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O_2 consumption and heterogeneity in time and space of sediments under eight different land use

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This work presents to the best of our knowledge the first study to account for spatial and temporal distribution of O_2 consumption from different soil sites under contrasting land use. Using the Vivisens sensor from Presens, which combines optical sensor foils with imaging technology, O_2 maps were determined in 8 different soil types representing different land uses with different substrates (glucose, humic acid and DI water) at an interval of 30 seconds for total 40 minutes (post-addition). Each treatment was replicated three times and pure sand and silt with little or no microbial activity were used as controls for comparison. Soil land use included forest (3, old, well developed and recent forests), cropland (2, conventional and non-conventionally treated), swamp, river-bed and a fallow land (with weeds). Our hypotheses were that i) land use will have an effect on soil O_2 consumption rate, ii) the soils under contrasting land-use will vary in their responses to different substrates and iii) at a given time point, the soils will exhibit spatial heterogeneity in their O_2 utilization behavior. Results showed that the land-use had an effect on soil O_2 consumption and thus metabolic rate. The soils turned anaerobic faster with glucose than with other substrates however with few exceptions such as the soil from swamp and that from old and well-developed forest with holm oaks did not show a considerable variation in its response to the addition of glucose and humic acid. The soils from the fallow field with weeds remained unresponsive to addition of all 3 substrates whereas a distinct substrate-effect was observed in the sediment from the adjacent cropland soil. The 3D plots obtained using the pictures at different time points (2 per sediment) established the spatial heterogeneity of soils in terms of their activity and O_2 consumption rate.