Bedrock nitrogen influences ecosystem nitrogen cycling

KATHERINE A. DYNARSKI[1*], SCOTT A. MITCHELL[1], SCOTT L. MORFORD[1], BENJAMIN Z. HOULTON[1]

[1]Department of Land, Air and Water Resources, University of California Davis, 1 Shields Avenue, Davis, CA 95616
[*]kadynarski@ucdavis.edu

Although not widely recognized as an ecologically significant source of N until recently, global mass-balance modelling suggests that weathering of N from bedrock could increase the global N budget by 10-20%. However, little is known about how this belowground N input may affect other ecosystem N cycling processes. Here, we examine N cycling across a series of forests in northern California with varying bedrock N content and show evidence of accelerated N cycling and potential N saturation in forests underlain by N-rich bedrock. We find that greater stores of N in bedrock are correlated with increases in soil, foliar, and litter N concentration. These increases in ecosystem N are accompanied by increased rates of leaf litter N fixation and rates of soil N mineralization. Furthermore, the $\delta^{15}N$ of soil, foliage, and leaf litter increases with increasing rock N inputs, suggesting enhanced gaseous N losses in forests receiving belowground inputs of N from bedrock. Ecosystem N use efficiency (defined as aboveground net primary productivity per unit N mineralization) decreases across our bedrock N gradient, suggesting saturation of plant N demands as the supply of N from bedrock increases. These findings mirror observations of other N-saturated temperate forest ecosystems, and suggest that bedrock N inputs influence ecosystem N cycling dynamics similarly to other N inputs such as deposition or N fixation. This underscores the ecological relevance of N from bedrock and its potential to influence ecosystem N cycling dynamics.