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Water Quality Monitoring Flows On

Results of the 2011 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. A total of six streams are sampled monthly from May through October by a cooperator from the University of Vermont or a NETN hydrologic technician. Physical and water chemistry parameters are measured each month and water samples are periodically collected 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.

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 at ROVA 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 the 2007 HOFR land acquisition. All sites are considered capable of supporting warm-water fisheries (bass, sunfish, etc.).

Monthly sampling parameters included water quality measurements (pH, specific conductance, temperature, and dissolved oxygen), weather, stream flow (discharge), and stream stage (water level). Water samples obtained in May and August were analyzed for acid neutralizing capacity (ANC), color, and nutrients. Nutrient chemistry parameters were analyzed from a grab sample.

Results and Findings

Complete details of 2011 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 for 2011 were within the appropriate range for all park waters.



The mighty Hudson River as viewed from the grounds of Vanderbilt Mansion NHS. Neil Weightman photo.

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 2011 monitoring season were basic, and were all between the upper and lower New York 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 the lake or pond. Certain species of fish, insects, and algae will predominate during the cooler temperatures of the spring and fall, yet be less apparent during the warmer temperatures of summer. Surface water temperatures appeared to be within the normal range of variability in 2011, though some of the July and August values from the less shaded sites reflected the contributions of high air temperature and solar radiation.

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 2011, and were above the most stringent state DO standard (except for the October 2011 measurement 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 2011 monitoring show most ROVA streams to be moderately colored. The highly elevated color measured in the May 2011 samples further indicates the possibility of substantial runoff input to the streams prior to the May monitoring visit, especially since the samples were not filtered before analysis. Monthly turbidity measurements, which began during the current monitoring season, may provide additional information on the impacts to ROVA streams from episodic runoff events.

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 2011 samples illustrates that ROVA streams were very well-buffered, likely due to the underlying geology. The May ANC measurements from all streams were the lowest in the NETN data history at ROVA. These values, 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).

Nutrient enrichment and the acceleration of eutrophication (when waters become rich in mineral and organic nutrients

that promote a proliferation of plant life - especially algae) have been identified in most NETN parks as one of the stressors of greatest concern. Several forms of total and dissolved phosphorus and nitrogen are measured to give managers information regarding the status and productivity of freshwater systems. Phosphorus levels are historically in the moderate to high range, and most 2011 results were slightly above the EPA Region 7 criterion value. The Fall Kill site, just downstream of Upper Val Kill Pond, had the highest phosphorus measurements of all the ROVA sites. This is likely due to the contribution of the higher nutrient loads in the pond water. Nitrogen levels were very high in August samples from both of the FDR Brook sites. Results for these three forms of nitrogen were moderately high in the remainder of the streams, and NO₂ was low at all sites. All ammonia (NH₃) test results were below the method reporting limit.

Summary

Most water quality parameters for the streams monitored in the Roosevelt-Vanderbilt National Historic Sites were within state standards, and were generally within the range of non-regulatory EPA ecoregional 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 park staff to provide critical baseline information on the chemical and physical status of the water resources Roosevelt-Vanderbilt National Historic Sites. Several changes will be implemented in the 2012 monitoring season, including taking monthly stream turbidity measurements, and the addition of sulfate, chloride, and dissolved organic carbon (DOC) analyses to the spring and summer water chemistry testing. These changes 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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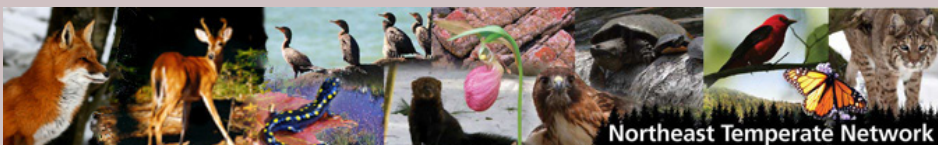
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Full Report online at:
<http://science.nature.nps.gov/im/units/NETN/index.cfm>



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