Effect of land use and land cover on greenhouse gas emissions from peatlands in the Paraíba Valley, Brazil

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Peatlands cover around 570 million hectares worldwide and although most are located in boreal environments, tropical peatlands cover 170 million hectares and store about 860 Gt of carbon. Peat soils store a large amount of carbon and have acted as sinks of atmospheric CO_2 for thousands of years but can also act as major sources of GHG emissions into the atmosphere when impacted by anthropogenic activities such as drainage, deforestation, forest fires, and changes from native to agricultural and livestock systems. These changes, besides disturbing the functions of this ecosystem, affect the dynamics of CO2 and CH4 flows. Therefore, the objective of this study is to evaluate the effect of land use change and land cover (LULC) on the dynamics of carbon emissions in tropical peatlands in the Vale do Paraíba region, São Paulo, Brazil. The sampling program was carried out in the lowlands of the Paraíba do Sul River, over different land cover: pastureland, native forest and irrigated rice crop. We used the static chamber technique to estimate GHG fluxes during two seasonal periods (wet season of 2017 and dry season 2018). Our results show that the highest CO_2 (g CO_2 m^{-2} yr^{-1}) fluxes were observed in the dry season in pastureland (3,210), followed by native forest (2,174) and irrigated rice crop (2,074). The higher values in the dry season was regulated mainly by peat moisture, organic matter content and groundwater level. The CH_4 fluxes (gCH_4 m^{-2} yr^{-1}) were mainly dependent on the moisture, temperature of the peat and groundwater level. The CH_4 fluxes were negative (uptake) for pastureland (-5.2) and native forest (-3.1) and positive (emission) for irrigated rice crop (3.1). In the rainy season, methane fluxes were similar for the three land covers, with emissions of 4.0, 4.2 and 3.1 gCH_4 m^{-2} yr^{-1} for native forest, pastureland and irrigated rice crop, respectively. These results suggest an increasing trend of CO_2 emissions in situations of higher temperature and deeper groundwater table, mainly driven by the drainage and deforestation of peatlands in the region. On the other hand, long-term drought conditions may promote methanotrophic activities and consumption of CH_4, decreasing

CH_4 emissions. Thus, the role of the peatlands as sink or source of GHG to the atmosphere will depend mainly on the dynamics of the LULC changes and land management.

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