

Nov 19, 2026

2026 CLM Tutorial

Land Use in the FATES

Gregory Lemieux
Staff Software Developer, LBNL

NGEE-Tropics

U.S. DEPARTMENT of ENERGY

Land Use and Land Cover Change (LULCC)

Why model?

- Changes in land characteristics impact fluxes of energy and water altering climate
- Peter Lawrence CESM Tutorial 2022

Goal Today

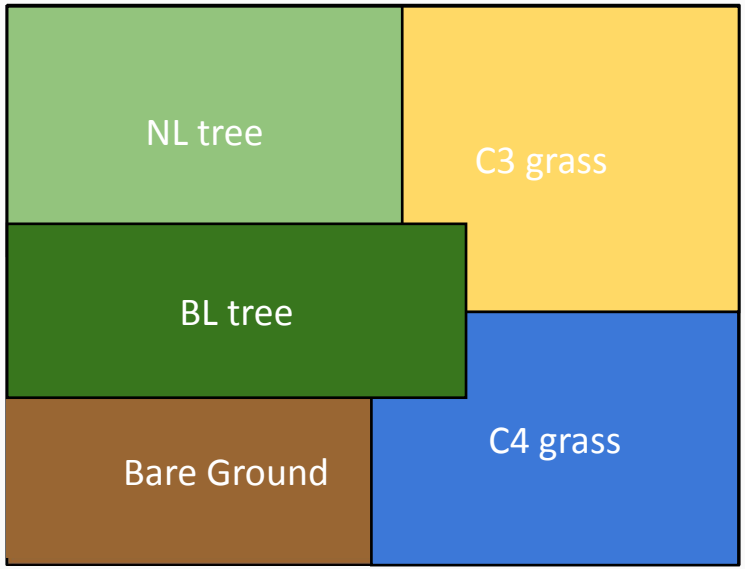
- How CLM and FATES fundamental structure impacts how each handles LULCC

Land Use versus Land Cover

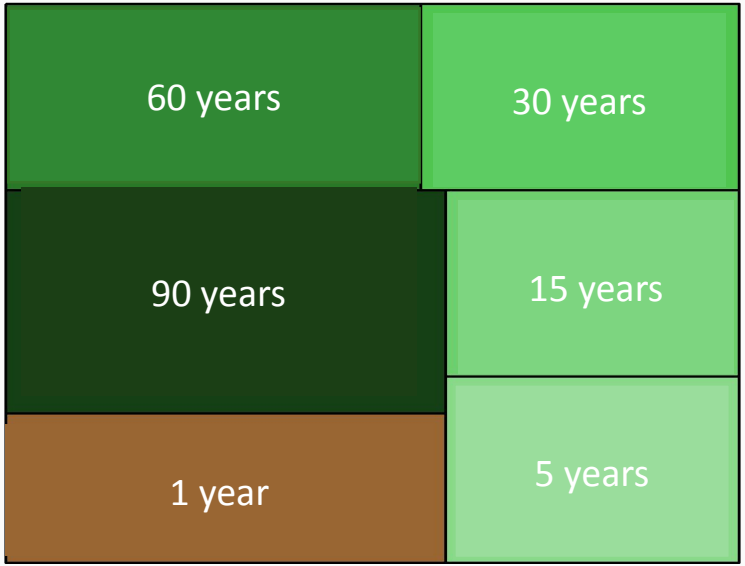
- ***Land Cover***: Physical features (e.g. trees/crops)
- ***Land Use***: Human management and activities on the land (i.e. disturbance)



