

## Pedogenesis via rock-‘eating’ trees

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Organisms are a state factor influencing pedogenic trajectories, but the underlying mechanisms are not well understood. In particular, the ability of individual tree species to uniquely affect soil development and associated biogeochemical dynamics is not well known.

In order to evaluate how N-fixing trees may alter soils through the generation of excess N-associated acidity, we examined rock weathering in a mixed species temperate rainforest ecosystem. <sup>87</sup>Sr/<sup>86</sup>Sr isotope ratios were used to trace the contribution of rock weathering and atmospheric inputs to base cations in foliar and soil exchangeable pools in six co-occurring tree species. We found that only the N-fixing tree species (*Alnus rubra*) deviated from all other species, associated with a 64% enhanced weathering supply [1]. This is likely a direct effect of nitric acid generation through excess N availability and net nitrification. In this way, the presence of tree species that routinely fix excess N could accelerate pedogenesis.

Carbonic acid from CO<sub>2</sub> production from biological respiration is often assumed to be the dominant weathering agent in soils. Organic acids secreted by plants, bacteria, fungi, and lichen are an additional biological weathering agent, known to accelerate mineral dissolution via a combination of both proton-promoted and ligand effects. In order to evaluate nitric acid weathering in the context of organic acids and carbonic acid, we performed column dissolution experiments on Columbia River Basalt, comparing nitric, citric, and carbonic acid across a range of pH conditions from 3.5 to 5.6. Analysis of effluent chemistry relative to mineral stoichiometry highlights the ability of citric acid to enhance dissolution of Fe-bearing minerals such as augite. As expected, dissolution increased with decreasing pH for all acids, and for many elements nitric acid was similarly effective as carbonic in driving dissolution and release. Ongoing modeling work is evaluating individual mineral dissolution rates and secondary mineral formation under each acid treatment.

[1] Perakis and Pett-Ridge (2019) *PNAS* **116**(11) 5009-5014.