EGU22-1064, updated on 11 Aug 2022
https://doi.org/10.5194/egusphere-egu22-1064
EGU General Assembly 2022

Soil methane (CH4) fluxes in cropland with permanent pasture and riparian buffer strips with different vegetation

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Methane (CH_4) has a global warming potential (GWP) 28-times that of carbon dioxide (CO_2) over a 100-year horizon. Riparian buffers strips are widely implemented for their water quality protection functions along agricultural land, but conditions prevailing within them may increase the emissions of greenhouse gases (GHGs), including CH_4. However, only small amount of information is available regarding the dynamics of unintended emissions of soil CH_4 in these commonplace features of agroecosystems and how the dynamics compare to those for agricultural land not containing buffer strips. To understand the dynamics of soil CH_4 fluxes from a permanent upslope pasture and contiguous riparian buffer strips with different (grass, willow, and woodland) vegetation as well as controls with no buffer vegetation, field measurements were carried out using the static chamber technique on a replicated plot-scale facility. Gas fluxes were measured periodically with soil and environmental variables between June 2018 and February 2019 at Rothamsted Research, North Wyke, United Kingdom. Soils under all treatments were sinks of soil CH_4 with the willow riparian buffer (-2555 ± 318.7 g CH_4 ha^{-1}) having the lowest soil CH_4 flux followed by the grass riparian buffer (-2532 ± 318.7 g CH_4 ha^{-1}), woodland riparian buffer (-2318.0 ± 246.4 g CH_4 ha^{-1}), no-buffer control (-1938.0 ± 374.4 g CH_4 ha^{-1}), and lastly, the upslope pasture (-1328.0 ± 89.0 g CH_4 ha^{-1}) which had a higher flux. The three vegetated riparian buffers were more substantial soil CH_4 sinks, suggesting that they may help reduce soil CH_4 fluxes into the atmosphere in similar agroecosystems.