



Water Quality Monitoring, Fiscal Year 2022

Overview

The Cumberland Piedmont Inventory and Monitoring Network (CUPN) began long-term water quality monitoring 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 10 sites (see map on page 2). Six sites are 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 Martin's Fork in Kentucky when the site is accessible. Based upon program requirements and specific park concerns, parameters were chosen for long-term monitoring including water temperature, specific conductance (SpC), pH, and dissolved oxygen (DO). Samples are analyzed in the lab for *Escherichia coli* (*E. coli*), turbidity and acid neutralizing capacity (ANC).

This brief summarizes data collected from October 12, 2021 through September 13, 2022. Water quality data are available by request to the Cumberland Piedmont Network.

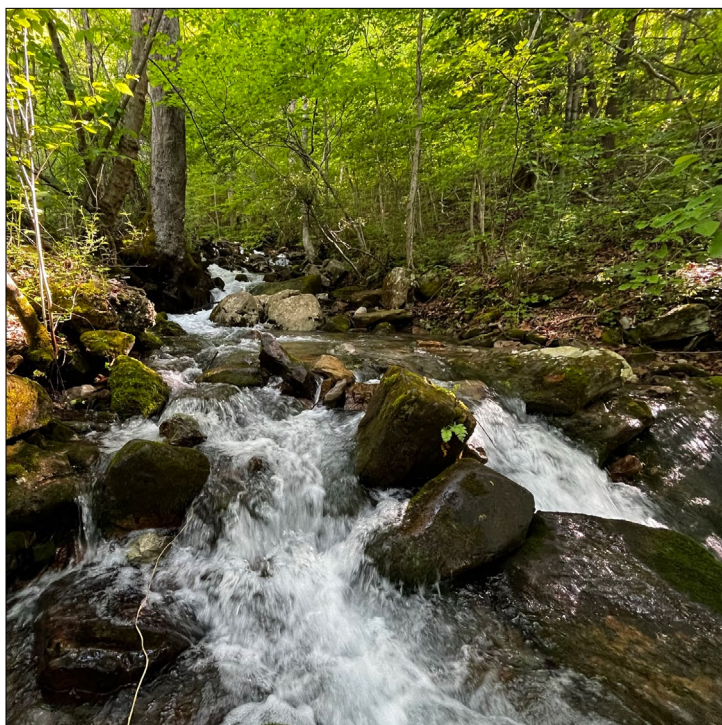


Figure 1. Gap Creek at Iron Furnace on May 10, 2022. Photo by Amy Settles.

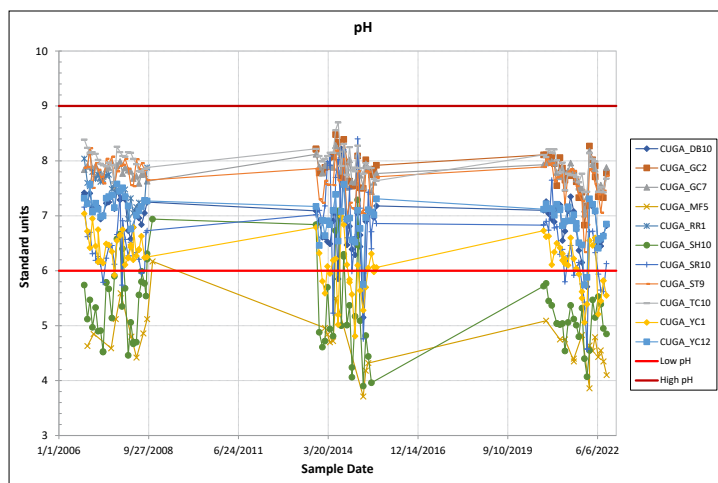


Figure 2. pH at Cumberland Gap National Historical Park from FY07–FY22. (DB10—Davis Branch, GC2—Gap Creek at Iron Furnace, GC7—Gap Creek 7, MF5—Martin's Fork 5, SH10—Shillalah Creek 10, SR10—Sugar Run Creek 10, ST9—Station Creek 9, TC10—Tunnel Creek 10, YC1—Little Yellow Creek 1, YC12—Little Yellow Creek 12).

