From Mudflow Prevention to Ecosystem Services Development, The Melsterbeek catchment, Sint-Truiden, Belgium

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Short title: Changed agro-management to prevent muddy floods, Belgium

Key Message: With the help of inhabitants and local governments, multi-functional soil conservations measures were implemented.

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What was the problem?

The city of Sint-Truiden is situated in the eastern part of the Belgian Loess plateau. It has a gently rolling landscape, dissected by streams draining water to the North. Annual mean precipitation ranges from 700–900 mm (Hufty, 2001). Loess is very susceptible to soil erosion, but due to its high soil fertility, there is a long agricultural tradition in this region. Arable land covers 65% of the total surface (Statistics Belgium, 2006). During the last three decades, the area covered by summer crops (sugar beet, maize, potatoes. and chicory) increased at the expense of winter cereals (Evrard et al., 2007). These summer crops provide little cover to the soil during the thunderstorms that occur during late spring or early summer. During intense rain storms, soil crusts with very low infiltration capacity are formed, resulting in high quantities of runoff (Evrard etal., 2008a). Almost 79% of the municipalities in Belgian Loess belt have been confronted with at least one flood caused directly by runoff from agricultural land during the last decade. 'Muddy floods' is defined as water flowing from agricultural fields carrying large quantities of soil as suspended sediment or bedload (Boardman et al., 2006). During the period 1992-2002, some parts of the city of Sint-Truiden has been affected by muddy floods at least 10 times.

What was done to solve it?

In 1997, the Flemish Government recognised that erosion and muddy floods are a major environmental problem in the Loess plateau. This resulted in the adoption of the 'Erosion Act' in2001, which made funds available for municipalities to implement soil erosion control measures (Evrard et al., in press). The real trigger to start action in the study area was the frequent flooding of the village Velm in 2002. After about 5 flooding events in 2002, the residents organised themselves and pressurized the local authorities to take action. As a result, the city of Sint-Truiden, 4 municipalities and a local water management agency decided to join hands. They set up a common structure to specifically address the problems of soil erosion and muddy flooding. They recruited a full-time soil erosion expert, whose task was to consult with farmers, landowners and relevant authorities (local, provincial, national), to formulate and supervise proposals for mitigation measures, and monitor and coordinate the soil erosion control policy in the Sint-Truiden region. As a result of this policy, this region has by far the most erosion control measures in Flanders. This initiative in the Melsterbeek

catchment was sponsored by the municipalities within this catchment and the local water management agency.

Several types of measures were implemented to mitigate muddy floods. A first type of actions aims at preventing runoff generation. Cover crops during the dormant period and alternative agricultural practices, such as conservation tillage, aim to prevent the generation of runoff. Grassed buffer strips at the bottom of fields (up to 6 m wide and 200 m long) were installed to enhance re-infiltration and to decrease net soil loss (Le Bissonnais et al., 2004). Along the hydrological network, grassed waterways were installed (min. 10 m wide) (Fiener and Auerswald, 2003). Finally, water retention structures (earthen dams) were built in order to buffer runoff and reduce peak discharges in the downstream villages. From 2002 to 2010 almost 20 hectares of grassed waterways, 150 hectares of grassed buffer strips, 40 earthen dams (retention ponds) and 150 ha of conservation tillage have been installed in the catchment. The costs for the implementation of the erosion control measures were financed up to 75 % by different government agencies.

During the monitoring period 2005–2007, several extreme rainfall events (with a maximum return period of 150 years) and 39 runoff events were recorded (Evrard et al., 2008b). However, the measures served their purpose by preventing any muddy flood in the downstream village. Peak discharge (per ha) was reduced by 69% between the upstream and the downstream extremities of the grassed waterway. Furthermore, runoff was buffered for 5 to 12 hours behind the dams, and the lag time at the outlet of the catchment was thereby increased by 75%. Sediment discharge was also reduced by 93% between the grassed waterway's inflow and the outlet, and gullies disappeared from the landscape. Hence, sediment transfer out of the catchment has been dramatically decreased.

What is the result in terms of ecosystem services provision?

At the start of this program, the single objective was to reduce soil erosion and muddy flooding. Other objectives were not considered at the start of the project. However, a few years after implementation of the soil erosion control measures, other benefits became clear as well: such as improvement of downstream water quality; reduction in downstream dredging costs; reduced psychological stress to inhabitants who were frequently threatened by muddy floods; increase in biodiversity (birds and mammals); and enhanced landscape quality due to the new green and blue corridors through the landscape. This certainly contributed to an increase in number of bikers and hikers who are exploring the area. Local entrepreneurs responded on this trend by transforming traditional farms into bed-&-breakfast facilities, and by promoting agro- and eco-tourism. In other words, the strategic intervention in the agro-ecosystem of Sint-Truiden triggered a whole range of primary and secondary benefits for the environment and the society, while the agricultural “disservices” have been significantly reduced. The total cost of the control measures is low (126€/ha/20 years). This figure is low if one compares to the saving of the damage and clean-up costs caused by muddy floods in the study area (54 €/ha/year) (Vandaele et al., 2006) and all the secondary benefits.

However, there are also limits on the multi-functional use of the soil conservation measures. For instance, a grass buffer strip is very effective tool for soil erosion reduction and a safe heaven for agro-biodiversity, but if the grass buffer strip is used too frequently by bikers, hikers or even quads, then it might loose its soil erosion control and biodiversity function. Another issue is that nature conservation organisations propose to use the new “green infrastructure” to further improve agrobiodiversity in the area (e.g. later mowing to increase survival rate of young birds, or planting of shrubs and trees). However, farmers manage the grass in a way convenient to them, and are suspicious about ‘green’ claims on their land. Because of these diverse expectations and claims, there is a potential risk for conflict between stakeholders. This means that the multiple use of the ecosystem services in this area has an optimum range, which needs to be identified and agreed by all concerned stakeholders in order to be sustainable.

What was necessary for this project to be successful?

There are multiple factors explaining the success of this project: Firstly, the serious impact of the mudflows on the daily life of the local inhabitants assured that there was a clear local demand to intervene in the ecosystem. This demand - together with a new legal framework - resulted in a strong institutional backing of the project. Secondly, most farmers felt uncomfortable about the regular negative publicity about their land-use practices, and were open to improve their public image by joining this program. Thirdly, subsidies to change land-use practices and financial resources the project were assured. Fourthly, as the intervention led to an improvement of other ecosystem services, there was an increase in public support for the program. Last but not least, the multi-stakeholder process facilitation was crucial for the process to succeed. This required extensive networking, personal contacts, trust building, signalling to stakeholders that they can influence the process, joint learning and ownership. This was provided by an inspiring 'champion organisation' and process facilitators.

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