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Building a conceptual framework for evaluating human-induced hydrological changes during the last millennium in the Mol-Dessel area (NE Belgium)

Koen Beerten, Bertrand Leterme, and Diederik Jacques
SCK-CEN, Institute Environment-Health-Safety, Mol, Belgium (kbeerten@sckcen.be)

During the last millennium, the surface environment of the Campine area, NE Belgium, underwent an enormous transformation from an open heather-dominated landscape with pristine Holocene soils and topography to a fragmented landscape with multiple land uses (forest, build area, heather, pasture, artificial lakes...), and heavily disturbed soils (degraded podzols) and topography (drift sand accumulation, ditches, sand quarries...). This transformation is expected to have caused an important change in the regional water balance and groundwater table depth. Understanding the mechanisms and processes that govern such changes is necessary to build a strong phenomenological basis for predicting future hydrological conditions as a result of landscape development (land use and land cover change.
Here, we present the results of the detailed landscape reconstruction of a sandy interfluve in the Nete catchment and assess conceptually the hydrological impact of this human-induced landscape transformation.

Historical maps, land use data, DTM's and detailed soil and geomorphological data (Beerten et al., 2012; Vandersmissen et al., submitted) were used to produce a set of relevant snapshots over the last 1000 years that are thought to be representative for a given hydrological condition at the studied interfluve.

The first geomorphic change investigated is the development of a human-induced drift-sand landscape between 500-250 years ago. The main impacts on the local hydrological conditions are assumed to be the modification of the shape of the groundwater table (being a subdued replica of topography) and the loss of the hydraulic barrier function of podzol soils during extreme events, due to podzol degradation.

Undoubtedly, reforestation of the interfluve during the second half of the 19th century had an impact on local recharge rates (i.e. decreasing recharge), resulting in a deeper groundwater table. The construction of ditches, up to 50 cm deep, to drain the newly established pine plantations, would certainly have amplified the lowering of the groundwater table. In the course of the 20th century, the construction of sand pits and the development of new industries (build area) have probably compensated the gradual deforestation with respect to the local hydrology.

The hydrological changes associated with the profound human-induced transformation of the landscape seem to have left traces in soil profiles. Clear discrepancies between the position of the present-day groundwater table and the position of palaeo-wetness indicators can be observed.

References

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