A healthy ecosystem can retain phosphorus in a plant available form. Soil health is commonly described though physical, chemical and biological components.

Phosphorus availability to plants and its potential to pollute waters is commonly evaluated through measuring soil phosphorus with extractants which emulate plant root exudates. Several different extractants have been proposed, and there is no clear consensus on what method to use. In addition some work has highlighted that it is the phosphorus saturation (i.e. ratio of phosphorus to iron and aluminium), which is more relevant for both plants and emissions. However the plant availability and emissions depend also on other factors: soil quality and soil health. We studied 24 Finnish test fields intensively from 2015−2018 to identify factors which could influence phosphorus emission risks and plant availability. The fields had varying soil types (clay, peat and sandy) and cultivation backgrounds.

The fields were tested for phosphorus concentrations using ammonium acetate, Mehlich 3, H3A, hydrochloric acid and water to give a range of phosphorus solubilities. In addition the phosphorus uptake was measured and several soil quality indicators were assessed (e.g. aggregate stability, water infiltration, microbial respiration, soil structure, rooting depth). The fields were found to differ more in their soil health parameters than in their phosphorus concentrations, which opens possibilities for increasing phosphorus uptake and decreasing emissions by improving soil health.

Soil phosphorus management is about more than just concentrations.

In addition to aggregate stability, also soil structure is a good indicator of soil productivity and emission risk. Visual evaluation of soil structure (VESS, Ball et al. 2007) can be used to quantify the differences.

With poor structure water will run-off on surface or go directly to drainage pipes through macropores. With good soil structure, water retention is high, water is directed to plant use and P has time to react with soil Fe and Al.

Soil phosphorus management is about more than just concentrations.