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Using MicroLEIS DSS to evaluate climate change impacts on land suitability in Andalusia, Spain

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Understanding the effects of climate change on land suitability for crop production has become an important issue with respect to food security in areas undergoing increasing population sizes. Land suitability for six common Mediterranean crops was evaluated under current conditions and future climate change scenario. This evaluation was performed using the Agro-ecological Decision Support System Micro LEIS (MicroLEIS DSS) through the application of Terraza and Cervatana models. Terraza model provides an experimental prediction for the bioclimatic deficiency in the 62 natural regions that represent the Andalusia region. This model is dependent on current climate data, future climate change scenario data, and crop response data including coefficient of photosynthetic efficacy (Kc), coefficient of efficiency (Ky), and soil water retention. Alternatively, the Cervatana model is used to estimate agricultural land use capability under different soil types. Soil morphological and analytical data were collected from SEISnet data base representative of the natural region (NUTS 2) of Andalusia by 62 soil profiles. Agro-climatic data, referred to temperature and precipitation were obtained from the CDBm-Andalusia database, which contains monthly average values of climate variables: mean temperature, maximum and minimum rainfall, number of days of rain and humidity, collected during a consecutive period of 30 years (1960-1990), that represent the current climate scenario. Future climate is represented under A1B scenario for theperiods 2040, 2070 and 2100. These scenarios have been calculated using climate change variation values from the State Meteorological Agency (AEMET, 2011). The results of the Cervatana model depends on Terraza output results (e.g. water deficit class and the risk of frost class) and other land properties including soil factors, slope factors, and erosion risk factors. In order to spatialize the evaluation data, both models were incorporated into a Geographic Information System. The results showed that climate change is likely to cause severe water stress in cultivation where the use of irrigation methods being essential to maintain agricultural productivity such as cotton and maize. Accordingly, results show the following trend from low to high suitability to climate change: cotton> maize> sunflower> potato>soybean> wheat. In addition, the soils more affected by climate change are Aridsols, Entisols and Inceptisols located at the eastern of Andalusia where the climate is also more arid. These soils will have high hazards of yield reduction and land capability under the scenario of climate change. This research highlights the importance of using models for enacting sensible water management policies in areas where vital economic crops are becoming more susceptible to climate change.

Key words: Crop suitability, Food Security, Cervatana model, Terraza model, Climate change, Water policy