CONFOEDERATIO,
RESEARCH DIVISION (CRD).

STADESTÉR 1.0.

A Global Database of 41000+ Cities from 3000BC to the Present.

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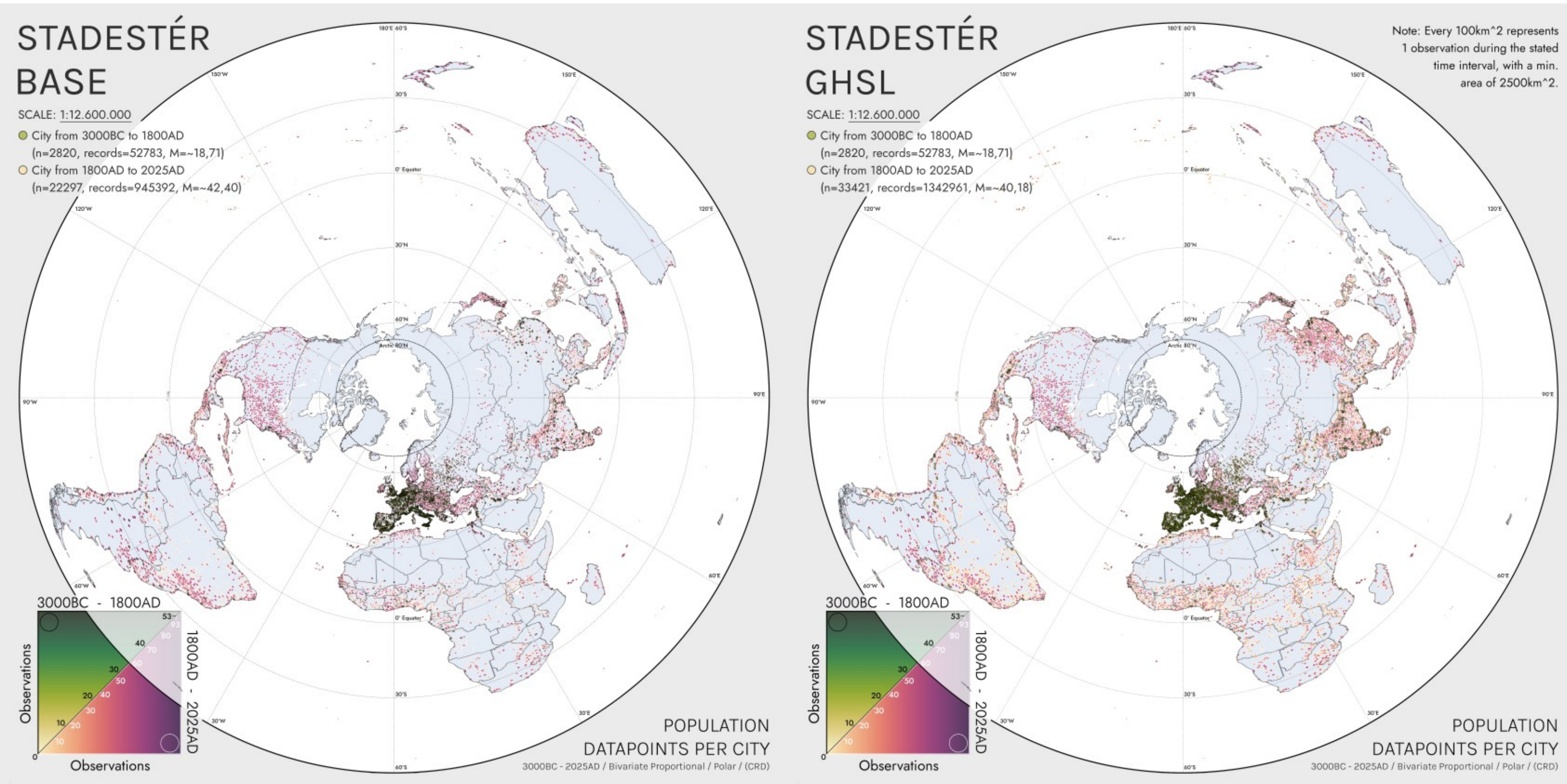


Figure 1. Population datapoints per city in Stadestér Base as compared to Stadestér-GHSL.

Abstract

Stadestér is an internally consistent global urban population database of ~41.214 cities and their populations from 3000BC to 2025AD as taken from Buringh, Chandler, de Vries, GHSL, GHS-POP, Modelski, Populstat, Reba et al., and Wikipedia. Resultant data was standardised, geolocated, cubic spline interpolated, and calculated at 1-year intervals via weighted geometric averages. Reliability was assessed via comparisons to other demographic sources and long-run urban estimates, out-of-model sampling, regional centre of population/gravity comparisons, and manual copychecking prior to calibration, deviating by a mean of 17,4% (SD = 13%) of HYDE/UN estimates over the long run.

To avoid duplicate entries, cities were merged based on their physical distance from one other as well as their semantic similarity between both contemporary and historical names. Metropolitan networks were corrected for by subtracting suburban populations from their metro area, and redistributing any negative numbers held by the metropolitan area back to their suburbs in a proportional manner. Geolocation was achieved via automated Selenium/Puppeteer scraping, the Google Places API, Google Maps, Nominatim/OSM, and manual transcription.

Area, density, rate of natural increase (RNI), and geospatial distributions of population within cities are also available at annual resolution starting from 1800AD. Note that rasters have only been outputted for the subset of HYDE years from 3000BC-2025AD, and that we provide an open-source CLI for generating data from specific years, in addition to a custom UI tool for geoprocessing and visualisation (Constele Red). Area/density calculations were derived from Angel, Bairoch, Clark, Pasciuti and Chase-Dunn, and Stanilov and Sykora. The work of Hanson, Ortman, and Storey on classical populations have not yet been implemented.

We also naturally provide rasters of global overall population and non-urban population as an alternative to HYDE3.2/3.3 based on HYDE corrected for outliers, McEvedy and Jones, and GHS-POP. To replace masked outliers, we created custom climate models based on the ALCC work of KK10/LUH2 as rural population fallbacks. Both the main substrata and fallback substrata were calibrated to reliable estimates of regional and global population.

Note. European decimals are used throughout this research. Accompanying each figure is a hyperlink for a full-resolution version of the image.

Background

What do we know about urban history? When this project had begun, we assumed this was a somewhat settled question - population figures had after all been published and tabulated in great detail for past cities, however HYDE3.3 had not done so, despite being commonly used in long run analysis and estimates of urbanisation, for example by Our World In Data, or as a background variable by V-Dem [1][2].

To their credit, it is confusing since HYDE3.1's methodological paper implies that urban population totals did use estimates of historical urban population, HYDE3.2's preprint implies otherwise, HYDE3.2's paper refers back to HYDE3.1's methodological paper, and there is an additional flowchart in said paper claiming that historical population was empirically derived:

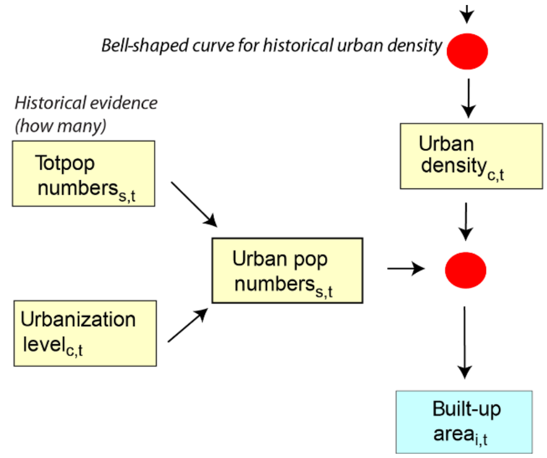


Figure 2. HYDE3.2's flowchart implying historical urban population is empirically derived (Urban pop numbers $_{s,t}$).

'Chandler (1987) and Mitchell (1993a, b, 1998) present hundreds of estimates for historical city population numbers, but they provide no area associated with them, therefore we decided to use historical urban densities as a proxy for computing built-up area instead'. [3]

'Finally, an important point to be made is that in this HYDE3.2 version no empirical data is systematically used (yet) to improve the historical land use reconstructions. All allocation in in [sic] the deep past is done by general, globally applicable HYDE allocation rules. As Morrison (2015) rightly pointed out, these rules are often made with a Euro-centric point of view'. [4].

HYDE3.3 does not have a corresponding methodological paper. It is difficult to tell which is which - we will charitably assume that urban population numbers not in land use, and that they did encode empirical figures. If so, there must have been a lot of clerical errors, because HYDE3.3's assessment of principal cities in antiquity are off by orders of magnitude from Chandler and Modelski:

City	HYDE Population (1000s)	Estimated Population (1000s)	Discrepancy	Sources
Chengdu	3,225	250	77,519x	Modelski [5]
Luoyang	1,386	260	187,59x	Modelski [5]
Chang'an	1	246	246x	Modelski [5]
Kaifeng	1,297	100	77,101x	Modelski [5]
Taxila	0,557	150	269,299x	Modelski [5]
Madurai	1,833	50	27,277x	Chandler [6]
Pataliputra	2,808	100	35,613x	Modelski [5]
Vaishali	2,168	100	46,125x	Modelski [5]
Alexandria	0,623	400	642,054x	Chandler,

Jerusalem	0,093	100	1075,268x	Modelski [5][6] Chandler [6]
Seleucia	0,147	400	2721,088x	Modelski [5]
Rome	2,741	450	164,174x	Hanson & Ortman (City Proper), Storey, Chandler [6][7][8]
Caracol	0	100	N/A	Modelski [5]
Geomean Discrepancy:	-	-	168,569x, SD = 778,214	

Figure 3. Table of urban population differences between HYDE and academic estimates (1AD). Estimated populations are geometric means.

It is certainly not as though these estimates improve with time, or even the advent of modern data. HYDE claims, for instance, that the largest cities in the Soviet Union in 1950AD were Chelyabinsk and Novosibirsk, and that their peak population densities were roughly twice that of Moscow. It is also not self-consistent within countries as diverse as Bhutan, Denmark, Iceland, Russia, or the pre-Columbian United States and Canada[1].

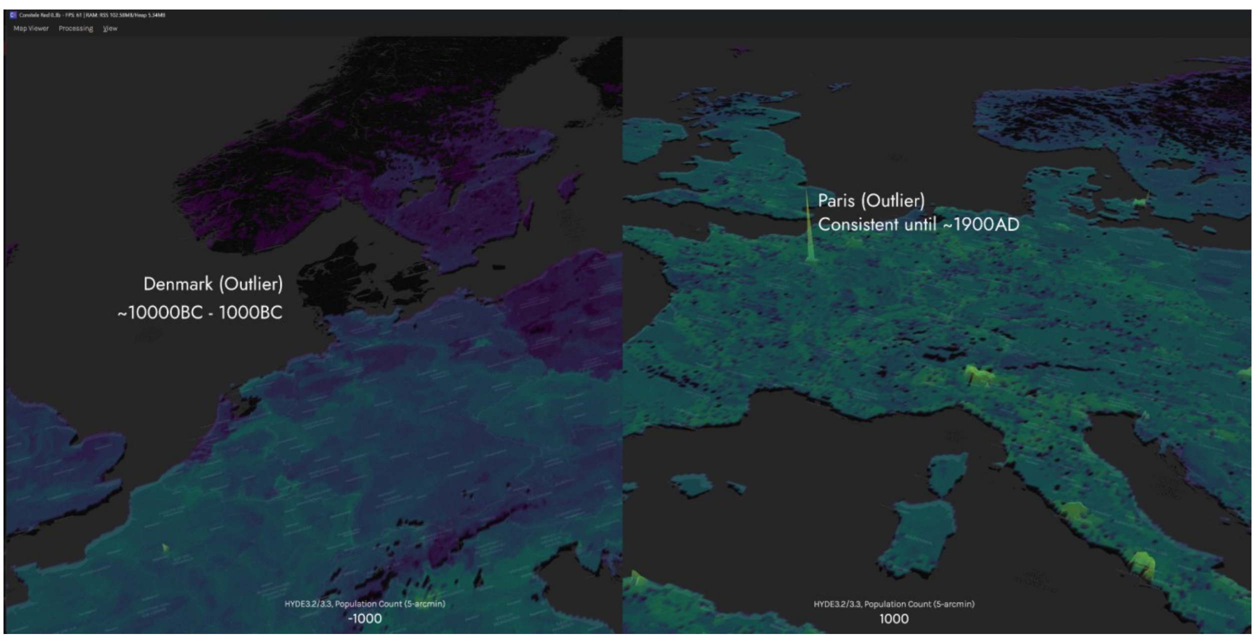


Figure 4. Screenshots of extant artefacting issues with with HYDE3.2/3.3 as viewed on an elevation heightmap in Constele Red.

All of this confusion is an especially undesirable outcome given that gridded population datasets are frequently used for urban planning or assessments of historical urban population [9].

Extant Datasets

Stadestér originated from an attempt to fix historical populations within HYDE. We had unfortunately found in the process that HYDE3.2/3.3 was unworkable even on a regional scale, and so had to scale processed HYDE population rasters first to McEvedy and Jones, then to estimates to Amerindigenous populations as carried out by Denevan, Snow, Alchon, Peros, and Milner [11][12][13][14][15]. We then merged HYDE3.2/3.3 to get rid of some of the outliers in the most recent iteration of the dataset, before recalibrating it to various estimates of regional and global population [16]. We will refer to this internal model throughout the paper as Velkscala 0.7.

An ideal solution for fixing urban populations within Velkscala 0.7 would have been to use existing comprehensive urban datasets at a global level, but despite large-scale advances in data sourcing from Wikipedia, YouTube, or various websites [17][18], organised tables and aggregations of urban data remain limited. The field of historical demography in general may evolve in an OSINT/open-source like manner similar to data science, but we have relied mainly on scholarly research in aggregating this dataset.

However, we found that existing work had generally low urban coverage, was spatiotemporally sparse, and often did not incorporate better modern data post-1975 or even post-2000 as made available by GHSL, with an error margin of ~4,5-11,6% from satellite data [19][20]. The largest dataset with global urban coverage was Reba et al., whose work encompassed only 1.741 unique cities. Buringh has consistent listings for 2.261 cities, most of which appear consistently, though only for the European continent.

We did not assess the error margins of these historical datasets, though we did assess discrepancies between estimates of total urban population and raw sums from our uncalibrated dataset once merged, and estimate an error margin of ~20-30% from general testing and validation. Both Chandler and Modelski were prone to overestimate the size of ancient, and in some cases, mediaeval cities [21].

We must advise anyone using our dataset to be cautious of this until we can manually revise these figures to more conservative estimates for antiquity utilising sources by regional specialists in future iterations of this dataset (for example that by Hanson and Ortman, Storey, Broadberry, van Zanden, TAVO, or work carried out by archaeological statisticians), whom we have (not yet) integrated.

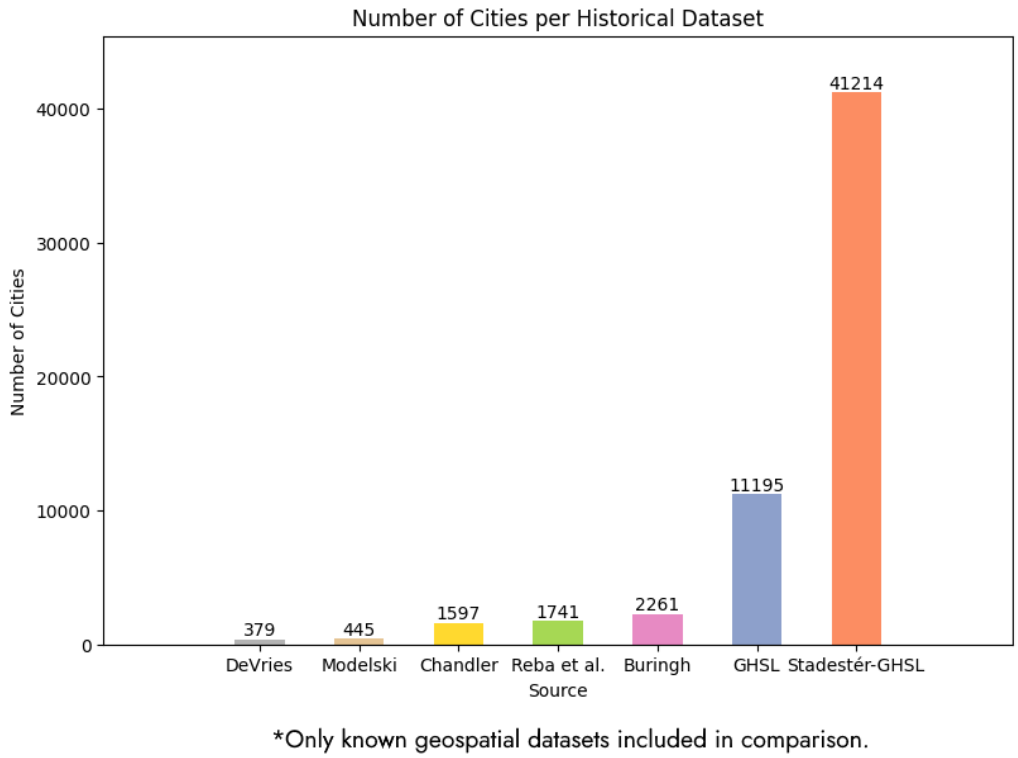


Figure 5. Number of cities in Stadestér compared to other datasets of historical population.

Dataset	Number of Cities	Geographic Domain	Time Domain	Sources
de Vries	379	Europe	1500AD-1800AD	[22]
Modelski	445	Global	3700BC-2000AD	[5]
Chandler	1.597	Global	2250BC-1975AD	[6]
Reba et al.	1.741	Global	3700BC-2000AD	[23]
Buringh	2.261	Europe	700AD-2000AD	[17]
GHSL	11.195	Global	1975AD-2025AD	[24]
Stadestér-GHSL	41.214	Global	3000BC-2025AD	N/A

Figure 6. Geographic coverage and sample sizes of peer urban demographic datasets compared to Stadestér-GHSL.

The synthesis of extant datasets has led to a general increase in the number of cities in Stadestér-GHSL, with 8.181 of these cities being observed prior to 1900AD. Due to the relatively large size of our target resolution rasters, 5-arcmin being roughly 9,275km at the equator, we judged it unnecessary to calculate individual urban densities prior to 1800AD, as pre-industrial growth typically resulted in compact cities, and our data is granular enough to capture distinct peri-urban settlements.

The largest pre-industrial urban centre was likely Angkor, and with a city centre of 15x15km, it would barely exceed 4 gridcells at a 5-arcmin resolution, though its irrigation network is much larger at ~1.000km^2 [25]. We were also unable to normalise much of the Wikipedia data during the course of this study, and ultimately did not integrate much of it into our dataset outside of some manual population fixes for the work of Reba et al.

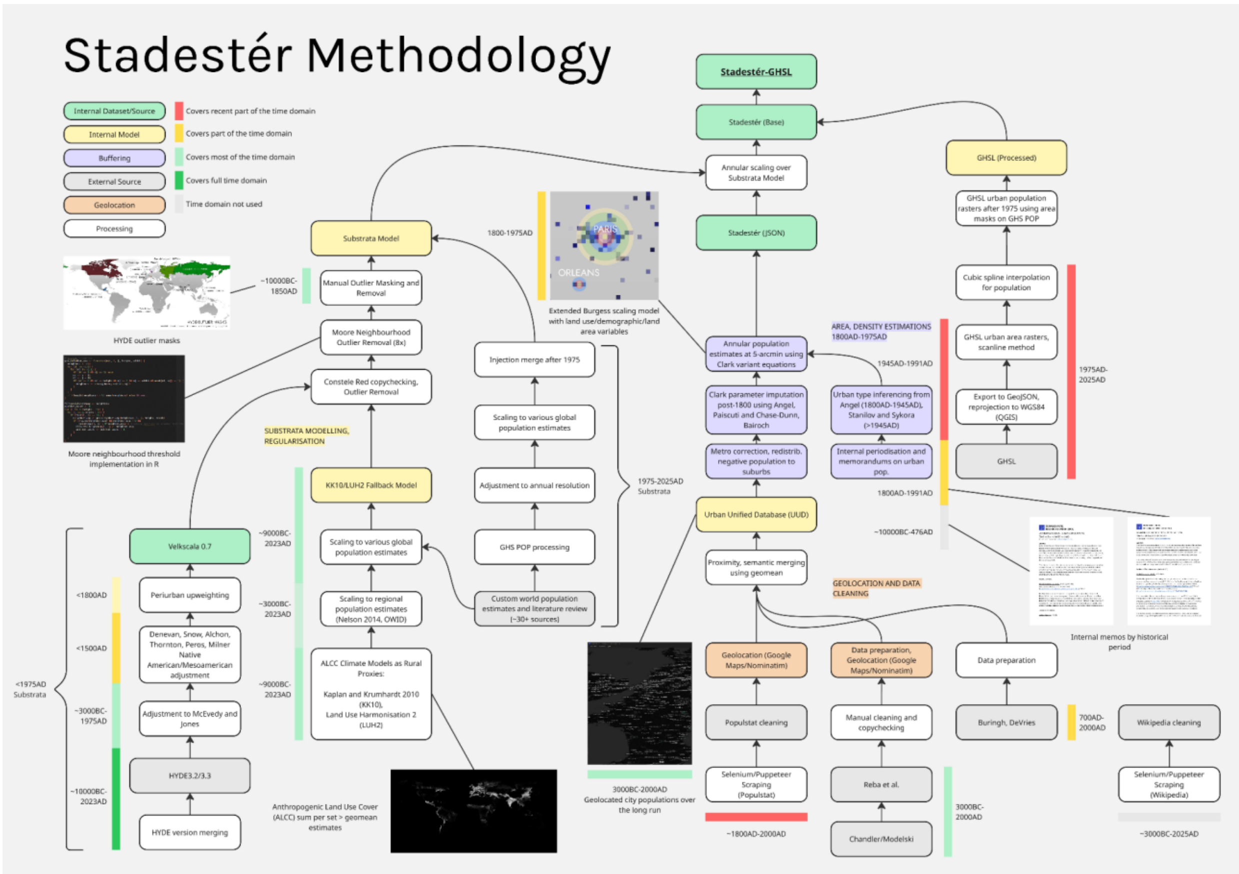


Figure 7. Schematic overview of Stadestér's design showing both the rural substrata model and urban dataset construction.

At present, Stadestér consists of five parallel models working in conjunction to produce urban population data - a global substrata model from Velkscala 0.7 utilising climate models as a fallback for rural population, a dataset of human settlements and their populations, weakly interpolated over time, and an area/density buffering model for them between 1800-2000AD as taken from our extant population figures and work done by Angel, Paiscuti, Chase-Dunn, Bairoch, and Stanilov and Sykora [26][27][28][29]. Unlike backcasted urban models, our urban model is casted forwards in time, such that it would enable us to perform out-of-model forecasting during the truncation period (1975AD-2000AD) between modern satellite data and our proxy model [30][31][32]. Reliable historical data is also available for a representative sample of 30 global cities over the same time period in the *Atlas of Urban Expansion* [33], which we were also able to visually compare against (Figure 32).

The final model are those by GHS-POP and GHSL-UCDB, which we use after 1975AD after downscaling to a consistent 5-arcmin resolution (4320x2160) for the same standard projection (WGS84 Equirectangular) [34]. We refer broadly to the resultant dataset as Stadestér, and will use qualifiers (Stadestér Base, Stadestér-GHSL, etc.) where appropriate.

Definitions & Glossary

- ALCC | Anthropogenic Land Cover Change (ALCC), taken here to be the cumulative fraction of a gridcell under anthropogenic use.
- Centre density, city centre density | The imputed density of a city at its city centre, typically measured in inhabitants per km^2, or ihb/km^2.
- GHSL | Global Human Settlement Layer (GHSL) dataset. When used in isolation, it refers specifically to GHSL-UCDB, or its urban layer by Melchiorri et al.
- GHS-POP | Refers specifically to GHSL population rasters from 1975-2025, as linearly interpolated and scaled to reliable estimates of world population.
- Global 30 | Refers to the 30 global cities taken as being a representative sample of varying world regions by Angel.
- Global 120 | Refers to the largest 120 cities by maximum population as present in Stadestér.
- KK10/LUH2 | Refers to a custom internal ALCC model as synthesised from KK10 (Kaplan and Krumhardt 2010) and LUH2 (Land Use Harmonization 2), as averaged and scaled to global population. Used as a fallback for HYDE/Velkscala 0.7.
- Stadestér-Base | The base dataset without the usage of GHSL layers post-1975.
- Stadestér-GHSL | Piecewise data set that uses Stadestér Base prior to 1975AD, and GHSL after 1975AD.
- Stadestér Global, Stadestér Global Population | Global population rasters including both urban and rural population.
- Stadestér Rural | Resultant rural population rasters that include both peri-urban and semi-urban populations in addition to purely rural populations.
- Stadestér Urban | Resultant urban population rasters that include only human settlements that qualify against the Stadestér definition of a city.
- Substrata | The synthesised internal model of non-urban population that we use after urban outlier removal from a merged version of KK10/LUH2 and Velkscala 0.7.
- Velkscala, Velkscala 0.7 | A previous database of global population utilising a custom internal variation of HYDE3.2/3.3 with rescaling done at the national level.

Historical Names

Due to the long time domain of Stadestér, we have generally decided to utilise the last contemporary romanised name present for each unique city (i.e. Capua as Santa Maria Capua Vetere, but Seleucia, part of Ctesiphon, has maintained its antique name, as it was abandoned in 762AD after being briefly known as Veh Ardashir/Vēh-Ardaxšēr) [Error! Reference source not found.][36]. Similarly, proximity and semantic merges have meant that cities may sometimes have the name of a close by city or neighbourhood, particularly as an artefact of disagglomeration and proximity merging in final datasets, as in the case of London, some of whose population entries were transferred to Kensington and Chelsea.

All listed historical and alternative names were merged under an `other_names` array which is present for each city's JSON entry.

What Is A City?

There is no settled definition of a city [37][38][39]. As such, we take a city to be any permanent human settlement mentioned in constituent sources until 1800AD, mentioned as a town or city in censuses, encyclopaedias, or yearbooks from 1800AD-1975AD, with the GHSL/UN definition of a city (degree of urbanisation) being adopted after 1975AD for Stadestér-GHSL [40][41][2].

Because this was not without its issues (i.e. there being no cities in the American South until 1980 by this definition outside New Orleans, Miami, Tampa, and Texas) [42], we have also retained legacy cities carried over from the 1800AD-1975AD definition in non-Stadestér-GHSL rasters, updating their populations forwards until 2023AD. If you wish to revise this definition, we recommend the use of threshold filtering over the dataset by area, city centre density, population, or any other variable provided in Stadestér, since we aim to create a relatively comprehensive listing of historical human settlements.

World Regions

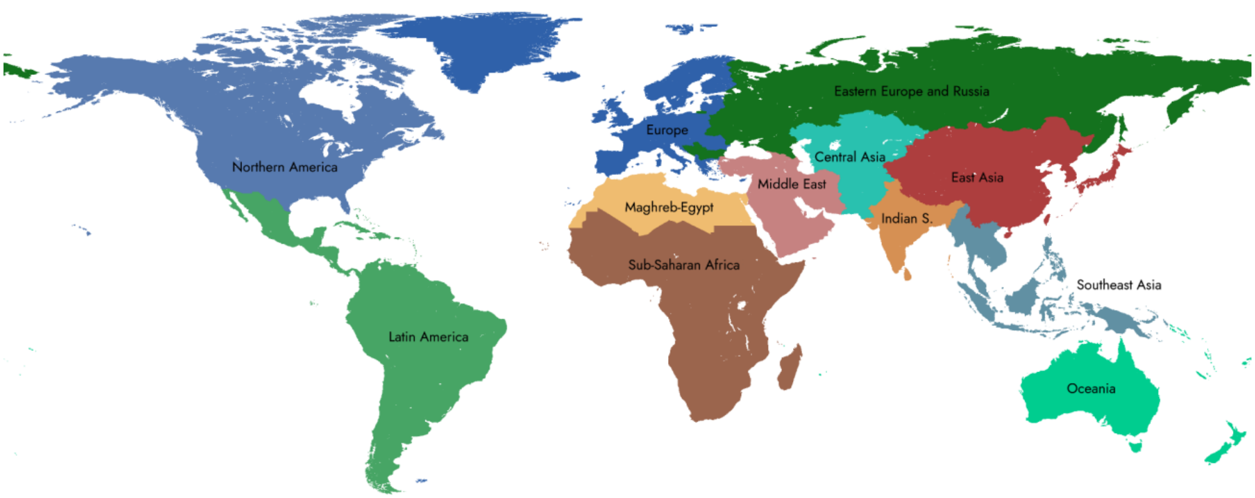


Figure 8. Choropleth map of major world regions as defined by Stadestér for statistical purposes.

In the interests of statistical transparency, we chose to use 12 major world regions for statistical purposes. These world regions cover each of the six inhabited continents, and are divided as follows:

- Northern America: the modern United States and Canada, both being primarily Anglo-settler colonies in the Americas.
- Latin America: those nations in the Latin American and Caribbean (UN) group, as well as French Guyana and Puerto Rico.
- Europe: national jurisdictions on the European continent which utilise the Latin alphabet and are not in Eastern Europe & Russia, as well as Greenland[3].
- Eastern Europe & Russia: nations in the Orthodox World which were formerly part of the Socialist Bloc and utilise the Cyrillic alphabet.
- Middle East: any nation primarily in West Asia, including those of the Southern Caucasus, as well as Iran.
- Maghreb-Egypt: the northernmost nations in Africa bordering the Mediterranean, excluding the Sahelian states, but including Western Sahara.
- Sub-Saharan Africa: any nation on the African Continent not situated in Maghreb-Egypt or Oceania.
- Central Asia: the landlocked nations of Central Asia, as well as Pakistan[4].
- Indian Subcontinent: comprised of India, Sri Lanka, the Maldives, and Bangladesh.
- Southeast Asia: the nations of ASEAN as well as Papua New Guinea[5].
- East Asia: China, Taiwan, the Korean Peninsula, and Japan[6].
- Oceania: the otherwise conventional definition of Oceania; extended to the Mascarenes and Mayotte[7].

Certainly there will never be a good non-arbitrary way to divide the Earth. What motivated us to divide statistical regions in such a manner were mainly differences in archival practices, infospheres, and documentation. In having such hard boundaries, we may at least assess the statistical quality of each region relative to its own recordkeeping.

Methodology

'What is now known about the pre-nineteenth century urban population of Europe? The short answer to this question must be: surprisingly little ... this negative appraisal may seem odd to some readers who are aware of the impressive advances made since the late 1950s in the study of historical demography'. – Jan de Vries, European Urbanisation (p. 17).

The good news is that we now know a surprisingly great deal not just of European cities prior to 1800, but of the world more generally, thanks to the enduring work of historical demographers.

The bad news is that in the years since de Vries issued his various statements, the field has effectively collapsed and died [43].

Presumably this occurred sometime between the first and second editions of the International Encyclopedia of the Social & Behavioral Sciences, when its entry switched from that of a living field to a biography [44], and it now occupies (n=7) ~1,1-1,7% of demographic papers presented out of a sample of 507 [46][8]. For those that might object to the portrayal of its collapse, let me remind you that in living fields, there are generally not academic perspective essays entitled 'Reach out to bring in rejuvenation: on the need to *populate* historical demography'[9].

Historical demography, in other words, must now be the work of us pseudonymous amateurs. Let us now explain that work.

Data Scraping

Lahmeyer (Populstat) was the last great historical demographer to have published exhaustive research [47]. However this work had not been geospatialised, and so required scraping and preprocessing [48]. A recursive scraper using CURL/JSDOM was first built to crawl Populstat and fetch relevant links to pages on the towns and settlements of various jurisdictions ('of some important towns'), and the resultant HTML tables were cleaned and processed into JSON files, with redundant keys having their population entries merged [49].

Relevant tables were selected with query selectors, with the first table row being taken as the header, as it typically contained years in Populstat. Any numeric headers that resolved to an integer were assumed to contain years, and the main table underneath had European figures parsed as such and multiplied by 1.000[10]. The first column was taken as containing the name of a place.

Variants of the name were appended to `other_names`, and generic field handling was implemented for various fields which did not match the pattern specified above. To help map agglomerations to non-agglomerations, we also mapped semantic patterns such as `(agglomeration)` and `is agglomeration of` onto one another, as we intended to utilise these mappings to avoid double counting both metropolitan and suburban populations in mixed registries, which has proven an issue even for modern gridded population maps and statistical agencies such as GEOSTAT and Canadian census data [50][51].

A general scrape of data from Wikipedia was also conducted utilising a scoring system in an attempt to associate Populstat cities with Wikipedia articles, but this approach proved noisy due to a weak implementation of NLP algorithms and near-indiscriminate table selection, and so we opted to exclude any resultant Wikipedia JSON data from the final model in Stadestér 1.0.

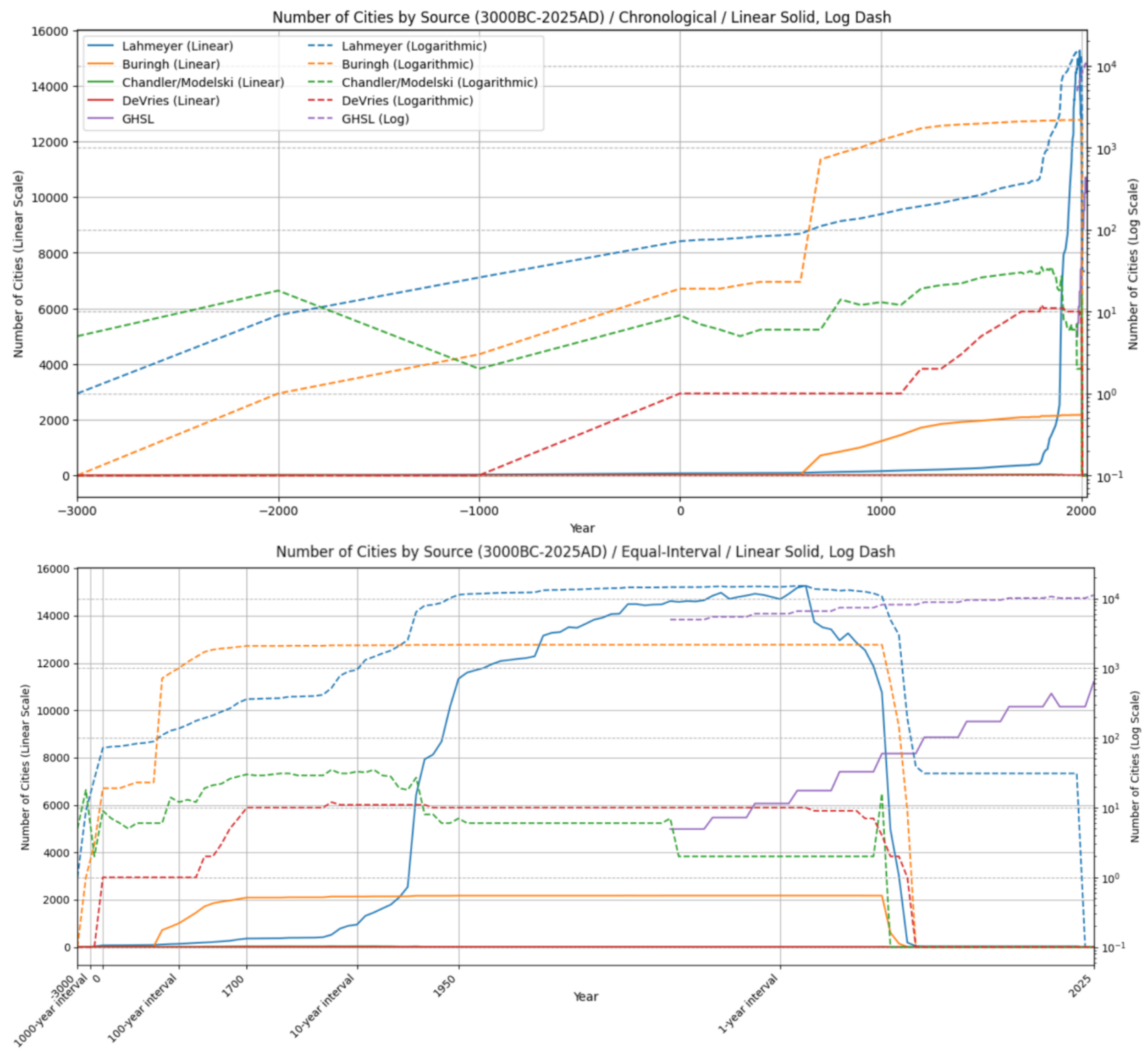


Figure 9. Provenance of principal sources of population data used in Stadestér over time (3000BC-2025AD). Note that Lahmeyer denotes Populstat.

Similar tasks have previously been attempted [52], but they differed from our use-case in that population figures and placenames are inconsistently placed and named, decimal notation differs, and that the order of magnitude chosen for population figures can differ dramatically from figures without distortion, as in the case of Berlin, to listing residents in millions, as in the case of Nanjing [53][54].

We propose in future iterations of Stadestér to utilise long-context LLM agents for data extraction, though significant problems would likely remain in terms of data structuring, though we view these challenges as surmountable [55][56]. Preprocessed datasets were also brought forth to cover different eras of the dataset - in particular, details from both Chandler and Modelski (via Reba et al) were synthesised by way of having equivalent keys merged into a single population object utilising weak geometric means as follows:

Let $S = \{x_1, x_2, \ldots, x_n\}$ be your set of values, where

$$S^+ = \{x_i \in S : x_i \geq 0\}, S^- = \{x_i \in S : x_i < 0\},$$

$n^+ = |S^+|, n^- = |S^-|, n = n^+ + n^- + n^0$, and n^0 is the number of zeroes.

$GM^+(S) = (\prod_{x \in S^+} x)^{1/n^+}, GM^-(S) = (\prod_{x \in S^-} |x|)^{1/n^-}$, where the weighted geomean function is:

$WEGM(S) = \frac{n^+}{n} GM^+(S) - \frac{n^-}{n} GM^-(S)$.

Definition 1. Given a set of negative and positive values, construct a weighted geometric mean such that a set of values S resolves to a single value.

Let $K = \cap_{j=1}^{m} keys(S_j)$ be the set of overlapping keys, where

$U = \cup_{j=1}^{m} keys(S_j)$ is the set of all keys, and $N = U \setminus K$ is the set of non-overlapping keys, where $V_k = \{S_1[k], S_2[k], \ldots, S_m[k]\}$ is the list of values for key k across all sets.

The weakly-resolved set of keys is then represented by the resolution map:

$R[k] = \{\ k \ \rightarrow WEGM(V_k)$ for $k \in K$, $k \rightarrow S_j[k]$ for $k \in N$, where $k \in keys(S_j)\}$.

Definition 2. Given multiple sets S_m, weakly resolve the set such that the resolution map R maintains the non-overlapping keys of each set, whilst applying a weighted geometric mean to remaining figures (Definition 1).

Of course, this means that $WGM(V_k) = R[k]$, where WGM is our weak geometric mean.

This type of implementation is a generalised workaround for being able to process negative numbers [57]. Weak geometric means differ from 'strong geometric means' in that strong geomeans are cubic spline interpolated over the course of the entire course of their domain prior to being geometrically averaged between overlapping values. Strong geometric means are generally more useful when there are enough data sources such that large divergences are smoothed out in processed data.

We mainly utilise a bounded log-space cubic spline interpolation, which we define as follows:

Given $X = \{x_1, x_2, \ldots, x_n\} \subset \mathbb{R}$, $Y = \{y_1, y_2, \ldots, y_n\} \subset \mathbb{R}_{\geq 0}$, let $x^* \in \mathbb{R}$ be the point at which to interpolate.

$L_i = \{\ log(y_i)$ if $y_i > 0$, $log(\epsilon)$ otherwise, where $\epsilon = 10^{-6}$.

Let $S(x_i) = L_i$ for $i = 1, \ldots, n \mid S(x)$ is the cubic spline interpolant, and

$L^* = S(x^*), y^* = exp(L^*)$.

Let x_p and x_n be the largest and smallest $x_i \mid x_p < x^* < x_n$, where $y_p = y(x_p), y_n = y(x_n)$.

$(\exists x_p \wedge \exists x_n) \rightarrow (y^*_{lin} := y_p + \frac{x^* - x_p}{x_n - x_p}(y_n - y_p))$, where the final value is bounded thus:

$\hat{y}^* = \{min(max(y_p, y^*_{lin}), y_n)$ if $(\exists x_p \wedge \exists x_n)$, y^* otherwise.

$BCS(X, Y, x^*) = \hat{y}^*$, where BCS represents the bounded cubic spline at a particular value.

Definition 3. Given a set of x-values over a domain X, and a set of y-values over a range Y, cubic spline interpolate the value x^* in log-space such that $x_p < x^* < x_n$.

Ergo, a strong geometric mean would have the resolution map $R[k] = SGM(V_k) = (\prod_{x^* \in D_k} BCS(X_k, V_k, x^*))^{1/|D_k|}$,
where D_k is the set of domain point integers that were sampled or interpolated.

Certainly analogous boundings on cubic splines have been attempted before, though strong geometric means do not seem to appear in the statistical literature, though their constituent parts (i.e. splines of weighted geometric means) and bounded cubic splines have been independently analysed, if only in a geometric, and not necessarily statistical context [58][59].

In any case, they have not been utilised in Stadestér 1.0 outside density modelling or global population estimates, and this can lead to larger swings in population entries than expected. We simply did not feel that there were enough ‘clean’ sources to utilise this approach, although we plan to implement such strong geometric means on a case-by-case basis in the future.

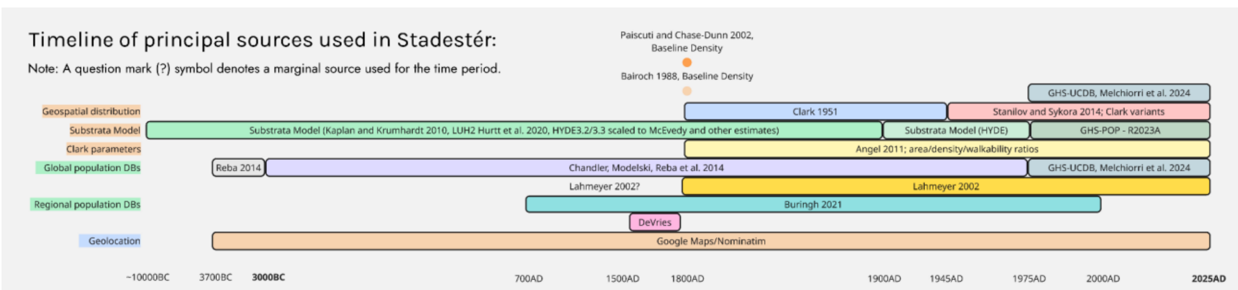


Figure 10. Timeline of sources used in Stadestér’s internal models (3000BC-2025AD).

Naturally, a particular issue was the scarcity of sourcing prior to 1800AD, with the number of cities (not accounting for peri-urban settlements) between 1800AD-2025AD accounting for 92,22% of the total dataset (n=33421), with the only 2.820 cities having unique records prior to 1800AD, the majority of which originated from Chandler, Modelski, Reba et al., Buringh, and de Vries. The share of records equally drops from n=1342961 after 1800AD to n=52783 (3,91%).

Ironically, the number of cities in Stadestér-GHSL also drops assiduously in 1975AD as the definition of a city changes, falling from n=~14922 to n=8691, as all other databases, and particularly Populstat are overridden by GHSL (note that this drop does not occur in the set of merged Stadestér urban rasters). This is in part due to density thresholds being introduced to define cities, which work relatively poorly unless adjusted by country, but are applied indiscriminately by GHSL/Degurba, resulting in a dearth of cities in countries where cars are widespread [60][61].

Apart from GHSL and Reba et al., remaining sources were already geolocated and came as CSV files which could be easily parsed [62][63]. GHSL city areas were processed in QGIS to convert from Mollweide to WGS84 Equirectangular, before their GeoJSON files were spit out before being fed into a MultiPolygon scanline process, with their ID fields (`ID_UC_G0`) being converted to 32-bit RGBA, where each pixel's decoded value is merely $n = 16777216r + 65536g + 256b + a$.

For cities small enough that a single pixel had not been written to the raster, a pixel was placed at their polygon centroid to represent that GHSL city. In GIS and raster processing, a centroid is typically analogous with the pole of inaccessibility, rather than a weighted centre of gravity, and this term is used interchangeably (unlike in geometry) [64][65].

GHS-POP rasters were separately from its 5-year resolution timespan between 1975-2025 (1975, 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015, 2020, 2025) via a keyframe approach, whereby in-between years used the spatial distribution of the previous keyframe scaled to the global population for that year [66].

The urban extents taken previously from GHSL-UCDB were used as masks for each urban centre, geolocated, and well-formed JSON objects with populations per year inferred from the intersection of GHS-POP and GHSL-UCDB rasters.

Data Preparation

Unfortunately, Reba et al. contained a multitude of errors which prevented us from using it without alteration. Part of this was due to semantic transcoding - Birmingham, UK, for example, was swapped with Birmingham, Alabama, and certain data fluctuations had to be normalised. An automated flagging process was implemented, whereby growth rates > +/-25% in a single year were flagged for manual review.

A number of corrections for the Reba dataset were issued as follows:

City Name	Year(s)	Action Taken	Rep. Val. (1000s)	Error
Aleppo, Syria	1300AD	Key deleted	N/A	Stray zero value
Alexandria, Egypt	361AD, 365AD	Key for 365AD moved to 361AD	N/A	Erroneous date for Alexandrian earthquake
Algiers, Algeria	1925AD	Changed pop.	222	Order of magnitude clerical error
Algiers, Algeria	All	Changed country to Algeria	N/A	Algiers was stated to be a city-state
Augsburg,	All	Changed	N/A	Spelled as 'Augsberg'

Germany		spelling to 'Augsburg'		
Birmingham, United States	All	Swapped with Birmingham, UK	N/A	Accidentally swapped with Birmingham, UK
Delhi, India	1375AD	Changed pop.	200	Order of magnitude clerical error
Delhi, India	1398AD	Changed pop.	25	Tamurlane sacking Delhi dated to 1450AD
Delhi, India	1596AD	Changed pop.	80	Order of magnitude clerical error
Fez, Morocco	1800AD	Changed pop.	60	Population randomly drops 42,8% in 1 year
Goa, India	1510AD	Key deleted	N/A	Population randomly drops 40% due to the Portuguese conquest. No known source affirms this[11].
Izmail, Ukraine	All	Changed country to Ukraine	N/A	Supposedly part of Romania
Lahore, Pakistan	1600AD	Changed pop.	200	Population randomly drops from 300.000 (1590AD) to 34.000 (1600AD)
Lahore, Pakistan	1622AD	Changed pop.	250	Population of Lahore allegedly rebounds from 34.000 to 500.000
Lahore, Pakistan	1627AD	Changed pop.	255	See previous entry
Lahore, Pakistan	1631AD	Changed pop.	284	Supposedly crashes again from 500.000 (1627AD) to 84.000 (1631AD)
Nanjing, China	1970AD	Changed pop.	2.000	Supposed population just 200.000
Nanjing, China	2000AD	Changed pop.	5.448,9	Supposed population of 1,2M in 2000AD
Palermo, Italy	1150AD	Changed pop.	125	Supposedly had 125 people, even though pop. was estimated at ~150.000 [68]
Philadelphia, United States	1914AD	Changed pop.	1.750	Order of magnitude clerical error
Skopje, Macedonia	All	Changed country to Macedonia	N/A	Skopje supposedly in Serbia
Srirangapatna, India	1780AD	Changed pop.	30	Figure of 150.000 comes from Buchanan, but given the city was 60,7ha, it defies belief [69][70]
Srirangapatna, India	1799AD	Changed pop.	50	See previous entry
Tbilisi, Georgia	1100AD	Key deleted	N/A	Stray zero value

Tokyo, Japan	2000AD	Key deleted	N/A	Population suddenly declines from 23M in 1975AD to 8,13

Figure 11. List of manual corrections issued for Reba (361AD-2000AD).

Although this process was certainly not rigorous, it is likely to have dealt with some of the more egregious values present in Reba et al for the time being. It is likely that many of the values will have to be systematically reappraised and reassessed in future versions, since Chandler and Modelski's estimates are known to have been exceptionally liberal and crude [71][72].

Geolocation

Much else can be learned from the dataset provided by Reba et al., namely the lesson of attrition via poor geolocation - an initial 10% of cities were removed for having no location, after which an additional 25% were 'cities where geolocations are suspect' (leaving just 67,5% of the original dataset).

To avoid such problems in our own collection of cities, a multi-stage fallback system was implemented using Selenium/Puppeteer, Google Maps, Google Places API, and OSM/Nominatim, with manual copychecking and coordinate assignment to catch any cases that fell through [73][74][75][76][77]. This approach was principally applied to Populstat data, which to our knowledge has not been geolocated by any extant projects, except in extremely limited cases, such as that of Brazil and a selected subset of national capitals from 1872AD-2007AD [78].

