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SALTFREE- Salinization in irrigated areas in the Mediterranean basin; risk evaluation using geophysical methods

Mohammad Farzamian (1), Fernando A. Monteiro Santos (1), Maria C. Gonçalves (2), Angelo Basile (3), Fethi Bouksila (4), Tarek Salim (5), Ana M.Paz (2), Nádia L. Castanheira (2), Maria Catarina Paz (1), Antonio Coppola (6), Giovanna Dragonetti (7), Roberto De Mascellis (2), Yasser Hamid (5), Ben Slimane A (4), and John Triantafilis (8)

(1) Universidade de Lisboa, IDL, Campo Grande ed. C8, 1749- 016 Lisbon, Portugal, (2) INIAV, Instituto Nacional de Investigação Agrária e Veterinária, Oeiras, Portugal, (3) Institute for Mediterranean Agricultural and Forestry Systems, Italian National Council of Research, Ercolano (NA), IT, (4) National Research Institute for Rural Engineering, Water and Forests (INRGREF), Box 10, 2080 Ariana, Tunisia., (5) Civil Engineering Department, Faculty of Engineering, Port Said University, Port Said, Egypt., (6) School of Agricultural, Forestry, Food and Environmental Sciences, University of Basilicata, Potenza, IT, (7) Land and Water Division, Mediterranean Agronomic Institute - International Centre for Advanced Mediterranean Agronomic Studies, Bari, IT, (8) Faculty of Science, School of Biological, Earth and Environmental Sciences, UNSW Australia, Sydney, NSW 2052, Australia

Salinization has been identified as a major cause of soil degradation in countries around the Mediterranean. Soil salinization limits agricultural productivity and can ultimately cause desertification and abandonment of the land. Salinization can also affect the quality of both ground and surface water resources, degrade infrastructures, and decrease biodiversity. Such effects represent major negative social, economic, and environmental impacts. The ecological conditions of the Mediterranean region favour salt accumulation in soils. Furthermore, agricultural practices such as irrigation and fertilization may further promote salt accumulation and accelerate land degradation in Mediterranean environments.
It is important to understand the processes controlling salinization in order to prevent further soil degradation. Traditional soil sampling methods, which require boreholes for soil sampling and analysis, difficultly lead to a comprehensive answer to this problem. This is because they cover only small and localized sites and may not be representative of the soil properties at the management scales. Furthermore, they are highly time and work consuming, resulting in costly surveys. Geophysical methods provide enormous advantageous compared to traditional methods of soil sampling because they allow for in-depth and non-invasive analysis, covering large areas in less time and at a lower cost.
The SALTFREE project is developing a framework for the evaluation of the salinization risk in the management scale, using state-of-the-art electromagnetic (EM) technique, in irrigated production systems in the Mediterranean basin. The project consortium is formed by five partners from four countries around the Mediterranean - Egypt, Italy, Portugal, and Tunisia in the scope of ARIMNET2 program.

The main aims of our study are:
I) Standardization of methodologies for the EM surveys and data inversion;
II) Use of electromagnetic electrical conductivity images (EMCI) obtained from inversion of EM data in conjunction with soil sampling and time-domain reflectometry (TDR) measurements to map the geospatial and temporal variability of salinity in the case-study plots;
III) Simulation of water flow and solute transport under different field conditions in order to predict the salinization evolution.
IV) Propose appropriate management strategies to ameliorate salinity.
The preliminary results of the project reveal that the EMCI obtained from join inversion of EM data, collected at different heights and orientations, shows good correlation with the electrical conductivity determined from the soil's saturation extract (ECe) and the TDR measurements. This allows us to image the geospatial and temporal variability of salinity in regional scale.

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