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MicroLEIS DSS, a sustainable land use and management decision support system for maximizing carbon sequestration

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In the European Union there is presently need to develop and demonstrate technologies for long-term carbon sequestration, which removes greenhouse gases (GHG) from the atmosphere. Carbon Capture and Storage (CCS) technology aims to capture CO2 and store it safely underground, including biomass transformation into long-term carbon storage.

In order to predict the effects of land use change on soil carbon sequestration it is necessary to know the current land carbon stocks. The vegetation carbon stock accounts for an estimated 5 percent or less of total land carbon. On the contrary, the largest land carbon stock lies below ground as soil carbon stock. In this sense, there are some examples for the estimations on soil carbon stocks in UK, 9,800 Mt (millions of tones or Tg); Spain, 3,778 Mt; or Andalusia, 604 Mt. Although the vegetation carbon stock is relatively small, plant matter is the single most important source of carbon inputs to the soil. This organic matter is derived from inputs of leaf, stem and root tissues to the soil that decompose over ten, hundreds and thousands of years. Within the vertical soil profile, the top-soil (0 – 25 cm) is the part most susceptible to carbon disturbance due to land use change, ploughing and runoff. However, significant quantities of carbon are held below these depths (sub-soil: 25 – 50 cm or 50 – 100 cm), and these carbon stocks are also susceptible to disturbance. Each particular soil possesses a limited carbon storage capacity which is a function of the vegetation type, climate, hydrology, topography and the intrinsic characteristics of the soil. Soil organic carbon takes from decades to centuries to accumulate, but carbon losses that result from land use changes that accelerate biotic (decomposition) and abiotic (disturbance, erosion) carbon cycling can occur rapidly, within years.

The balance between inputs of soil organic carbon, primarily from vegetation/land use, and losses, as a result of decomposition, leaching and erosion, determines whether the land is sequestering carbon.

Land use planning can consider strategies to prevent or reduce soil carbon loss as a result of land use and management changes. Also, it is necessary to consider soil carbon stocks and sequestration in the context of climate change and land degradation and their interactions.

MicroLEIS DSS is an agro-ecological decision support system for soil-specific planning of land use changes and soil management programs. The application of this technology aims to optimize biomass production and minimize environmental risks, and presently it is also priority to maximize carbon sequestration. In this sense, preliminary results are obtained for Andalusia region based on standard data base such as CORINE Land Cover, (CLC) and SEIS.net soil data bank as input data in order to be used through Europe.

Keywords: Carbon sequestration, Climate change, CORINE Land Cover, MicroLEIS, Soil.