The complete set of names for each city was iterated over until latitude and longitude coordinates could be established. In many cases, our Selenium/Puppeteer agent proved only semi-reliable, and so its fetched coordinates were double-checked with the Google Places API. In all, this geolocation process took 24 days from start to finish on a high-end consumer workstation over n=23.619 cities, though we did not multithread or distribute our work.

Manual fixes were issued for Bristol and Washington, D.C. for Populstat, although this appears to have been the extent of geolocation errors, which we estimate to occupy ~0,008-0,1% of the geolocated set. Datasets which already came with coordinate pairings were not re-geolocated, though this may have caused some aspects of proximity merging to have suffered.

Data Merging

Merging in Stadestér was primarily done on a proximity threshold, with semantic matches altering the proximity threshold needed to qualify for a city to be merged into another. This is of course, a subset, or weak implementation of distance-based clustering [79]. This was applied over the set of all cities as follows:

Let $C = \{c_{1,}c_2, \dots, c_n\}$ be the set of cities in all datasets, where each city $\{x_i, y_i\} \subseteq c_i$ and $name(c_i) \in c_i$, where:

$sem(c_i, c_j) = \{1$ if $name(c_i) \equiv name(c_j) \vee name(c_i) \subset name(c_j)$, 0 otherwise | $sem(c_i, c_j)$ defines a semantic match,

$T'(c_i, c_j) = \{T_{sem}$ if $sem(c_i, c_j) = 1$, T otherwise; where T is the base proximity threshold, T' is the adjusted threshold for semantic matches, and $T_{sem} \neq T$.

Then for each city c_i,

Let $M_i = \{c_j \in C \setminus \{c_i\} : \ d(c_i, c_j) < T'(c_i, c_j)\}$ be the list of candidate cities such that

$$c_i^* = arg\ min_{c_j \in M_i} d(c_i, c_j),$$

$c_i^* = mergePop(c_i, c_i^*)$.

Definition 4. Given multiple datasets such that the universal set of cities C may contain redundancies, merge the populations of duplicate cities until $\forall c_i \rightarrow \ (M_i = \emptyset)$.

Differences in distance between points $(x_1, y_1), (x_2, y_2)$ was merely Euclidean in terms of degrees, such that $d_{lat} = x_j - x_i, d_{lng} = y_j - y_i$, and $d(c_i, c_j) = \sqrt{{d_{lat}}^2 + {d_{lng}}^2}$. Whether a semantic match was detected depended entirely on either an exact name match or substring match in the case of data merging, with the closest city favoured for matching cities to be merged into. This may be ill-fitted when it comes to geodesic distances, but as threshold distances are typically infinitesimal, this was not generally viewed as a concern [80].

Proximity thresholds were encoded thus:

- Buringh: $T = 0{,}05$; $T_{sem} = 1$
- Chandler-Modelski: $T = 0{,}1$; $T_{sem} = 1$
- de Vries: $T = 0{,}1$; $T_{sem} = 1$

A generalised merge population function was defined as being an extension of the weak geometric mean, such that $mergePop(c_i, c_i^*) = WGM(Population(c_i) \cup Population(c_i^*))$. In any case, preliminary values would be divided by a metro-adjustment geomean scalar based on the weighted set of discrepancies between conventional populations and metro populations if a dataset was flagged as having metropolitan figures. Only Chandler, Modelski, and Reba et al. met this criteria. Those datasets whose coordinates had less significant figures were assigned larger proximity thresholds.

The order of precedence for data merging was principally Populstat > Chandler/Modelski > de Vries > Buringh.

Metro Adjustment

Metro adjustment has previously been performed to avoid double counting both agglomerative and urban populations, though these methods appear to have varied widely and were reliant on uniform hierarchical data, where synthetic/administrative nth-level subdivisions were capable of covering the entirety of a national jurisdiction [81][82]. Given that Stadestér contains both mixed historic and modern data, such approaches would quickly become infeasible the further back in time one went.

After duplicate keys were removed, the metropole was generally determined from encoded `is_agglomeration_of` (for dependent cities) and `(agglomeration)` substrings contained within each city's name. Metro cities were determined by an exact match/substring/Levenshtein distance scoring system within a list of candidate cities which were determined by their Haversine distance and population observations such that $|Population(c_i)| < |Population(c_i^*)| \wedge d_{haversine}(\{x_i, y_i\}, \{x_i^*, y_i^*\}) < 250$, where the Haversine distance is given in kilometres.

Certainly it is intuitive that cities with a greater number of population observations should generally be more important or serve as the metropole for nearby smaller settlements [83][84], as it follows a well-known curvilinear relationship between an object's sample-size and its weighting [85], even if this was not applied in a purely rank-ordinal sense.

Once suburbs were mapped onto their respective metropoles, there needed to be a reliable method of adjustment of population for each year, especially given the prevalence of mixed data. This was accomplished by subtracting the populations of each suburb from their metropole, and proportionally redistributing any negative remainders back to the suburbs. Because the sum of all suburbs and their metropole form a closed system, any proportional negative remainder is guaranteed to be less than the population of an individual suburb, where our formulation as follows:

Given a metropole c_m and a set of suburbs $s = \{s_1, s_2, \ldots, s_k\}$, where each city has a population $Population(c_m), Population(s_j)$ for $j = 1, \ldots, k$, where:

> $\{c_m, s_1, \ldots, s_k\}$ forms a closed system $Population(c_m) + \sum_{j=1}^{k} Population(s_j) = \Sigma Pop$, where $\sum Pop$ is a constant.
>
> Let $R = Population(c_m) - \sum_{j=1}^{k} Population(s_j)$,
>
> If $R < 0$: $\forall s_j (Population(s_j) := Population(s_j) - \frac{Population(s_j)}{\sum_{i=1}^{k} Population(s_i)})|R|$, where
>
> > $\alpha_j = \frac{Population(s_j)}{\sum_{i=1}^{k} Population(s_i)} \mid Population'(s_j) = Population(s_j) - \alpha_j |R|$, since $\sum_{j=1}^{k} \alpha_j = 1 \wedge |R| = \sum_{j=1}^{k} \alpha_j |R|$.
>
> Where for $\forall s_j (\alpha_j |R| < Population(s)) \because$
>
> > $\alpha_j |R| = \frac{Population(s_j)}{\sum_{i=1}^{k} Population(s_i)} |R| < Population(s_j) \Leftrightarrow |R| < \sum_{i=1}^{k} Population(s_i)$.

By construction ($R = Population(c_m) - \sum_{j=1}^{k} Population(s_j) < 0 \Rightarrow$

$$|R| = \sum_{j=1}^{k} Population(s_j) - Population(c_m)) \wedge (Population(c_m) > 0, |R|$$

$$< \sum_{j=1}^{k} Population(s_j)$$

$\therefore \ \forall j(\alpha_j |R| < Population(s_j)$.

Definition 5. Assuming a set of suburbs s attached to a metropole c_m, subtract ΣPop from $Population(c_m)$ and proportionally redistribute any negative remainder R such that $R = 0$, and all suburbs have a positive population.

Certainly this is a very similar problem to overlapping geometries in areal weighting as seen in earlier case examples, though the difference is primarily that metros and their suburbs are typically represented as points in historic data, meaning that they are represented as a directed graph rather than nested geometries whose administrative levels may differ [86][87]. As such, analogous methods may be extended to a more generally applicable solution.

Naturally, one would prefer dasymetric mapping to buffer out populations contained in point data, but as we do not have complete built-up extents, we have decided to settle for point kriging-based areal interpolation methods based upon our substrata layers, from which we can infer land use and geography of gridcells surrounding a centre point [88][89]. It is equally possible to scan historical maps to form vector geometries of the extents of built-up areas in the past, though we have not done so [90].

Since it can be demonstrated that the end population of such a mixed data system can never exceed the population of its metropolitan area (in which case negatives are 'carried' to suburbs), and does not significantly undershoot it either, such an approach can only lead to generalised improvements in accuracy by removing double-counted populations, although it is significantly lossy when it comes to discrete city populations individually.

This approach compares favourably against both GHSL and Reba et al at the macro-level (Figure 25). Since not everyone may agree with this approach, and it can result in data noise at the micro-level (Figure 38), we provide both non-metro adjusted and metro-adjusted versions of our dataset for end users, particularly for those looking at the histories of individual cities.

We define the production of this hybrid land use and resultant rural population map more strictly in our sections on ALCC Fallback Modelling/Substrata Modelling.

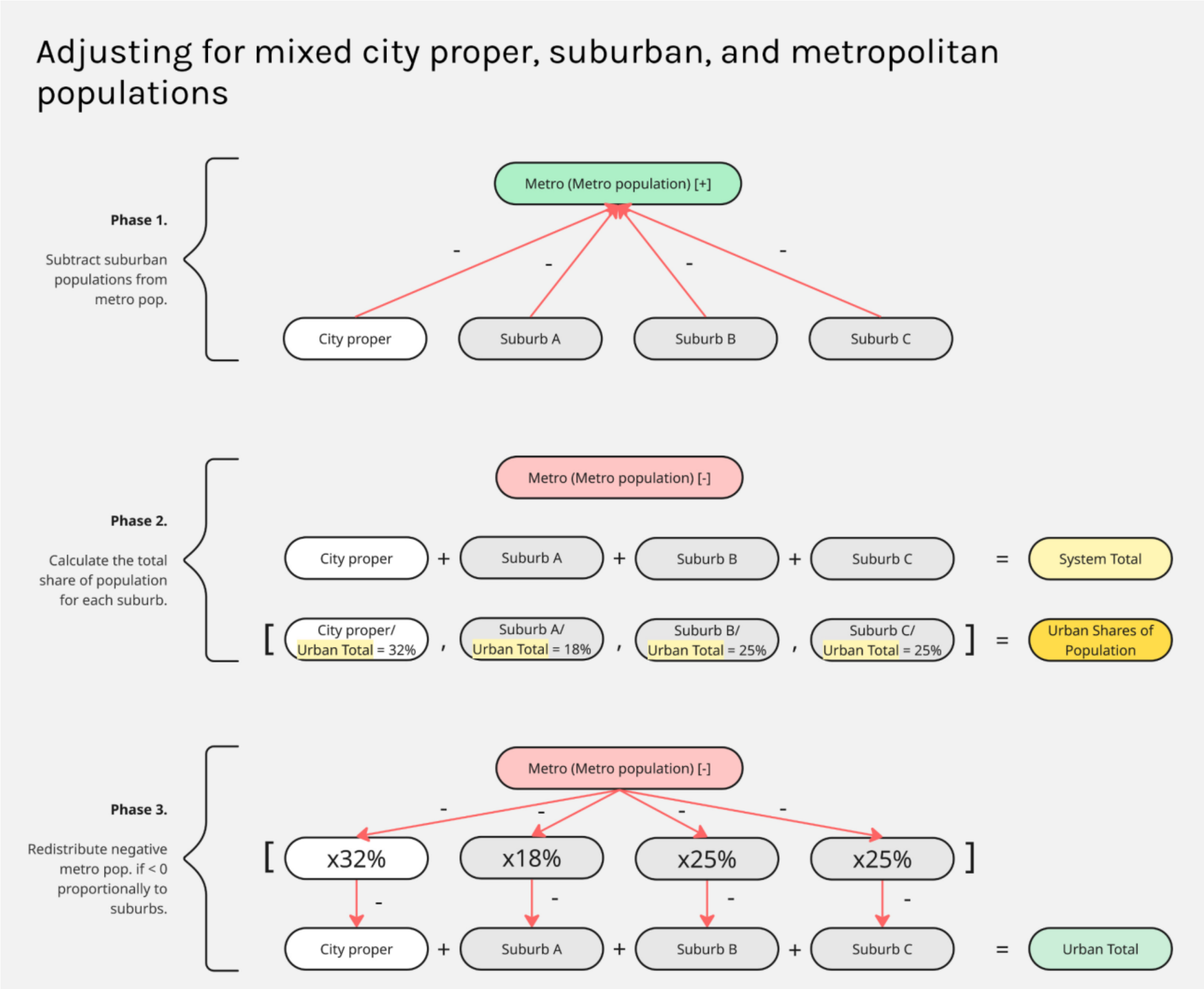


Figure 12. 3-step schematic view of how mixed population figures were adjusted for agglomerative effects within Stadestér.

Given that solutions such as manual disaggregation of urban data were unworkable due to scaling issues, and extant solutions for modern gridded datasets involve area-based solutions where the boundaries of cities and subdivisions are clearly defined in a hierarchical manner, this was the best compromise method that we could envision to regularise mixed data. In addition, whether or not cities were counted as metropolitan was defined by the encoding of the datasets merged – Populstat routinely assesses whether a city's figures are likely to be reflective of its agglomeration, for example.

The main purpose in removing double-counting as we saw it was to improve the fidelity of gridded urban data that could then be used to inform future models as well as the production of raster series (i.e. Stadestér Global, Stadestér Urban, Stadestér Rural) which represent gridded total populations, gridded urban populations, and gridded rural populations respectively.

Population Buffering

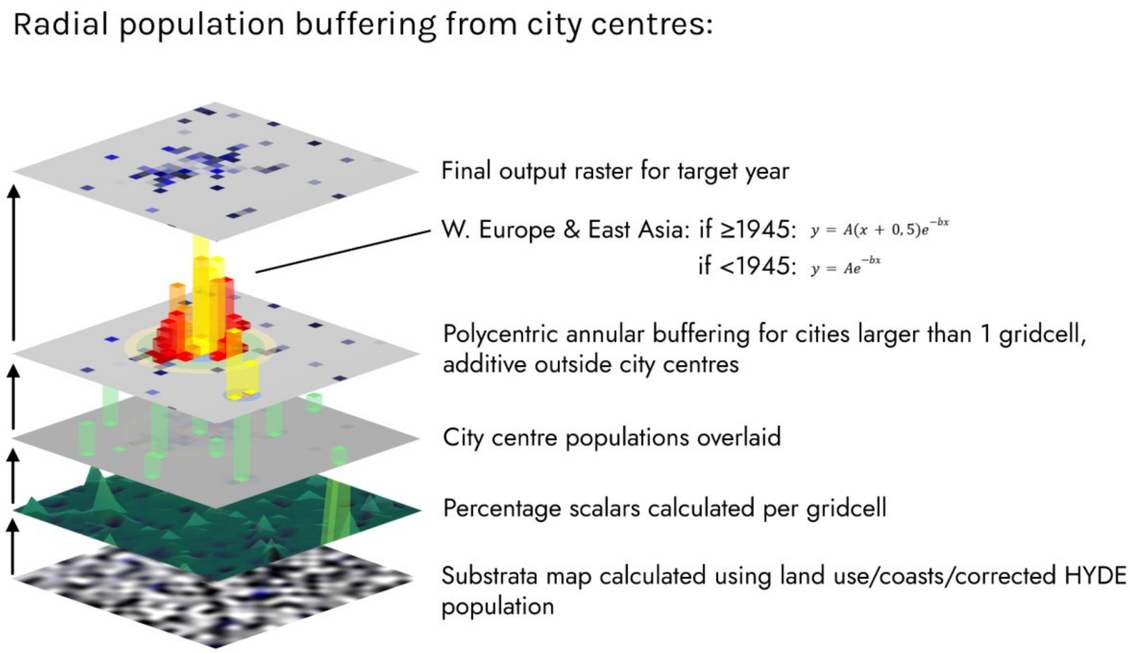


Figure 13. Sample visualisation of region-specific annular buffering over a large urban area (Paris and the *Grande Couronne*).

The annular/radial population buffering model utilised in Stadestér 1.0 is primarily an extended Burgess model factoring in both land use, potential population distribution (from dasymetric mapping) and geographic stocks [91]. Density and resultant population is calculated per annular ring. The density between each ring functions entirely as a probability density function as measured from the urban centre, and is thus capable of representing both industrial and preindustrial cities [92][93]. Furthermore, such annular buffers are additive, meaning that they are capable of representing polycentric cities [94].

Of course, since annular rings were being evaluated over a gridmap, this required fractional interpolation for pixels which were only partly inside of an annulus [95]. A density model was cobbled together from Bairoch, Paiscuti and Chase-Dunn, Angel, Stanilov and Sykora, and most notably Clark's research on urban density and walkability and ease of transport.

Such models were only developed for the period between 1800AD-1991AD, with the expectation that we could perform out-of-model forecasting for the period between 1975AD-2000AD, when GHSL data becomes available, as well as over the Global 30, for which well-formed historical data was present[12].

<u>Global Density from 1800-1815AD:</u> ~175-190/ha [28]

Much of the global-level data during this time period comes from Bairoch's *Cities and economic development*, as well as Angel 2010. It is also during this period that city densities become near perfectly Zipfian by country, as seen in a case example of Great Britain [90]. Prior to 1800, density ranks are believed to have been log-normal [96][97].

We considered utilising estimated regional population density from HYDE/substrata models to inform estimates of population density for each urban area using a raster buffering technique, but we ultimately decided against it.

Clark provides the radial function $y = Ae^{-bx}$ for estimating urban density, where x is the distance in km from the centre of the city, and y is the density of the resident population at the centre of the city in thousands per km^2. A is the density of the resident population at the centre of the city, and b is effectively that of the degree of public transport available [98].

That information was not entirely useful to us, since we sought to inform our radial spread estimates using only two parameters: urban density of a city, and its population. The data that we took to inform our estimates came primarily from Angel's *Atlas of Urban Expansion* (2016).

Area/Density Calculations

We mainly assumed a base model as follows: $\Delta area = 1{,}27(\Delta population)$, R^2 = 0,969 between 1900-2000; $ihb/ha = -130ln(x) + 634$, R^2 = 0,99; where x was the density ordinal of a city globally. [99][Xu et al].

Given that the sample size used in the original equation was n=120, and the mean density 128ihb/ha, the generalisable version of city centre density should be:

$y = 130ln(\frac{n/120}{x}) + d + 506$, where d = mean global density, n = total sample size, and x = density rank-ordinal of a city globally.

The initial area baseline was to be calculated by dividing the population in 1800AD by 182,5 to fetch the total number of hectares, with the area to be iteratively calculated per city first before fetching a city's ihb/ha.

Radial Spread Calculations

Implied population densities were taken from modelled area and cubic spline interpolated population values to establish rank ordinals to inform imputed city centre densities prior to calculating cities' ihb/ha, whereby A was the city centre density previous, and b was informed by the walkability ratio present in Angel's various world regions using a strong geometric mean (SGM). Parameter b is further expounded upon by Newling [101].

Immediately prior, we standardised walkability ratios by taking the value such that $WR_{year} = 1 - max(\frac{\Sigma WR_{year}}{|WR|})$, where WR represents a walkability ratio time-series for a specific world region, and $1800 \leq year \leq 2000$. Base walkability ratios were specified as follows for the Global 30:

City/Region	S1 Year:Value	S2 Year:Value	S3 Year:Value	S4 Year:Value	S5 Year:Value
W. EU & JP					
London	1800:1,6	1880:1,9	1929:1,6	1955:1,7	1989:1,7
Moscow	1800:1,7	1893:1,6	1939:1,6	1957:1,6	1991:2,1
Paris	1800:1,5	1900:1,6	1928:1,6	1955:1,8	1987:1,6
Tokyo	1800:1,4	1892:1,4	1929:1,5	1954:1,6	1990:1,4
Warsaw	1800:1,6	1888:1,6	1936:1,6	1958:1,5	1992:1,6
E. Asia					
Bangkok	1800:1,5	1900:1,6	1922:1,7	1953:1,5	1988:2,0
Beijing	1800:1,5	1900:1,4	1929:1,6	1959:1,7	1988:1,8
Kolkata	1800:1,4	1883:1,7	1931:1,8	1961:1,6	1990:1,6
Manila	1800:1,4	1898:1,5	1945:1,7	1971:1,6	1990:1,7
Mumbai	1800:1,5	1909:1,6	1931:1,5	1968:1,5	1991:1,8
Shanghai	1800:1,4	1902:1,5	1944:1,4	1973:1,8	1991:1,7
MENA					
Algiers	1800;1,4	1903:1,6	1929:1,9	1972:1,7	1987:1,7
Cairo	1800:1,5	1897:1,6	1927:1,6	1960:1,6	1992:1,7
Istanbul	1800:1,6	1899:1,8	1934:1,8	1960:1,7	1990:2,0
Jeddah	1800:1,9	1900:1,7	1925:1,5	1964:1,6	1990:1,7
Kuwait City	1800:1,6	1900:2,1	1922:1,8	1963:2,0	1990:2,1
Tehran	1800:1,5	1899:1,4	1925:1,5	1956:1,6	1987:2,0
Tel Aviv	1800:1,4	1917:1,4	1929:1,5	1956:1,6	1987:2,0
Africa					
Accra	1800:1,6	1903:1,6	1929:1,8	1956:1,5	1991:1,7
Johannesburg	1800:1,5	1900:1,7	1938:1,6	1957:1,7	1990:2,3
Lagos	1800:1,4	1900:1,6	1920:1,6	1962:1,8	1984:1,8
Nairobi	1800:2,0	1906:1,6	1926:1,5	1964:1,5	1988:1,6
Lat Am.					
Buenos Aires	1800:1,3	1887:1,4	1918:1,4	1964:1,5	1989:1,6
Guatemala	1800:1,5	1900:1,4	1936:1,6	1976:1,7	1990:1,9
Mexico City	1800:1,4	1886:1,4	1929:1,5	1970:1,7	1990:1,7
Santiago	1800:1,4	1900:1,5	1930:1,5	1970:1,7	1990:2,0
Sao Paulo	1800:1,5	1905:1,6	1929:1,7	1974:1,7	1988:1,7
LRDC					

Chicago	1800:1,5	1893:1,5	1945:1,6	1967:1,4	1989:1,7
Los Angeles	1800:1,7	1907:1,4	1937:1,7	1970:1,8	1990:2,0
Sydney	1800:1,5	1895:1,7	1945:1,8	1975:1,7	1991:1,8

Figure 14. Table of walkability ratios for the Global 30, where higher figures are worse. Base figures were then processed and inverted prior to annular density calculation.

The World Postwar (1945AD-1975AD)

In the postwar world, the urban regions of the globe can largely be collapsed into five categories: Anglo-Settler Colonies, Western Europe and East Asia, the Socialist World, and that of the Global South, as urban patterns increasingly diverged between them. Much of the data here comes from Pénzes et al. in addition to Stanilov and Sykora and Bertaud [102][103]. Clark variant equations were derived from best fit integrations between Clark and observed density dropoff formulas provided by Pénzes et al, Angel, and Guterbock.

Anglo-Settler Colonies

Modified Clark: $y = xe^{-0,067x}$

Note that because this is prior to 1975AD, 'Anglo-Settler Colonies' included those countries under white minority rule in Sub-Saharan Africa, i.e. modern-day South Africa and Zimbabwe (Rhodesia), which often followed an American style of urban planning complete with residential segregation and suburbanisation [104]. Starting in the 1980s, its general applicability in South Africa and Zimbabwe are likely to have waned [105].

The negative exponential density-distance function applicable to Anglo-Settler colonies is attested to by Guterbock, with density peaking outside the city centre crater. Whilst Guterbock defended Clark's Law, it is clear that the contribution of b (walkability) gradually converged to be close to zero in such cities (declining from b=0,326 in 1940 to b=0,133 by 1990), and we have thus excluded it from the equation [106].

Western Europe and East Asia

Modified Clark: $y = A(x + 0,5)e^{-bx}$

Certainly of the density in Western Europe and East Asia remained stagnant during this period, with urban metropoles retaining much of their initial density, despite limited amounts of suburbanisation in the immediate aftermath of World War II [107][108][109][110].

Socialist World

Modified Clark: $y = \frac{1}{1+e^{4(x-1,8)}}$

Urbanisation in the socialist world was given by 'spatial chaos' until the large-scale takeover of Soviet-style central planning, which focused many cities and so-called 'monotowns' onto heavy industry, with large-scale concrete prefab developments constructed to serve as housing [111][112].

This of course led to an inverse logistic curve in which the density dropoff was very sharp, as socialist microdistricts often surrounded an inner 'old city' [113][114][115]. To what extent there was a small city centre crater has not been generally quantified and hunting about for literature on the (post)socialist city is an exhausting business.

In any case, we thought its exclusion would not skew our dataset since our resolution at 5 arcminutes is quite large, and the development of socialist cities were generally constrained until the 1970s and 1980s, during which time we have good satellite data in any case [116][13].

Like in Anglo-Settler colonies, whether or not a city was walkable was entirely irrelevant: central planners imposed urban development from above, and haphazard housing often sprung up as infill, whether in the form of the dachas of the core republics of the Soviet Union, or informal settlements/*mahalale* between the 'canyons' of many systematised buildings in Romania [117][118].

Global South

Modified Clark: $y = Ae^{-bx}$

No such modification was needed for the rapidly urbanising cities of the Global South, to which Clark's law applied handily [119][120]. Certainly in the context of the Cold War, it deserved to be a separate category, since development there is quite organic [121].

These models were truncated and replaced with GHSL satellite data starting from 1975AD onwards, although we also performed out-of-model forecasting between 1975-2000AD in an attempt to verify the applicability of the sort of radial buffering seen above (Testing and Validation).

ALCC Fallback Modelling

At this point, one required a potential population model at a global scale on which the annular buffering process aforementioned could be reliably performed. These substrata maps generally consist of a dual-model approach - a Velkscala 0.7 primary model, and a KK10/LUH2 secondary model that served as a fallback. In both cases, we sought to address the underrepresentation of rural population, which is generally believed to range from -53% to -84% in most gridded datasets [122].

To this end, Velkscala 0.7 underwent peri-urban upweighting by a factor of 2, and both the KK10/LUH2 fallback model and Velkscala 0.7 were systematically scaled to global population. In addition, ALCC models generally have a maximum population ceiling to downweight urban population, since gridcells cannot exceed more than 100% of their land cover being utilised for anthropogenic purposes [123]. Because all stocks were anthropogenic for each dataset, we took the liberty of adding them up to fetch the total fraction of each gridcell under anthropogenic land use. The stocks of each dataset were divided as follows:

Land Use Harmonization 2 (LUH2) [124]:

- `c3ann` | C3 annual crops
- `c3nfx` | C3 nitrogen-fixing crops
- `c3per` | C3 perennial crops
- `c4ann` | C4 annual crops
- `c4per` | C4 perennial crops
- `pasture` | Managed pasture
- `urban` | Urban land use

Kaplan and Krumhardt 2010 (KK10) [125]:

- Fraction of gridcell under anthropogenic land use

Where both datasets intersected (900AD-1850AD), we took the additive mean of both datasets per gridcell as being representative of anthropogenic land use, multiplying it by estimates of regional and world population.

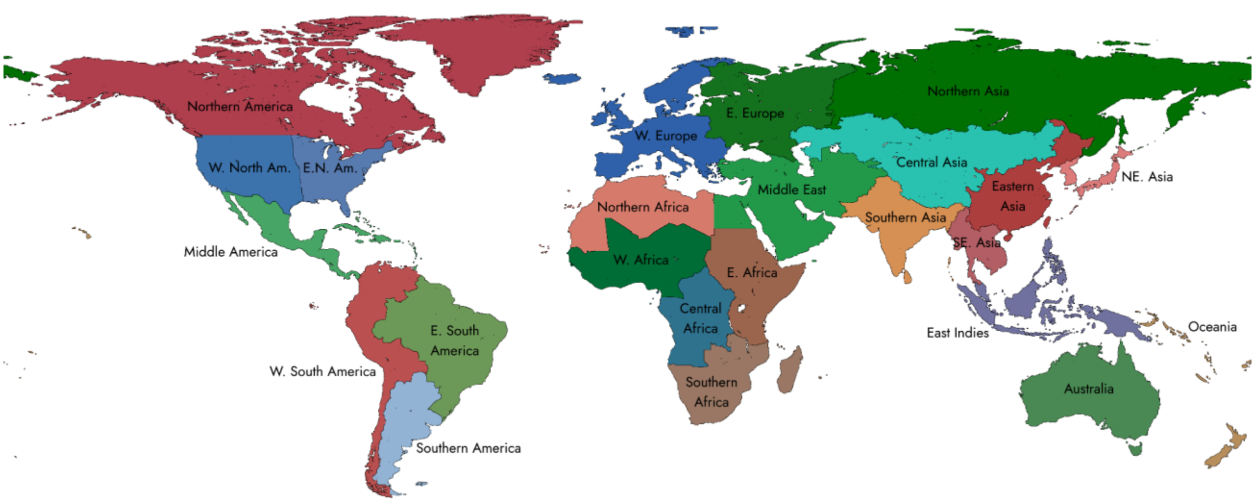


Figure 15. Chloropleth map of world regions as defined by Nelson.

We used the world regions as developed by Nelson in the *Historical Atlas of the Eight Billion* to perform regional scaling prior to world population scaling such that populations were generally representative, if not at a granular level [16].

After being regionally and globally scaled, KK10/LUH2 rasters were produced for all intersecting HYDE years to serve as its principal fallback.

Substrata Modelling

The main sources which we utilised to produce long-run estimates of global population should be given some mention here. They were Woytinski and Woytinski 1950, Winkler-Prins 1950, Clark 1967 (lower), Clark 1967 (upper), Tuve 1970, Winkler-Prins 1970, McEvedy and Jones 1978, Durand 1974 (lower), Durand 1974 (upper), Durand 1977 (lower), Durand 1977 (upper), McEvedy and Jones 1978, Biraben 1980, Richards 1980, Bogue 1985, Merrick et al. 1986, Eric 1987, Grigg 1987, Demeny 1988, Stern K. 1990, United Nations 1990, WRI 1990, Kapitsa 1997, Kremer 1993, Klein Goldewijk and Battjes 1995, Maddison 2001, PRB 1973-2016, HYDE 2010-2020, UN 2015, UN 2019-2024, US Census Bureau 2017, Macrotrends 2025, and Gapminder, in order of appearance [126][127][128][129][130][131][132][133][134][135][136][137][138][139][140][141][142][143][144][145][146][147][148][149][150][151][152].

In the case of Macrotrends, it was mainly used to plug population estimates from 2023-2025AD, since such data is very recent, and is thus typically estimated by contemporary data sources prior to any formal publications. Strong geometric means were utilised to average between the sources cited above. This had not been used for city populations, since there were much fewer estimates for population datapoints between them, and they disagreed more heavily, whilst global population estimates seemingly agree in general on overall figures [153].

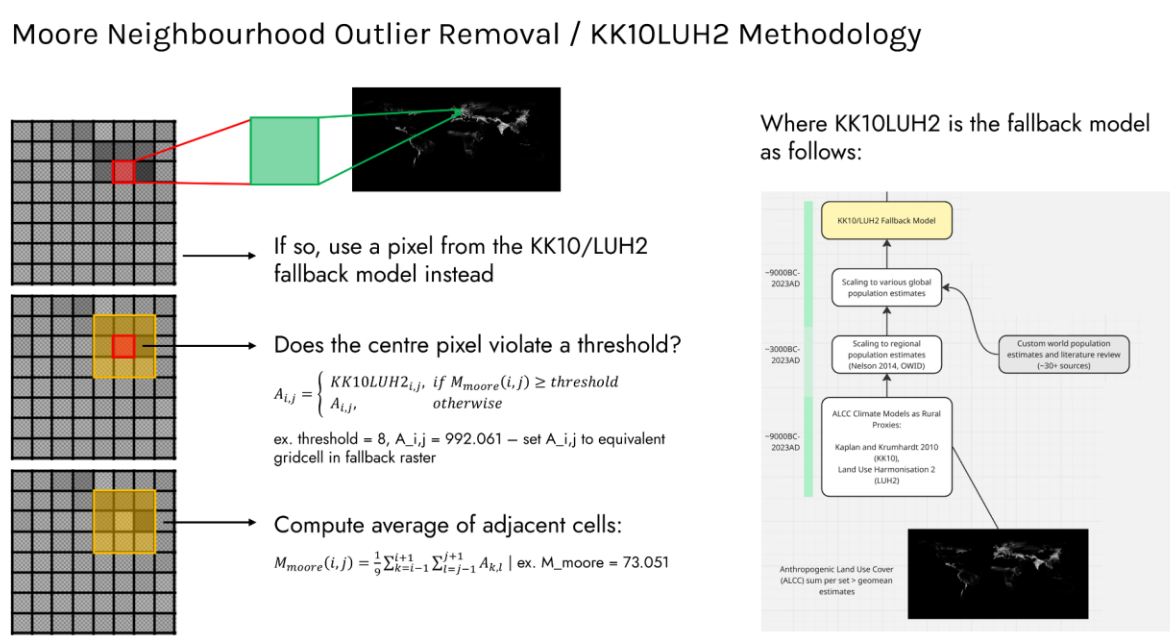


Figure 16. Moore neighbourhood outlier removal.

Since KK10/LUH2 served as our principal fallback model, the task now fell to us to determine when to use it after we had calibrated Velkscala 0.7 to regional and global population estimates in the same manner. For this, we performed a first pass utilising Moore's neighbourhood with a threshold of 8 to detect and remove stray pixels. Flagged pixels were replaced with their corresponding population values in the underlying KK10/LUH2 raster.

Whilst this approach is common for geospatial outlier detection in semiconductor manufacturing (where it is known as GDBC/GDBN), it does not appear to be as common in statistics, even though it effectively performs edge/stray pixel detection and is cheap to compute [154][155]. It would appear to us to be a natural exaptation of the fact that Moore neighbourhood analysis is relatively robust when it comes to edge detection, such that fine tuning filtering/threshold algorithms would reliably flag any localised artefacts or stray pixels which appear in gridded data [156].

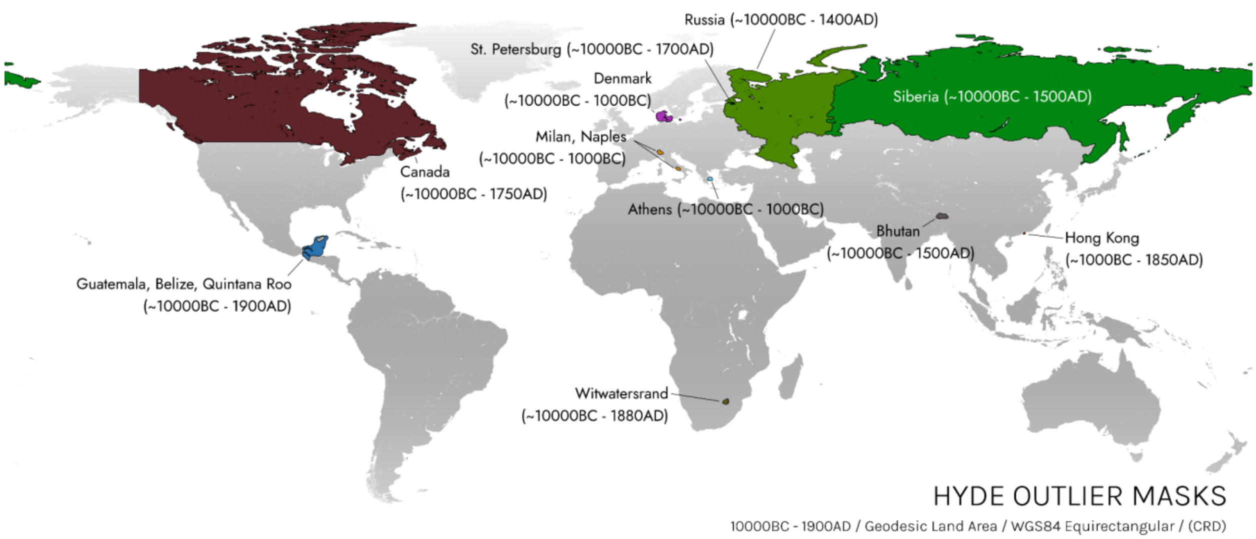


Figure 17. Map of masked HYDE3.2/3.3 outliers.

After first-pass outlier removal, a second pass had to be made to replace HYDE3.2/3.3 regions - now inherited by Velkscala 0.7 - in which population distributions simply appeared either incongruous with the historical record or implausible. In some cases, such as that of the pre-Columbian United States, we were forced to leave such artefacting issues alone since their replacement would have required specialised regional modelling beyond even the scope of our KK10/LUH2 fallback - neither HYDE nor ALCC climate models were up to this task [157].

We certainly hope to establish a better model of sedentary and non-sedentary populations in Northern America and Siberia at some later date, since these regions remain under-modelled relative to other areas prior to 1500AD [158][159][160]. Manual masks were encoded for second-pass outlier removal, in which entire regions were replaced by underlying KK10/LUH2 rasters for problematic years[14].

Regional Outlier	Start Date	End Date	Replaced	Notes
Athens	10000BC	1000BC	Yes	2nd-pass replacement
Beirut, LB	10000BC	1000AD	Yes	1st-pass replacement
Bhutan	10000BC	1500AD	Yes	2nd-pass replacement
Canada	10000BC	1750AD	Yes	2nd-pass replacement; replaced by region-specific modelling
Denmark	10000BC	1000BC	Yes	2nd-pass replacement
Eastern CAR	10000BC	2025AD	No	Requires manual correction[15]
Guatemala, Belize, and Quintana Roo	10000BC	1900AD	Yes	2nd-pass replacement
Hong Kong	10000BC	1850AD	Yes	2nd-pass replacement
Milan, Naples; IT	10000BC	1000BC	Yes	2nd-pass replacement
Paris, Pontoise; FR	10000BC	1500AD	Yes	1st-pass replacement
Russia	10000BC	1400AD	Yes	2nd-pass replacement
Siberia	10000BC	1500AD	Yes	2nd-pass replacement
St. Petersburg, RU	10000BC	1700AD	Yes	2nd-pass replacement
United States (Amerindigenous)	10000BC	1870AD	Yes	Replaced by region-specific modelling
Witwatersrand-Johannesburg, ZA	10000BC	1880AD	Yes	2nd-pass replacement

Figure 18. Table of spatiotemporal domains of manual outlier masks compared to all known regional outliers for HYDE3.2/3.3.

Like with first-pass Moore neighbourhood outlier removal, the area covered by these masks were replaced with pixel values from the underlying KK10/LUH2 fallback model. Final substrata rasters were checked and confirmed to be self-consistent prior to calibration to global population estimates, with errors from the geomean falling between 1-2%.

Satellite Data post-1975

Post-1975AD, we utilised GHS-POP data as scaled back up to global population, since `gdalwarp -r sum`, which we utilised for downscaling and reprojecting GHS-POP rasters from Mollweide (30-arcsec) to WGS84 Equirectangular (5-arcmin) was relatively lossy [161]. This truncation was done only for Stadestér-GHSL, and not Stadestér Base, both of which we intended on keeping as intermediate lines prior to final raster processing.

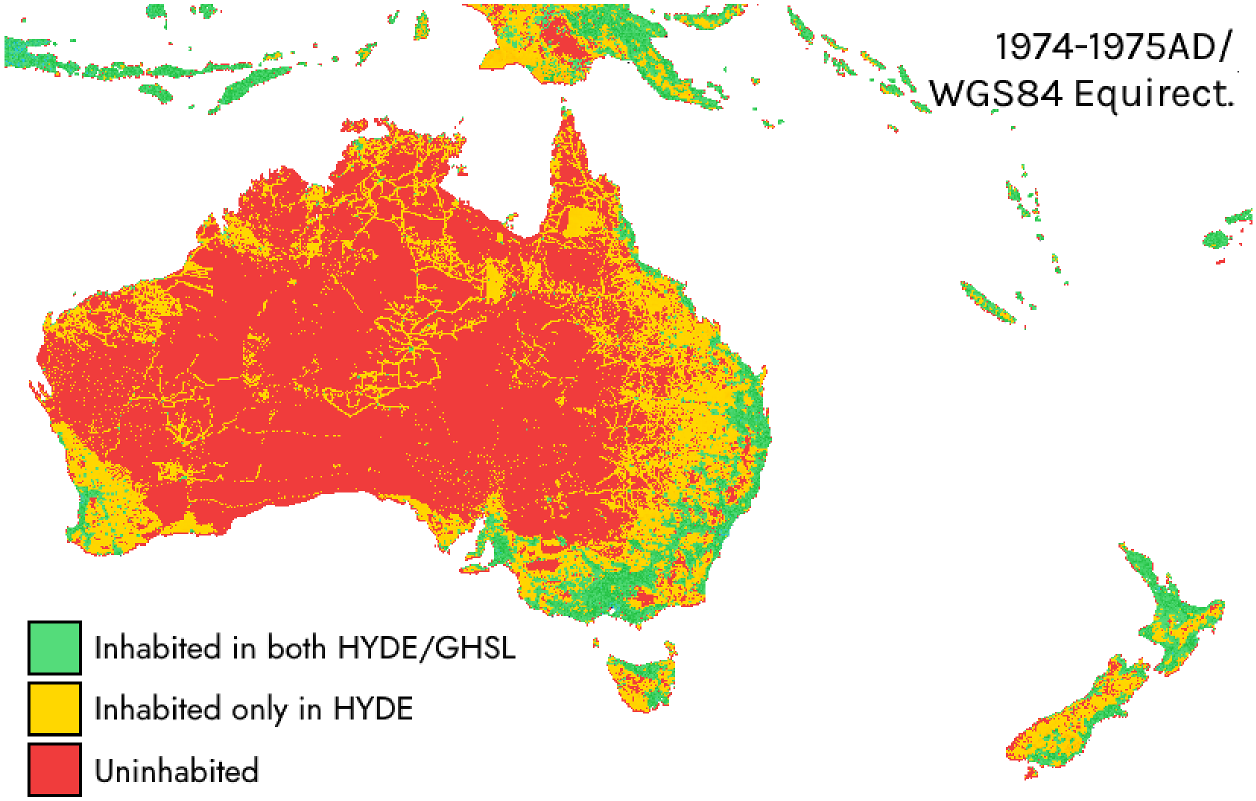


Figure 19. Rural discontinuity between HYDE and GHS-POP in the Australian Outback (1974AD-1975AD).

In most cases, this break was discontinuous from HYDE was due to the abrupt change in how rural populations were modelled in GHS-POP, which systematically underestimates the prevalence of rural populations when compared to HYDE [162]. The number of populated pixels between 1974AD-1975AD thus drops from 1.535.141 to 961.179, or a decline of n=573962 (37,39%). This is highly significant in raw area terms, but it is difficult to assess how this could have been rectified without falling back to HYDE, which is overzealous when it comes to areal coverage of modern rural populations, if not necessarily their quantity. Part of this overzealous coverage is due to LandScan's reliance on nighttime lights which are prone to blooming errors, uninhabited roads, coastal fishing fleets, and natural gas flaring [163][164].

As always, the truth is likely to lie somewhere in the middle - the areal coverage provided by GHSL is likely to be quite accurate, and HYDE's assessment of modern rural populations is likely to be somewhat more reliable than the persistent undercount present in GHSL. But we certainly have not focused nearly as much on modern data as we have on the data of the past, for the models there are plenty, and the models here are few.

Raster Processing

At this point, we looked upon our work, and saw that it was not good, for it had only included urban data, and no part of the cohesive whole - namely that of non-urban and total populations at an equivalent gridcell level. To address this, we first created hybrid urban rasters by maintaining Stadestér Base cities for pixels in which GHSL had recorded a null value for urban population, provided that the city had population entries persisting after 1975AD.

These new urban rasters were then overlaid on top of the rural substrata series earlier generated)and calibrated to global population estimates previously listed to form global population rasters over the long run. Finally, we subtracted urban values from these global population rasters to form a series of peri-urban and rural population rasters. These raster series are generally available as follows, encoded in 32-bit int format:

- Stadestér Population | `./output/stadester_population_rasters`
- Stadestér Rural | `./output/stadester_rural_rasters`
- Stadestér Urban | `./output/stadester_urban_rasters`

These 32-bit int formats are analogous to single-year GeoTIFFs, flattened into PNG form such that they are accessible from conventional raster image editors [165]. One might recall earlier that we stated that Northern America would require specialised modelling and not mere outlier removal.

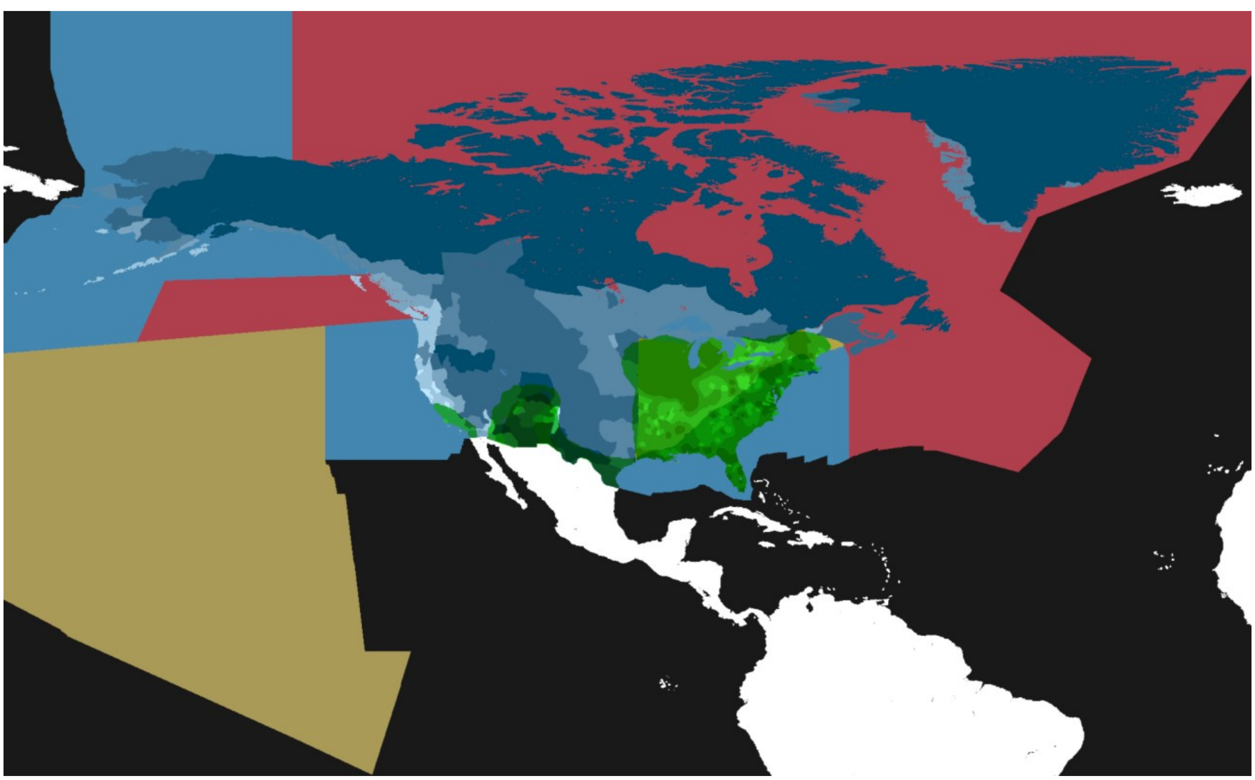


Figure 20. Approximate choropleth map of Native American and First Nation population and agricultural distribution in Northern America (10000BC-1600AD).

We thus commissioned a new internal model, Project Centaur, whose sole job it was to fix the rather sorry state that Northern American population distributions had found itself in as a result of botched outlier removal and KK10/LUH2's various methodological shortcomings for the region. Like all internal models, it and its corresponding input data is available as part of Stadestér open-source code package.

Our main sources of region-specific estimates for this work came from McEvedy and Jones for regional trends and presumed heavy agricultural zones, Nevle and Bird for our agricultural and irrigation data, Williams, Driver and Massey, Milner and Chaplin, Dye, Swanson (who were both used for estimations of the Hawaiian Islands), and Nelson for macro-regional population trends [166][167][168][169][170][171].

These areal maps were then scaled over the rural substrata series previously mentioned over data-specific time domains: roughly from 10000BC-1600AD on the North American continent, and from 1100AD-1896AD on the Hawaiian Islands. We do not pretend this model is perfect: for instance, much more detailed tribal estimates are available from the likes of Krzywicki and Jones [172][173], as well as possible nation-by-nation spatiotemporal kriging of p3k14c [174]. But that is principally a matter of regional demographics, not urban demographics, and so we have thus declined its inclusion in this dataset[16].

Finally, these rasters were scaled back up to global population estimates and post-processed. It is worth mentioning that when we speak of rural populations, we mean only populations that are non-urban in our dataset, and they may often include suburban, periurban, and exurban settlements. Despite these changes, there still exists a 1974/1975 discontinuity due to a seemingly arbitrary lower bound cut-off in GHS-POP of ~64ihb/gridcell, meaning that many rural regions that fall beneath that density threshold are not included in our global raster.

It may also be that this is a consequence of rescaling GHS-POP back to global population estimates from earlier to address failures in `gdalwarp`, but it should add up regardless, since it is a top-down constrained model [175].

