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Evaluating Climate Change Impacts on Cereal Yields, Water Balance, and Irrigation Strategies in the La Balisa Sub-Catchment

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Climate change (CC) poses a critical threat to Mediterranean agri-food systems, with increasing water scarcity and climate variability jeopardising agricultural sustainability. This study assesses the impacts of CC on cereal yields and water balance in the La Balisa Sub-catchment (SCAB) in Segovia province, Spain, a region where rainfed winter cereals, such as barley and wheat, dominate agricultural production. Using a combination of hydrological and crop modelling frameworks (SWAT and AquaCrop), the research evaluates water demand, crop performance, and potential adaptation strategies, including an increase in irrigation areas, improvements in irrigation efficiency, and the selection of cereal varieties with different growth cycles.

The analysis integrates six global climate models (GCMs) from the IPCC's AR6 (SSP 4.5 and SSP 8.5), regionalised by AEMET, to project water availability and agricultural productivity under future scenarios. Baseline data reflects current agricultural and climatic conditions, serving as a reference to quantifying the effects of CC on yields and water resources. The study focuses on understanding the phenological responses of barley and wheat, a key rainfed cereal crop in the region, to shifting precipitation patterns, temperature extremes, and water stress.

Preliminary findings suggest that rising water stress and climate extremes could significantly reduce yields and increase water demand for agricultural purposes without adaptation. However, strategies such as expanding irrigation coverage, improving water-use efficiency, and optimising crop management through varietal selection show promise in mitigating these effects. The study highlights the need for adaptive management and integrating advanced irrigation and crop management strategies to sustain cereal production and water balance in semi-arid Mediterranean regions facing CC challenges.