

Amending Water Quality through Nature-inspired Principles – an Overview



ALSBAACH, C.M.E.¹, DEKKER, S.C.¹, LUTZ, S.R.¹, ROZEMEIJER, J.C.²

¹ Copernicus Institute of Sustainable Development, Utrecht University, Princetonlaan 8a, 3584CB Utrecht, The Netherlands

² Subsurface and Water Quality, Deltares, Daltonlaan 600, 3584 BK Utrecht, The Netherlands

Contact: c.m.e.alsbach@uu.nl

Take-away

We have found seven measures that can **improve water quality**.

We expect that we can prioritize those measures by expert knowledge and literature review.

We would like to have your opinion as an expert! See bottom of the poster for more

Background

The hydrological and nutrient cycles in agricultural catchments have been impacted drastically by human intervention, causing a decline in water quality.

As climate change is only expected to increase the pressure on water quality¹, it is of great importance that we identify ways in which we can improve and maintain water quality for future generations.

Why nature-based?

- Often **cheaper** than technical equivalents
- **Highly efficient** at nutrient removal and retention
- Wide range of **side-benefits**, such as increased biodiversity and carbon capture
- Positively influence the hydrological cycle, which **increases climate resilience**
- Can help close **nutrient cycles**

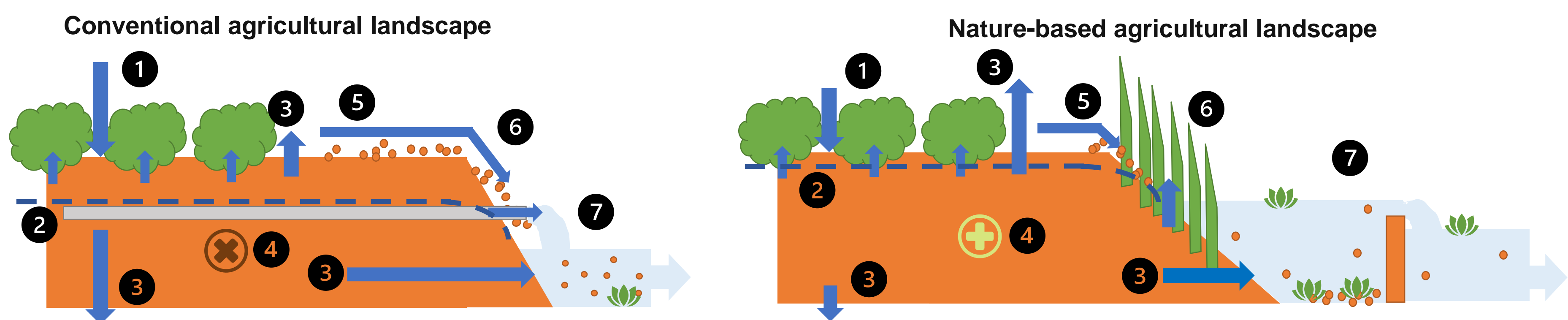


Figure 1. Nutrient dynamics in the current and proposed agricultural landscape of Dutch sandy soils. Arrows convey direction and magnitude of nutrient transport, though they are not proportional. Description of numbers can be read in Table 1.

Table 1. Explanation of nutrient processes as shown in Figure 1.

Conventional	Nature-based
<p>1 Conventional agriculture often uses considerable quantities of (artificial) fertilizer, of which only part can be taken up by crops.</p>	<p>Application of carbon-rich fertilizer and organic amendments stimulate soil health and slowly release nutrients over time.</p>
<p>2 Drainage artificially lowers the groundwater level, allowing for quick delivery of nutrients to nearby channels, with little chance for denitrification or retention of nutrients.</p>	<p>Removal of drainage heightens the water table. This increases water availability during dry times and enhances denitrification.</p>
<p>3 Low groundwater table and poor soil health reduces denitrification (returning nitrogen to the atmosphere) and nutrient retention, enhancing nutrient losses.</p>	<p>Eluviation is reduced due to increased denitrification and reduced nutrient losses due to increased soil health and higher groundwater tables.</p>
<p>4 Conventional agriculture is often associated with poor soil health due to compaction, decreased carbon stocks, loss of soil structure and reduced soil biodiversity. These factors contribute to reduced nutrient retention capacity.</p>	<p>By shifting to less intensive farming methods, soils become healthier: less compacted, store more carbon, have a better soil structure and a more diverse soil organism community, which contributes to soil nutrient retention capacity.</p>
<p>5 Due to intensive farming, soil structure decreases and soils become more susceptible to erosion. Soils also become compacted and infiltration capacity decreases. Lastly, bare soils surfaces are usually left in winter. As a result, nutrient-rich sediments enter waterways via surface runoff.</p>	<p>By increasing soil structure and infiltration capacity due to less intensive farming practices and organic matter amendments, soil structure improves, occurrences of overland flow decrease and soils become less susceptible to erosion. Winter cover crops protect the soil against erosion in winter.</p>
<p>6 Narrow banks with steep inclines allow for soil erosion and have a draining effect on the bordering field.</p>	<p>Broad, gently sloping banks increase the riparian zone where vegetated buffer strips can filter sediment, take up nutrients and enhance denitrification</p>
<p>7 Straight and narrow ditches with little vegetation cut through the landscape, efficiently transporting nutrients and sediment downstream.</p>	<p>Ditches are widened and vegetation is allowed to take hold. Stream morphology is adjusted to allow for sedimentation. Periodical removal of vegetation and sediments prevents saturation and closes the nutrient cycle.</p>

Which measure do you think will be most effective?

Or do you have any other suggestions? Please let us know by writing your suggestion with your reference on a post-it or by filling in the survey in the QR code and clicking the link.

