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Effect of land use change for bioenergy on greenhouse gas emissions from a wet marginal soil in New York State, USA.

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Millions of hectares of marginal lands in the Northeast USA no longer used for agriculture are suitable for production of second-generation cellulosic bioenergy crops, offering the potential for regional bioenergy production without inducing food vs. fuel competition for prime farmland. Abundant water resources, close proximity between production and markets, and compatibility with existing agricultural systems all favor development in the region. Yet, little is known about how sustainable bioenergy crop production on marginal lands is regarding greenhouse gas emissions. In a 10-ha field trial on wet marginal soils in upstate New York, we are assessing the effect of land use change (from fallow land to perennial grass stands) on N_2O and CH_4 emissions. The deep clay loam is unsuited for row-crop agriculture because it is too dry in summer and too wet in winter. Monthly chamber campaigns were performed from April to November 2012 to monitor large scale (10-20 m resolution) differences caused by land cover type (n=4 for both switchgrass, reed-canary grass and a 50-yr unplowed control) across soil moisture gradients (n=5 soil moisture levels per replicate). Additional weekly campaigns assessed the smaller scale spatial and temporal variability in emissions at meter-scale. Here we present results of both the large and small-scale patterns in greenhouse gas emissions from this marginal soil, and discuss effects of soil properties and hydrologic conditions as potential drivers. Insight gained about the environmental impact of bioenergy crops can be used to assess the sustainability of using this region's underutilized land base for energy production.