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Management Decisions and Surrounding Landscape Context Impact Methane Dynamics from Subtropical Wetlands

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Atmospheric CH4 concentrations are rising due to anthropogenic activities, largely associated with agriculture and land-use changes. Globally, wetlands are an important source of CH4, but there is uncertainty surrounding the impact that anthropogenic activities are having on CH4 production and emissions from wetlands embedded within larger agricultural systems. This study investigated the role of management and land-use change associated with grazed pastures in sub-tropical Florida on net CH4 emissions and ecosystem properties from wetlands nested within the landscape. This research further determined key mechanisms by which management decisions at the landscape scale modulates CH4 emissions from the embedded wetlands. Net CH4 exchange was measured using a closed chamber system with an open path CH4 analyzer (LI-7700, LI-COR, Inc., Lincoln, NE USA) over two complete wet/dry seasonal cycles from wetlands embedded either in intensively managed pastures (improved) or less managed pastures (semi-native), both grazed and ungrazed. The experiment was a full factorial design with n=4. Net CH4 emissions were consistently higher from improved wetlands (2.82 μmol m-2 s-1) relative to semi-native wetlands (1.77 μmol m-2 s-1) during the wet season, almost a 4-fold difference. During the dry season, these differences became negligible, with little to no CH4 emissions from either wetland type. Grazing had no discernable effect on CH4 emissions from wetlands. Intensive management surrounding wetlands increased soil wetness (46.4% VWC) and above ground biomass (235.2 g DW m-2) compared to wetlands embedded in less managed pastures (43.3% VWC; 127.4 g DW m-2). Both factors are important components of the CH4 cycle and likely effected CH4 emissions from these wetlands. While the mechanism is uncertain, it is likely that these the differences can be explained by increased soil anaerobic environment, additional substrate for methanogenic bacteria and/or increased CH4 transport through plants. This experiment demonstrated that management decisions associated with subtropical pastures will impact CH4 emissions from wetlands embedded within the pastures, increasing the positive feedback to the climate system.