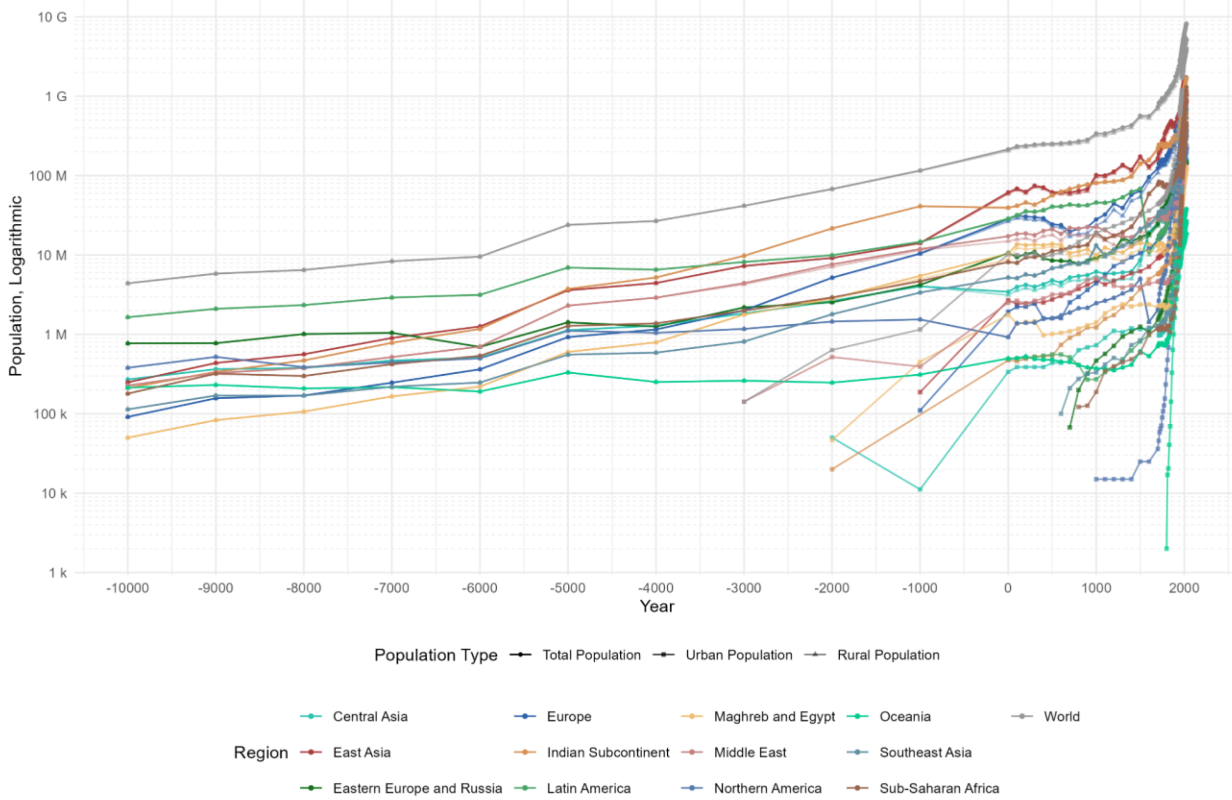


Figure 21. Regional and global urban/rural/total populations as given by direct summation.

But just because GGWP, GRUMP, LandScan or GHS-POP (with perhaps the exception of WorldPop) believe that no one lives on farms anymore in the modern day is no reason to examine how our model performs historically [122].

Of course it must be noted that Stadestér's gridded models of historical population are beyond the scope of mere urban population, but existing datasets are so sparse and flawed that we have had little choice but to release this dataset to serve as a stopgap. Despite the precision of our figures, estimates of regional populations in the dim and distant past are inherently uncertain, and they ought to be treated as such. Nonetheless, we believe our regional figures are within a range of +/-25%.

The primary flaw in such data is mainly temporal – Stadestér's urban data only extends as far back as 3000-3700BC in a meaningful sense, and so the various populations of settlements such as proto-cities and urban formations prior to that are not caught. Such populations have thus been encoded as being 'rural' or 'peri-urban', even if these classifications are not entirely accurate.

Region	-3000	-2000	-1000	1	500	1000	1500	1600	1700	1800	1900	2000
Northern America	1,17	1,45	1,54	0,92	1,59	2,48	5,02	1,44	2,04	8,42	104,95	310,70
Latin America	8,18	9,94	14,66	28,71	40,78	45,93	68,40	11,02	15,44	24,45	74,93	515,85
Europe	2,01	5,17	10,45	28,30	24,34	28,03	64,49	95,78	123,97	179,42	362,95	488,10
Eastern Europe & Russia	2,18	2,54	4,20	10,57	8,53	9,48	16,72	18,50	24,73	47,86	118,84	232,50
Middle East	1,84	2,64	4,04	3,44	4,81	6,18	8,63	19,33	25,57	29,63	38,14	227,60
Maghreb-Egypt	4,43	7,63	11,89	17,25	21,11	22,59	19,86	28,09	31,71	33,97	46,84	251,23
Sub-Saharan Africa	1,78	2,84	5,46	10,39	13,82	9,92	14,13	13,68	13,15	13,08	27,50	144,22
Central Asia	1,99	2,92	4,69	8,16	11,22	19,17	32,82	59,16	77,28	77,33	99,60	663,41
Indian Subcontinent	0,26	0,25	0,31	0,50	0,48	0,37	0,61	0,53	0,71	0,85	7,34	27,09
Southeast Asia	9,78	21,63	41,17	39,52	56,49	81,03	142,33	158,78	220,58	252,64	324,38	1.220
East Asia	0,81	1,79	3,37	5,20	6,82	13,22	21,32	24,27	31,24	39,37	90,64	526,03
Oceania	7,27	9,17	14,18	61,45	61,77	101,48	174,04	130,46	165,40	374,48	467,48	1.477
World	41,70	68,97	116,96	214,41	251,76	340,90	568,37	561,04	732,82	1.081	1.764	6.084

Figure 22. Table of regional and global population totals for selected benchmark years, Millions.

It was extremely important for us to get these tables right, and not to be off because of some dull coding error. In this regard, these figures come from internal verification procedures, and the model was run several times to guarantee consistent results and reproducibility.

In particular, our rural substrata model was stored in a separate repository for organisational purposes, as part of Velkscala 0.7, which is attached in the supplemental materials in the appendix below. All best practices were followed in an attempt to avoid this issue: 1) automating the generation of figures such that they could be repeatedly checked and to ensure that figures were sensible, 2) stepping through code using LLMs to find and flag logic errors, 3) publishing code as open-source Git repositories prior to submission, in addition to providing CLI/UI tools for ensuring data reproducibility and easier visualisation [176].

It very well may be that this has not caught everything - databases such as ours are not static projects, but long-term bits of work whose versioning is iterative and subject to revision. There is every chance that this dataset will be updated in the time following its original submission.

In this case, the latest version is preferable, but the Velkscala 0.7/Stadestér 1.0 versions shall always be available in the Releases section for use[17].

Of particular instability are some of the early Eastern European populations, whom it may be argued to be overfitted to climactic modelling. In general, proxy modelling (either climactic or based on genetic bottlenecking) appears to pose major problems for Russian populations, since they overstate the number of inhabitants [177]. In our case, however, this came from KK10/LUH2 overfitting, with much of the population hovering between 8-10M within the modern Russian frontier (including all of Northern Asia under the UN geoscheme) based on carrying capacity.

However, we also doubt the traditionally lowballed figures of Siberian population of ~270.000-300.000 prior to the Russian conquest in the broadest sense (as given by Hartley or McEvedy) [178], simply based off the fact that this would imply a population density on par with modern day Greenland, and it is not as though the Danish state has encouraged the population growth of that place in recent memory [179]. In fact, modern habitability is overwhelmingly defined by economic and job prospects, and Greenland has little in the way of that.

But Siberia is not Eastern Greenland, and if even 7,5% of the estimated 4 million contemporaneous Jurchens lived in Outer Manchuria, this would already exceed our conservative population budget [180]. The Mongolians are traditionally stated as counting one million at the time of the 1206 Kurultai [181], and 23,29% of their controlled area is believed to have been north of the Mongol frontier [182].

Add up the Mongolians that lived in the southern steppes of Siberia, the Bashkirs, the Turkic khanates, and the various native tribes of Siberia on top of that, and figures in the range of 150.000-300.000 for Northern Asia start looking less and less plausible. These are not populations on the periphery, but within what is now Siberia/Northern Asia. If we accept the 300.000 figure, then the 3.000 Chukchi warriors (from arguably the least hospitable peninsula in Siberia) assembled to fight Vladimir Atlasov at a single battle near Anadyrsk would have represented a formidable 1-2% of the entire population of Siberia [183].

We therefore advise more cautious estimates of 900.000-1,2 million for the Siberian population before the Russian conquest, but accept that specialised modelling for this region (apart from roughly-fitted climate modelling) has not been implemented in Stadestér 1.0.

Region	-3000	-2000	-1000	1	500	1000	1500	1600	1700	1800	1900	2000
Northern America	0,00	0,00	0,00	0,00	0,00	0,02	0,03	0,03	0,04	0,36	27,16	158,05
Latin America	0,00	0,00	0,00	0,49	0,56	0,27	0,82	0,98	1,25	1,83	13,67	370,85
Europe	0,00	0,00	0,11	1,93	1,60	4,41	10,59	11,91	15,41	23,97	95,56	311,23

Eastern Europe & Russia	0,00	0,00	0,00	0,00	0,00	0,47	1,25	1,07	1,52	3,04	13,71	146,68
Middle East	0,14	0,52	0,39	2,51	3,16	5,12	3,93	4,36	4,60	4,48	8,07	150,36
Maghreb-Egypt	0,00	0,05	0,45	1,77	1,01	1,41	2,38	2,39	2,19	2,15	4,22	78,73
Sub-Saharan Africa	0,00	0,00	0,00	0,00	0,00	0,19	0,59	1,00	1,19	1,29	3,15	213,41
Central Asia	0,00	0,05	0,01	0,34	0,44	0,73	1,16	1,20	1,28	1,17	3,09	95,29
Indian Subcontinent	0,00	0,02	0,00	0,47	0,54	1,22	3,72	4,97	5,81	8,29	16,31	401,78
Southeast Asia	0,00	0,00	0,00	0,00	0,00	0,33	0,84	1,21	1,27	1,85	4,51	223,58
East Asia	0,00	0,00	0,19	2,70	2,75	4,74	6,23	7,12	9,08	11,84	25,55	685,83
Oceania	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	2,14	19,83
World	0,14	0,64	1,16	10,21	10,06	23,91	32,54	36,24	53,64	60,26	217,14	2.856

Figure 23. Table of regional and global urban populations for selected benchmark years, Millions.

The urban population, unlike our rural populations are not modelled or estimated, but rather a direct sum of the population of all cities at a given point in time. Unlike with Stadestér Base or Stadestér-GHSL, urban rasters carry persistent population between both models as mentioned earlier.

Particular notice should be given to where urban populations decline: in Latin America between 500AD-1000AD (-51,79%), the Middle East from 2000BC-1000BC (-25%) and 1000AD-1500AD (-23,24%), in the Maghreb and Egypt from 1AD-500AD (-42,94%), in the Indian Subcontinent from 2000BC-1000BC (-100%). These of course, correlate with the Classic Maya Collapse [184], Late Bronze Age urban declines [185], the Late Antique period [186][187], and the fall of the Indus Valley civilisations [188], into which our constituent sources (particularly Chandler and Modelski) likely placed great stock.

We are not members of such declinist schools when it comes to the population overall, but we do believe that urban populations shrunk by some margin (even if not as dramatic as claimed by Reba et al) during such periods. There are also some rounding errors present in the above graph - Oceania’s urban population in 1800AD is recorded as being ~2.000 within the dataset but is still <10.000, and therefore rounded down.

Region	-3000	-2000	-1000	1	500	1000	1500	1600	1700	1800	1900	2000

Northern America	1,17	1,45	1,54	0,92	1,59	2,46	5,00	1,42	2,00	8,07	77,79	152,66
Latin America	8,18	9,94	14,66	28,22	40,22	45,66	67,58	10,04	14,19	22,62	61,25	145,00
Europe	2,01	5,17	10,34	26,38	22,74	23,62	53,90	83,88	108,56	155,45	267,39	176,86
Eastern Europe & Russia	2,18	2,54	4,20	10,57	8,53	9,01	15,47	17,43	23,21	44,82	105,13	85,82
Middle East	4,29	7,11	11,50	14,74	17,95	17,47	15,94	23,73	27,11	29,49	38,77	100,87
Maghreb-Egypt	1,78	2,79	5,01	8,62	12,80	8,51	11,75	11,28	10,96	10,93	23,29	65,49
Sub-Saharan Africa	1,84	2,59	4,03	3,10	4,37	5,45	7,47	18,12	24,29	28,46	35,05	132,31
Central Asia	1,99	2,92	4,69	8,16	11,22	18,98	32,23	58,15	76,09	76,04	96,45	450,00
Indian Subcontinent	9,78	21,61	41,17	39,05	55,95	79,81	138,61	153,81	214,77	244,35	308,07	818,52
Southeast Asia	0,81	1,79	3,37	5,20	6,82	12,88	20,49	23,05	29,97	37,52	86,13	302,45
East Asia	7,27	9,17	14,00	58,75	59,02	96,74	167,80	123,34	156,32	362,64	441,93	791,54
Oceania	0,26	0,25	0,31	0,50	0,48	0,37	0,61	0,53	0,71	0,85	5,20	7,26
World	41,44	68,82	115,17	204,08	241,62	321,89	536,80	525,79	688,20	1.021	1.547	3.228

Figure 24. Table of regional and global rural and peri-urban populations for selected benchmark years, Millions.

Finally, populations of non-urban populations were arrived at by simply subtracting urban populations from the total populations. There is not a great deal of discrete modelling in this regard, and our rural rasters explicitly also include peri-urban and exurban populations.

Because disaggregation of urban populations were limited in earlier years, particularly prior to 1800AD, it is often the case that boundaries between urban and rural at a 5-arcmin resolution will be subtle if visible at all. Similar lossy effects can be seen in other gridded models at which the higher resolution is some sort of raster abstraction [189].

Testing and Validation

Methodologies are naturally only as good as their testing and validation allow them to be, and so we have opted to build our models in a way that makes cross-comparison useful in addition to being able to perform out-of-model forecasting/sampling. Note that to avoid any potential issues regarding land area/coastline imprecision or gaps between borders that might exist

[190][191], we simply binned values based off k-NN per pixel classifiers within a colourmap [192].

There are only so many ways one can attempt an estimation of how 'off' a historical dataset is, since there are only a limited set of ground truths and other scholarly estimates we can compare against. Error calculations may be performed at the macro- (HYDE/Reba/UN/WPP), meso- (GHSL/plausibility checking), and micro- level (Global 30 + aggregated literature reviews for each city), all of which we promptly run through below before coming to conclusions on final error margins.

Macro-Validation, Dataset Comparisons

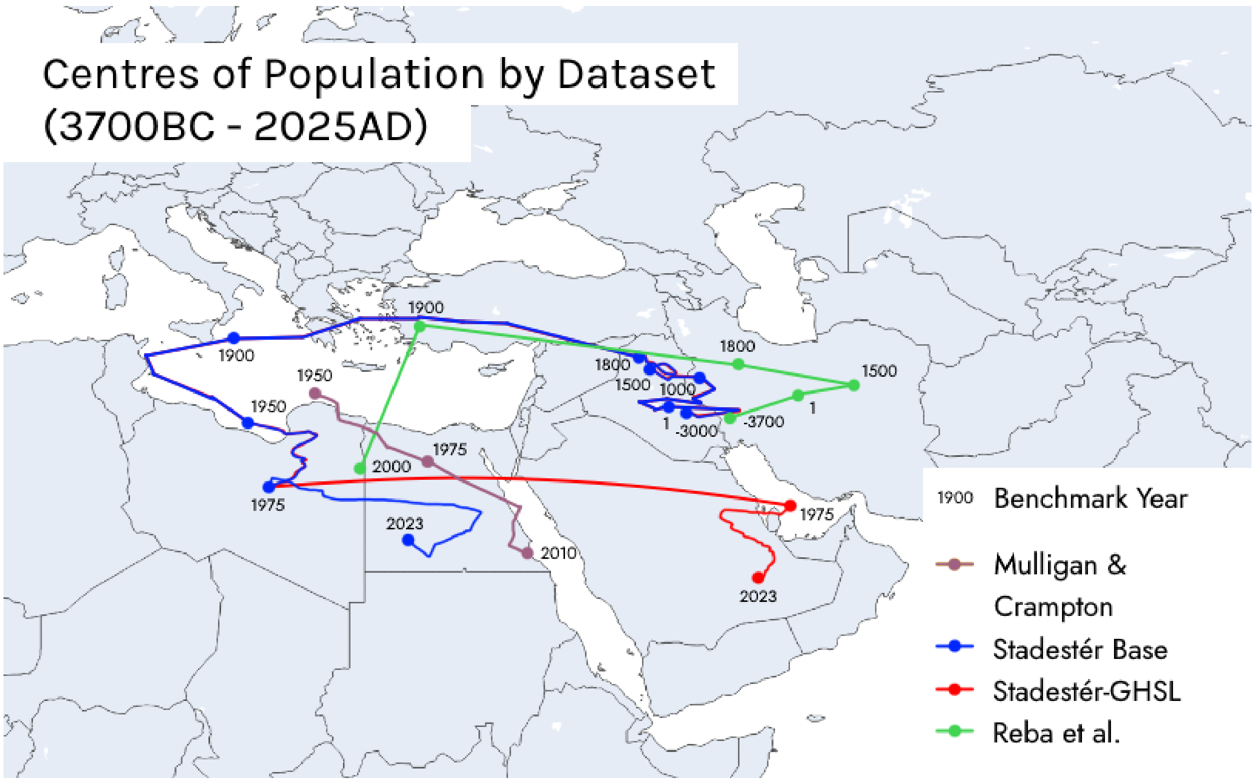


Figure 25. Centres of population comparison between GHSL, Stadestér, Mulligan and Crampton, and Reba et al. over time (3000BC-2025AD).

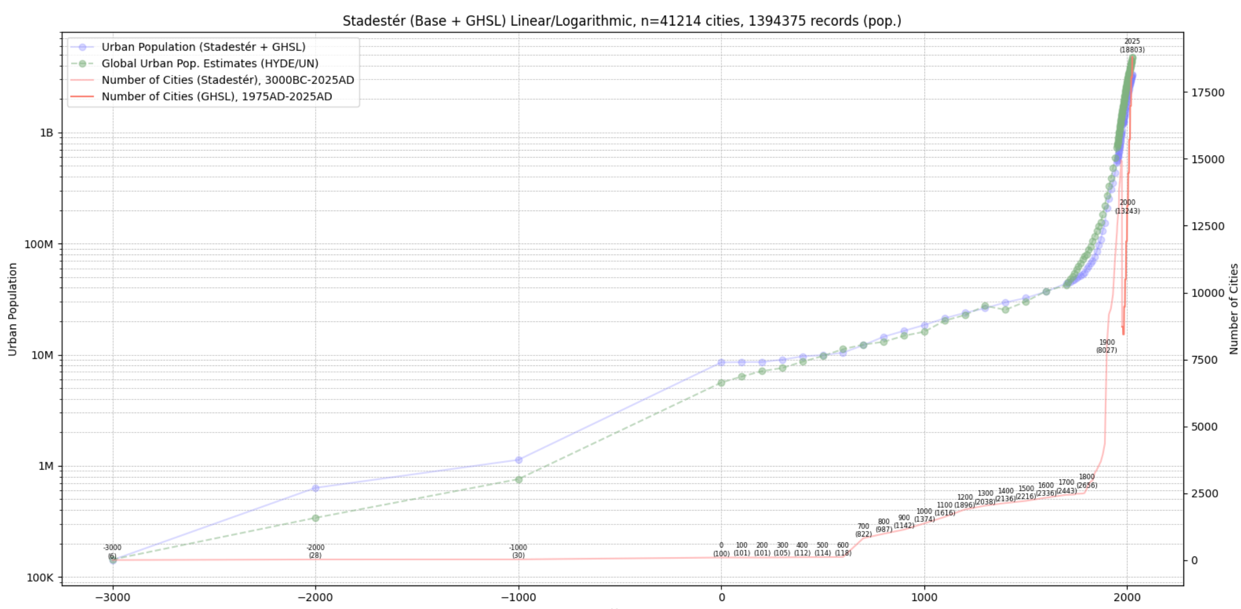
Testing how much our urban dataset varies from those of respected historical and contemporary estimates is certainly of great value, and is relatively routine in that sense [193]. Taking the distance between centres of population or gravity are the primary means by which we have decided to compare not just differences in total populations, but also in urban distribution between datasets.

Unfortunately, Reba is the only long-term global urban dataset with significant coverage prior to 1800AD. We find in general that Stadestér Base's distance couples relatively tightly with that of Reba et al. (~220km to ~577km, or 1,1-2,8% as measured on the Earth's great circle), with a maximum separation at 1500AD of ~1.170km, although the urban centre of population is much more stable prior to the Industrial Revolution than the trajectory plotted by Reba.

We do not believe this sort of anchoring can be explained by the Eurocentric biases introduced by Buringh, since there is no sudden discontinuity upon the introduction of Buringh or De Vries in 600AD and 1500AD respectively. There is a marked discontinuity between Stadestér Base and Stadestér-GHSL post-1975, in which GHSL has a dearth of North American and Latin American cities as previously covered due to density cutoffs.

Stadestér Base is on the other hand within (410km to 450km or ~2-2,2%, max = ~935km) as calculated from the UNWPP's urban centre of gravity between 1950AD and 2010AD [194]. By contrast, GHSL has a discrepancy from the UNWPP's centre of gravity by ~2.323,52km, or 11,60% as compared to Earth's radius, and nearly six times that of the discrepancy between Stadestér Base and the UNWPP despite one being a historical dataset, and the other being a modern urban dataset.

A comparison to HYDE (which purports similar data) in terms of spatial distribution was not made since its urban areas are decided by simply allocating urban populations to river valleys before fading into modern built-up areas. This phenomenon may be independently visualised at the HYDE portal [195].



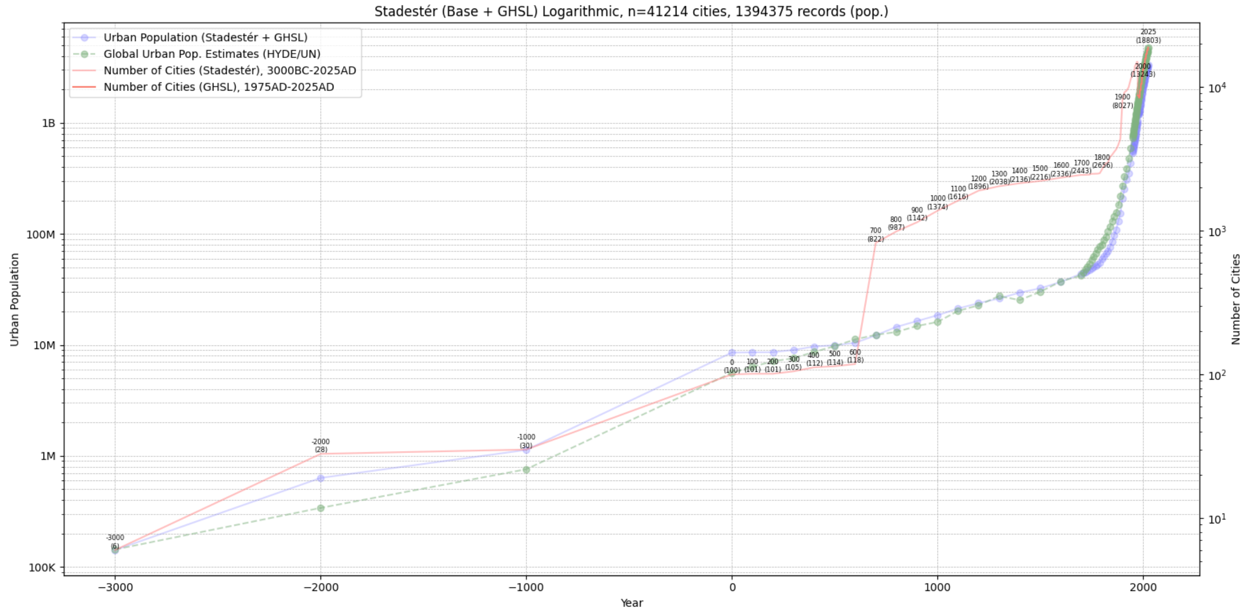


Figure 26. Raw totals of discrete city populations and sample size in Stadestér over time compared to HYDE/UN estimates (3000BC-2025AD).

There are certainly weaknesses in our sample sizes for the deep past - prior to 700AD there are only n=118 cities in Stadestér, mainly from Reba et al. The jump from n=118 to n=822 cities between 600AD-700AD is mainly given by the introduction of Buringh (and later De Vries), meaning the distribution of cities, no matter how discrete, takes on something of a Eurocentric character until ~1800AD, when Populstat affords us a more granular picture.

At the moment, there is not much we can do about this, since historical demographers have long neglected areas outside of Europe, and the fact that the ‘historical demography of Africa and South Asia’ had effectively ‘plummeted in the 1990s’ does not lend itself to confidence [196]. Nearly 40% of historical demography publications in the journal *Population Studies* since 1947 have been on the British Isles alone. The Eurocentric ratios of the other major journals of demography are not much better [197].

What then, of Central Asia, the pre-Columbian Americas, Africa, East Asia, the Indian Subcontinent, and other such centres of historical urbanism which we are keenly interested in? They will have to wait. After all, there is much correcting to do with Chandler and Modelski’s extant figures to begin with, and we could only ever feel confident in the proxy modelling of other world regions after sourcing their estimates and disaggregating them [198].

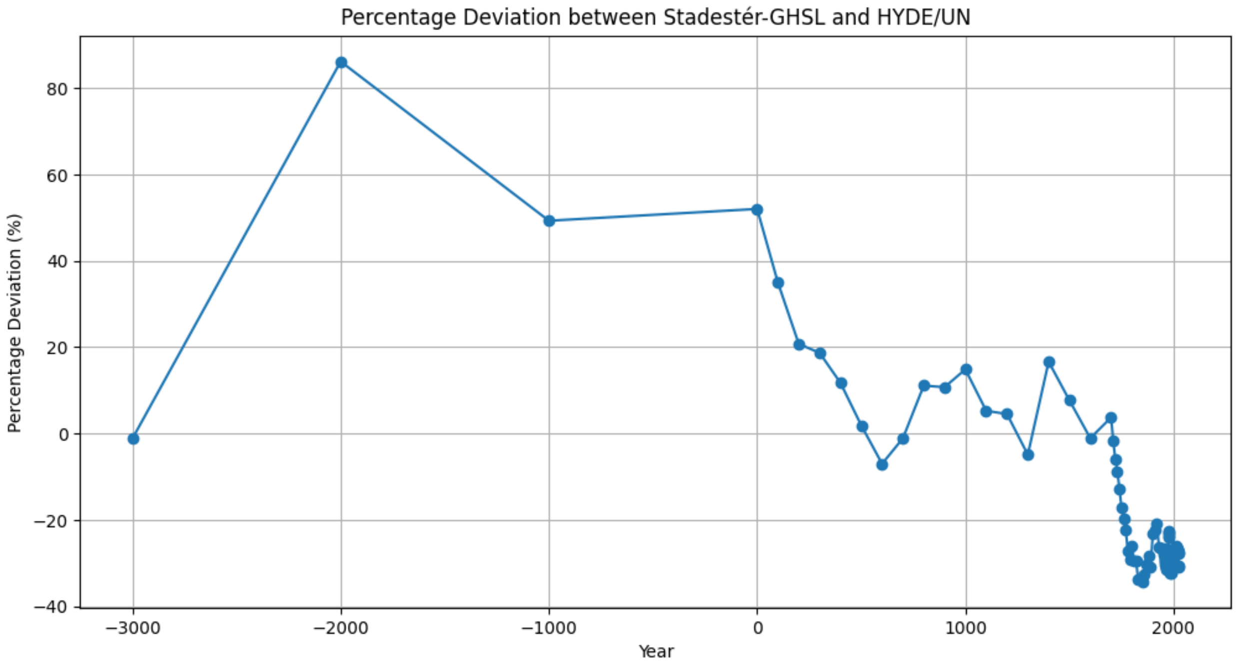


Figure 27. Percentage deviation between Stadestér-GHSL raw sums of city populations and HYDE/UN estimates over time (3000BC-2025AD).

Stadestér's sums of all city populations consistently deviate by only ~20-30% from HYDE/UN estimations for the time period after 1AD without any calibration when speaking in an equal-interval capacity, although relatively large outliers (from -1,13-86,15%) also exist prior to antiquity.

However, because there are relatively few datapoints of this sort (n=4), overall margins of error as compared to HYDE/UN estimations are fairly small (n=121; M=-17,4%; SD=13%). In log-space, of course, Stadestér's bottom-up estimates line up remarkably well with established top-down ones that are in common circulation [199].

By comparison, current academic models (n=10) of urban land cover (typically based on modern satellite or census data) display a relative mean deviation of 51,9% (CV=71%). [200]. Since urban land cover is tightly coupled to urban population models (especially in dasymetric mapping and historical or hindcasted proxy models) as well as in verification, it is at some level a representative proxy of what we believe about the size of urban populations themselves [201][202][203].

Meso-Validation, Out-of-Sample Forecasting

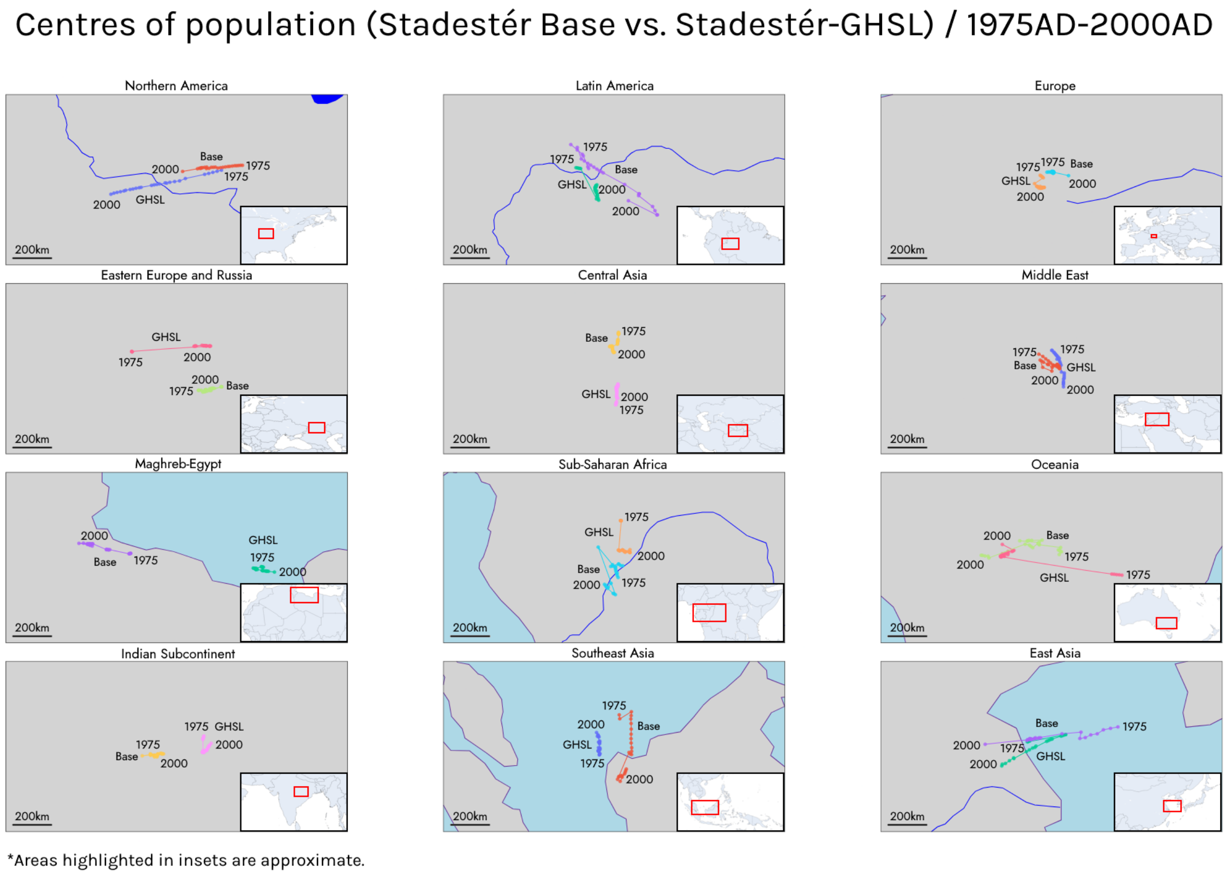


Figure 28. Centre of population comparison between GHSL and Stadestér Base for all world regions (1975AD-2000AD).

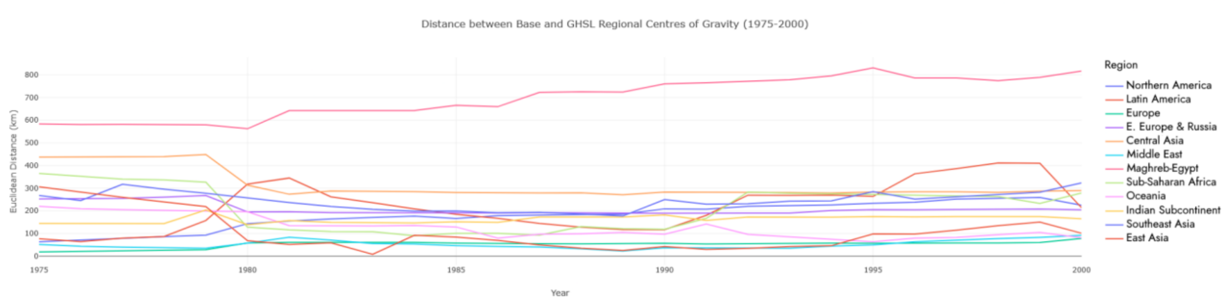


Figure 29. Euclidean distance between GHSL and Stadestér Base for all world regions (1975AD-2000AD).

We also attempted an assessment for the variation in regional centres of population between Stadestér Base and GHSL in terms of urban population. Average deviations between the two models varied from a minimum 51,67km (Europe) to a maximum of 699,47km (Maghreb-Egypt).

For all world regions, discrepancies were relatively tame but moderate (M = 214,23km; SD = 175,86km), with the obvious exception of the Maghreb and Egypt, for whom distances between approximate centres of population diverge rather than converge (M = 699,47km; SD = 88,25km).

This is due to a westwards drift in the base model as compared to an eastwards drift (towards Egypt and the Nile Delta) in GHSL, likely since the definitions of urban centres in Egypt in one of our main constituent sources (Populstat) lists the definition of cities in Egypt as being constant, i.e. ~40.000 inhabitants in 1986', and many rural conurbations in the Nile Delta were not counted as separate cities by administration [204].

Of course, it is important to keep in mind here the errors relative to the dimension of each region as well. Percentages are the fraction of the value given as compared to the longest geodesic line that fits within a given world region's boundaries.

Region	Min. Deviation	Max. Deviation	Mean (% Error)	SD (% Error)	Longest Geodesic
Northern America	63,04	258,77	178,30 (2,13%)	58,95 (0,71%)	~8.359
Latin America	63,98	411,14	220,00 (1,79%)	106,72 (0,87%)	~12.278
Europe	18,17	77,74	51,67 (0,84%)	14,97 (0,24%)	~6.120
Eastern Europe & Russia	189,05	267,33	207,66 (2,87%)	25,69 (0,36%)	~7.241
Central Asia	207,61	448,36	313,31 (9,03%)	63,46 (1,83%)	~3.470
Middle East	22,45	91,82	51,28 (1,38%)	18,28 (0,49%)	~3.728
Maghreb-Egypt	561,87	830,42	699,47 (13,49%)	88,25 (1,70%)	~5.185
Sub-Saharan Africa	89,62	364,87	211,97 (2,87%)	97,14 (1,32%)	~7.376
Oceania	63,21	219,37	125,86 (1,10%)	48,96 (0,43%)	~11.395
Indian Subcontinent	138,48	203,40	162,55 (3,99%)	15,95 (0,39%)	~4.076
Southeast Asia	177,07	323,15	243,60 (3,29%)	40,10 (0,54%)	~7.404
Eastasia	7,67	305,78	105,13 (1,77%)	85,74 (1,44%)	~5.954
World (Avg.)	133,52	316,85	214,23 (3,80%)	175,86 (0,86%)	N/A

Figure 30. Comparisons of deviations between Stadestér-Base and Stadestér-GHSL by each world region's centre of population in kilometres.

Note. Longest geodesic figures are approximate and are the diagonal of the bounding box of the largest contiguous geometry after per-pixel kNN-binning.

If we assume GHSL to be our ground truth model, then mean percentage errors for urban population distributions between Stadestér Base and GHSL varied from 0,84% to a high of 13,49%. Since we derive most modern population estimates past 2000AD from GHSL, our base population data diverges past 2000AD as data becomes scarcer and scarcer when not including either GHS-POP or GHS-UCDB. Fortunately, our main Stadestér Urban raster series merges both, and we therefore recommend its use for gridded population models.

Figure 31. Comparisons of urban growth between Stadestér-Base and Stadestér-GHSL for the Global 30, metro-adjusted (1800AD-2000AD). Population circle sizes come from final year data for the metro-corrected version of Stadestér.

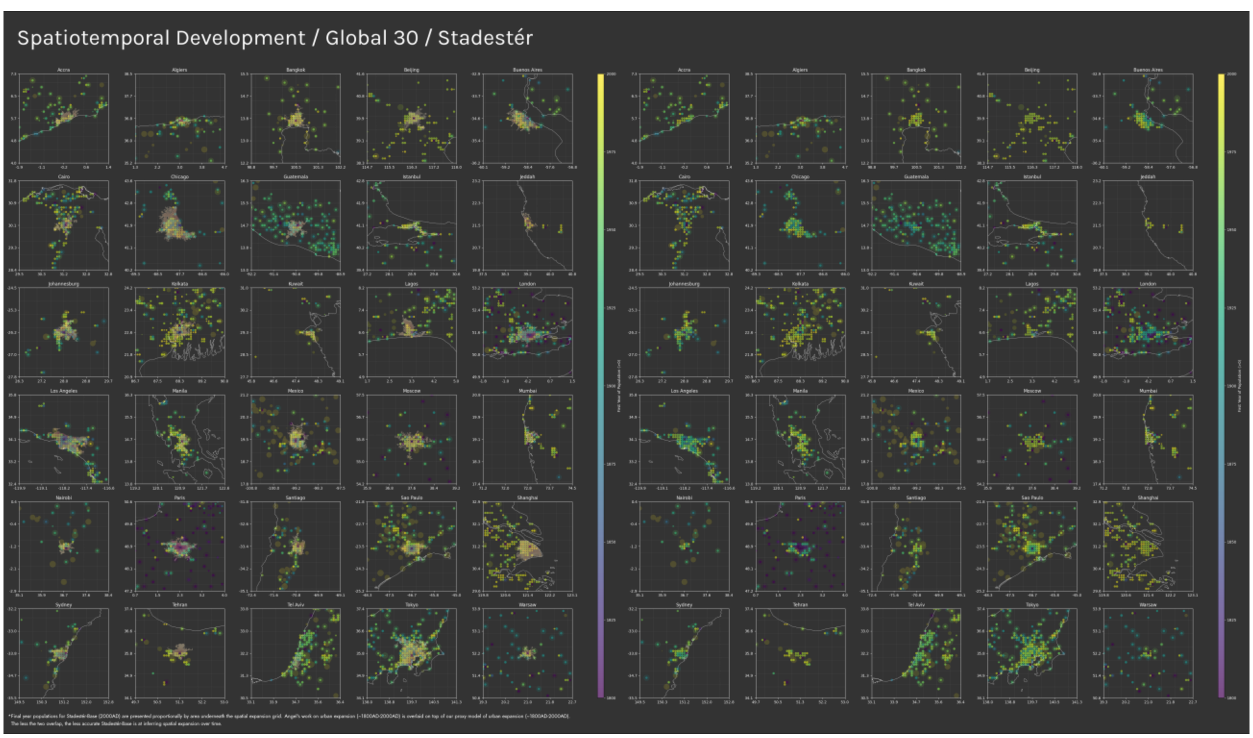


Figure 32. Overlay comparisons of urban growth between Stadestér-Base and the *Atlas of Urban Expansion* (1800AD-2014AD).

The exceptionally high number (n=41.214) of metropole, suburban, and peri-urban settlements also allow us to carry out spatial expansion comparisons between 1800AD and 2000AD utilising our population buffering model as discussed earlier. Overlay data for ground-truth comparisons of urban expansion were extracted from the Atlas of Urban Expansion's Historical Data section [33].

Since spatial expansion is forecasted only based off the rural substrata rasters mentioned previously in addition to population records starting in 1800AD, urban expansion data in Stadestér between 1800-2000AD are by definition the results of a forecasted proxy model, and we can therefore perform out-of-model sampling and cross-comparisons to the Global 30 as defined by Angel, those cities being Accra, Algiers, Bangkok, Beijing, Buenos Aires, Cairo, Chicago, Guatemala, Istanbul, Jeddah, Johannesburg, Kolkata, Kuwait, Lagos, London, Los Angeles, Manila, Mexico, Moscow, Mumbai, Nairobi, Paris, Santiago, Sao Paulo, Shanghai, Sydney, Tehran, Tel Aviv, Tokyo, and Warsaw.

No specialised data fitting was performed for this area/density model beyond what has already been mentioned. In general, per-pixel visual results overlap tightly with the Atlas of Urban Expansion (Figure 32), and data is of high enough fidelity to visualise global urban expansion patterns. We provide the non-temporally dependent Jaccard indices of each city in Figure 38. Tests of this type are also possible with urban hindcasted models, such as that of Li et al (1870AD-2020AD/2100AD), but we have not performed such peer tests [30].

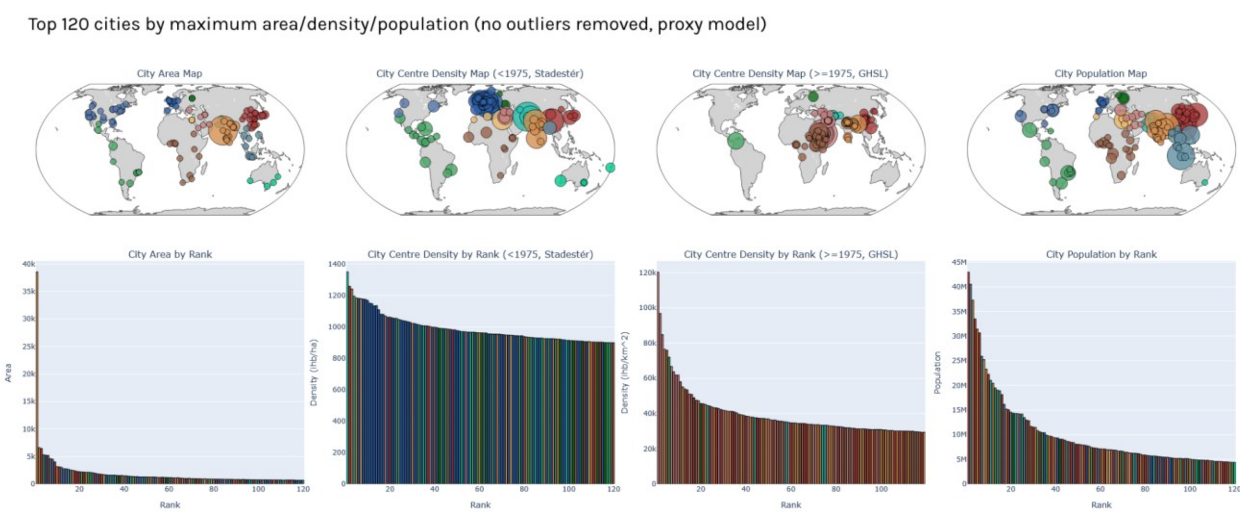


Figure 33. Largest 120 cities globally by maximum area, density, and population, sorted by world region (30000BC-2025AD).

Of course, whilst the proxy model's underlying area and density assumptions are tempered by the underlying rural substrata in what it is allowed to do, as well as the polycentric nature of Stadestér's core population data, it would also be helpful to illustrate how it performs in terms of area and density prediction.

There are major problems in defining urban density, and we specifically utilise modelled city centre density here since it was a requirement for the Clark model (in ihb/ha). An obvious problem that arises is that the differing definitions of urban density mean that there is no easy way to cross-compare the accuracy of our proxies of it to some list of the densest cities in the real world [205][206].

Mumbai also appears as a major outlier in terms of guesstimated area in our models, due principally to its persistent exponential growth as a discrete city from 1800AD-2000AD as compared to other metropoles which were often eventually disaggregated into constituent polycentric suburbs.

Rank	Area (Proxy)	City Centre Density, <1975, Base	City Centre Density, >=1975, GHSL	Population
1	Mumbai	Ghazni	Ar Rujum	Shenzhen
2	Dhaka	Jiulong	Al Ma'azibah	Jakarta
3	Shenzhen	Sikandarabad	Al Qal'ah	Dhaka
4	Cali	Taxila	Jotsoma	Tokyo (GHSL)
5	Lille	Kozhikode	Karora	Ghaziabad
6	Tokyo	Katowice	Tiquisio	Shanghai (GHSL)
7	Jakarta	Banha	Al Jama'im	Manila
8	Los Angeles	Wandsbek	Sarvestan	Cairo (GHSL)
9	Hiroshima	Wetter	Zahr al Husa	Kolkata
10	Hajipur	Essen	Al Ghawl	Seoul (GHSL)
11	Shanghai (GHSL)	Salerno	Natinga	Karachi
12	New York (GHSL)	Brussels	Bangarmau	Mumbai (GHSL)
13	Miami	Stockton-on-Tees	Bike	Sao Paulo (GHSL)
14	New York (Base)	Cannes	Lintou	Bangkok
15	Bangkok	Burg	Ath Thahirah	Mexico City
16	Quezon City	Birmingham	Inticho	Beijing
17	Kolkata	Lancaster	Pingchang	New York (Base)
18	Nagoya	Zefat	Nimule	Bengaluru
19	Seoul (GHSL)	Virovitica	Ar Rawnah	Osaka
20	Osaka	Nagasaki	N/A	Ho Chi Minh
21	Buenos Aires	Cobh	Longshui	Moscow (GHSL)
22	Beijing	Brighton	Aliganj	Lahore
23	Ghaziabad	Holguin	Toraghundi	Istanbul
24	Mexico City	Amarapura	Dianjiang	New York

				(GHSL)
25	Sao Paulo	Bytom	Al Masaliyah	Buenos Aires
26	Chicago (GHSL)	Nurnberg	Dhupguri	Los Angeles
27	Jieyang	Bar-le-Duc	Rongchang	Kinshasa
28	Houston	Liverpool	Sareyn	Lagos
29	Suzhou	Massa	Hechuan	Luanda
30	Johannesburg	Patna	Al Hudayyah	Suzhou
31	Cairo (GHSL)	Avallon	Neragyatanah	Chennai
32	London	Elblag	Adan Baraka	Lima
33	Toronto	Vitoria	Bhola	Jieyang
34	Sao Paulo	Bayonne	Wusheng	Bogota
35	San Jose	Perth	Shehong	London (GHSL)
36	Melbourne	Montreal	Kharameh	Rio de Janeiro (GHSL)
37	Hangzhou	Fujieda	Togechane	Hajipur
38	Moscow (GHSL)	Akko	Jalpaiguri	Taipei
39	Tehran	Brugges	Bugama	Hyderabad
40	Ho Chi Minh	Agadez	Jingbian	Tehran
41	Benin City	Braganca	N/A	Paris (GHSL)
42	Paris	Beograd	Sikandra Rao	Moscow (Base)
43	Sydney	Huancavelica	Hudur	Shanghai (Base)
44	Kozhikode	Gilwice	Tulak	Dar-es-Salaam
45	Kuala Lumpur	Ensenada	Xishui	Bandung
46	Chicago (Base)	Cacheu	Yuechi	Johannesburg
47	Phoenix	Montceau	Sandila	Chongqing
48	Surabaya	Lanzhou	Derudeib	Kuala Lumpur
49	Washington D.C.	Heidelberg	Bisalpur	Wuhan
50	Rio de Janeiro (GHSL)	Arbon-Rorsch	Koohanjan	Nanjing
51	Istanbul	Montbeliard	Gobindaganj	Riyadh
52	Kochi	Suva	Mojiang Hani	Ahmedabad
53	Detroit	Le Creusot	Qaraziadin	Nagoya
54	Dallas-Fort Worth	Sebinkarahis	Uige	London (Base)
55	Colombo	Chatham	El Hawata	Kozhikode
56	Lagos	Gardiz	Famenin	Sao Paulo (Base)
57	Shanghai (Base)	Yarumal	Garasse	Tianjin
58	Denver	Denain	Khail	Addis Ababa
59	Moscow (Base)	Panama City	Manakhah	Chicago
60	Owerri	Ahmadnagar	Yingshan	Khartoum
61	Seattle	Rostov	Kebkabiya	Surat
62	Accra	Vancouver	Shahganj	Chengdu
63	Maharajganj	Krivodol	Ghatampur	Cairo (Base)
64	Riyadh	Wicklow	Jamame	Alexandria
65	Onitsha	Oakland	Narus	Baghdad
66	Chennai	Santos	Bishan	Hangzhou

67	Montreal	Mannheim	Longquanyi	Surabaya
68	Nanjing	Jaunpur	Krishnanagar	Pune
69	Bengaluru	Olesnica	Filtu	Nairobi
70	Bandung	Chorzow	Meshkan	Santiago
71	Lima	San Marino	Ad Darumah	Abidjan
72	Taipei	Ambala	Jais	Amman
73	Khartoum	Mortherwell	Safipur	Luxor
74	Luanda	Qabis	Shinkot	Seoul (Base)
75	Hanoi	Liege	Shahrak	Kabul
76	Cairo (Base)	Gallivare	Al 'Udayn	Yangon
77	Dar es-Salaam	Pila	Shamsabad	Shenyang
78	Lahore	Surgidero	Jalesar	Mumbai (Base)
79	Hyderabad	Rapperswil	Burka	Accra
80	Tamluk	Zeila	Kavar	Beijing
81	Ruhr	Bogazzilyan	Nanxi	Onitsha
82	Chengdu	Puerto Wilch	Al Mirqab	Miami
83	Portland	Retalhuleu	Seka	Madrid
84	Phoenix	Lille	Hilat Ashat	Faisalabad
85	Dubai	Karachi	Yenice	Hefei
86	Las Vegas	Bremen	Bitou	Toronto
87	Karachi	Kalisz	Khayran	Yaounde
88	Linyi	Kogarh	Pengshui	Ruhr
89	Tehran	Ahmadabad	Nanbu	Xi'an
90	Kampala	Thionville	Hamero	Mashhad
91	Durban	Caracas	Amber	Chicago
92	Quanzhou	Siegburg	Utraula	Paris (Base)
93	Santiago	Vancouver	Lezhi	Lucknow
94	Seoul (Base)	Mexico City	Buram	Kampala
95	Milan	Polonaruwa	Meichuan	Chattogram
96	Perth	Artemivsk	Bendaravadi	Rio de Janeiro (Base)
97	San Diego	Kortrijk	Daying	Zhengzhou
98	Wuhan	Conde	As Sayyid	Singapore
99	Rio de Janeiro (Base)	Khiva	Wegeda	Kano
100	Sacramento	Saint Petersburg	Faridpur	Kochi
101	Philadelphia	Bridgetown	Kibet	Hanoi
102	Ponnani	Dubrovnik	Siyana	Kumasi
103	Chicoutimi	Kampala	Bhinga	Rawalpindi
104	Manchester	Zary	Wereta	Saint Petersburg
105	Orlando	Lens	Kattapanna	Philadelphia
106	Shenyang	Cazin	Tongrim	Jeddah
107	Mumbai	Shenyang	Sahabad	Hong Kong
108	London	Aachen	Weixin	Mogadishu
109	Kollam	Ait Melloul	Chhibramau	Colombo

110	Saint Petersburg	Barauni	Kangdong	San Jose
111	Brisbane	Shizuoka	Soku	Santo Domingo
112	Jeddah	Johannesburg	Hardoi	Harbin
113	Cape Town	Gorna Orjach	Aleta Wendo	Casablanca
114	Xi'an	Kitakyushu	Hargele	Dubai
115	Baghdad	Leuven	Bolo	Tokyo (Base)
116	Berlin	Petrozavodsk	El Afweyn	Tianjin
117	Birmingham	Anamoros	Ed Al Fursan	Douala
118	Monterrey	Hurstville	Tongjiang	Kanpur
119	Madrid	Tadjourah	Jhenaidah	Belo Horizonte
120	Yogyakarta	Butiaba	N/A	Sydney

Note: This is metro-adjusted Stadestér Base, meaning that large metropolitan areas are disaggregated compared to GHSL. GHSL often groups together built-up areas - Shenzhen for instance, is the entirety of the Pearl River Delta. The rank is given by a city's maximum area/density/population, not that of its last year.

