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Late Holocene sediment budgets of the Geul River catchment, the Netherlands; an example of human influences on valley development

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The attractive landscape of the cross-bordering Geul River valley (the Netherlands and Belgium) provides excellent conditions for agriculture and tourism, but the Geul River is also the subject of many nature protection projects. The combination of commercial use and conservation in the Geul River valley is very important, but also very difficult. To support a sustainable development of the Geul River valley, we must understand the past and present processes in the river valley and the main factors influencing these processes.

In this case study (part of the Ways of Water project), we use the fluvial deposits from the Geul River to determine, quantify and model the impact of changes in climate and land use on fluvial processes and catchment development for the Geul River. A combined approach of field and modeling studies is applied.

The field results clearly illustrate the young and dynamic character of the Geul River and the effects of land-use changes on sediment yield. At several locations 2-5 meters of fine grained overbank sediments have been deposited since early medieval times, associated with large scale deforestation. The field results also show that the Geul River has very likely been an active lateral migrating river before medieval times with just little sedimentation during longer periods.

A spatially distributed soil erosion and sediment delivery model (WATEM/SEDEM)

was used to calculate hillslope sediment delivery to the river channels in the Geul catchment. Several different land-use scenarios were run with the model to illustrate the human impact on valley sedimentation. Predicted amounts of sediment being delivered to the river are compared to the actual amounts of sediment stored in the valley. By this means we can calculate the amount of sediment transported downstream by the river and thus determine the river's capability to handle large sediment fluxes.

With the combined approach of field and modeling studies we show that a dramatic increase in sedimentation took place during the Medieval Period as a result of large scale forest clearings in the catchment area of the Geul River. The deforestation (in combination with heavy rain) resulted in the activation of several large alluvial fans. The results show that the Geul River catchment is highly sensitive to changes in land-use. Further modeling studies will test the sensitivity of the catchment to changes in climate.