FATES/CLM Differences Reminder



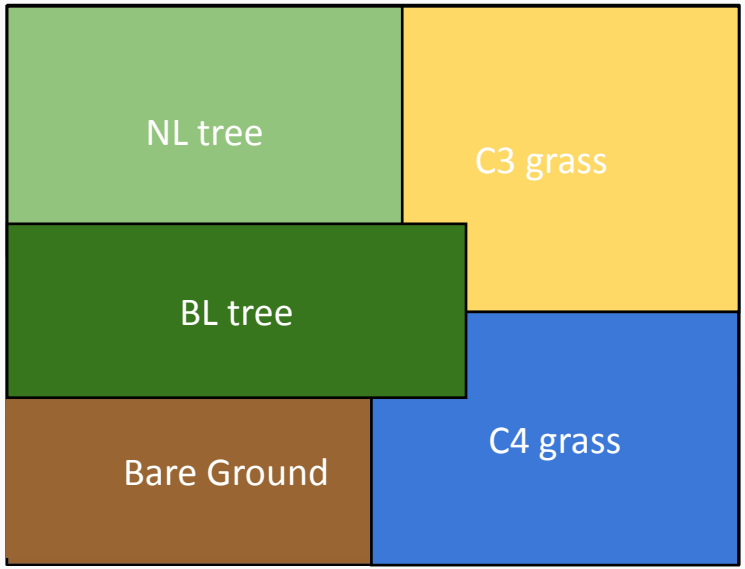
CLM: PFT tiling



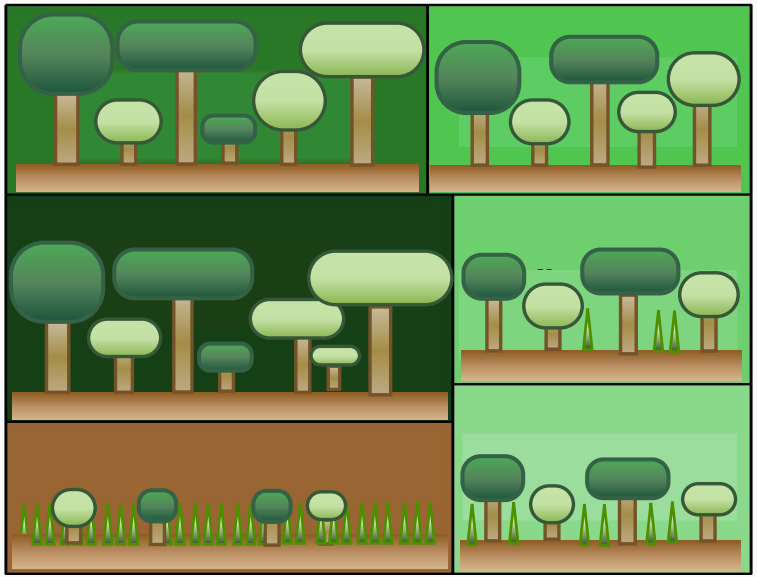
FATES: Time-since-disturbance

FATES/CLM Differences Reminder

Time-since-disturbance tiles contain **cohorts of plants, defined by PFT and size**.

