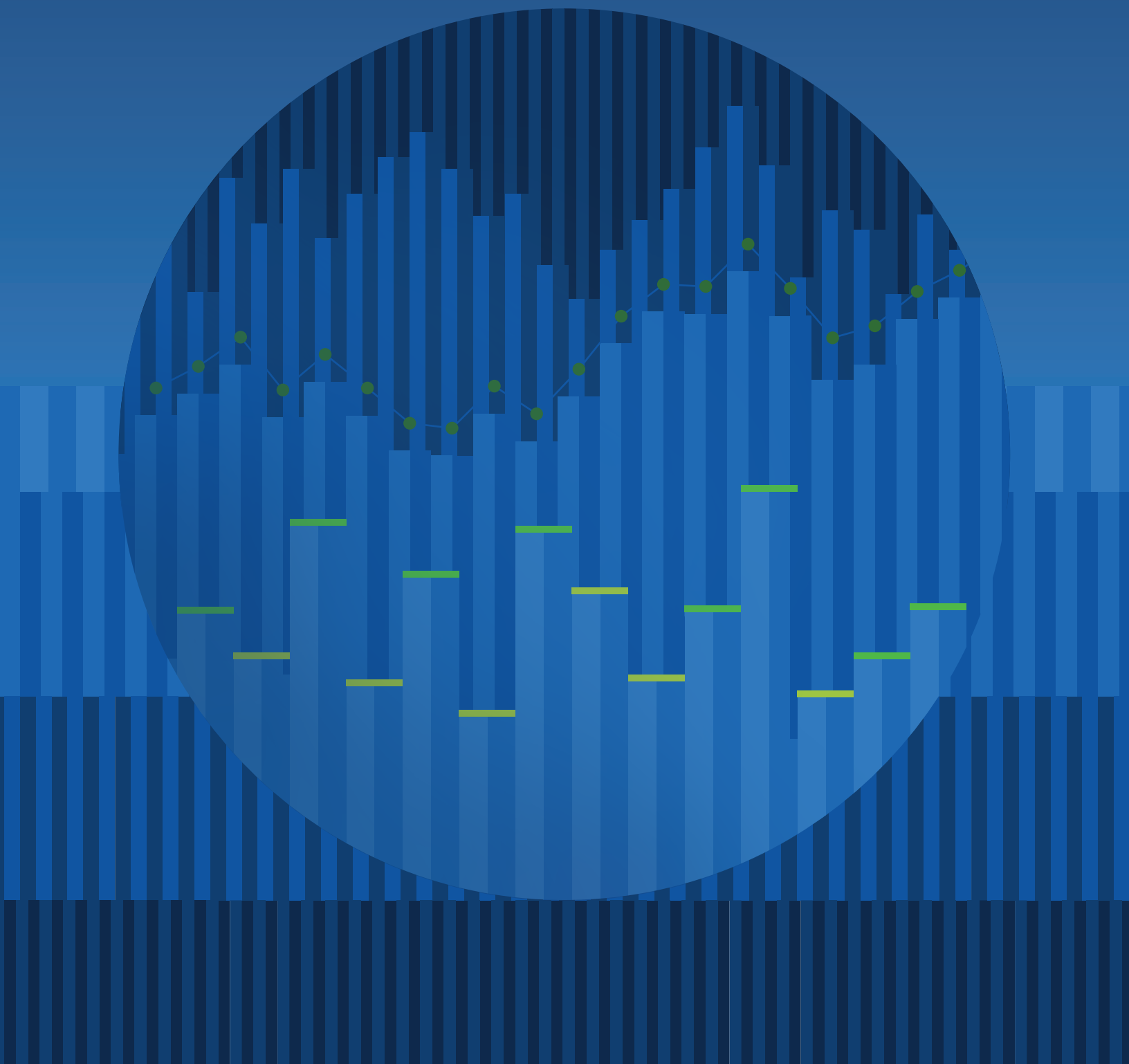
VERTICAL URBANISM INDEX REPORT 2024

Council on Tall Buildings and Urban Habitat



INTRODUCTION

ABOUT THE VERTICAL URBANISM INDEX

Cities today face growing challenges to balance population growth, climate resilience, and sustainability. The Vertical Urbanism Index (VUI) addresses these complexities by analyzing the intersection of tall buildings, density, and livability. Developed as a part of CTBUH's City Advocacy Forum initiative, the VUI is more than a ranking system—it's a dynamic tool empowering urbanists and policymakers with actionable insights.

Leveraging CTBUH's Tall Building Database, satellite-derived datasets, and open data from the United Nations and elsewhere, the VUI evaluates how vertical growth impacts urban cores and sprawl, offering a global perspective on local challenges. By standardizing fragmented datasets and integrating advanced technologies, the VUI bridges critical data gaps.

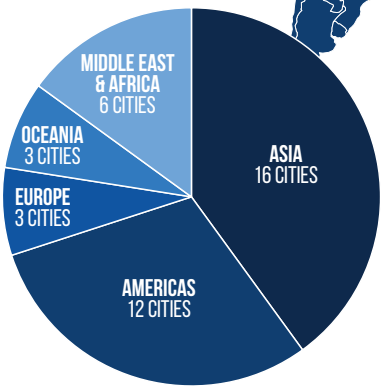
This report highlights the VUI's first-year achievements and future direction, paving the way for cities to innovate and thrive. Together, we're shaping a sustainable urban future through data-driven collaboration.

2024 HIGHLIGHTS

CTBUH conducted an analysis of 40 urban agglomerations as part of the inaugural Vertical Urbanism Index (VUI). Cities were chosen based on three key criteria: a significant number of completed, under-construction, or proposed tall buildings (over 100 meters), robust data availability, and geographic diversity.

While the precise threshold is still undefined, a clear point of diminishing returns emerges when correlating increasing density with improving livability. As additional cities are incorporated into the VUI, CTBUH expects to gain deeper insights into the intersection of density, tall buildings, and livability.

The analysis revealed some unexpected findings. Among the 40 cities studied, higher-than-average density was negatively correlated with livability. Furthermore, the relationship between tall buildings and density proved more nuanced: contrary to conventional expectations, cities with more tall buildings tended to have lower population densities on average.



