Nitrogen Fertilization Does Not Impact CH_4 and N_2O Emissions in Restored Agricultural Wetlands

Restoring drained peatlands is considered a climate change mitigation action. However, mitigating effects of wetlands restored for agricultural production largely depends on management intensity.

In a recent article in the *Soil Science Society of America Journal*, researchers report on the effect of nitrogen (N) fertilization on CH_4 and N_2O emissions in restored peatlands converted to rice production in the Sacramento–San Joaquin Delta, where soil subsidence and intensive greenhouse gas emissions are undermining the sustainability of regional agriculture.

The team found that N fertilization at rates up to 200% of the commonly applied rate (80 kg N ha\(^{-1}\)) lowered grain yields and did not improve plant above- and below-ground biomass production. Additionally, the fertilization did not change plant contribution to soil-dissolved organic carbon pools and CH_4 emissions, demonstrated by two \(^{13}\text{C}-\text{CO}_2\) pulse labeling experiments in the field. Ultimately, N fertilization did not affect total annual CH_4 and N_2O emissions.

This study suggests that N availability is not the limiting factor that regulates CH_4 and N_2O emissions in these restored degraded peat soils. Management other than N fertilization may determine the effectiveness of rice cultivation as a regional solution to mitigate greenhouse gas emissions in the Delta.


Landscape Position Differentiates Contrasting Clay Mineralogy in Vernal Pools

Vernal pools are shallow ponds during the rainy season that are completely dry in the summer. They are noted for their unique flora and fauna. Soils are critical to the hydrologic function of the vernal pools, but little is known about the soil mineralogy, which contributes to both their hydrologic and biogeochemical behavior.

In a recently published article in the *Soil Science Society of America Journal*, researchers describe the soil mineral components of a vernal pool watershed on a basalt flow in southern California and interpret the mineral origins and relationships to the soil hydrologic environment.

Kaolin, derived from feldspar weathering, is the predominant clay mineral in the loamy upper slope soils. Excess silica and other soluble cations from mineral weathering in upper slope soils are flushed with percolating water to the lower slope positions where they accumulate and precipitate as smectite, producing clayey Vertisols. Redox conditions favor iron oxides on upper slopes, imparting reddish hues to the soils, whereas lower slope soils accumulate manganese oxides, which precipitate as the soils dry and impart dark colors.

Recognizing and interpreting soil mineralogical differences is key to understanding the chemistry and drainage patterns that support the unique organisms in this ecosystem.


New research suggests that N availability is not the limiting factor that regulates CH_4 and N_2O emissions in the restored peatlands converted to rice production in the Sacramento–San Joaquin Delta. *Photo courtesy of Flickr/Robert Couse-Baker.*


Early spring (top) and late summer views of the vernal pool landscape in southern California.