



**NGEE-Tropics**



U.S. DEPARTMENT OF  
**ENERGY**

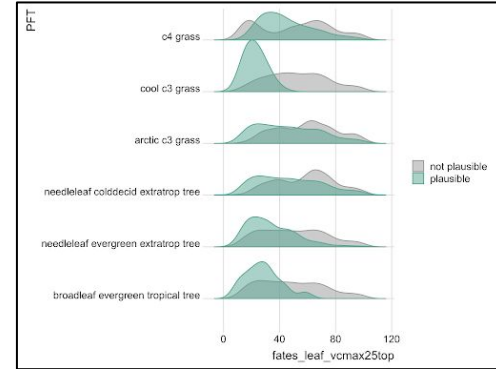
Office of  
Science

# FATES Development Plans and Progress

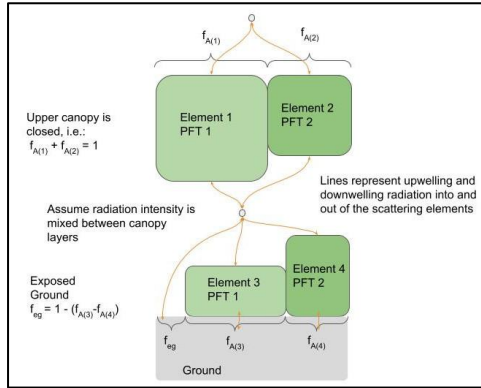
Gregory Lemieux, LBNL  
CESM Land Model Working Group Meeting 2024

# Model updates

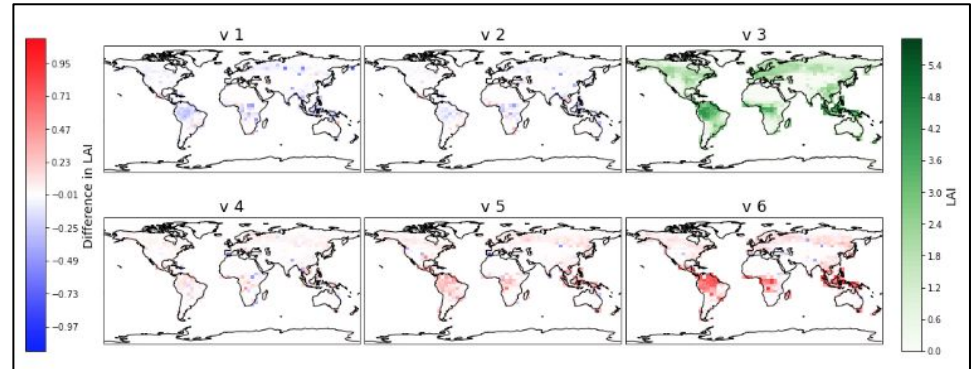
- Calibration Cascade (Rosie Fisher, Adrianna Foster, Jessica Needham)
  - Related: see Jessie's talk on vertical scaling
- Two-stream radiation (Ryan Knox)



CTSM-FATES emulator derived  
Vcmx parameters



Two-stream radiation scatter element representation



Vertical scaling of leaf maintenance respiration comparison

# Model updates - Tree Recruitment Scheme (TRS)

- Adam Hanbury-Brown (UC Davis)
- Mechanistically constrains the carbon availability for recruitment based on forest floor conditions
- Improves predictions of recruitment rate at Barro Colorado Island

