

**LUH2 v0.2****1 OVERVIEW**

In preparation for sixth phase of the Coupled Model Intercomparison Project (CMIP6), a new set of global gridded land-use forcing datasets are being developed to link historical land-use data and future projections in a standard format required by climate models. This new generation of “land use harmonization” (LUH2) builds upon past work from CMIP5, and includes updated inputs, higher spatial resolution, more detailed land-use transitions, and the addition of important agricultural management layers. The finalization of the new datasets is planned for January 2016, following one year of development and testing with input from the community beginning with the initial prototype release, and continuing with this and future updates. Ultimately, the major attributes of the datasets are planned to include:

- Global domain
- 1500-2100 land-use states, transitions, and gridded mgt layers
- Common history
- Official CMIP6 Tier 1 future scenarios
- 0.25 x 0.25 degree spatial resolution
- 12 possible land-use states including separation of Primary and Secondary natural vegetation into Forest and Non-forest sub-types, Pasture into Managed Pasture and Rangeland, and Cropland into multiple crop functional types
- >100 possible transitions per grid cell per year, including crop rotations
- Agriculture management layers including irrigation, fertilizer, tillage, and biofuel management

These datasets are being developed as a contribution of the Land-Use Model Intercomparison Project (LUMIP) to the Forcings Group for CMIP6. The primary points of contact for these data are:

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## 2 DESCRIPTION

**\*\*\*Note: LUH2 v0.2 is a prototype, intended for model testing and development only. The emphasis in this version is on the format of the intended data products; data values are ad hoc or experimental, and not intended nor suitable for publication quality work. Future updates will refine static datasets, update historical estimates, and add future projections.\*\*\***

LUH2 v0.2 is a prototype of future conditions, and covers the period 2015-2100. It is built off the final states from a previous prototype covering historical conditions (LUH2 v0.1). The future land-use inputs used for v0.2 are from prototype land-use data for SSP4\_3.7 from GCAM (quarter-degree, annual gridded cropland, pasture, and urban grid-cell fractions). These inputs have been harmonized with the historical data using similar algorithms to previous LUH datasets. Crop type disaggregation and management layers are included in this release, but are currently based on historical data inputs only (IAM inputs will be used in future releases). Wood harvesting is not currently included in this version but will be based on IAM inputs in future releases. As with LUH2 v0.1, all states, transitions and management layers are computed and available here as *\*draft\** values over the future period. These data are suitable for model testing and development only, and are not suitable for applications or publications.

Major attributes of this version include:

- Future time domain (2015-2100)
- Harmonization with previous prototype of historical period (v0.1)
- Partial use of preliminary input data from one IAM/RCP/SSP

### 2.2 Files

Files can be downloaded from:

<https://luh.umd.edu/~LUH2/v0.2/>

The datasets are comprised of several NetCDF files:

LUH2 v0.2:

- states.nc (638 MB)
- transitions.nc (838 MB)
- management.nc (226MB)
- staticData\_quarterdeg.nc (32MB)

2.2 Variable Names and Units

2.2.1 States: (units fraction of grid cell unless otherwise specified)

primf: forested primary land  
 primn: non-forested primary land  
 secdf: potentially forested secondary land  
 secdn: potentially non-forested secondary land  
 pastr: managed pasture  
 range: rangeland  
 urban: urban land  
 c3ann: C3 annual crops  
 c3per: C3 perennial crops  
 c4ann: C4 annual crops  
 c4per: C4 perennial crops  
 c3nfx: C3 nitrogen-fixing crops  
 secma: secondary mean age (units: years)  
 secmb: secondary mean biomass density (units: kg C/m<sup>2</sup>)

2.2.2 Transitions:

Transitions between land use states (units fraction of grid cell per y)

All in format <state1\_to\_state2>

Wood harvest: (units fraction of grid cell)

primf\_harv: wood harvest area from primary forest  
 primn\_harv: wood harvest area from primary non-forest  
 secmf\_harv: wood harvest area from secondary mature forest  
 secyf\_harv: wood harvest area from secondary young forest  
 secnf\_harv: wood harvest area from secondary non-forest

Wood harvest: (units kg C)

primf\_bioh: wood harvest biomass from primary forest  
 primn\_bioh: wood harvest biomass from primary non-forest  
 secmf\_bioh: wood harvest biomass from secondary mature  
 forest  
 secyf\_bioh: wood harvest biomass from secondary young  
 forest  
 secnf\_bioh: wood harvest biomass from secondary non-forest

2.2.3 Management:

Irrigation: (units fraction of crop area)

irrig\_c3ann: irrigated fraction of C3 annual area  
 irrig\_c3per: irrigated fraction of C3 perennial area  
 irrig\_c4ann: irrigated fraction of C4 annual area  
 irrig\_c4per: irrigated fraction of C4 perennial area

irrig\_c3nfx: irrigated fraction of C3 N-fixing area

Fertilizer: (units kg N/ha/yr (crop season))

fertl\_c3ann: fertilizer rate for C3 annual crops

fertl\_c4ann: fertilizer rate for C4 annual crops

fertl\_c3per: fertilizer rate for C3 perennial crops

fertl\_c4per: fertilizer rate for C4 perennial crops

fertl\_c3nfx: fertilizer rate for C3 N-fixing crops

Tillage: (units fraction of cropland area)

tillg: tilled area of cropland

Biofuel crops (fraction of crop type area occupied by biofuel crops)

crpbf\_c3ann: C3 annual crops grown as biofuels

crpbf\_c4ann: C4 annual crops grown as biofuels

crpbf\_c3per: C3 perennial crops grown as biofuels

crpbf\_c4per: C4 perennial crops grown as biofuels

crpbf\_c3nfx: C3 N-fixing crops grown as biofuels

Biofuel wood harvest (units of fraction of wood harvest biomass)

rndwd: industrial roundwood fraction of wood harvest

fulwd: traditional fuelwood fraction of wood harvest

combf: commercial biofuels fraction of wood harvest

Harvest (units of fraction of biomass harvested annually)

fharv\_c3per: fraction of C3 perennial crops harvested annually

fharv\_c4per: fraction of C4 perennial crops harvested annually

#### 2.2.4 Static:

ptbio: potential biomass density of natural vegetation (units: kg C / m<sup>2</sup>)

fstnf: forest/non-forest mark (units: binary flag for forest (1) or non-forest (0))

carea: area of grid cell (units: km<sup>2</sup>)

ccode: country codes (units: ISO 3166-1 numeric code)

icwtr: icew/water fraction (units: fraction of grid cell area)