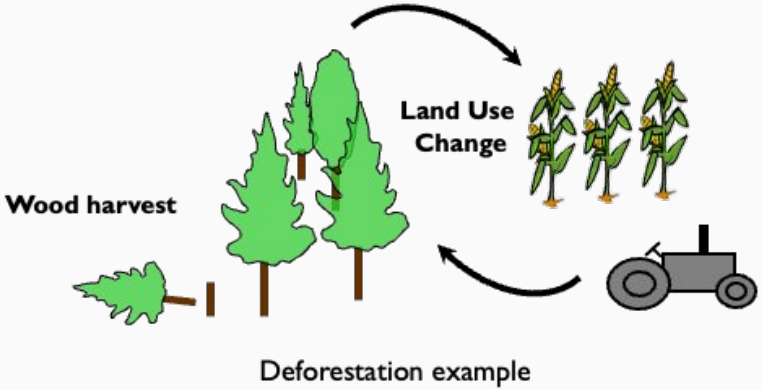


CLM: PFT tiling



FATES: Time-since-disturbance

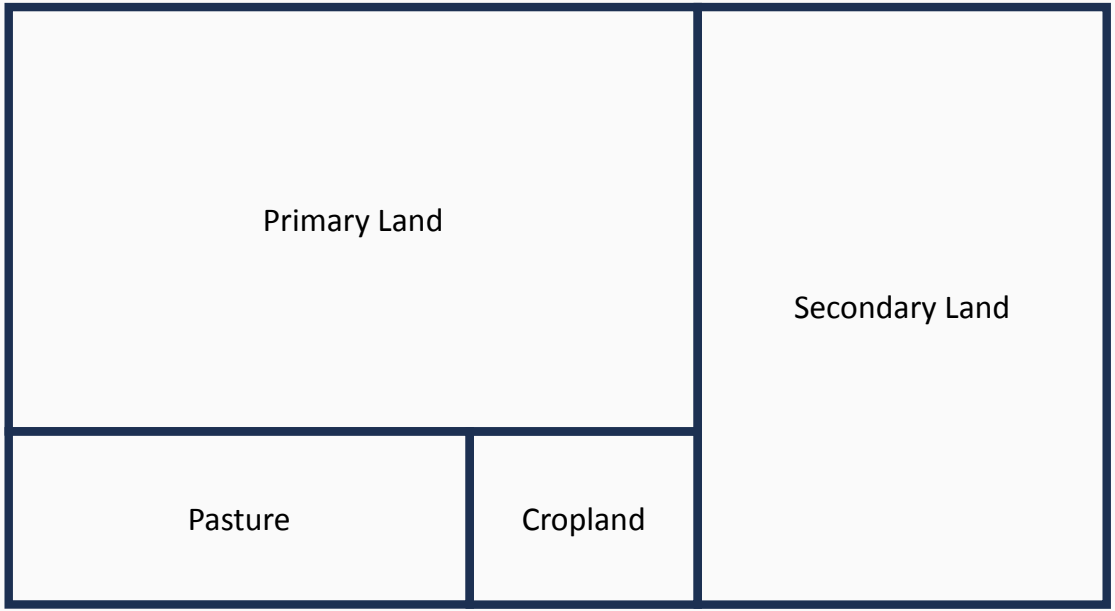
Representation in CLM



- Land use and cover change via prescribed area changes
- Annual time series dataset with fractional area of all PFTs
- *Net* changes in area, no *gross* transitions tracking