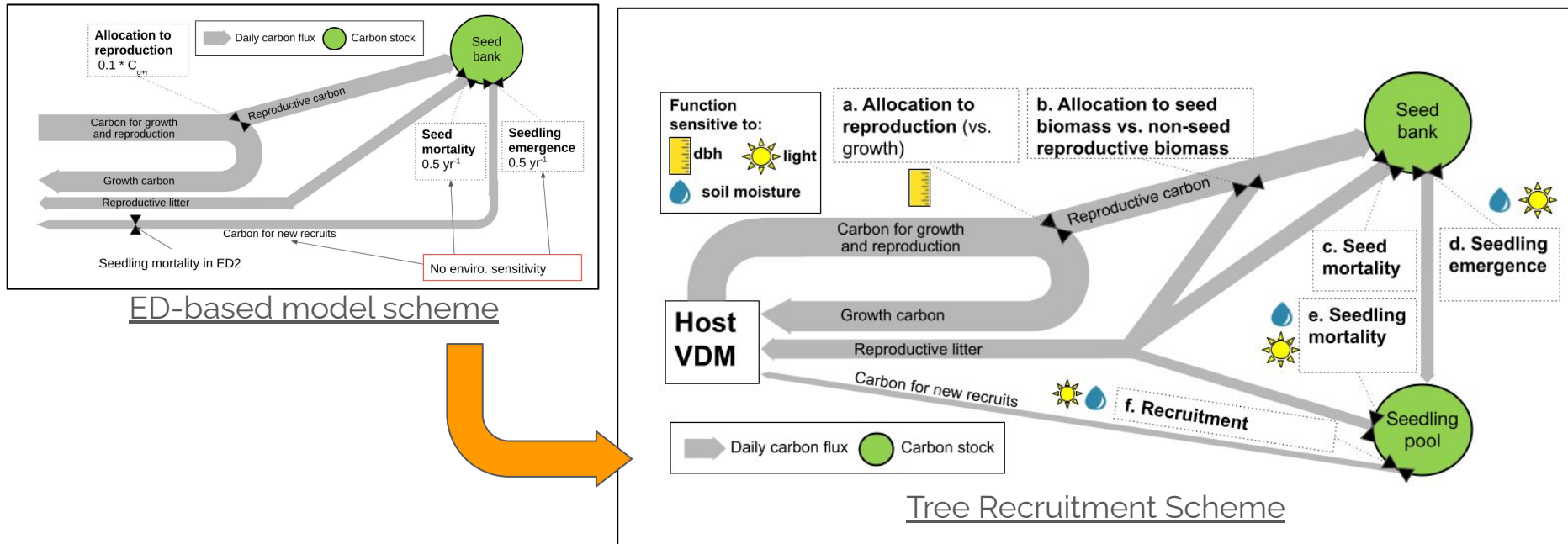
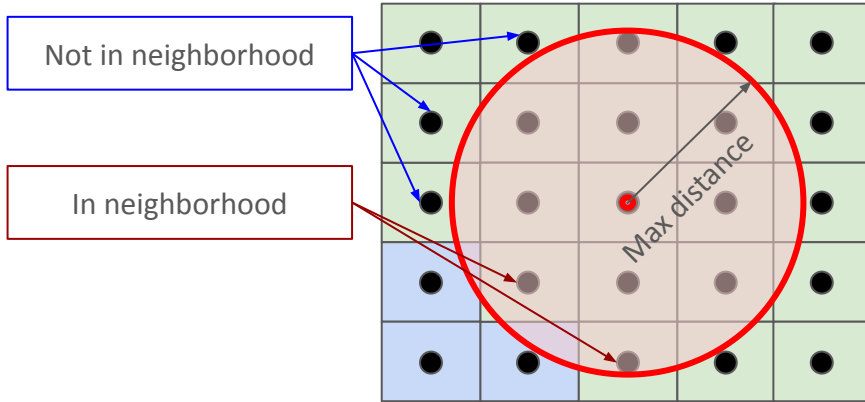


