Supplementary Material

Table S1. Reclassification of the reference and target dataset for accuracy assessment analysis. The reference (GLC-SHARE) and classified (LUH2) data were reclassified into four common classes: (1) forest, (2) crops, (3) open areas, and (4) urban. Classes absent in the focus dataset were masked-out.

original class code	**original class name**	**code (name) after reclassification**
	GLC-SHARE	
1	Artificial surfaces	4 (urban)
2	Cropland	2 (crops)
3	Grassland	3 (open areas)
4	Tree covered areas	1 (forest)
5	Shrubs covered areas	3 (open areas)
6	Herbaceous vegetation, aquatic or regularly flooded	3 (open areas)
7	Mangroves	1 (forest)
8	Sparse vegetation	3 (open areas)
9	Bare soil	3 (open areas)
10	Snow and glaciers	masked-out
11	Water bodies	masked-out
	LUH2	
1	C3 annual crops (c3ann)	2 (crops)
2	C3 nitrogen-fixing crops (c3nfx)	2 (crops)
3	C3 perennial crops (c3per)	2 (crops)
4	C4 annual crops (c4ann)	2 (crops)
5	C4 perennial crops (c4per)	2 (crops)
6	Managed pasture (pastr)	3 (open areas)
7	Forested primary land (primnf)	1 (forest)
8	Non-forested primary land (primn)	3 (open areas)
9	Rangeland (range)	3 (open areas)
10	Potentially forested secondary land (secdf)	1 (forest)
11	Potentially non-forested secondary land (secdn)	3 (open areas)
12	Urban land (urban)	4 (urban)