HONG KONG	MELBOURNE	SAO PAULO	MIAMI
TORONTO	DUBAI	LOS ANGELES	ABU DHABI
NEW YORK CITY	TEL AVIV	DOHA	GOIANIA
TOKYO	SYDNEY	JAKARTA	SAN FRANCISCO
SINGAPORE	ISTANBUL	MANILA	CHONGQING
HANGZHOU	SEOUL	MEXICO CITY	WUHAN
SHENZHEN	VANCOUVER	RIYADH	HO CHI MINH CITY
MUMBAI	OSAKA	CHENGDU	RECIFE
LONDON	BUSAN	HOUSTON	BANGKOK
BRISBANE	CHICAGO	MOSCOW	CAIRO

2024 SCORES

TALL BUILDINGS

New York City, Toronto, and the Pearl River Delta (Guanghzou, Foshan, Shenzhen) lead in tall building scores, reflecting their global prominence in vertical development.

Similar to density, there is a significant gap between the top and bottom rankings. The rapid growth of tall buildings in cities like Wuhan and Jakarta is expected to surpass their peers' average by 2025.

DENSITY

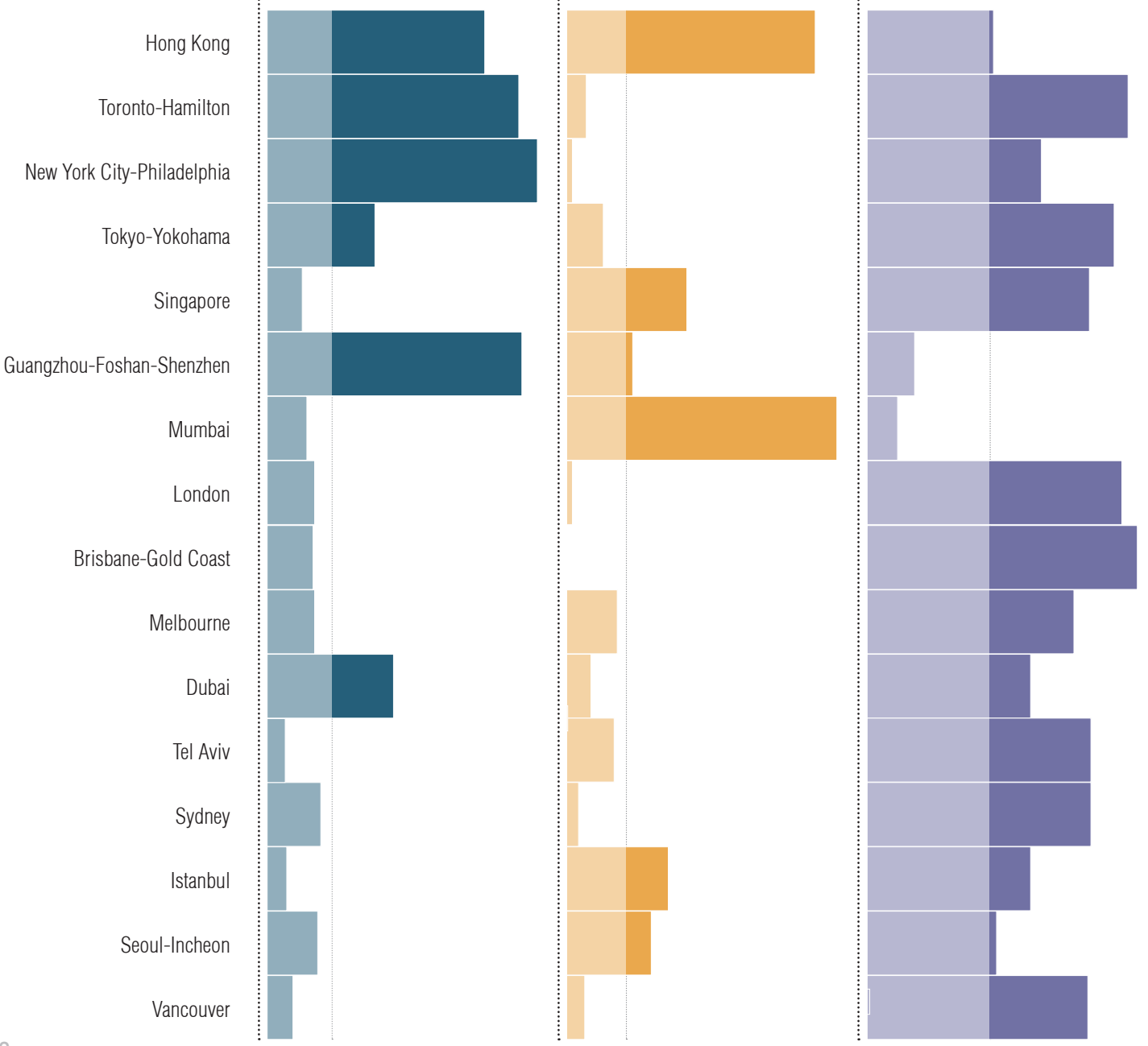
Mumbai and Hong Kong stand out for their exceptionally high density, while most American and Australian cities lie at the low-density end of the spectrum.

