Analysis of the riparian vegetation dynamics through the RIPFLOW model. Climate change scenarios in three European countries.

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The RIPFLOW model is a useful tool for the simulation of riparian vegetation distribution in space and time. This model simulates the vegetation succession or retrogression in response of physical parameters. Beside its scientific value, this is a practical tool to tackle water management issues and restoration projects results uncertainties. RIPFLOW has been applied in the Alpine region and in Mediterranean semiarid environments with satisfying results. The study sites are Terde, Ribeira and Drau. Terde is a natural stretch of the Mijares River within the Júcar River Basin District (Spain). Ribeira is also a natural stretch located in the unregulated course of the Odelouca River basin (Portugal). The Austrian site lies along the upper course of the Drau River and it is a free flowing reach which has been restored 10 years ago. Two climate change scenarios were analyzed for each study site. In the climate change scenarios set up the hydrometeorological series were adapted to consider the monthly variations expected by the HadCM3-PROMES regional climate model for Spain and HadCM3 for Portugal. We selected SRES A2 and SRES B2 as the more probable pessimistic and optimistic emission scenarios respectively, both for the same 2070-2100 period. The analysis of those scenarios required the comparison with the reference period results (1960-1990). The Austrian partner applied instead the GCMECHAM5 climate model, using the results of scenario A1B as optimistic and A2 as pessimistic climate change options. The reference period was the same as the described for the Mediterranean sites. The results from the climate change scenarios analysis were coherent in both Mediterranean study sites, Terde and Ribeira. Both scenarios showed a river channel widening with substantial decrease of the early succession phases, leading to species lost, aging of the remaining riparian vegetation and spreading of upland forest inwards the river. This trend was more pronounced in the worst scenario, suggesting that extreme climatic change will promote the disappearance of pioneer or young succession stages of the riparian woodlands in Mediterranean rivers. The simulations of the Austrian case study highlight a stationary percentage composition of the older succession phases which are not heavily affected even by large floods. On the other hand, the younger succession phases abundance fluctuate in response of the flow variations determined by the climate change scenarios. In addition, those scenarios produced a generalized reduction on evapotranspiration rates in the stretches, harder during dry years and for the pessimistic scenario. Although there were important differences between scenarios results, they were lower as expected in spite of the great variations between hydrological inputs of each scenario definition all over the simulation periods.