Significant Findings

In FY22, there were eight violations of *E. coli* state standards. There were three exceedances of the Tennessee *E. coli* standard, all recorded at Gap Creek 7. Gap Creek 7 showed overall elevated *E. coli* levels in FY22 with a mean of 410 MPN/100 mL. There were four exceedances of the Kentucky *E. coli* standard and one exceedance of the Virginia standard in FY22.

There were 42 apparent violations of pH water quality standards in FY22. Martin's Fork and Shillalah Creek (Figure 2) have a baseline pH below the Kentucky State Lower Limit Standard of 6.0 SU and all measurements in FY22 were below the lower limit. pH was below the state standard (6.0 SU for Tennessee, Kentucky, and Virginia) in 54% of measurements at Sugar Run Creek 10, 71% at Little Yellow Creek 1, and 14% at Little Yellow Creek 12 and Davis Branch. However, this low pH is likely reflective of local natural conditions. The local silica sandstone bedrock is near devoid of carbonate minerals, providing limited natural buffering. As a result, surface water pH is very close to that of the precipitation.

Water Quality Standards

As Cumberland Gap waters flow through three states, applicable limits depend on the location of the stream. For *E. coli* bacteria, 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 (Table 1). Kentucky provides a higher standard for cold water habitats for dissolved oxygen (DO) at 5.0 mg/L. Sugar Run, Martin’s Fork and Shillalah Creek are considered cold water.

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

Parameters	Kentucky	Virginia	Tennessee
Water Temperature (°C/°F)	< 31.7/89.1	< 31.0/87.8	< 30.5/86.9
Dissolved Oxygen (mg/L)	> 4.0/5.0	> 4.0	> 5.0
pH (range)	6.0–9.0	6.0–9.0	6.0–9.0
SpC (µS/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 sampling will resume in fiscal year 2028.

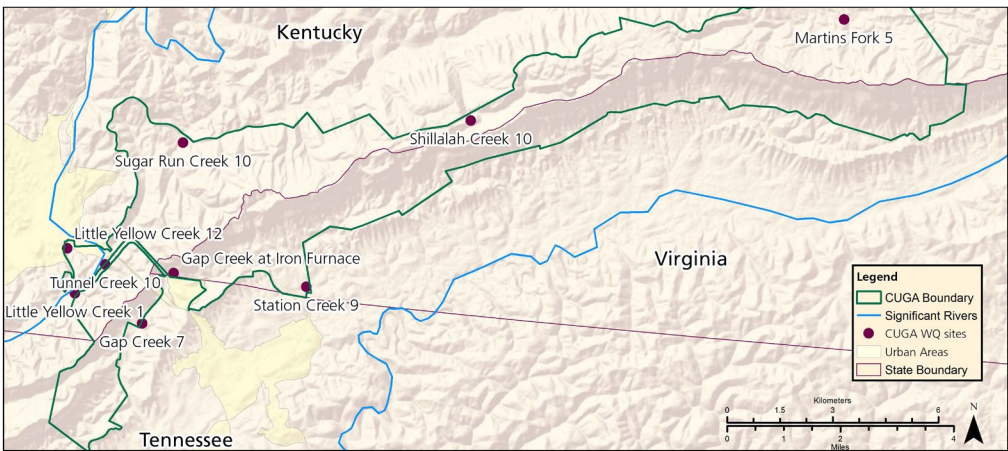
About the Cumberland Piedmont Network

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.



Map of Cumberland Gap National Historical Park water-quality monitoring sites.

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For More Information

CUPN Home Page: <https://www.nps.gov/im/cupn/index.htm>
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