Soil mapping as a tool for mitigation and adaptation to climate change

Panagiotis Dalias, Marinos Markou and Michalis Omirou

Georeferenced soil sampling and analysis is used today to create digital maps delineating physicochemical characteristics, soil available nutrients and soil organic carbon status of soils. These maps can greatly help farmers and agriculturists in the selection of optimum crop management practices, and policy makers in making critical decisions.

As major carbon storage systems, soils are essential not only for sustainable agriculture but also for climate change mitigation. Information included in soil organic carbon maps for example, can prove a powerful tool to guide decision-making on practices increasing soil carbon sequestration, restoration or preservation of soil carbon stocks. They can be also used to quantify, with a certain precision depending on the spatial resolution, the amount of organic carbon actually stored in the soil up to a certain soil depth and the total sequestration potential. Since countries are required to have a national system of institutional and legal arrangements in place to ensure the proper and timely management on greenhouse gas (GHG) emissions to the atmosphere (mineralization and sequestration of soil organic carbon) digital soil mapping can significantly assist the applied measuring, reporting and verification systems.

Agriculture is accountable for an influential part of all human induced climate gas emissions worldwide. Arable farming emits CO₂ and N₂O, a great part of which is associated with the use of nitrogen fertilizers. Digital maps aided by Geographic Information System databases are included in techniques that aim at reducing GHG by making optimum fertilizer application decisions easier and more accurate. These technologies can result in optimizing returns on inputs of nitrogen whilst potentially minimizing volatilization and leaching losses.

Hence, while maintaining similar yields and reducing production costs, soil fertility maps combined with fertilizer application software can make agriculture respond simultaneously to the food security challenges, depletion of natural resources and climate change.

Land use planning is to guide decisions in such a way that the resources of the environment are put to the most beneficial use for man, and at the same time they are conserved for the future, especially in places such as the Mediterranean coastal area where fields with fertile soils are scarce and where residential and touristic development is still active. Land evaluation supported by digital soil mapping could significantly contribute to the process of land use planning and to optimum decisions related to competing uses for the same part of earth’s surface taking into account goals of adaptation and mitigation to climate change.