ASSESSMENT OF METHANE EMISSIONS IN REWETTED SWAMPS USING STABLE CARBON ISOTOPE ANALYSIS

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Rewetting of drained peatlands and swamps is increasingly promoted as a climate-mitigation strategy due to its potential to reduce carbon dioxide emissions and restore ecosystem functions [1]. However, rewetting may also enhance methane production, creating uncertainty about the overall greenhouse gas balance of restored wetlands [2]. Understanding the sources and formation pathways of methane in re-wetted systems is therefore essential for evaluating their climatic impact, yet field-based isotopic evidence from restored swamps remains limited. The objective of this preliminary study is to investigate changes of methane emissions following swamp rewetting using stable carbon isotope ratio ($\delta^{13}C$) measurements and to determine whether isotopic signatures can provide early indications of microbial methane generation in newly reestablished wet conditions.

In this study, methane samples were collected from a swamp site using and analyzed using a cavity ring-down spectroscopy (CRDS) analyzer (Picarro G1112-i). Preliminary $\delta^{13}C$ results indicated a greatly depleted isotopic signature typically associated with microbial methane production under anaerobic conditions. The observed isotopic composition provides initial evidence that suitable hydrological conditions promote microbial processes responsible for methane formation. The preliminary results also highlight the sensitivity of isotopic measurements for detecting early-stage changes in greenhouse gas dynamics of swamps.

[1] J. Leifeld and L. Menichetti, “The underappreciated potential of peatlands in global climate change mitigation strategies,” Nature Communications, vol. 9, no. 1, p. 1071, Mar. 2018, doi: 10.1038/s41467-018-03406-6.

[2] T. He et al., “Meta-analysis shows the impacts of ecological restoration on greenhouse gas emissions,” Nature Communications, vol. 15, no. 1, p. 2668, Mar. 2024, doi: 10.1038/s41467-024-46991-5.