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Adoption of SWC measures in South Limburg (The Netherlands): Experiences of a water manager

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ABSTRACT

In the loess area of the southern part of Limburg soil erosion is responsible for damage in the agricultural area and the associated runoff leads to flooding of urban areas and deposition of mud on the infrastructure.

Since the second half of last century erosion hazards and damage have increased, due to more intensive tillage of the soil. With a general use of artificial fertilizers, organic matter content of the soil dropped to critical levels. Besides that, activities in agriculture like enlargement of fields, use of heavy machinery and activities outside the agricultural area like the extension of the built-up area and infrastructure led to less infiltration and consequently to more runoff. The expected change of the climate – more intensive rain showers – may even aggravate the erosion problem in the future. Moreover, the general policy of protection of the urban areas against flooding is developing to a higher protection level.

The public sector is responsible for general policies to control erosion and to bring the damage of flooding back to acceptable levels. The basic principle is to tackle the erosion problem at the source, on the farmer's field with measures among others by the introduction of non-turning-ploughing and mulching and preservation and expansion the area of grassland. At local level, specific erosion control measures and financial arrangements are made. Municipalities are supposed to prepare and guide local level erosion plans, where measures are taken to complement the individual on-farm erosion control measures. Municipalities have to solve small-scale problems (bottlenecks) with local flooding and sedimentation of mud, especially on infrastructure. To prevent flooding the Water Authority has the task to develop the water infrastructure mainly to buffer water and to convey runoff at a safe discharge (grass strips, grassed waterways).

In the combat against erosion the farmers and the farmer's organizations took their responsibility. The efforts resulted in 1990 in an Erosion Ordinance (EO) lately revised in 2003. The EO is primarily a responsibility of the farmer's organisations. In 2000 authorities involved in erosion and flood control signed a covenant in which generic and specific interventions were agreed upon to realize in a period of 4 years. Tough the agreed measures are only partly realized in this period, the intentions of the covenant are still valid. In 2003 the farmer organizations introduced in the revised EO a new instrument: the Farm Erosion Management Plan (FEMP) in which a farmer can take its own responsibility to keep erosion risk at an acceptable level and to organize his own farm strategy. By taking enough measures in the FEMP, the farmer gets dispensation of several measures otherwise due to the EO. Farmers can rely on EU-subsidies when applying erosion control measures (cross-compliance). Both the EO and the FEMP are part of the EU Common Agricultural Policy (CAP).

In spite of legislation, accepted responsibilities at different levels and financial support (incentives), erosion control interventions do not (yet) cover the whole area and not all stakeholders are equally motivated to implement and maintain the measures. In practice monitoring of the fulfilment of the EO and the FEMP is quite complicated, because of scattered land property, the complexity of the instruments and lack of (trained) controllers. At the moment the Water Authority is evaluating the effectiveness of measures taken by the FEMP in relation to general legislation of the EO.

At municipality level several plans to solve the problems at locations where flooding and mud deposition occurs frequently are ready, but lack of funds will postpone execution of some of them.

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Introduction

In the loess area of South Limburg (The Netherlands) soil erosion is responsible for damage in the agricultural area and runoff volumes subsequently cause damage by flooding urban areas and block infrastructure. The magnitude and the frequency of soil erosion events on the fields and occurrence of muddy flows in the villages has increased during the last three decades, due to a general decrease of water storage capacity in the area and a consequent higher rate of surface runoff (Duijsings, 1994; Van Dijk, 2001; Geelen, 2006). This is the result of shorter crop rotations, up-scaling of agriculture, poor soil structure by compaction and a gradual decrease in the area of grassland. With a general use of artificial fertilizers, the organic-matter content of the soil dropped to critical levels, which further contributed to the degradation of soil structure. The expected climate change may even aggravate the erosion problem in the future (Kwaad, 1991; Hooijer et al., 2004; Krahe et al., 2005; Witter et al., 2006; Ward et al., 2008). Wintertime is expected to be less cold and with wetter periods. Summers will have more warm and dry periods as well as more intensive rain showers. Severe thunderstorms pose a high-potential risk of soil erosion and flooding. At least 10% extra discharge volume is expected on top of the design rain shower (30 mm in 20 min, recurrence period 25 years, airport Maastricht—Aachen). In places where runoff concentrates – in natural channels – the risk of gully erosion will increase.

Several severe erosion events at the end of the 1970s and the beginning of the 1980s put soil erosion on the political agenda. Discussion on the extent of negative effects of erosion, however, did not originate from the farmers but from the village inhabitants. They were not involved in the causes of the increased soil erosion, but had to contribute financially to the maintenance of public and private properties, as well as to cope with the annoyance and damage of flooding and mud accumulation.