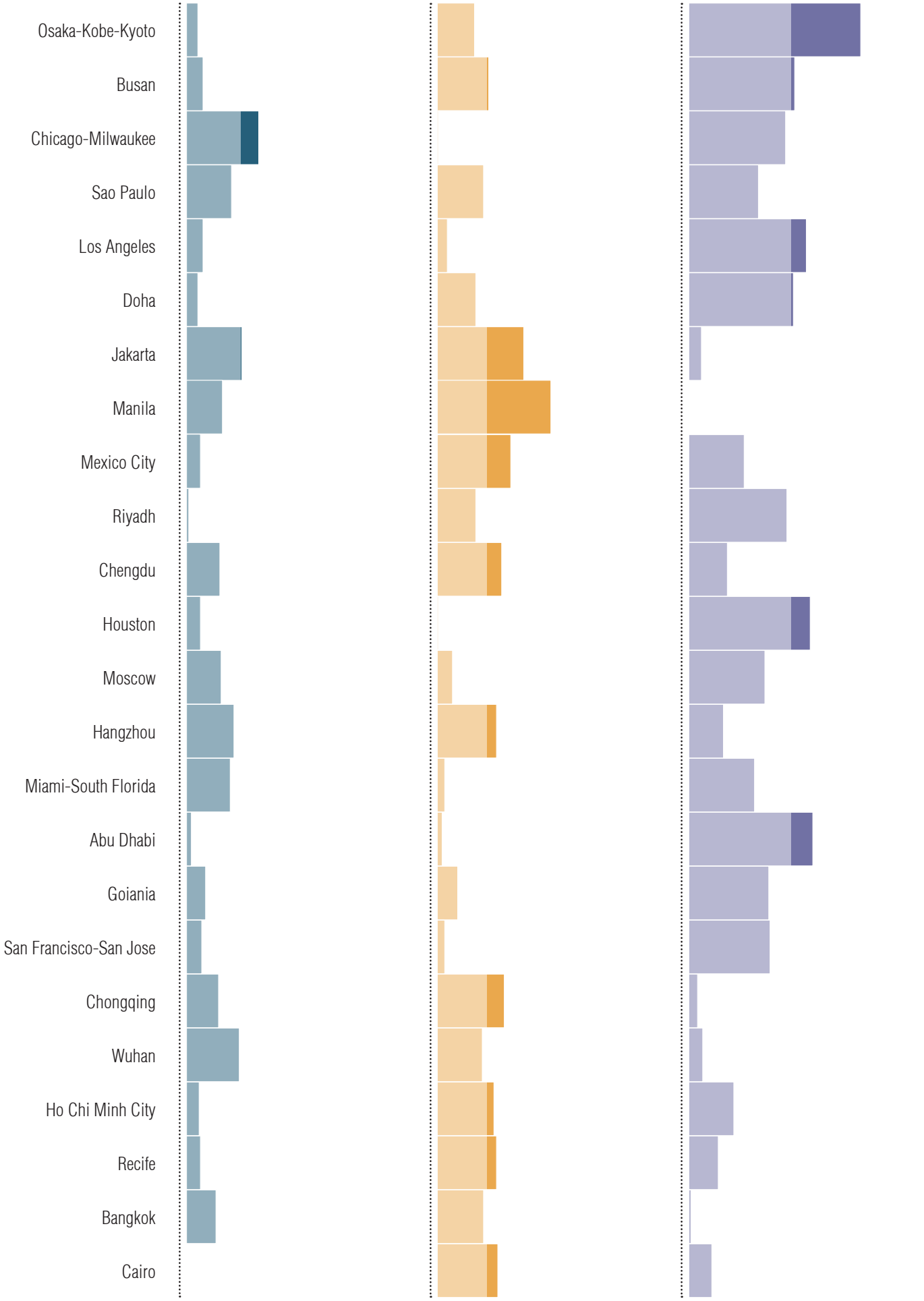
In nearly every city, above-average density did not align with a high number of tall buildings—71% of the time, tall buildings clustered in areas with below-average density.

LIVABILITY

Cities in countries with higher levels of economic development generally achieved higher livability scores.

With the exception of a few cities, tall buildings and density were negatively correlated with livability. Each 1-point increase in livability was associated with a 0.08-point rise in the number of tall buildings and a 0.14-point decline in density.




Osaka-Kobe-Kyoto
Busan
Chicago-Milwaukee
Sao Paulo
Los Angeles
Doha
Jakarta
Manila
Mexico City
Riyadh
Chengdu
Houston
Moscow
Hangzhou
Miami-South Florida
Abu Dhabi
Goiania
San Francisco-San Jose
Chongqing
Wuhan
Ho Chi Minh City
Recife
Bangkok
Cairo
mean tall building score
mean density score
mean livability score

