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Three-dimensional reconstruction techniques to study ditches eco-hydrology

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Agricultural ditches are common linear features of cultivated landscapes assuming several primary functions: soil water drainage, retention of pollutants, soil erosion prevention. In Mediterranean hilly areas, ditches shape a network over a catchment in order to convey surface runoff out of the plots during short but intense storms. Furthermore, these man made ditches provide valuable habitat for fauna and flora. Our study aims at exploring how the hydraulic functioning of ditches is affected by biotic activities occurring at ditch scale, such as plant development (canopy height, vegetation covering and blockage factor which is the fraction of the channel cross-section blocked by vegetation, which all determines the flow resistance due to vegetation) and soil disturbance by burrowing herbivores. To this end, we applied a stereophotogrammetric study to monitor vegetation and ditch geometry on a 100 meters long ditch segment. The study was conducted from April to December 2014 on an agricultural ditch in South of France. Plant species were collected for referencing and manifestation of soil disturbance by Mediterranean Pine Vole were noticed. The data collected gathered a chronosequence of twenty point clouds at 1 mm resolution. Clouds coherence and precision were confronted to Terrestrial Lidar Scans acquired in April and September 2014 for validation. Clouds were classified to disentangle the ground from the canopy vegetation . The Pine Vole excavations and the plant species were classified inside the ground and vegetation clouds, respectively. Different vegetation metrics related to ditch hydraulics were estimated and map from the chronosequence : the canopy height dynamics, the vegetation cover dynamics and the blockage factors dynamic.. Vegetation metrics appears to be highly variable temporally and spatially, mainly due to plant development and species traits. Thanks to these three-dimensional reconstruction techniques, data clouds at high resolution linked to hydraulic parameters offers new opportunities to better understand and simulate the hydraulic functioning of ditches affected by biotic activities.