Trend analysis and abrupt changes detection using MODIS and Landsat data to support Natura 2000 habitats planning and management in Umbria, Italy

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**Abstract.** Habitats' mapping and monitoring are essential to implement the European Directive 92/43/EEC and protect and manage the Natura 2000 network. Understanding habitat dynamics in space and time is crucial to assess the protection measures' effectiveness and support the definition of sustainable management strategies and practices. Field surveys are needed for habitat detection and identification; however, analyzing trends and processes requires gathering adequate spatial and temporal information, time-consuming and expensive activities, especially when dealing with large areas. Despite the known limitations compared to on-field surveys, Earth observation by satellite remote sensing offers many possibilities for cost-effective, timely, and reproducible vegetation analysis. In this context, this study aims to perform a long-term analysis of vegetation within the Natura 2000 network's areas in Umbria (Central Italy), focusing on grasslands habitats (Annex I types 6210 and 6230\*). The objective is to assess the protection's effectiveness in the last 21 years and gather helpful information to address more sustainable planning and management strategies. We used the NDVI and the EVI indices obtained from the MODIS and Landsat datasets from 2000 to 2021. Satellite data were preprocessed, modeled, and analyzed within the Google Earth Engine cloud platform. We applied the Mann-Kendall test to identify and quantify significative long-term trends and Breaks for Additive Season and Trend (BFAST) algorithm to characterize the trend components further and identify possible abrupt land cover changes. The analysis was performed on all the Natura 2000 areas in Umbria. Results show that combining the two approaches is effective for characterizing long-term trends and identifying rapid and possibly uncontrolled changes. Moreover, this information helps detect the areas where the conservation measures related to the Natura 2000 network have been more (or less) successful and address more appropriate management strategies for grasslands of European concern.

References

Tassi, A., Vizzari, M., 2020. "Object-Oriented LULC Classification in Google Earth Engine Combining SNIC, GLCM, and Machine Learning Algorithms" Remote Sensing 12, no. 22: 3776. https://doi.org/10.3390/rs12223776

Gigante, D., Attorre, F., Venanzoni, R., Acosta, A., Agrillo, E., Aleffi, M.. 2016. A methodological protocol for Annex I Habitats monitoring: the contribution of Vegetation science. Plant Sociology, 53, 77– 87. https://doi.org/10.7338/pls2016532/06