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Land use and land cover change processes in small watersheds: A strategy for identifying patterns and hotspots at continental scale

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Land use and land cover change (LULCC) significantly affects the drainage characteristics of catchments. Consequently, this may alter both the availability of surface water and groundwater and the vulnerability of certain areas to extreme hydrological events (e.g. pluvial flash floods due to the altered catchment hydrological response). These effects of LULCC can vary considerably from place to place, thus site-specific studies are required to investigate their impact in combination with those effects produced by other stressors (Mensah et al., 2022). Nevertheless, conducting such detailed studies will require considerable resources and time. Therefore, it is relevant to identify patterns and hotpots to better inform decision making when it is necessary to focus or save efforts in this regard. Considering this, a strategy has been proposed to be implemented for analysing the impact of LULCC processes on the hydrology of small watersheds in several European countries over the last three decades.

The impact on the drainage characteristics are determined using a hydrological model based on the SCS Curve Number (CN) approach. This approach and methods based on CN are widely used to analyse the impact of LULCC; and indeed, it has been successfully used to analyse the impacts of urbanisation on surface runoff in the contiguous United States (Chen et al., 2017). Unlike other studies, where the main unit of analysis was administrative units, this research focusses on small watersheds. Consequently, watersheds in which LULCC has occurred can be selected and modelled independently. This approach helps to reduce the masking of effects that may be present when modelling LULCC-affected watersheds together with non-affected watersheds. Although impacts on runoff were analysed, the discussion focusses on the variation of the CN, since the SCS-CN method has limitations and it has shown slightly less accurate results than other alternative and derived methods (Walega & Salata, 2019).

For the analysis of LULCC processes, categories of change processes were defined on the basis of the 44 CORINE's thematic classes around sub-groups of interest, considering their hydrological characteristics (expected level of water retention). For classes that suppose a more intense anthropogenic intervention (artificial surfaces and agricultural areas), the discretisation of LULCC processes were defined in more detail. Discussions and conclusions were drawn on how processes such as deforestation, regeneration and reforestation/revegetation of burnt areas,

urban densification, green urbanisation or changes in crop types have affected the different drainage areas analysed around Europe.

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