Territories and landscapes of Mediterranean olive groves in the framework of Soil 0-live project

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PROLOGUE

The first thing Manuel does on the cold February mornings in the Sierra Sur of Jaén is fill the small fuel tank of his leaf blower. This tool has become essential to him since he decided a few seasons ago to harvest the olives as they fall to the ground, rather than directly from the tree. The process is simple and requires little labor: he shakes the tree, and the olives—due to their advanced stage of ripeness—fall by gravity, like ripe fruit. Once on the ground, they are "blown," swept, and loaded into trailers that are taken to the mill for processing.

What Manuel doesn't know—or isn't fully aware of—is that since he changed to this seemingly more efficient harvesting model, only 40% of what he loads into his trailer is actually fruit, while the remaining 60% consists of branches, leaves, and especially stones and soil of various particle sizes. His trailer is small, 1,000 kilos, just one of thousands of trailers that, each day, thousands of olive growers in the region fill using this late ground-harvesting method.

Fully aware of the poor oil quality this method will yield—far from the standard of Extra Virgin Olive Oil (EVOO)—there is a common belief that the cost savings from reduced labor justify the trade-off in product quality. However, this calculation is flawed, as the denominator in the cost/benefit equation does not include the irreversible loss of the fertile soil horizon, which contains organic carbon, and essential nutrients for plant growth and reproduction such as nitrogen, phosphorus, and potassium, nor the cost associated with topsoil erosion. Some authors estimate this loss of fertile soil to be between 29-47 tons per hectare per year, representing 29–40% of agricultural soil in the Andalusian region. This chronic loss of fertility becomes a trap of unsustainability

for farmers, due to rising costs caused by the decreasing productivity of traditional olive groves, increasingly reliant on expensive chemical fertilizers.

Mr. Angelopoulos is worried because his mother is not responding to treatment, and what initially seemed like a cold has now turned into antibiotic-resistant pneumonia, landing her in the hospital. He was thinking of her while fertilizing his olive grove in Kalamata with organic compost produced and sold by the neighboring pig farm. For him—who a few years ago decided to convert his land into an organic olive grove—it's ideal, as it minimizes his carbon footprint, moves him closer to a local circular economy, and frees him from dependence on costly external inputs.

These days, he feels particularly proud of having taken a step towards a more sustainable agriculture, despite the skepticism of neighbors always so concerned with immediate profitability. What Mr. Angelopoulos doesn't know is that the animal-based compost he applies to his olive grove doesn't come alone—it is literally loaded with antibiotics that are commonly used in livestock farming. The initial diagnosis made by Soil O-live determined that 68.3% of the more than 500 soil samples analyzed contained residues of antibiotics in varying amounts, from nearly all known antibiotic families, including quinolones, ß-lactams, tetracyclines, and sulfonamides. Unsurprisingly, the presence of Antibiotic-Resistant Genes (ARGs) has been documented in certain bacterial taxa in the samples analyzed by the Soil O-live project.

These are just two examples of agronomic realities in olive cultivation from two different socio-economic and geographical contexts, but with the same consequence: the degradation of Mediterranean olive grove soils, which we document in the European Horizon research program under the Soil O-live project, a research project within the Soil Deal for Europe Mission.

Understanding the Soil Mission Through the Lens of the Mediterranean Olive Grove

When we talk about soil, we often think of it as something inert, a backdrop to human activity, a passive element in the landscape. But soil is, in fact, a living system—one of the most vital components of our planet's health and our own which provides essential ecosystems services such as the nutrient cycling, the maintenance of the carbon stock or watering filtering. This is the fundamental message behind the European Union's Soil Mission: to recognize soil as a non-renewable resource under threat, and to act collectively and urgently to protect it.

Just as Manuel and Mr. Angelopoulos illustrate two very different agricultural realities, they also embody the types of challenges that the EU Soil Mission seeks to address. The Soil Mission's goals are ambitious but necessary:

- Protect and restore soil health so that at least 75% of EU soils are healthy by 2030.
- Support sustainable farming systems that preserve fertility and biodiversity.
- Promote data-driven monitoring and research through living labs and lighthouses—testbeds of innovation where farmers, scientists, and local communities work together to regenerate soil.
- Raise public awareness that soil is not just dirt—it's the foundation of food, ecosystems, water cycles, and climate stability.

Soil degradation is not a theoretical threat—it is already a reality in regions like Andalusia, where traditional olive groves lose up to 47 tons of fertile soil per hectare each year, or in Kalamata, where even organic practices can unwittingly contribute to antibiotic contamination and the spread of antimicrobial resistance.

The Soil O-live project, within the Soil Mission, is one of the many efforts to address this complex issue by focusing on one iconic landscape: the Mediterranean olive grove. These groves, deeply rooted in the history and culture of southern Europe, are now facing an uncertain future. Climate stress, unsustainable farming practices, and economic pressures are combining to put unprecedented strain on their soils.

But there is hope.

Through Soil O-live, researchers are analyzing soil samples, tracking pollutants, measuring erosion, and working with farmers to test regenerative practices—cover crops, composting, biodiversity corridors, and more. They are also documenting how socio-economic decisions—like choosing cheaper methods or trusting in short-term profits—can have long-term ecological consequences, jeopardizing the future of the olive cultivation in the region.

What the Soil Mission ultimately invites us to do is this:

To look below the surface.
To listen to what the soil is telling us.
And to act—before it's too late.

Because soil is not only the ground beneath our feet.
It is the ground for our future.

Geographical and Social Aspects to Understand Soil Health

To talk about soil health without talking about territory is to stay on the surface. Soil does not exist in a vacuum: it is formed, transformed, and degraded within specific geographical, social, and economic contexts. Every landscape tells a story—of climate, topography, rain and drought—but also of human choices, agricultural culture, global markets, rural migration, inherited knowledge, and forgotten traditions.

This book begins with a clear conviction: *we cannot tackle the soil crisis in Mediterranean olive groves without understanding the human and geographical context in which that crisis unfolds*. That's why, instead of starting with statistics and technical diagnostics, we begin with people and places. Why does one farmer decide to leave fruit on the ground? What leads another to rely on organic fertilizer without knowing what it truly contains? How do rural abandonment, monoculture, intensification or agricultural policies shape the condition of the soil?

Soil degradation is not just a physical process—it is a symptom of a broader imbalance between land and those who cultivate it. Understanding that imbalance requires close attention to geographic aspects (land use, slope, erosion, climate, infrastructure, water access) and social and economic factors (farm size, decision-making, access to technical knowledge, subsidy policies, local culture).

This book offers an interdisciplinary and place-based perspective across different Mediterranean landscapes and realities of the same: a reading of soil through the lens of land and people, as a necessary foundation for designing realistic, equitable, and sustainable solutions.

Only by understanding the full picture can we begin to restore what is now at risk: not just the soil, but the bond between rural communities and their land.

Jaén 30/7/2026 – Antonio José Manzaneda. Soil O-live project Coordinator.