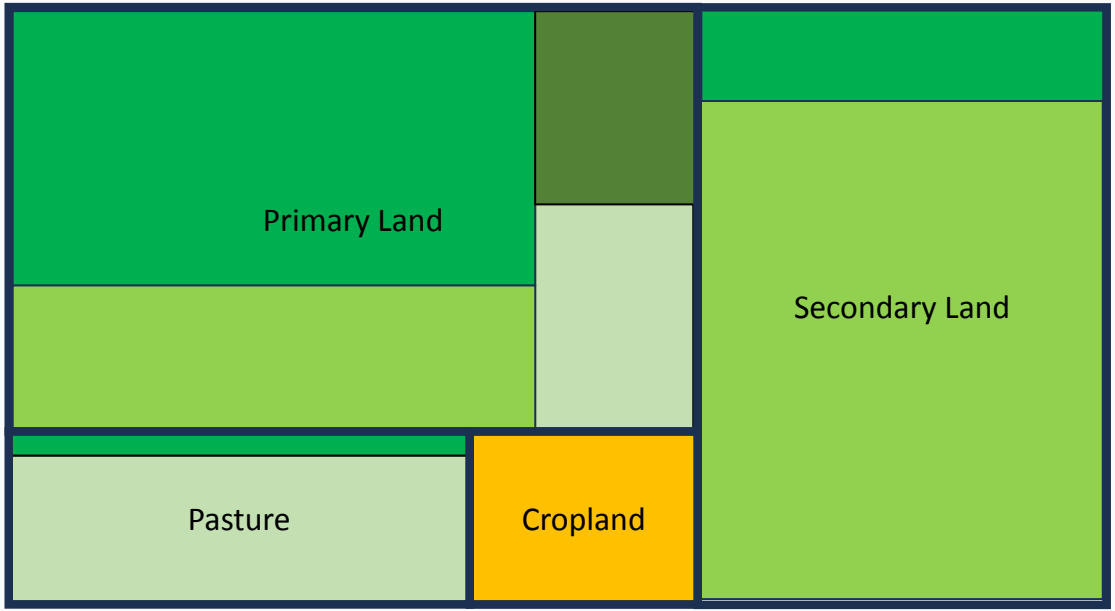
Representation in FATES

Land-use type as a high-level categorical variable



PFT Land Cover Fraction

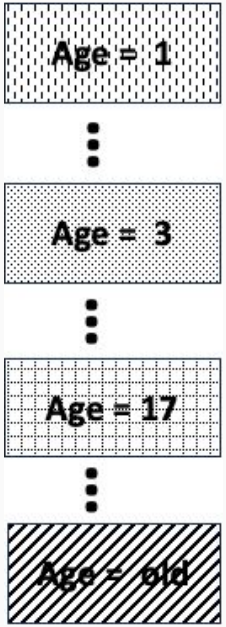
Prescribed land cover is available as an additional categorical patch variable

