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Does riparian forest composition affect oxygen demand? Effects of leaf litter species on microbial respiration in a coastal plain blackwater stream

Heavily-forested blackwater streams in North America's coastal plain receive large yearly inputs of organic matter in the form of tree leaves. Differences in leaf chemistry among tree species can affect several components of biotic communities in streams, including oxygen-consuming bacteria and fungi. Therefore, differences in riparian forest composition may also be expected to affect dissolved oxygen (DO) concentration, an indicator of aquatic ecosystem health. The low levels of DO observed in many coastal plain blackwater streams may be due in part to decomposition of riparian tree leaves. However, the magnitude of this effect is difficult to separate from other sources of oxygen demand, and may vary according to relative abundances of certain tree species. A preliminary study examined differences in microbial respiration rates among leaves of common riparian tree species in Georgia\'s coastal plain. Coarse-mesh bags containing abscised leaves of red maple (Acer rubrum var. trilobum), water oak (Quercus nigra), and Ogeechee tupelo (Nyssa ogeche) were incubated in a third-order reach of the Little River. Litter bags were sampled bi-weekly to determine microbial respiration rates and breakdown rates of leaves. Tree species, temperature, and length of submersion time had significant effects ($p < 0.05$) on microbial respiration rates, with microbes on tupelo leaves consuming the most oxygen per gram of leaf tissue. Tupelo leaves also broke down more rapidly than leaves of other tree species, followed by red maple and water oak, respectively. These results illustrate an additional level of complexity in total maximum daily load development and determination of natural stream DO concentrations: different types of natural organic matter inputs contribute to oxygen demand in quantitatively different ways.

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