ELLIS, ALEXANDER, STEPHEN HUBBELL, and CATHERINE POTVIN. McGill University, Montreal, Quebec H3A-1B1. Photosynthetic responses of 21 tropical tree species to elevated CO_2.

In an effort to understand the potential impact of changes in the global atmosphere on tropical forests, I measured short-term, leaf-level photosynthetic rates from a suite of tropical trees for which growth and relative abundance data is known. Photosynthetic measurements were taken on in-situ trees at ambient (350 MICROLITERS/L) and elevated (750 MICROLITERS/L) CO_2 in both the wet and dry seasons for 21 species on Barro Colorado Island, Panama. Trees were separated into three functional groups (pioneer, intermediate, or shade-tolerant) to facilitate observing not only interspecific differences in performance at elevated CO_2 but also possible shifts in competitive ability among these ecological groups. A response to elevated CO_2 was detectable in all species. Also, results show strong species-specific responses to CO_2, indicating that each species responds differently to the same stimulus. However, there was no characteristic response of functional groups to CO_2. This fertilization effect is strongly influcenced by seasonal cycles with the highest photosynthetic enhancement observed during the dry season. A strong relationship between growth and photosynthesis under ambient CO_2 is also observed. Our results demonstrate that the response of tropical trees to elevated CO_2 can be detected based on their leaf-level responses under the heterogeneous conditions of the forest.

ELLISON, AARON M. and LESZEK A. BLEDZKI. Mount Holyoke College, S. Hadley, MA 01075, USA. Are sponge infaunal communities structured?

Sponges (Porifera) are discrete islands of habitat for many infaunal species; however, the habitat structure (sponge size and shape) changes over the infauna's lifespan. As prelude to a study of community structure in such dynamic habitats, we examined relationships between: infaunal species composition and host sponge identity; number of infaunal species and sponge volume; infaunal body size (length) and species abundance; and guild structure and infaunal species composition in three species of Caribbean shallow-water marine sponges. Thirty-five macroinvertebrate taxa (> 1 mm body length) were found in 30 sponges in three species (range in volumes 50-1500 ml). Haliclona implexiformis hosts a unique infaunal assemblage relative to the other two species, while Lissodendoryx isodictyalis and Tedania ignis have similar infaunal species. There was a strong correlation between number of species and sponge volume ($\log[S] = 0.59 \log[V]$), and infaunal assemblages of small sponges were nested within those of larger sponges. No clear relationships between body length and species abundances were observed, as many species breed in sponges and presence of young individuals in a given sponge obscures 'equilibrial' body size-abundance relations. Similarly, we found no evidence for competitively-based guilds in these infaunal communities. We hypothesize that sponge infaunal communities rarely reach equilibrium because of the dynamic nature of their living habitat.

ELLNER, STEPHEN P. North Carolina State University, Raleigh, NC, 27695, USA. Combining mechanistic and statistical models to study population dynamics.

Models of population dynamics are often used for three distinct purposes: prediction and management, characterizing the dynamics (e.g. noise vs. chaos), and identifying underlying mechanisms. In most cases the models are either purely phenomenological time-series models (e.g. nonlinear autoregression), or mechanistic models with a minimal set of parameters having specific biological interpretations (e.g. the LPA model for *Tribolium*). However our true state of knowledge is usually somewhere between these extremes. I propose that a reasonable modeling strategy then is to develop a "semi-mechanistic" model, which incorporates reliably known mechanisms and processes, but retains statistical flexibility on less well known aspects. Comparing phenomenological, mechanistic, and semi-mechanistic models for epidemic dynamics data, a semi-mechanistic model is shown to provide a better description of the dynamics as measured by forecasting accuracy. The fitted model can then be used to characterize the dynamics, showing in this case (a) a mix of "noise" and "nonlinearity" with both components too large to ignore, and (b) oscillations between local (in state space) chaos and stability. This case study also illustrates how a suite of models can be compared objectively to identify the amount and kind of mechanistic information that should be hard-wired into a model to maximize accuracy and reliability.

ELLSWORTH, DAVID S. Brookhaven National Laboratory, Upton, N.Y. 11973-5000, USA. Acclimation of trees to shade and elevated carbon dioxide in a field free-air CO_2 enrichment experiment (FACE).

Leaf photosynthetic capacity has been observed to decline in response to both shade and elevated CO_2. Yet examination of the effects of elevated CO_2 on plants actually growing in low-light, forest conditions has rarely been conducted. A shade-intolerant tree species (Pinus taeda) was grown in a forest for 133 days over the summer under elevated CO_2 (550 MICROmol mol^{-1} CO_2) in the free-air CO_2 enrichment (FACE) facility in Duke Forest in the North Carolina piedmont. Photosynthetic enhancement by CO_2 (photosynthetic rate at 550 MICROmol mol^{-1} CO_2 relative to the rate at current ambient CO_2) was slightly greater for lower-canopy, shaded branches (165%) than for upper-canopy sun branches (160%). The results are interpreted with respect to theoretical predictions of prevailing limitations to photosynthesis in response to both shade and elevated CO_2. These findings may have significant implications for the distribution of photosynthetic resources within different levels of the forest canopy under elevated CO_2 conditions that may prevail in the future.