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Calibration of a stochastic model for riparian vegetation dynamics from LiDAR acquisitions

Melissa Latella, Matteo Bernard Bertagni, Paolo Vezza, and Carlo Vincenzo Camporeale
Politecnico di Torino, DIATI, Torino, Italy (melissa.latella@polito.it)

The distribution of phreatophyte riparian vegetation can be described by a stochastic model for vegetation growth. According to this, vegetation dynamics are influenced by the topography of the riparian transect and the randomness of hydrological fluctuations, acting as a dichotomous Markov noise. Also, the response of vegetation to this forcing, i.e. its rate of growth and decay, depends of its intrinsic biological features, which are represented in the model by specific input parameters. Despite most of these parameters has already been set and literature value provided for the most common tree species in riparian environments, the one representing the vegetation decay still needs to be properly calibrated.
To this purpose, a segment of Cinca River (Spain) is here modelled, aiming to obtain a calibration of the decay rate of riparian vegetation in temperate climate. The choice of the study river was done according to the availability of hydrological and LiDAR data. The processing of LiDAR raw data allowed to define the digital terrain model of the study area, providing the geometrical input data of the model. Moreover, LiDAR acquisitions returned a measure of vegetation height and its spatial density, thus leading to the estimation of riparian above-ground biomass, which represents the model output. As the decay rate was the sole unknown parameter for the modelling of the study river, its calibration was possible. Furthermore, as LiDAR provided a highly detailed geometry, the outcome of calibration was not a single value of decay rate for the entire riparian corridor, but a set of values for increasing altitude bands, thus allowing the investigation of its relation with topographic position.