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The impact of sheep grazing on the carbon balance of a peatland

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This study estimates the greenhouse gas (GHG) fluxes resulting from sheep grazing upon upland peat soils. Previous studies have been limited to individual flux pathways or to comparing the presence to the absence of sheep grazing. Therefore, this study combines a model of the physical impact of grazing with models of: biomass production; energy usage in sheep; and peat accumulation. These combined modelling approaches enables this study to consider the indirect and direct impacts of sheep upon the carbon and greenhouse gas balance of a peatland at different grazing intensities as well as the changes between states of grazing. The study considered four vegetation scenarios (Calluna sp., Molinia sp.; reseeded grasses, and Agrostis-Festuca grassland) and a mixed vegetation scenario based upon the vegetation typical of upland peat ecosystems in northern England. Each scenario was considered for altitudes between 350 and 900 m above sea level and for grazing intensities between 0.1 and 2 ewes/ha. The study can show that the total GHG flux at the vegetative carrying capacity tended to decline with increasing altitude for all vegetation scenarios considered except for Molinia sp. The average total GHG flux for all scenarios was 1350 kg CO_2eq/ha/yr/ewe/ha, and on average 91% of the fluxes were directly from the sheep and not from the soil ,and are therefore not unique to a peat soil environment. The study suggests that emissions factors for upland sheep have been greatly underestimated. By comparing the total flux due to grazers to the flux to or from the soil allows the study to define a GHG carry capacity. i.e. the grazing intensity at which the flux due to grazing is equal to the sink represented by the peat soils, this GHG carrying capacity varies between 0.2 and 1.7 ewes/ha with this capacity declining with increasing altitude for all model scenarios.