Figure 34. Rank-ordinal tables of the top 120 cities in each category (area, city centre density, population) over the entire time domain.

Despite not being directly comparable due to measurement differences and metro correction, such assessments give us a chance to see whether the conclusions of a model are mostly sensible, in part by regional-level density classifications. The large amount of dense European cities (n=54, 45%) of the Global 120 in Stadestér Base can largely be explained as the legacy of early European industrialisation and urbanisation [207][208].

Region	Area, City Count	Centre Density City Count, <1975, Base	Centre Density City Count, >=1975, GHSL	Population, City Count
Northern America	25	3	0	9
Latin America	10	14	0	11
Europe	10	54	0	6
Eastern Europe & Russia	2	8	1	3
Central Asia	2	5	1	5
Middle East	7	5	27	8
Maghreb-Egypt	2	3	0	5
Sub-Saharan Africa	12	7	31	17
Oceania	4	4	0	1
Indian Subcontinent	16	9	29	18
Southeast Asia	9	1	0	10
Eastasia	21	7	25	27

Figure 35. Table of the number of cities in the top Global 120 per variable listed above.

After 1975AD, our data shows a large-scale migration in the densest cities eastwards towards Africa and Asia (n=31, 25,83%; n=81, 67,5%), which are consistent with other visualisations or uses of GHSL [209]. However, the GHSL's list of densest cities are not generally matched by those of Demographia, which filters only for urban areas with a population >500k [210].

Thus it is difficult to say with any confidence how accurate our internal proxy metrics are. From a broad regional standpoint, they certainly seem to align with macrohistorical trends, outliers notwithstanding [211][212]. At the very least, the results are on the whole not patently absurd - for instance, there remains a low number of cities in Northern America within Stadestér Base which belong to the Global 120 in terms of density (n=3, 2,5%).

These results are not however representative of the final rasters, since Stadestér Urban is additionally filtered over substrata maps informed by population distributions, meaning they reflect the spatially explicit results seen in earlier figures rather than the somewhat abstract intermediate parameters demanded by Clark and associated variant equations (Figure 30, Figure 31).

Micro-Validation, Manual Copychecking

Similar to how many scientific models have data portals in which resulting rasters can be easily inspected (for instance, the HYDE Portal, or the GHSL's Global Visualisation, or GPW's Worldview), we decided to embark on the creation of custom data processing and visualisation software in the form of Constele Red [42][213].

Constele Red is somewhat unique in that it is architecturally a multi-threaded, asynchronous spatiotemporal processing suite with a DAG node editor in addition to performing 3D map visualisation tasks via Maptalks and Codemirror v5 [214][215]. We chose to offer dataflow editing capabilities in Constele Red since we intend on the eventual integration of Stadestér data processing and visualisation to allow for better reproducibility by other researchers.

The visualisation suite, particularly in the form of various mapmodes, was utilised to inform various manual copychecking efforts and to flag various anomalous results in any of Stadestér's constituent sources.

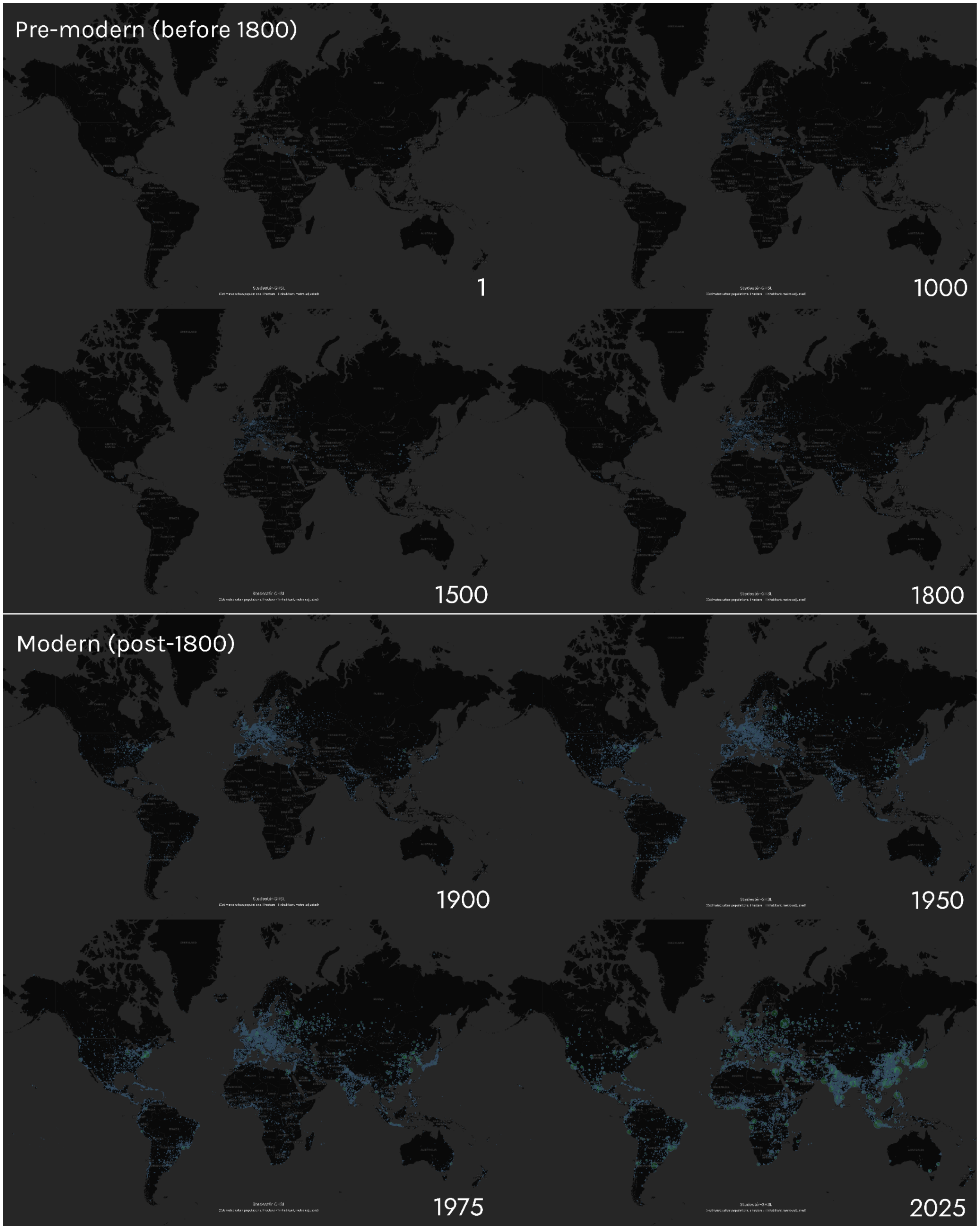


Figure 36. Screenshots of Stadestér-GHSL without labels in Constele Red for benchmark years. 1 hectare = 1 inhabitant, metro adjusted (1AD-2025AD).

Manual copychecking is by its nature something of a last resort, since it is non-systematic. As such, we often utilised elevation heightmaps to visualise GeoPNG rasters produced by Stadestér in addition to viewing raw geolocated population figures. Few of the findings from the field of cartographic labelling are represented in web-native mapping libraries [216][217].

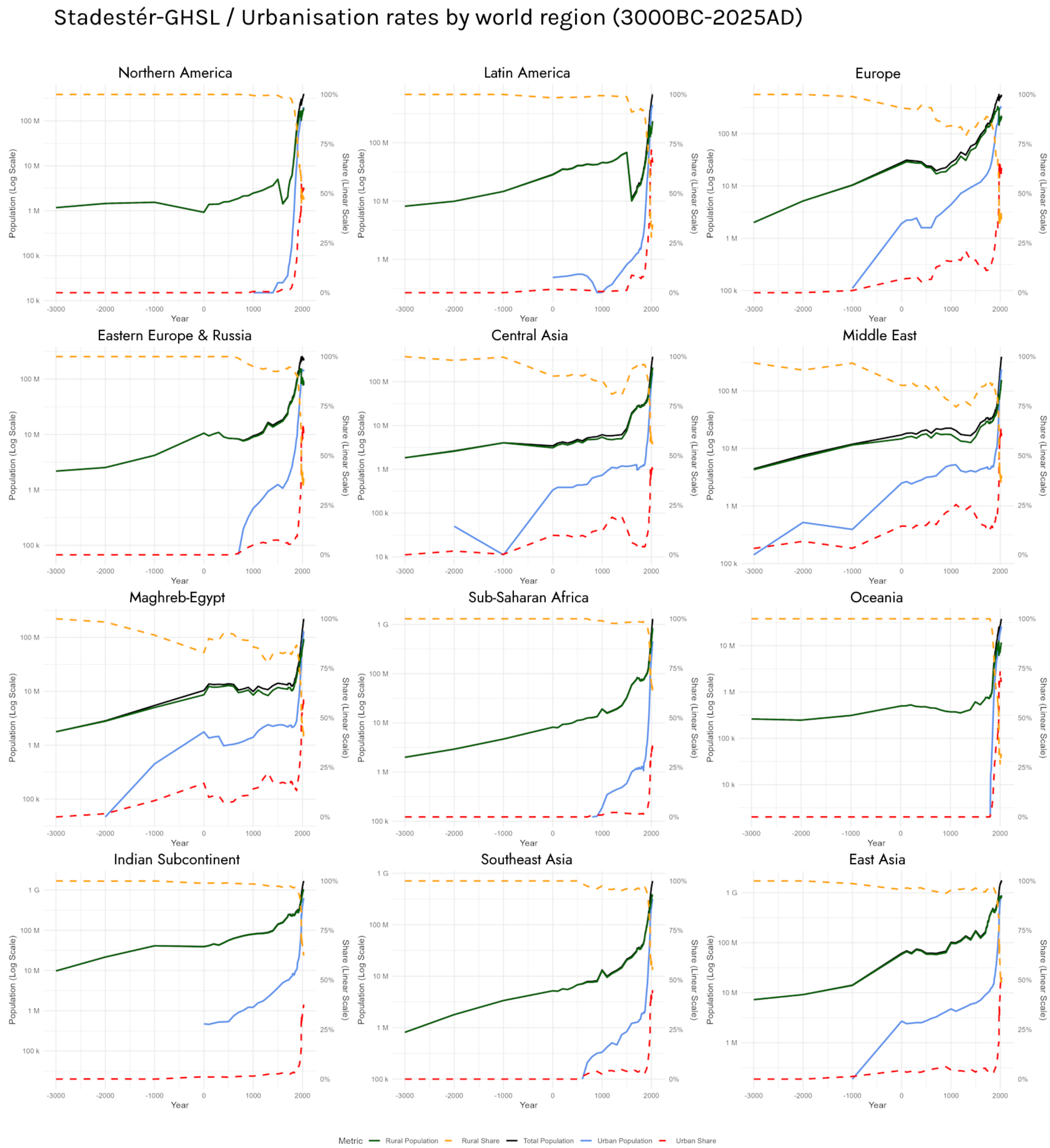


Figure 37. Urbanisation rates by world region in Stadestér-GHSL (3000BC-2025AD).

The high number of cities leads to label crowding, even for earlier years in Stadestér (Figure 35), and so figures typically had to be assessed at very close range.

Figures and auto-generated animations were additionally prepared in advance and programmed in Python/R such that they could serve as an additional form of visualisation for the overall dataset, even though at this stage we must admit that a great deal of code tidying and consolidation is needed before each figure can be accounted for. Still, the individual Node.js, Python, and R files used to generate the graphs and tables in this paper can be found in the linked source repository in line with data and code availability standards [218]. They can also be found in the full datavault version of Stadestér 1.0, since some intermediate files used to produce the results in this paper exceed 100MB.

In general, urbanisation by world region aligns closely with rasters as present in Stadestér Urban with the exception that the rates have been taken from discrete city objects as opposed to consolidated rasters.

[ ] Metro-adjusted / [ ] Non-metro adjusted. Figures are given in thousands.

Year	Accra		Algiers		Bangkok		Beijing		Buenos Aires	
1	0	0	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	60	60	0	0
1500	0	0	20	20	0	0	672	672	0	0
1600	0	0	77	77	0	0	707	707	0	0
1700	0	0	100	100	0	0	685	685	3	3
1800	0	0	78	100	45	45	1.137	1.137	35	35
1850	0	0	29	54	162	162	1.648	1.648	74	74
1900	17	17	31	97	541	541	1.649	1.649	672	771
1950	156	167	120	331	778	778	2.069	2.069	782	3.164
1975	1.098	1.098	1.521	1.521	3.699	3.699	5.153	5.153	8.567	8.567
2000	2.778	2.778	2.216	2.216	8.903	8.903	10.010	10.010	11.737	11.737
2025	5.890	5.890	3.316	3.316	19.048	19.048	18.151	18.151	14.180	14.180
	Cairo		Chicago		Guatemala		Istanbul		Jeddah	
1	0	0	0	0	0	0	109	109	0	0
500	0	0	0	0	0	0	498	498	0	0
1000	94	114	0	0	0	0	330	330	0	0
1500	360	380	0	0	30	30	204	204	0	0
1600	255	275	0	0	25	25	685	685	0	0
1700	155	175	0	0	31	31	750	750	0	0
1800	171	191	0	0	25	25	560	560	20	20
1850	241	261	59	59	37	37	748	778	26	26
1900	503	597	1.671	1.671	77	82	862	941	30	30
1950	2.974	3.296	3.889	3.889	280	326	391	1.050	95	95
1975	7.420	7.420	4.477	4.477	1.131	1.131	5.123	5.123	480	480
2000	15.302	15.302	5.124	5.124	2.068	2.068	10.589	10.589	2.369	2.369

2025	25.230	25.230	5.319	5.319	2.901	2.901	14.210	14.210	4.842	4.842
	Johannesburg		Kolkata		Kuwait		Lagos		London	
1	0	0	0	0	0	0	0	0	31	31
500	0	0	0	0	0	0	0	0	35	35
1000	0	0	0	0	0	0	0	0	20	38
1500	0	0	0	0	0	0	0	0	0	61
1600	0	0	0	0	0	0	0	0	0	175
1700	0	0	0	0	0	0	0	0	7	552
1800	0	0	258	368	0	0	0	0	768	864
1850	0	0	329	439	0	0	0	0	0	2.321
1900	102	102	615	1.010	0	0	38	38	0	4.504
1950	89	805	1.940	3.535	0	0	241	241	0	3.343
1975	1.820	1.820	10.922	10.922	768	768	2.645	2.645	7.393	7.393
2000	4.272	4.272	18.301	18.301	1.566	1.566	7.726	7.726	7.646	7.646
2025	8.593	8.593	23.315	23.315	3.703	3.703	12.846	12.846	10.408	10.408
	Los Angeles		Manila		Mexico		Moscow		Mumbai	
1	0	0	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	80	81	82	0	0
1600	0	0	28	28	9	58	106	109	0	0
1700	0	0	31	31	66	82	109	114	0	60
1800	0	0	77	77	107	131	247	259	115	143
1850	2	2	113	113	152	180	346	371	428	583
1900	184	192	207	207	266	370	1.088	1.135	773	822
1950	1.388	2.022	955	1.010	955	2.234	4.345	4.612	2.595	2.725
1975	8.257	8.257	8.457	8.457	11.138	11.138	8.507	8.507	8.505	8.505
2000	11.631	11.631	17.526	17.526	17.250	17.250	11.172	11.172	15.639	15.639
2025	13.474	13.474	25.921	25.921	17.639	17.639	14.384	14.384	20.453	20.453
	Nairobi		Paris		Santiago		Sao Paulo		Shanghai	
1	0	0	0	0	0	0	0	0	100	100
500	0	0	0	0	0	0	0	0	100	100
1000	0	0	15	18	0	0	0	0	100	100
1500	0	0	161	174	0	0	0	0	100	100
1600	0	0	230	248	0	0	0	0	31	31
1700	0	0	517	559	13	13	0	0	44	44
1800	0	0	533	601	29	29	12	12	93	93
1850	0	0	953	1.314	86	86	16	16	186	186
1900	0	0	1.894	2.679	280	285	198	225	551	551
1950	138	138	1.714	3.774	1.238	1.349	2.294	2.711	5.136	5.136
1975	564	564	7.398	7.398	2.826	2.826	10.645	10.645	4.557	4.557

2000	2.586	2.586	8.371	8.371	5.191	5.191	17.018	17.018	13.812	13.812
2025	6.646	6.646	9.328	9.328	6.634	6.634	19.485	19.485	30.679	30.679
	Sydney		Tehran		Tel Aviv		Tokyo		Warsaw	
1	0	0	0	0	0	0	0	0	0	0
500	0	0	0	0	0	0	0	0	0	0
1000	0	0	0	0	0	0	0	0	0	0
1500	0	0	0	0	0	0	0	0	7	7
1600	0	0	0	0	0	0	0	60	25	25
1700	0	0	0	28	0	0	485	685	18	18
1800	2	2	27	27	0	0	485	685	126	126
1850	48	48	0	74	0	0	580	780	162	162
1900	457	479	124	225	0	0	889	1.566	686	719
1950	960	1.647	1.043	1.145	50	280	1.623	5.010	610	757
1975	2.254	2.254	4.152	4.152	600	600	24.050	24.050	1.398	1.398
2000	3.005	3.005	6.867	6.867	1.633	1.633	30.304	30.304	1.684	1.684
2025	4.375	4.375	9.363	9.363	2.628	2.628	33.156	33.156	2.000	2.000

Figure 38. Population tables for the Global 30 (metro vs. no metro adjustment) as compared to Angel and Wikipedia for selected benchmark years (1AD-2025AD),, Thousands.

As is typically the case for datasets of this sort, it is only at the very discrete level that we can both see the impacts metro adjustment (disaggregation) has on Stadestér data when it comes to discrete objects in addition to being able to compare figures given at a particular year to their real-world populations [219]. For the urban historian, it is likely best to cross-compare results between both branches of our dataset: the metro-adjusted version for spatial disaggregation, and the non-metro adjusted version if they are only interested in the population records of a given place.

Micro-Validation, Global 30 (City-Level)

So far, the measurements of deviation previously used have assessed errors in global urban population to be on the whole between ~±17,4% (SD=13%), as previously estimated based on comparisons to HYDE/UN global urban population estimates (Figure 27). Regional out-of-sampling errors are similarly constrained between 0,84%-13,49% for modern data that can be substantively verified using modern satellite-based data comparisons (Figure 28, 29).

However, this does not necessarily answer what error rates are for specific cities, nor for the deep past. This is solvable for many of the world's major cities, such as those in the Global 30 that have already been previously compared to Angel's *Atlas of Urban Expansion* for the time period between 1800AD-2014AD. We now undertake a general literature review to see what can be assessed of each of the Global 30's population over the long run to assess discrete margins of error.

We will mainly be using the non-metro adjusted populations to judge comparable figures. In these assessments, the Ground Truth (GT) model refers to 'ground truthing' in social science modelling, which may come from plausible estimates or simulations as defined by DARPA or IBM [220][221][222]. In this ML definition, it is perfectly acceptable for the GT to merely mean plausible estimates, which all population figures are to varying degrees - no figure, ancient or modern, reliably counts every inhabitant. Nor is modern data necessarily flawless - differences in how populations are measured and the boundaries of cities lead to a great deal of variation - as much as in pre-modern estimates.

Standard deviations (SDs) when describing the distributions of deviations from GT estimates should be taken with a grain of salt, since there are obviously so many datapoints available for a given urban time-series. They are intended to be used to quantify broad-range estimates of errors across the entire set (Global 30) rather than individual cities.

It is important to set forth some ground rules in how we may come to conclusions on how much Stadestér deviates from the estimated ground truth - deviations are only to be calculated where data both intersects, and where data is not extrapolated (the linear interpolation of years in GT is however fine).

Accra

The highest resolution data for Accra's population comes from Acheampong, who uses metropolitan figures, as well as various censuses after 1970AD [223][224]. We thus reconstruct long-run data as follows from Acheampong - 1901AD: 19.396; 1911AD: 39.750; 1921AD: 98.836; 1931AD: 177.140; 1950AD: 274.779; 1955AD: 391.875; 1960AD: 450.842; 1965AD: 529.265; 1970AD: 626.694; 1975AD: 763.337; 1980AD: 899.649; 1985AD: 1.036.081; 1990AD: 1.191.730; 1995AD: 1.405.387; 2000AD: 1.696.510; 2005AD: 1.910.228; 2010AD: 2.123.945; 2015AD: 2.376.455; 2020AD: 2.512.708; 2025AD (projected): 2.784.435.

Brinkhoff cites the Ghana Statistical Service for 1970AD, 1984AD, 2000AD, 2010AD, and 2021AD (metro), and its population data is recorded respectively - 624.091, 969.195, 1.658.937, 2.070.463, 5.445.692. Where possible, we will use Brinkhoff's figures to construct the following table of selected years.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD									17	167	1.098	2.778	5.890
GT					<1	~3-4	~12	~15	~18-20	275	763	1.658	5.445

STAD = Stadestér, GT = Ground Truth (Acheampong, Brinkhoff); Thousands

Since we are counting modern boundaries, we have also included earlier sources in our Ground Truth, such as assertions of precolonial populations in areas that are now considered Accra, i.e. Amanfro [225][226][227]. Of course, as Acheampong notes, 'the administrative boundary of AMA has changed over the years, which makes it difficult to identify population trends'.

This comes to a slight deviation (M=13,1%-15,0%; SD=37,5%-38,7%).

Algiers

The habitations of Algiers are somewhat better queried. A great deal of work has been done on the precolonial populations of that city by Cresti [228]. We take a household as mentioned by Cresti to refer to ~4 inhabitants. We must of course clarify our sources prior to 1500AD - for 1AD we know that Icosium was a Roman veterans' colony in which 3.000 veterans were settled [229][230]. The later figure was allegedly asserted by Theodor Mommsen according to Wikipedia, but we cannot take Wikipedia's word for it. This figure (at the very least the ballpark for it) is additionally attested to by Bowman and Wilson's work on Roman *Settlement, Urbanization, and Population* [231][232].

For figures after the 1800s, we take our numbers from Çelik, who lists populations as follows: 1839AD: ~48.000, 1896AD: ~120.000, 1926AD: ~212.000 [233], as well as the UN's WUP from 2018 [234].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD				20	77	100	100	54	97	331	1.521	2.216	3.316
GT	~3	~15	<1	~12	~48,8	~50	~30-35	~60	~120	516	1.507	2.141	3.004

STAD = Stadestér, GT = Ground Truth (Plinius, Bowman and Wilson, Cresti, Celik, UN WUP 2018); Thousands. Dates for 1AD-500AD are for Icosium, dates >1000AD are for Algiers.

This deviation is moderate (M=36-40,8%; SD=70-77,2%), with Stadestér being somewhat less accurate in earlier years.

Bangkok

Despite Bangkok's long and storied past since the 1400s, population records and estimates prior to the 1850s are relatively rare. Bunnag et al. gives it this discouraging note: 'It is striking how great the importance of demography for Siam's history [sic], yet how limited the body of population data is that can be drawn upon in historical research, prior to unhelpful qualitative suggestions of how figures could be estimated [235].

That has never stopped us before of course, and we are not in favour of papers suffixed with the word 'Towards' in any case, since they are 'towards' something, and never actually solve the problem stated. Since 1919, routine censuses have been taken of the place, and we will use this as our ground truth in addition to compilations by Sternstein for 1850AD [236], or ~350.000-400.000. Prior to this, our estimates come from Kulachol who gives the population in the 1820s as being 50.000-80.000, the lower figure which we shall use for 1800AD [237]. The contemporary area of this mandala is given as being 414ha, or 120,77-193,24ihb/ha.

It just so happens we know what the size of Bangkok in the preceding centuries was as documented both by Van Roy and La Loubere [238][239]. La Loubere gives an estimate of ~41ha (1691). Van Roy, whose work is decidedly not from the 1600s, gives the following areas. Pre-1782: 210ha; 1782-1785: 430ha. Since we already have our figure for 1800AD we need not work on it. This yields the following population estimates of 4.952-7.923 for 1600AD, the lower figure being preferable, and 25.361-40.580 for 1700AD, the lower figure again being more plausible. After 1950AD, we again use the WUP. For 2025AD, we use the metropolitan figure given by Metro Futures [240]. This yields the following table:

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD							45	162	541	778	3.699	8.903	19.048
GT					~5	~25	50	~375	~550	1.360	3.842	6.395	20.307

STAD = Stadestér, GT = Ground Truth (La Loubere, Van Roy, Kulachol, Sternstein, UN WUP 2018, Metro Futures); Thousands.

This deviation is slight (M=-11,7%; SD=31,1%).

Beijing

As one of the world's foremost cities, Beijing's demographic history is well-documented, but not very well-sourced. Wikipedia provides the longest running time-series for Beijing's historical population, but the issue is that it provides no source for them. We thus take our estimates from *The Population History of China (1368-1953)* by Cao as well as the UN's WUP (2018). For 1000AD, the estimate given is ~60.000-70.000, with the population falling to 144.000 in 1644AD during the Ming-Qing transition, and rebounding to 539.000 in 1647AD. The population in the census of 1881-1882 is shown as being 776.111 [241].

Otherwise, Cao lists the population as being ~900.000 for 1480AD-1500AD, rising to 1 million by 1600AD, and being 987.000 in 1781AD [242]. This is the same population listed for 1800AD by van Zanden [243]. In 1900AD, Beijing's population was Some other supplemental figures are from *The Cambridge Economic History of China* by Ma and von Glahn, who cites the figures of 200.000 for 930AD, 400.000 for 1207AD, 750.000 for 1700AD [244]. The figures can be pushed somewhat further if we accept CNU's estimates for pre-930AD, namely ~70.685 in 1AD and ~170.000 in 500AD [245]. In 1913AD, the population was 727.863 [246, p. 94]. For benchmark years where data is missing, we now apply linear interpolation.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD			60	672	707	685	1.137	1.648	1.649	2.069	5.153	10.010	18.151
GT	~71	~170	60-70	900	1.000	750	987	~858	728	1.671	4.828	10.285	22.596

STAD = Stadestér, GT = Ground Truth (Han, Cao, Xu et al, Ma and von Glahn, Gamble and Burgess, CNU, UN WUP 2018); Thousands.

With the exception of 1850-1900AD, Stadestér's accuracy here is not all that bad (M=14,4-16,2%; SD=44,32-45,23%).

Buenos Aires

Unlike the somewhat absurd digging that old cities require, Buenos Aires is a new city, founded in 1580AD, and we must thus get 1600AD and 1700AD out of the way first. In 1590AD, the population was sort of a joke - sixty men and Juan de Garay (61) [247]. In 1744AD, the population is stated as being a much more substantive 11.600, and the population in 1771AD is 20.207 [248], increasing to 90.000 by 1855AD [249]. After this, routine censuses were carried out - the population reaching 663.854 in 1895AD, 1.575.814 in 1914AD, and after 1950AD, we use the UN WUP 2018 as a rule [250]. Like always, intermediate results are linearly interpolated.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD						3	35	74	771	3.164	8.567	11.737	14.180
GT					<1	8	44	86	903	5.166	9.143	12.504	15.752

STAD = Stadestér, GT = Ground Truth (Tapson, Sanchez, Vicario, INDEC, UN WUP 2018); Thousands.

In general, Stadestér underestimates as compared to our ground truth, but irregularities are far more constrained (M=-21,6%; SD=18,3%).

Cairo

The story of Cairo as a distinct city is far younger than the story of Egypt as an ancient civilisation. Babylon Fortress was assessed as being able to hold 1.000 men when first constructed in 300AD (8ha), but the city soon took on a civilian nature [251][252]. Its growth must have been steady, for by the Council of Chalcedon in 451AD, it had gained itself a bishop, and mere fortresses do not typically gain bishops [253]. What is now Cairo was then conquered in September 641AD by Amr ibn al-As, by which time the *Tubinger Atlas des Vorderen Orients* (TAVO) lists various settlements around Cairo as major settlements [TAVO, B VII 2]. Al-Fustat's population continued to increase - it was assessed at 120.000 in 800AD, increasing to 150.000-300.000 by 1000AD [254][255][256].

The population was tempered by the plague, which killed roughly ~90.000 of the city's population. In 1500AD, the population was again stated at 270.000 [257][258], increasingly slightly to 300.000 by 1600AD, the population remaining much the same by 1700AD. By 1798AD, its population had virtually not budged due to 'a series of plagues, famines, brutal economic exploitation and factional strife', standing at 263.700 during the French campaign in Egypt [259]. The population increased to 256.679 by 1846AD according to Jomard, and by 1897AD the population was 570.062, cholera notwithstanding [260]. The remaining years come from the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD			114	380	275	175	191	261	597	3.296	7.420	15.302	25.230
GT		~40-50	~150-300	270	300	300	264	257	570	2.494	6.450	13.626	23.074

STAD = Stadestér, GT = Ground Truth (Cooper, Sheehan et al, Kjeilen, Nooraddin, Yagur, Winter, McCarthy, UN WUP 2018); Thousands.

Here, deviations are slight, though present (M=-2,3-1,3%; SD=24,8-28,6%).

Chicago

Chicago is one of those cities for which there is not much speculation, as there are consistent decennial US censuses [261]. Metro populations are non-comparable here, since agglomerations in Stadestér-Base are not always equivalent to metropolitan areas. In this case, Stadestér-Base uses county subdivisions (Cook County) [262].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD								59	1.671	3.889	4.477	5.124	5.319
GT								30	1.699	3.621	5.398	5.376	5.182

STAD = Stadestér, GT = Ground Truth (US Census, FRED); Thousands.

Disregarding 1850AD which is a clear (but manageable) outlier, and to a limited extent 1975AD (which is covered anyway by GHS-POP for that year, since we are only comparing figures to Stadestér-Base), Stadestér is slightly higher than the GT scenario (M=13,9%; SD=37,8%).

Guatemala

As is the norm in Stadestér-Base, pre-Columbian Latin American settlements are listed separately from those after the Spanish conquest, and so we will be focused here on the history of Guatemala after 1500AD, and it was first in 1527AD that the city was founded. The early population of the city is well-attested to by Lutz's *Santiago de Guatemala, 1541-1773* [263][264]. The population is thus stated as being ~6.150 in 1599AD, and ~15.900 in 1699AD. The population increased to 12.354 in 1769AD, before declining to 7.000-8.000 in 1800AD [265]. In 1850AD, it was contemporaneously estimated at 40.000 by Baily [266], which had roughly more than doubled by the 1911 Encyclopaedia Britannica listed its 1905AD population as 97.000 [267].

Populations between 1500AD-1800AD are not comparable for Stadestér-Base, since they include *La Antigua Guatemala*, whose population history is simply recorded separately - Lutz puts it at 6.655 in 1600AD, 30.000 in 1700AD, and the population of *La Antigua Guatemala* is widely believed to be 10.000-17.500 (25.000 total) by 1800AD, but for the former figure I could not find a scholarly source [268][269][270]. We now add these to our preceding estimates.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD				30	25	31	25	35	77	280	1.131	2.068	2.901
GT					13	~30-46	24,5-25,5	~40	97	361	1.053	1.973	3.230

STAD = Stadestér, GT = Ground Truth (Lutz, Fendler, Borah, Bailey, Jickling, Woodward, Encyclopaedia Britannica, UN WUP 2018); Thousands.

With the exception of 1500AD, which we will drop since deviations may only be evaluated for intersecting years, there exists a slightly persistent underestimation for Stadestér-Base (M=-8,8 to -5,2%; SD=14,1-21,2%).

Istanbul

Perhaps no city on this list, outside of Rome, has had its historical populations so thoroughly estimated. The numbers until 1500AD are taken from *The Cambridge Companion to Constantinople* and *The Oxford Handbook of Byzantine Studies*. Prior to 324AD, it was estimated that the population of Byzantion was 25.000, increasing to around ~430.000-450.000 prior to the Nika Riots, and declining to 400.000-750.000 in 541AD, of which we shall use the lower point [271]. By the late 600s, the population had declined to 70.000, from which it supposedly rebounded to a maximum of 300.000-400.000 by 1081AD according to Stathakopoulous, a figure which remained steady until the Latin occupation in 1204AD [272]. Kaldellis prefers the lower figures.

By 1261AD, the population had again shrunk due to the Latin occupation, traditionally stated to be 50.000-100.000. Surely something of this magnitude could have happened, foreign travellers of the period consistently reported the city to be 'half empty' [273]. By the onset of the Black Death, the population had recovered somewhat, perhaps to 140.000 in 1340AD given an urban mortality of 50%. By 1400AD, the population stood at just 70.000, and even fewer still by 1453AD: just 40.000-50.000 [274].

By 1480 the population had again rebounded to 60.000-70.000 [275]. After the Ottoman takeover, somewhat routine censuses existed in the city - by 1540AD, the number of Greek households increased by 46,23%, the number of Armenians by 317%, the number of Jews by 92,4%, and the number of Europeans in Galata by 28,31%. The population that seems to be most corroborated is that of 400.000 between 1520AD and 1535AD, increasing to 540.000-600.000 around 1600AD. By 1700AD, various jizya records put at ~500.000-700.000 according to Mantran [276][277]. We will accept the lower numbers for reasons soon discussed.

In 1800AD, the city was still constrained inside the Theodosian Walls. By 1794AD, the population stood at 426.000 according to Nüfus, reaching 359.089 in 1829AD, 490.000-796.000 by 1864-1875AD, 606.000-722.000 by 1877AD, 895.000 in 1894AD, 1.116.946 from 1896-1897AD, 1.159.000 in 1901AD, and 1.600.000 during World War I (1914-1916AD) [278].

Why we prefer the lower figures for the period from 1520AD to 1794AD is primarily due to the fact that Ottoman censuses and jizya records almost always counted Muslims and non-Muslims (and very often men vs the total population) separately, and almost always only the total number of households and/or dwellings/neighbourhoods. This lead to a great deal of speculation, but the high figures simply do not align with the city's known 19th and 20th-century trajectory.

From here on the population figures given can use the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD	109	498	330	204	685	750	560	778	941	1.050	5.123	10.589	14.210
GT	25	371	250-330	210-220	540-600	500	426	426-583	1.148	967	3.600	8.744	16.237

STAD = Stadestér, GT = Ground Truth (Kaldellis, Stathakopoulous, Berger, Ehrlich, Öz Ugur, Kazpat, UN WUP 2018); Thousands.

With the exception of 1AD, whose figure of 25.000 we cannot positively affirm, since it is extrapolated, and the city was founded in 667BC, the deviation is moderately biased upwards (M=16,5-24,6%; SD=21,8-27,4%).

Jeddah

Fortunately some very good individual work has been done on the various cities of the Islamic World; in the case of Jeddah, this work lays with Hartmann and Ann Marr. In 500AD and 1000AD the city was an unwalled town, with a male population estimated at 5.000. Unless the city had a very great gender imbalance in those days, the population may be stated to stand at 9.000-10.000. In 1814AD, the population was described as standing at 12.000-15.000 [279]. By 1911AD, *Britannica* documents this population as being estimated at 20.000, and its population in the years since are well-documented [280].

Unfortunately the interceding years do not have a great deal written about them given the relatively low population of Jeddah in those days.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD							20	26	30	95	480	2.369	4.842
GT		5	5	11-13	11-14	12-14	12-15	15-17	20-30	119	594	2.509	5.022

STAD = Stadestér, GT = Ground Truth (Bosworth, Hartmann and Ann Marr, Britannica, UN WUP 2018); Thousands.

Here, Stadestér contains a somewhat slight upwards bias (M=5,4-20,2%; SD=26,1-35%).

Johannesburg

The modern population of Johannesburg is defined by the Witwatersrand Gold Rush, which began in 1886AD, at which time the population was 400 [281]. As such, the modern population of the city becomes incredibly easy to construct. By 1890AD, its population had increased to 25.000, swelling to 155.642 by April 1904AD [282]. After this, we use the UN WUP 2018 as previously discussed.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD									102	805	1.820	4.272	8.593
GT									118	911	1.498	3.046	6.445

STAD = Stadestér, GT = Ground Truth (Pretorius, Britannica, UN WUP 2018); Thousands.

Once again, we see a slight but consistent deviation (M=14%, SD=22,5%).

Kolkata

The modern history of Kolkata first began in the 1690s with the consolidation of Kalikata, Gobindapur, and Sutanuti. At this point, it could not have been spoken of as a city, but a mere collection of villages, whose population was quite migratory - Kalikata likely had no settled population in 1690AD [283].

It is in 1706AD that the first good proxies of Calcutta's population can be taken - land use, described in acres to the hundreths. 132,74 acres of houses of a total settled area of 161,48 acres. It is just as well, of course: in 1752AD we know there stood 9.451 houses on 1.805,76 acres of land, or 5,23 houses on an acre, and the assumption in 1752AD was that of 8 persons to a house, i.e. 41,84 persons/acre.

Thus we would arrive at a 1700-1704AD population on the order of 5.000-5.553, with Alexander Hamilton of Calcutta placing the population in 1710AD at 12.000 [284]. In 1800AD, the population was then estimated at 500.000. An 1837 census of the city records its population as standing at 406.700, should suburbs be included [285]. The Census of 1901 and 1911 respectively record Calcutta's population in 1872AD as 721.512, in 1900AD as 987.045, and in 1911AD as standing at 1.043.307 [286]. The rest of the figures are accorded to by the UN's WUP 2018 until 2025AD, due to the city's recent intense urbanisation [287].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD							368	439	1.010	3.535	10.922	18.301	23.315
GT						5-12	500	524	987	4.604	8.166	13.097	20.534

STAD = Stadestér, GT = Ground Truth (Cotton, Deb Roy, Routledge, O'Malley, UN WUP 2018, Chandramouli); Thousands.

Here, our deviations are not much pronounced (M=3,3%; SD=24,9%).

Kuwait

For such modern Middle Eastern and North African cities, Bosworth recommends those works by Dumper, for which the entry on Kuwait City is written by Turner. That ever industrious Danish explorer, Carstin Niebuhr, had apparently travelled to the city in 1760AD, alleging its population at 10.000. In 1700AD, it was certainly not 10.000, but a small fishing village, whose population may have been <2.000-5.000 [288][289]. By 1800AD, its population reached ~15.000, and by 1850AD, 25.000.

In 1904AD, Lorimer (whose work *Gazetteer of the Persian Gulf, Oman and Central Arabia* functions as a de-facto census in all but name), placed Kuwait's population at 35.000 [290]. After this date, we use the figures given to us by the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD											768	1.566	3.703
GT						<2-5	15	25	35	63	688	1.300	3.405

STAD = Stadestér, GT = Ground Truth (Al-Loughani, Turner, Lorimer, UN WUP 2018); Thousands.

The deviation here is slightly biased upwards, if not by much (M=13,6%; SD=5%).

Lagos

Lagos has an older history than one would believe, being significantly inhabited as early as the 1400s [291]. We know little of its population then - only that its population is best enumerated in the years after 1866AD - 25.083 in that year, 32.508 in 1891AD, 38.387 in 1901AD, 73.766 in 1911AD, 99.700 in 1921AD, 126.000 in 1931AD, and 230.250 in 1951AD [292]. It is here that the limits of historical demography begin to show themselves.

Forgive us then, if the proxies are not nearly as delicate. In 1850AD, Lagos's urban area was assessed to be 21,44% of what it was in 1900AD. This implies a population of 8.230 in 1850AD, immediately prior to the Reduction of Lagos [293]. Its population was in all likelihood 2.000-3.000 based on the history of its urban expansion in 1600AD-1700AD; its population as stated must have been at least 7.000 (including the slave population) in the 1800s [294]. It is reasonable to then suggest that its population was likely ~1.000 in 1500AD, and <1.000 in the 1400s.

Perhaps some later scholar can illuminate us on what the population of Eko really was, for these are informed guesstimates. In the sense of calculating margins of error, only population figures after 1900AD are truly relevant.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD									38	241	2.645	7.726	12.846
GT				<1	2	3	7+	8-20	38	325	1.890	7.281	17.156

STAD = Stadestér, GT = Ground Truth (George, Ugboajah, Olukoju, Bigon, UN WUP 2018); Thousands.

Here, Stadestér is a good fit for overlapping years (M=-1%, SD=24,2%).

London

No such radical reassessments are warranted for London, whose population history is covered with quite some frequency. The city was first founded in 47AD during Roman times, before which its population must have been less than 5.000 [295]. In 60AD this population climbed to 30.000, then to 45.000-50.000 by 200AD [296]. In 407AD, Lambert estimates that its population had fallen to half its Roman level, or 17.500, increasing to 18.000 by 1086AD at the time of the Domesday Book [297].

Cox's *Demographia*, who cites Weinreb and Hibbert's *The London Encyclopedia* then states the figure to increase to 20.000-25.000 by 1200AD, 40.000-50.000 by 1340AD on the eve of the Plague, which killed between 25-50% of the population, a third is the figure traditionally cited, after all, a third of the City of London became uninhabited [298]. By 1349AD then, its population would have been reduced to ~29.700, which by 1377AD could plausibly have stood at 40.000, which though a figure appearing only in pop history, is certainly plausible [299]. By 1500AD the population of London had rebounded to perhaps 60.000-70.000 as written by Wallace, and it is starting in 1550AD that professional estimates become available.

CamPop notes that the city contained ~80.000 in 1550AD (Krylova and Earn put this at 120.000, and their estimates are somewhat more granular). By 1600AD, Weinreb and Hibbert write that it was probably 200.000, in 1650AD 350.000-400.000, and both Krylova and Earn and Tellier write in 1700AD that it first exceeded 490.000-500.000 [300][301]. From then on, routine estimations, then censuses (starting in 1785AD) become available.

The population increased to 660.000 by 1735AD, 670.000 in 1745AD, 675.000 in 1750AD, 680.000 in 1755AD, 730.000 in 1775AD, 859.234 in 1785AD, and 1.007.703 in 1795AD, settling at just above a million (1.096.784) by 1800AD, after which its population is assured. In 1851AD its population was 2.651.939, increasing to 6.509.889 by 1901AD. At this point, we use the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD	31	35	38	61	175	552	864	2.321	4.504	3.343	7.393	7.646	10.408
GT	<5	10-17	18	60-70	200	490-500	1.097	2.652	6.510	8.361	7.124	7.273	9.841

STAD = Stadestér, GT = Ground Truth (Wallace, Cox, Lambert, Wallace, Mortimer, Tellier, Krylova and Earn, UN WUP 2018); Thousands.

Earlier years are unfortunately quite off, leading to various wild swings (M=47,1-59,5%; SD=141-151%), and this is the first great fault of the model we run into, improving only in 1500AD.

Los Angeles

As a recent city, Los Angeles's population is not hard to figure. It was founded in 1781AD with a population of 44 settlers, a figure which increased to ~650 by 1820AD [302][303]. Census data becomes available starting in 1850AD, with LA's population recorded at 1.610, climbing to 170.298 by 1900AD (within LA County) [304]. By 1950AD, this population had been substantially disaggregated, leaving 1.970.358 within the confines of LA County [302].

The metropolitan area sprawled with the onset of suburbanisation. From 1975AD, we use the more expansive UN WUP numbers which aligns with the agglomeration of Los Angeles as traditionally defined.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD								2	184	1.388	8.257	11.631	13.474
GT							<1	2	170	1.970	8.926	11.798	12.678

STAD = Stadestér, GT = Ground Truth (LA Almanac, Guinn, Hunt, US Census, UN WUP 2018); Thousands.

As Los Angeles is a new city, we find very little overall bias (M=-4%; SD=12,5%).

Manila

In 1500AD, the precolonial population of Maynila probably stood at ~2.000, and by 1570AD the population of Maynila, Tondo and other settlements probably numbered ~43.000 [305]. The population remained much the same in 1600AD - 20.000 Indios, 20.000 Chinese, and just 1.000 Spanish, a total of 41.000 [306]. 36.000 is the figure given by Newson, whose work on historical Filipino demography is exceptionally complete. By 1700AD, the population was 32.000-50.000, and the population by 1825AD 115.000-120.000 [307].By 1876AD, this had increased to 93.595, 176.777 by 1887AD, and 219.928 by 1903AD [308]. For the period after 1950AD, we use GHS-POP with metro boundaries as used by CASA, UCL [209].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD					28	31	77	113	207	1.010	8.457	17.526	25.921
GT				~2	36-41	32-50	98-106	104-107	220	1.544	11.300	18.300	24.800

STAD = Stadestér, GT = Ground Truth (Pante, Hawkley, Newson, Britannica, UN WUP 2018, GHS-POP/UCL); Thousands.

The deviation for Manila is slightly underestimated (M=-11,5% to -17,4%; SD=12,2-13,7%).

Mexico

When we speak of Mexico City, it is only Mexico-Tenochtitlan and Mexico City that are included as being in common in Stadestér, and so comparisons should be made to that entity. Upon the eve of Spanish conquest in 1519AD, Berdan writes the population likely numbered 150.000-200.000 (including neighbouring settlements). The city was traditionally believed to have been settled in 1325AD, meaning that it must have a more established population history than that [309]. It seems to be that for nearly all historians, populations exist in a post-colonial or post-conquest sense, almost as though Tenochtitlan only started to exist as soon as Cortez envisaged it rising out of the waters of Lake Texcoco.

This then, is an infuriating business. Fortunately, there do exist certain estimates - in 1325AD, the population was estimated as being ~3.000 with 29 calpulli [310]. We know more of its political history. In 1391AD, Huitzilihuitl ascended to the throne and the status of Tenochtitlan was somewhat increased, and it was only in 1427AD that the Triple Alliance was formed, bringing in Tetzcoco and Tlacopan.