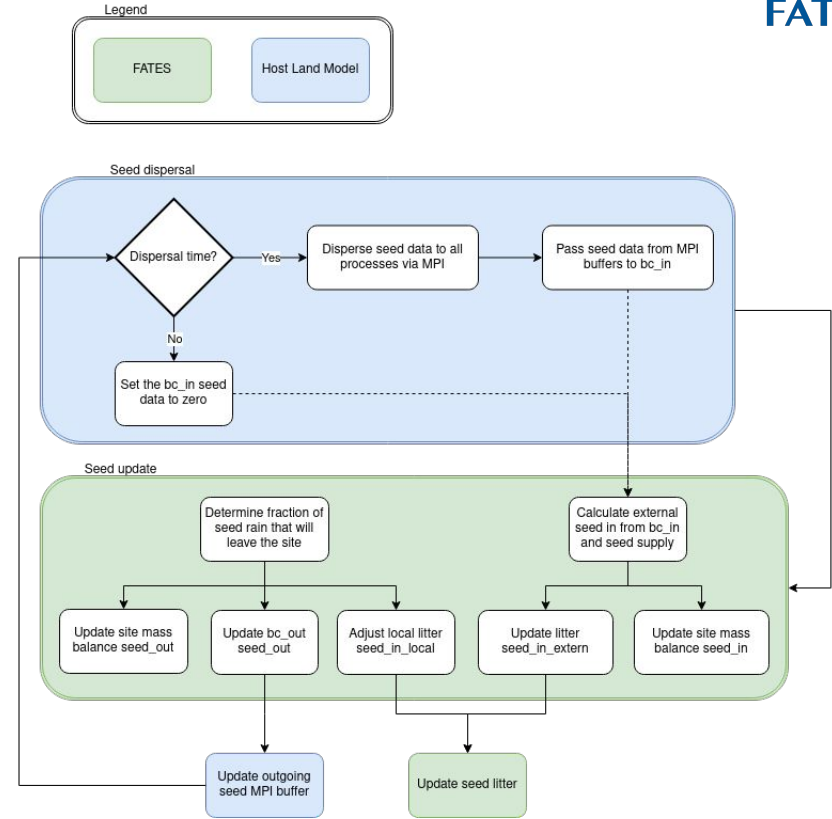
Figure courtesy of Adam Hanbury-Brown

# Model updates - Cross-Gridcell Seed Dispersal

- Yanlan Liu (Ohio State) and Gregory Lemieux
- Implements Bullock et al dispersal kernels
- Disperses across grid cells at user-defined cadence and maximum distance
- Supports unstructured grid cells



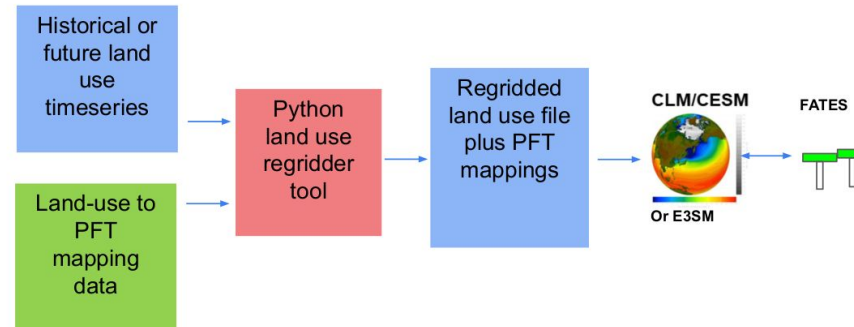
Cross-grid dispersal neighborhood



Dispersal design flowchart

# Model updates - Land Use Change

- Version 1: On main/master branches
  - Introduces land use label for FATES patches
- Version 2: In development (FATES PR #1116)
  - Land use x PFT mapping (see Charlie's upcoming talk)
- FATES Land Use data tool
  - Python tool to minimally process raw Land-Use Harmonization (LUH2) time series data
  - Leverages xESMF, a high-level python ESMF interface for regridding
  - V2 tool handles generating land use x pft mappings
  - Future development: Attempt dask implementation for fast distributed processing

