

Title: Next-Generation Ecosystem Experiments (NGEE)-Tropics Phase 2 Overview

Jeffrey Chambers^{1*} (PI), Deb Agarwal¹, Stuart Davies², Rosie Fisher³, Kolby Jardine¹, Michael Keller⁴, Charles Koven¹, Lara Kueppers¹, Ruby Leung⁵, Nathan McDowell⁵, Alistair Rogers⁶, Charuleka Varadharajan¹, Anthony Walker⁷, Jeffrey Warren⁷, Chongang Xu⁸

¹Lawrence Berkeley National Laboratory, Berkeley, CA;

²Smithsonian Tropical Research Institute, Washington, DC; ³National

Center for Atmospheric Research, Boulder, CO; ⁴United States Forest Service, Washington, DC; ⁵Pacific Northwest National Laboratory, Richland, WA; ⁶Brookhaven National Laboratory, Upton, NY

⁷Oak Ridge National Laboratory, Oak Ridge, TN;

⁸Los Alamos National Laboratory, Los Alamos, NM;

Contact: (jchambers@lbl.gov)

Project Lead Principal Investigator (PI): Jeff Chambers, LBNL

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Project Abstract: Tropical forests cycle more CO₂ and water than any other biome and are critical to Earth's energy balance. Yet processes controlling tropical forest carbon cycling are not well established, and large uncertainties in observational estimates and Earth system model (ESM) projections of net carbon fluxes remain unresolved, contributing significant uncertainty to climate projections. In support of BER's mission to advance a predictive understanding of Earth's climate and environmental systems, the Next Generation Ecosystem Experiments (NGEE)- Tropics aims to develop an improved predictive understanding of tropical forests and Earth system feedbacks to changing environmental drivers over the 21st Century. A strong synthetic coupling of modeling and experiment-observational methods (i.e. ModEx) is our fundamental approach toward attaining this goal, with our grand deliverable a representative, process-rich tropical forest ecosystem model, extending from bedrock to the top of the vegetative canopy- atmosphere interface, in which the dynamics and feedbacks of tropical ecosystems in a changing climate can be modeled at the scale and resolution of a next generation ESM grid cell.

Our work in Phase 1 revealed several high-priority areas for model development, evaluation, and parametrization, leading to the identification of three Research Focus Areas (RFAs) for Phase 2 that will advance understanding and model representation of processes at the individual (RFA1), community to regional (RFA2), and regional and global (RFA3) scales in E3SM-FATES. The science within these RFAs is organized into ModEx Work Packages (WP). Each WP is tightly coupled to existing model code within DOE's Energy Exascale Earth System Model (E3SM)-FATES, or focused on developing new process representation in the model. The WPs within each RFA are coordinated to enable the delivery of RFA-level goals for FATES development and evaluation.

E3SM-FATES is the unifying platform at the center of this organizational structure, providing integration of scientific advances across all three RFAs, and ultimately enabling the NGEE-Tropics team to address our key science questions. This RFA and WP structure along with our comprehensive ModEx approach NGEE-Tropics Phase 2 also allows testing of scientific hypotheses and reduction of uncertainty in emergent model outcomes for our RFA Science Questions.