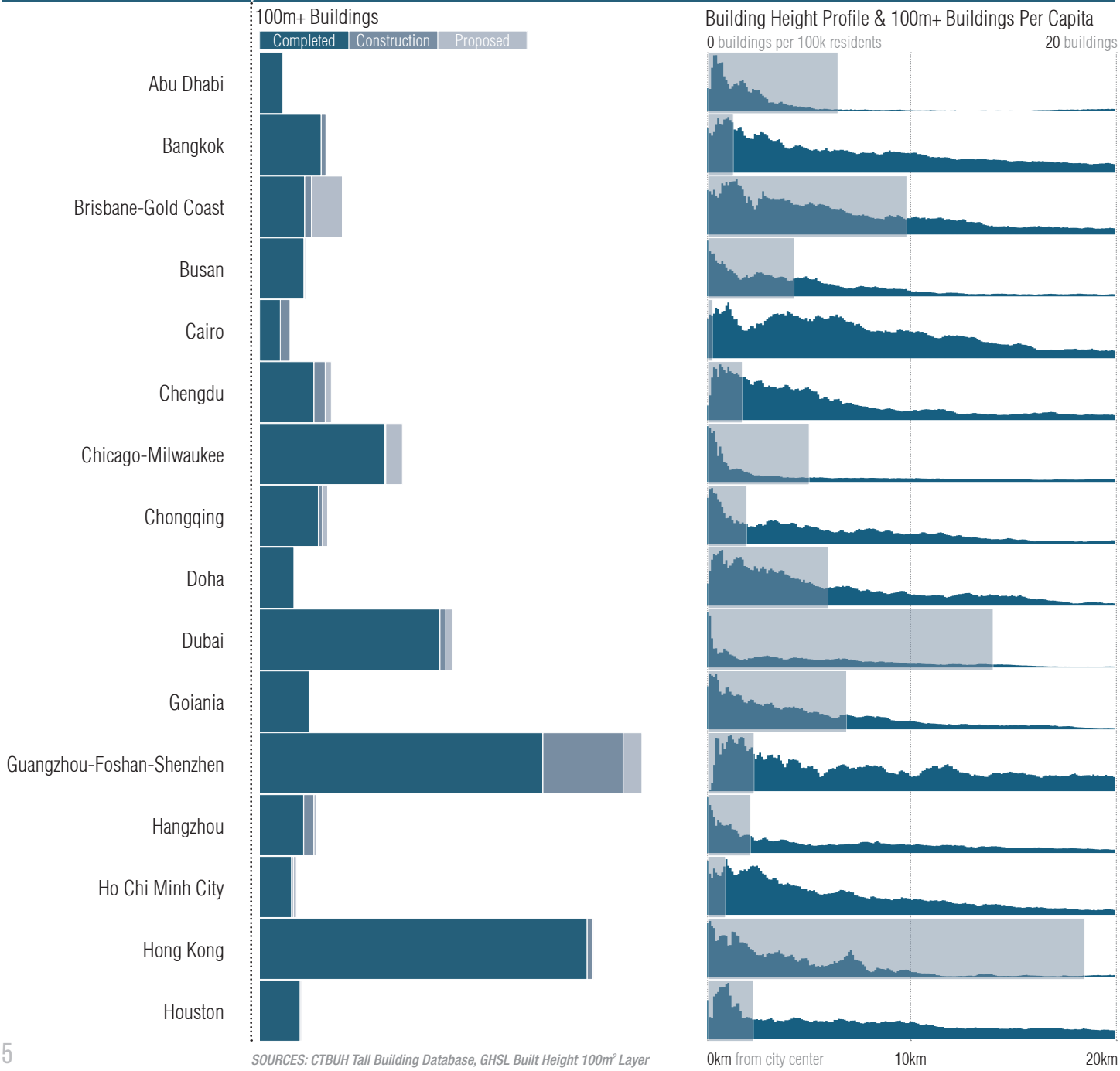
TALL BUILDINGS

NOTES

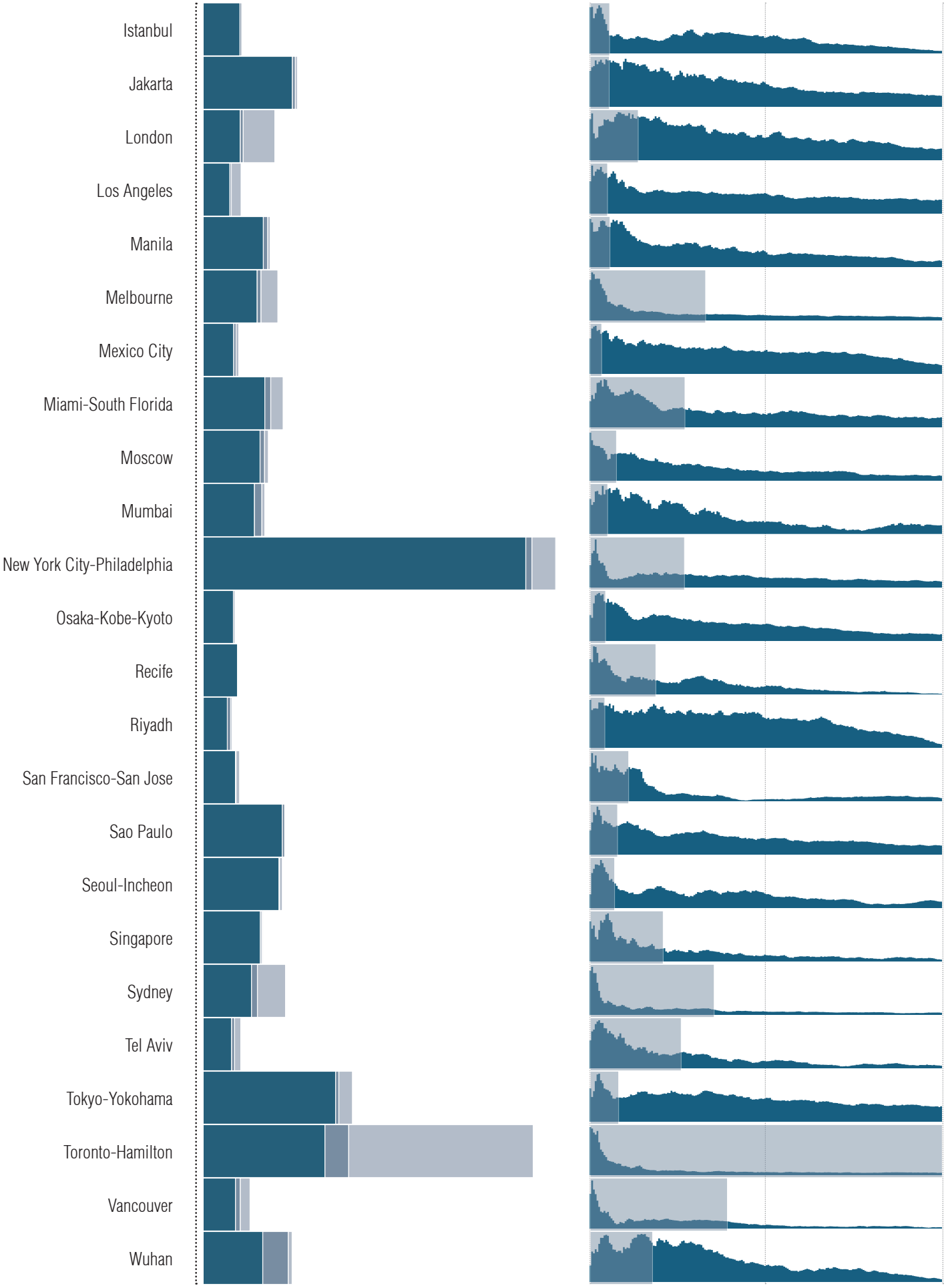
Tall buildings were analyzed in a longitudinal context, examining each city's construction timeline, ongoing projects, and, where available, projections for the next decade. Beyond nominal counts, the relationship between tall buildings and density was explored through metrics like the number of tall buildings per capita (see figure, right) and their correlation with high-density areas.

In 22 of the 40 cities studied, building height and density were strongly correlated, suggesting these cities achieved densities primarily through vertical growth. However, these patterns varied. For instance, Shenzhen and Wuhan demonstrated a near-perfect 1-to-1 correlation between building height and density up to 20 kilometers from their centers. In contrast, Vancouver exhibited this correlation everywhere except the immediate square kilometer around its central business district (CBD).

