



Water Quality Monitoring Update

Results of the 2012 Water Quality Monitoring Season for Roosevelt-Vanderbilt NHS

Background

The Northeast Temperate Network (NETN) monitors a variety of natural resource indicators, which it calls “vital signs”, for 12 parks in the northeast and the Appalachian National Scenic Trail. The vital signs for freshwater bodies are water chemistry, nutrient enrichment, water quantity, and the detection of invasive plant species. These were chosen to address the NPS Inventory and Monitoring Program objective to detect change in the status of physical, chemical, or biological attributes of the ecosystem.

Methods

Detailed descriptions of all monitoring methods can be found in NETN’s Freshwater Monitoring protocol available for download from the network’s website. In 2012, NETN hydrologic technician Brian Schuetz measured physical and water chemistry parameters each month and periodically collected water samples for analysis at the University of Maine. All monitoring data are incorporated into a series of comprehensive databases that feed into an EPA data system.

Vanderbilt Mansion National Historic Site (VAMA), Eleanor Roosevelt National Historic Site (ELRO), and the Home of Franklin D. Roosevelt National Historic Site (HOFR) are commonly grouped together as the Roosevelt-Vanderbilt National Historic Sites (ROVA). Primarily managed to preserve and interpret cultural resources, these national historic sites exhibit a regionally-important array of water resources including over 4 miles of streams, 13.75 acres of ponds, 38.8 acres of freshwater wetlands, 25 acres of tidal freshwater wetlands, and 1.1 miles of frontage along the lower Hudson River all contained within 682 acres.



Upper Crum Elbow creek. Bill Gawley photo.

All of the basic field water-chemistry parameters and nutrients identified by the vital signs program have been collected intermittently since 1994 at 11 stations in ROVA. Beginning in 2006, six sites were monitored for the NETN long-term monitoring program. These include five of the original 11 sites mentioned above, as well as an additional site established on the stream in a 2007 HOFR land acquisition. All sites are considered capable of supporting warm-water fisheries (bass, sunfish, etc.). See NETN’s Google Earth park module for locations of monitoring sites.

Monthly sampling included water quality measures of pH, specific conductance, temperature, dissolved oxygen, weather, stream flow (discharge), and stream stage (water level). In May and August, water samples are obtained and analyzed for acid neutralizing capacity, color, and nutrients. Beginning in 2012, fractions of grab samples of water were also analyzed for dissolved organic carbon, chloride, and sulfate.

Results and Findings

Complete details of 2012 monitoring season findings can be found in the full report which is available for downloading from the website. Brief synopses of some findings are available below.

Specific conductance measures the ability of water to carry an electrical current. If it increases it can be an indicator of pollutants in the water. Specific conductance values from 2012 were within the appropriate range for park waters, and were generally within the range of the data from previous years.

The **pH** of a water body reflects how acidic or basic the water is, measured on a scale of 1 to 14, with 7 being neutral. Acid waters are below 7, and alkaline waters are above 7. A one unit change in pH represents a 10-fold change in acidity or alkalinity. New York standards, like those of most northeast states, indicate that a pH between 6.5 and 8.5 is within the acceptable range. pH values from the 2012 monitoring season were basic, and were all between the upper and lower state water quality standards.

Temperature can affect water chemistry and biology. For example, the amount of oxygen that water can hold is directly related to the temperature of the water: the higher the temperature, the less oxygen it can hold. Temperature can also determine the kinds of plants and animals found in a lake or pond. Certain species of fish, insects, and algae will predominate during the cooler temperatures of spring and fall, yet be less apparent during the warmer temperatures of summer. The majority of the surface water temperatures appeared to be within the normal range of variability in 2012, although September

and November temperatures were all in the lower range of this distribution.

Dissolved oxygen (DO) is a critical indicator of water quality because aquatic life generally needs certain concentrations to thrive. Low oxygen can directly kill or stress organisms such that they will not be able to successfully reproduce or grow. All park sites were well oxygenated in 2012 and above the most stringent state standard, except for the July and August measurements at Fall Kill.

