

LUH2 v1.0h beta

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. Ultimately, the major attributes of the datasets are planned to include:

- Global domain
- 850-2100 annual land-use states, transitions, and gridded mgt layers
- Common history
- Official CMIP6 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, 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 v1.0h_beta 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 close to final but will likely change in the finished product, and are not intended nor suitable for publication quality work. *****

LUH2 v1.0h_beta is a beta release of our historical land-use forcing dataset, and covers the period 850-2015. As with previous prototypes, it uses new HYDE 3.2 draft historical data on cropland, pasture, urban and irrigation to enable an increase in temporal domain and thematic resolution. Grazing lands are split into managed pasture and rangeland categories, and crop type disaggregation, management layers, and irrigation are included. Historical wood harvest data is based on updated FAO and HYDE inputs, as well as other historical wood harvest estimates. All states, transitions and management layers are computed and available here as *DRAFT* values. These data are suitable for model testing and development only, and are not suitable for applications or publications.

Major new attributes of this version (LUH2 v1.0h) include:

- New nitrogen fertilizer data, based on Xin et al. 2015 (Nature)
- New FAO crop type data used in conjunction with Monfreda et al. 2008 crop type data.
- New representation of crop rotations between the different crop functional types.
- New representation of changing shifting cultivation rates and patterns.
- New representation of national wood harvest demand 850-2015.
- New map of underlying potential biomass density and recovery rate.
- New gridded flooded fraction of C3 Annual crop types, based on data from HYDE 3.2
- Global forest loss 2000-2012 constrained with Landsat-based forest loss data from Hansen et al. 2013 (Science).

Following the release of this beta dataset, we will be accepting feedback from the scientific community that we will incorporate into the final version which is planned for end of March 2016.

2.2 Files

Files can be downloaded from:

https://luh.umd.edu/~LUH2/LUH2_v1_beta/

The datasets are comprised of several NetCDF files:

LUH2 v1.0h_beta historical:

- states.nc (4.9GB)
- transitions.nc (14.0GB)
- management.nc (1.4GB)

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/m²)

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 / m²)

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

carea: area of grid cell (units: km²)

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

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