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## Interacting abiotic, biochemical and management factors explain soil organic carbon in Pyrenean grasslands

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Grasslands are one of the major sinks of terrestrial soil organic carbon (SOC). Understanding how environmental and management factors drive SOC is challenging because there are scale-dependent effects, and large scale drivers affecting SOC both directly and through drivers working at fine spatial scales. Here we address how regional and landscape factors, and grazing management, soil properties and nutrients, and herbage quality factors affect SOC in mountain grasslands in the Pyrenees. Taking advantage of the high variety of environmental heterogeneity in the Pyrenees, we fitted a set of models with explicative purposes including variables that comprise a wide range of environmental and management conditions. We found that temperature seasonality (MMT) was the most important abiotic driver of SOC in our study. MMT was positively related to SOC but only under certain conditions: exposed hillsides, steep slopes and relatively highly grazed areas. High MMT conditions probably are more favourable for plant biomass production, but landscape and grazing management factors buffer the conversion of this biomass into SOC. Concerning biochemical SOC predictors, we obtained some unexpected interaction effects between grazer type, soil nutrients and herbage quality. Soil N was a crucial factor modulated by effects of livestock species and neutral-detergent fibre content of vegetation. Herbage recalcitrance effects varied depending on grazer species. These results highlight the need to expand knowledge about grassland SOC drivers under different environmental and management conditions.