

## **Diminished Greenhouse Gas Emissions from Flooded Rice Paddies under Projected Future Climates**

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Rice paddies are a major contributor to greenhouse gas emissions, especially methane and nitrous oxide that have 20 to >300 times the effect, respectively, of carbon dioxide on a per molecule basis. With an increasing demand (and need) for rice, it is important to understand whether and to what extent greenhouse gas emissions from rice paddies will be altered with a changing climate.

We performed paddy soil incubations under today's climate and the postulated climate of the year 2100 for Californian and Cambodian rice-growing regions. Additional incubations were used to determine the effect of either just elevated temperature or just elevated atmospheric CO<sub>2</sub> on greenhouse gas emissions. Our data indicates that a rapid transition of 5°C higher temperatures nearly eliminates nitrous oxide and methane production, whereas doubled atmospheric CO<sub>2</sub> alone stimulates methane and nitrous oxide emissions. Overall, the effect of temperature on greenhouse gas emissions is more pronounced than changes in atmospheric CO<sub>2</sub>, leading to a net decrease in greenhouse gas emissions from rice paddies under future climatic conditions. The observed atmospheric data are further budgeted with data for water-extractable and solid phase carbon and nitrogen, and they are correlated to other plant nutritional elements of the soil. The changes in greenhouse gas emissions are explained by tracking the abundance and activity of the soil microbial community with 16S rRNA gene and transcript qPCR, respectively.

The study provides a better understanding of the role rice paddies will play for global greenhouse gas emissions in the future. Further, the results of this work allow for an assessment of soil nutrient and contaminant contributions to rice yields under future climatic conditions.