



Water Quality Summary, Fiscal Year 2015

Overview

The Cumberland Piedmont Network (CUPN) began long-term monitoring of water quality at Cumberland Gap National Historical Park (CUGA) in fiscal year 2007 (October 2007 through September 2008). Sampling occurs monthly during two consecutive years, followed by five off years. Water quality is measured at ten sites. Six sites are located in Kentucky (Davis Branch, Tunnel Creek, Sugar Run, Shillalah Creek, and two sites on Little Yellow Creek), two sites are in Tennessee (Gap Creek 7 and Gap Creek at Iron Furnace), and one site is in Virginia at Station Creek. Additionally, samples are taken at Martins Fork in Kentucky when the site is accessible. Based upon program requirements and specific park concerns, a set of parameters was chosen for long-term monitoring, including the field measures of water temperature, specific conductance (SpC), pH, and dissolved oxygen (DO). Samples undergo laboratory analysis for *Escherichia coli* (*E. coli*), turbidity and acid neutralizing capacity (ANC).

This brief summarizes data collected from 1 October 2014 through 30 September 2015. Water quality data are available by request to the Cumberland Piedmont Network, or on our website: <http://science.nature.nps.gov/im/units/cupn/index.cfm>.



Figure 1. Gap Creek at the Iron Furnace on 9 December 2014. Image by Amy Wilson and Zach Bollheimer.

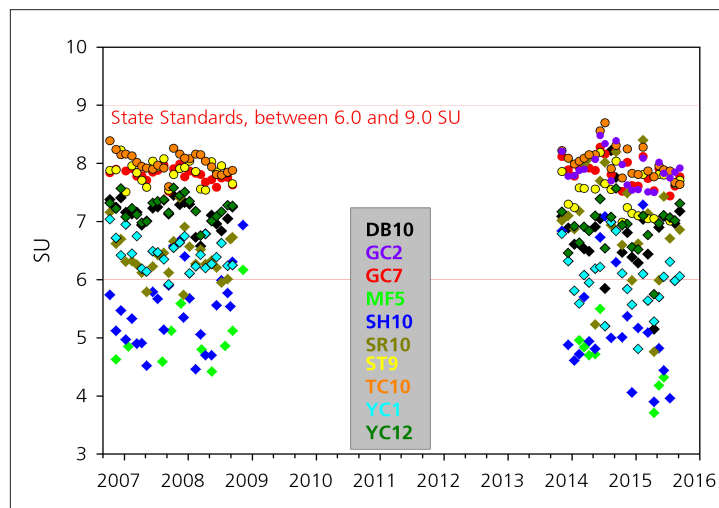


Figure 2. pH at Cumberland Gap National Historical Park FY14-FY15. Sites denoted with diamonds are those located in the silica sandstone watersheds of Cumberland Mountain (DB10—Davis Branch, GC2—Gap Creek at Iron Furnace, GC7—Gap Creek 7, MF5—Martins Fork 5, SH10—Shillalah Creek 10, SR10—Sugar Run Creek 10, ST9—Station Creek 9, TC10—Tunnel Creek 10, YC1—Little Yellow Creek 1, YC12—Little Yellow Creek 12).

Significant Findings

Highlights of Fiscal Year 2015 Monitoring

There were 24 violations and 24 apparent violations of water quality standards. Seven samples exceeded the 50 NTU limit for turbidity and 17 were above *E. coli* standards. Low pH was observed at all Kentucky sites. This low pH reflects the natural conditions of the Kentucky side of Cumberland Mountain. The local silica sandstone bedrock is basically devoid of carbonate minerals and thus provides no natural buffering, as surface water pH is very close to that of the precipitation. The state stipulates that a water body is not in violation if it reflects a natural condition. Elevated *E. coli* values typically occurred during high flow events and are indicative of bacteria being washed into the streams. This relationship is characteristic of non-point source contamination, but it is worth noting that even the forested Shillalah Creek watershed exceeded the standard at high flow. This is likely attributable to wildlife.

Park Water in Good Condition

Generally, the water quality of Cumberland Gap National Historical Park is in good condition. Low ANC makes the Kentucky streams particularly vulnerable to acid precipitation.

Water Quality Standards

As Cumberland Gap waters flow through three states, applicable limits depend on the location of the stream. Kentucky currently does not impose a standard for *Escherichia coli* bacteria, so we have adapted the EPA recommendations for “Full Contact Recreation.” Acid Neutralizing Capacity (ANC) and Specific Conductance (SpC) are without state standards or federal guidelines. These parameters are useful in interpreting water quality. Kentucky provides a higher standard for cold water habitats for DO at 5.0 mg/L. Sugar Run, Martins Fork and Shillalah Creek are considered cold water.