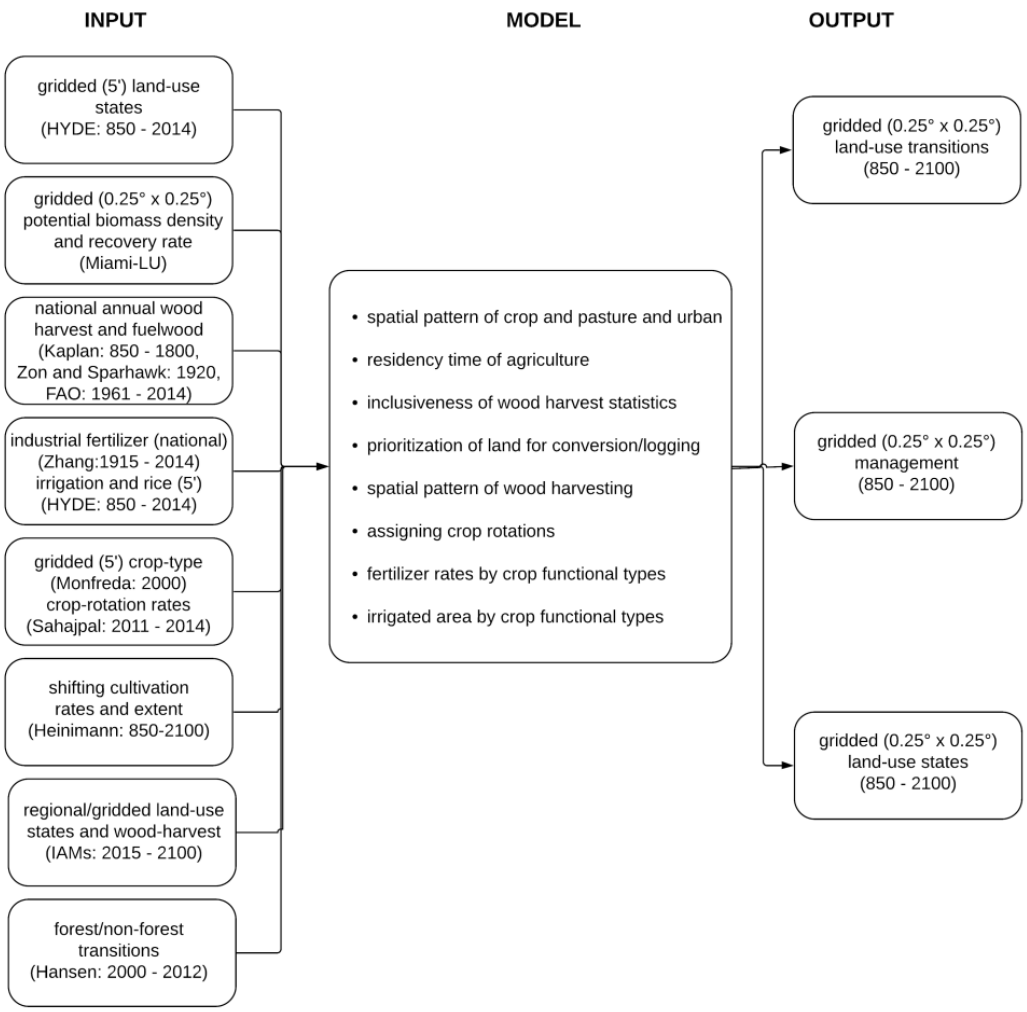

Figure S1. Framework to generate land use and land cover states of Land-Use Harmonization (LUH2, Hurtt et al . 2020)

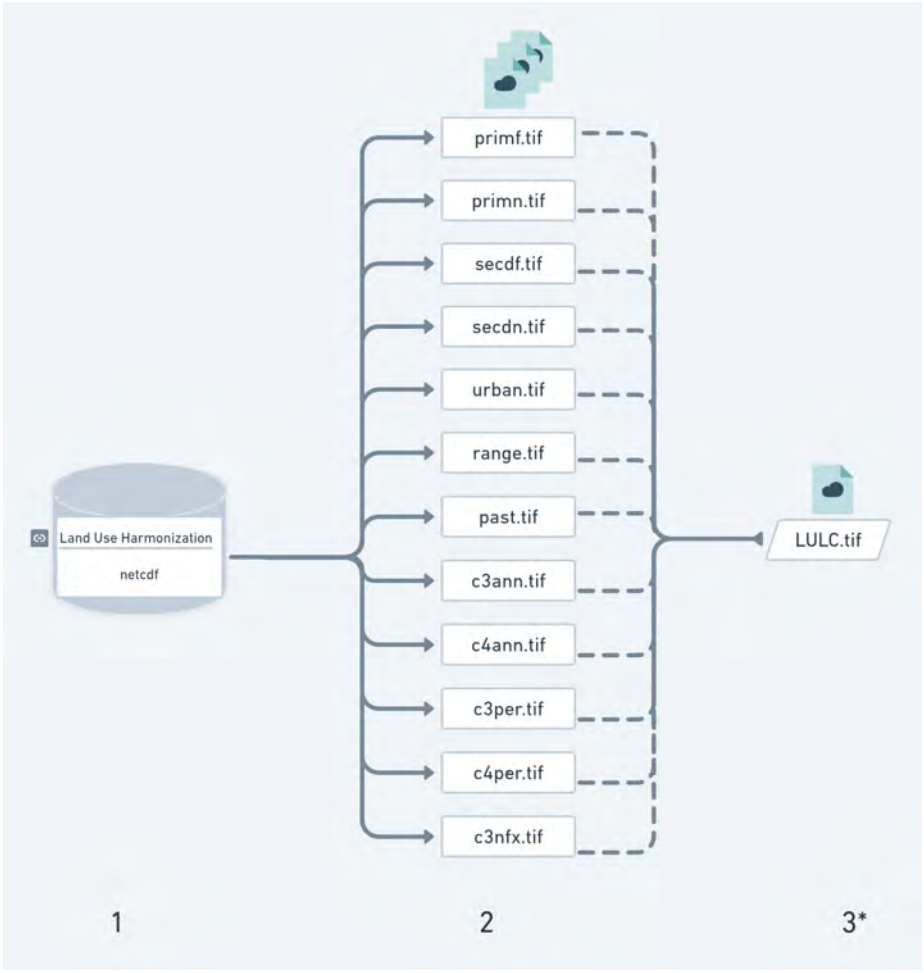

Figure S2. Workflow: (1) Extract every single state per year from 850 to 2100, with two future scenarios (SSP2-4.5 and SSP5-8.5) from 2015 on; (2) Save every state (continuous data) into "State-files" in TIFF format; and (3*) Create new (categorical data) of land-use land-cover combining 12 states into "LULC -iles" in TIFF format.

