



Monitoring vegetation growth and morphodynamic effects after stream restoration

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Vegetation processes are widely recognized as a key component on the ecological and morphological development of river channels. Moreover, plants reduce flow velocities and bed-shear stresses by increasing the local hydraulic roughness and thus increasing water levels. Therefore, monitoring the vegetation development is an important activity in river management not only for protecting ecological services, but also in flood risk reduction; especially in times of a changing climate. This paper presents the analysis the effects of riparian vegetation growth on the morphology of a lowland restored stream located in The Netherlands, the Lunterse beek. An Unmanned Aerial Vehicle (UAV) was used to obtain aerial imagery at different time steps which was the basis for generating land cover maps with semi-automated image classification. In addition hydrological series and multi-temporal high-resolution bathymetric data allowed analysing river bed morphology and the relevance of seasonality. The UAV campaigns were found a crucial step to ease the vegetation mapping and monitoring. The morphological change observed in this stream, represented by the channel-width adjustment and the cross sectional evolution, is slowed down once vegetation is established on the stream. Results of this work show that the vegetation root system assert a strong control on soil stabilization, even during the winter season when the plants biomass is highly reduced. Seasonal variations in plant development appear important only during the first stages of establishment, when vegetation has a low density and, more importantly, a root system that is not fully developed yet.