Dynamics of riparian plant communities, a new integrative ecohydrological modelling approach

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The Riparian Vegetation Dynamic Model (RVDM) integrates the impacts of the hydrological extremes on the vegetation, the vegetation evolution and the competition between different vegetation classes. Considering a daily time step and a detailed spatial resolution, RVDM allows the analysis of the dynamic vegetation distribution in riverine areas during a simulated period. The riparian vegetation wellbeing and distribution are considered to be conditioned by the river hydrodynamics in RVDM. Using biomass loss functions, the stress caused by hydrological extreme events is translated into changes on the distribution of the vegetation. These extreme events are considered as removal and asphyxia associated to floods, and wilt related to droughts. The variables considered to determine the impacts are water shear stress, water table elevation and the soil moisture, respectively. RVDM includes the modelling of the natural evolution of the vegetation. The potential recruitment in bared areas, the plant growth and the succession/retrogression between plant categories are included in the model conceptualization. The recruitment takes place when seeds presence, germination and seedlings establishment overcome, so it depends on the plant reproductive period and the environmental conditions. Light use efficiency determines the vegetation growth in terms of biomass production while the soil moisture limits this biomass production and the successional evolution. Finally, the competition modelling considers the advantages between successional patterns under the specific soil moisture conditions of each unit area. Several meteorological, morphological, hydrological and hydraulic inputs are required. In addition, an initial vegetation condition is required for RVDM to start the simulation period. The model results on new vegetation maps that are considered as new inputs in the next model step. Following this approach the model simulates iteratively al the processes day by day. This model represents an improvement respect to previous models in the way of understanding the riparian dynamics. Currently, RVDM has been already implemented in a Mediterranean semi-arid river reach and a sensitivity analysis to analyze the influence of the different vegetation parameters has been performed. The good results obtained indicate that the model is suitable for scenarios analysis and for environmental flows establishment.