Virtual Forest Clearcutting: Modeling the Effects of Forest Harvest on Streamflow through Parameter Regionalization

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Forests provide a number of important water-related ecosystem services and play an important role as controllers of the hydrologic cycle. Catchment experiments have found evidence that changes in forest cover can alter streamflow regimes. But can effects of forest harvest on streamflow regimes also be predicted with help of a modeling approach? In this contribution we demonstrate that parameter regionalization of a hydrological model is a promising method to perform virtual forest clearcutting, because it relates the calibrated model parameters to a catchment's physical properties. We analyzed the hydrological behavior of 14 partially-nested catchments in Northern Sweden with slightly different topography, land cover, size and geology. For each catchment, the conceptual hydrological HBV light model was calibrated and parameters sensitive to forest cover percentage were identified. By modifying these parameters according to their statistical relationships with forest cover, we seek to virtually harvest the forest in each catchment and to simulate the consequences for streamflow. This approach can be easily applied to other regions or up-scaled to larger areas and, thus, theoretically allows the prediction of forest clearcutting effects on streamflow.