

PROJECT INFORMATION

Project title: Phosphorus cycling in European forests

Project ID: 205

Contact person: Mathias Neumann // mathias.neumann@boku.ac.at
Pasi Rautio // pasi.rautio@luke.fi

PROJECT DESCRIPTION

Motivation

Water, temperature, radiation and nutrients are recognized to be the main factors limiting plant growth. While for the first three gridded datasets exist, robust information on nutrients requires field measurements. The ICP Forests network offer such high-quality information.

Water availability and atmospheric CO₂ concentration have been driving water use efficiency (WUE) in recent decades and there is mounting evidence that CO₂ improves WUE (Adams and others 2020). Current research suggest that nitrogen (N) and phosphor (P) availability are critical missing pieces to understand limiting factors of plant growth more broadly (Terrer and others 2019; Du and others 2020).

Concept

We will use a combination of field measurements (meta-analysis, ICP monitoring plots) and gridded data products, such as climate, N deposition, radiation or land cover. ICP Forests Level II plots provide a link between P in foliage and litterfall and allow calculating P resorption (including leaching and P relocation to soil), that is the amount of P re-absorbed by the plant before shedding leaves/needles. ICP Forests Level I plots will provide more broad coverage with P concentration in leaves and allow testing spatial variability in more detail. Stand measurements allow us to estimate aboveground components and analyse whether stand structure modifies P resorption. Soil data (e.g. carbon, total P) will be critical in our analysis to conceptually close the P cycling and help us evaluate confounding effects of varying soil conditions (De Vos and others 2015).

Our hypothesis is that P limitation will become more pertinent, (1) under decreasing N limitations due to increasing N deposition and (2) under higher water use efficiency caused by increasing atmospheric CO₂ concentrations and/or changes in water availability.

We will link our results with suitable forest growth datasets such as remote sensing based maps and/or harmonized field measurements of components of net primary production (Neumann and others 2016, 2018, 2020). This will give us insight whether P limitations and resorption has had influence on previous forest growth and provide a more solid evidence base to be used for assessing future conditions.

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