Regarding existing tall building stock, New York City, Hong Kong, and the Guangzhou-Foshan-Shenzhen metropolitan region lead both the study and global rankings. When including under-construction and proposed projects, Toronto-Hamilton takes the lead, particularly notable given its relatively low urban population compared to other cities.



SOURCES: CTBUH Tall Building Database, GHSL Built Height 100m² Layer



SOURCES: CTBUH Tall Building Database, GHSL Built Height 100m² Layer

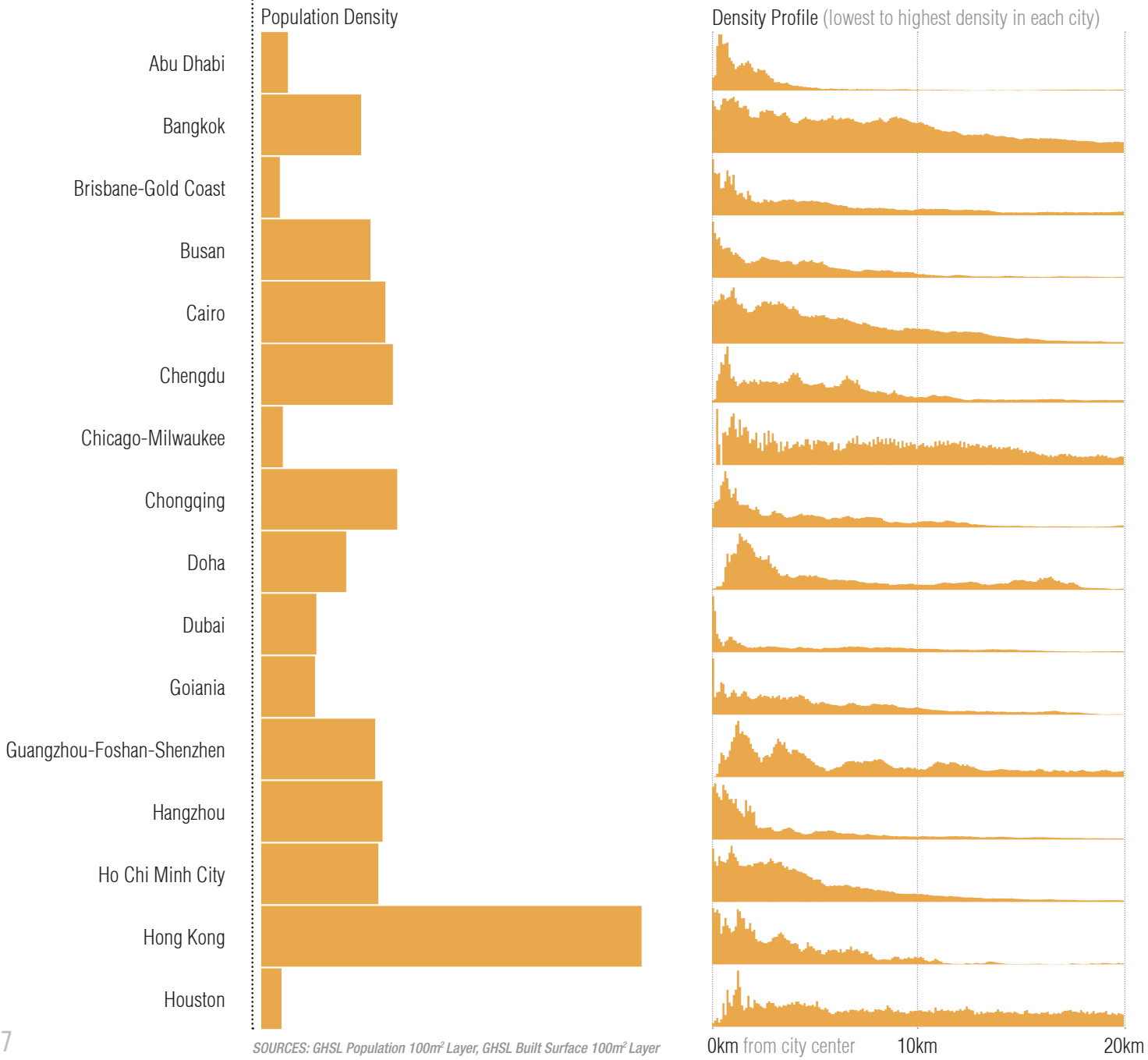
DENSITY

NOTES

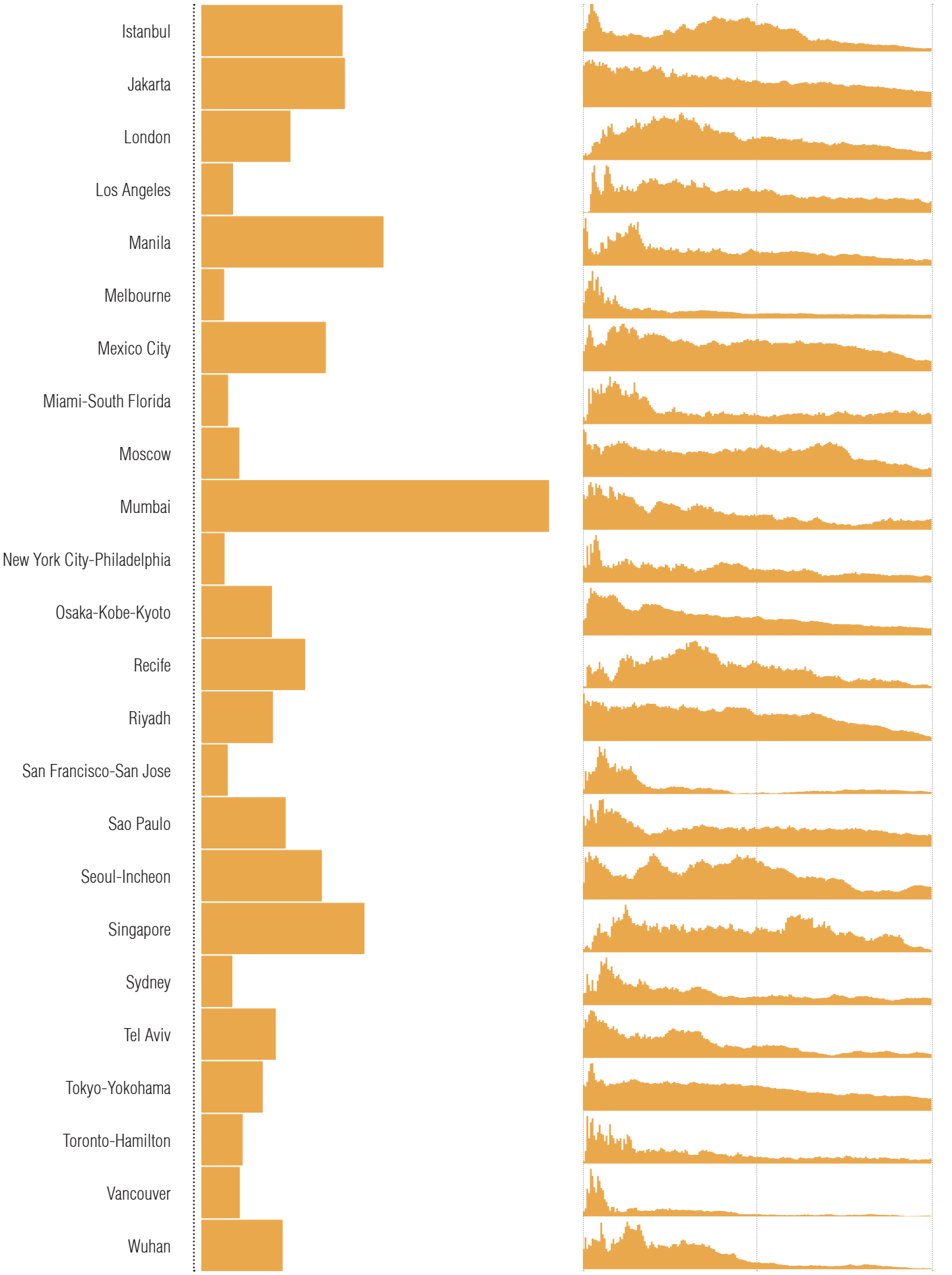
Population density is commonly measured as the ratio of residents to the surface area of a city. However, this single metric fails to reflect how density is distributed across an urban agglomeration, which can encompass thousands of square kilometers of urbanized land.

Using the European Commission's Degree of Urbanisation (DEGURBA) classification system to define urban boundaries, CTBUH first calculated the basic density of each area (see figure, left). To analyze the spatial dynamics of urban growth or contraction over time, these classifications were applied to population data at five-year intervals, dating back to 1975.