Global Confusion Matrix

Classification Data	Reference Data: forest (1)	crops (2)	open areas (3)	urban(4)	UserAccuracy	UserAccuracyVariance
forest (1)	52196	1483	24341	29	66.88%	0.0033
crops (2)	4312	15358	12716	48	47.35%	0.00543
open areas (3)	17262	2139	92711	31	82.67%	0.00222
urban(4)	240	280	365	135	13.24%	0.02081
Weights	78049	32434	112143	1020		
ProducerAccuracy	70.53%	79.74%	71.24%	55.56%		
ProducerAccuracyVariance	0.00274	0.00531	0.00177	0.06061		
PortmanteauAccuracy	78.69%	90.62%	74.58%	99.56%		
PortmanteauAccuracyPartial	52.27%	42.27%	61.99%	11.97%		

OverallAccuracy	**0.7172**
OverallAccuracyVariance	**0.00179**
AllocationDisagreement	**0.20236**
Shift	**0.01463**
Exchange	**0.18773**
QuantityDisagreement	**0.08044**
AMI	**0.34385**
AMIAdjusted	**0.34166**
AMIVariance	**0.00412**
Kappa	**0.51263**
KappaVariance	**0**

Afrotropical Confusion Matrix

Classification Data		Reference Data					
		forest (1)	crops (2)	open areas (3)	urban(4)	UserAccuracy	UserAccuracyVariance
	forest (1)	3713	13	5064	0	42.24%	0.01033
	crops (2)	394	578	2852	1	15.11%	0.01135
	open areas (3)	1016	207	19142	0	93.99%	0.00326
	urban(4)	2	2	33	1	2.63%	0.05158
	Weights	8790	3825	20365	38		
	ProducerAccuracy	72.45%	72.25%	70.66%	50.00%		
	ProducerAccuracyVariance	0.01119	0.03026	0.00283	0.69296		
	PortmanteauAccuracy	80.35%	89.49%	72.22%	99.88%		
	PortmanteauAccuracyPartial	36.39%	14.28%	67.61%	2.56%		

OverallAccuracy	**0.70973**
OverallAccuracyVariance	**0.00365**
AllocationDisagreement	**0.08656**
Shift	**0.01163**
Exchange	**0.07493**
QuantityDisagreement	**0.20371**
AMI	**0.16566**
AMIAdjusted	**0.16545**
AMIVariance	**0.00762**
Kappa	**0.35468**
KappaVariance	**0.01055**

Australasian Confusion Matrix

		Reference Data					
		forest (1)	crops (2)	open areas (3)	urban (4)	UserAccuracy	UserAccuracyVari
Classification Data	forest (1)	1317	45	1440	0	47.00%	0.01848
	crops (2)	69	634	450	0	54.99%	0.02873
	open areas (3)	55	105	8011	1	98.03%	0.00301
	urban (4)	3	3	14	5	20.00%	0.16003
	Weights	2802	1153	8172	25		
	ProducerAccuracy	91.20%	80.56%	80.80%	83.33%		
	ProducerAccuracyVariance	0.01405	0.02595	0.00503	0.29403		
	PortmanteauAccuracy	86.73%	94.47%	83.01%	99.83%		
	PortmanteauAccuracyPartial	44.96%	48.55%	79.51%	19.23%		

OverallAccuracy	**0.82019**
OverallAccuracyVariance	**0.00546**
AllocationDisagreement	**0.03637**
Shift	**0.00247**
Exchange	**0.0339**
QuantityDisagreement	**0.14343**
AMI	**0.38316**
AMIAdjusted	**0.38294**
AMIVariance	**0.0186**
Kappa	**0.5696**
KappaVariance	**0.01585**

Indomalayan Confusion Matrix

		Reference Data					
		forest (1)	crops (2)	open areas (3)	urban (4)	UserAccuracy	UserAccuracyVariance
Classification Data	forest (1)	4146	155	690	3	83.02%	0.01041
	crops (2)	113	3247	851	6	77.00%	0.0127
	open areas (3)	709	161	2171	0	71.39%	0.01607
	urban (4)	10	20	16	5	9.80%	0.08243
	Weights	4994	4217	3041	51		
	ProducerAccuracy	83.29%	90.62%	58.23%	35.71%		
	ProducerAccuracyVariance	0.00862	0.00891	0.01227	0.24442		
	PortmanteauAccuracy	86.34%	89.38%	80.27%	99.55%		
	PortmanteauAccuracyPartial	71.16%	71.32%	47.22%	8.33%		