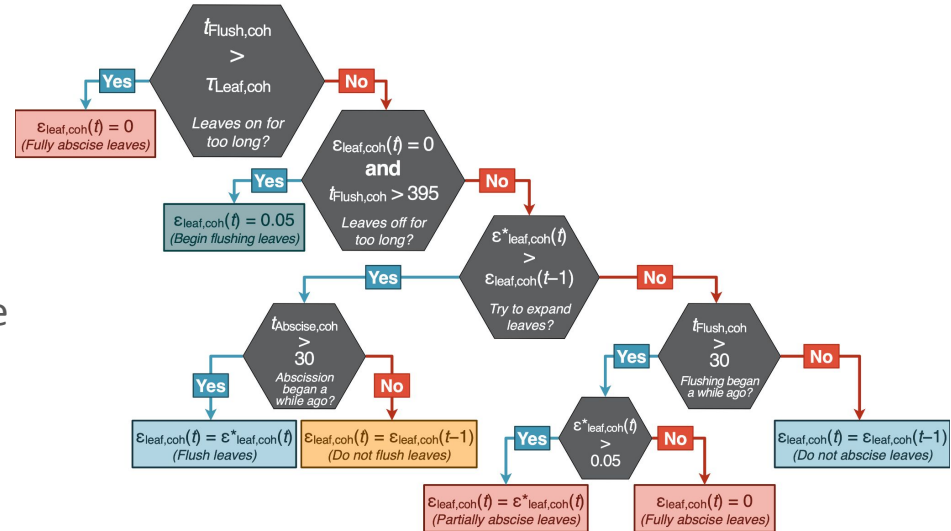


FATES Land Use Data Tool pipeline

# Model updates - Notable fixes and improvements

- Refactoring
  - FATES modules (Adrianna Foster)
  - FATES API I/O (John Alex, external contrib.)
- Long duration exact restart issue #1051 fixed (Ryan Knox et al.)
- Drought Deciduous phenology updates (Marcos Longo)
- Kumarathunge temperature acclimation (Claire Zarakas, Qianyu Li, Charlie Koven)
- Atkin Respiration added (Charlie Koven)

Drought-deciduous leaf phenology (semi-deciduous)



Semi-deciduous abscission/flushing logic chain

# Model development plans

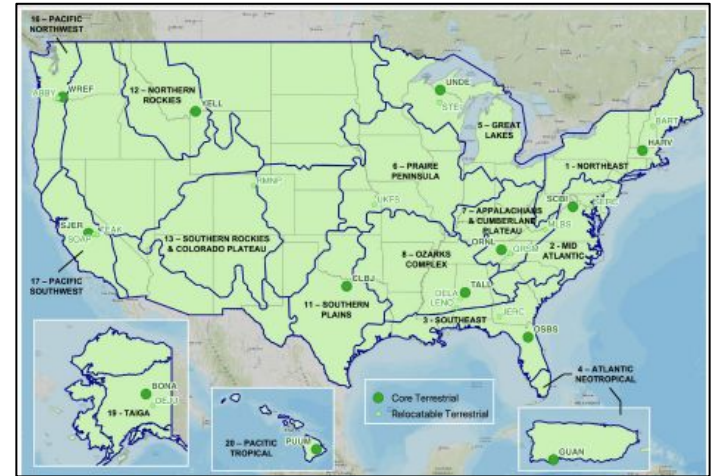
- Performance improvements (Ryan Knox)
  - Photosynthesis solver efficiency and more
- Fire
  - Active crown fire (Adrianna Foster)
  - Representing tropical forest edge burning from escaped management fires (Sam Rabin)
- Dynamic columns
  - Coupling permafrost, wildfire, and vegetation dynamics for NGEE-Arctic Phase 4 deliverable (Greg Lemieux, Charlie Koven)
- Tooling (Greg, Ryan, and CTSM software engineering Team)
  - On-the-fly FATES parameter file generation
  - Unit testing and code coverage of FATES python tools
- Tutorial development
  - NGEE-Tropics + Alliance for Tropical Forest Science (ATFS) funding September 2024 tutorial
  - Leveraging existing NGEE tutorial container infrastructure, local to user's laptop
  - Simplified and interactive version JupyterBook hosted online

# Participation



- Reminder: FATES can run at NEON sites
  - NEON tutorial: <https://ncar.github.io/ncar-neon-books>
- FATES Google Group: [https://groups.google.com/g/fates\\_model](https://groups.google.com/g/fates_model)
- 2024 FATES Tutorial: <https://go.lbl.gov/fates-tutorial-2024>

This block contains two overlapping screenshots. The top-left screenshot shows the "FATES User's Guide" website, which includes a search bar, a sidebar with navigation links like "How-To" and "Overview", and a main content area. The bottom-right screenshot shows the GitHub repository for "NGEET / fates", specifically the "Discussions" tab. It features a "Welcome to the FATES Discussion board" message and a list of discussion topics, including "2024 FATES Tutorial Announcement" and "SPITFIRE modes".



NEON Sites

<https://fates-users-guide.readthedocs.io/>

<https://github.com/NGEET/fates/discussions>



## Acknowledgment

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NEXT-GENERATION ECOSYSTEM EXPERIMENTS-TROPICS



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