Color in pond and stream water is caused by natural metallic ions, humus and peat materials, plankton, weeds, and industrial wastes. **Apparent color** is determined using water samples that have not had suspended particles filtered out. Color can be a rough indicator for organic acidity. Median color values from 2006 to 2012 monitoring show most ROVA streams to be moderately colored. The highly elevated color measured in the May samples from both Crum Elbow Creek sites indicates the possibility of substantial runoff input to this stream prior to the May monitoring visit, especially since the samples were not filtered before analysis.

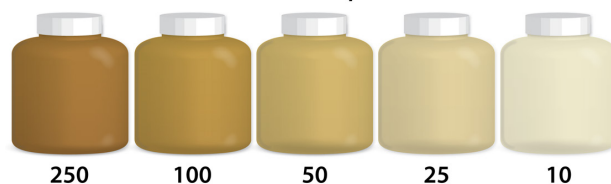
Acid neutralizing capacity (ANC) is also known as alkalinity, or buffering capacity. It is due primarily to the presence of naturally available bicarbonate, carbonate, and hydroxide ions, with bicarbonate being the major form. Acid neutralizing capacity measured in the 2012 samples illustrates that ROVA streams were very well-buffered, likely due to the underlying geology. The May (Spring) ANC measurements from all streams were lower than the August measurements which, along with lower May pH values, may illustrate the effects of episodic acidification from spring snowmelt and runoff (as well as the ability of the robust ANC to counteract the acidification pulses).

NETN began measuring **dissolved organic carbon (DOC)** for the first time in 2012. Carbon is a nutrient required for biological processes. Sources of organic carbon in water include humic substances from plant and soil organic matter, wetland peat deposits, and atmospheric deposition. Certain forms of DOC can contribute to “tea” color in water, which can affect light attenuation. It also affects the transport (solubility and bioavailability) of metals, including mercury, in aquatic systems. DOC concentrations in most streams in temperate zones range from 1 mg/L to 20 mg/L, with a worldwide mean of 5.75 mg/L. All ROVA waters DOC concentrations were relatively low in 2012 and closely reflected apparent color results.

This was also the first year of turbidity testing for network waters. **Turbidity** is the measure of the relative clarity of a liquid. It is measured by passing light through a water sample to determine how much light is scattered, and the results are reported in nephelometric turbidity units (NTU). Turbidity is caused by suspended matter or impurities that interfere with the clarity of the water. These impurities may include clay, silt, finely divided inorganic and organic matter, soluble colored organic compounds, and plankton and other microscopic organisms. Turbidity can create aesthetic, ecological, and health issues, and could be an indication of runoff from construction,

Turbidity (NTU)

Water Samples:



Samples of different turbidity levels.

roads, agriculture, or other types of pollution. Suspended solids prevent sunlight from reaching aquatic plants, inhibiting photosynthesis which may reduce the amount of dissolved oxygen in the water. Sediment also absorbs heat, so turbidity can raise the surface water temperature. Turbidity can make it hard for fish to see their prey, and heavy loads of suspended solids can even clog fish gills and filter-feeding structures of aquatic macroinvertebrates. Turbidity values measured in all streams during 2012 were all in the low range of dry-weather turbidity of surface waters, which normally ranges from 0 to 10 NTU.

Summary

Most water quality parameters for the monitored streams were within state standards, and were generally within the range of EPA criteria, where applicable. The majority of values were within the ranges of the historic NETN monitoring data from ROVA.

Monitoring under the NETN protocol builds on the historic water quality monitoring by the National Park Service and other agencies to provide critical baseline information on the chemical and physical status of the streams monitored in Roosevelt-Vanderbilt National Historic Sites. Several changes implemented in the 2012 monitoring season, including the addition of sulfate, chloride, and dissolved organic carbon analyses to the spring and summer water chemistry testing, will expand the scope and usefulness of the monitoring data. As more data are collected, the ability to detect changes outside this natural range of variability will increase, which in turn will more clearly indicate the status of the vital signs of water quality, nutrient enrichment, water quantity, and the detection of invasive plant species.

More Information

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Full Report online at:
<http://science.nature.nps.gov/im/units/netn/monitor/programs/lakesPonds/lakesPonds.cfm>



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