In the early 1990s the Provincial Authority, the Water Authority and the Agricultural Board started practical erosion research – the “Erosion Normalisation Project South Limburg (ENPSL)” – in which the efficacy of various agricultural measures aimed at reducing water erosion was investigated in detail on field slopes and in fields (Geelen et al., 1995, 1996; Kwaad, 1994; De Roo et al., 1994). Next to insight in tillage issues the research led at catchment level to the development and validation of a simulation model—the Limburg Soil Erosion Model (LISEM) which forecasts flooding and erosion on field locations (De Roo, 1993; De Roo et al., 1996a,b; Jetten and De Roo, 2001; Stolte, 2003; Van Dijk, 2001).

In response to the foreseen increase in soil erosion and flooding, stakeholders in Limburg reacted by enacting legislation, making regulations and arrangements, including executing measures. The conservation actions started at farmer’s level and were after a few years followed by initiatives of the authorities. From then the interventions were integrated.

In order to have more insight in the role of stakeholders in the integrated approach of tackling the erosion problem, the main competencies (related to erosion and flooding) of these stakeholders – authorities with legal power – are given below:

- Provincial Authority: drawing up spatial planning; landscape management; supervision of regional water management; developing soil policy and soil conservation strategies.
- Water Authority: management of surface water; management of water quality; maintenance and strengthening of dikes along main rivers.
- Agricultural Board: looking after the interests of farmers; representation of the farmers in conference with other institutions (stakeholders).
- Land Consolidation Committees: design of consolidation plans; regulation of the execution of consolidation works; designing a new allotment; dealing with objections of land users.
- Municipalities: drawing up a zoning plan for the rural area of the Municipality; drawing up legislation (among other things related to soil erosion and flooding); solve problems on locations where flooding occurs.

The offsite problems caused by flooding and sedimentation in South Limburg are much bigger than the onsite damage. The integral approach and public support contributed very much to alleviate the trouble. The cooperation and the understanding between stakeholder groups were good – in spite of differences in methods of approach – resulting in the remedy of most of the flooding in the last 10–15 years. The establishment of rules and the execution of the conservation work at different levels and scales by all stakeholder groups together can be considered elaborate usefulness of experience for water managers in other countries in the world. Additionally a lot of lessons were learned about the tenability of issuing instructions and rules.

Study area

The south-eastern part of The Netherlands, Southern Limburg (Fig. 1), is characterized by a gently undulating topography (40–200 m above sea level) and the hills are mostly covered with a loess layer of 2–5 m (Bouten et al., 1985). According to current knowledge, loess (aeolian silt) and loess like sediments cover as much as 10% of the Earth’s surface and forms some of the world’s most productive soils. They are the product of the Quaternary Glacial period and the resulting dust accumulation ranging (in Europe) from the maritime areas of NW-Europe (France, Belgium) over Central Europe to the Ukraine and the Russian plains (Haase et al., 2007). The loess soil of Limburg (40,000 ha) – rich in lime, containing >70% quartz grains in the silt fraction (2–50 μm) – is typical of the scattered loess area of north-western Europe. The profile consists of a plough layer which is not very dark and which has rather low-organic matter content, a yellowish subsurface horizon with a weak platy structure and finer textured subsoil with weak but coarse prismatic structure (De Bakker, 1979). Due to the loamy texture, low-organic matter content and rather weak structure, loess soils are very sensitive to water erosion and are prone to slaking.

The present land use in South Limburg is mainly arable crops, nearly 50% of the area, of which is covered by 9% of sugar beets, 21% of potatoes, 26% of silage-maize, 39% of cereals and 5% other crops. Crops of which the cultivation area is increasing are flax, rapeseed, (winter and summer) barley for brewing of beer and some vegetables crops like carrots, leek and chicory. The rest of the study area is mainly grassland (41%) and orchards (8%).

Already in the band ceramic period, Stone Age (about 3000–1500 AD), the first farmers settled in this area. As a result of the natural fertility and easy workability of the soil, this area was colonised in Roman times (around 50 AD). The Roman farms with large fields were in turn surrounded by the small fields of smallholders and the farm labourers. From Medieval times onwards, villages were established along the watercourses in the valleys. Later on villages also appeared on the plateau and the area of arable land increased proportionally (Spaan et al., 2006).

In archaeological studies in valleys in the neighbourhood of Maastricht a clear relation was shown between the thickness of different colluvium layers and the intensity of occupation during the past 7000 years (Meys, 2008). The filling with colluvium during the last two centuries had a magnitude that was never shown before during the occupation history of this area (Kerkstra et al., 2007).