

Table S1. A summary of global urban land-cover datasets.

Dataset	Extent	Data Source(s)	Period	Resolution	Proportion of Global Land Area	Accuracy
Global constructed impervious surface area (ISA) [1]	Constructed ISA	DMSP/OLS LandScan 2004	2000–2001	1 km	0.43% in 2001	--
Global urban extent [2,3]	Built-up area (excludes parks)	MODIS	2001–2002	500 m	0.51% in 2002	OA is 93%; R ² is 0.90
Global human built-up and settlement extent (HBASE) dataset [4]	Built-up area	Landsat TM/ETM	2011–2013	0.5–10 m	—	OA is 86.6%
Global Human Settlement Layer (GHSL) [5, 6]	Urban centers/ clusters	Multiple sources	1975–2018	0.5–10 m	—	OA > 90%
Global 1-km annual urban dynamics [7]	Built-up area	DMSP/OLS 1 km	1992–2013	1 km	0.53% in 2013	R ² is 0.89 in China and 0.95 in USA
Global urban land (GUL) [8]	ISA	Landsat TM/ETM	1990–2010	30 m	0.63% in 2010	Kappa is 0.43–0.50
Global urban ISA and green space [9]	Urban ISA and green space fractions	DMSP/OLS, MODIS and GlobeLand30	2015	250 m	0.30% (ISA) and 0.17% (green space) in 2010	MRE is 0.19
Global urban expansion (GUE) [10]	Built-up area	DMSP/OLS, MODIS NDVI, and LST	1992–2016	1 km	0.42% in 2016	OA is 90.0%; Kappa is 0.47
Global urban boundaries [11]	Built-up area	GAIA	1990–2018	30 m	0.54% in 2018	R > 0.8
Global artificial impervious area (GAIA) [12]	Artificial ISA	Landsat TM/ETM/8; Sentinel-1 Synthetic Aperture Radar	1985–2015	30 m	0.53% in 2015	Kappa is 0.78 in 2015

Global ISA (MSMT) [13]	ISA	Landsat 8/ Sentinel-1 SAR/SRTM DEM	2015	30 m	—	OA is 95.1%; Kappa is 0.90
World Settlement Footprint 2015 (WSF2015) [14]	Human settlements	Sentinel-1/ Landsat 8	2015	10 m	0.95% of the emerged surfaces	AA is 89.33%; Kappa is 0.78
Urban Footprint Processor(UFP)[15]	Human settlements	TanDEM-X/ TerraSAR-X	2011–2012	12 m	—	OA is 85.04%; Kappa is 0.69

Table S2. The thresholds for mapping urban boundaries in each urban ecoregion.

ID	Urban ecoregions	Sampled cities	Samples	Threshold
1	Temperate forest	Houston, New York, Richmond, Miami, Brisbane, Canberra, Sydney	825	40
2	Temperate forest	Aberdeen, Bergen, Budapest, London, Moscow, Warsaw	1030	40
3	Temperate forest	Anqing, Beijing, Chengdu, Shenyang, Tokyo, Zhengzhou	446	50
4	Temperate grassland	Albuquerque, Las Vegas, Phoenix	539	40
5	Temperate grassland	Baku, Baghdad, Kayseri, Tehran	515	50
6	Tropical broadleaf forest	Havana, Manaus	474	35
7	Tropical broadleaf forest	Bata, Lagos	119	35
8	Tropical, sub-tropical forest	Guangzhou, Hue, Kuala Lumpur, Mandalay	653	50
		New Deli, Pondicherry	251	45
9	Tropical, sub-tropical savannah	Brasilia, Buenos Aires Curitiba, Rio de Janeiro	599	35
10	Tropical, sub-tropical savannah	Addis Ababa, Bamako	716	50
11	Tropical, sub-tropical grassland	Lima, Cape Town	187	35
12	Temperate Mediterranean	Casablanca, Istanbul, Madrid, Los Angeles	427	40
13	Arid, semi-arid desert	Aswan, Cairo, Kuwait City, Sana	642	50
14	Arid, semi-arid steppe	Aksu, Almay, Lhasa, Urumqi	557	50
15	Boreal forest, tundra	Fairbanks, Yakutsk	450	35

Table 3. The values of Normalized Difference Vegetation Index (vegetation) (NDVI_{veg}), Normalized Difference Vegetation Index (soil) (NDVI_{soil}), the slope in the linear regression between FVC_i and $NGSI_i$ in each urban ecoregion (β), and impervious surface area (ISA) and green space (GS) fractions in each urban ecoregion.

ID	Urban ecoregion	NDVI _{veg}	NDVI _{soil}	β	ISA fraction	GS fraction
1	Temperate forest	64	34	0.9111	56.65%	39.34%
2	Temperate forest	64	25	0.9117	61.37%	29.60%
3	Temperate forest	65	23	0.9362	64.32%	27.04%
4	Temperate grassland	54	18	0.7974	65.50%	31.05%
5	Temperate grassland	62	24	0.6409	60.27%	28.28%
6	Tropical broadleaf forest	66	24	0.6520	61.89%	30.87%
7	Tropical broadleaf forest	48	27	0.7293	45.42%	49.38%
8	Tropical, sub-tropical forest	56	30	0.9785	60.73%	30.30%
9	Tropical, sub-tropical savannah	54	26	0.7792	66.11%	29.21%
10	Tropical, sub-tropical savannah	48	17	1.0258	55.23%	38.36%
11	Tropical, sub-tropical grassland	46	29	0.7333	62.55%	29.99%
12	Temperate Mediterranean	59	20	0.8307	56.42%	39.10%
13	Arid, semi-arid desert	64	31	0.9214	54.52%	30.26%
14	Arid, semi-arid steppe	67	23	0.8095	60.99%	26.54%
15	Boreal forest, tundra	64	34	0.7598	38.94%	57.48%

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