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Monitoring and mapping soil functionality in degraded areas of organic European vineyards

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Soil malfunctioning, caused by an improper land preparation before vine plantation and/or management, is a common problem in European vineyards. Soil malfunctioning can include: reduced contribution of the soil fauna, poor organic matter content, imbalance nutritional status, altered pH, water deficiency, soil compaction and/or scarce oxygenation. To address these problems, ReSolVe, a transnational European research project, aimed at testing the effects of selected agronomic strategies for restoring optimal soil functionality in degraded areas within organic vineyard. The project involves 8 research groups in 6 different EU countries (Italy, Spain, France, Sweden, Slovenia, and Turkey) with experts from several disciplines including soil science, ecology, microbiology, grapevine physiology, viticulture, and biometry.

The experimental vineyards are situated in Italy (Chianti hills and Maremma plain, Tuscany), Spain (La Rioja), France (Bordeaux and Languedoc), and Slovenia (Primorska) for winegrapes, and in Turkey (Adana and Mersin) for tablegrapes. Three different restoring strategies have been implemented: (i) compost, (ii) green manure with winter legumes, and (iii) dry mulching with cover crops. These strategies have being tested according to their efficiency to improve i) plant and root growth; and ii) grape yield and quality; optimize iii) the quality of soil ecosystem services; and iv) the terroir effect.

The first activity of the project was characterizing and mapping the degraded areas within experimental vineyards. In the work we used non-invasive technologies to characterize soil and plant status. In Spanish and Italian vineyards, the delineation of degraded areas was performed by gamma-ray spectroscopy for topsoil, RGB machine vision for canopy status and thermography for plant water status. Gamma-ray spectroscopy measured continuously the natural gamma-ray emitted from the first 30-40 cm of soil, calculating the contribution of the main radionuclides (^{40}K, ^{232}Th, and ^{238}U). The spectra of gamma-ray were able to provide information about mineralogy, texture, surficial stoniness and carbonates. RGB and thermal cameras were used to assess canopy porosity, leaf area exposure and vine water status of both degraded and non-degraded areas. All soil, canopy and water status parameters were mapped.

Keywords: Organic vineyards, soil functionality, biodiversity, soil management, non-invasive technologies**.**