The urban hydrology and growth of the settlement before the Spanish conquest was modelled by González-Rul as cited by Cordova, with fractions of urban area (compared to their 1519AD boundaries) given as follows: 2,465% in 1325AD, 8,172% in 1404AD, 12,110% in 1428AD, and 81,32% by 1446AD (area over intersection) [311]. Unlike what is commonly suggested, the city never truly sat on solid ground - only on chinampas and tlateles. The various floods in any case would not have reduced the population of Tenochtitlan [312].

We thus estimate the pre-Spanish population as follows. 1325AD: ~3.000, 1404AD: ~13.000-

14.000, 1428AD: ~18.000-20.000, 1446AD: ~121.980. This may seem drastic, but we know that it was under Itzcoatl's reign from 1427AD-1440AD that the city likely achieved its greatest period of urban growth [313][314].

Now, one turns to the population of Mexico City after the Spanish conquest. In 1570AD, assuming that each Amerindian labourer had 3 dependents, the city may have hit a low of 62.000 in the 1570s. By 1646AD it is likely the population stood at just 118.000 - 48.000 Europeans and 70.000 Amerindians [315], remaining about the same in 1700AD at ~100.000 [316]. In 1790-1794AD, it was probably ~104.760 based off the Revillagigedo census [317]. In 1811AD, the population had increased slightly to 113.000 immediately prior to independence [318]. By 1870AD, Mexico City could probably have been said to be home to ~250.000-310.000 inhabitants, tripling to 934.463 by 1900-1910AD [319][320].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD				80	58	82	131	180	370	2.234	11.138	17.250	17.639
GT				143-180	84	100	109	204-243	934	3.365	10.734	18.457	22.752

STAD = Stadestér, GT = Ground Truth (Berdan, Gutiérrez, Cordova, Montero-Rosado, Boyer, Pineo, Ragsdale, Klein, Johns, INEGI, UN WUP 2018); Thousands.

Here, our historical estimates for Mexico City are mainly underestimated (M=-20,4% to -23%; SD=22,9-23,8%).

Moscow

Of all the cities on this list, it is perhaps the Muscovites that have least documented their own city's early history. The story of Moscow is that of the ever-expanding circumference of its Kremlin and various walls. No censuses were carried out of the place until the 1800s. Whether or not Russian cities like Moscow constituted a city prior to 1500AD at all has been challenged by some [321][18].

We can attempt a recounting of its early population as follows. In 1600AD, Moscow had 80.000-100.000, a midpoint of 90.000 inhabitants [322]. Sigismund von Herberstein reported a population of 41.500 adult males (~83.000 inhabitants) in 1557AD. The population was reduced to ~30.000 when the Crimean Tatars sacked Moscow, 'burning everything but the Kremlin' in 1571AD [323].

At this point we must remember that there were a great deal of wooden hovels beyond the wall which constituted various *posady* which could be sheltered in the *kreml'* in times of war. Our walled estimates come from the *Großer Historischer Weltatlas, Zweiter Teil, Mittelalter* [Engel et al. p. 64-65]. Engel et al. report the expansion of the walled area in 1557AD to be 106ha, meaning that 783,01 inhabitants would have been associated with every walled hectare of

Moscow. They of course did not live within the walls, but were merely associated with them.

From 950AD-1156AD, the walls encompassed 2,36ha, the *kreml'* encompassing 12,7ha in 1156AD, rising slightly to 18,7ha by 1339-1340AD, doubling to 32,9ha by 1367AD, and by the time of Shaw's estimates, they were what was already stated. This yields population the respective population figures of ~2.000 prior to 1156AD, ~9.000-10.000 (1156AD), ~15.000 (1340AD), and finally ~25.000-30.000 (1367AD). By 1400AD, it might have achieved a population of ~50.000 [324].

Colton helps us fill in the gaps since 1600AD by providing a handy estimate of what its population might have been, namely ~200.000 by 1650AD, stagnating until 1700AD, before a decline due to the reassignment of capital status to Saint Petersburg, after which time Moscow's population drops to 140.000-150.000 in 1725AD, rebounding to ~175.000 in 1790AD [325]. In 1805AD, Moscow's population was then recorded as 216.953 [326], increasing to 270.200 in 1811AD [327], decreasing to 251.000 by the time of the September fire in 1812AD, dropping to ~10.000 in its immediate aftermath.

The population series is then as follows, with figures from Colton unless mentioned otherwise: 306.000 (1830AD), 337.000 (1852AD), 377.800 (1858AD, Blackwell), 364.000 (1862AD), 602.000 (1871AD), 753.000 (1871AD), 1.039.000 (1897AD), 1.346.000 (1907AD), 1.618.000 (1912AD), 1.984.000 (1915AD, November), 2.017.000 (1917AD, February), 1.854.000 (1917AD, September), 1.716.000 (1918AD, April), 1.550.000 (1919AD), 1.027.000 (1920AD, August), with the population converging to modern data in the years since.

We now assemble our population time-series in a likewise manner to the cities that came before.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD				82	109	114	259	371	1.135	4.612	8.507	11.172	14.384
GT			~2	~71	~80-100	~200	217	337	1.039	5.356	7.623	10.005	12.731

STAD = Stadestér, GT = Ground Truth (Shaw, French and Ioffe, Engel et al., Lambert, Colton, Lyall, Blackwell, UN WUP 2018); Thousands.

The deviation for Moscow is also relatively slight, though it should be warned that the volatility in earlier years is moderate (M=4,3-7%; SD=16,5-20,7%).

Mumbai

We must start with Bombay before the British, as that is the most difficult part of this enterprise - British bureaucrats kept notoriously thorough records. The easiest part of this is the Portuguese period, in which 10.000 people lived on Salsette Island in 1553AD [328]. The population thus prior must have been considerably less than that, not including Bassein. When the Portuguese had arrived in 1530AD, the Seven Islands of Bombay ‘consist[ed] of about 400 houses, both large and small, and with a population of between five and ten thousand made up of the Koli, Bhandari, and Panchkhalasi castes only’ [329].

From the qualitative descriptions Narayan later gives, we can infer that the population in 1295AD was perhaps ~5.000, increasing to ~7.000-8.000 by the time of the Portuguese arrival (the description Da Cunha gives is after the arrival of an additional 3.000 converts), [330]. Prior to this, the population was marginal, and if we assume the castes to be of equal proportion, the population likely fluctuated between 1.000-2.000 from the time of the first villages in 200BC to 1000AD [331]. The population before 200BC must have been marginal, less than 1.000, though archaeological finds would suggest its existence since at least 1000-950BC [332][333].
The population history of the city since 1661 is much better known: 10.000 (1661AD), 15.000 (1664AD), 60.000 (1673AD), 16.000 (1718AD), 70.000 (1744AD), 60.000-140.000 (1764AD), 113.726 (1780AD), 235.000 (1812AD), 180.000 (1814AD), 229.000 (1830AD), 236.000 (1836AD), 644.605 (1872AD) 773.196 (1881AD), 821.764 (1891AD) [334]. In 1901AD, the population was recorded by census at 812.912.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD						60	143	583	822	2.725	8.505	15.639	20.453
GT	<1	1-2	2	6-7	10	34	190	395	813	3.089	7.685	16.147	22.089

STAD = Stadestér, GT = Ground Truth (Chhabria, Da Cunha, Raganathan, UN WUP 2018); Thousands.

Here, deviations are relatively slight (M=11,1%; SD=31,7%).

Nairobi

Prior to settlement, Nairobi was occupied by the Maasai whose pastoralist population implied a mobile population before the city’s founding in 1899AD. By 1902AD it had a population of 5.000, by 1906AD some 11.000, and by 1910AD some 16.000 [335][336]. The place is a new city, and thus its accounting becomes quite simple, rising to 24.000 by 1921AD [337]. After this we use the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD										138	564	2.586	6.646
GT									5	137	677	2.214	5.767

STAD = Stadestér, GT = Ground Truth (Owen, Aiyar, Juuti et al, UN WUP 2018); Thousands.

Since Nairobi is a modern city, discrepancies are very slight (M=4%, SD=13,5%).

Paris

Refounded as a *civitas* in 52BC, by 1AD-100AD, the traditional figure cited for Lutetia's population is ~5.000-8.000 within 94,69ha, a figure which comes from Bekker-Nielsen [338][339]. This population had certainly declined to the conservatively lower end of this by 308AD-380AD, perhaps 6.000-7.000 as judged by the size of the new enclosure [340].

At its nadir in 500AD, it might have plausibly reached ~3.000, but this is the minimum figure I have seen anywhere [341]. Wikipedia lists Paris's population as 30.000 in 510AD. That is almost certainly false, since Lutetia could not have contained more than 10.000 people at most. Perhaps somewhere in the mix, the two were confused and a clerical error made.

By 1000AD, its population was estimated at 50.000, increasing to 100.000 by 1200AD, and >200.000 by 1300AD. By 1329AD, it stood at ~250.000-290.000 [342][343]. This of course declined during the Plague, but by how much? Tuchman states the death rate was 800/day at its peak, and that it killed 50.000 or 'half the population', and Olea and Christakos write that it lasted from the end of August 1348 to the Winter of 1349-1350, or 'close to a year and a half' [344][345]. Such a long duration really would suggest a high mortality.

Perhaps the population of Paris by 1350AD was ~125.000 as we might guess from Tuchman as extrapolated to the figures most established these days. By 1400AD however, it had been revived - the population now stood at 275.000, though it declined by 1500AD in the wake of the Hundred Years' War back to 225.000 [346]. It is finally here that modern figures become available thanks to the tireless work of Biraben and Blanchet, who also have year-by-year estimations starting then, but we shall use the second-hand estimates that they found reliable.

In 1565AD, the population stood at 294.000, falling to 220.000 by the end of the siege of 1590. In 1636AD, the population was likely 440.000, increasing only slightly to 480.000 in 1684AD, and by 1767AD, ~600.000. In 1792AD, after the Revolution, the population was enumerated at 608.782, 616.693 (1795AD), 547.726 (1801AD) [347]. After this, routine censuses become available - in 1851AD the population was now 1.053.262, increasing to 2.714.068 by 1901AD [348]. After 1950AD, we use the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD			18	174	248	559	601	1.314	2.679	3.774	7.398	8.371	9.328
GT	~6-7	3	50	225	268	503	548	1.053	2.714	6.283	8.558	9.737	11.347

STAD = Stadestér, GT = Ground Truth (Bowman and Wilson, Pessoa, Tapia, Arnoux, Gallois, Tuchman, Olea and Christakos, Burke, Biraben, Demographia, UN WUP 2018); Thousands.

With the exception of 1000AD for which little data for the city of Paris was known, discrepancies are slight (M=-12,3%; SD=23,6%).

Santiago

The early history of Santiago de Chile was preceded by those of its native inhabitants in the Napocho Valley, who numbered ~8.000-10.000 according to Mackenna and de Olivares. In 1549AD, 8 years after the founding of the city, the population was estimated at 500 Spaniards, and including mestizos and Amerindians, 1.000. By 1553AD, this had increased to at least 1.500, and by 1575AD, the population was 2.500 [349].

The population in 1600AD could not have been more than 5.000 [350]. To use only the confirmed populations from the Bishopric of Santiago between 1700-1835AD, the population in 1700AD was at least 20.100, increasing to 37.084 by 1758AD, and 34.492 by 1767AD. One refers the lower numbers since the Bishopric of Santiago encompasses slightly more than the boundaries of Santiago de Chile [351]. The population in 1813AD was likely 69.101, and 129.639 by 1854AD. In 1865AD, the population was then 168.553 [352][353]. By 1907AD, the population had reached 332.724, and the city was now in the territory of routine censuses [354].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD						13	29	86	285	1.349	2.826	5.191	6.634
GT					5	20	59	124	305	1.322	3.138	5.658	6.999

STAD = Stadestér, GT = Ground Truth (Braman, Johnson and Carmagnani, Carmagnanio, Lavados and Chamudes, Censo Jeneral, Censo chileno de 1907, UN WUP 2018); Thousands.

Santiago's population, especially during the colonial period is relatively underestimated (M=-18,1%; SD=17,2%).

Sao Paulo

Founded in 1554AD, the population of early Sao Paulo is recorded as being 140 hearths, which judging from its correspondence to total population, would imply at least 1 'hearth' (or household) per 13,21 inhabitants (including slaves and Amerindians). Thus the population of Sao Paulo in 1570AD was probably no more than 1.800-2.000, increasing to 2.000 by 1583AD, and maintaining that population until 1590AD, when it had at least 3.700 inhabitants. By 1672AD, this had increased to a healthy 11.500 [355]. Detailed distributions of Brazilian population start to become available starting in the 1770s [356].

The trouble is that this data is mainly distributed by captaincy. Kuznesof writes that this had again decreased to 6.000 (900 households) by 1765AD, before rebounding to 11.300 by 1802AD, and 14.000 by 1836AD [357]. In 1872AD, the population was then recorded at 50.113, and by 1886AD, this had increased to 74.893 [358]. In 1890AD, it had barely budged to 63.934, but by 1902AD, the population was then estimated at 332.000 as recorded by Britannica [359]. Vidal and Klein give a figure of 281.256 (1900AD), increasing to 430.069 (1910AD), 654.578 (1920AD), 989.396 (1930AD), 1.164.067 (1934AD), 1.480.116 (1940AD), and 1.800.863 (1945AD).

For the purposes of this study, we will use the latter estimates, along with those of the UN WUP 2018 from 1950AD onwards.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD							12	16	225	2.711	10.645	17.018	19.485
GT					~5	10	11	28	281	2.334	9.614	17.014	22.990

STAD = Stadestér, GT = Ground Truth (Carrara, Alden, Kuznesof, Vidal and Klein UN WUP 2018); Thousands.

Although early data for Sao Paulo is lacking for Stadestér, deviations are otherwise slight (M=-6%; SD=19,5%).

Shanghai

Founded in 751AD in Songjiang District as a garrison town, Shanghai's population at its outset could not have been any more than perhaps ~1.000-5.000 [360]. Its actual civilian counterpart was founded in 991AD and grew to 12.000 by the early 1100s, swelling to 250.000 by 1127AD after the fall of Kaifeng to Jurchen invaders [361]. This increased to 300.000 by 1292AD [362], and the last clear portrait of Shanghai's population is in 1580AD, by which point it had shrunk back down to just 100.000 inhabitants [363].

The growth rate from that point onwards is documented by Cheung et al., who records 0,22% annual growth to 1722AD, and 0,42% annual growth to 1861AD [364]. This would imply a population in 1600AD of ~105.000, in 1700AD of ~130.000, and in 1800AD of ~192.000. At this point, the population of the city becomes well-documented - Henriot et al's *The Population of Shanghai (1865-1953)* gives the population of Shanghai in 1844AD as stranding at just 289.323, swelling to ~600.000 in 1910AD. By 1929AD, the population stood at 961.846 [365]. After this, we use the population figures given by the UN WUP.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD	100	100	100	100	31	44	93	186	551	5.136	4.557	13.812	30.679
GT			~9-10	~156	~105	~130	192	318	553	4.288	5.658	14.247	30.482

STAD = Stadestér, GT = Ground Truth (Guan, Quan et al, Cao, Cheung et al, Henriot et al, UN WUP 2018); Thousands.

Shanghai is our second large-scale failure (after London) due to issues prior to 1000AD, leaving us with heavy deviations (M=62,2%; SD=283%).

Sydney

Sydney's population is particularly well-documented, being a new city, and Australian statistics track this well. In 1796AD, it had 2.953 inhabitants, and time-series data is recorded as such: 10.815 (1828AD), 16.232 (1833AD), 19.729 (1836AD), 29.973 (1841AD), 38.358 (1846AD), 44.240 (1851AD), 53.358 (1856AD), 629.503 (1911AD), 1.863.217 (1954AD) [366][367]. After 1950AD, we use the UN WUP 2018.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD								48	479	1.647	2.254	3.005	4.375
GT							~4	44	489	1.690	3.118	3.780	5.185

STAD = Stadestér, GT = Ground Truth (Australian Bureau of Statistics, Census 1856, UN WUP 2018); Thousands.

As Sydney is a newer city, Stadestér's fit is very stable (M=-9,9%; SD=12,5%).

Tehran

Tehran is one of those cities for which it is easier to find references. Bosworth mentions that it must have been founded before 1116AD, and that is certainly the case - Holliday mentions that it was inhabited 8kya and called Cheshmeh Ali at the time of the First Shi'i Imam, a village on the northern outskirts of Ray. At this point, it was nothing more than a village, and the first references to Tehran occurred between 874-885AD [368][369].

By the time of the Mongol invasion, it had 12 quarters, being a considerable town. The city had no walls, and it was still known for being a predominantly agricultural village. Its population in 1000AD therefore could not have been more than 3.000, increasing to perhaps ~6.000 by the time of the Mongol invasions assuming 500 per quarter. It is mentioned as a particularly large village from 1258-1336AD [370]. In 1627AD, Herbert states it had approximately 3.000 houses, and assuming 4-8 inhabitants per house, this would give it a population of ~12.000 [371]. It could not have been much more than this - in 1796AD, Bosworth (citing Olivier) remarks that it did not exceed more than 15.000.

By 1836AD, this population had exploded to ~80.000 under half a century of Qajar rule, exceeding ~100.000 by the 1890s, a figure which increased to 212.000 by 1922AD, and 540.000 by 1940AD [372][373]. After this, we use the population figures given by the UN WUP.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD						28	27	74	225	1.145	4.152	6.867	9.363
GT			~3	~9-10	~12	13	15	85	~137	1.041	4.273	7.128	9.730

STAD = Stadestér, GT = Ground Truth (Bosworth, Holliday, TAVO, Britannica, Amanat, UN WUP 2018); Thousands.

The discrepancy here is moderate (M=27,2%; SD=39,4%).

Tel Aviv

Tel Aviv is a new city when treated separately from Jaffa, founded entirely after the 19th century in 1909AD with a housing association consisting of 60 plots, i.e. ~180-240 inhabitants at most. In 1914AD, this had grown to 2.000 inhabitants, in 1915AD 2.679, and in April 1925AD, some 20.000 [374][375]. By 1937AD, this had risen to 150.000, and by 1939AD 160.000. Immediately after the end of World War II in 1945AD, it was 166.660 [376].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD										280	600	1.633	2.628
GT										418	1.186	~1.900	~2.800

STAD = Stadestér, GT = Ground Truth (UN WUP 2018, GHS-POP); Thousands.

The deviation here is moderate (M=-25,6%; SD=16,8%), probably due to changing administrative boundaries between 1948-1950AD.

Tokyo

The historical population of Edo prior to the city's reinvention as Tokyo is taken to be one of traditional figures - in 1530AD, prior to its formal settlement, it could be estimated at 10.000, and was likely similar in 1500AD [377]. In 1700AD, it apparently stood at just shy of 1.000.000, perhaps ~900.000 or so [378].

Even so, Japanese demographics are surprisingly well-documented by Wikipedia prior to the Meiji Restoration, and here Saito writes that the population was ~430.000 in 1650AD, 1.220.000 in 1750AD, 1.150.000 in 1850AD, and 595.905 by 1873AD [Saito p. 48-63]. Of course we must bear in mind that this includes various changes in administrative boundaries. In 1900AD, the population stood at 1.947.300 [379].

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD					60	685	685	780	1.566	5.010	24.050	30.304	33.156
GT				~10	290	~900	~1.185	1.150	1.947	11.275	26.615	34.450	37.036

STAD = Stadestér, GT = Ground Truth (Harada, Hall, Saito, Tokyo Metropolitan Government, UN WUP 2018); Thousands.

For Tokyo, discrepancies are relatively high since Stadestér consistently underestimates GT, likely due to the effects of greater disaggregation (M=-31,7%; SD=26,8%).

Warsaw

For nearly of all Warsaw's history, its population has been documented - at the very least by registers under the Commonwealth. The city is first mentioned in 1313AD. In 1500AD, its population was 4.500, increasing to 20.000 by 1596AD-1600AD. By 1611AD, the population had presumably declined somewhat and stood again at ~14.000. From the late 16th century (1550s-1600AD), the population was assessed at ~10.000 [380]. In 1655AD, it was 18.000, and after the end of The Deluge in 1666AD, it was just ~6.000 [381]

By 1754AD, the city had recovered from its earlier disasters between The Deluge and the early 1700s, and the population was 24.000, increasing to 115.000 by 1792AD [382]. By the end of the Napoleonic Wars, it was 81.250, and in 1833AD, it was ~138.746 [383]. By 1850AD it was 163.375, increasing to 383.000 by 1882AD, and by 1903AD, the population stood at 756.000 [384][385][19].

After 1950AD, we use the UN WUP 2018 to establish a consistent baseline.

	1	500	1000	1500	1600	1700	1800	1850	1900	1950	1975	2000	2025
STAD				7	25	18	126	162	719	757	1.398	1.684	2.000
GT				4-5	20	~24	~103	163	756	768	1.444	1.666	1.800

STAD = Stadestér, GT = Ground Truth (Davies, YIVO, Kobielski, Wronski, Dawson and Davies, UN WUP 2018); Thousands.

For Warsaw, deviations are slight (M=3,9-10%; SD=17,7-25,6%).

City	Lower M	Upper M	Lower SD	Upper SD	Jaccard Index
Accra	13,1%	15,0%	37,5%	38,7%	0,375
Algiers	36%	40,8%	70%	77,2%	0,277
Bangkok	-11,7%	-11,7%	31,1%	31,1%	0,580
Beijing	14,4%	16,2%	44,32%	45,23%	0,421
Buenos Aires	-21,6%	-21,5%	18,3%	18,3%	0,545
Cairo	-2,3%	-1,3%	24,8%	28,6%	0,493
Chicago	13,9%	13,9%	37,8%	37,8%	0,529
Guatemala	-8,8%	-5,2%	14,1%	21,2%	0,415
Istanbul	16,5%	24,6%	21,8%	27,4%	0,440
Jeddah	5,4%	20,2%	26,1%	35%	0,347
Johannesburg	14%	14%	22,5%	22,5%	0,628
Kolkata	3,3%	3,3%	24,9%	24,9%	0,403
Kuwait	13,6%	13,6%	5%	5%	0,492
Lagos	-1%	-1%	24,2%	24,2%	0,346
London	47,1%	59,5%	141%	151%	0,625
Los Angeles	-4%	-4%	12,5%	12,5%	0,713
Manila	-17,4%	-11,5%	12,2%	13,7%	0,506
Mexico	-23%	-20,4%	22,9%	23,8%	0,542
Moscow	4,3%	7%	16,5%	20,7%	0,524
Mumbai	11,1%	11,1%	31,7%	31,7%	0,401
Nairobi	4%	4%	13,5%	13,5%	0,449

Paris	-12,3%	-12,3%	23,6%	23,6%	0,584
Santiago	-18,1%	-18,1%	17,2%	17,2%	0,482
Sao Paulo	-6%	-6%	19,5%	19,5%	0,615
Shanghai	62,2%	62,2%	283%	283%	0,573
Sydney	-9,9%	-9,9%	12,5%	12,5%	0,653
Tehran	27,2%	27,2%	39,4%	39,4%	0,316
Tel Aviv	-25,6%	-25,6%	16,8%	16,8%	0,439
Tokyo	-31,7%	-31,7%	26,8%	26,8%	0,687
Warsaw	3,9%	10%	17,7%	25,6%	0,478
Total (Avg.)	2,66%	3,91%	37,47%	39,35%	0,532

Figure 39. Mean deviations and Jaccard indices for each of the Global 30 for population and spatial expansion.

Out of our sample of 30 literature reviews, Stadestér failed 2 of them for the deep past, namely those of London and Shanghai, which deviated massively from accepted scholarly estimates (M=47,1%-59,5%; SD=141-151%) and (M=62,2%; SD=283%) respectively. Even including these outliers, average deviations across all 30 cities were relatively low, albeit with a moderately large spread.

The Jaccard indices between Angel's map of spatial expansion and Stadestér's proxied spatial expansion between 1800AD-2000AD are also a tight fit at M=0,532 considering the difference in spatial resolution - Stadestér has a 5-arcmin resolution, and Angel's resolution as evaluated is at 30-arcsec [386].

Margins of Error

At a global level we estimate that our deviations are consistently off by perhaps 20-30% from period-appropriate estimates (M=-17,4%; SD=13%, n=121), whilst this varies regionally from a low of (M=0,84%; SD=0,24%) in Europe to a high of (M=13,49%; SD=1,70%) in terms of regional-level spatial deviations (n=12).

At the most granular level of individual cities, we estimate that Stadestér is off by 20-30% on average, even if overall means and standard deviations are nominally lower (M=2,66-3,91%; SD=37,47%; min=31,7%; max=62,2%).

Results

Note. For a complete listing of supplementary tables, datasets, and software, view the Appendix.

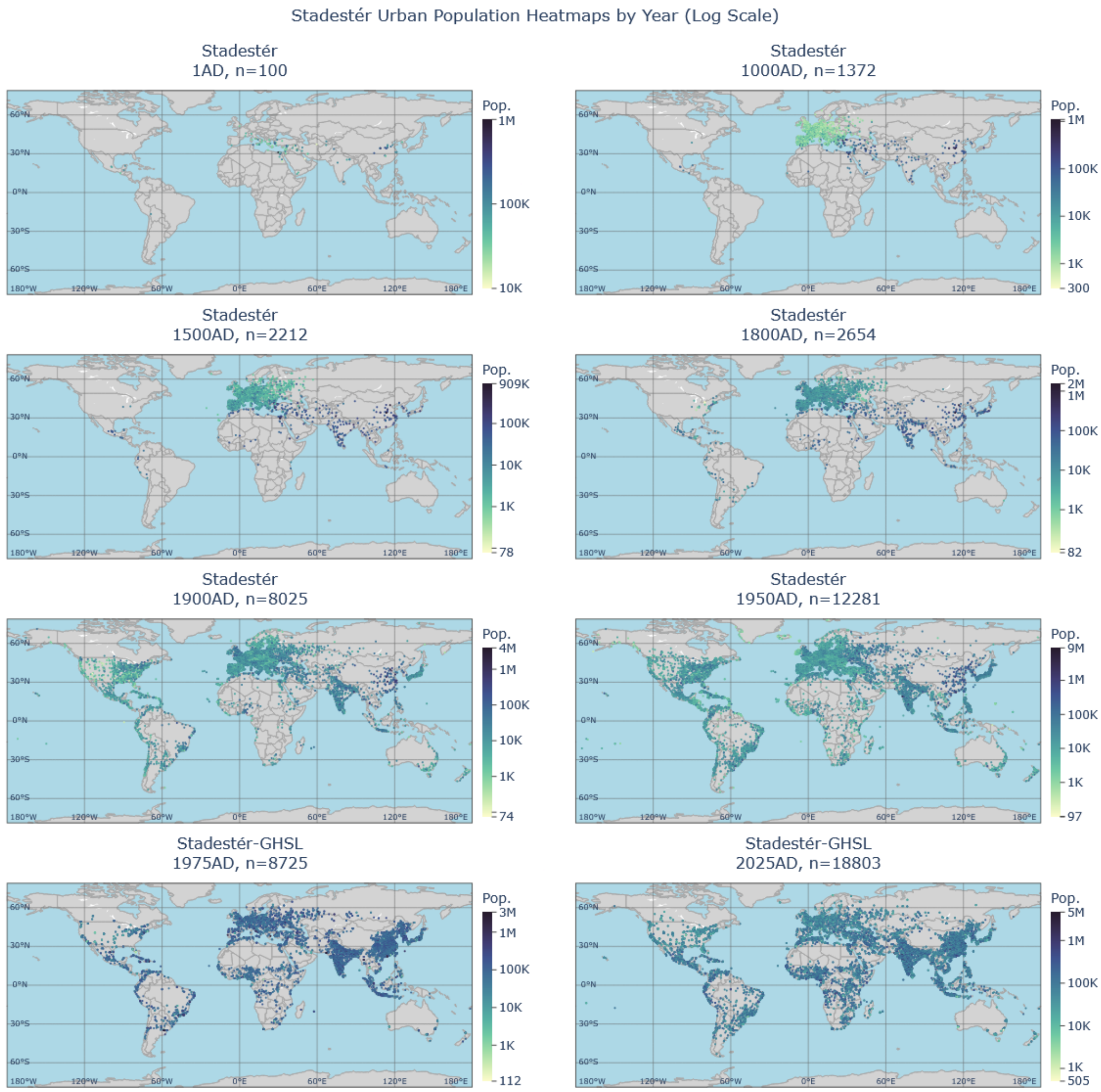


Figure 40. Urban gridcell heatmap for selected benchmark years in Stadestér-GHSL, metro adjusted (1AD-2025AD).

Historical maps and data have been constructed for urban, rural, and total populations and estimates, including discrete city-by-city objects in JSON format, for all ~41.000 cities. In addition, maps are at a consistent 5-arcmin resolution with global coverage, and are generated at 1000-year intervals from 10000BC-1AD, at 100-year intervals from 1AD-1700AD, at 10-year intervals from 1700AD-1950AD, and at 1-year intervals annually since to the Present (2025AD). All raster series are available from 10000BC-2025AD.

This was chosen to match the resolution provided by HYDE so that Stadestér could act as a supplement/alternative to its data, particularly for urban areas. Discontinuities between Stadestér Base and Stadestér-GHSL are deliberately smoothed over by performing a partial union for Stadestér Base data, where if a particular pixel is empty, base data is used to write to that pixel instead.

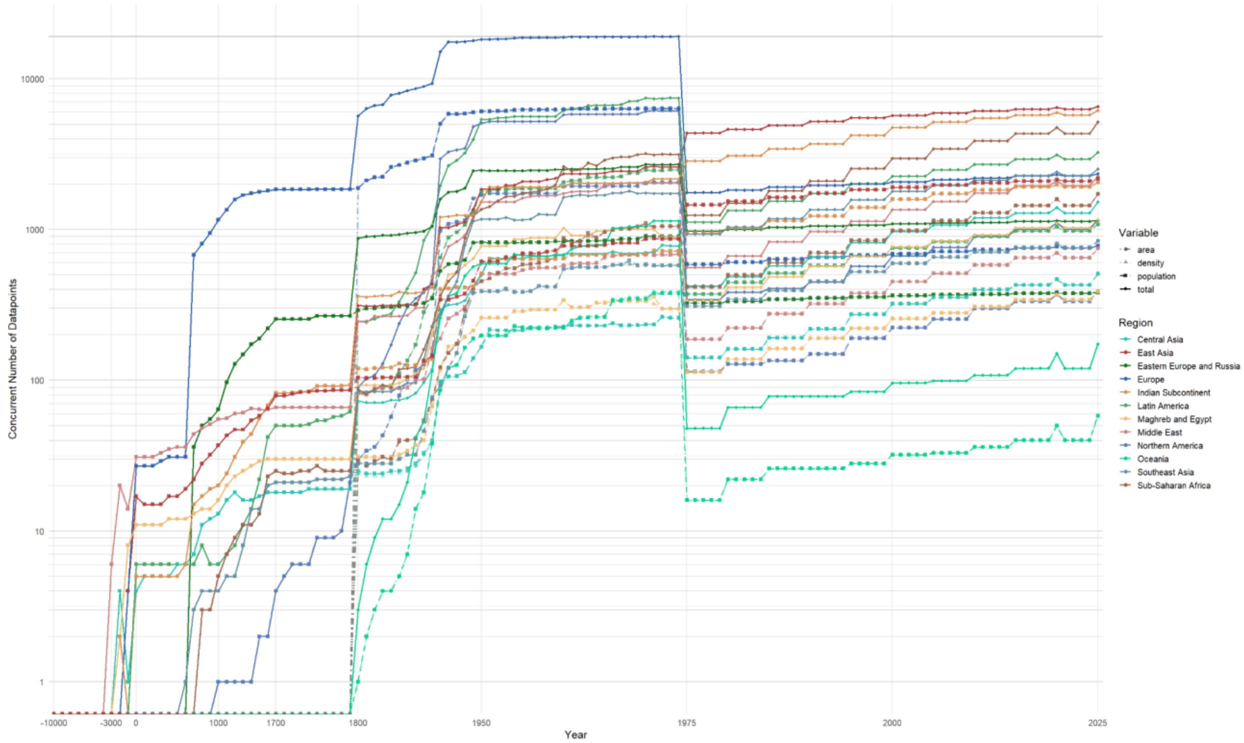


Figure 41. Number of datapoints for area/density/population per world region (3000BC-2025AD).

In terms of discrete cities, data on area, density, and population is provided at annual resolution, especially after 1800AD, and are matched to modern satellite-based data from GHSL post-1975AD. Input models such as that used for LUH2/KK10 are presented separately and given in supplemental materials. 30.019 of these cities are given in Stadestér Base and a additional 11.195 in Stadestér-GHSL, making this dataset a nearly 17-24x increase in size over previous peer datasets such as Reba et al.

For comparison, the UN WUP includes only 1.860 settlements, though these are filtered for urban areas with a population >300.000, and only to 2018AD, whereas our data runs until 2025AD (albeit using GHSL projections) [234]. There is a qualitative difference too - it encodes areal as well as density proxies, even if these proxies are intrinsically modelled for periods prior to 1975AD.

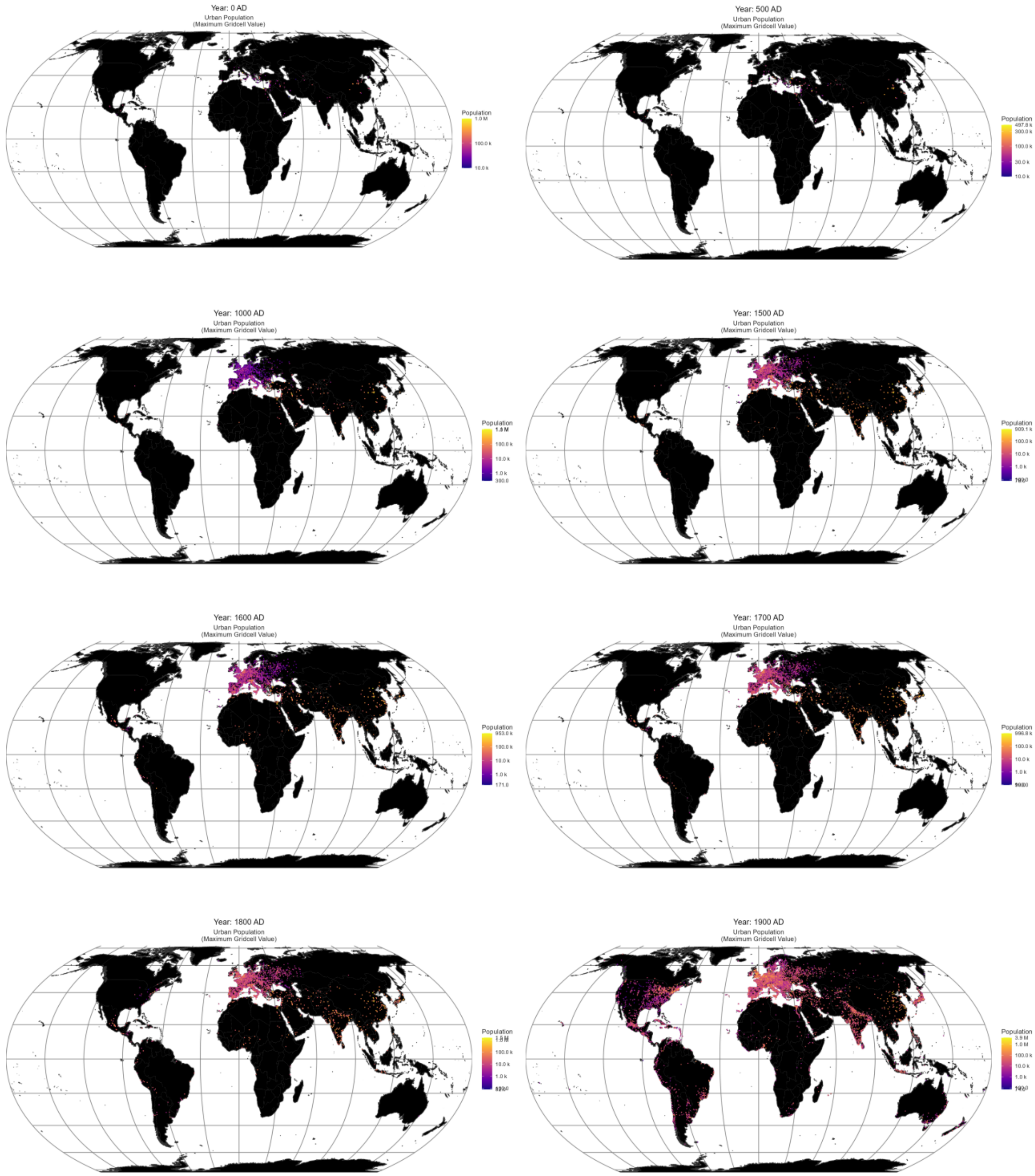
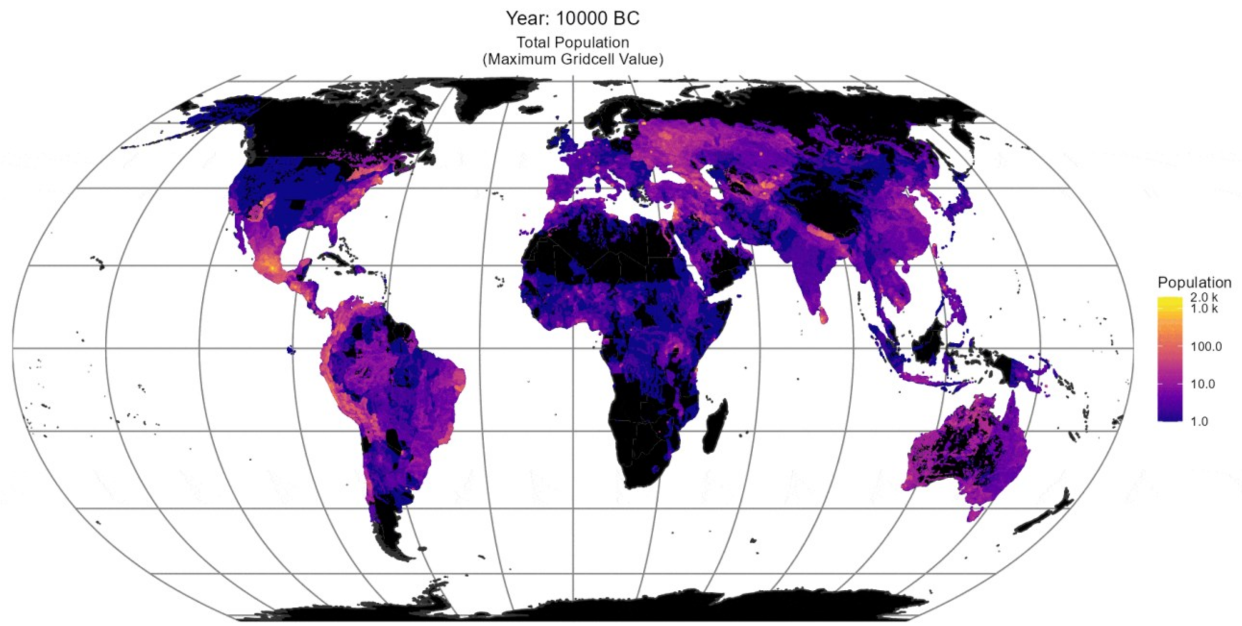


Figure 42. Urban population heatmaps from generated rasters for selected benchmark years (1AD-1900AD).

Certainly we hope that plenty of the internal models as used in the construction of this dataset will be useful to others. There are for instance, a great deal of hindcast models for historical urban expansion [387][388][389]. We would like to think that our model of historical forecasting is a somewhat original and more generally-applicable choice since it allows for out-of-sample testing and is generally applicable to all locations so long as a population history of that place exists.



[Figure 43](). Animated heatmap of global population as modelled by Stadestér (10000BC-2025AD).

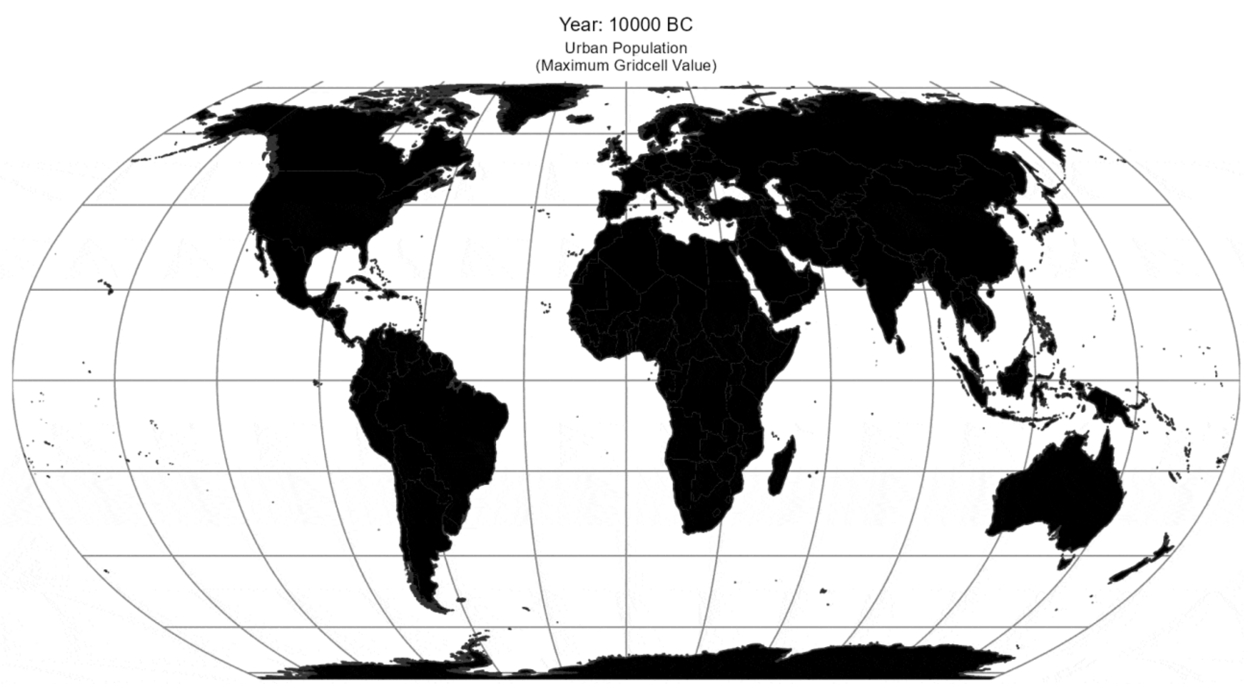


Figure 44. Animated heatmap of urban populations as modelled by Stadestér (10000BC-2025AD).

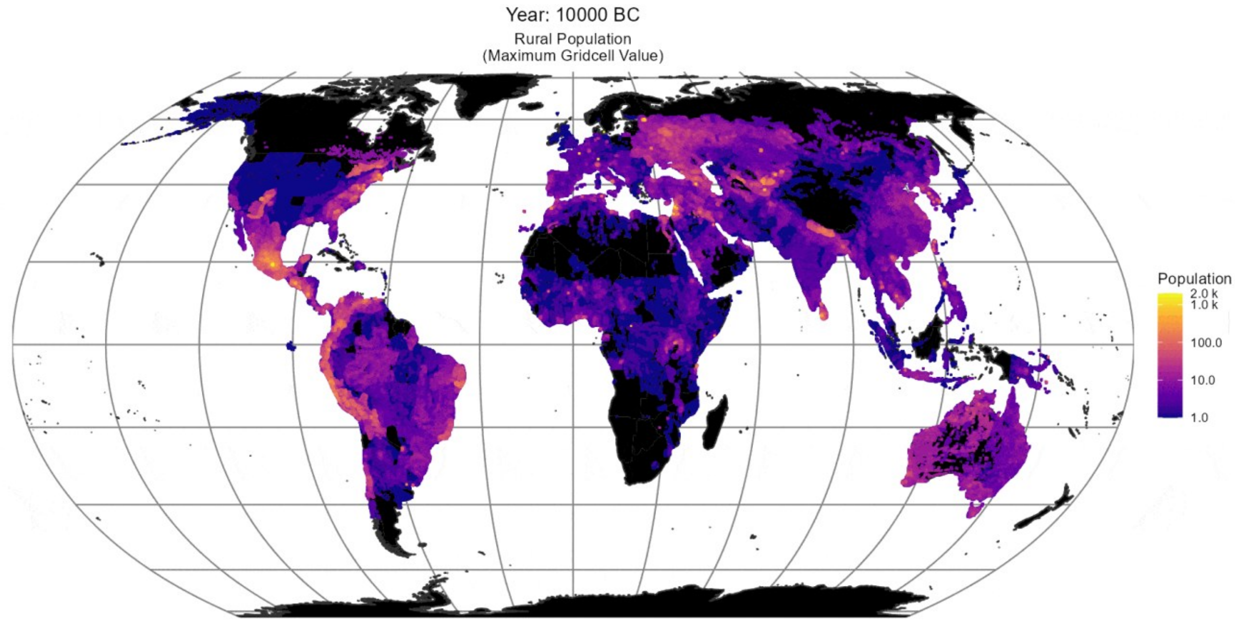


Figure 45. Animated heatmap of rural and peri-urban populations as modelled by Stadestér (10000BC-2025AD).

We have also produced time-series animations of Stadestér's models of total population (Figure 43), urban population (Figure 44), and rural population (Figure 45) to help visualise population changes, the R code for which is included in the source repository. Note that scales are relative to the minimum and maximum populations of all cells for that specific year. If these animations do not render on your device, consider clicking on the link by Figure n.

Additionally, Stadestér is granular enough such that it is capable of visualising losses in urbanisation due to historical events such as plagues or wars, should their effects be pronounced enough, such as those of the Tokaido Belt during World War II or the depopulation of Central Europe in the Thirty Years' War become visually apparent [390][391]. We would like to caution, however, that such data is not fine-grained enough for population analysis at a yearly-resolution, but only the event as a whole.

It is of course always possible that some better project than this exists for the same purpose outside of the sources we have named here. However, to our knowledge, this is the largest extant historical dataset for urban, rural, and global populations. Regional gridded datasets (i.e. for China, Spain, or the United States) also exist, but are typically focused only on the recent past (1700s/1800s-2025AD) [392][393][394].

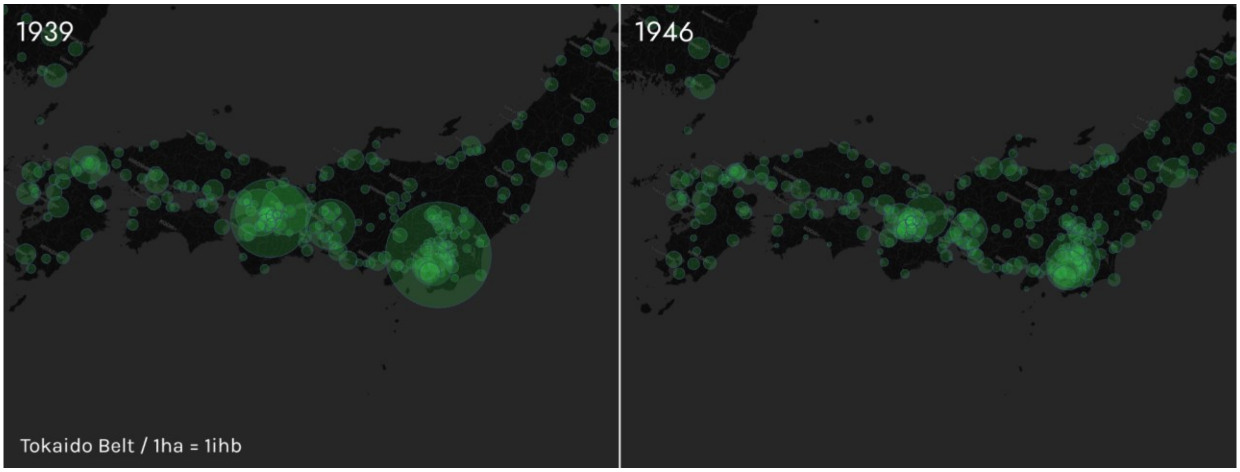


Figure 46. Map of urban population shrinkage in the Tokaido Belt during World War II, Stadestér (1939AD, 1946AD).

