Geophysical Research Abstracts
Vol. 19, EGU2017-10703, 2017
EGU General Assembly 2017

Irrelevant water-management scales for flood prevention, water harvesting and eutrophication control.

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This poster will give three examples of popular water-management methods, which we discovered had very little effect in practice because they were applied on irrelevant scales. They all use small scale solutions to large scale problems, and did not provide expected results due to neglecting the magnitude of components in the large-scale water budget.
1) Flood prevention: ponds are considered to be able to buffer water discharge in catchments and was suggested as a measure to reduce the 20-years return floods in an exposed areas in Sweden. However, when experimenting with several ponds allocation and size in a computational model, we found out that ponds had to cover 5-10% of the catchment to convert the 20-yr flood into an average flood. Most effective was to allocate one single water body at the catchment outlet, but this would correspond to 95 km2 which is by far too big to be called a pond.

2) Water Harvesting: At small-scale it is designed to increase water availability and agricultural productivity in smallholder agriculture. On field scale, we show that water harvesting decreases runoff by 55% on average in 62 investigated field-scale trials of drainage area $\leq$ 1ha in sub-Saharan Africa (Andersson et al., 2011). When upscaling, to river basin scale in South Africa (8–1.8$\times$106 km2), using a scenario approach and the SWAT hydrological model we found that all smallholder fields would not significantly alter downstream river discharge (<0.3% change on average with some effect on low flows). It shows some potential to increase crop yields but only in some water-scarce areas and conditioned on sufficient fertilizers being available (Andersson et al., 2013).

3) Eutrophication control: Constructed wetlands are supposed to remove nutrients from surface water and therefore 1,574 wetlands were constructed in southern Sweden during the years 1996-2006 as a measure to reduce coastal eutrophication. From our detailed calculations, the gross removal was estimated at 140 tonnes Nitrogen per year and 12 tonnes Phosphorus per year in these wetlands. However, this only reduced the load to the sea by 0.2% for nitrogen and 0.5% for phosphorus (Arheimer and Pers, 2016). The wetland area was minor compared to the total area and load (41 km2 vs. 164,000 km2). For the eventual effect in the coast, additional consideration must be taken to the coastal nutrient balance as inflow from the sea may effluent the effect, even in protected archipelagos and semi-enclosed bays (Arheimer et al, 2015).

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