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Water Quality Monitoring Flows On

Results of the 2011 Water Quality Monitoring Season for Saratoga NHP

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 four park 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.

There are 8 miles of perennial streams divided between four watersheds in the park that all flow into the Hudson River. These watersheds are the Kroma Kill, Mill Creek, American’s Creek and Great Falls Creek. In addition, the historic ruins of the old Champlain Canal cut across the downstream end of the major drainages of park, and water from the Hudson River can back up into the park. Since there are no major ponds or impoundments in Saratoga, NETN monitoring is designed to characterize only the streams in the park. One monitoring site has been identified in each major watershed where water quality samples can be taken and streamflow measured. In addition, there are major tributaries in the Mill Creek watershed within park boundaries, and thus an additional site has been identified on the North Fork of Mill Creek. The three park streams monitored by NETN are considered warm water fisheries, capable of supporting bass, perch, sunfish, and similar species. Kroma Kill is a third order stream in the park and is monitored upstream of the first bridge crossing along the Park Entrance Road.

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 **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.



View looking downstream on the Kroma Kill. NPS photo.

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 the July values 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, except for the Upper Mill Creek June measurement. The July measurements from American's Creek and Upper Mill Creek were only slightly below the most stringent state DO standard. All other 2011 DO measurements were above the standard.

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. Color measurements from 2011 monitoring were near or above median color values from 2006 to 2011 monitoring, and show park streams to be highly colored. Much of the color is likely due to runoff and sediment input to the streams, rather than dissolved constituents, 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 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 park streams were extremely well-buffered, likely due to the underlying geology. May ANC measurements follow the typical seasonal pattern of being lower than August values. This effect is likely due to the contribution of episodic acidification from spring snowmelt and runoff (and also illustrates 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. Test results for three forms of nitrogen were moderately high in most 2011 samples, especially in Kroma Kill and the Mill Creek Confluence site. Results for NO₂ were low at all sites. All ammonia (NH₃) test results were below the method reporting limit. Most total phosphorus results for 2011 were near or below the EPA Ecoregion 7 criterion, and two other forms of phosphorus were low in all streams.

Summary

Most water quality parameters for the streams monitored in Saratoga National Historical Park are within state standards, and are generally within the range of non-regulatory EPA ecoregional criteria, where applicable. The majority of values are within the ranges of the historic NETN monitoring data. ANC measurements showed that all streams had sufficient buffering to avoid severely depressed pH values from spring snowmelt and runoff that can contribute acidity and sediment to the stream water.

Monitoring under the NETN protocol builds on the historic water quality monitoring by park staff and other agencies to provide critical baseline information on the chemical and physical status of the water resources Saratoga National Historical Park. Several changes have been 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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Full Report online at:
<http://science.nature.nps.gov/im/units/NETN/index.cfm>



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