Improving mineral weathering models by accounting for belowground carbon allocation

ROSENSTOCK, N.P.[1]*, WALLANDER, H.[2], BAHR, A[2] AND BELYAZID, S.[1]

[1]Centre for Environmental and Climate Research, Lund University

[2]Department of Microbial Ecology, Swedish University of Agricultural Sciences

*correspondance: rosenstockn@gmail.com

Accurate estimates of the supply of elements from mineral weathering to forest soils are crucial to critical load calculations, ecosystem models, and sustainable forest management, particularly in light of increased interest in the use of forest biofuels for energy production [1]. The dynamic ecosystem model ForSAFE is based on a soil chemistry and mineral weathering model originally developed to estimate critical loads for acid deposition, and has since been further developed to model forest growth dynamics and soil carbon storage [2]. A model that explicitly describes rooting dynamics and nutrient uptake as well as belowground carbon allocation is needed to evaluate the effects of global change, fertilization, and alternative management scenarios on the carbon storage, nutrient retention, and productivity of forests.

We applied the model ForSAFE to describe forest growth and soil solution values at an experiment forest, which is co-limited by nitrogen and phosphorus, where we have applied N- and P-fertilization treatments. We used both site-collected data, published data, and data from mesocosm experiments conducted by our group to add a dynamic rooting response module that describes how rooting depth and belowground carbon allocation respond to changing nutrient demands of their host trees. These additional mechanisms allow our model to better describe how ecosystems, total mineral weathering and biological weathering can be expected to respond to global change and increased harvest intensity. Additionally, this model serves as a platform to describe new advances in our understanding of how biology contributes to soil weathering rates. We will also discuss strategies to model the contribution of mycorrhizal fungi to mineral weathering.

[1] Akselsson et al (2007), *For. Eco. & Manag.* **238** ,167–174.
[2] Wallman *et al* (2005), *For. Eco. & Manag.* **207**, 19-35.