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Hydrological behaviour of a forested catena

D. Deraedt (1), F. Ridremont (2), H. Claessens (2), and A. Degré (1)

(1) Soil – Water Systems, GxABT, Univ. Liège, Gembloux, Belgium (deborah.deraedt@ulg.ac.be), (2) Forest and Nature Management, GxABT, Univ. Liège, Gembloux, Belgium

At the time when the significance of water becomes more than obvious, we realize the utility of models that describe hydrological phenomena and that permit the optimization of water management. The soil properties, as they have an influence both on hydrology and on plant development, are an element really essential in this type of model. But, as for tree characteristics, these properties are spatially and temporally variable. Therefore this research will specially focus on the case of forested slopes.

The study will be divided into three parts. The first will characterize the vertical and the horizontal heterogeneity of the structural and hydrodynamic properties of soil. To do this, in addition to the analysis of the soil sampled along the slope, moisture sensors will be installed on different places on a slope and on different depths. For the greatest part it will be capacitive sensors whose values will be confirmed by TDR sensors. Each sensor will be inserted to cover the largest pedological and topographic variability. The second part of the study will permit to characterize the water flux repartition into the horizons down the slope. We will therefore apply a dye to surface on the top of the slope. The bottom of the slope will be equipped with an experimental system which collects water for each soil layer. The third parts will deal with the forest stand heterogeneity along the slope. We will measure characteristics such as tree height, roots repartition, stem circumference and also for different periods of the year, leaf area index (LAI). At the end of the research, we will measure tree rings for a dendrochronolocical study.

The collected data will be analyzed to determine the slope effects on the soil properties, on the water flux distribution into the soil layer and on the tree characteristics. Afterwards the relations and the interactions can be conceptualized and introduced into a physical hydrological model.

The studied slope is located on the Houille watershed in the West of the Belgian Ardenne. The site is situated under a Douglas fir cover (Pseudotsuga menziesii (MIRB.) FRANCO). It is about 170 meters long with an average slope of 25%.

There are only few studies that attempt to connect physical models and the tree growth at the slope scale, leaving a vast untapped investigation area in the hydrological modelling. The study of this variability would afford possibility to improve hydrological models. From the point of view of the climate change, such a model would e.g. determine the best adapted species to each forest site.