

Table S1. Settlement area and population datasets used in land efficiency modelling, ordered by scale.

	Build-up Data	Input data/ Method	Population Data	Input Data/ Methods	Area
Schiavina et al. [18]	GHS-Built (JRC) (1975, 1990, 2000, 2015)	Satellite imagery (Landsat)/ Artificial intelligence and machine learning	GHS-POP (1975, 1990, 2000, 2015)	Census data (CIESIN GPW), GHS-BUILT/ Disaggregation to build-up area	global
Wang et al. [20]	China's Land Use/Cover Datasets (CLUDs) (Data Centre for Resources and Environmental Sciences) (1990, 2000, 2010)	Landsat Thematic Mapper, Enhanced Thematic Mapper (TM/ETM+)	Census Data (The Fourth, Fifth, Sixth National Population Census, National Bureau of Statistics of China) (1990, 2000, 2010)	Census Data/ Disaggregation to 1 km x1 km grid	country (China)
Nicolau et al. [21]	COC (DGT—Directorate-General for Territory) (2007, 2010, 2015) CLC (EEA—European Environment Agency) (1990, 2000, 2006, 2012)	Landsat 4/5 TM, Landsat 7 ETM SPOT-4/5, IRS P6 LISS III IRS P6 LISS III, RapidEye Sentinel-2A/B, Landsat 8/ computer-assisted photo-interpretation	Census Data (2001,2006, 2007, 2011, 2015)	Census Data/ Aggregation to municipalities	country (Portugal)
Zhou et al. [19]	1. GAIA (1985–2018) 2. GHS-Built (1975, 1990, 2000, 2015) 3. GLC_FCS-2020 (2020) 4. GlobeLand30 (2000, 2010, 2020)	1. Landsat TM, ETM+, OLI, VIIRS NTL, Sentinel-1 SAR/ Exclusion–inclusion algorithm and temporal consistency check 2. Landsat MSS, TM, ETM+ /Symbolic machine learning 3. Landsat 8 surface reflectance, Sentinel-1 SAR/ Random forest classifier 4. Landsat TM, ETM+, OLI, HJ-1/ POK (based on pixels, objects and knowledge)	WorldPop (2000, 2005, 2010, 2015, 2020)	Landsat ETM+/ machine learning and asymmetric modelling	country (China)
Mudau et al. [9]	Satellite Imagery—SPOT 5, SPOT 2, Landsat 5 (United States Geological Survey (USGS) and the South African National Space Agency (SANSA))	SPOT 5/ Artificial Intelligence and symbolic machine learning which use radiometric, textural morphological features and reference data Landsat 5 and SPOT 2/ kNN object-based image analysis technique used textural and radiometric value (1996, 2001)	Census Data Statistics South Africa (1996, 2001, 2011)	Census Data/ Disaggregation to sub-place unit	local (sub-place unit in South Africa)
Aquilino et al. [22]	1. The European Settlement Map (Copernicus Land Monitoring Services) (2012) 2.Satellite Imagery—Sentinel-2 images (2019-2020)	1.SPOT 5 and SPOT 6 / Automated classification based on machine learning. 2.Sentinel-2 images (the United States Geological Survey (USGS) Earth Explorer/ support-vector machine (SVM) classifier	Census Data (the Italian National Institute of Statistics) (2001, 2011, 2019) Urban Atlas (2012, 2018)	Census data/ Dasymetric Mapping Method	local (Bari, Italy)