The Contribution of Duff Consumption to Fire Emissions and Air Pollution of the Rough Ridge Fire

The 2016 Southern Appalachian wildfires were unprecedented. The *International Journal of Wildland Fire* published the paper, "The contribution of duff consumption to fire emissions and air pollution of the Rough Ridge Fire", authored by Fengjun Zhao, Yongqiang Liu, Scott Goodrick, Benjamin Hornsby (Center for Forest Disturbance Science of USFS Southern Research Station), and Jeffrey Schardt (Chattahoochee-Oconee National Forests of USFS Region 8). The authors examined duff consumption that occurred in the Rough Ridge Fire (RRF) and found that duff burning was a major source of pollutant emissions and air quality impacts. The RRF burned 27, 868 acres in the Cohutta Wilderness (Georgia) from mid- October to late November 2016. In the southern Appalachians, duff is generally unavailable for wildfires to consume due to its high moisture content. In the RRF, the duff layer was substantially burned under the extended drought conditions that occurred in 2016. The authors measured fuel types and loading at the RRF, calculated fuel consumption, fire emissions, and simulated smoke and air quality impacts.

Key Findings:

- Deep duff layer: The measured fuels had a very deep duff layer that had accumulated over decades due to the lack of historical fires. Duff accounted for nearly half of the total fuel loading. Most of the duff layer was burned by the RRF.
- Large fire emission: The burning of this deep duff layer contributed substantially to the increased fire emissions at the fire site. The PM2.5 emissions from the measured fuel loading and consumption were more than twice of those calculated based on the Fuel Characteristic Classification System (FCCS) fuel loading and consumption.

Duff layers measured in unburned areas (Sites 1 and 3) and burned areas (Sites 2 and 4)

- Air pollution: The large fire emissions estimated based on the measured fuel consumption proliferated the air pollution episodes in metro Atlanta. In contrast, smoke simulations using the emissions based on the FCCS fuel consumption and a hypothetical normal-moisture scenario did not produce the air pollution episodes. This highlights the contribution of the duff burning under drought to the air pollution episode within Atlanta.

Implications:

The findings suggest that the better quantification of the duff layer in areas such as the southern Appalachians could lead to greatly improved air quality predictions. In addition, prescribed fire can consume the litter layer and therefore prevent it from decomposing to form a deep duff layer. On the Cohutta Wilderness lands where the current fire management plan does not specifically allow prescribed fire due to its wildlife impacts, the application of prescribed fire to reduce duff accumulation and prevent air pollution of future wildfires should be explored.

Link to full article