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Evaluation of soil contamination risk under climate change scenarios using Pantanal model in a Mediterranean area

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In this research, contamination vulnerability of Mediterranean soils was evaluated, using Andalusia (southern Spain; 87,600 km2) as a pilot area. The following components of the agro-ecological decision support system MicroLEIS DSS have been used: 1) SDBm, soil profile database, 2) CDBm, agroclimate database 3) MDBm, database of agricultural management, and 4) Pantanal model, specific assessment model for the vulnerability of soil contamination focus on nitrogen, phosphorous, heavy metals and pesticides. After the application of the model, results may be grouped into five vulnerability classes: V1-none, V2-low, V3-moderate, V4-high and V5-extreme for each specific contaminant. Physical and chemical data, and morphological description of 62 selected soil profiles from the study area were used in this study. Soil profiles were classified at sub-group level of USDA Soil Taxonomy, resulting in 37 units included in orders Inceptisols (26,9%), Entisols (21.2%), Alfisols (19.8%), Vertisols (17.9%), Mollisols (7.2%), Ultisols (4.3%) and Aridisols (2.8%). The CDBm database contains monthly average values of climate variables: mean temperature, maximum and minimum monthly rainfall, number of days of rain and humidity, collected during a consecutive period of 30 years that represent current climate scenario, and future climate scenarios (2040, 2070 and 2100). These scenarios have been calculated using climate change variation values from the State Meteorological Agency (AEMET, 2011). The MDBm contains information about agricultural use and management of wheat crop. The Pantanal expert model was applied to each soil-unit. Results showed that 9.0%, 11.6%, 29.5% and 50.8% of the total studied area was classified as V1, V2, V3, and V4, respectively, for pesticide contamination under the current climatic scenario. Under the future climate change scenario, 7.7%, 10.0%, 17.7% and 64.6% of the total studied area was classified as V1, V2, V3 and V4, respectively, for pesticide contamination. Following the same trend, 9.2 %, 10.8%, 52,8% and 27.2% of the study area were classified as V1, V2, V3 and V4 due to heavy metals contaminates; in contrast to 23.4%, 4.7%, 62.7%, 9.2% for the same classes, respectively, under the future climate change scenario. In addition, results showed that nitrogen vulnerability classes will decrease under future climate change scenarios, which might be considered a positive trend under a climate change scenario. With regard to phosphorus contaminants, there is little difference between climatic scenarios.

Key words: MicroLEIS DSS, land degradation, soil properties, climate conditions