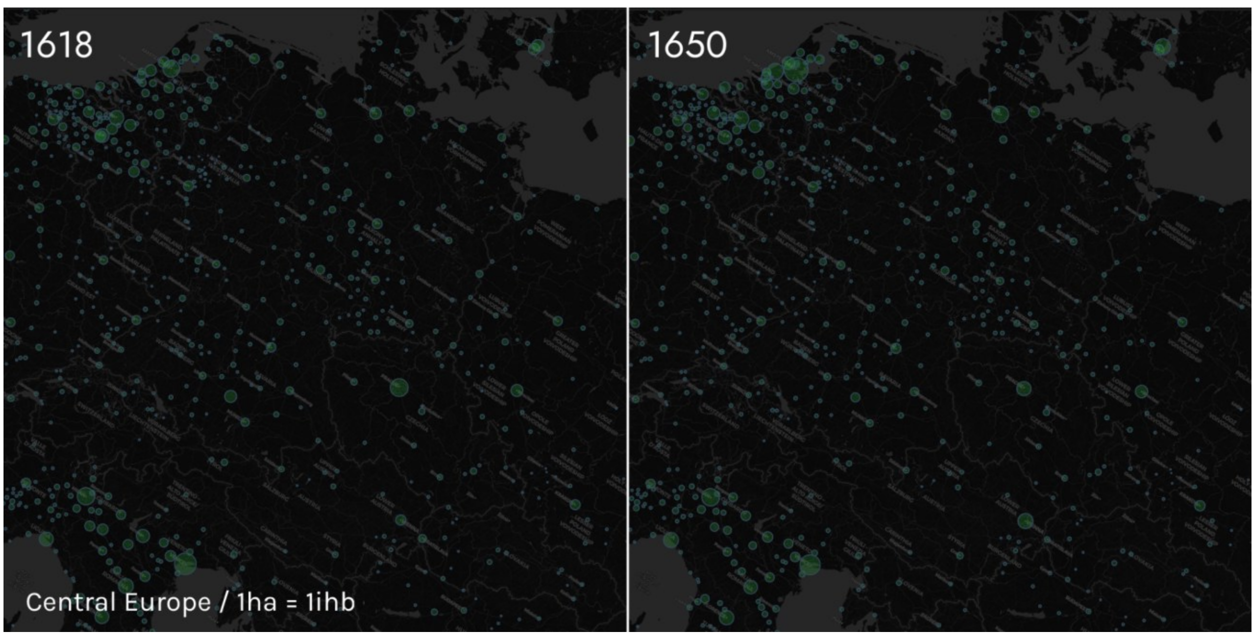


Figure 47. Map of urban population shrinkage in Central Europe due to the Thirty Years' War, Stadestér (1618AD, 1650AD).

The contents of Stadestér as a complete dataset are as follows, excluding raw input and intermediate data, which is also provided in the appendix. An asterisk denotes a dataset which is available at the HYDE resolution previously discussed, whereas no asterisk indicates annual 1-year resolution.

- Global Population Rasters (~10000BC-2025AD)*
- Global Rural Rasters (~10000BC-2025AD)*
- Global Urban Rasters (~3000BC-2025AD)*

- Metro-adjusted (GHSL), JSON and Rasters
- Metro-adjusted (Non-GHSL), JSON and Rasters
- Non-metro adjusted (GHSL), JSON and Rasters
- Non-metro adjusted (Non-GHSL), JSON and Rasters

For most users of our dataset interested in the distribution of urban population, we recommend utilising the main metro-adjusted Stadestér-GHSL version of our data, whereas non-metro adjusted versions are preferable for discrete urban population histories. JSON files include area and density proxies.

Limitations

A brief retelling of our flaws and faults are in order. With a database as vast as this, it has obviously proven a great challenge to systematically flag every stray pixel or population result, and there may exist the occasional edge case for merging or scraping logic, which mainly uses concurrent distance-based clustering in a literal sense [395].

The most significant outliers we discovered in our manual copychecking of the dataset are as follows:

1. The overstatement of the population of Barrow, Alaska in 1900AD (where it is listed as ~53.000), when the population should be no more than 658 [396],
2. An overlooked outlier mask for Jakarta in our population rasters which causes anachronistically high population for the region due to HYDE (though this is not present in our principal urban datasets),
3. Bristol being duplicated after 1500AD due to the incorrect coordinates being transcribed for the city for de Vries,
4. Cincinnati being registered as a city prior to 1800AD with 10.000 inhabitants due to errors with Reba et al's transcription, as the Fort Ancient culture was not known to be in the immediate vicinity of the city [397],
5. Certain scraping issues with individual British nations (i.e. Scotland, Wales, Northern Ireland) for Populstat, sometimes resulting in their exclusion. This had to be manually fixed.

What can we learn from the outliers we encountered in our research? We can at least infer that their qualitative nature should tell us that outliers in Stadestér are generally not as severe as those found in HYDE/Reba et al, and that more importantly, they are not meaningful enough to affect the overall distribution of regional population. This is also quantitatively likely to be the case (Margins of Error).

Known Inaccuracies

There are also several regional inaccuracies present within the KK10/LUH2 fallback model that we used for Stadestér Rural where outliers were present. These mainly come down to overestimations of population in historically sparse areas, and we feel the need to disclose them here since we have not yet begun the task of reliably calibrating their regional populations.

Only Siberia is seriously affected by this issue (having an erroneous pre-Russian population of 4M as compared to ~900k-1,2M), but there may be smaller regional pockets in which ahistorically high populations may persist. The root of the problem is due to imprecision in our OCR/graph extraction software (due to clumping and zoning issues) regarding Nelson as opposed to any issues with the technique itself [398].

Additionally, our work on modelling Native American populations is preliminary and should be treated as such, though it represents a likely improvement over HYDE or other historically gridded population models.

Metro-Adjustment Algorithms

One must also be careful in how the spatial disaggregation of otherwise agglomerative effects should be interpreted, since formal metropolitan administrative divisions do not always neatly align with agglomerations. Suburbs and the metros they belonged to were determined via semantic analysis of Populstat tables after proximity merging.

Because of WGM merging (Definition 2), populations in metro-adjusted datasets when analysed discretely (instead of as a raster) may fluctuate heavily year-by-year, and this must be kept in-mind when using the non-raster data from the recommended dataset. Additionally, agglomerative definitions are quite subjective, even if Lahmeyer typically encoded such relations based on modern census definitions [399].

Conclusion

'Most of the books and papers mentioned so far have been written by people who were not trained as historical demographers ... this is not chance: very few [...] are interested in population figures except at a parochial level. What they like best is writing papers - long papers, on small subjects, with no conclusions'. - McEvedy and Jones (p. 358).

Much work remains to be done. In particular, we wish to embark on a systematic reassessment of Chandler and Modelski, whose 'issues ... are well known to scholars of urban and demographic history. And so, 'What can be done?'. The answer is naturally to build a better dataset, starting with the cities of antiquity, yet such work has not been achieved in the archaeological field [72].

We hope that Stadestér 1.0 represents at least a stepping stone on that path towards better data, and we encourage the reader to embark on this great compilation of data, with a reputable source or estimate for each figure, for we are amateurs too.

There are also additional supplemental datasets that we have linked in the appendix for your use - Velkscala 0.7 which we mentioned in our rural substrata modelling, as well as Eoscala 1.2 which contains gridded GDP PPP estimations per gridcell based on Maddison Project and Global GDP disaggregation, LU/Population variables, and rolling OLS regression. Eoscala 1.2 is currently a pilot project, and so we would advise one to avoid it until future work on Velkscala 1.0/Eoscala 1.5 can be achieved [Kätzchen].

Production repositories for both Constele Red and Stadestér are located on GitHub if one is inclined to use the latest versions of each dataset/application [Constele Red][Stadestér]. To reproduce these results from original input datasets, call `console generateMetroCorrectedBase()` or `console generateNonMetroCorrectedBase()` depending on the version you would like to reproduce. We also provide static mirror versions of both Constele Red and Stadestér 1.0 as-is for end-use if you do not feel like manually installing or configuring dependencies.

It is highly unlikely that this body of work will ever amount to much in interest or profit, apart from perhaps saving some poor researcher in the next century a couple of months. And if that is the case, then we are glad to have done it.

Appendix

Processed Datasets

- Global Population Rasters (~10000BC – 2025AD) | [1.0, Gdrive][1.0, GitHub][1.0, Proton]
- Global Rural Rasters (~10000BC - 2025AD) | [1.0, Gdrive][1.0, GitHub][1.0, Proton]
- Global Urban Rasters (~3000BC - 2025AD) | [1.0, Gdrive][1.0, GitHub][1.0, Proton]
- Metro-adjusted, GHSL (JSON and Rasters) | [1.0, Gdrive][1.0, Proton]
- Non-Metro, GHSL (JSON and Rasters) | [1.0, Gdrive][1.0, Proton]

- Constele Red [GitHub] | [0.3b, Gdrive] – Used for visualising Stadestér results. If you wish to install 0.3b *in situ*, use the Gdrive link.
- Stadestér CLI [GitHub] | [1.0, Gdrive] – Used for processing Stadestér. If you wish to install 1.0 *in situ*, use the Gdrive link.

Secondary Datasets

- Eoscala [1.2, Github] – Gridded GDP PPP per gridcell, 5-arcmin. Not updated to Stadestér data. GitHub link is to preliminary release.
- Velkscala [0.7, Github] – Gridded substrata populations, 5-arcmin. Hybridised with KK10/LUH2 and used for substrata processing. GitHub link is to production.

Tables

- 120 Largest Cities (by max. area, density, or population) | [CSV, Gdrive][CSV, GitHub] | [Figure 33]
- 120 Largest Cities in Central Asia | [CSV, Gdrive][CSV, GitHub] | [Figure 48]
- 120 Largest Cities in East Asia | [CSV, Gdrive][CSV, GitHub] | [Figure 49]
- 120 Largest Cities in Eastern Europe & Russia | [CSV, Gdrive][CSV, GitHub] | [Figure 50]
- 120 Largest Cities in Europe | [CSV, Gdrive][CSV, GitHub] | [Figure 51]
- 120 Largest Cities in the Indian Subcontinent | [CSV, Gdrive][CSV, GitHub] | [Figure 52]
- 120 Largest Cities in Latin America | [CSV, Gdrive][CSV, GitHub] | [Figure 53]
- 120 Largest Cities in Maghreb-Egypt | [CSV, Gdrive][CSV, GitHub] | [Figure 54]
- 120 Largest Cities in the Middle East | [CSV, Gdrive][CSV, GitHub] | [Figure 55]
- 120 Largest Cities in Northern America | [CSV, Gdrive][CSV, GitHub] | [Figure 56]
- 120 Largest Cities in Oceania | [CSV, Gdrive][CSV, GitHub] | [Figure 57]
- 120 Largest Cities in Southeast Asia | [CSV, Gdrive][CSV, GitHub] | [Figure 58]
- 120 Largest Cities in Sub-Saharan Africa | [CSV, Gdrive][CSV, GitHub] | [Figure 59]
- Global urban/rural population shares compared to HYDE/UN | [CSV, Gdrive][CSV, GitHub] | [Figure 26]
- Regional urban/rural population shares compared to HYDE/UN | [CSV, Gdrive][CSV GitHub]

Note. Tables below treat Stadestér Base and GHSL cities separately, meaning that if a city only has population entries after 1975AD, it belongs to GHSL rather than Stadestér Base, and vice versa. Some names have been truncated for brevity. All figures are drawn from metro-adjusted Stadestér-GHSL.

Actual raster data (i.e. in Stadestér Urban) treats both cases as persistent.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Karachi		0	0	0	0	0	0	4.538	21.032	834	25.218
2	Lahore		0	0	0	0	0	0	4.315	14.305	898	15.930
3	Kabul		0	0	0	0	0	0	723	6.255	371	16.859
4	Faisalabad		0	0	0	0	0	0	1.075	5.677	326	17.413

5	Rawalpindi; Islamabad		0	0	0	0	0	0	794	4.914	550	8.934
6	Tashkent		0	0	0	0	0	0	2.155	3.875	598	6.479
7	Drigh Road Cantonment		0	0	0	0	114	1.005	0	0	473	13.924
8	Peshawar		0	0	0	0	0	0	778	3.497	508	6.885
9	Gujranwala		0	0	0	0	0	0	749	3.109	231	13.458
10	Multan		0	0	0	0	0	0	778	2.970	268	11.710
11	Hyderabad; Kotri		0	0	0	0	0	0	874	2.956	144	20.531
12	Almaty		0	0	0	0	0	0	858	2.316	331	6.996
13	Lahore	Lahaur, Lâhawr	0	0	254	80	200	832	0	0	265	17.474
14	Sialkot		0	0	0	0	0	0	445	1.831	180	11.723
15	To`skent	Tashkent, Ta`skent, Toshkent	0	0	0	0	160	710	0	0	163	34.036
16	Tashkent		0	0	0	30	178	787	0	0	213	16.503
17	Herat		0	0	0	0	0	0	184	1.489	88	16.922
18	Dushanbe		0	0	0	0	0	0	482	1.472	183	8.242
19	Bishkek		0	0	0	0	0	0	565	1.428	198	7.213
20	Mardan		0	0	0	0	0	0	181	1.291	215	6.978
21	Shymkent		0	0	0	0	0	0	242	1.240	240	5.165
22	Sargodha		0	0	0	0	0	0	374	1.128	82	15.275
23	Astana		0	0	0	0	0	0	225	1.128	163	6.921
24	Ashgabat		0	0	0	0	0	0	226	1.079	123	8.771
25	Mingora; Saidu Sharif		0	0	0	0	0	0	149	973	112	10.224
26	Quetta		0	0	0	0	0	0	213	969	151	6.455
27	Namangan		0	0	0	0	0	0	161	928	231	4.017
28	Samarqand		0	0	0	0	0	0	364	893	219	4.076
29	Kandahar		0	0	0	0	0	0	89	873	92	9.486
30	Faisalâbâd	Lâyalpur, Lyallpur	0	0	0	0	0	168	0	0	135	14.901
31	Sukkur		0	0	0	0	0	0	220	826	62	13.399
32	Almaty	Alma-Ata, Dzhetysu, Vjernyj, Werny	0	0	0	0	24	291	0	0	100	18.162
33	Gujrat		0	0	0	0	0	0	235	802	68	12.004
34	Abbottabad		0	0	0	0	0	0	123	801	107	8.158
35	Andijon		0	0	0	0	0	0	217	793	183	4.333
36	Nowshera		0	0	0	0	0	0	100	772	119	6.488
37	Fergana; Margilan		0	0	0	0	0	0	173	759	216	3.516
38	Bahawalpur		0	0	0	0	0	0	224	739	83	9.394
39	Mazar i sharif		0	0	0	0	0	0	230	738	61	12.096
40	Sahiwal		0	0	0	0	0	0	191	694	77	10.683
41	Taxila; Wah		0	0	0	0	0	0	55	693	140	5.075
42	Jhang		0	0	0	0	0	0	327	485	56	13.467
43	Okara		0	0	0	0	0	0	183	679	36	19.619

44	Mansura	Brahmanabad	0	65	65	65	111	344	0	0	61	34.176
45	Rahim Yar Khan		0	0	0	0	0	0	0	653	66	11.155
46	Bannu		0	0	0	0	0	0	98	637	163	6.331
47	Larkana		0	0	0	0	0	0	171	634	36	18.972
48	Kabul	Kâbol	0	0	25	51	70	169	0	0	72	22.167
49	Jalalabad		0	0	0	0	0	0	62	618	122	5.546
50	Kasur		0	0	0	0	0	0	236	553	36	17.607
51	Hyderâbâd	Haiderâbâd	0	0	0	0	68	230	0	0	60	17.435
52	Qaraghandy	Karaganda	0	0	0	0	0	281	0	0	46	15.218
53	Multân	Mooltan	0	0	34	30	86	232	0	0	61	23.151
54	Swabi		0	0	0	0	0	0	0	524	105	5.266
55	Dera Ghazi Khan		0	0	0	0	0	0	83	508	64	15.352
56	Qarshi		0	0	0	0	0	0	132	512	149	3.551
57	Shahkot; Khurrianwala		0	0	0	0	0	0	0	504	73	7.680
58	Osh		0	0	0	0	0	0	254	481	84	5.777
59	Bi`skek	Bishkek, Frunze, Pishpek	0	0	0	0	8	156	0	0	69	15.010
60	Mansehra		0	0	0	0	0	0	82	474	84	7.807
61	Kohat		0	0	0	0	0	0	81	465	67	6.947
62	Shabqadar		0	0	0	0	0	0	0	454	126	6.927
63	Karâchi (agglomeration)		0	0	0	0	20	0	0	0	7	401.910
64	Jhelum		0	0	0	0	0	0	71	433	52	9.231
65	Sadiqabad		0	0	0	0	0	0	58	433	48	9.656
66	Haripur		0	0	0	0	0	0	85	432	61	12.144
67	Du`sanbe	Dju`sambe, Dushanbe, Dyushambe (until 1929), Stalinabad (1929-1961)	0	0	0	0	0	153	0	0	56	10.733
68	Aktobe		0	0	0	0	0	0	110	421	92	4.733
69	Landhi Korangi		0	0	0	0	0	0	0	0	25	17.003
70	Hafizabad		0	0	0	0	0	0	121	417	30	15.131
71	Daska		0	0	0	0	0	0	118	408	31	14.695
72	Kamoke		0	0	0	0	0	0	115	397	41	13.913
73	Joharabad; Khushab		0	0	0	0	0	0	80	376	51	12.095
74	Chiniot		0	0	0	0	0	0	142	314	21	19.903
75	Charsadda		0	0	0	0	0	0	129	384	50	9.102
76	Dera Ismail Khan		0	0	0	0	0	0	0	382	63	6.591
77	Raiwind		0	0	0	0	0	0	0	379	64	10.822
78	Muzaffargarh		0	0	0	0	0	0	163	336	62	10.239

79	Pakpattan		0	0	0	0	0	0	123	338	29	17.568
80	Râwalpindi	Raulpindi	0	0	0	0	86	188	0	0	20	78.655
81	Gujrânwâla	Gûjrânwâlah, Gajranwala, Goojranwalla	0	0	0	0	29	117	0	0	41	17.506
82	Peshâwar (agglomeration)		0	0	0	0	94	173	0	0	34	16.791
83	Jizzakh		0	0	0	0	0	0	200	357	101	3.535
84	Ghazni		0	0	0	0	0	0	355	89	23	17.763
85	Mirpur Khas		0	0	0	0	0	0	110	348	29	14.216
86	Khost		0	0	0	0	0	0	0	339	128	3.267
87	Karaganda		0	0	0	0	0	0	327	304	63	5.643
88	Takht Bhai; Jalala; Shergarh		0	0	0	0	0	0	0	333	93	7.467
89	Gojra		0	0	0	0	0	0	92	333	26	13.849
90	Muridke		0	0	0	0	0	0	106	328	40	10.818
91	Yar Hussain; Colonel Sher Kalay; Turlandi		0	0	0	0	0	0	0	328	71	6.501
92	Narowal		0	0	0	0	0	0	68	321	30	14.554
93	Jaranwala		0	0	0	0	0	0	94	318	24	14.489
94	Wazirabad		0	0	0	0	0	0	71	317	45	10.297
95	Burewala		0	0	0	0	0	0	74	314	40	10.114
96	Taloqan		0	0	0	0	0	0	0	307	40	7.687
97	Jacobabad		0	0	0	0	0	0	0	305	27	12.255
98	Mandi Bahauddin		0	0	0	0	0	0	70	304	34	9.742
99	Nukus		0	0	0	0	0	0	166	290	74	4.049
100	Nawabshah		0	0	0	0	0	0	91	298	27	11.859
101	Qoqand		0	0	0	0	0	0	102	297	81	3.662
102	Pavlodar		0	0	0	0	0	0	195	263	61	5.220
103	Semey		0	0	0	0	0	0	228	292	91	4.400
104	Samarqand	Samarkand, Afrosiab, Maracanda	100	80	60	50	60	158	0	0	3	105.174
105	Shikarpur		0	0	0	0	0	0	82	284	18	17.755
106	Shahrisabz		0	0	0	0	0	0	0	283	87	3.257
107	Khanewal		0	0	0	0	0	0	80	275	46	7.815
108	Hazro; Ghorghushti		0	0	0	0	0	0	0	281	73	3.879
109	Symkent	Shymkent, Chimkent, Isfidshab	0	0	0	0	12	110	0	0	34	17.388

110	A`sgabat	Ashgabat, A`schabad, Ashkhabad, Poltoratsk (from 1919-1927)	0	0	0	0	25	137	0	0	29	16.948
111	Kunduz		0	0	0	0	0	0	227	265	39	11.348
112	Kostanay		0	0	0	0	0	0	256	163	42	6.640
113	Râwalpindi Cantonment		0	0	0	0	0	0	0	0	19	15.875
114	Khanpur		0	0	0	0	0	0	0	264	28	10.974
115	Urgench		0	0	0	0	0	0	110	261	66	3.959
116	Aktau		0	0	0	0	0	0	0	260	53	4.896
117	Dadu		0	0	0	0	0	0	92	253	16	17.160
118	Semey	Semipalatinsk	0	0	0	0	28	127	0	0	23	20.994
119	Muzaffarabad		0	0	0	0	0	0	0	237	26	9.754
120	Vehari		0	0	0	0	0	0	56	241	30	8.423

Figure 48. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Central Asia.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Pearl River Delta		0	0	0	0	0	0	2.142	42.988	6.454	6.661
2	Tokyo		0	0	0	0	0	0	24.050	33.156	5.191	6.453
3	Shanghai		0	0	0	0	0	0	4.557	30.679	3.128	9.808
4	Seoul		0	0	0	0	0	0	10.122	22.262	2.282	12.475
5	Beijing		0	0	0	0	0	0	5.153	18.151	2.179	8.803
6	Keihanshin		0	0	0	0	0	0	14.335	12.654	2.246	6.915
7	Suzhou		0	0	0	0	0	0	1.788	11.540	1.802	6.404
8	Jieyang		0	0	0	0	0	0	1.304	10.579	1.961	5.395
9	Taipei		0	0	0	0	0	0	3.723	9.687	972	9.966
10	Shanghai	Shang-hai	100	100	100	93	551	5.136	0	0	1.198	39.973
11	Chongqing		0	0	0	0	0	0	1.523	8.450	653	12.940
12	Wuhan		0	0	0	0	0	0	1.729	8.079	772	10.466
13	Nanjing		0	0	0	0	0	0	1.753	8.061	1.012	7.965
14	Nagoya		0	0	0	0	0	0	6.087	7.722	2.401	3.355
15	Tianjin		0	0	0	0	0	0	2.603	7.331	671	11.999
16	Chengdu		0	0	0	0	0	0	2.806	5.610	880	8.907
17	Hangzhou		0	0	0	0	0	0	1.110	6.387	1.547	5.497
18	Sŏul	Seoul, Keijo, Kyŏngsong	0	0	125	192	211	1.537	0	0	785	19.512
19	Shenyang		0	0	0	0	0	0	3.863	6.175	748	11.960

20	Beijing	Peking, Pei-ching, Peiping, Khanbalik	0	60	672	1.137	1.649	2.069	0	0	354	68.609
21	Hefei		0	0	0	0	0	0	1.345	5.646	606	9.317
22	Xi'an		0	0	0	0	0	0	1.562	5.299	691	7.947
23	Zhengzhou		0	0	0	0	0	0	976	5.126	642	8.671
24	Hong Kong		0	0	0	0	0	0	2.876	4.808	220	22.196
25	Harbin		0	0	0	0	0	0	1.720	4.592	471	9.749
26	Tôkyô	Edo, Yedo, Yeddo, Tokio	0	0	0	485	889	1.623	0	0	302	101.447
27	Tianjin	Tientsin, T'ien-chin	0	0	0	130	930	2.089	0	0	578	17.103
28	Taiyuan		0	0	0	0	0	0	778	4.332	367	11.804
29	Wenzhou		0	0	0	0	0	0	1.968	3.838	546	7.662
30	Urumqi		0	0	0	0	0	0	941	3.974	355	11.195
31	Jinan		0	0	0	0	0	0	1.271	3.825	562	7.897
32	Beijiao	North Point	0	0	0	0	192	1.560	0	0	404	12.060
33	Busan		0	0	0	0	0	0	2.427	3.263	378	10.611
34	Dalian	Dairen, Luda, Luda, Lu-ta, Talien, T'alien, Dalnji, Dalny	0	0	0	0	0	633	0	0	424	14.269
35	Nanning		0	0	0	0	0	0	584	3.696	256	14.436
36	Qingdao		0	0	0	0	0	0	901	3.683	589	6.830
37	Nanchang		0	0	0	0	0	0	1.028	3.641	506	9.428
38	Dalian		0	0	0	0	0	0	1.555	3.600	516	8.395
39	Changchun		0	0	0	0	0	0	1.881	3.520	411	12.129
40	Quanzhou		0	0	0	0	0	0	886	3.385	801	4.509
41	Changsha		0	0	0	0	0	0	1.230	3.247	429	8.662
42	Kunming		0	0	0	0	0	0	512	3.218	362	8.962
43	Shijiazhuang		0	0	0	0	0	0	1.003	3.100	494	7.890
44	Shenyang	Mukden, Shen-yang, Fengtien, Moukden	0	0	125	200	123	1.593	0	0	11	342.112
45	Ningbo		0	0	0	0	0	0	344	2.953	523	5.647
46	Fuzhou		0	0	0	0	0	0	918	2.880	260	11.252
47	Guangzhou	Canton, Kwangchow, Kuang-chou, Kanton	0	200	175	777	659	1.488	0	0	185	44.409
48	P'yongyang		0	0	0	0	0	0	1.453	2.868	228	13.095
49	Wuhan	Hankow, Hankou, Wu-han, Wuchang	0	85	68	159	817	1.419	0	0	209	31.041
50	Changzhou		0	0	0	0	0	0	347	2.773	613	4.735
51	Chongqing	Chungking, Ch'ung-ch'ing, Yu,	0	0	0	53	438	1.332	0	0	364	15.965

		Tchongking, Pahsien										
52	Guiyang		0	0	0	0	0	0	1.009	2.758	302	9.255
53	Lanzhou		0	0	0	0	0	0	1.176	2.689	250	10.758
54	Tangshan		0	0	0	0	0	0	722	2.651	455	5.827
55	Nantong		0	0	0	0	0	0	472	2.609	658	5.488
56	Yokohama		0	0	0	0	238	901	0	0	341	19.584
57	Ôsaka		0	0	0	324	644	0	0	0	201	66.806
58	Daegu		0	0	0	0	0	0	1.512	2.300	289	9.564
59	Putian		0	0	0	0	0	0	353	2.463	453	5.437
60	Taichung		0	0	0	0	0	0	1.488	2.318	313	7.750
61	Pusan	Busan, Fusan, Husan	0	0	0	28	69	536	0	0	374	24.974
62	Harbin	Ha'erbin, Ha-erh-pin, Pinkiang, Pingkiang, Charbin, Kharbin	0	0	0	0	41	921	0	0	148	72.684
63	Kaohsiung		0	0	0	0	0	0	1.520	2.295	375	6.169
64	Fukuoka		0	0	0	0	0	0	1.834	2.213	450	5.137
65	Zhuhai; Macau		0	0	0	0	0	0	309	2.253	274	16.268
66	Taiyuan	Taiyuan, Yanggu, Yangku, T'ai-yuan	0	31	61	40	274	408	0	0	272	25.083
67	Wuhu		0	0	0	0	0	0	374	2.138	197	10.853
68	Handan		0	0	0	0	0	0	245	2.100	251	8.366
69	Hohho		0	0	0	0	0	0	821	2.030	315	8.985
70	Sapporo		0	0	0	0	0	0	1.506	1.931	353	6.112
71	Nunjiang	Nenjiang	0	100	150	50	260	1.180	0	0	257	18.250
72	Yinchuan		0	0	0	0	0	0	247	1.913	253	7.562
73	Lanzhou	Lanchow, Kao lan, Gaolan, Lan-chou	0	17	22	84	295	293	0	0	38	1.388.817
74	Xiamen City		0	0	0	0	0	0	461	1.677	186	11.860
75	T'aipei	Taibei, Tai-pei, Taipeh, Taihôku, Thaipefu	0	0	0	0	43	542	0	0	211	30.148
76	Luoyang		0	0	0	0	0	0	761	1.604	355	5.332
77	Xi'an	Sian, Hsi-an, Chang'an, Sianfu, Si-ngan, Singan-fu, Siking, Ch'ang-an	420	600	126	224	251	581	0	0	169	21.213
78	Qingdao	Tsingtao, Ch'ing-tao, Tsingtau	0	0	0	0	800	897	0	0	43	42.395
79	Xuchang		0	0	0	0	0	0	248	1.822	352	6.861
80	P'yõngyang		43	60	60	67	109	689	0	0	215	18.250
81	Anyang		0	0	0	0	0	0	488	1.737	209	8.309
82	Huaiyin		0	0	0	0	0	0	360	1.717	203	9.358

	District											
83	Zibo		0	0	0	0	0	0	540	1.680	429	5.350
84	Zibo	Zhangdian, Changtien, Chang-tien, Tzepo, Tzupo, Tzu-po	0	0	0	0	0	0	0	0	170	11.329
85	Chengdu	Chengtu, Ch'eng-tu	248	75	78	109	335	779	0	0	177	21.468
86	Baotou		0	0	0	0	0	0	725	1.645	235	8.138
87	Fushun	Funan, Fu-shun	0	0	0	0	0	579	0	0	125	34.150
88	Ulaanbaatar		0	0	0	0	0	0	238	1.634	235	6.954
89	Kunming	K'un-ming, Yunnan	0	0	50	46	59	465	0	0	202	17.859
90	Xuzhou		0	0	0	0	0	0	924	1.310	258	8.404
91	Linyi		0	0	0	0	0	0	355	1.555	829	4.429
92	Jilin City		0	0	0	0	0	0	1.147	1.475	139	14.636
93	Yichang		0	0	0	0	0	0	213	1.573	156	10.085
94	Datong		0	0	0	0	0	0	705	1.572	223	7.117
95	Zhangzhou		0	0	0	0	0	0	327	1.536	417	7.786
96	Daejeon		0	0	0	0	0	0	454	1.504	204	8.961
97	Anshan		0	0	0	0	0	0	1.009	1.496	191	9.806
98	Ganzhou		0	0	0	0	0	0	70	1.477	150	9.846
99	Taizhou		0	0	0	0	0	0	115	1.395	334	8.870
100	Cixi		0	0	0	0	0	0	0	1.459	339	6.606
101	Changchun	Hsinking, Ch'ang-ch'un, Xinjing	0	0	0	85	85	720	0	0	128	32.204
102	Jinan	Tsinan, Chi-nan	0	0	0	65	217	657	0	0	165	17.896
103	Gwangju		0	0	0	0	0	0	547	1.428	190	9.295
104	Xiuying District		0	0	0	0	0	0	378	1.374	212	7.249
105	Anshan	An-shan	0	0	0	0	0	319	0	0	169	16.661
106	Liuzhou		0	0	0	0	0	0	589	1.318	220	7.324
107	Zhengzhou	Chengchow, Cheng-chou, Chenghsien	100	150	175	190	195	328	0	0	122	25.936
108	Xuzhou	Suchow, Pengcheng, Hsu-chou, Suchowfu, Suchou, Tongshan, T'ung-shan	0	0	58	75	94	353	0	0	163	18.249
109	Qiqihar	Tsitsihar, Qiqiha'er, Chichihaerh, Ch'i-ch'i-ha-erh, Lungkiang	0	0	0	0	30	243	0	0	158	44.174
110	Binhai New Area; Jinnan		0	0	0	0	0	0	450	1.429	383	4.225

111	Shijiazhuang	Shihkiachwang, Shih-chia-chuang	0	0	0	0	0	268	0	0	134	17.410
112	Xining		0	0	0	0	0	0	496	1.424	146	11.391
113	Guiyang	Kweiyang, Kuei-yang	0	0	16	65	95	254	0	0	168	17.243
114	Tobata		0	0	0	0	0	85	0	0	166	24.961
115	Nagoya		0	0	0	91	126	526	0	0	85	70.216
116	Nara		0	0	0	0	0	0	1.329	958	392	3.500
117	Kôbe	Hiogo (as a part of it)	0	0	0	21	239	682	0	0	145	30.540
118	Hiroshima		0	0	0	0	0	0	1.233	1.150	343	4.414
119	Kaifeng		0	0	0	0	0	0	421	1.296	193	7.509
120	Senda		0	0	0	0	0	0	783	1.270	298	4.285

Figure 49. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, East Asia.

[■] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Moscow		0	0	0	0	0	0	8.507	14.384	1.545	9.366
2	Moskva	Moscow	0	0	81	247	1.088	4.345	0	0	1.188	18.996
3	Saint Petersburg		0	0	0	0	0	0	3.654	4.879	550	8.871
4	St Petersburg		0	0	0	245	1.291	3.010	0	0	379	19.088
5	Kyiv		0	0	0	0	0	0	1.936	2.575	422	7.286
6	Minsk		0	0	0	0	0	0	1.073	2.094	245	8.590
7	Kyjiv	Kiev, Kiïv, Kyyiv	0	44	40	20	257	938	0	0	308	17.390
8	Kharkiv		0	0	0	0	0	0	1.411	1.284	238	7.051
9	Ni`'znij Novgorod		0	0	55	13	94	794	0	0	259	17.579
10	Yekaterinburg		0	0	0	0	0	0	1.420	1.102	208	8.229
11	Charkiv	Charkov, Kharkov	0	0	0	10	188	861	0	0	251	18.096
12	Nizhny Novgorod		0	0	0	0	0	0	1.318	1.190	232	6.454
13	Novosibirsk		0	0	0	0	0	0	1.236	1.343	281	6.211
14	Novosibirsk	Novonikolayevsk	0	0	0	0	0	595	0	0	136	12.798
15	Omsk		0	0	0	0	0	0	1.114	869	250	5.334
16	Minsk	Měneskъ, Mińsk Litewski, Mińsk Białoruski	0	0	4	13	136	614	0	0	195	14.869
17	Belgrade		0	0	0	0	0	0	815	1.201	195	6.286

18	Samara		0	0	1	4	92	575	0	0	223	17.453
19	Odesa		0	0	0	0	0	0	1.065	978	176	8.599
20	Kazan		0	0	0	0	0	0	958	1.127	248	5.396
21	Dnipro		0	0	0	0	0	0	966	762	204	5.493
22	Samara		0	0	0	0	0	0	1.049	943	146	7.994
23	Jekaterinburg		0	0	0	9	45	611	0	0	189	15.368
24	Rostov-on-Don		0	0	0	0	0	0	1.028	1.029	193	7.132
25	Miensk	Minsk, Mensk	0	0	0	13	94	349	0	0	190	14.871
26	Beograd	Belgrad, Belgrade, Belgrado, Singidunum	0	4	28	20	33	377	0	0	1	2.500.874
27	Sofia		0	0	0	0	0	0	817	1.068	201	6.016
28	Volgograd	Caricyn, Tsaritsyn, Zaryzin; from 1925-1961: Stalingrad	0	0	0	4	65	497	0	0	217	17.823
29	Donetsk		0	0	0	0	0	0	896	691	221	4.641
30	Chelyabinsk		0	0	0	0	0	0	956	809	228	6.081
31	Ufa		0	0	0	0	0	0	859	872	124	8.086
32	Odesa	Odessa	0	0	1	5	418	606	0	0	171	12.839
33	Novokuzneck	Novokuznet sk, Kuzneck, Kuzneck-Sibirski, Stalinsk	0	0	0	0	3	292	0	0	111	24.604
34	Voronezh		0	0	0	0	0	0	893	864	183	5.852
35	Omsk		0	0	0	0	49	426	0	0	151	19.673
36	Donec'k	Donets'k, Stalino, Juzovka	0	0	0	0	35	256	0	0	100	26.257
37	Sredets		0	5	6	43	174	708	0	0	98	18.223
38	Kazan'	Kasan	0	1	13	41	131	513	0	0	106	24.351
39	Perm'		0	0	0	6	46	445	0	0	148	43.172
40	Saratov		0	0	0	0	0	0	824	761	151	6.144
41	`'Cel'abinsk	Chelyabinsk	0	0	0	0	26	383	0	0	110	17.384
42	Dnipropetrovs'k	Dnepropetrovs'k, Dniepropetrovsk, Dnjepropetrovsk, Ekatrinoslav, Jekatrinoslav	0	0	1	8	120	401	0	0	131	17.727
43	Ufa		0	0	0	9	50	262	0	0	145	18.826

44	Zaporizhzhia		0	0	0	0	0	0	671	625	193	5.015
45	Sofija	Sofia, Sredec	0	0	25	45	56	457	0	0	55	74.696
46	Saratov		0	0	5	18	116	395	0	0	103	15.896
47	Krasnodar		0	0	0	0	0	0	751	754	224	6.054
48	Volgograd		0	0	0	0	0	0	751	633	154	5.241
49	Lviv		0	0	0	0	0	0	634	604	102	8.185
50	Makhachkala		0	0	0	0	0	0	246	741	127	6.782
51	Vorone`'z	Voronezh	0	0	2	18	83	374	0	0	98	18.031
52	Krasnojarsk	Krasnoyarsk, Krasny Jar	0	0	0	0	27	279	0	0	141	13.091
53	Kryvyi Rih		0	0	0	0	0	0	672	471	160	4.903
54	Sverdlovs'k		0	0	0	0	0	89	0	0	58	17.807
55	Tula		0	0	0	0	0	0	713	307	96	7.582
56	Barnaul		0	0	0	0	0	0	644	446	127	6.469
57	Krasnoyarsk		0	0	0	0	0	0	607	560	105	8.241
58	Izhevsk		0	0	0	0	0	0	525	584	110	6.373
59	Vladivostok		0	0	0	0	0	0	587	437	103	7.520
60	Yaroslavl		0	0	0	0	0	0	575	525	117	5.897
61	Tyumen		0	0	0	0	0	0	325	628	152	4.538
62	Kryvyi Rih	Krivij Rig, Krivoi Rog	0	0	0	3	19	278	0	0	111	14.364
63	L'viv	Lviv, Lvov, L'vov, Lwów, Lemberg	0	3	12	42	189	369	0	0	66	17.905
64	Chi?in?u		0	0	0	0	0	0	501	451	101	6.081
65	Khabarovsk		0	0	0	0	0	0	515	538	167	4.723
66	Orenburg		0	0	0	0	0	0	470	406	100	6.901
67	Homel		0	0	0	0	0	0	320	571	75	7.617
68	Ryazan		0	0	0	0	0	0	479	427	105	5.548
69	Jaroslavl'	Yaroslavl'	0	0	3	22	79	351	0	0	66	22.166
70	Penza		0	0	0	0	0	0	481	436	101	5.934
71	Kirov		0	0	0	0	0	0	508	289	61	9.440
72	Tula		0	0	2	42	115	304	0	0	56	17.332
73	Kemerovo		0	0	0	0	0	0	490	431	118	4.657
74	Tomsk		0	0	0	0	0	0	469	466	78	7.768
75	Astrakhan		0	0	0	0	0	0	479	520	156	3.733
76	Krasnodar		0	0	0	4	70	249	0	0	90	13.852
77	Irkutsk		0	0	0	0	0	0	459	435	101	5.793
78	Naberezhnye Chelny		0	0	0	0	0	0	56	499	107	5.418
79	Mykolaiv		0	0	0	0	0	0	388	412	94	5.883

80	I`'zevsk	Ustinov, Izhevsk, I`'zevskij, I`'zevski Zavod	0	0	0	7	40	226	0	0	79	12.022
81	Tver		0	0	0	0	0	0	467	339	80	6.308
82	Irkutsk		0	0	0	11	52	289	0	0	70	16.298
83	Chabarovsk	Chabarovka	0	0	0	0	24	252	0	0	59	16.332
84	Vladivostok		0	0	0	0	47	244	0	0	64	13.232
85	Luhansk		0	0	0	0	0	0	428	342	87	5.793
86	Cheboksary		0	0	0	0	0	0	348	438	100	5.459
87	Ivanovo		0	0	0	0	0	0	472	368	80	6.202
88	Mariupol		0	0	0	0	0	0	473	363	136	3.739
89	Rostov	Rostov-Velikij, Rostov-Jaroslavski	0	6	9	5	0	17	0	0	8	5.664.935
90	Barnaul		0	0	0	0	34	195	0	0	60	13.833
91	Murmansk		0	0	0	0	0	0	384	273	75	6.324
92	Mariupol'	`Zdanov, Zhdanov	0	0	0	3	36	255	0	0	73	16.165
93	Ulyanovsk		0	0	0	0	0	0	325	378	101	5.010
94	Novokuznetsk		0	0	0	0	0	0	432	289	64	7.200
95	Ivanovo		0	0	0	14	57	307	0	0	56	14.945
96	Kaliningrad		0	0	0	0	0	0	317	438	102	4.512
97	Astrachan'	Astrakhan, Khadzhi-Tarkhan	0	42	42	27	124	269	0	0	42	45.737
98	Vladimir		0	0	0	0	0	0	393	227	49	8.846
99	Rajon Swerdlowski		0	0	0	0	0	0	379	286	81	5.926
100	Codru		0	0	1	15	104	217	0	0	53	11.594
101	Chisinâu	Kishinev, Ki`sin'ov	0	0	0	0	122	135	0	0	40	37.223
102	Kemerovo	`'S`'ceglovsk , Shcheglovsk	0	0	0	0	0	202	0	0	45	12.336
103	Penza		0	0	0	14	63	206	0	0	56	15.973
104	Sarajevo		0	0	0	0	0	0	372	236	94	6.092
105	Podolsk		0	0	0	0	0	0	252	414	96	4.635
106	Makijivka	Makiyivka, Makiïvka, Makaevka, Dmitrijevsk, Dmitriyevsk	0	0	0	0	0	287	0	0	37	12.850
107	Skopje		0	0	0	0	0	0	355	403	95	4.764
108	Arkhangelsk		0	0	0	0	0	0	395	213	69	5.997
109	Ul'janovsk		0	0	0	13	43	155	0	0	54	15.709

110	Ulan-Ude		0	0	0	0	0	0	363	245	90	4.787
111	Mahilio?		0	0	0	0	0	0	268	399	76	5.420
112	R'azan'	Ryazan	0	2	2	9	46	125	0	0	56	16.607
113	Vinnytsia		0	0	0	0	0	0	299	356	69	6.236
114	Orenburg		0	0	0	6	77	208	0	0	64	13.737
115	Brest		0	0	0	0	0	0	152	398	70	6.154
116	Hrodna		0	0	0	0	0	0	193	395	55	7.188
117	Mykolajiv	Mykolayiv, Mikolaiv, Nikolaev, Nikolajev, Nikolayev, Verchnoleninsk, Verkhnoleninsk	0	0	0	4	94	193	0	0	59	13.408
118	Magnitogorsk		0	0	0	0	0	0	301	352	129	4.066
119	Ni`'znij Tagil	Nizhnii Tagil	0	0	0	5	31	246	0	0	54	14.314
120	Smolensk		0	0	0	0	0	0	314	280	53	7.423

Figure 50. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Eastern Europe and Russia.

[■] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	London		0	0	0	0	0	0	7.393	10.408	1.649	6.312
2	Paris		0	0	0	0	0	0	7.398	9.328	1.421	6.565
3	London	Londinium	31	20	0	768	0	0	0	0	725	54.898
4	Madrid		0	0	0	0	0	0	2.947	5.680	680	8.504
5	Ruhr		0	0	0	0	766	1.893	0	0	488	11.187
6	Paris	Lutetia (Lutetia Parisiorum), Parisii	0	15	161	533	1.894	1.714	0	0	310	110.269
7	Kensington and Chelsea		0	12	50	773	3.389	1.761	0	0	272	16.026
8	Berlin		0	0	7	123	1.613	2.796	0	0	415	36.891
9	Barcelona		0	0	0	0	0	0	2.232	3.908	438	8.959
10	Berlin		0	0	0	0	0	0	3.021	3.550	687	5.213
11	Roma	Rome, Rom	796	33	35	146	444	1.645	0	0	413	20.795
12	Athens		0	0	0	0	0	0	2.931	3.167	417	8.411
13	Milano	Milan, Milaan, Mailand,	48	36	80	127	423	1.059	0	0	359	23.285

		Mediolanum										
14	Gazi		75	75	30	15	253	1.331	0	0	576	14.846
15	Milan		0	0	0	0	0	0	2.958	3.136	785	4.465
16	Madrid		0	0	0	165	487	1.365	0	0	325	22.469
17	Naples		0	0	0	0	0	0	2.588	2.885	618	5.326
18	Ruhr (GHSL)		0	0	0	0	0	0	2.846	2.719	880	3.376
19	Birmingham		0	0	0	0	0	0	2.287	2.617	685	3.821
20	Manchester		0	0	0	0	0	0	2.176	2.540	751	3.382
21	Rome		0	0	0	0	0	0	1.951	2.476	467	5.783
22	Manchester		0	2	3	50	287	392	0	0	106	217.654
23	Wien	Vienna, Vienne, Becs, Vindobona	0	8	29	240	1.680	1.667	0	0	210	16.911
24	Rotterdam-Den Haag		0	0	0	0	0	0	1.614	2.174	677	3.547
25	Hamburg		0	2	22	112	714	1.526	0	0	212	26.750
26	Budapest	Aquincum, Boedapest	0	3	22	55	736	1.469	0	0	263	17.199
27	Barcelona	Barcino	0	4	25	98	438	947	0	0	187	29.767
28	Bucharest		0	0	0	0	0	0	1.728	1.971	260	9.463
29	Vienna		0	0	0	0	0	0	1.573	2.057	325	6.328
30	Warsaw		0	0	0	0	0	0	1.398	2.000	415	5.701
31	Lisbon		0	0	0	0	0	0	1.284	1.975	426	4.682
32	Budapest		0	0	0	0	0	0	1.839	1.744	368	5.877
33	Munich		0	0	0	0	0	0	1.374	1.828	345	5.298
34	Hamburg		0	0	0	0	0	0	1.621	1.734	478	3.886
35	Birmingham		0	0	0	19	163	308	0	0	4	345.465.036
36	Amsterdam		0	0	11	201	529	834	0	0	150	20.150
37	Torino	Turin, Taurasia, Augusta Taurinorum, Turijn	0	2	9	65	319	669	0	0	188	22.194
38	München		0	1	15	48	468	824	0	0	207	17.829
39	Stockholm		0	0	0	0	0	0	786	1.544	339	4.554
40	Bucuresti	Bucarest, Bucharest, Bukharest, Boukhorest, Bukarest	0	0	4	35	282	1.076	0	0	222	19.293
41	Brussels		0	0	0	0	0	0	971	1.469	235	6.533
42	Liverpool		0	0	0	0	0	0	1.416	1.243	388	3.912
43	Valencia; Torrent		0	0	0	0	0	0	977	1.404	223	7.790
44	Glasgow		0	0	0	53	600	856	0	0	130	17.204

45	Turin		0	0	0	0	0	0	1.288	1.243	212	7.009
46	Liverpool		0	0	0	63	423	63	0	0	105	4.420.108
47	Warszawa	Warschau	0	0	7	126	686	610	0	0	124	49.742
48	Frederiksberg		0	0	21	100	476	113	0	0	55	280.598
49	Copenhagen		0	0	0	0	0	0	1.037	1.258	314	4.166
50	Amsterdam		0	0	0	0	0	0	931	1.223	308	4.797
51	Köln	Cologne, Cöln	0	14	48	15	273	392	0	0	94	49.628
52	Prague		0	0	0	0	0	0	975	1.201	263	4.610
53	Frankfurt am Main		0	0	15	17	169	330	0	0	95	82.309
54	Praha	Prag, Praga, Prague	0	8	70	75	297	944	0	0	125	18.140
55	Lyon; Villeurbanne		0	0	0	0	0	0	839	1.195	256	4.667
56	Cologne		0	0	0	0	0	0	865	1.156	296	3.906
57	Napoli	Naples, Napels, Neapel, Neapolis, Parthenope	0	8	113	341	346	549	0	0	50	55.617
58	Katowice		0	0	0	0	0	0	1.097	879	278	4.194
59	Dublin		0	0	0	0	0	0	793	1.125	301	3.736
60	Rotterdam		0	0	5	55	330	673	0	0	123	17.818
61	Porto		0	0	0	0	0	0	706	1.060	324	3.343
62	Leeds; Bradford		0	0	0	0	0	0	858	1.054	321	3.290
63	Glasgow		0	0	0	0	0	0	1.025	992	309	3.439
64	Helsinki; Vantaa		0	0	0	0	0	0	270	1.001	384	2.952
65	Tirana		0	0	0	0	0	0	151	996	115	8.659
66	Brussel	Bruxelles, Brussels	0	0	0	0	0	0	0	0	0	26.741.745.133.200.700
67	Dusseldorf; Neuss		0	0	0	0	0	0	745	922	246	4.486
68	Frankfurt; Offenbach am Main		0	0	0	0	0	0	677	916	193	4.747
69	Marseille		0	0	0	0	0	0	728	912	188	4.929
70	Stockholm		0	0	9	73	274	586	0	0	91	18.249
71	Stuttgart		0	0	0	0	0	0	773	909	257	4.003
72	Bilbao; Barakaldo		0	0	0	0	0	0	899	729	118	9.453
73	Lille		0	0	0	0	0	0	809	907	228	4.190

74	Oslo		0	0	0	0	0	0	441	890	244	3.646
75	Genova	Genoa, Genua, Gènes	0	14	78	91	198	678	0	0	77	19.928
76	Wuppertal		0	0	1	18	278	353	0	0	114	15.283
77	Marseille	Massilia	0	5	26	56	436	562	0	0	75	22.944
78	Düsseldorf		0	0	3	17	180	382	0	0	114	19.766
79	Riga		0	0	0	0	0	0	715	517	155	5.359
80	Riga		0	2	9	30	292	503	0	0	84	20.397
81	Thessaloniki		0	0	0	0	0	0	604	783	117	7.806
82	Valencia		0	9	48	75	179	430	0	0	72	23.257
83	Lodz		0	0	0	0	0	0	762	583	137	6.069
84	Newcastle upon Tyne		0	0	0	0	0	0	783	770	239	3.305
85	Gravenhage, 's-	Den Haag, The Hague, La Haye, L'Aja	0	0	6	38	211	560	0	0	92	17.536
86	Antwerp		0	0	0	0	0	0	488	768	327	2.907
87	Bonn		0	0	0	0	0	0	598	756	274	2.761
88	Newcastle upon Tyne		0	0	8	37	212	294	0	0	71	68.624
89	Dortmund		0	0	0	0	0	0	743	710	257	3.032
90	Genoa		0	0	0	0	0	0	740	523	101	7.330
91	Dublin	Baile Átha Cliath, Eblana	0	4	25	165	287	459	0	0	57	22.624
92	Hannover		0	0	14	19	228	360	0	0	95	19.838
93	Krakow		0	0	0	0	0	0	603	723	176	4.688
94	Palermo		0	0	0	0	0	0	669	666	136	5.577
95	Wuppertal; Solingen		0	0	0	0	0	0	696	651	238	3.607
96	Leipzig		0	2	8	32	452	608	0	0	80	19.048
97	Toulouse		0	0	0	0	0	0	267	713	252	3.309
98	Lódz	Lodsch, Litzmannstadt	0	0	1	8	288	564	0	0	88	27.398
99	Florence; Prato		0	0	0	0	0	0	619	711	196	4.665
100	Oslo		0	0	3	12	202	349	0	0	107	17.955
101	Mannheim		0	0	0	4	0	0	0	0	1	1.434.811
102	Seville		0	0	0	0	0	0	575	696	80	8.881
103	Zagreb		0	0	0	0	0	0	607	644	151	5.418
104	Lyon	Lugdunum, Lyons	50	50	42	133	419	357	0	0	53	23.766

105	Zurich		0	0	0	0	0	0	251	689	187	3.686
106	Bristol		0	0	0	0	0	0	515	681	173	3.935
107	Palermo	Panormus, Panhormus	0	72	40	134	305	492	0	0	56	17.515
108	Sheffield		0	0	0	0	0	0	549	665	219	3.038
109	Lisboa	Olisipo, Felicitas Julia	0	15	60	222	329	597	0	0	47	22.406
110	Hanover		0	0	0	0	0	0	619	664	204	3.775
111	Zürich	Zurich	0	3	5	12	151	386	0	0	87	20.482
112	Nottingham		0	0	0	0	0	0	514	651	178	3.656
113	Kraków	Krakau, Cracow, Cracovia	0	3	22	26	105	378	0	0	80	18.545
114	Nuremberg		0	0	0	0	0	0	548	646	171	3.899
115	Bordeaux		0	0	0	0	0	0	440	643	208	3.211
116	Wroclaw	Breslau	0	0	22	60	419	362	0	0	62	123.418
117	Zaragoza		0	0	0	0	0	0	446	624	76	10.693
118	Dresden		0	0	4	59	409	436	0	0	59	22.555
119	Göteborg		0	0	1	12	125	326	0	0	89	18.056
120	Helsinki	Helsingissä, Helsingfors	0	0	0	7	93	388	0	0	101	16.038

Figure 51. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Europe.