OverallAccuracy	**0.77778**
OverallAccuracyVariance	**0.00726**
AllocationDisagreement	**0.16638**
Shift	**0.00821**
Exchange	**0.15817**
QuantityDisagreement	**0.05584**
AMI	**0.68145**
AMIAdjusted	**0.68053**
AMIVariance	**0.01927**
Kappa	**0.66383**
KappaVariance	**0.01096**

Neartic Confusion Matrix

Classification Data		Reference Data					
		forest (1)	crops (2)	open areas (3)	urban (4)	UserAccuracy	UserAccuracyVarianc
	forest (1)	11729	175	2001	5	84.32%	0.00604
	crops (2)	682	2787	1212	9	59.42%	0.01406
	open areas (3)	6635	343	14118	6	66.90%	0.00635
	urban (4)	123	45	51	85	27.96%	0.05054
	Weights	13910	4690	21102	304		
	ProducerAccuracy	61.19%	83.19%	81.22%	80.95%		
	ProducerAccuracyVariance	0.00482	0.01187	0.00494	0.07307		
	PortmanteauAccuracy	75.95%	93.84%	74.38%	99.40%		
	PortmanteauAccuracyPartial	54.94%	53.06%	57.94%	26.23%		

OverallAccuracy	**0.71787**
OverallAccuracyVariance	**0.0043**
AllocationDisagreement	**0.15068**
Shift	**0.02375**
Exchange	**0.12693**
QuantityDisagreement	**0.13146**
AMI	**0.40274**
AMIAdjusted	**0.40182**
AMIVariance	**0.01058**
Kappa	**0.52534**
KappaVariance	**0.00756**

Neotropical Confusion Matrix

Classification Data		Reference Data					
		forest (1)	crops (2)	open areas (3)	urban (4)	UserAccuracy	UserAccuracyVariance
	forest (1)	9426	18	4619	7	66.99%	0.00777
	crops (2)	528	571	2754	3	14.81%	0.01121
	open areas (3)	838	48	6739	7	88.30%	0.00721
	urban (4)	3	1	12	11	40.74%	0.18887
	Weights	14070	3856	7632	27		
	ProducerAccuracy	87.32%	89.50%	47.71%	39.29%		
	ProducerAccuracyVariance	0.00565	0.02355	0.00461	0.15835		
	PortmanteauAccuracy	76.50%	86.90%	67.65%	99.87%		
	PortmanteauAccuracyPartial	61.05%	14.56%	44.88%	25.00%		

OverallAccuracy	**0.65456**
OverallAccuracyVariance	**0.00508**
AllocationDisagreement	**0.09166**
Shift	**0.02013**
Exchange	**0.07153**
QuantityDisagreement	**0.25378**
AMI	**0.28524**
AMIAdjusted	**0.24522**
AMIVariance	**0.01024**
Kappa	**0.42383**
KappaVariance	**0.00958**

Paleartic Confusion Matrix

		Reference Data					
		forest (1)	crops (2)	open areas (3)	urban (4)	UserAccuracy	UserAccuracyVariance
Classification Data	forest (1)	19963	1379	9455	13	64.79%	0.00533
	crops (2)	1430	6950	4674	28	53.13%	0.00855
	open areas (3)	7968	1242	39798	5	81.20%	0.00346
	urban (4)	86	167	219	20	4.07%	0.01747
	Weights	30810	13082	49013	492		
	ProducerAccuracy	67.79%	71.37%	73.50%	30.30%		
	ProducerAccuracyVariance	0.00442	0.00808	0.00275	0.10935		
	PortmanteauAccuracy	78.23%	90.45%	74.77%	99.45%		
	PortmanteauAccuracyPartial	49.54%	43.79%	62.81%	3.72%		

OverallAccuracy	**0.71449**
OverallAccuracyVariance	**0.0028**
AllocationDisagreement	**0.23055**
Shift	**0.00282**
Exchange	**0.22774**
QuantityDisagreement	**0.05496**
AMI	**0.32896**
AMIAdjusted	**0.32544**
AMIVariance	**0.00625**
Kappa	**0.5053**
KappaVariance	**0**