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Land evaluation for olive growing after tobacco and its implication on soil erosion

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Fruit and crop cultivation represents the main food source and produce important incomes in many countries worldwide but, in many cases, they can cause soil erosion and lead to extreme land degradation. Understanding and quantifying the impact of land use on soil erosion is essential to achieve sustainable land management. In Umbria region in Central Italy, olive and tobacco are two of the most profitable crops, spread on the slopes of mountains and hills or in the Tiber river valley, respectively. In particular, tobacco production, spread in the last decades along the plains and foothills of the northern part of the region, posed serious threats to the ecosystem, causing soil erosion and representing an alarming source of chemical pollution.

In this study, the environmental advantages of replacing tobacco crop with perennial olive groves were evaluated. For this purpose, a method is proposed, initially, to evaluate land suitability for olive cultivation based on machine learning methods and on a set of geomorphological and climatic variables, and then to evaluate the impact of land use conversion from arable crops to olive groves on soil erosion, using LANDPLANER model and considering different rainfall scenarios. LANDPLANER is able to estimate the effects of rainfall on the triggering of landslides and erosion processes and their competition on the slopes. Results show that such conversion is sustainable for more than 40% of the current tobacco production area and it may reduce soil erosion up to 50%. This study provides a framework that starting from a statistical model for land evaluation for new agricultural purposes, assesses the impact of land use change on soil erosion. It provides a method useful to promote a sustainable use of soil, taking into account also effects of agricultural changes effect on soil erosion and degradation.