[■] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Dhaka		0	0	0	0	0	0	4.762	37.307	6.611	7.485
2	Ghaziabad		0	0	0	0	0	0	6.273	31.423	2.139	14.690
3	Kolkata		0	0	0	0	0	0	10.922	23.315	2.482	13.287
4	Mumbai		0	0	0	0	0	0	8.505	20.453	738	27.714
5	Bengaluru		0	0	0	0	0	0	2.423	15.179	1.008	15.860
6	Chennai; Tambaram; Avadi		0	0	0	0	0	0	4.573	11.466	1.052	12.785
7	Hajipur; Muzaffarpur		0	0	0	0	0	0	764	9.755	3.166	7.487
8	Hyderabad		0	0	0	0	0	0	2.917	9.455	889	10.636
9	Ahmedabad		0	0	0	0	0	0	2.623	7.899	365	21.640
10	Kozhikode		0	0	0	0	0	0	578	7.612	1.341	11.563
11	Surat		0	0	0	0	0	0	990	7.101	296	23.989
12	Pune		0	0	0	0	0	0	2.459	6.674	580	11.507

13	Mumbaî	Bombay	0	0	0	115	773	2.595	0	0	38.497	17.180
14	Lucknow		0	0	0	0	0	0	1.504	5.215	513	11.204
15	Chattogram		0	0	0	0	0	0	1.356	5.176	519	11.088
16	Kochi		0	0	0	0	0	0	1.185	5.069	1.266	5.484
17	Colombo		0	0	0	0	0	0	1.981	4.721	1.206	3.915
18	Kanpur; Unnao		0	0	0	0	0	0	2.093	4.414	309	16.298
19	Jaipur		0	0	0	0	0	0	970	4.229	458	9.600
20	Delhi	Dillî, Dehli	0	0	76	190	184	813	0	0	470	24.910
21	Calcutta	Kalikata	0	0	0	258	615	1.940	0	0	191	76.722
22	Kathmandu		0	0	0	0	0	0	239	3.863	350	11.036
23	Varanasi		0	0	0	0	0	0	1.753	3.812	381	16.382
24	Savar		0	0	0	0	0	0	210	3.696	592	6.718
25	Indore		0	0	0	0	0	0	1.055	3.599	281	12.807
26	Kollam		0	0	0	0	0	0	407	3.464	710	4.879
27	Patna; Danapur		0	0	0	0	0	0	907	3.434	262	13.751
28	Nagpur		0	0	0	0	0	0	1.309	3.400	286	11.888
29	Kalyan-Dombivli		0	0	0	0	0	0	790	3.215	175	18.371
30	Thiruvananthapuram		0	0	0	0	0	0	830	3.167	361	8.772
31	Chennai	Madras, Chennapattanam	0	0	0	112	504	1.352	0	0	390	17.566
32	Asansol		0	0	0	0	0	0	1.517	2.887	249	11.762
33	Maharajganj		0	0	0	0	0	0	129	2.841	1.120	18.412
34	Agra		0	0	0	0	0	0	1.131	2.790	209	14.356
35	Ponnani		0	0	0	0	0	0	55	2.752	754	4.041
36	Bhopal		0	0	0	0	0	0	520	2.599	249	10.681
37	Tamluk		0	0	0	0	0	0	555	2.451	889	6.041
38	Chandigarh		0	0	0	0	0	0	615	2.418	344	7.029
39	Coimbatore		0	0	0	0	0	0	1.059	2.360	407	8.147
40	Prayagraj		0	0	0	0	0	0	1.127	2.359	156	15.122
41	Ludhiana		0	0	0	0	0	0	646	2.323	226	10.280
42	Vadodara		0	0	0	0	0	0	725	2.269	214	10.605
43	Madurai		0	0	0	0	0	0	972	2.184	219	12.152
44	Meerut		0	0	0	0	0	0	896	2.169	233	10.641
45	Dhanbad		0	0	0	0	0	0	909	2.079	298	8.223
46	Jamshedpur		0	0	0	0	0	0	778	2.008	161	12.472
47	Nashik		0	0	0	0	0	0	405	1.971	192	10.265
48	Brahmanbaria		0	0	0	0	0	0	477	1.945	557	6.433

49	Ahmadâbâd	Ahmedabad, Amdâbâd	0	0	79	275	182	769	0	0	80	183.501
50	Bangalore	Bengalûru, Bangalur	0	0	0	50	180	742	0	0	268	18.250
51	Bibhutpur		0	0	0	0	0	0	0	1.870	607	3.630
52	Ranchi		0	0	0	0	0	0	493	1.818	200	10.088
53	Aligarh		0	0	0	0	0	0	749	1.694	106	19.544
54	Thrissur		0	0	0	0	0	0	158	1.645	271	6.069
55	Visakhapatnam		0	0	0	0	0	0	562	1.634	211	9.211
56	Jabalpur		0	0	0	0	0	0	714	1.621	147	11.028
57	Hyderâbâd	Haiderâbâd, Haïder-Abad	0	0	25	112	370	971	0	0	159	24.695
58	Bareilly		0	0	0	0	0	0	652	1.609	165	21.037
59	Dhulian		0	0	0	0	0	0	202	1.567	268	5.846
60	Marhaura		0	0	0	0	0	0	0	1.559	651	2.485
61	Rajkot		0	0	0	0	0	0	578	1.554	130	12.826
62	Vasai-Virar		0	0	0	0	0	0	346	1.551	128	12.147
63	Chhatrapati		0	0	0	0	0	0	703	1.543	126	13.337
64	Jodhpur		0	0	0	0	0	0	459	1.541	232	6.692
65	Dhaka	Dacca	0	0	0	125	71	133	0	0	115	45.789
66	Gwalior		0	0	0	0	0	0	635	1.529	122	13.915
67	Raipur		0	0	0	0	0	0	374	1.529	173	8.836
68	Kishoreganj		0	0	0	0	0	0	182	1.512	594	11.716
69	Gorakhpur		0	0	0	0	0	0	712	1.484	141	12.094
70	Mehsi		0	0	0	0	0	0	0	1.454	652	2.903
71	Moradabad		0	0	0	0	0	0	613	1.447	108	17.759
72	Durg		0	0	0	0	0	0	291	1.433	187	7.666
73	Tiruchirappalli		0	0	0	0	0	0	610	1.378	150	9.761
74	Guwahati		0	0	0	0	0	0	291	1.376	194	7.092
75	Vijayawada		0	0	0	0	0	0	721	1.240	121	15.179
76	Gyanpur		0	0	0	0	0	0	208	1.324	585	23.093
77	Khulna		0	0	0	0	0	0	473	1.081	131	10.586
78	Salem		0	0	0	0	0	0	657	1.300	155	11.945
79	Kânpur	Cawnpore	0	0	0	0	196	684	0	0	132	18.254
80	Amritsar		0	0	0	0	0	0	660	1.303	128	12.451
81	Mysuru		0	0	0	0	0	0	666	1.298	142	9.941
82	Saharanpur		0	0	0	0	0	0	510	1.253	96	16.452
83	Kota		0	0	0	0	0	0	441	1.220	132	9.244
84	Sylhet		0	0	0	0	0	0	358	1.207	87	13.873
85	Begusarai		0	0	0	0	0	0	286	1.194	216	6.502
86	Dehradun		0	0	0	0	0	0	367	1.191	169	8.530

87	Tiruppur		0	0	0	0	0	0	337	1.157	189	7.323
88	Bhubaneshwar		0	0	0	0	0	0	205	1.174	155	9.435
89	Kottayam		0	0	0	0	0	0	721	943	268	5.590
90	Jalandhar		0	0	0	0	0	0	700	1.171	144	9.339
91	Jammu		0	0	0	0	0	0	386	1.161	140	11.035
92	Solapur		0	0	0	0	0	0	474	1.110	82	14.604
93	Berhampore		0	0	0	0	0	0	456	1.072	123	13.811
94	Puducherry		0	0	0	0	0	0	222	1.059	88	12.029
95	Pune	Poona, Punen	0	0	0	106	161	467	0	0	89	40.555
96	Colache		0	0	0	0	0	0	403	1.002	325	3.339
97	Darbhanga		0	0	0	0	0	0	312	992	151	12.140
98	Biratnagar		0	0	0	0	0	0	67	988	195	5.915
99	Faizabad		0	0	0	0	0	0	490	872	79	16.313
100	Shahajadpur		0	0	0	0	0	0	327	978	265	7.102
101	Gaya		0	0	0	0	0	0	252	970	128	8.426
102	Mangaluru		0	0	0	0	0	0	429	967	228	4.241
103	Dharwad		0	0	0	0	0	0	402	948	57	25.146
104	Krishnanagar		0	0	0	0	0	0	575	938	71	33.839
105	Lucknow	Lakhnau, Lacknau	0	0	0	241	273	486	0	0	70	19.859
106	Sitamarhi		0	0	0	0	0	0	136	917	224	8.599
107	Firozabad		0	0	0	0	0	0	433	860	51	23.244
108	Erode		0	0	0	0	0	0	596	829	159	10.643
109	Kutubdia		0	0	0	0	0	0	57	886	430	2.140
110	Bikaner		0	0	0	0	0	0	237	880	95	9.267
111	Farrukhabad		0	0	0	0	0	0	456	576	64	20.001
112	Bokaro		0	0	0	0	0	0	418	864	99	8.726
113	Guntur		0	0	0	0	0	0	617	835	77	15.651
114	Imphal		0	0	0	0	0	0	266	830	202	4.207
115	Muzaffarnagar		0	0	0	0	0	0	351	829	71	16.199
116	Kotwali		0	0	0	0	0	0	158	827	127	6.512
117	Bakhtiyarpur		0	0	0	0	0	0	154	825	154	6.709
118	Nâgpur		0	0	0	77	48	297	0	0	30	166.958
119	Chittagong	Châttagâm	0	0	0	0	36	141	0	0	49	54.676
120	Munger		0	0	0	0	0	0	234	812	115	9.734

Figure 52. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Indian Subcontinent.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Sao Paulo		0	0	0	0	0	0	10.645	19.485	2.111	9.273
2	Mexico City		0	0	0	0	0	0	11.138	17.639	2.134	9.029
3	Buenos Aires		0	0	0	0	0	0	8.567	14.180	2.186	6.487
4	Lima; Callao		0	0	0	0	0	0	3.549	10.828	984	11.004
5	Bogota; Soacha		0	0	0	0	0	0	3.396	10.419	534	19.512
6	Rio de Janeiro		0	0	0	0	0	0	5.966	9.854	1.285	7.668
7	São Paulo		0	0	0	12	198	2.294	0	0	1.616	18.570
8	Santiago		0	0	0	0	0	0	2.826	6.634	801	8.282
9	Rio de Janeiro		0	0	0	44	614	2.108	0	0	769	26.104
10	Santo Domingo		0	0	0	0	0	0	1.149	4.593	483	9.510
11	Belo Horizonte		0	0	0	0	0	0	1.319	4.377	609	7.187
12	Guadalajara		0	0	0	0	0	0	2.004	4.138	598	7.389
13	Monterrey		0	0	0	0	0	0	1.623	4.011	685	5.889
14	Recife		0	0	0	0	0	0	1.810	3.848	491	7.836
15	Ciudad de México	México, Mexico City	0	0	0	107	266	955	0	0	295	36.766
16	Fortaleza		0	0	0	0	0	0	1.022	3.324	413	8.049
17	Salvador		0	0	0	0	0	0	1.237	3.305	323	10.233
18	Lima		0	0	0	54	121	770	0	0	475	18.743
19	Medellin		0	0	0	0	0	0	1.924	3.215	233	14.118
20	Guayaquil		0	0	0	0	0	0	933	3.248	315	10.343
21	Caracas		0	0	0	0	0	0	2.427	2.667	311	10.178
22	Guatemala City		0	0	0	0	0	0	1.131	2.901	470	6.296
23	Bogotá		0	0	0	20	120	599	0	0	490	16.159
24	Porto Alegre		0	0	0	0	0	0	1.197	2.763	599	4.672
25	Funza		0	0	20	26	181	1.127	0	0	433	14.667
26	Cali		0	0	0	0	0	0	1.152	2.692	186	14.471
27	Quito; Sangolqui		0	0	0	0	0	0	635	2.606	380	6.857
28	Curitiba		0	0	0	0	0	0	734	2.513	566	4.479
29	Goiania		0	0	0	0	0	0	211	2.457	531	4.628
30	Buenos Aires	Ciudad de Nuestra Señora Buenos Aires	0	0	0	35	672	782	0	0	357	145.062
31	Manaus		0	0	0	0	0	0	367	2.369	272	8.709
32	Port-au-Prince		0	0	0	0	0	0	974	1.733	275	9.880
33	San Jose		0	0	0	0	0	0	623	2.273	491	4.628
34	Belem		0	0	0	0	0	0	724	2.192	273	8.031
35	Barranquilla		0	0	0	0	0	0	848	2.167	157	13.800
36	Maracaibo		0	0	0	0	0	0	827	2.142	295	7.358
37	El Alto; La Paz		0	0	0	0	0	0	752	2.064	291	7.092
38	Santa Cruz de la Sierra		0	0	0	0	0	0	167	2.017	303	6.656
39	Puebla		0	0	0	0	0	0	570	1.950	375	5.231

40	Campinas		0	0	0	0	0	0	170	1.834	434	4.227
41	Ceilandia		0	0	0	0	0	0	117	1.799	283	6.563
42	Asuncion		0	0	0	0	0	0	570	1.175	477	3.808
43	Sao Goncalo		0	0	0	0	0	0	909	1.735	296	5.861
44	Havana		0	0	0	0	0	0	1.480	1.633	323	5.758
45	San Salvador		0	0	0	0	0	0	975	1.616	264	7.189
46	Tegucigalpa		0	0	0	0	0	0	422	1.654	163	10.144
47	Belo Horizonte	Bello Horizonte; Cidade de Minas	0	0	0	0	14	430	0	0	240	14.773
48	Panama		0	0	0	0	0	0	284	1.612	277	5.821
49	Valencia		0	0	0	0	0	0	331	1.601	330	5.205
50	Toluca		0	0	0	0	0	0	83	1.594	395	4.036
51	Tijuana		0	0	0	0	0	0	235	1.538	294	5.232
52	Cordoba		0	0	0	0	0	0	859	1.468	320	4.930
53	La Habana	Havana	0	0	0	68	196	558	0	0	156	18.638
54	Managua		0	0	0	0	0	0	432	1.436	216	6.649
55	Leon		0	0	0	0	0	0	433	1.384	202	6.932
56	Montevideo		0	0	0	0	0	0	1.354	1.219	237	5.872
57	Porto Alegre		0	0	0	4	75	401	0	0	279	14.528
58	Torreon		0	0	0	0	0	0	313	1.364	233	5.853
59	Cochabamba		0	0	0	0	0	0	195	1.358	293	4.633
60	Recife	Pernambuco	0	0	0	24	138	465	0	0	186	17.045
61	Salvador	Baía, Bahia, Salvador do Bahia, São Salvador	0	0	0	45	224	508	0	0	163	17.821
62	San Pedro Sula		0	0	0	0	0	0	185	1.302	211	6.169
63	Vila Velha		0	0	0	0	0	0	283	1.292	203	6.364
64	Ciudad Juarez		0	0	0	0	0	0	519	1.215	298	4.384
65	Sao Luis		0	0	0	0	0	0	210	1.272	242	5.257
66	Santiago	Santiago de Chile	0	0	0	29	280	1.238	0	0	167	140.157
67	Nezahualcóyo tl		0	0	0	0	0	0	0	0	102	12.519
68	Caracas	San León de Caracas	0	0	0	31	78	0	0	0	26	328.681
69	Montevideo		0	0	0	6	265	804	0	0	225	13.253
70	Rosario		0	0	0	0	0	0	705	1.187	199	6.344
71	Gustavo A. Madero	Villa Gustavo A. Madero, Guadalupe Hidalgo	0	0	0	0	6	372	0	0	154	9.296
72	Natal		0	0	0	0	0	0	361	1.133	210	5.396
73	Santos		0	0	0	0	0	0	660	1.128	158	7.140
74	Joao Pessoa		0	0	0	0	0	0	164	1.120	198	5.658
75	Mendoza		0	0	0	0	0	0	468	1.063	208	5.112
76	Maceio		0	0	0	0	0	0	275	1.046	163	6.418
77	Bayamon		0	0	0	0	0	0	370	749	327	3.116
78	San Luis Potosi		0	0	0	0	0	0	412	1.005	173	6.063
79	Arequipa		0	0	0	0	0	0	265	1.005	166	6.053
80	Maracay		0	0	0	0	0	0	315	866	182	6.290
81	Trujillo		0	0	0	0	0	0	286	991	94	10.547

82	Guadalajara		0	0	0	32	94	371	0	0	133	17.260
83	San Miguel de Tucuman		0	0	0	0	0	0	426	986	170	5.802
84	Teresina		0	0	0	0	0	0	214	983	197	5.016
85	Cartagena		0	0	0	0	0	0	373	926	114	8.538
86	Aracaju		0	0	0	0	0	0	136	921	140	6.581
87	Campo Grande		0	0	0	0	0	0	87	911	249	3.658
88	Queretaro		0	0	0	0	0	0	88	909	169	5.378
89	Barquisimeto		0	0	0	0	0	0	422	854	139	6.495
90	Monterrey	Monterey	0	0	0	11	52	340	0	0	137	17.240
91	Bucaramanga		0	0	0	0	0	0	386	894	67	13.338
92	Medellín		0	0	0	5	51	241	0	0	67	43.536
93	Aguascaliente s		0	0	0	0	0	0	167	878	142	6.285
94	Córdoba		0	0	0	0	49	415	0	0	125	19.747
95	Rosario	Rosario de Santa Fé	0	0	0	0	105	496	0	0	98	16.640
96	Santo Domingo		0	0	0	12	17	205	0	0	139	25.348
97	Cuernavaca; Temixco		0	0	0	0	0	0	86	866	196	4.420
98	Guayaquil		0	0	0	23	60	227	0	0	120	24.226
99	Merida		0	0	0	0	0	0	289	853	182	4.686
100	Valparaiso		0	0	0	0	0	0	555	838	152	5.516
101	Sao Jose dos Campos		0	0	0	0	0	0	137	836	192	4.353
102	Chihuahua		0	0	0	0	0	0	334	832	192	4.345
103	Curitiba	Curytiba	0	0	0	6	50	249	0	0	143	14.960
104	Cucuta		0	0	0	0	0	0	245	817	114	7.168
105	Cali		0	0	0	7	13	182	0	0	5.285	16.422
106	San Justo	La Matanza (municipality incl. La Tablada, Tapiales)	0	0	0	0	17	161	0	0	130	15.746
107	Cuiaba		0	0	0	0	0	0	61	802	236	3.398
108	Hermosillo		0	0	0	0	0	0	208	779	162	4.894
109	San Salvador		0	0	0	0	56	170	0	0	111	19.895
110	Belém	Belém do Para	0	0	0	12	161	339	0	0	100	23.233
111	La Plata		0	0	0	0	0	0	454	763	201	3.795
112	Iztapalapa	Ixtapalapa	0	0	0	0	7	159	0	0	112	9.883
113	Mexicali		0	0	0	0	0	0	202	737	161	4.575
114	Saltillo		0	0	0	0	0	0	168	736	151	5.176
115	Barcelona		0	0	0	0	0	0	237	689	144	5.140
116	Ciudad de Guatemala	Guatemala la Nueva, Guatemala City	0	0	30	25	77	280	0	0	91	16.785
117	Brasília		0	0	0	0	0	0	0	0	70	12.790
118	Sorocaba		0	0	0	0	0	0	361	712	147	4.845
119	Maracaibo		0	0	0	22	40	248	0	0	89	20.811
120	San Juan		0	0	0	0	34	321	0	0	86	15.634

Figure 53. Table of the 120 largest cities by maximum population, alongside

area/density/population statistics, Latin America.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Cairo; Giza		0	0	0	0	0	0	7.420	25.230	1.680	15.018
2	Qâhirah, Al-	Al-Qâhirah, Cairo, Al-Qahira, El-Qahira, Masr el-Kâhira, Kairo	0	94	360	171	503	2.974	0	0	908	18.380
3	Alexandria		0	0	0	0	0	0	2.547	6.931	439	15.789
4	Luxor		0	0	0	0	0	0	92	6.314	324	19.489
5	Casablanca		0	0	0	0	0	0	1.756	4.578	415	11.031
6	Algiers		0	0	0	0	0	0	1.521	3.316	468	7.086
7	Tunis		0	0	0	0	0	0	698	2.790	488	5.718
8	Iskandarîyah, Al-	Al-Iskandarîyah, El-Iskandarîya, Alexandria	1.000	160	50	5	345	1.237	0	0	535	12.005
9	Rabat		0	0	0	0	0	0	606	2.094	203	10.316
10	Banha		0	0	0	0	0	0	124	1.877	337	5.812
11	El Mansura		0	0	0	0	0	0	413	1.708	198	10.244
12	Dar el Beida	Casablanca, Dar-el-Beida, Ad-Dâr al-Baydâ	0	0	0	0	9	644	0	0	251	11.050
13	Fez		0	0	0	0	0	0	437	1.434	106	13.531
14	Tangier		0	0	0	0	0	0	255	1.300	86	15.119
15	Al Zaqaziq		0	0	0	0	0	0	338	1.296	136	15.342
16	Oran		0	0	0	0	0	0	455	1.261	178	10.030
17	Tripoli		0	0	0	0	0	0	455	1.248	465	3.217
18	El-Djazaïr	Alger, Algiers, El-Jazaïr, El-Djezaïr	0	0	20	78	31	120	0	0	47	83.273
19	Marrakesh		0	0	0	0	0	0	322	1.153	124	9.296
20	Asyut		0	0	0	0	0	0	277	1.153	145	10.582
21	Suhaj		0	0	0	0	0	0	224	1.104	174	6.649
22	El Mahalla El Kubra		0	0	0	0	0	0	385	1.102	70	15.749
23	Jîzah, Al-	Al-Jîzah, Al-Giza, Giza, Gizeh, El-Giza	0	0	0	0	0	6	0	0	182	259.414
24	Tanta		0	0	0	0	0	0	384	942	62	15.193
25	Agadir		0	0	0	0	0	0	0	926	116	7.986
26	Port Said		0	0	0	0	0	0	282	875	57	15.345
27	Badrashayn, Al-	Al-Badrashayn	198	526	690	789	821	838	0	0	47	18.154
28	Meknes		0	0	0	0	0	0	316	748	72	10.386
29	Mit Ghamr		0	0	0	0	0	0	130	745	111	9.479

30	Faiyum		0	0	0	0	0	0	193	741	59	17.911
31	Damietta		0	0	0	0	0	0	177	727	123	6.316
32	Blida		0	0	0	0	0	0	121	703	95	7.403
33	Tarâbulus	Tarâbulus al-Gharb, Tripoli(s), Tripoli di Barbaria, Oea	0	0	16	16	37	124	0	0	87	23.246
34	Beni Suef		0	0	0	0	0	0	98	666	90	9.078
35	Sfax		0	0	0	0	0	0	219	649	182	3.567
36	Rabat-Salé		0	0	0	0	0	302	0	0	67	16.557
37	Djelfa		0	0	0	0	0	0	0	613	40	15.322
38	Oujda		0	0	0	0	0	0	245	609	67	9.096
39	Benghazi		0	0	0	0	0	0	195	600	150	4.210
40	Kenitra		0	0	0	0	0	0	150	589	74	8.656
41	Al Ismailiya		0	0	0	0	0	0	209	585	71	8.250
42	Boumerdes		0	0	0	0	0	0	0	560	161	3.480
43	Suez		0	0	0	0	0	0	124	558	75	7.433
44	Damanhur		0	0	0	0	0	0	162	555	48	11.557
45	Al Minya		0	0	0	0	0	0	120	550	55	10.769
46	Sousse		0	0	0	0	0	0	75	537	124	4.332
47	Tûnis	Toûnis, Tunis, Tunes	0	15	65	95	170	329	0	0	42	22.851
48	Constantine		0	0	0	0	0	0	322	508	93	7.449
49	Al Marsâ	La Marsa	175	50	50	50	50	9	0	0	3	18.250
50	Tetouan		0	0	0	0	0	0	173	482	39	13.030
51	Tahta		0	0	0	0	0	0	63	476	73	9.006
52	Wahrân	Oran, Ouahran	0	0	30	5	87	271	0	0	71	23.643
53	Aswan		0	0	0	0	0	0	158	473	60	7.883
54	Annaba		0	0	0	0	0	0	257	472	80	5.895
55	Rabat	Ar-Ribât, Er Rabât	0	0	46	43	39	117	0	0	32	67.447
56	Shibin Al-Kom		0	0	0	0	0	0	83	469	52	9.017
57	Al Abbasa al Sharqiya		0	0	0	0	0	0	53	434	94	4.830
58	Sanhur		0	0	0	0	0	0	0	415	97	6.971
59	Al Wadi		0	0	0	0	0	0	93	410	107	4.169
60	Nag Hammadi		0	0	0	0	0	0	335	244	70	6.583
61	Faqous		0	0	0	0	0	0	65	388	65	7.543
62	Mit Habib		0	0	0	0	0	0	0	385	124	3.108
63	Kafr Al Sheikh		0	0	0	0	0	0	109	380	37	13.302
64	Batna		0	0	0	0	0	0	86	378	41	9.219
65	Setif		0	0	0	0	0	0	118	366	49	8.113
66	Al-Manshah		0	0	0	0	0	0	0	365	76	4.806
67	Marrakech	Marräkush, Marrakesh	0	0	50	30	88	239	0	0	37	22.555
68	Fès	Fez, Fäs	0	27	130	70	84	204	0	0	31	18.327
69	Al-Asafra		0	0	0	0	0	0	52	357	54	10.446
70	Safi		0	0	0	0	0	0	144	353	39	9.624
71	Shubrâ al-Khaymah	Shubra el-Kheima,	0	0	0	0	0	48	0	0	40	12.813

		Shoubra el-Kheima, Shobra el-Kheima										
72	Balyana		0	0	0	0	0	0	0	347	85	5.096
73	Dusuq		0	0	0	0	0	0	96	344	38	9.208
74	Sidfa; Al Badari		0	0	0	0	0	0	0	344	78	6.352
75	Qacentina	Constantine, Qoussantina, Qustantînah, Cirta	0	0	39	40	52	129	0	0	28	50.000
76	Minya Al-Qamh		0	0	0	0	0	0	0	328	54	8.105
77	Mallawi		0	0	0	0	0	0	69	325	28	12.924
78	Girga		0	0	0	0	0	0	65	323	47	8.842
79	Banha		0	0	0	0	0	0	0	314	70	4.482
80	Misrata		0	0	0	0	0	0	0	311	179	2.710
81	Biskra		0	0	0	0	0	0	66	311	47	6.610
82	Bûr Sa'îd	Port-Said	0	91	125	125	44	193	0	0	7	44.642
83	Suways, Al-	As-Suways, Al-Suways, Suez, As-Suweis, El-Suweis	0	0	0	0	18	130	0	0	42	18.612
84	Kafr Al-Zaiyat		0	0	0	0	0	0	78	303	55	6.980
85	Annaba	Bône, Bona, Annâbah, Hippo	0	0	0	0	36	107	0	0	31	16.850
86	Tlemcen		0	0	0	0	0	0	73	294	60	5.670
87	Al Harafsha		0	0	0	0	0	0	51	292	75	8.590
88	El Oued		0	0	0	0	0	0	0	281	51	5.517
89	Bilbeis		0	0	0	0	0	0	71	281	41	12.006
90	Sers Al Layyan; Manuf		0	0	0	0	0	0	0	281	39	10.310
91	Al-Santa		0	0	0	0	0	0	0	278	51	5.828
92	Samalut		0	0	0	0	0	0	51	278	39	10.918
93	Dairut		0	0	0	0	0	0	53	276	32	8.624
94	Tantâ	Tantah	0	0	0	0	57	150	0	0	27	16.676
95	Mahallah, Al-, al-Kubrâ	Al-Mahallah al-Kubrâ, Mehalla al-Kobra, El-Mahalla el-Koubra	0	0	0	0	36	135	0	0	27	17.383
96	Qena		0	0	0	0	0	0	241	190	37	10.043
97	Meknès	Miknäs, Mequinez	0	0	45	45	54	164	0	0	22	28.907
98	Sidi Bel Abbes		0	0	0	0	0	0	116	265	32	8.541
99	Diyarb Nigm		0	0	0	0	0	0	0	264	59	8.637
100	Hulwân	Helwan, Hilwan, Heluan	0	0	0	0	0	73	0	0	30	11.189
101	Nador		0	0	0	0	0	0	69	262	50	5.242
102	Kolea		0	0	0	0	0	0	0	261	64	4.082
103	Tebessa		0	0	0	0	0	0	65	260	31	8.603

104	Tima		0	0	0	0	0	0	62	255	38	7.516
105	Al-Wasitah		0	0	0	0	0	0	55	254	32	8.496
106	Skikda		0	0	0	0	0	0	65	253	59	4.287
107	El Jadida		0	0	0	0	0	0	87	251	40	7.484
108	Ouargla		0	0	0	0	0	0	0	250	45	5.562
109	Tiaret		0	0	0	0	0	0	64	247	30	8.226
110	Abnud		0	0	0	0	0	0	238	77	55	5.412
111	Hammamet		0	0	0	0	0	0	0	237	80	3.761
112	Laghouat		0	0	0	0	0	0	0	235	25	9.418
113	Mostaganem		0	0	0	0	0	0	61	234	44	5.323
114	Abu Kabir		0	0	0	0	0	0	63	233	28	10.540
115	Banghâzî	Benghazi, Bengasi, Berenice	0	0	0	0	22	68	0	0	26	18.578
116	Beni Mellal		0	0	0	0	0	0	72	230	22	10.780
117	Khouribga		0	0	0	0	0	0	114	227	21	12.078
118	Imbaba	Embabe, Embabeh	0	0	0	0	16	116	0	0	24	14.607
119	Al-Mahmudiya; Fuwah		0	0	0	0	0	0	92	214	27	8.660
120	Bejaia		0	0	0	0	0	0	76	223	50	5.565

Figure 54. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Maghreb and Egypt.

[■] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Istanbul		0	0	0	0	0	0	5.123	14.210	1.269	11.308
2	Tehran		0	0	0	0	0	0	4.152	9.363	825	11.349
3	Riyadh		0	0	0	0	0	0	632	7.970	1.108	7.193
4	Baghdad		0	0	0	0	0	0	2.049	6.892	688	10.017
5	Amman		0	0	0	0	0	0	807	6.425	520	12.356
6	Mashhad		0	0	0	0	0	0	1.283	5.377	474	11.344
7	Jeddah		0	0	0	0	0	0	480	4.842	696	6.957
8	Dubai; Sharjah; Ajman		0	0	0	0	0	0	141	4.565	854	5.346
9	Tehrân	Teheran	0	0	0	27	124	1.043	0	0	1.515	22.347
10	Damascus		0	0	0	0	0	0	1.145	3.772	270	13.969
11	Aleppo		0	0	0	0	0	0	639	3.084	243	15.471
12	Sana'a		0	0	0	0	0	0	154	3.760	218	17.246
13	Kuwait City		0	0	0	0	0	0	768	3.703	490	7.558
14	Ankara		0	0	0	0	0	0	1.259	3.696	357	10.353
15	Karaj		0	0	0	0	0	0	838	3.585	299	11.991
16	Izmir		0	0	0	0	0	0	1.580	2.458	307	9.908
17	Baghdád	Bagdad, Baghdâd	0	1.100	90	79	203	353	0	0	308	37.253
18	Dammam; Al		0	0	0	0	0	0	316	2.635	508	5.187

	Khubar											
19	Tel Avi Saba		0	0	0	0	0	0	600	2.628	333	7.893
20	Bursa		0	0	0	0	0	0	352	2.366	216	11.632
21	Basra		0	0	0	0	0	0	352	2.132	188	11.338
22	Doha; Al Rayyan		0	0	0	0	0	0	74	1.980	392	5.085
23	Baku; Khyrdalan		0	0	0	0	0	0	1.250	1.973	340	6.609
24	Ahwaz		0	0	0	0	0	0	475	1.908	245	7.842
25	Mecca		0	0	0	0	0	0	319	1.876	233	8.053
26	Beirut; Jounieh		0	0	0	0	0	0	1.816	1.538	202	12.420
27	Isfahan		0	0	0	0	0	0	389	1.818	328	5.541
28	Gaziantep		0	0	0	0	0	0	210	1.681	134	12.547
29	Mosul		0	0	0	0	0	0	370	1.678	153	13.668
30	Medina		0	0	0	0	0	0	108	1.565	262	5.974
31	Erbil		0	0	0	0	0	0	403	1.514	226	9.715
32	Ankara	Angora, Ancyra, Engüri, Engour, Engürisü	34	34	34	36	38	367	0	0	178	23.260
33	Antalya		0	0	0	0	0	0	0	1.373	258	5.320
34	Al-Najaf		0	0	0	0	0	0	174	1.362	130	10.476
35	Manama		0	0	0	0	0	0	106	1.362	301	4.988
36	Tabriz		0	0	0	0	0	0	378	1.319	164	8.041
37	Ta'izz		0	0	0	0	0	0	233	1.285	72	17.844
38	Yerevan		0	0	0	0	0	0	973	1.028	194	6.607
39	Kirkuk		0	0	0	0	0	0	119	1.239	117	10.587
40	Sincan; Etimesgut		0	0	0	0	0	0	121	1.169	87	13.442
41	Baki	Baku, Baky	0	0	0	0	140	537	0	0	164	15.522
42	Duhok		0	0	0	0	0	0	0	1.143	78	14.652
43	Shiraz		0	0	0	0	0	0	519	707	188	7.236
44	Istanbul	Byzantium, Constantinopel, Stambul	109	330	204	560	862	391	0	0	73	128.506
45	Tbilisi		0	0	0	0	0	0	884	988	152	7.970
46	Karbala		0	0	0	0	0	0	106	1.079	106	10.176
47	Gaza; Jabalia		0	0	0	0	0	0	206	1.061	79	13.425
48	Maale Adumim; Ramallah; Bethlehem; Albireh		0	0	0	0	0	0	62	1.055	177	5.958
49	Al Hillah		0	0	0	0	0	0	133	1.031	214	4.968
50	T'bilisi	Tiflis	0	0	100	24	176	594	0	0	137	17.087
51	Jerusalem		0	0	0	0	0	0	301	1.023	79	12.948
52	Sarvestan		0	0	0	0	0	0	234	1.018	16	63.654
53	Konya		0	0	0	0	0	0	0	1.017	240	4.287
54	Al Ain		0	0	0	0	0	0	0	672	221	4.547
55	Dimashq	Damascus, Ash Shâm, Esh-Shâm, Dima`sq, Damas	35	300	65	92	152	369	0	0	94	18.996

56	Zakho		0	0	0	0	0	0	0	971	65	15.736
57	Kharameh		0	0	0	0	0	0	177	968	24	40.335
58	Homs		0	0	0	0	0	0	185	914	107	10.303
59	Kayseri		0	0	0	0	0	0	120	893	160	5.902
60	Ad Diwaniyah		0	0	0	0	0	0	192	884	66	13.397
61	Erevan	Yerevan, Jerewan, Eriwan	0	0	0	15	30	321	0	0	124	24.464
62	Sulaymaniyah		0	0	0	0	0	0	252	870	112	9.678
63	Al Ahsa		0	0	0	0	0	0	245	797	178	4.805
64	Kavar		0	0	0	0	0	0	151	847	26	32.558
65	Qom		0	0	0	0	0	0	102	844	101	8.357
66	Ibb		0	0	0	0	0	0	73	844	59	14.298
67	Nasiriyah		0	0	0	0	0	0	138	833	69	12.067
68	Kermanshah		0	0	0	0	0	0	244	830	113	7.346
69	Basrah	Basra, Bassora(h), Al Basrah, Bussora(h), Busra(h), al-Basrah	0	100	60	65	41	120	0	0	4	227.350
70	Hodeidah		0	0	0	0	0	0	136	777	59	13.264
71	Al Mushahidah		0	0	0	0	0	0	217	773	237	3.260
72	Adana		0	0	0	0	0	0	473	523	128	8.456
73	?anl?urfa		0	0	0	0	0	0	119	762	68	11.237
74	Abu Dhabi		0	0	0	0	0	0	0	509	108	7.045
75	Kocaeli		0	0	0	0	0	0	162	747	150	4.977
76	Mersin		0	0	0	0	0	0	166	655	114	6.463
77	Muscat; Muttrah		0	0	0	0	0	0	0	735	148	4.963
78	Bayrût	Beirut, Beyrouth, Berytus	0	0	0	0	120	306	0	0	63	20.681
79	Halab	Aleppo, Alep, Haleb, Beroea	55	40	70	73	161	384	0	0	69	21.816
80	Riyâdh	Ar-Riyâdh, Riaad, Riad, Er-Riad	0	0	0	0	30	85	0	0	94	18.420
81	Irbid		0	0	0	0	0	0	96	705	80	8.852
82	Bi'r Rubak		0	0	0	0	0	0	132	686	53	12.944
83	Urmia		0	0	0	0	0	0	162	685	100	6.864
84	Amarah		0	0	0	0	0	0	123	659	66	9.978
85	Diyarbakir		0	0	0	0	0	0	125	649	75	9.413
86	Samsun		0	0	0	0	0	0	160	644	77	8.358
87	Mosul	Al Mawsil, al-Mawsil	120	46	45	45	65	147	0	0	65	21.248
88	Sumgayit		0	0	0	0	0	0	125	637	145	4.895
89	Van		0	0	0	0	0	0	87	624	64	9.744
90	Mashhad	Meshed, Ma`shad	0	0	0	20	68	213	0	0	81	18.123
91	Eskisehir		0	0	0	0	0	0	198	608	70	8.692
92	Seeb		0	0	0	0	0	0	0	604	137	4.412
93	Tabuk		0	0	0	0	0	0	0	587	86	6.820
94	Khamis Mushayt		0	0	0	0	0	0	0	581	97	5.988
95	Latakia		0	0	0	0	0	0	136	573	60	9.636

96	Esfahân	Isfahan, Ispahan, Aspanada	0	45	50	52	81	212	0	0	58	17.409
97	Kahramanmara?	0	0	0	0	0	0	179	554	62	8.942	12.255
98	Jiddah	Jeddah, Jedda, Djeddah, Juddah, Gedda, Gidda	0	0	0	20	30	95	0	0	86	16.982
99	Rasht		0	0	0	0	0	0	189	554	73	7.691
100	At Ta'if		0	0	0	0	0	0	228	490	99	5.566
101	Khan Yunis		0	0	0	0	0	0	66	551	101	5.455
102	Hatay		0	0	0	0	0	0	72	549	77	7.126
103	Tabrîz	Tebriz, Tauris	0	20	250	75	185	272	0	0	46	44.804
104	Jafar Muhammad Ali		0	0	0	0	0	0	150	545	73	7.466
105	Zahedan		0	0	0	0	0	0	0	542	66	8.207
106	Denizli		0	0	0	0	0	0	154	502	89	7.542
107	Ammân	Rabbah Ammon, Rabbath Amon, Philadelphia	0	0	0	0	0	88	0	0	59	12.834
108	Kerman		0	0	0	0	0	0	61	514	108	4.761
109	Malatya		0	0	0	0	0	0	136	510	49	10.417
110	Hamedan		0	0	0	0	0	0	121	504	76	6.648
111	Ctesiphon	Taq-I Kisra	400	0	0	0	0	0	0	0	N/A	N/A
112	`Adan		0	0	0	0	0	0	0	497	42	11.842
113	Izmir	Smyrna	108	108	108	127	198	232	0	0	31	46.539
114	Yazd		0	0	0	0	0	0	0	488	118	4.133
115	Al-Kut		0	0	0	0	0	0	87	487	59	8.255
116	Tripoli		0	0	0	0	0	0	54	309	33	14.603
117	Batman		0	0	0	0	0	0	0	482	41	11.752
118	Ramadi		0	0	0	0	0	0	88	464	71	6.531
119	Adana	Seyhan, Batnae	0	0	0	30	45	144	0	0	2	275.422
120	Haifa		0	0	0	0	0	0	173	450	122	3.756

Figure 55. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Middle East.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	New York	New York City	0	0	0	88	3.864	8.846	0	0	2.746	14.120
2	New York		0	0	0	0	0	0	11.738	14.198	3.031	4.684
3	Los Angeles		0	0	0	0	0	0	8.257	13.474	4.498	2.996
4	Chicago		0	0	0	0	1.671	3.889	0	0	1.307	8.515
5	Miami		0	0	0	0	0	0	1.843	5.733	2.784	2.059
6	Toronto		0	0	0	0	0	0	2.173	5.566	1.620	3.436
7	Chicago		0	0	0	0	0	0	4.477	5.319	2.046	2.683

8	Philadelphia		0	0	0	46	1.332	2.268	0	0	755	14.714
9	Bay Area		0	0	0	0	0	0	3.194	4.718	1.614	2.923
10	Houston		0	0	0	0	0	0	344	4.301	1.859	2.314
11	San Francisco		0	0	0	0	366	1.080	0	0	600	11.288
12	Washington D.C.		0	0	0	0	0	0	1.046	3.472	1.301	2.914
13	Boston		0	0	0	29	651	1.764	0	0	468	17.990
14	Montreal		0	0	0	0	0	0	2.087	3.222	1.020	3.159
15	Washington D.C.		0	0	0	5	273	772	0	0	631	10.442
16	Phoenix		0	0	0	0	0	0	291	2.609	1.304	2.001
17	Dallas		0	0	0	0	0	0	595	2.577	1.237	2.084
18	Denver		0	0	0	0	0	0	535	2.425	1.194	2.031
19	Las Vegas		0	0	0	0	0	0	0	2.372	851	2.787
20	Detroit		0	0	0	0	0	0	2.244	1.919	1.251	1.932
21	Philadelphia		0	0	0	0	0	0	1.855	2.286	661	3.574
22	Vancouver		0	0	0	0	0	0	739	2.198	649	3.387
23	Seattle		0	0	0	0	0	0	372	2.100	1.123	1.870
24	Saint Louis	St. Louis	0	15	15	15	586	1.006	0	0	300	18.250
25	San Diego		0	0	0	0	0	0	475	1.977	778	2.541
26	Mont-Royal		0	0	0	0	263	15	0	0	93	20.130
27	Portland		0	0	0	0	0	0	312	1.840	877	2.098
28	Pittsburgh		0	0	0	2	304	882	0	0	389	8.909
29	Phoenix		0	0	0	0	0	0	143	1.725	867	1.989
30	Sacramento		0	0	0	0	0	0	221	1.697	759	2.236
31	Boston		0	0	0	0	0	0	1.142	1.669	508	3.306
32	Detroit	Fort Pontchartrain du Détroit	0	0	0	0	284	1.607	0	0	342	6.208
33	Baltimore		0	0	0	32	492	932	0	0	229	11.612
34	Austin		0	0	0	0	0	0	0	1.580	628	2.516
35	Los Angeles	El Pueblo de la Reina de los Angeles, LA	0	0	0	0	184	1.388	0	0	278	7.884
36	Calgary		0	0	0	0	0	0	68	1.525	533	2.861
37	San Antonio		0	0	0	0	0	0	74	1.514	640	2.365
38	Houston		0	0	0	0	55	691	0	0	279	7.343
39	Cincinnati	Losantiville	0	0	10	10	345	603	0	0	192	18.250
40	San Diego		0	0	0	0	25	327	0	0	269	8.006
41	Orlando		0	0	0	0	0	0	0	1.232	750	1.642
42	Minneapolis-St. Paul		0	0	0	0	0	0	588	1.218	611	2.015
43	Cleveland		0	0	0	0	0	0	1.196	723	542	2.207
44	Edmonton		0	0	0	0	0	0	303	1.144	435	2.631
45	Baltimore		0	0	0	0	0	0	702	1.127	449	2.545
46	Salt Lake City		0	0	0	0	0	0	202	1.109	527	2.104
47	Vancouver		0	0	0	0	25	339	0	0	131	22.784
48	New Orleans		0	0	0	9	297	579	0	0	163	16.055
49	Montréal		0	0	0	22	0	712	0	0	1	12.518.216
50	Saint Petersburg		0	0	0	0	0	0	470	943	705	1.337
51	Cleveland		0	0	0	0	394	923	0	0	177	5.417
52	New Orleans		0	0	0	0	0	0	795	821	417	2.302

53	Hartford	Newtown	0	0	0	3	84	191	0	0	172	14.531
54	San Antonio	San Antonio da Bexar	0	0	0	0	68	454	0	0	151	7.846
55	Columbus		0	0	0	0	0	0	146	875	442	1.980
56	Dallas		0	0	0	0	59	508	0	0	114	8.470
57	Milwaukee		0	0	0	0	0	0	701	834	391	2.604
58	St. Louis		0	0	0	0	0	0	532	797	439	2.063
59	Winnipeg		0	0	0	0	0	0	398	753	287	2.623
60	Fresno		0	0	0	0	0	0	154	747	334	2.237
61	Milwaukee		0	0	0	0	279	663	0	0	105	8.011
62	Indianapolis		0	0	0	0	192	431	0	0	114	7.763
63	Toronto		0	0	0	0	205	568	0	0	113	15.114
64	Tampa		0	0	0	0	0	0	124	709	431	1.645
65	Arlington; Grand Prairie		0	0	0	0	0	0	0	699	361	1.936
66	Albany		0	0	0	7	96	160	0	0	97	12.298
67	Bakersfield		0	0	0	0	0	0	103	644	298	2.161
68	El Paso		0	0	0	0	0	0	127	639	289	2.211
69	Pittsburgh		0	0	0	0	0	0	638	491	279	2.288
70	Oklahoma City		0	0	0	0	22	266	0	0	89	9.373
71	Memphis		0	0	0	0	108	407	0	0	85	12.581
72	Honolulu		0	0	0	0	41	241	0	0	81	13.095
73	Norfolk		0	0	0	0	0	0	204	622	383	1.687
74	Quebec City		0	0	0	0	0	0	255	619	275	2.251
75	Ottawa		0	0	0	0	0	0	295	605	208	2.907
76	Atlanta		0	0	0	0	0	0	0	603	292	2.064
77	Buffalo		0	0	0	0	341	565	0	0	94	6.436
78	Winnipeg		0	0	0	0	41	219	0	0	70	14.302
79	Toledo	Ohio	0	0	0	0	131	392	0	0	44	14.335
80	Seattle		0	0	0	0	144	486	0	0	68	9.467
81	Columbus		0	0	0	0	126	404	0	0	89	9.863
82	Phoenix		0	0	0	0	7	238	0	0	81	10.241
83	Buffalo		0	0	0	0	0	0	544	440	240	2.267
84	Honolulu		0	0	0	0	0	0	242	542	179	3.062
85	Provo; Lehi		0	0	0	0	0	0	0	535	183	2.921
86	North York		0	0	0	0	0	0	0	0	43	15.563
87	Jacksonville		0	0	0	0	30	183	0	0	107	9.470
88	North Richland Hills		0	0	0	0	0	0	0	524	268	1.954
89	Edmonton		0	0	0	0	0	202	0	0	71	13.995
90	Kansas City		0	0	0	0	152	399	0	0	64	14.011
91	Louisville		0	0	0	0	0	0	183	506	352	1.580
92	Riverside		0	0	0	0	0	0	0	496	198	2.504
93	Oklahoma City		0	0	0	0	0	0	168	492	313	1.572
94	Atlanta	Terminus, Marthasville	0	0	0	0	91	388	0	0	72	8.432
95	Minneapolis		0	0	0	0	225	481	0	0	56	8.579
96	Tucson		0	0	0	0	0	0	137	466	237	1.967
97	Albuquerque		0	0	0	0	0	0	148	456	214	2.132
98	Escondido		0	0	0	0	0	0	0	450	193	2.329
99	Nashville	Nashborough	0	0	0	0	79	166	0	0	101	8.743
100	Hamilton		0	0	0	0	0	0	268	446	173	2.580

