Poster #97

Tropical Root Exudate Responses to Changing Water and Nutrients
TES Early Career Award

Daniela F. Cusack[1], Lee H. Dietterich[1], Mark Ciochina[1], Benjamin L. Turner[2], and S. Joseph Wright[2]

[1] University of California, Los Angeles
[2] Smithsonian Tropical Research Institution

Contact: Daniela Cusack [dcusack@geog.ucla.edu]

Organic matter exuded by plant roots can have major implications for carbon cycling and plant growth via effects on soil biota and chemistry. As a flux of carbon into soil, root exudates can be sequestered in soil by becoming trapped in soil aggregates or sorbed to soil minerals, they can be respired by microbes, or they can trigger increased release of C from soil via priming effects. In light of the importance and complexity of root exudation, we sought to understand how growing conditions affect exudation, and to test and refine three methods for measuring exudates.

We used a long-term field fertilization experiment in Panama, and growth chamber experiments using the Neotropical trees *Tetragastris panamensis*, *Tabebuia rosea*, and *Ochroma pyramidale*, to investigate effects of nutrients, water, and AMF on root exudation in tropical forests. We assessed treatment effects on exudation, comparing results from (1) collecting dissolved C after incubating roots in aerated water, (2) leaching soil pore water directly from a C-free soil matrix, and (3) using mesh bag "traps" filled with C-free matrix to collect exuded C.

Preliminary results from the field show that root exudation rates have a trend toward a negative relationship with stem diameter at breast height ($P = 0.08$, $R2 = 0.14$), but no significant relationship with fertilization. We hypothesize that per-root exudation rates decrease with plant age because of developmental changes in the importance of acquiring nutrients and storing carbohydrates. Alternatively, mature trees may be able to invest exudates in nutrient uptake more efficiently than younger trees by targeting exudates more precisely to where they can deliver the greatest returns. We predict that refining field methods using results from the growth chamber experiment will allow for improved detection of root exudate responses to field treatments.

In conclusion, improved techniques are needed to better assess root exudation as a large-scale ecosystem process. We caution against the premature development of a single standard method for measuring root exudation. Instead, we emphasize that different methods illuminate meaningfully different components of root exudation, so we urge workers to carefully match methods to research questions. Finally, for phenomena as complex and subtle as root exudation, it is desirable to validate experimental results with multiple independent methods.