# Trend Analysis of climatic variables and impacts in dehesa systems: a study case in Sierra Morena, Southern Spain

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"Dehesa" systems are one of the Mediterranean-mountain ecosystems with high relevance from both the environmental (biodiversity) and economic (livestock farming, including Iberian pork food industry) point of view. They are the result of the long-term co-evolution of indigenous ecosystems and human settlement, in a sustainable balance between conservation and feedbacks. During the last decades, this savanna-like system has undergone different problems, mainly associated with "seca" episodes (a disease of oak trees that results in drying and final death, caused by a fungus but very likely triggered by external physical conditions). Beyond monitoring and early-detection networks, a reliable analysis of precipitation and temperature trends, on different time scales, is needed to further understand causality of these episodes and estimate potential future situations. Moreover, the persistence of the oak-tree cover is essential to maintain livestock activities in these areas; Iberian pork production relying on the oak-fruits availability is a high value economic activity that not only maintains extensive farming under environmentally sustainable conditions, but also keeps a populated rural network in these areas.

This work shows the potential impacts of global warming in dehesas from the results of a climate trends analysis in a study site in Sierra Morena (Córdoba, southern Spain) included in the Natural Park of Sierra-Cardeña and Montoro, together with phenological information of the oak-tree covers, field data and time-lapse camera imagery.

The results highlight the variability of the climate and hydrology regimes during the last 50 years in this area; the indicators associated to temperature showed the most significant trends, whereas precipitation indicators had less significant results. The estimated impacts on the oak-trees phenology, a key issue to assess risks from seasonal early droughts or late frosts, show some delay in the blooming stage and a shortening of this phase, among other results. Other interesting variables such as soil temperature in the surface horizon were determined and analyzed in the study.

The spatially distributed results identified the critical areas within this Natural Park in terms of the most likely hazards associated to climate trends that vegetation are facing and will face in the short-term future if these trends persist. The GIS-based assessment system provided by this work also plays an important role for the Park managers and other interested stakeholders from the economic activities supported by the ecosystem services this dehesa provides.