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Floating Vegetation as a Driver of CH4 Emissions in Small Ponds Across Louisville, KY

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Floating Vegetation as a Driver of CH_4 Emissions in Small Ponds Across Louisville, KY*

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Wetlands are vital ecosystems that play a key role in biogeochemical cycling. Vegetated wetlands are usually net sinks for carbon dioxide (CO_2) as plants grow faster than they decompose and organic carbon (C) is buried in anoxic sediments. However, the organic-rich anoxic sediments of wetlands also make them the largest natural source of methane (CH_4) to the atmosphere. Larger lakes and reservoirs have been extensively studied with respect to their roles as sinks or sources for greenhouse gases (GHG), but smaller bodies of water (<10,000m^2) are investigated less frequently, despite the fact that they may emit disproportionately large amounts of GHG relative to their size.

This study investigated two pathways of GHG emissions (diffusion and ebullition) from small bodies of water in Louisville, KY to determine the relative impacts of floating vegetation cover (*Lemna* and *Wolffia* spp., duckweed) on pond GHG emissions. A portable greenhouse gas analyzer and floating static flux chamber were used to measure diffusive fluxes of CO_2 and CH_4 along a four-point transect in each pond. At each of the four locations, sediment cores were collected for the estimation of sediment C content. Three ebullition traps were also deployed at evenly spaced intervals along a transect for one week. Algal biomass and floating vegetation areal coverage, layer thickness and density were estimated as well, and nutrient concentrations and environmental factors such as pH, temperature, PAR, and dissolved oxygen were measured at each site.

Floating vegetation layer thickness and density were the best predictors of both diffusive and ebullitive fluxes of CH_4 across sites, with significantly higher emissions of CH_4 in the presence of floating vegetation. With its high turnover rate, sinking duckweed likely provides a source of labile organic C to oxygen-consuming and methanogenic sediment microbes, while thick layers of live duckweed generate hypoxia or anoxia in ponds by blocking oxygen diffusion into the water column. However, sediments in duckweed ponds also contained significantly higher concentrations of organic C than open-water pond sediments at depths up to 10 cm, suggesting potentially higher rates of C storage. Therefore, the net effect of duckweed coverage on C cycling in small ponds is uncertain. Future research will need to weigh the apparent enhancement of sediment C content against enhanced C emissions, to fully appreciate the effects of floating vegetation on the C source-sink status of small ponds.

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