101	Colorado Springs		0	0	0	0	0	0	0	446	229	1.946
102	Calgary		0	0	0	0	0	162	0	0	56	13.064
103	Providence		0	0	0	0	0	0	339	437	179	2.470
104	Tulsa		0	0	0	0	0	0	88	434	277	1.567
105	Scranton		0	0	0	0	128	432	0	0	30	20.387
106	Newark		0	0	0	0	271	425	0	0	49	8.591
107	Denver		0	0	0	0	131	381	0	0	51	10.960
108	Cincinnati		0	0	0	0	0	0	325	414	224	1.955
109	Indianapolis		0	0	0	0	0	0	113	418	254	1.646
110	Stockton		0	0	0	0	0	0	107	409	162	2.522
111	Memphis		0	0	0	0	0	0	0	402	274	1.497
112	Kansas City		0	0	0	0	0	0	103	399	244	1.634
113	The Woodlands		0	0	0	0	0	0	0	398	130	3.062
114	Fort Worth		0	0	0	0	45	285	0	0	46	8.852
115	Kitchener		0	0	0	0	0	0	85	388	147	2.640
116	Louisville		0	0	0	1	204	360	0	0	68	7.292
117	Portland		0	0	0	0	133	349	0	0	49	7.919
118	Jacksonville		0	0	0	0	0	0	0	380	291	1.305
119	Toledo		0	0	0	0	136	307	0	0	57	7.511
120	Mission Viejo		0	0	0	0	0	0	72	370	184	2.225

Figure 56. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Northern America.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Sydney		0	0	0	0	0	0	2.254	4.375	1.378	3.175
2	Melbourne		0	0	0	0	0	0	1.905	4.011	1.611	2.490
3	Sydney		0	0	0	2	457	960	0	0	407	10.631
4	Auckland		0	0	0	0	0	0	614	1.624	638	2.545
5	Brisbane		0	0	0	0	0	0	347	1.359	701	1.939
6	Perth		0	0	0	0	0	0	521	1.357	784	1.731
7	Melbourne		0	0	0	0	469	709	0	0	112	97.651
8	Adelaide		0	0	0	0	0	0	557	938	493	1.903
9	Brisbane		0	0	0	0	108	413	0	0	93	27.943
10	Adelaide		0	0	0	0	160	395	0	0	38	88.798
11	Port Louis		0	0	0	0	0	0	420	557	143	4.238
12	Point Cook		0	0	0	0	0	0	0	501	126	3.979
13	Perth		0	0	0	0	6	198	0	0	1	5.083.079
14	Newcastle		0	0	0	0	52	149	0	0	31	69.737
15	Gold Coast		0	0	0	0	0	0	0	279	208	1.662
16	Christchurch		0	0	0	0	52	178	0	0	23	48.996
17	Christchurch		0	0	0	0	0	0	197	278	124	2.245
18	Wellington		0	0	0	0	47	189	0	0	31	18.401
19	Suva		0	0	0	0	0	0	87	243	78	3.155
20	Auckland		0	0	0	0	34	41	0	0	19	93.997
21	Newcastle		0	0	0	0	0	0	53	205	126	1.641

22	Wollongong	0	0	0	0	4	75	0	0	28	15.555
23	Saint-Denis	0	0	0	0	0	0	102	190	60	5.351
24	North Lakes	0	0	0	0	0	0	0	180	63	2.854
25	Hamilton	0	0	0	0	0	0	0	176	80	2.203
26	Geelong	0	0	0	0	0	0	71	166	104	1.594
27	Bankstown	0	0	0	0	3	95	0	0	23	12.860
28	Canberra	0	0	0	0	0	21	0	0	25	22.824
29	Wellington	0	0	0	0	0	0	81	154	64	2.408
30	Nouméa	0	0	0	0	0	0	0	153	76	2.490
31	Wollongong	0	0	0	0	0	0	0	149	108	1.380
32	Honiara	0	0	0	0	0	0	0	137	39	3.518
33	Hobart	0	0	0	0	37	85	0	0	11	18.689
34	Canterbury	0	0	0	0	0	98	0	0	9	14.312
35	Mamoudzou	0	0	0	0	0	0	0	128	26	4.904
36	Tauranga	0	0	0	0	0	0	0	123	105	1.167
37	Langwarrin	0	0	0	0	0	0	0	122	76	1.608
38	Randwick	0	0	0	0	0	97	0	0	8	15.093
39	Geelong	0	0	0	0	25	56	0	0	9	35.107
40	Fairfield	0	0	0	0	0	56	0	0	12	15.045
41	Parramatta	0	0	0	0	12	64	0	0	11	18.017
42	Suva	0	0	0	0	1	36	0	0	0	1.196
43	Papeete	0	0	0	0	0	0	0	110	50	2.225
44	Moorabbin	0	0	0	0	0	0	0	0	6	16.950
45	Thuringowa Central	0	0	0	0	0	0	0	108	73	1.474
46	Butler	0	0	0	0	0	0	0	107	38	2.806
47	Le Port	0	0	0	0	0	0	0	106	52	2.044
48	Campbelltown	0	0	0	0	0	0	93	104	51	2.141
49	Huntfield Heights	0	0	0	0	0	0	0	104	77	1.357
50	Saint-Denis	0	0	0	0	36	36	0	0	7	28.839
51	Manukau	0	0	0	0	0	0	0	0	7	16.172
52	Broadmeadows	0	0	0	0	0	0	0	0	6	16.553
53	Camberwell	0	0	0	0	9	76	0	0	11	12.443
54	Sunshine Coast	0	0	0	0	0	0	0	97	64	1.512
55	Waitakere	0	0	0	0	0	35	0	0	11	10.717
56	Penrith	0	0	0	0	0	0	0	93	43	2.174
57	Toowoomba	0	0	0	0	0	0	0	93	55	1.690
58	Marrickville	0	0	0	0	0	62	0	0	6	17.162
59	Preston	0	0	0	0	0	0	0	0	5	17.069
60	Nunawading	0	0	0	0	0	0	0	0	6	16.256
61	Hamilton	0	0	0	0	2	35	0	0	9	40.080
62	Rockingham	0	0	0	0	0	0	0	89	53	1.679
63	Melton	0	0	0	0	0	0	0	89	27	3.284
64	Ryde	0	0	0	0	0	55	0	0	7	14.561
65	Dunedin	0	0	0	0	24	75	0	0	6	33.219
66	Mandurah	0	0	0	0	0	0	0	85	81	1.050
67	Liverpool	0	0	0	0	0	22	0	0	10	17.145
68	Dunedin	0	0	0	0	0	0	53	84	46	1.828
69	Rockdale	0	0	0	0	0	61	0	0	6	14.663

70	Sunshine		0	0	0	0	0	0	0	0	5	16.706
71	Devonport	> see also: Burnie-Devonport	0	0	0	0	4	10	0	0	107	17.289
72	Caulfield		0	0	0	0	0	71	0	0	5	15.585
73	Enfield		0	0	0	0	0	0	0	0	5	17.147
74	Beau Bassin-Rose Hill		0	0	0	0	0	27	0	0	7	16.413
75	Southport	Gold Coast, Tweed Heads + Coolangatta, GoldCoast-Tweed	0	0	0	0	0	13	0	0	10	11.881
76	Holroyd		0	0	0	0	0	43	0	0	7	16.142
77	Townsville		0	0	0	0	11	37	0	0	7	17.535
78	Penrith		0	0	0	0	7	17	0	0	8	13.874
79	Woodville		0	0	0	0	0	0	0	0	4	17.147
80	Palmerston North		0	0	0	0	0	0	0	75	37	2.031
81	Ballarat		0	0	0	0	49	44	0	0	5	32.795
82	Port Vila		0	0	0	0	0	0	0	73	34	2.430
83	Lower Hutt		0	0	0	0	0	0	0	71	45	1.570
84	Cleveland		0	0	0	0	0	0	0	71	49	1.440
85	Doncaster	Doncaster and Templestowe	0	0	0	0	0	0	0	0	5	14.042
86	Hobart		0	0	0	0	0	0	60	70	46	1.648
87	Leichhardt		0	0	0	0	0	45	0	0	5	17.563
88	Pakenham		0	0	0	0	0	0	0	68	23	2.956
89	Ballarat		0	0	0	0	0	0	0	68	47	1.494
90	Coburg		0	0	0	0	0	54	0	0	5	13.791
91	Marion		0	0	0	0	0	0	0	0	4	17.114
92	Upper Coomera		0	0	0	0	0	0	0	67	28	2.403
93	Heidelberg		0	0	0	0	0	0	0	0	4	16.924
94	Port Louis		0	0	0	0	56	16	0	0	5	82.575
95	Le Tampon		0	0	0	0	0	0	0	66	24	2.800
96	Knox		0	0	0	0	0	0	0	0	4	15.864
97	Helensvale		0	0	0	0	0	0	0	66	27	2.439
98	Frankston		0	0	0	0	0	0	0	0	4	16.321
99	Salisbury		0	0	0	0	0	0	0	0	6	11.168
100	Springvale		0	0	0	0	0	0	0	0	4	15.276
101	Toowomba		0	0	0	0	19	38	0	0	5	23.548
102	Keilor		0	0	0	0	0	0	0	0	4	16.013
103	Ipswich		0	0	0	0	9	32	0	0	6	18.228
104	Saint-André		0	0	0	0	0	0	0	61	24	2.526
105	Saint Kilda		0	0	0	0	0	53	0	0	4	16.329
106	Caloundra		0	0	0	0	0	0	0	60	35	1.716
107	Apia		0	0	0	0	0	0	0	60	35	1.715
108	Elizabeth North		0	0	0	0	0	0	0	59	28	2.111
109	Northcote		0	0	0	0	0	50	0	0	4	15.656
110	Footscray		0	0	0	0	0	53	0	0	4	15.828
111	Wanneroo		0	0	0	0	0	0	0	0	7	17.367
112	Essendon		0	0	0	0	0	52	0	0	4	16.002
113	Cairns		0	0	0	0	0	0	0	58	37	1.557

114	Mount Annan		0	0	0	0	0	0	0	57	23	2.494
115	Woollahra		0	0	0	0	0	35	0	0	4	16.530
116	Oakleigh		0	0	0	0	0	0	0	0	3	16.854
117	Prahran		0	0	0	0	0	53	0	0	3	17.575
118	Ipswich		0	0	0	0	0	0	0	56	36	1.555
119	Gosford		0	0	0	0	0	0	0	0	6	15.052
120	North Canberra		0	0	0	0	0	0	0	55	21	2.641

Figure 57. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Oceania.

[ ] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Jakarta		0	0	0	0	0	0	11.548	40.545	4.614	8.787
2	Quezon City; Manila		0	0	0	0	0	0	8.457	25.921	2.555	10.145
3	Bangkok		0	0	0	0	0	0	3.699	19.048	2.697	7.063
4	Ho Chi Minh City		0	0	0	0	0	0	2.409	14.558	1.487	9.790
5	Bandung		0	0	0	0	0	0	3.459	8.691	988	8.797
6	Kuala Lumpur		0	0	0	0	0	0	521	8.413	1.340	6.279
7	Surabaya		0	0	0	0	0	0	3.609	6.857	1.304	5.259
8	Yangon		0	0	0	0	0	0	1.965	6.191	545	11.360
9	Singapore		0	0	0	0	0	0	1.973	5.118	438	12.015
10	Hanoi		0	0	0	0	0	0	1.508	4.966	925	7.579
11	Medan; Binjai		0	0	0	0	0	0	1.688	4.351	607	7.167
12	Jakarta	Djakarta, Batavia, Jacatra	0	0	0	55	46	1.784	0	0	152	135.653
13	Krung Thep	Bangkok	0	0	0	45	541	778	0	0	331	42.896
14	Lewe		0	0	0	0	0	0	3.735	60	173	26.306
15	Thành Phô Hô' Chí Minh	Ho Chi Minh City, Saigon, Gia Dinh	0	0	0	0	101	1.131	0	0	239	54.796
16	Semarang		0	0	0	0	0	0	1.605	3.274	603	5.430
17	Cebu City		0	0	0	0	0	0	563	3.192	416	7.672
18	Manila	Manilla	0	0	0	77	207	955	0	0	295	28.845
19	Yangôn	Rangoon	0	0	0	30	229	659	0	0	516	15.062
20	Tasikmalaya		0	0	0	0	0	0	1.083	2.923	546	5.417
21	Yogyakarta		0	0	0	0	0	0	1.735	2.743	678	4.942
22	Phnom Penh; Ta Khmao		0	0	0	0	0	0	74	2.419	358	8.671
23	Makassar		0	0	0	0	0	0	806	2.242	343	6.577
24	Palembang		0	0	0	0	0	0	1.088	2.203	245	8.992
25	Singapore	Singapur, Singapura, Xinjiapo	0	0	0	0	190	882	0	0	232	16.638
26	Denpasar		0	0	0	0	0	0	297	2.006	388	5.170

27	Pyinmana		0	0	0	0	0	0	1.914	557	171	18.053
28	Malang; Batu		0	0	0	0	0	0	1.175	1.888	330	5.792
29	Mandalay		0	0	0	0	0	0	572	1.849	205	9.022
30	Johor Bahr		0	0	0	0	0	0	133	1.703	418	4.075
31	Can Tho		0	0	0	0	0	0	72	1.653	329	6.502
32	Davao City		0	0	0	0	0	0	209	1.651	227	7.274
33	Slawi		0	0	0	0	0	0	1.158	1.482	405	4.556
34	Cirebon		0	0	0	0	0	0	765	1.634	267	6.121
35	Surabaya	Soerabaja	0	0	0	50	146	822	0	0	171	51.528
36	Surakarta; Karanganyar; Boyolali		0	0	0	0	0	0	1.311	1.497	394	4.354
37	San Fernando		0	0	0	0	0	0	214	1.513	308	4.912
38	Tarogong		0	0	0	0	0	0	555	1.473	310	6.762
39	Purwokerto; Purbalingga		0	0	0	0	0	0	1.136	1.273	328	6.567
40	Batam City		0	0	0	0	0	0	0	1.412	186	7.590
41	Ha nôi	Hanoi, Dong Kinh, Tong King, Kescho	0	0	45	60	98	267	0	0	91	90.925
42	Pekalongan		0	0	0	0	0	0	976	1.280	307	5.335
43	Bandar Lampung		0	0	0	0	0	0	143	1.258	176	7.147
44	Pekanbaru		0	0	0	0	0	0	94	1.226	234	5.239
45	Samarinda		0	0	0	0	0	0	182	1.225	157	7.805
46	Padang		0	0	0	0	0	0	367	1.211	216	5.606
47	Da Nang		0	0	0	0	0	0	218	1.179	225	5.239
48	Bandung	Bandoeng	0	0	0	0	101	658	0	0	102	52.207
49	Hai Phong		0	0	0	0	0	0	575	922	244	9.121
50	Mataram		0	0	0	0	0	0	203	1.010	195	5.178
51	Dagupan		0	0	0	0	0	0	0	973	359	2.711
52	Sembawang		0	0	0	0	0	0	207	960	66	14.550
53	Cagayan de Oro		0	0	0	0	0	0	120	950	127	7.481
54	Jambi		0	0	0	0	0	0	268	946	134	7.060
55	Banjarmasin		0	0	0	0	0	0	466	925	113	8.182
56	Hãi Phong	Haiphong, Haifong	0	0	0	0	0	136	0	0	98	27.210
57	Ciledug	Tjiledoeg, Chiledug	0	0	0	0	0	428	0	0	91	11.940
58	Quezon City		0	0	0	0	0	156	0	0	93	13.478
59	Ipoh		0	0	0	0	0	0	216	862	227	3.797
60	Pontianak		0	0	0	0	0	0	266	839	158	5.472
61	Kota Kinabalu		0	0	0	0	0	0	59	811	171	4.742
62	Medan		0	0	0	0	11	233	0	0	145	11.713
63	Cilacap		0	0	0	0	0	0	733	509	102	11.104
64	Lipa		0	0	0	0	0	0	0	768	210	3.924
65	Semarang	Samarang	0	0	0	20	88	363	0	0	100	29.839
66	George Town		0	0	0	0	0	0	297	757	134	5.647
67	Tulungagung		0	0	0	0	0	0	371	674	254	4.755
68	Iloilo City		0	0	0	0	0	0	260	729	170	5.025

69	Jepara		0	0	0	0	0	0	434	682	171	5.558
70	Balikpapan		0	0	0	0	0	0	177	703	116	6.056
71	Chiang Mai		0	0	0	0	0	0	0	692	225	3.077
72	Bacolod		0	0	0	0	0	0	237	691	126	5.482
73	Cilegon		0	0	0	0	0	0	101	687	188	3.652
74	Kudus		0	0	0	0	0	0	348	639	164	6.694
75	Kuningan		0	0	0	0	0	0	276	657	179	3.673
76	Palembang		0	0	0	25	56	259	0	0	75	23.769
77	Cianjur	Tjiandjur	0	0	0	0	0	48	0	0	84	14.444
78	Thon Buri		0	0	0	0	0	185	0	0	53	13.853
79	Kuala Lumpur	D.B. Kuala Lumpur	0	0	0	0	47	218	0	0	59	30.974
80	Baguio		0	0	0	0	0	0	105	599	84	7.133
81	Pare		0	0	0	0	0	60	0	0	78	14.077
82	Cipanas		0	0	0	0	0	0	433	535	65	9.277
83	Zamboanga City		0	0	0	0	0	0	127	592	103	5.982
84	Kuching		0	0	0	0	0	0	170	588	131	4.488
85	Cilacap	Tjilatjap, Chilachap, Chilatjap	0	0	0	0	0	46	0	0	87	18.243
86	Long Xuyen		0	0	0	0	0	0	184	551	186	26.337
87	Jember		0	0	0	0	0	0	560	506	96	8.357
88	Ambon		0	0	0	0	0	0	87	559	74	7.558
89	Malacca City		0	0	0	0	0	0	0	544	204	2.832
90	Selong		0	0	0	0	0	0	154	530	145	5.697
91	Kupang		0	0	0	0	0	0	172	530	119	4.702
92	Indramayu		0	0	0	0	0	24	0	0	68	17.094
93	Ujungpandang	Makasar	0	0	0	0	21	280	0	0	66	16.649
94	Klaten		0	0	0	0	0	26	0	0	72	14.620
95	Viet Tri		0	0	0	0	0	0	338	105	106	12.511
96	Jember	Djember	0	0	40	40	40	80	0	0	62	18.250
97	Jolo		0	0	0	0	0	0	508	63	26	22.672
98	Balung		0	0	0	0	0	0	188	468	156	5.218
99	Gorontalo		0	0	0	0	0	0	179	504	93	5.697
100	Bukit Mertajam		0	0	0	0	0	0	169	498	164	3.035
101	Purwakarta		0	0	0	0	0	0	162	497	104	5.413
102	Kebumen		0	0	0	0	0	44	0	0	67	13.730
103	Kediri		0	0	0	0	0	0	358	490	129	4.295
104	Kebumen		0	0	0	0	0	0	479	300	84	9.766
105	My Tho		0	0	0	0	0	0	146	462	146	9.760
106	Dà Nãng	Tourane, Turan, Danang	0	0	0	0	0	66	0	0	75	16.004
107	Manado		0	0	0	0	0	0	192	483	94	6.192
108	Jombang		0	0	0	0	0	0	253	464	130	5.884
109	Vung Tau		0	0	0	0	0	0	66	477	99	4.816
110	General Santos		0	0	0	0	0	0	72	470	103	4.590
111	Pematang		0	0	0	0	0	0	366	448	76	9.381

#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
	Siantar											
112	Phuket		0	0	0	0	0	0	0	463	124	3.781
113	Phnom Penh	Phnum Penh, Panompeng	0	70	70	70	41	151	0	0	32	66.536
114	Surakarta	Solo	0	0	0	92	125	339	0	0	36	21.081
115	Nha Trang		0	0	0	0	0	0	196	444	99	6.974
116	Bekasi		0	0	0	0	0	0	0	0	51	9.869
117	Blitar		0	0	0	0	0	0	259	413	166	3.242
118	Port Moresby		0	0	0	0	0	0	65	442	72	6.141
119	Hat Yai		0	0	0	0	0	0	0	437	81	5.428
120	Tay Ninh		0	0	0	0	0	0	0	437	103	4.240

Figure 58. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Southeast Asia.

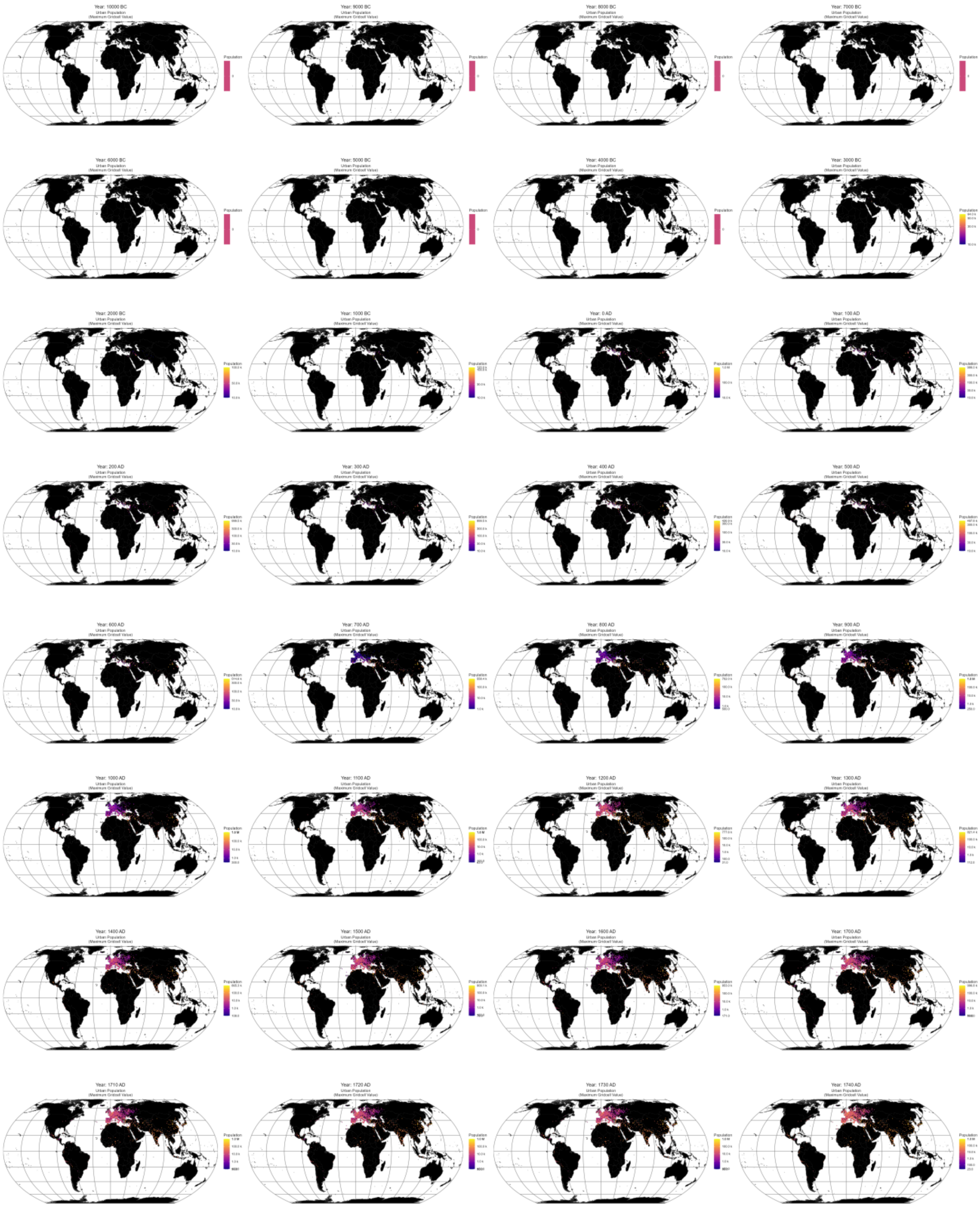
[■] GHSL / [ ] Stadestér Base. Population figures are given in thousands.

	Name		Population								Max. (km^2)	
#	Current	Hist.	0	1000	1500	1800	1900	1950	1975	2025	Area	Density
1	Kinshasa		0	0	0	0	0	0	1.077	12.946	487	26.583
2	Lagos; Ikeja		0	0	0	0	0	0	2.645	12.846	1.199	10.714
3	Luanda		0	0	0	0	0	0	0	11.672	936	12.470
4	Dar es-Salaam		0	0	0	0	0	0	357	8.919	907	9.833
5	Johannesburg		0	0	0	0	0	0	1.820	8.593	1.756	4.893
6	Addis Ababa		0	0	0	0	0	0	883	7.280	465	15.657
7	Khartoum		0	0	0	0	0	0	1.097	7.115	958	7.427
8	Nairobi		0	0	0	0	0	0	564	6.646	598	11.114
9	Abidjan		0	0	0	0	0	0	1.039	6.450	503	12.824
10	Accra; Tema		0	0	0	0	0	0	1.098	5.890	1.121	5.255
11	Onitsh		0	0	0	0	0	0	789	5.788	1.090	5.310
12	Yaoundé		0	0	0	0	0	0	453	5.479	313	17.505
13	Kampala		0	0	0	0	0	0	608	5.178	810	6.392
14	Kano		0	0	0	0	0	0	772	5.111	419	12.197
15	Kumasi		0	0	0	0	0	0	414	4.923	469	10.497
16	Mogadishu		0	0	0	0	0	0	439	4.798	186	25.798
17	Douala		0	0	0	0	0	0	401	4.458	280	15.921
18	Cape Town		0	0	0	0	0	0	1.218	4.338	695	6.242
19	Antananarivo		0	0	0	0	0	0	291	4.255	442	9.627
20	Ibadan		0	0	0	0	0	0	818	4.044	574	7.045
21	Dakar		0	0	0	0	0	0	916	3.970	277	14.333
22	Bamako		0	0	0	0	0	0	353	3.961	407	9.731
23	Lusaka		0	0	0	0	0	0	254	3.658	360	10.161
24	Ouagadougou		0	0	0	0	0	0	160	3.616	495	7.306
25	Kasai-Oriental		0	0	0	0	0	0	894	3.596	134	26.837
26	Owerri		0	0	0	0	0	0	65	3.595	1.144	3.142
27	Maputo		0	0	0	0	0	0	552	3.533	570	6.199
28	Durban		0	0	0	0	0	0	619	3.271	807	4.053
29	Brazzaville		0	0	0	0	0	0	1.193	3.191	201	17.726
30	Coyah;		0	0	0	0	0	0	605	2.991	305	9.807
31	Lubumbashi		0	0	0	0	0	0	223	2.908	354	8.214

32	Cotonou		0	0	0	0	0	0	378	2.647	479	6.420
33	Port Harcourt		0	0	0	0	0	0	276	2.624	310	8.464
34	Lomé		0	0	0	0	0	0	203	2.498	346	7.220
35	Freetown		0	0	0	0	0	0	318	2.151	205	10.490
36	Harare		0	0	0	0	0	0	498	2.076	603	3.993
37	Monrovia		0	0	0	0	0	0	182	2.050	302	6.787
38	Kinshasa		0	0	0	0	0	178	0	0	425	15.270
39	Kaduna		0	0	0	0	0	0	372	1.938	304	6.375
40	Benin City		0	0	0	0	0	0	319	1.912	386	5.454
41	N'Djamena		0	0	0	0	0	0	216	1.910	222	8.604
42	Beni		0	0	0	0	0	0	478	1.873	70	26.753
43	Pretoria		0	0	0	0	0	0	591	1.826	477	3.829
44	Nouakchott		0	0	0	0	0	0	64	1.625	178	9.131
45	Kigali		0	0	0	0	0	0	69	1.622	286	5.670
46	Mombasa		0	0	0	0	0	0	211	1.618	181	8.938
47	Warri		0	0	0	0	0	0	161	1.618	207	7.815
48	Uyo		0	0	0	0	0	0	0	1.606	271	5.926
49	Niamey		0	0	0	0	0	0	165	1.601	222	7.210
50	Kananga		0	0	0	0	0	0	109	1.539	94	16.369
51	Hargeisa		0	0	0	0	0	0	252	1.500	84	17.862
52	Aba		0	0	0	0	0	0	351	1.472	187	7.872
53	Klipgat		0	0	0	0	0	0	0	1.464	393	3.724
54	Bujumbura		0	0	0	0	0	0	118	1.403	141	9.953
55	Ilorin		0	0	0	0	0	0	343	1.360	215	6.324
56	Lubango		0	0	0	0	0	0	0	1.331	146	9.118
57	Abuja		0	0	0	0	0	0	0	1.322	319	4.145
58	Serrekunda		0	0	0	0	0	0	103	1.313	181	7.257
59	Bobo-Dioulasso		0	0	0	0	0	0	112	1.297	170	7.632
60	Maiduguri		0	0	0	0	0	0	237	1.293	157	8.238
61	Aboh; Nnarambia		0	0	0	0	0	0	65	1.282	365	3.513
62	Bangui		0	0	0	0	0	0	374	1.270	122	10.413
63	Sekondi-Takoradi		0	0	0	0	0	0	189	1.256	136	9.234
64	Cabinda		0	0	0	0	0	0	0	1.220	98	12.451
65	Touba		0	0	0	0	0	0	292	1.170	161	7.832
66	Enugu		0	0	0	0	0	0	261	1.086	165	6.584
67	Adis Abeba	Addis Ababa, Addis Abeba, Âddîs Âbebâ	0	0	0	0	19	361	0	0	150	13.056
68	Uige		0	0	0	0	0	0	1.039	238	43	35.812
69	Tshikapa		0	0	0	0	0	0	182	1.075	52	20.668
70	Malanje		0	0	0	0	0	0	61	1.052	79	13.318
71	Nyala		0	0	0	0	0	0	77	1.039	104	9.988
72	Otite		0	0	0	0	0	0	209	1.036	108	10.355
73	Nampula		0	0	0	0	0	0	115	1.029	119	8.645
74	Zanzibar City		0	0	0	0	0	0	91	1.027	121	8.486
75	Lilongwe		0	0	0	0	0	0	0	1.019	136	7.491
76	Mwanza		0	0	0	0	0	0	0	977	175	5.586
77	Jos		0	0	0	0	0	0	171	966	202	4.782
78	Sokoto		0	0	0	0	0	0	217	954	110	8.671
79	Blantyre		0	0	0	0	0	0	0	942	191	6.607

80	Kisangani		0	0	0	0	0	0	249	929	100	9.291
81	Libreville		0	0	0	0	0	0	132	917	196	4.679
82	Umuahia		0	0	0	0	0	0	0	917	141	6.663
83	Luena		0	0	0	0	0	0	0	892	82	10.880
84	Cuito		0	0	0	0	0	0	0	880	85	10.349
85	Kalemie		0	0	0	0	0	0	0	872	53	16.461
86	Ikorodu		0	0	0	0	0	0	85	863	303	3.600
87	Bukavu		0	0	0	0	0	0	335	852	65	13.109
88	Cape Town	Kaapstad	0	0	0	0	41	391	0	0	103	20.007
89	Oshogbo		0	0	0	0	0	0	209	833	157	5.952
90	Ibadan		0	0	0	0	174	422	0	0	89	16.789
91	Porto-Novo		0	0	0	0	0	0	202	815	149	5.470
92	Abeokuta		0	0	0	0	0	0	230	807	174	4.637
93	Nsukka		0	0	0	0	0	0	103	807	194	4.158
94	Arusha		0	0	0	0	0	0	0	807	169	4.772
95	Gqeberha		0	0	0	0	0	0	288	806	217	3.716
96	Oyo		0	0	0	0	0	0	104	792	120	6.597
97	Bata		0	0	0	0	0	0	0	790	88	8.975
98	Kamina		0	0	0	0	0	0	0	783	40	19.571
99	Goma		0	0	0	0	0	0	172	776	84	9.235
100	Tamale		0	0	0	0	0	0	65	774	132	5.865
101	Pointe-Noire		0	0	0	0	0	0	258	666	186	4.824
102	Yola; Jimeta		0	0	0	0	0	0	214	764	112	6.818
103	Zinder		0	0	0	0	0	0	128	749	46	16.282
104	Lagos		0	0	0	0	38	241	0	0	80	19.057
105	Evaton		0	0	0	0	0	0	286	738	120	6.151
106	Djibouti		0	0	0	0	0	0	76	735	69	10.654
107	Kitwe		0	0	0	0	0	0	113	732	117	6.255
108	Malabo		0	0	0	0	0	0	0	729	71	10.274
109	Kebkabiya		0	0	0	0	0	0	111	727	21	34.642
110	Zaria		0	0	0	0	0	0	194	721	102	7.067
111	Lokoja		0	0	0	0	0	0	0	716	96	7.456
112	Akure		0	0	0	0	0	0	170	713	171	4.865
113	Likasi		0	0	0	0	0	0	0	713	65	10.962
114	Bouaké		0	0	0	0	0	0	173	705	106	6.650
115	Huambo		0	0	0	0	0	0	191	583	94	8.554
116	Garoua		0	0	0	0	0	0	156	700	67	10.441
117	Al-Ubayyid		0	0	0	0	0	0	172	680	83	8.188
118	Accra	Akkra, Akra	0	0	0	0	17	156	0	0	80	27.483
119	Benin City		0	0	0	50	296	552	0	0	1.440	17.440
120	Bissau		0	0	0	0	0	0	78	674	83	8.126

Figure 59. Table of the 120 largest cities by maximum population, alongside area/density/population statistics, Sub-Saharan Africa.


Year: 10000 BC
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Year: 1100 AD
Year: 1200 AD
Year: 1300 AD
Year: 1400 AD
Year: 1500 AD
Year: 1600 AD
Year: 1700 AD
Year: 1710 AD
Year: 1720 AD
Year: 1730 AD
Year: 1740 AD
Urban Population
(Maximum Gridcell Value)
Population


Year: 1750 AD
Urban Population
(Maximum Gridcell Value)
Year: 1760 AD
Urban Population
(Maximum Gridcell Value)
Year: 1770 AD
Urban Population
(Maximum Gridcell Value)
Year: 1780 AD
Urban Population
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Urban Population
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Year: 1800 AD
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Urban Population
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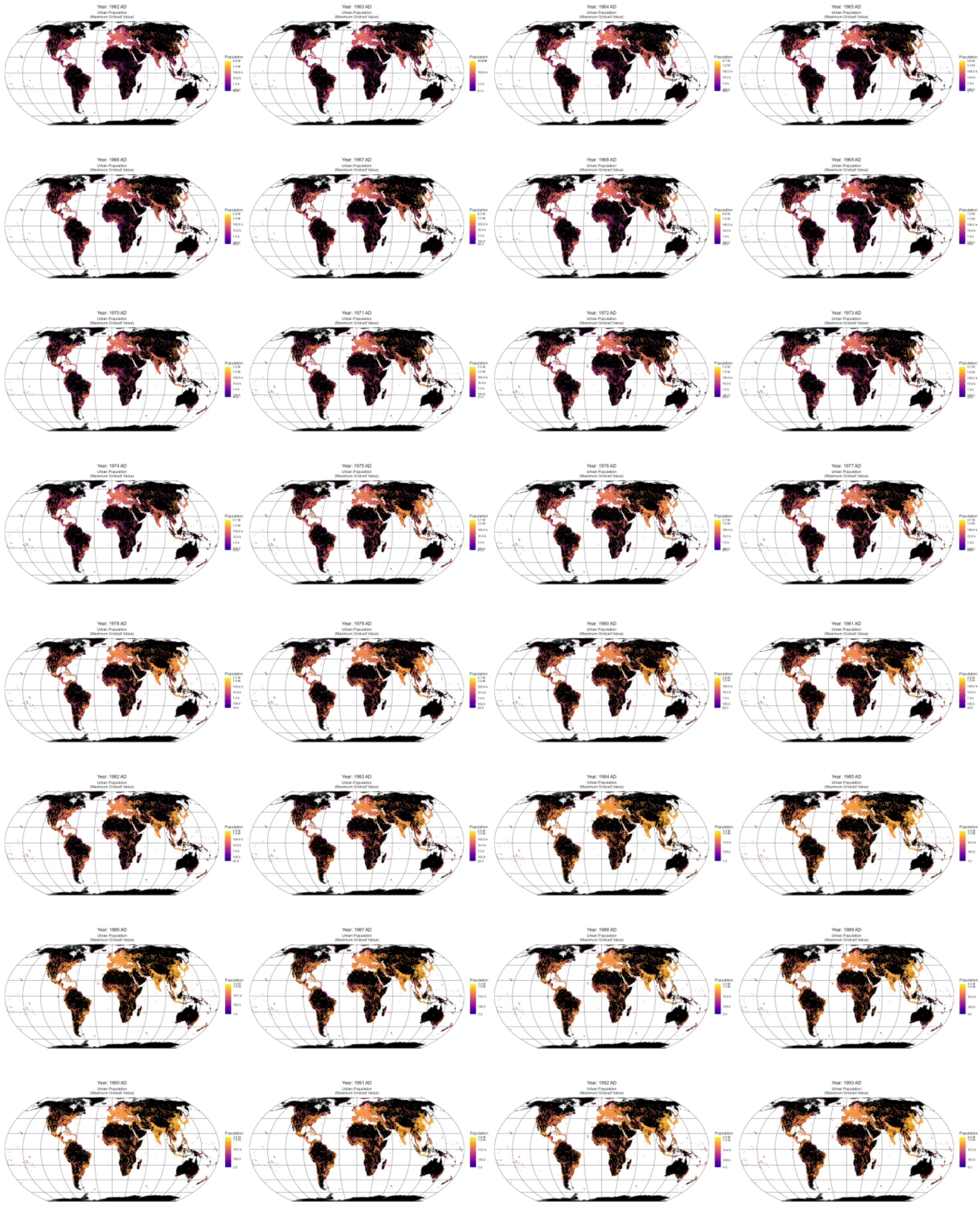
Urban Population
(Maximum Gridcell Value)
Year: 1957 AD
Urban Population
(Maximum Gridcell Value)
Year: 1958 AD
Urban Population
(Maximum Gridcell Value)
Year: 1959 AD
Urban Population
(Maximum Gridcell Value)
Year: 1960 AD
Urban Population
(Maximum Gridcell Value)
Year: 1961 AD
Urban Population
(Maximum Gridcell Value)
Population


Year: 1962 AD
Urban Population
(Maximum Gridcell Value)
Year: 1963 AD
Year: 1964 AD
Year: 1965 AD
Year: 1966 AD
Year: 1967 AD
Year: 1968 AD
Year: 1969 AD
Year: 1970 AD
Year: 1971 AD
Year: 1972 AD
Year: 1973 AD
Year: 1974 AD
Year: 1975 AD
Year: 1976 AD
Year: 1977 AD
Year: 1978 AD
Year: 1979 AD
Year: 1980 AD
Year: 1981 AD
Year: 1982 AD
Year: 1983 AD
Year: 1984 AD
Year: 1985 AD
Year: 1986 AD
Year: 1987 AD
Year: 1988 AD
Year: 1989 AD
Year: 1990 AD
Year: 1991 AD
Year: 1992 AD
Year: 1993 AD
Population

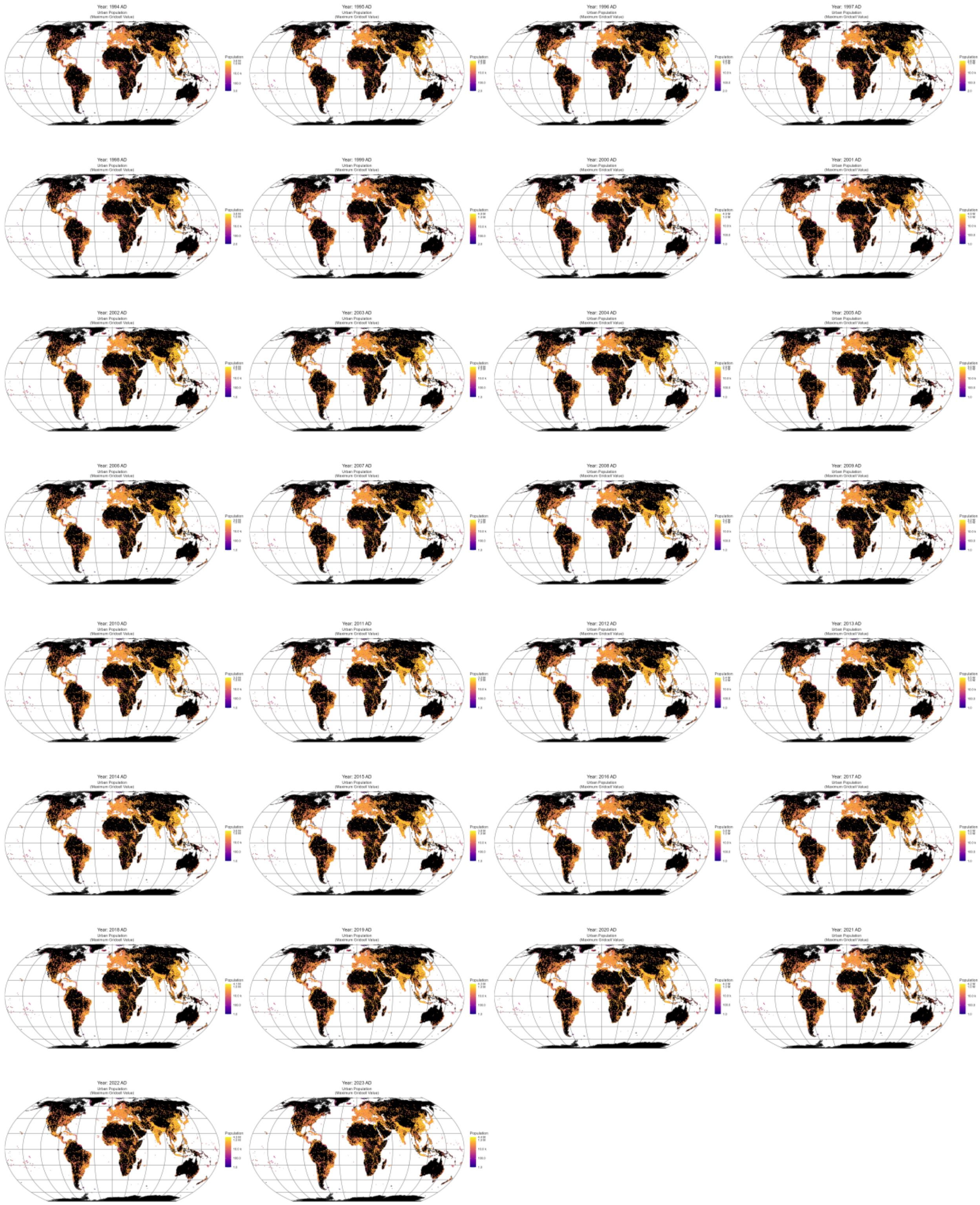


Figure 60. Static visualisation of Stadestér urban population rasters for all selected years.

Sources

Note that the manner in which sources are cited can be found via its bracketed form, i.e. [162], or [#]. Some works have been cited multiple times where their page numbers were different, or where the work contained different sections written by different authors. In addition, sources that have been critiqued are cited here, as well as sources that have proved foundational to our work (see Figure 10 for a list of such sources).

Since our work involves the encoding and large-scale synthesis of various datasets, some of the sources with which we have worked will naturally have various issues. Our assessments of their reliability may be found in text.

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Footnotes

[1] Both 1AD and 1950AD are primary benchmark years: one represents the start of the Common Era, and the other the end of Before Present (BP).

[2] Recently it appears the UN has officially adopted the GHSL definition of a city for statistical purposes (degree of urbanisation), though it appears slightly problematic to us that the official global urban population would drop precipitously by ~28,41% because of it - from 4,61 billion to 3,3 billion.

[3] This definition also means it includes European dependencies in the Atlantic, i.e. the Falklands or St. Helena. In general, island European settler colonies and dependencies east of the Cape are in 'Oceania', whilst those in the Atlantic are in 'Europe'.

[4] We include those regions in Central Asia which were often under some form of Persian administration. Pakistan's relatively late colonisation by Britain does not make including it in the Indian Subcontinent very helpful from a long-term perspective. In any case, it also helps to separate out the earlier Indus Valley civilisation. Additionally, Urdu is written in the Perso-Arabic script, so modern recordkeeping has a hard boundary. That is reason enough.

[5] Papua New Guinea is in the Malay Archipelago, which is why it is included here.

[6] Until very recently, Mongolia was a part of the Qing Empire, and before that had constant interactions with Chinese civilisations, most notably in the form of the Yuan Dynasty. Like CJK, the Hudum Mongol bichig requires special handling. Vietnam is not included here, as virtually all its historic documents today have been transcribed into the Latin alphabet; it is instead in Southeast Asia.

[7] Oceania is extended to the Mascarenes and Mayotte due to the former's late settlement by Europeans, and the fact that the latter remains a European dependency.

[8] As taken from the IUSSP International Population Conference (2013), PAA annual meeting (2015). This sort of sampling is now impossible - the IUSSP's Historical Demography panel was cancelled for the 6th year straight [45].

It is now filed under 'Past Panels and Groups'. From 1997-2018, there were 5 reboots and an annual presence, but the most recent panel (the 6th) has no roman numeral and only met for one year. The call for papers (2022) is after their last report (2021), in which they announce the conference is cancelled due to COVID-19. The panel was shelved immediately after their call for papers. They list a total of four publications from proceedings for the period from 2018-2021. That works out to one publication a year. If you are perhaps thinking that COVID extends into 2025, I assure you none of the present panels are inactive. None of them, however, are on historical demography.

[9] Perhaps living fields such as anthropology do have essays entitled 'on the need to populate anthropology', but I am not aware of any such phenomenon. As Lee puts it, 'In addition, the emergence of young innovative researchers who spearhead historical demography has become a rare occurrence, thereby eroding the pool of published research theses from which to quote'. If new research is so rare that one is struggling for works to cite, I certainly would not portray the field as alive.

As Werlin, who quotes Steve Hindle puts it: ‘The increasingly muffled conversation between historical demographers and early modern historians has, depressingly, deteriorated still further into a dialogue of the deaf’.

[10] Buringh and de Vries, to my knowledge, also utilise figures in their thousands, typically either with European decimals or whole numbers.

[11] There is a single source, Kerr 1824, who claims 6.000-9.000 deaths of the Muslim inhabitants [67].

[12] Much of this section was typed up in preliminary memoranda, which was held internally, including supplemental memoranda on preindustrial density that was ultimately deemed not relevant to Stadestér 1.0.

[13] There is a great degree of dispute over exactly how density drops off or how world regions ought to be divided. We have opted for a Cold War sort of division to model urban regions between 1945-1975AD, but these sorts of strict equations are more rules of thumb for radially buffered dasymetric mapping than anything else.

[14] Outliers were processed as part of Velkscala, whose shared production repository with Eoscala is linked in the appendix below.

[15] The Eastern Central African Republic, to my knowledge, displays consistent artefacting even in models reliant upon satellite data, such as GHS-POP, GPWv4, or LandScan.

[16] This does not mean that we do not work on regional demographics - on the contrary: Velkscala is our non-urban demographic dataset, but Stadestér is reserved for urban populations, in the same manner that Eoscala is for historical economics.

[17] Other platforms such as Zenodo may have other equivalents, i.e. ‘Files’. We principally use GitHub for the purpose of disseminating the latest up-to-date models.

[18] Shaw also makes the assertion that some historians hold this opinion with regards to Moscow specifically.

[19] Lesczynska does not provide the raw census figures for 1850AD and 1882AD, these were fetched second-hand from YIVO.