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Accounting for carbon exchanges in a semiarid oak savanna (dehesa).

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Semiarid oak savannas (grasslands with scattered trees), partially covered, subject to regular droughts, grazing, and high levels of solar radiation, are nonetheless, typically carbon sinks regarding CO2. However, dehesas are a productive system, a trait shared with other savannas, and they are shaped by their uses for economic production. One of its multiple uses, livestock extensive farming, key to its economic profitability and to the preservation of the agrosilvopastoral system structure, modifies the Greenhouse gas (GHG) balance by adding a significant amount of CH4 and N2O into the cycle. Recent reports and publications have evaluated and compared different types of livestock management within the context of climate change. GHG emissions, extensive use of the soil resource, or the introduction of nitrogen into the system, are some of the generated effects that cause a negative evaluation of extensive farming. Nevertheless, the importance of this sector, given its extension and impact on production and rural development, demands a more rigorous evaluation. It is necessary to precisely account for the fluxes in their totality (including the CO2 sink effect) and the relationships between them. Currently, there are few studies that determine the GHG balance of dehesas, and they are mainly centred on CO2 fluxes without integrating the influence of livestock, or in meadows without a tree layer (which changes the CO2 balance). The net global warming potential of dehesas is unknown, given that very few direct and long-term flux measurements have been taken on them. In this work, CO2 and H2O fluxes from an eddy covariance tower located in an Andalusian dehesa were processed (standard corrections), filtered and homogenized, including filling gaps using artificial neural networks. We calculated the annual CO2 budget since 2015, to assess the sink/source nature of the area. In a modeling exercise to be able to close the carbon cycle, we estimated CH4 and N2O depending on the number of livestock present in the area by season/year, evaluating the tipping point.