The most insightful analysis involved measuring density in concentric rings at 100-meter intervals from each urban agglomeration's centroid, extending outward to 20 kilometers (see figure, right). Compared to the overall density figure (left), CTBUH developed a weighted density profile for each agglomeration to assess the efficiency of density distribution—specifically, how intuitively population density is concentrated relative to the city center.



SOURCES: GHSL Population 100m² Layer, GHSL Built Surface 100m² Layer



SOURCES: GHSL Population 100m² Layer, GHSL Built Surface 100m² Layer

LIVABILITY

SOCIAL

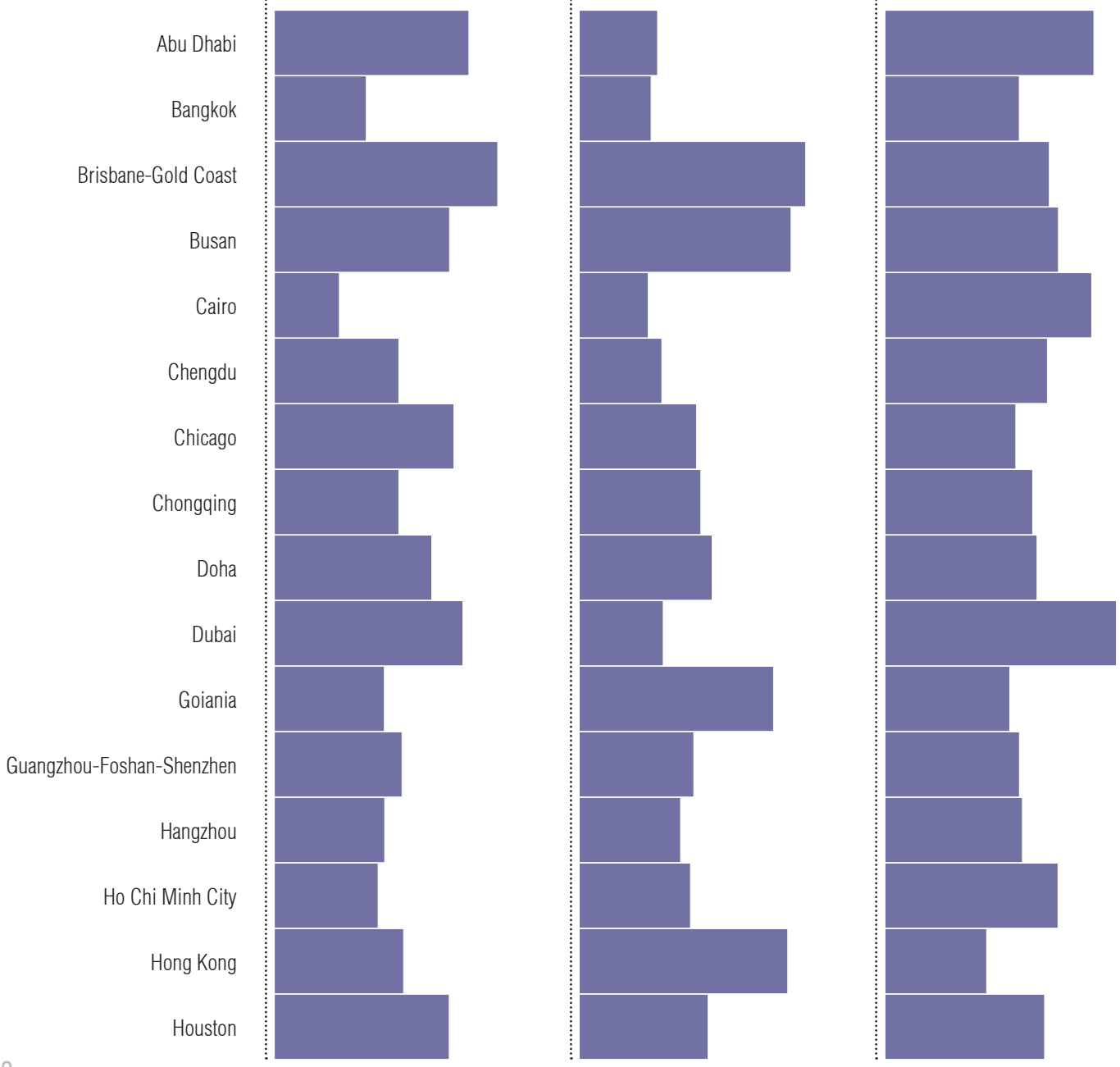
Cities are evaluated along axes of education, healthcare, presence of substandard housing, and their trends in urbanized vs. non-urbanized population over time. The cities that best support their populations socially have high rates of literacy, completion of secondary education, stable governance, and a high proportion of urbanized population in place of low-density sprawl. **2024's leading social city was Singapore**.

