



Analysis of the riparian vegetation dynamics through the RIPFLOW model. Disturbed flow scenarios in Mediterranean rivers.

Alicia García-Arias (1), Félix Francés (1), Francisco Martínez-Capel (2), Rui Rivaes (3), Patricia Rodríguez-González (3), Antonio Albuquerque (3), and Teresa Ferreira (3)

(1) Research Institute of Water Engineering and Environment, Universidad Politécnica de Valencia, Spain (algarar2@posgrado.upv.es), (2) Research Institute for Integrated Management of Coastal Areas, Universidad Politécnica de Valencia, Spain, (3) Forest Research Centre, School of Agronomy, Technical University of Lisbon, Portugal

The RIPFLOW model simulates riparian vegetation distribution in space and time. It takes into account the vegetation succession or retrogression in response of physical parameters. Beside its scientific value, this is a practical tool to manage the water resources of rivers with different characteristics. The study sites are Terde, a natural stretch from the Mijares River (Spain), and Monte da Rocha, a river course regulated by the upstream (approximately 1km) Monte da Rocha dam in Sado river (Portugal). The disturbed flow analyzed scenarios were two for each study site. The first one took into account the regulation by a dam and the second one considered an established environmental flow with monthly variability. Both scenarios results were compared to the natural flow simulation results. The flow regulation scenario in Terde took as reference the Arenós dam regulation, located in the Mijares River downstream the Terde stretch, between 1988 and 2006. The establishment of the regulated daily flow in Terde considered the regulated daily flow in Arenós and the ratio between the global contribution in Terde and the global contribution in Arenós (inflow to the reservoir) for each year. Monte da Rocha took into account as flow regulation scenario the flow regime exerted by the Monte da Rocha dam in the last 10 years period. The environmental flow establishment methodology was proposed by the water administration of the Júcar River Basin, and it is based on studies of physical habitat simulation. Considering the minimum flow (0.203 m³/s), correspondent to the month of minimum monthly average (September), the environmental flow in every other month should follow a pattern of variability similar to the natural flow regime. For this reason, the environmental flow for each month (except September, minimum) was calculated as the product of the minimum and a variability factor. This variability factor was calculated from the natural flow regime (monthly data), as the squared root of the ratio of each monthly average to the minimum monthly average flow. The analysis of this scenario included the period between 1988 and 2009. For Monte da Rocha the minimum environmental flow was calculated using the Portuguese national methodology proposed. The regulation scenario results showed differences in those areas near the stream affected directly by high values of shear stress, especially after very wet years. The shear reduction due to the theoretical regulation favoured the succession evolution and consequently reduced the presence of initial and pioneer zones. The Monte da Rocha regulation scenario results were in accordance with the vegetation assessment performed in 2010. This result confirmed once more the predictive potential of this tool allowing an adequate water management considering the fluvial ecosystems, and using the succession phases performance well characterized by the model. In the regulated flow scenarios analysis, the evapotranspiration was reduced near the stream and increased in further zones during very wet years. On the contrary, dry years result showed an increasing evapotranspiration on the stream surrounding areas while the natural flow allowed higher levels in remote areas. The environmental flow scenario results indicated that in semiarid Mediterranean environments, low flow values are enough to allow the succession evolution, with no clear tendencies for evapotranspiration rates near the stream, some of them higher than the natural flow regime rates and others very lower. The water managers should take into account that although the riparian ecosystem evolution seems to be favoured with minimum ecological flow establishment, no retrogressions finally cause that the terrestrial vegetation replaces the riparian one. Although there were important differences between scenarios results, they were lower as expected.