Table 1. Applicable water-quality standards for Kentucky, Virginia, and Tennessee (mg/L—mg per liter, $\mu\text{S}/\text{cm}$ —microsiemens per centimeter, MPN—most probable number, NTU—Nephelometric Turbidity Units, NS—no standard).

	KY	VA	TN
Water Temperature ($^{\circ}\text{C}$)	< 31.7	< 31.0	<30.5
Dissolved Oxygen (mg/L)	> 4.0/5.0	> 4.0	> 5.0
pH between	6.0-9.0:	6.0-9.0	6.0-9.0
SpC ($\mu\text{S}/\text{cm}$)	NS	NS	NS
ANC (mg/L CaCO_3)	NS	NS	NS
<i>E. coli</i> (MPN/100 ml)	< 298	< 235	< 487
Turbidity (NTU)	< 50	NS	NS

Future Monitoring

Water quality sampling is scheduled to resume in fiscal year 2021.

About the Cumberland Piedmont Network

In 1999, the National Park Service initiated a long-term ecological monitoring program, known as “Vital Signs Monitoring,” to provide the minimum infrastructure to allow more than 270 national park system units to identify and implement long-term monitoring of their highest-priority measurements of resource condition. The overarching purpose of natural resource monitoring in parks is to develop scientifically sound information on the current status and long-term trends in the composition, structure, and function of park ecosystems, and to determine how well current management practices are sustaining those ecosystems.

The NPS Vital Signs Monitoring Program addresses five goals for all parks with significant natural resources:

- Determine the status and trends in selected indicators of the condition of park ecosystem,
- Provide early warning of abnormal conditions,
- Provide data to better understand the dynamic nature and condition of park ecosystems,
- Provide data to meet certain legal and Congressional mandates, and
- Provide a means of measuring progress towards performance goals.

Effective long-term management and stewardship of natural resources in the Cumberland Piedmont Network begins with baseline knowledge of these resources. To acquire this knowledge, an inventory program was established by the National Park Service with the goals of acquiring baseline information for a variety of resources, from bibliographic information to species occurrence and distribution.

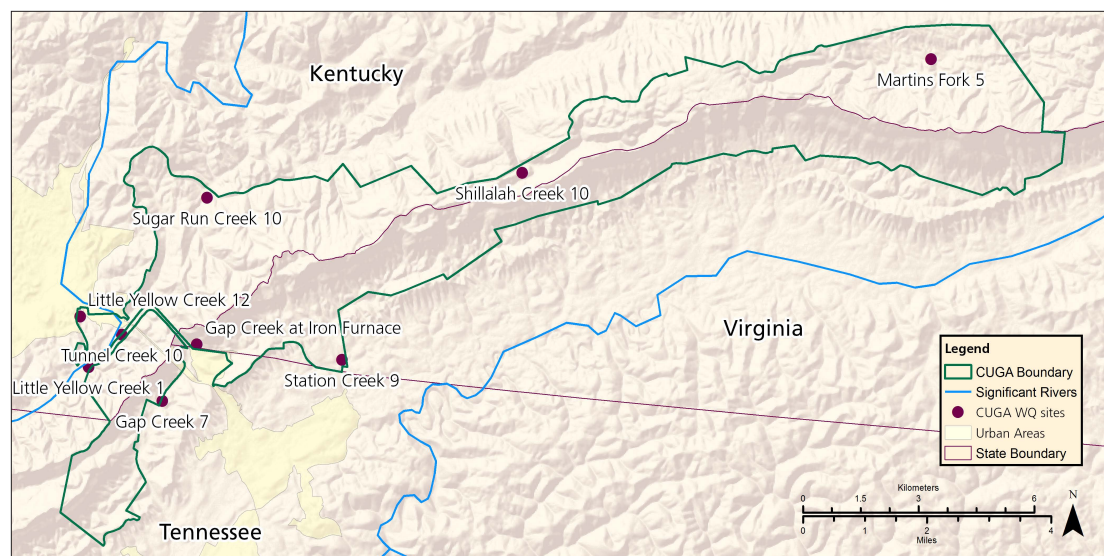


Figure 3. Map of Cumberland Gap National Historic Park water-quality monitoring sites.

For More Information

CUPN Home Page: <http://science.nature.nps.gov/im/units/cupn/index.cfm>

CUPN Reports & Publications: <http://science.nature.nps.gov/im/units/CUPN/publications.cfm>

About the NPS Inventory & Monitoring Program: <http://science.nature.nps.gov/im/index.cfm>

Data Downloads via the Natural Resource Information Portal: <http://irma.nps.gov>