ENVIRONMENTAL

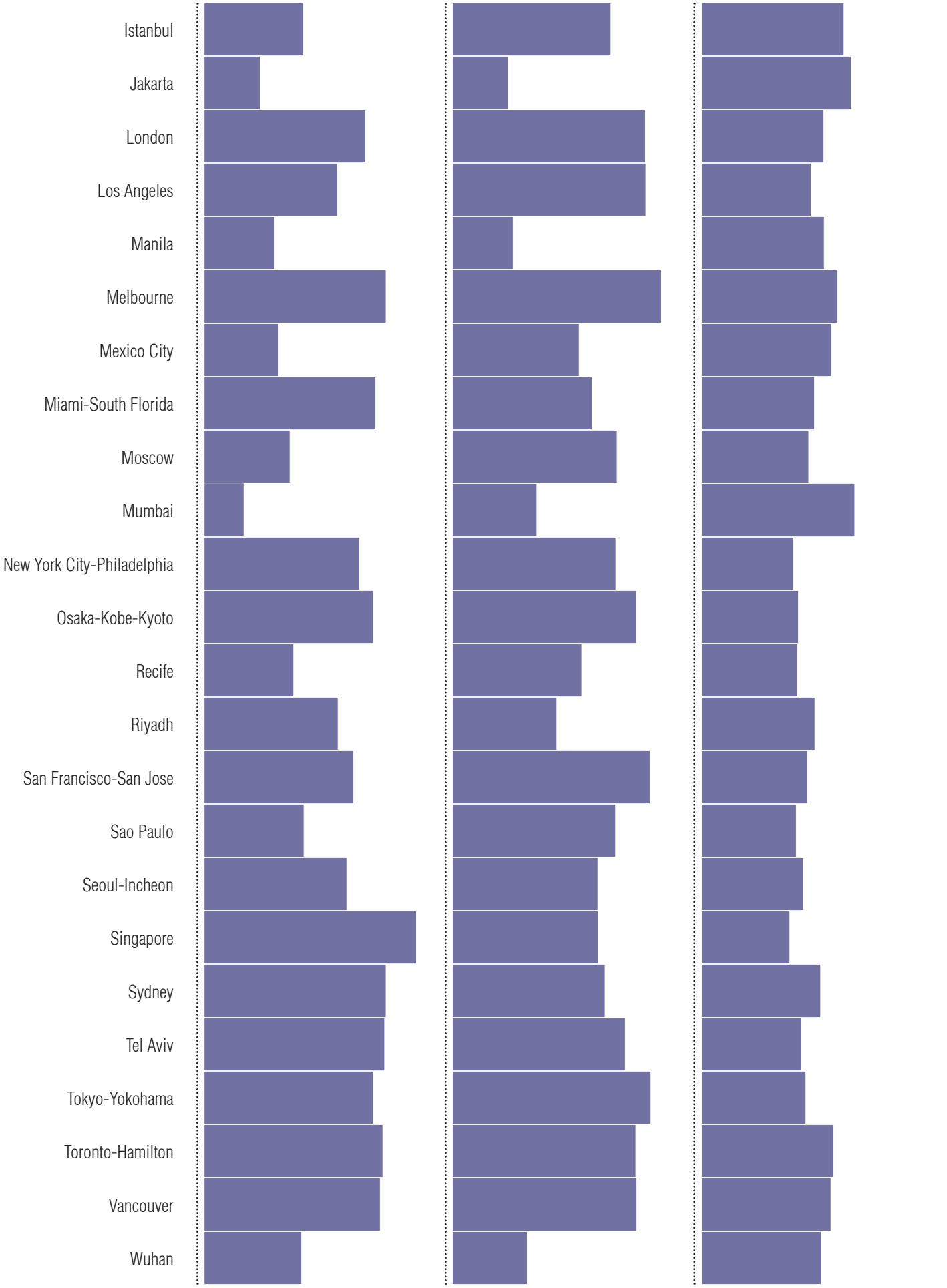
Measures of quality (green space, air, water) are combined with ease of access (rapid transit, parks, open space) to assess the environmental success of each city. The cities that earn higher environmental marks have a high proportion of residents living within 500 meters of parks and transit, have low annual PM2.5 exposures, and have grown more in population than in urban footprint. **2024's leading environmental city was Melbourne**.

ECONOMIC

The economic health of the city as a whole are evaluated alongisde the capacity of the median resident to afford basic necessities. Critically, the median income-to-housing ratio and income inequality are scored relative to the city's annual growth in GDP, as nominal growth only tells half of the affordability story. **2024's leading Economic city was Dubai**.



