

Rice Farming and Macrophyte Dynamics Monitoring Through Sentinel-2 MSI as a Proxy of Disturbance of Agricultural Practices over an Enclosed Bay

Jesús Soriano-González, Eduard Angelats, Maite Martínez-Eixarch and Carles Alcaraz (Spain)

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SUMMARY

Coastal regions are highly dynamic and productive ecosystems with high ecological and economical value. Given the co-existence and interaction of different human activities, both in land and on sea, it is a priority an Integrated Coastal Management (ICM) ensuring their sustainability. In this sense, in the biosphere reserve of the Ebro Delta (NW Mediterranean, Spain), natural ecosystems co-exist with human economic activities. Rice farming is the main activity on the area and is likely to have environmental impacts on coastal areas such as bays, where paddies irrigation channels discharge. Therefore, understanding the interaction between rice farming and the coastal ecosystem is essential for developing an ICM. With this aim, we monitored rice paddies, by using remote sensing data, and macrophytes (seagrass meadows and macroalgae mats) in the Delta-Bay system (Alfacs Bay), as disturbance indicator. Using Sentinel-2 MSI imagery, rice growing dynamics and crop phenology were characterized through the Normalized Vegetation Index (NDVI) and Normalized Water Index (NDWI) over a two-year period. Agricultural management practices such as fertilization were obtained from farmers. For aquatic vegetation, after atmospheric correction for ocean colour remote sensing, spectral band combination of Sentinel-2 MSI together with field observations were used in a supervised classification method to assess the spatial coverage of seagrass and macroalgae communities. The combination of NDVI and NDWI proved to be suitable to identify hydroperiod and crop phenology of rice paddies. The supervised classification of the bay's vegetation showed spatiotemporal dynamics related with previous results in scientific literature. Aquatic vegetation presented a different temporal pattern in the northern than in the southern margin of the Alfacs Bay, which can be related to rice crop growing cycle. In the northern margin, where rice irrigation channels flow out (i.e. freshwater, nutrients, etc.), overgrowing macroalgae episodes occurred. However, in the southern margin, without the direct impact of the irrigation network, overgrowing-macroalgae was not reported. These results highlight the need for a global management strategy to ensure the sustainability of both human economic activities and natural systems and prove the suitability of Sentinel-2 as a support tool for future policy decision making.

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