

## AQUIREMOTE – Use of Remote Sensing Data as a Support for the EU Agri-Environmental Policies for Achieving a Good Status of Groundwater with respect to Nitrates

### Summary

The Water Framework Directive establishes that the pressures and impacts of human activity on the status of groundwater must be identified for the establishment of measures that ensure the good compliance of the environmental objectives. This good water status can only be accomplished with an integrated vision of the water cycle and public participation for policy implementation. The effect of agriculture and animal breeding on water quality is also subject of the EU Nitrates Directive. The Nitrates Directive forms an integral part of the WFD and aims to reduce or prevent surface and ground waters pollution, caused or induced by nitrates from agricultural sources and to promote the use of good farming practices. The Nitrate Vulnerable Zones (NVZs) are WFD protected areas, and are defined as areas where the groundwater contains or could contain (if no action is taken to reverse the trend) more than 50 mg/L of nitrates.

So far, we have relied on discrete samples collected biannual or monthly, and laboratory analyses that can take long time to complete. The climate variability is an important key driver in the groundwater status, since it affects agro-ecosystems. Soil moisture plays a crucial role in the water cycle, as it has influence on the distribution of precipitation between surface runoff and infiltration. Previous studies have demonstrated that the alluvial areas are some of the most vulnerable to nitrate diffuse pollution from agriculture, due to a combination of factors including: the shallow water table of alluvial aquifers, the high heterogeneity of the intrinsic permeability of the alluvial deposits and the land uses undertaken on the lower terraces and floodplains along river banks, which are usually associated with irrigated agriculture. The NVZ of Tagus river, hereafter referred to as NVZ-T, is located in the central part of the Portuguese mainland, covering an area of 2417 km<sup>2</sup>.

Our study was conducted in the NVZ-T in a vineyard located at "Companhia das Lezírias" (Figure 1). The main aim of this work is to explore novel techniques related with the use of satellite images for assessing soil moisture content (SMC) and, by doing that, starting to develop tools which will support the aforementioned EU policies.

A cost-effective approach, comprehending remotely sensed imagery and field measurements, was tested to delineate the zones in a vineyard with a low SMC (Figure 2).

The Random Forest performed very well in classifying the topsoil zones with a lower SMC during the autumn-winter period. This

delineation allows the prevention of the occurrence of areas affected by salinisation, indicating which areas will need irrigation management strategies to control the salinity, especially under climate change, and the expected increase in droughts (Figure 3).

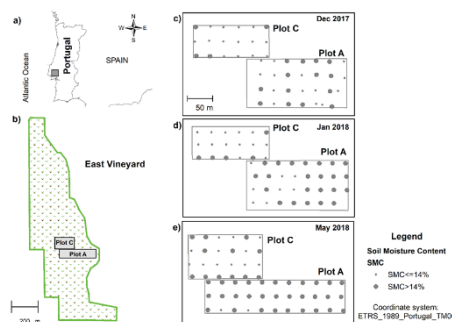


Figure 1. Fieldwork conducted at Companhia das Lezírias – a) Location of the study area; b) Pilot areas located in the vineyard; c), d), e) their monitoring network.

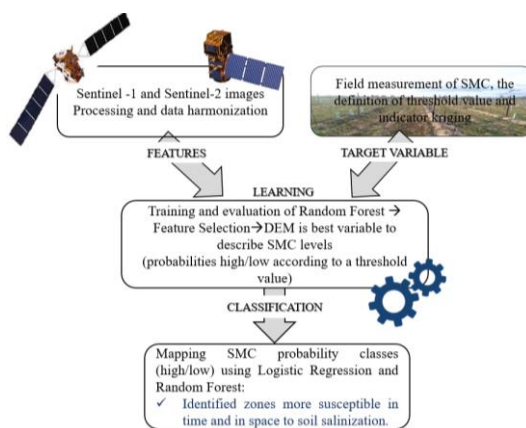


Figure 2. Workflow diagram of the methodology developed in AQUIREMOTE project to map the soil moisture content (SMC).

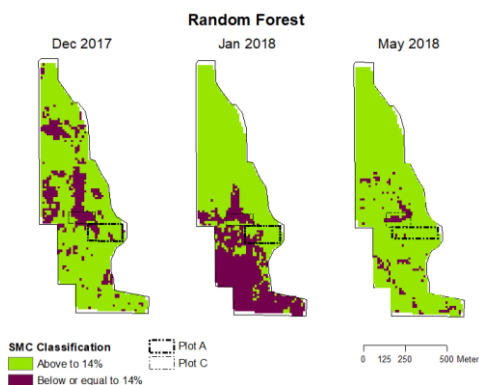


Figure 3. Mapping the temporal evolution of the soil moisture content (SMC) probability classes using Random Forest.

### Project Reference

### Leading Institution

CERIS – Civil Engineering Research and Innovation for Sustainability (Portugal)

### Partners

Companhia das Lezírias (Portugal)

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### CERIS Research Team

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### Funding

CERIS – Civil Engineering Research and Innovation for Sustainability

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7 500.00€

### CERIS

7 500.00€

### Project Website