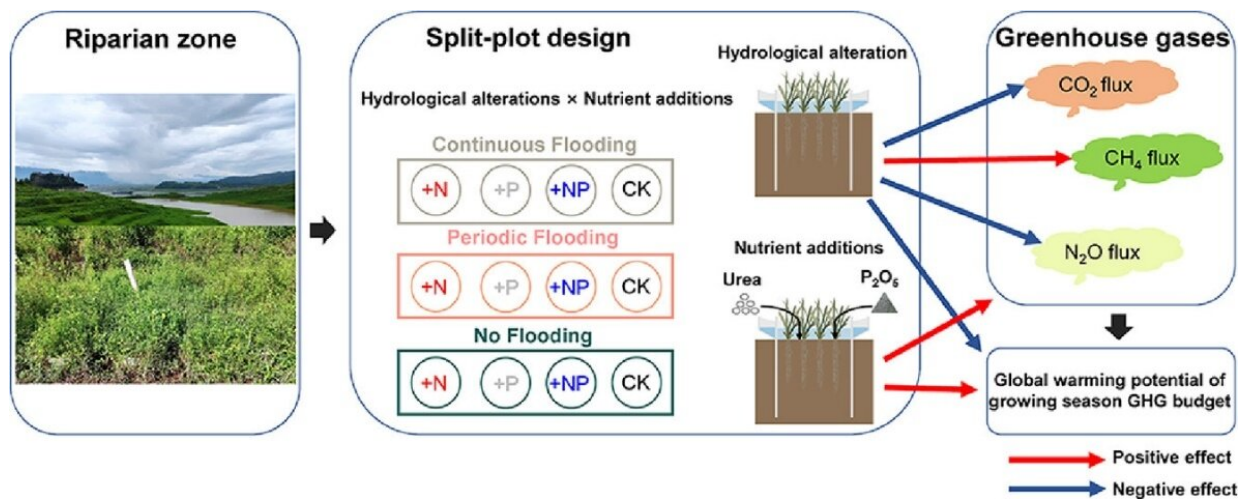


# Hydrological alteration and nutrient input greatly affect greenhouse gas emission

August 25 2021, by Zhang Nannan



Experimental design and the divergent effects of hydrological alteration and nutrients input on greenhouse gases emissions. Credit: WBG

Changes in global rainfall patterns and the construction of artificial dams have led to widespread alteration of hydrological processes in riparian ecosystems. Meanwhile, intensified agricultural activities have resulted in enhanced inputs of nitrogen (N) and phosphorus (P) into the riparian ecosystems associated with the Yangtze River. However, it remains unclear how the greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, and N<sub>2</sub>O) respond to both the hydrological alterations and nutrient input in the riparian zone.

To investigate the effects of hydrological changes and nutrients input on

the [greenhouse](#) gases in riparian zone, Ph.D. student Shi Wenjun, supervised by Prof. Zhang Quanfa and Ye Chen of the Wuhan Botanical Garden of the Chinese Academy of Sciences, conducted an in situ experiment in the water level fluctuation zone of the Three Gorges Reservoir.

This experiment was carried out at Zhongxian Revegetation Station of Chongqing, China. The prescribed hydrological alterations (i.e., continuous flooding, periodic flooding, no flooding) and nutrients addition experiments (N addition, P addition, N + P addition, and control plots) were established at nine 15×3 m blocks along the elevation gradient.

Results revealed that hydrological alterations significantly affected the emissions of three greenhouse gases. Continuous flooding significantly reduced CO<sub>2</sub> and N<sub>2</sub>O emissions across all the nutrient addition treatments, but greatly increased CH<sub>4</sub> emissions.

The simultaneous addition of nitrogen and phosphorus promoted the [emission](#) of greenhouse gases, while phosphorus addition alone significantly reduced the N<sub>2</sub>O fluxes.

The quantitative PCR approach (qPCR) analysis revealed that continuous flooding significantly reduced the abundances of functional genes associated with CH<sub>4</sub> oxidation, nitrification, and denitrification process, while N+P addition increased the abundances of functional genes.

Therefore, hydrological alterations and nutrients input mainly affect greenhouse gases emissions by changing soil [environmental factors](#) (soil redox conditions, [moisture content](#), soil organic carbon) and the abundance of related functional genes.

Using the widely used global warming potential (GWP, on a 100-year time horizon), this study estimates that the water level fluctuation zone of the Three Gorges Reservoir has a positive net GWP. Continuous flooding treatment could reduce GWP, while N+P will increase GWP.

This research is of great significance for clarifying the mechanism of [greenhouse gases](#) emissions of the riparian ecosystems and calculating the carbon budget of the water level fluctuation zone of the Three Gorges Reservoir.

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Results were published online in *Water Research*, titled "Divergent effects of hydrological alteration and nutrient addition on greenhouse gas emissions in the water level fluctuation zone of the Three Gorges Reservoir, China."

**More information:** Wenjun Shi et al, Divergent effects of hydrological alteration and nutrient addition on greenhouse gas emissions in the water level fluctuation zone of the Three Gorges Reservoir, China, *Water Research* (2021). [DOI: 10.1016/j.watres.2021.117308](#)

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