

## **ABSTRACT**

### **DIAGNOSIS OF THE DESERTIFICATION OF THE SOILS USED FOR CITRUS CULTIVATION IN THE MEDITERRANEAN AREA OF SOUTH-EASTERN SPAIN.**

Desertification is a major issue in arid and semi-arid regions due to climate change. The European Union is dedicated to achieving its 2030 Agenda and the Sustainable Development Goals (SDGs), specifically goal 15.3, which aims to “combat desertification, restore degraded land and soil, including land affected by desertification, and work towards a world where land degradation neutrality (LDN) is achieved”. The European Union is currently developing methodologies. This Doctoral Thesis provides valuable experiences that can aid in achieving these objectives. The study monitored eleven “living labs” in the Region of Murcia, covering 220 hectares of irrigated lemon tree cultivation. This region is one of the most sensitive areas in Europe, classified as critical or very critical in terms of desertification, over a period of eight years.

The aim of this study is to diagnose soil desertification in the Mediterranean area resulting from the cultivation of *Citrus limon* L. This serves as an example of the application of the new conceptual model of land degradation neutrality and ODS 15.3.

The objectives of this study are:

1) To conduct a pilot test for diagnosing desertification in citrus cultivation areas with arid or semi-arid climates and under irrigation; 2) Establish a new diagnostic paradigm for desertification and degradation by applying new indicators based on the philosophy of LDN and ODS 15.3.1. 3) Estimate the evolution of desertification in the pilot areas at the 2030 and 2050 horizons.

The diagnostic methodology consisted of data collection, baseline and monitoring, determination of indicator values, and calculation of the transformative impacts of each indicator. The content of the improved text is as close as possible to the source text, and no new aspects have been added. The methodology employed 20 indicators, including carbon as a mitigation indicator (carbon sink), chemical degradation indicators IADQS (salinisation and fertility), and those proposed by LDN: % soil organic carbon, % vegetation cover, and production.

The following conclusions can be drawn from the obtained results:

The diagnosis of the state of desertification has enabled the classification of the 11 living labs into three categories of land degradation, based on evidence.

The developed methodology is appropriate for global planning, but its application must be local. It is an open system that can be applied to rainfed or irrigated soils. The number of IADQS indicators, both state and speed, can be extended, and the LDN integration criteria of “one out, all out” can be applied. This helps to identify not only the hot spots but also the cause or causes of degradation.

The management of organic matter, by adding organic waste and incorporating it into the soil by surface turning, has proved to be one of the fundamental pillars in the fight against desertification, the mitigation of climate change, production as a socio-economic factor and, therefore, for sustainable development.

A new diagnostic paradigm for desertification/land degradation is proposed. This paradigm suggests adding the objective of 'improving sustainability' to the LDN desertification objectives of 'increasing productivity'. This addition will increase the ecosystem services provided by the soil (see Figure 1).

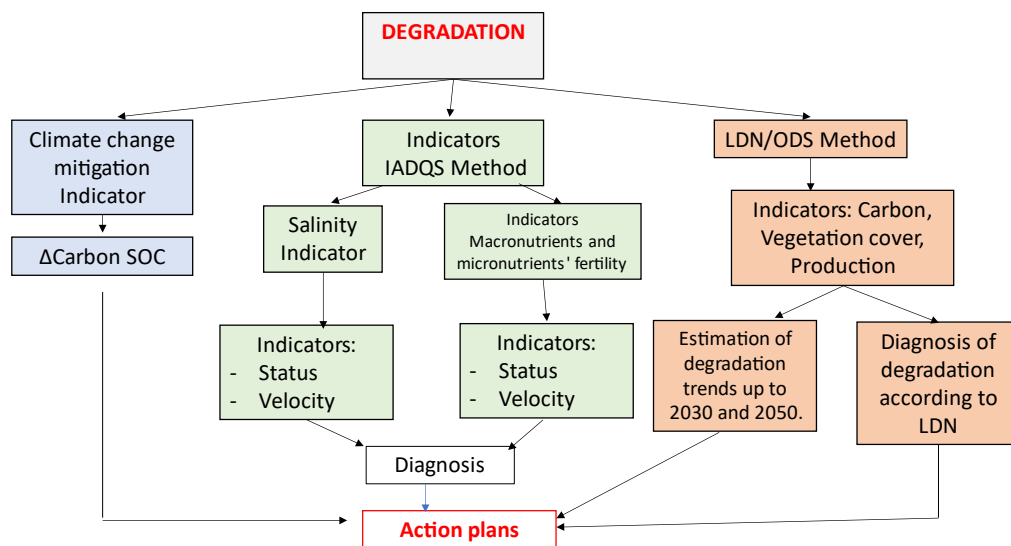


Figure 1. Proposed scheme for diagnosing desertification and soil degradation in *Citrus limon L.* crops for LDN targets and ODS 15.3.1.

Action plans should be created, tested, adapted, and demonstrated on the ground through monitoring. It is important to note that there are no one-size-fits-all solutions to soil desertification.