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Recovery times of riparian vegetation

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Riparian vegetation is a key element in a number of processes that determine the eco-geomorphological features of the river landscape.
Depending on the river water stage fluctuations, vegetation biomass randomly switches between growth and decay phases, and its biomass exhibits relevant temporal variations.
A full understanding of vegetation dynamics is therefore only possible if the hydrological stochastic forcing is considered.
In this vein, we focus on the recovery time of vegetation, namely the typical time taken by vegetation to recover a health state starting from a low biomass value (induced, for instance, by an intense flood).
The minimalistic stochastic modeling approach is used for describing vegetation dynamics (i.e. the noise-driven alternation of growth and decay phases). The recovery time of biomass is then evaluated according to the theory of the mean first passage time in systems driven by dichotomous noise.
The effect of the main hydrological and biological parameters on the vegetation recovery was studied, and the dynamics along the riparian transect was described in details. The effect of climate change and human interventions (e.g., river damming) was also investigated.
We found that: (i) the oscillations of the river stage delay the recovery process (up to one order of magnitude, with respect to undisturbed conditions); (ii) hydrological/biological alterations (due to climate change, damming, exotic species invasion) modify the timescales of the recovery. The result provided can be a useful tool for the management of the river. They open the way to the estimation of: (i) the recovery time of vegetation after devastating floods, clear cutting or fires and; (ii) the timescale of the vegetation response to hydrological and biological alterations.