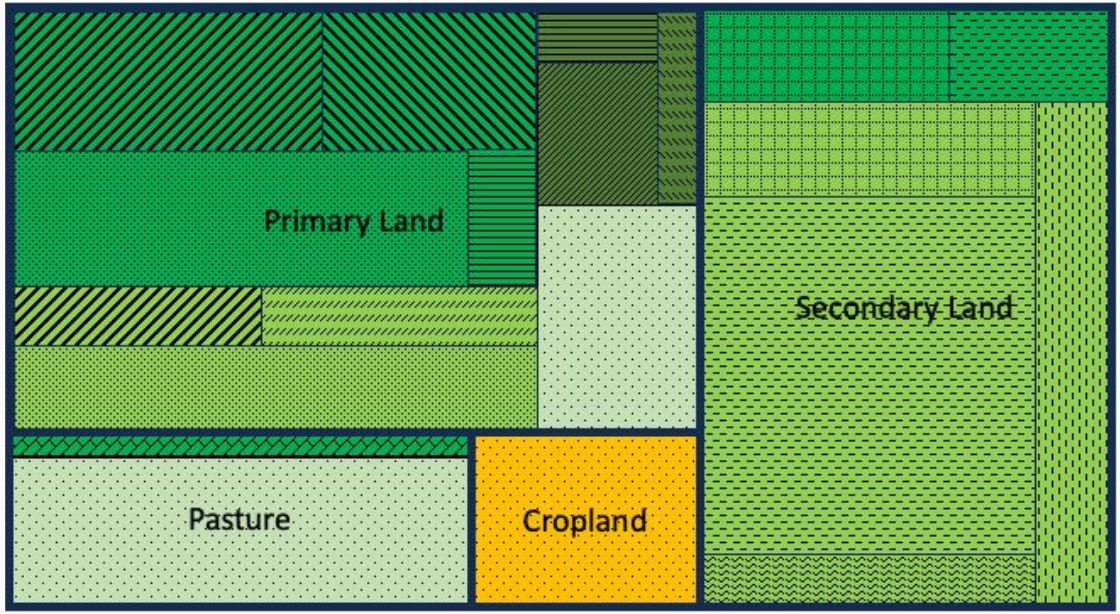


PFT 1
PFT 2
PFT 3
PFT 4
PFT 5*

Patch Age

Age-since-disturbance as a continuous patch variable within both

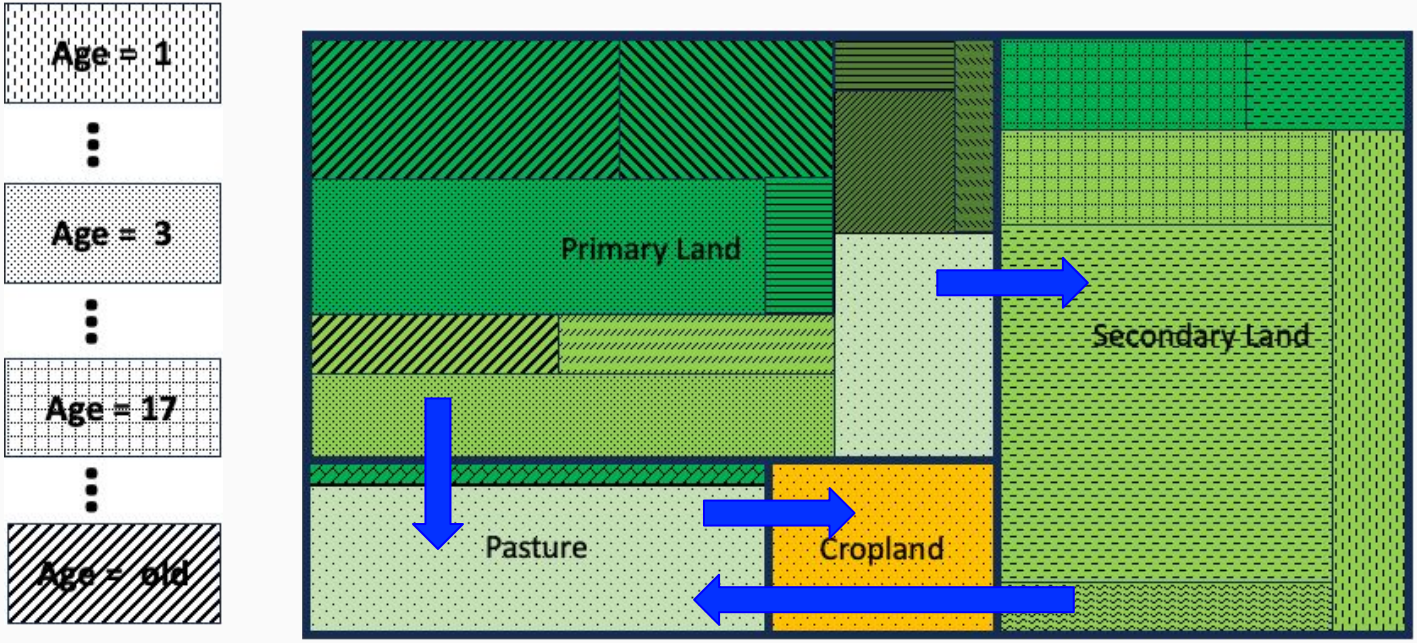




PFT 1
PFT 2
PFT 3
PFT 4
PFT 5*

Land Use Change

Gross land-use transition rates drive updates to the patch PFT- and age-tiling mosaic



Data Drivers

Primary Data Source: Land-Use Harmonization (LUH) project

- State, transitions and management data
- Hurtt, G. C. et al., doi:10.5194/gmd-13-5425-2020

CLM Land use data tool

- Translates LUH data into fraction PFT and CFT values
- Outputs used by CLM tooling to produce surface dataset and land use timeseries
- Lawrence et al, doi:10.5065/29s7-7b41

FATES Land Use data tool

- Minimally processes LUH data into FATES compatible timeseries
- Utilizes CLM land use data tool products to develop PFT x landuse map

THANK YOU!

Acknowledgment

Next Generation Ecosystem Experiments(NGEE)-Tropics is grateful for funding and support from the U.S. Department of Energy, Office of Science, Biological and Environmental Research program

We also thank the strong domestic and international collaborations across numerous universities and research organizations that make our efforts possible.



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Backup Slide

Quick User's Guide to FATES Land Use

Step 1: Prepare land-use data via this tool: tools-fates-landusedata

Step 2: Decide on phase (i.e. spin-up, transient)

Step 3: Set namelist options:

- fluh_timeseries - file-path to transition data from
- flandusepftdat - file-path to pft fractions per lu-category
- fates_harvest_mode - switch defining how to harvest
- fates_lu_transition_logic - select rule-set for converting lands

Spin up

Find a steady state transition that leads to approximate 1850 conditions and spin up using that.

(analogous to classic CLM I1850 compsets)