SOURCES: GHSL Population 100m² Layer, GHSL Built Surface 100m² Layer, World Bank (World Development Indicators), UN-Habitat Urban Indicators Database



SOURCES: GHSL Population 100m² Layer, GHSL Built Surface 100m² Layer, World Bank (World Development Indicators), UN-Habitat Urban Indicators Database

COMMENTARY

2025 OUTLOOK

Building on the City Advocacy Forum initiative, CTBUH plans to significantly enhance the Vertical Urbanism Index in 2025. This expansion will increase the number of urban areas analyzed and will provide deeper, more actionable insights into the relationship between tall buildings, density, and livability. By refining methodologies and integrating more comprehensive datasets, CTBUH aims to create a richer, more interactive user experience through advanced web-based data tools that allow stakeholders to explore trends and correlations at multiple scales.

The establishment of baseline data for 40 cities in 2024 provides a strong foundation for tracking longitudinal trends across key subject areas, including the spatial distribution of tall buildings, density metrics, and livability indices. As tall buildings continue to rise across the globe and cities expand both vertically and horizontally, understanding the delicate balance between high-density development and livability becomes ever more urgent. The 2025 iteration of the VUI will aim to shed light on these dynamics, helping cities optimize their growth strategies while addressing sustainability, affordability, and community needs.

METHODOLOGY

Tall Buildings (see page 5)—historical completion timeline, projects currently under construction, and a projection of future growth based on the confirmed number of proposals.

Density (see page 7)—nominal density; dispersion of density from the agglomeration's population clusters, weighted relative to overall population.

Livability (see page 9)—grouped into three categories of analysis: Social, Environmental, and Economic, including metrics such as literacy, educational attainment, life expectancy, access to healthcare, urbanized population, urban sprawl factor (greenfield development), average annual PM2.5 exposure, rapid transit access, public park access, income inequality, affordability of basic necessities, median income to median housing price ratio, annual economic growth.

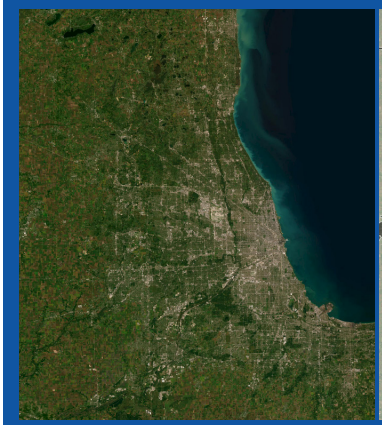
DEFINING URBAN AREAS

Using the European Commission's Degrees of Urbanisation (DEGURBA) classification system, CTBUH delineated urban agglomeration boundaries for each of the 40 cities analyzed. The core city, or "urban center," was defined as having a minimum population density of 1,500 residents per square kilometer and a total population of at least 50,000. The boundaries of the urban agglomeration were then extended to include all contiguous square kilometer cells with a density of at least 300 residents.

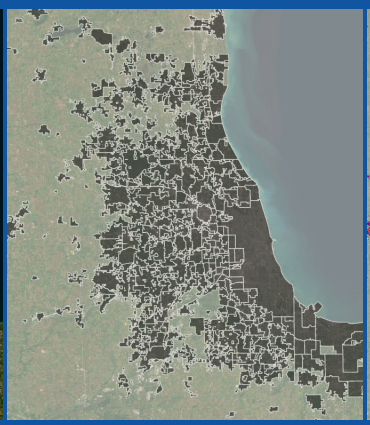
This methodology resulted in some unexpected—and potentially controversial—boundaries. For example, the urban areas of New York City and Philadelphia were treated as a single agglomeration.

CLOSER LOOK CHICAGO

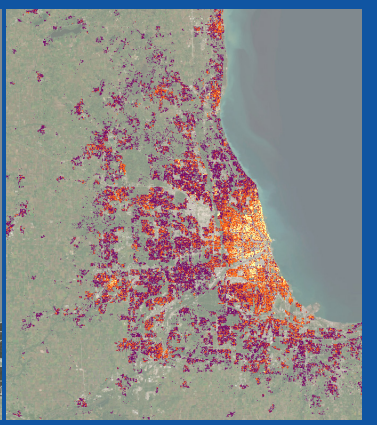
Using Chicago as an example, the three maps below illustrate how urban areas are defined using satellite data from the Global Human Settlement Layer (GHSL) database. The first two maps—depicting urban development and official urban boundaries—fail to accurately reflect the degree and extent of urbanization across the region. In contrast, the final map, classified using the DEGURBA methodology, provides a comprehensive representation of urbanity extending outward from the urban core.



AERIAL VIEW



AREA MUNICIPALITY BOUNDARIES



POPULATION DENSITY

VERTICAL URBANISM INDEX 2024

HONG KONG TORONTO NEW YORK CITY TOKYO SINGAPORE HANGZHOU SHENZHEN MUMBAI LONDON BRISBANE MELBOURNE DUBAI TEL AVIV SYDNEY ISTANBUL SEOUL VANCOUVER OSAKA BUSAN CHICAGO SAO PAULO LOS ANGELES DOHA JAKARTA MANILA MEXICO CITY RIYADH CHENGDU HOUSTON MOSCOW MIAMI ABU DHABI GOIANIA SAN FRANCISCO CHONGQING WUHAN HO CHI MINH CITY RECIFE BANGKOK CAIRO

PARTNERSHIP

As a **CTBUH City Advocacy Forum Program Partner**, your organization will be at the forefront of shaping the cities of tomorrow and at the heart of delivering pioneering solutions to the most pressing urban challenges.

You'll gain unparalleled visibility among key decision-makers, access to a global network of influencers, and the opportunity to position your brand as a leader in urban innovation and sustainability.

To become a **City Advocacy Forum Program Partner,** contact CTBUH Business Development Director Jen Hall, jhall@ctbuh.org

Learn more about the **Vertical Urbanism Index** and CTBUH's **City Advocacy Forum** at caf.ctbuh.org

CHART: BUILDING HEIGHT PROFILE (TOP) AND DENSITY PROFILE (BOTTOM) OF THE 40 CITIES IN THE 2024 VERTICAL URBANISM INDEX, FROM 0 TO 20 KILOMETERS OUT FROM THE CITY CENTER