharge (m^3/s):** a measurement of the volume of water that flows through a stream in one second.

❖ **Dataset Timeframe:**

1994-2016. Data were recorded every fifteen minutes during this period. The data in this dataset was compressed into daily averages.

❖ **Data Collection Methods:**

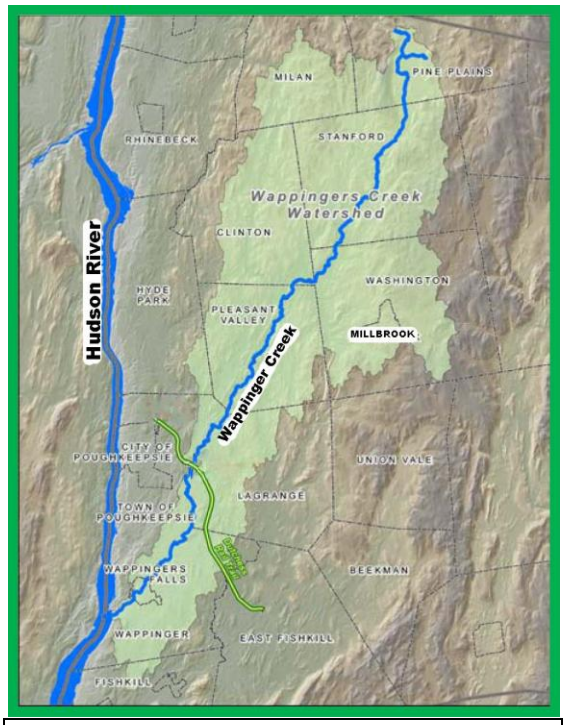
Monitoring equipment on Wappinger Creek

Stream gaging and temperature equipment is located on the East Branch of Wappinger Creek in the Fern Glen on the Cary Institute property. The gaging equipment is situated in a stilling well, which is located on the leeward side of an old bridge abutment. Stream height is monitored using a float and pulley system with a measuring tape (formerly a wire). The pulley is connected to an incremental shaft encoder, which is monitored using a datalogger. Stream temperature and conductivity are monitored using a temperature/conductivity sensor, which sits on the bed of the stream near the stilling well. Instantaneous height, temperature and conductivity measurements are recorded and stored every fifteen minutes.

You will notice some gaps in the data due to probes malfunctioning or needing recalibration. In addition, certain variables (such as conductivity) were not monitored during the initial setup.

❖ **Information about Site:**

The stream is a tributary to the main branch of Wappinger Creek, which flows into the Hudson River at Wappingers Falls. The creek as it passes through the Cary Institute property is a relatively clean, unimpaired forest stream. It harbors reproducing populations of brown trout as well as other important native fish and is habitat for breeding birds including common merganser and wood duck. The Village of Millbrook sewage treatment plant is about 1.6 km upstream of this monitoring site. The Village of Millbrook (population 1400) and the roads in the watershed of the stream are important sources of road salt to the stream.



Wappinger Creek is a tributary to the Hudson River. Source: Dutchess County Government

❖ **Source of Datasets:**

These data were collected at the Cary Institute of Ecosystem Studies in Millbrook, NY in the Wappinger Creek and provided by Vicky Kelly.

❖ **Inquiry Idea Starters:**

- *Is there a correlation between water height and water discharge? If so, what would account for that?*
- *Are there seasonal trends among any of the variables? What might account for that?*
- *How have salt levels changed over time? Do they peak in any particular time of year?*

❖ **Additional Resources:**

- This Data Jam Level 1 dataset explores precipitation and discharge at the same Wappinger Creek site during Hurricane Floyd (1999): http://www.caryinstitute.org/students/hudson-data-jam-competition/data-jam-data-sets/level-1-hurricane-impacts-hudson-river

- Definition of stream flow and information about how it is calculated from the EPA and USGS**:**
  - https://archive.epa.gov/water/archive/web/html/vms51.html
  - https://water.usgs.gov/edu/watercyclestreamflow.html

- Current research on road salt pollution from the Adirondack Watershed Institute at Paul Smith's College: http://www.adkwatershed.org/road-salt-research

- Information from the USGS about environmental factors that affect water temperature: https://water.usgs.gov/edu/temperature.html

❖ **Extension Ideas:**

- Do water temperatures or water discharge affect fish populations?
- What variables may affect population density of different organisms?
- Does conductivity fluctuate seasonally in places that don't have snow?
- Does data from Wappinger Creek correlate with data from the Hudson or other nearby tributaries? Try using the interactive grapher on the Hudson River Environmental Conditions Observing System to compare to conditions in the Hudson: http://hudson.dl.stevens-tech.edu/hrecos/d/index.shtml

❖ **References:**

Kelly, Vicky. Personal Interview. 18 Aug. 2017.

Stromberg, Joseph. 26 Jan. 2014. "What Happens to All the Salt We Dump On the Roads?" *Smithsonian Magazine,* https://www.smithsonianmag.com/science-nature/what-happens-to-all-the-salt-we-dump-on-the-roads-180948079/. Accessed 18 Aug. 2017.

"Wappinger Creek." DPW-Parks, Dutchess County Government, www.co.dutchess.ny.us/CountyGov/Departments/DPW-Parks/PPDRTwappingercreek.pdf. Accessed 18 Aug. 2017.