

Initial WRF landuse table

&noahmp_modis_veg_categories

NVEG = 20

&noahmp_modis_parameters

1	'Evergreen Needleleaf Forest'	USGS	14	
2,	'Evergreen Broadleaf Forest'	USGS	13	
3,	'Deciduous Needleleaf Forest'	USGS	12	
4,	'Deciduous Broadleaf Forest'	USGS	11	
5,	'Mixed Forests'	USGS	15	
6,	'Closed Shrublands'	USGS	8	"shrubland"
7,	'Open Shrublands'	USGS	9	"shrubland/grassland"
8,	'Woody Savannas'	USGS	8	"shrubland"
9,	'Savannas'	USGS	10	
10,	'Grasslands'	USGS	7	
11	'Permanent wetlands'	Avg of USGS	17 and 18	(herb. Wooded wetland)
12,	'Croplands'	USGS	2	"dryland cropland"
13,	'Urban and Built-Up'	USGS	1	
14	'cropland/natural vegetation mosaic'	USGS	5	"cropland/grassland"
15,	'Snow and Ice'	USGS	24	
16,	'Barren or Sparsely Vegetated'	USGS	19	
17,	'Water'	USGS	16	
18,	'Wooded Tundra'	USGS	21	
19,	'Mixed Tundra'	USGS	22	
20,	'Barren Tundra'	USGS	23	

LAKES = 21

- 1) LANDMATE_PFT_v1.1_Europe_0.018deg_2015.nc interpolated to 0.11° with conservative remapping. The PFT percentages are adjusted proportionally so that they sum 1.
- 2) 1st translation using the following table:

LUCAS LUC PFT	Original PFTs from Peter	WRF PFT	First translation to Modis
1	Tropical broadleaf evergreen	2	Evergreen Broadleaf Forest
2	Tropical broadleaf deciduous	4	Deciduous Broadleaf Forest
3	Temperate broadleaf evergreen	2	Evergreen Broadleaf Forest
4	Temperate broadleaf deciduous	4	Deciduous Broadleaf Forest
5	Evergreen coniferous	1	Evergreen Needleleaf Forest
6	Evergreen deciduous	3	Deciduous Needleleaf Forest
7	Evergreen shrubs	6	Closed Shrublands (USGS 8 "shrubland")
8	Deciduous shrubs	6	Closed Shrublands (USGS 8 "shrubland")

9	C3 grasses	10	Grasslands
10	C4 grasses	10	Grasslands
11	Tundra	19	Mixed Tundra
12	Swamps	11	Permanent wetlands
13	Crops	12	Croplands (USGS 2 "dryland cropland")
14	Irrigated crops	-----	
15	Urban	13	Urban and Built-Up
16	Bare	16	Barren or Sparsely Vegetated

3) Add the missing landcover categories:

- 3.1) Irrigated crops in Modis table to be filled with the USGS properties of "Irrigated Cropland and Pasture" (field 3). To replace Savannas
- 3.2) C3 and C4 percentage added to form a unified "Grassland" field
- 3.3) Percentage of the 3 types of tundra in Modis converted into fraction of tundra types which are multiplied by PFT11 whenever PFT11 >0. This adds 2 more layers of tundra: Wooded Tundra and Barren Tundra – PFT18, PFT20
- 3.4) Shrubs PFT7 and 8 added to form a unified "shrubland". Maps similar to closed shrubland. Percentage of the 3 types of shrubland in Modis converted into fraction of shrubs types which are multiplied by PFT7+PFT8 whenever PFT7+PFT8 >0. This adds 2 more layers of shrubs: open shrubs and woody savannas – PFT7, PFT8
- 3.5) Missing "Mixed Forests" – set to zero
- 3.6) Missing "cropland/natural vegetation mosaic" – set to zero
- 3.7) Added PFT17 for water. Land use from WRF's LANDUSEF
- 3.8) Added PFT21 for lakes. Water percentage taken from ESA CCI. Water percentage from 1950 to 1992 constant in time and equal to 1992. Percentage of water from 1992 onwards evolves with time according to ESA CCI
- 3.9) Missing "snow and ice". Permanent snow and ice from ESA CCI. Snow and ice percentage from 1950 to 1992 constant in time and equal to 1992. Percentage of snow and ice from 1992 onwards evolves with time according to ESA CCI. **Future permanent snow and Ice should be retrieved from GCM and added to LANDUSEF.**

- 4) All LUCAS LUC PFTs adjusted to account for water, snow and ice, i.e. $\% \text{PFT} = \% \text{PFT}_{\text{ori}} \times (1 - (\% \text{water} + \% \text{snow} + \% \text{ice}))$
- 5) **LU_INDEX** in each grid box corresponds to the PFT with the maximum percentage in that grid box. Probably best to set `surface_input_source=1` in `namelist.input` and let WRF determine **LU_INDEX** from the percentages in the land use file

Final map with dominant vegetation:

WRF_LUCAS_LUC_v1.0_ESACCI_LUH2_historical_0.11deg_1950_2015_LUINDEX_v2.nc

Map with difference between 1950 and 2015 LUINDEX:

WRF_LUCAS_LUC_v1.0_ESACCI_LUH2_historical_0.11deg_1950-2015_LUINDEX_diff.nc

Map with percentage of vegetation for each PFT:

WRF_LUCAS_LUC_v1.0_ESACCI_LUH2_historical_0.11deg_1950_2015_Land_cat_v2.nc

Final conversion table

&noahmp_modis_parameters

1	'Evergreen Needleleaf Forest'	Evergreen coniferous
2,	'Evergreen Broadleaf Forest'	Temperate broadleaf evergreen
3,	'Deciduous Needleleaf Forest'	Evergreen deciduous
4,	'Deciduous Broadleaf Forest'	Temperate broadleaf deciduous
5,	'Mixed Forests'	0
6,	'Closed Shrublands'	% of Evergreen shrubs + Deciduous shrubs
7,	'Open Shrublands'	% of Evergreen shrubs + Deciduous shrubs
8,	'Woody Savannas'	% of Evergreen shrubs + Deciduous shrubs
9,	'Irrigated Cropland'	Irrigated Crops
10,	'Grasslands'	C3 + C4 grasses
11	'Permanent wetlands'	swamps
12,	'Croplands'	Crops
13,	'Urban and Built-Up'	Urban
14	'cropland/natural vegetation mosaic'	0
15,	'Snow and Ice'	From ESA CCI
16,	'Barren or Sparsely Vegetated'	Bare
17,	'Water'	From model Land-Sea mask
18,	'Wooded Tundra'	% of tundra
19,	'Mixed Tundra'	% of tundra
20,	'Barren Tundra'	% of tundra
21,	'Lakes'	From ESA CCI water