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Evaluating Soil Contamination Risks by using MicroLEIS DSS in El-Fayoum Nile Province, Egypt

S. K. Abd-Elmabod^{1,2}, R. R. Ali³, M. Anaya-Romero¹ and D. de la Rosa¹

¹Evenor-Tech *Spin-off* Co., CSIC-IRNAS,

Ave. Reina Mercedes 10, 41012 Sevilla, Spain

²Centre for Advanced Mediterranean Agronomic Studies (CIHEAM),

Ave. Montañana 1005, 50059 Zaragoza, Spain

Soils and Water Use Department, National Research Centre, Cairo, Egypt

Abstract. The Agro-ecological Decision Support System, MicroLEIS DSS, was applied to investigate and predict soil degradation in soils of the province of El-Fayoum, one of the western desert areas of the Arab Republic of Egypt, with an area of 149,300 ha approximately. The Pantanal land evaluation model for contamination risks of phosphorus, nitrogen, heavy metals and pesticides, as one constituents of this DSS, was used. It is an expert system model based on three kinds of information: I) monthly meteorological data contains average values of climate variables: mean temperature, maximum and minimum rainfall, number of days of rain and humidity, collected during a consecutive period of 44 years, from the station of El-Fayoum; II) soil survey data collected from 46 soil profiles representative of the study area and stored in the MicroLEIS SDBm plus database; and III) agricultural information on soil use and management for major crops in the area, from scientific publications of the Ministry of Agriculture. The model application results are grouped in four vulnerability classes: V1-none, V2-low, V3-moderate and V4-high for each specific contaminant. Results obtained in El-Fayoum area show that 2.8%, 45.2% and 52% of total studied area were classified as V1, V3, and V4 vulnerable land due to phosphorous contamination. However, 95.9 % and 4.1% of total studied area were classified as V3, and V4 vulnerable land due to nitrogen and heavy metals, and 6.1 %, 21.5 %, 68.8 % and 2.8% of total studied area were classified as V1, V2, V3, and V4 vulnerable land due to pesticides. Additionally, Typic Torripasamment soils have a high vulnerability classes for all the types of contaminants although they represents less extension area, about 2600 ha. Finally, for each soil type, the Pantanal application in a hypothetical recommended scenario has helped to define agricultural management systems for reduced use of inputs like water, fertilizers and pesticides, and so minimizing the risk of soil degradation due to contamination. In conclusion, MicroLEIS DSS appears to be a useful tool in this part of arid regions, such as north of Africa (Egypt), to formulate sustaining agro-ecological systems. Although information about land resources in this part of Africa is rather scarce, these innovative agro-ecological strategies can be applied and adapted in other agricultural provinces from the Arab Republic of Egypt in order to achieve a regional sustainable land management.

Keywords: decision support tools, MicroLEIS DSS; SDBm plus, El-Fayoum, contamination risks, Pantanal model