Integrating Land-use and Forest Degradation Dynamics into FATES

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Tropical Forest Degradation Workshop, Manaus, Nov. 11

What is FATES?

- "Functionally Assembled Terrestrial Ecosystem Simulator"

- Cohort and patch based vegetation model, built on ED and PPA ideas, to resolve disturbance, light competition, and growth and mortality dynamics of trees at ESM scales.

- CLM-derived biophysics, SPITFIRE-based fire model, many mechanistic developments underway (nutrients, hydraulics, etc.)

- Integrated into two ESMs: CESM2/CLM5 and E3SM.

Early Successional PFT
Late Successional PFT

Most Recently
Disturbed

Longest Time
Since Disturbed

Koven et al.,
In review, Biogeosci.
Discussions
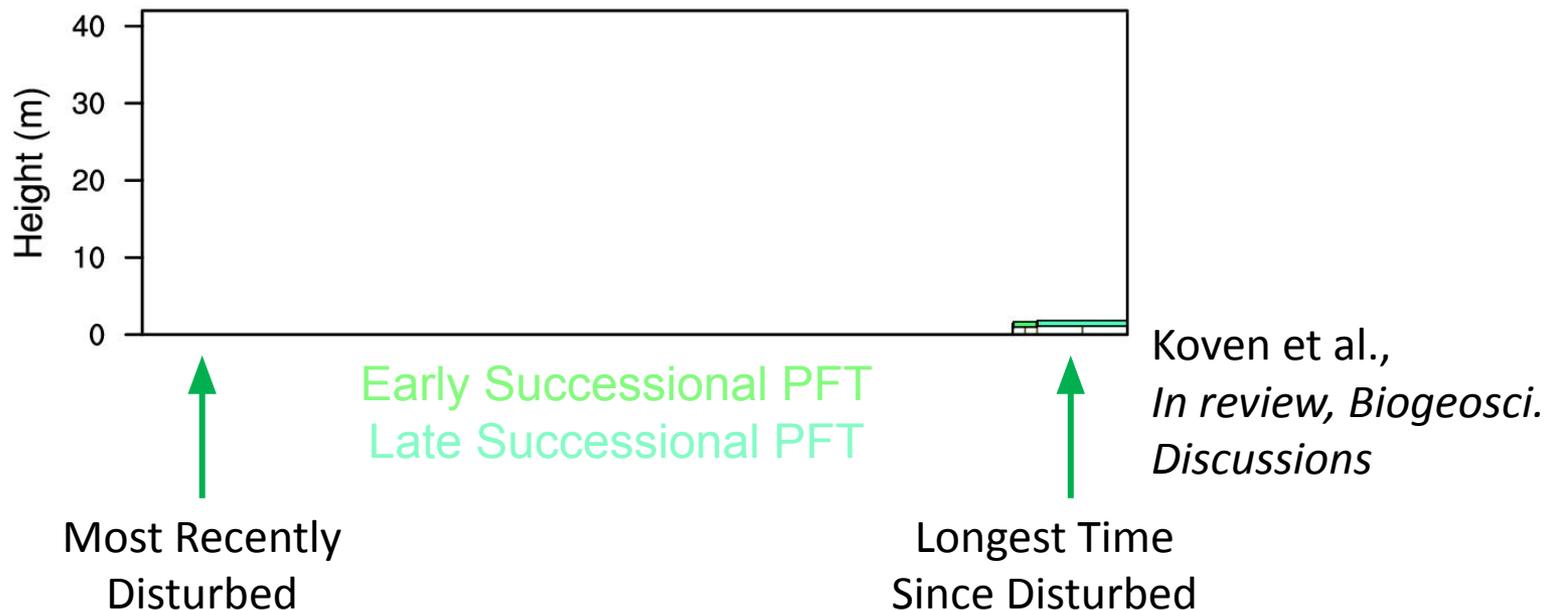
Representing land use and forest degradation in FATES

- Currently has selective logging module (Huang et al., in review)

- Specifies direct logging fraction by PFT, minimum tree size, infrastructure damage, collateral mortality, …

- Tracks primary and secondary forest on differently labeled patches, doesn't allow primary and secondary patches to fuse.

- Currently building hooks to drive with large-scale (CMIP-type) datasets, either by area logged or by mass of carbon logged.

- How to identify parameter values for different logging types? (and how many different logging types to distinguish?)
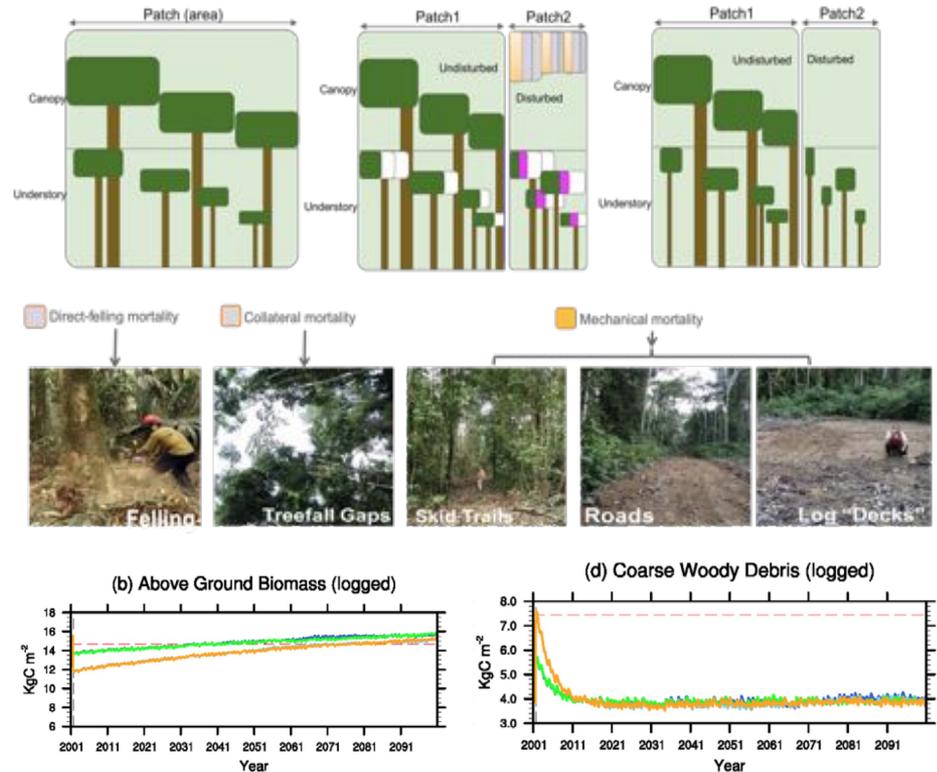
Huang et al., in review

- E.g., the above plus: logging intensity, maximum tree size, other criteria for logged trees?

How to test model with anthropogenic disturbance against observations?

As part of NGEE-Tropics project, testing FATES representation of land use effects on forest structure in three ways:

1. In Puerto Rico, where secondary forests are widespread, will run FATES across island and compare to (pre-Maria) airborne lidar campaign (G-LiHT)

2. Test FATES predictions of biomass and canopy structure against airborne lidar observations in Amazon (INPE EBA project), Borneo, and DRC, as well as GEDI data pan-tropically

3. Test against Tanguro experimental fire treatment