How to prevent wetlands from contributing to climate change? – Response of the wetland carbon dioxide sink function to climate change scenarios and water level management

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PRACTICE ABSTRACT

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Stress factors such as climate change and drought may switch the role of temperate wetlands such as peatlands from carbon dioxide (CO2) sinks to sources, leading to positive feedback on global climate change. Water level management has been regarded as an important climate change mitigation strategy as it can sustain the natural net CO2 sink function of a wetland.
Little is known about how effectively water level management can sustain the CO2 sink function to mitigate global warming. We assessed the effect of climate change on the CO2 exchange of south Swedish temperate peatlands, which were either unmanaged or subject to water level regulation. Climate chamber simulations were conducted using experimental peatland mesocosms exposed to current and future representative concentration pathway (RCP) climate scenarios (RCP 2.6, 4.5 and 8.5).

The results showed that all managed and unmanaged systems under future climate scenarios could serve as CO2 sinks throughout the experimental period. However, the 2018 extreme drought caused the unmanaged mesocosms under the RCP 4.5 and RCP 8.5 to switch from a net CO2 sink to a source during summer. Surprisingly, the unmanaged mesocosms under RCP 2.6 benefited from the warmer climate and served as the best sink among the other unmanaged systems.

Water level management had the greatest effect on the CO2 sink function under RCP 8.5 and RCP 4.5, which improved their CO2 sink capability up to six and two times, respectively. Under the current climate scenario, water level management had a negative effect on the CO2 sink function, and it had almost no effect under RCP 2.6. Therefore, we conclude that water level management is necessary for RCP 8.5, beneficial for RCP 4.5 and unimportant for RCP 2.6 and the current climate.

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