

# High Severity Wildfire Impacts Water Yield and Water Quality in Southern Appalachian Watersheds

The 2016 wildfires in the southern Appalachians burned 150,000 acres between 21 fires in NC, SC, GA, and TN. A recent paper in the journal Hydrological Processes, titled “[Watershed-scale vegetation, water quantity, and water quality responses to wildfire in the southern Appalachian mountain region, United States](#)”, authored by Peter Caldwell et al., examines vegetation, water yield, and water quality post 2016 wildfires.

## Study Location and Methods:

- Nantahala National Forest, NC: oak-hickory dominated mature forest watersheds with moderate to high coverage of evergreen shrubs.
- 2 burned watersheds within the 14,175-acre Tellico Fire and 2 burned watersheds within the 3,236 acre Camp Branch Fire. Each burned watershed was paired with a nearby and similar unburned watershed.
- Plots were established in each watershed to measure vegetation, forest floor, and soil nitrogen.
- For the burned watersheds, fire severity was derived from plot data and satellite imagery, and was estimated and mapped.
- Each watershed was instrumented in February 2017 to record streamflow and water quality, which were followed through December 2018.

## Key Findings:

- For all watersheds, mortality occurred at higher rates than in typical prescribed fires. Fire severity was greatest in the Tower watershed located in the Camp Branch Fire, having 65% of the land burned at high severity. Mean tree mortality and BA loss across all burned plots was 41% and 17%, respectively.
- Duff consumption and mineral soil exposure was extensive where high severity fire occurred.
- Water yield (streamflow) response was greater in these burned sites than when similar BA loss have occurred post timber harvest, possibly due to duff consumption increasing overland water flow and reducing infiltration into the soil.
- Stream concentrations of soil cations and anions (Ca, K, Mg, Cl, SO<sub>4</sub>) were also elevated in the short term, but did not exceed the water quality standards for trout streams.
- Elevated levels of nitrogen (ammonium and nitrate) and phosphorus were found in streams, especially in the high severity Tower watershed. This had not been found in previous studies of stream water after prescribed fire.
- In the Tower watershed, stream nitrate levels were even greater than in previous studies in which entire watersheds were clearcut.



## Take Home Points:

- Where high severity fire occurred, the water yield, nitrogen, and phosphorus increases were consistent with that found in high-severity western fires.
- Because the threat of high-severity wildfire is expected to increase in the southern Appalachians due to climate change, the authors state that the results of this study indicate that: *“it will become increasingly important to manage fuel loads through prescribed fire...”*

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