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Presenter Information

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Measuring the Contribution of Bald Cypress "Knees" to Greenhouse Gas Emissions During Climate Extremes*

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Bottomland hardwood forest soils and vegetation can be significant sources of greenhouse gasses, such as carbon dioxide (CO_2) and methane (CH_4), to the atmosphere, but these dynamics are subject to change given increasing global climate extremes. Little is known about the role of aboveground woody root structures ("knees") of *Taxodium distichum* (Bald cypress) trees in these carbon dynamics. We are investigating the contribution of knees to bottomland hardwood forest source-sink dynamics of CH_4 and CO_2. We measured CO_2 and CH_4 fluxes from individual knees, soils, and 1 m^2 plots of combined knees and soil that varied in knee density. Measurements were collected within Dunn Slough of Clarks River National Wildlife Refuge during moderate-to-severe drought conditions in the Fall of 2022 and during non-drought conditions in the Spring of 2023. In drought conditions, we expect aerobic soils to limit the production of CH_4 (methanogenesis), and convert soil and woody surfaces to sinks through enhanced opportunities for CH_4 oxidation (methanotrophy). While soils did act as CH_4 sinks, individual knees were still CH_4 sources. Knee emissions also increased with soil (p-value < 0.001) and air (p-value = 0.002) temperatures. Within the 1 m^2 plots, there was no effect of knee density on net CH_4 uptake; soils in high knee density plots tended to have higher CH_4 uptake (not statistically significant, p-value = 0.476), but there were also more knees available for emissions. Soil CO_2 emissions increased in plots with high knee densities (p-value = 0.037), potentially due to increased root respiration. Similar to CH_4, there was no effect of knee density on CO_2 emissions. We are currently investigating whether increases in soil CO_2 emissions are being counterbalanced by potential photosynthetic organisms unaccounted for within the plot (e.g., bryophytes and algal crusts). During Spring of 2023, all sampled knees had higher CH_4 emissions following a rain event, however it was only significant in the knees located in a side channel (p-value = 0.03), and not those located in the main channel (p-value = 0.15). Comparison between drought and non-drought conditions showed three knees in the main channel emitting on average ~ 139x higher levels of CH_4, though the overall change in the channel was not significant (p-value = 0.09). Sampling is ongoing to see if this pattern holds. Results from this study can be used to improve our understanding of wetland greenhouse gas dynamics in changing climatic extremes.

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