Objective and Background

Objective = global application of plant demography and trait-based dynamic vegetation (via FATES) within ACME.

The inclusion of vegetation demography into Earth System Models (ESMs) will better represent plant ecology, and vegetation processes that govern fluxes of carbon, energy, water. However, incorporating dynamic vegetation demography poses huge challenges owing to the increased model complexity, and demands for model testing.

Integrated model development with experimental science (Model-Experiment, MODEX) via NGEE-Tropics, NGEE-Arctic.

Approach: ALM-FATES

FATES model (Functionally-Assembled Terrestrial Ecosystem Simulator)
- Carbon pools, fluxes, allocation; litter fluxes; phenology; regeneration, growth, mortality, photosynthesis, respiration represented by FATES, which is derived from the Ecosystem Demography Model (ED).
  - Incorporates discretized Perfect Plasticity Approximation (PPA) for canopy structure and testing radiative transfer schemes.
  - Canopy physics, soil BGC, land surface hydrology, represented by ACME Land Model (ALM).

Methods:
1) Site level ALM-FATES testing in Brazil
   - Lowland, old-growth tropical forest, with 10 years of observed data.
   - Compare model results using dynamic, structured vegetation against "big-leaf" models.
   - What is the response of the tropical forest carbon sink with rising CO2, out to 2100?
2) ALM-FATES Global Simulations
   - Global evaluation of NPP, LAI

Impact: ALM-FATES Global Runs

Initial ALM-FATES NPP and LAI results using 6 interacting and competing PFTs.

Comparable results to "big-leaf" models.