

Dissolved black carbon: what is it and how much moves through longleaf pine forests?

Forests are known to improve water quality by reducing the runoff of sediment and pollutants into streams, lakes, wetlands and other water bodies. Trees also add important nutrients to the soil during storms, when falling rain rinses the leaves, branches, and trunks of trees. This direct contact with trees enriches rainwater with organic compounds. Carbon and other nutrients are carried by rain to the soil in the form of dissolved organic matter (DOM). This nutrient-carrying rain is classified in two ways. It is considered “throughfall” if it falls through leaves and branches on its way to the forest floor, or “stemflow” if it flows down tree trunks and into soils. In fire-adapted forests such as longleaf pine, throughfall and stemflow may also contain complex carbon-rich compounds produced from the burning of organic matter, known as “black carbon”. This black carbon dissolves, washes through the landscape, and settles in river and ocean sediments as an important and long-term form of carbon storage. Just how much throughfall and stemflow contribute to the flow of DOM and black carbon through forests and into rivers is unknown.

DBC than throughfall, but the amount of stemflow water was small compared to throughfall. Overall, throughfall and stemflow transport a substantial amount of carbon, including black carbon, into the soil. The fate of these different types of carbon is still unknown, but the ratio of DBC to DOM in this study suggests that more of the black carbon is transported into rivers, while other forms of DOM are retained and possibly recycled into forest soils.

MORE INFORMATION

Wagner, S., S. Brantley, S. Stuber, J. Van Stan, A. Whitetree, and A. Stubbins. Dissolved black carbon in throughfall and stemflow in a fire-managed longleaf pine forest. *Biogeochemistry* 146: 191-207.

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Tree Stemflow Samples

We measured the concentration of total tree DOM and dissolved black carbon (DBC) in throughfall and stemflow in a longleaf pine woodland. Longleaf pine ecosystems are characterized by frequent low-intensity fires, which suggests that large amounts of DBC might be present and ready for transport during rain events. Both throughfall and stemflow were rich in DOM and both had higher DBC concentrations than rainfall. The amount of DOM and DBC varied directly with the size of the storm and the density of the canopy. Stemflow had higher concentrations of DOM and

KEY POINTS

Black carbon, a form of organic carbon produced by the burning of plant materials during forest fires, represents a long-lived form of carbon that can move through watersheds and accumulate in rivers and ocean sediments.

In frequently-burned longleaf pine woodlands, black carbon from smoke is deposited on leaves and branches or forms when flames make direct contact with tree trunks.

Rainfall that contacts these plant surfaces transports much of that accumulated black carbon back to forest soils, but this amount is relatively small compared to the total amount of black carbon produced during fires and stored in soils.