Geophysical Research Abstracts
Vol. 17, EGU2015-6959, 2015
EGU General Assembly 2015


# Nutrients and light limit biomass growth of N2-fixing but not non-fixing trees in tropical forests after 15 years of fertilization

Annette Trierweiler (1), Joseph Wright (2), Klaus Winter (2), and Lars Hedin (1)

(1) Department of Ecology and Evolutionary Biology, Princeton University, Princeton, United States, (2) Smithsonian Tropical Research Institute, Balboa Ancón, Panama

Tropical forests contribute a major fraction to the land C sink but the role of soil nutrients in limiting tree biomass growth in response to rising atmospheric $CO_2$ is poorly known. Recent findings suggest that, following disturbance, successionally young forests may be deficient in nitrogen (N) and/or phosphorus (P), however nutrient manipulations of mature forests have revealed surprisingly weak effects of nutrients on the stem growth of mature individual trees. It is unclear how such weak experimental nutrient effects are reconciled with the existence of broad geographical correlations between soil nutrients and forest biomass growth. While tree growth is a complex function of nutrients, light, and canopy status, it is plausible that responses differ across different plant functional types. Here we use data from the longest running tropical fertilization experiment to ask first whether different functional groups have different nutrient needs, second, whether a differential nutrient limitation response will affect biomass accretion, and third, whether there is an interactive light-nutrient effect. Finally we examined how nutrient responses changed over time.

We show that, in an intact and biodiverse mature tropical forest in Panama, N2-fixing trees more than double their basal area growth rate when exposed to increased soil P and N in the first 11 years of fertilization, for an overall 60% increase over 15 years. In contrast, there was no effect of nutrient treatment on the growth of non-fixing trees. We found a strong interactive effect of soil nutrients and light on fixer tree growth as the greatest growth response was in mature canopy-level trees with full access to light and potentially new nitrogen through fixation. In addition, the positive nutrient effect declined over the 15 years, rather than the expected increase. Our findings suggest that N2-fixing tree species may play a disproportionately important role in governing tropical forest response to changes in soil nutrients and rising atmospheric $CO_2$.