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Dynamic LiDAR-NDVI classification of fluvial landscape units

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The lower basin of the Coatzacoalcos River is a wide floodplain in which, during the wet season, local and major flooding are distinguished. Both types of floods, intermittent and regional, are important in terms of resources; the regional flood sediments enrich the soils of the plains and intermittent floods allow obtaining aquatic resources for subsistence during the heatwave. In the floodplain different abandoned meanders and intermittent streams are quickly colonized by aquatic vegetation. However, from the 1990s, the Coatzacoalcos River floodplain has important topographic changes due to mining, road and bridges construction; erosion and sedimentation requires continuous parcel boundaries along with the increasing demand of channel reparation, embankments, levees and bridges associated to tributaries. NDVI data, LiDAR point cloud and various types of flood simulations taking into account the DTM are used to classify the dynamic landscape units. These units are associated to floods in relation with water resources, agriculture and livestock. In the study area, the first returns of the point cloud allow extracting vegetation strata. The last returns correspond to the bare earth surface, especially in this area with few human settlements. The surface that is not covered by trees or by aquatic vegetation, correspond to crops, pastures and bare soils. The classification is obtained by using the NDVI index coupled with vegetation strata and water bodies. The result shows that 47.96% of the area does not present active vegetation and it includes 31.53% of bare soils. Concerning the active vegetation, pastures, bushes and trees represent respectively 25.59%, 11.14% and 13.25%. The remaining 1.25% is distributed between water bodies with aquatic vegetation, trees and shrubs. Dynamic landscape units' classification represents a tool for monitoring water resources in a fluvial plain. This approach can be also applied to forest management, environmental services and habitat analysis. Thus, the unsupervised LiDAR-NDVI approach coupled with flood simulation developed here, allows studying environmental behavior without introducing subjective considerations.