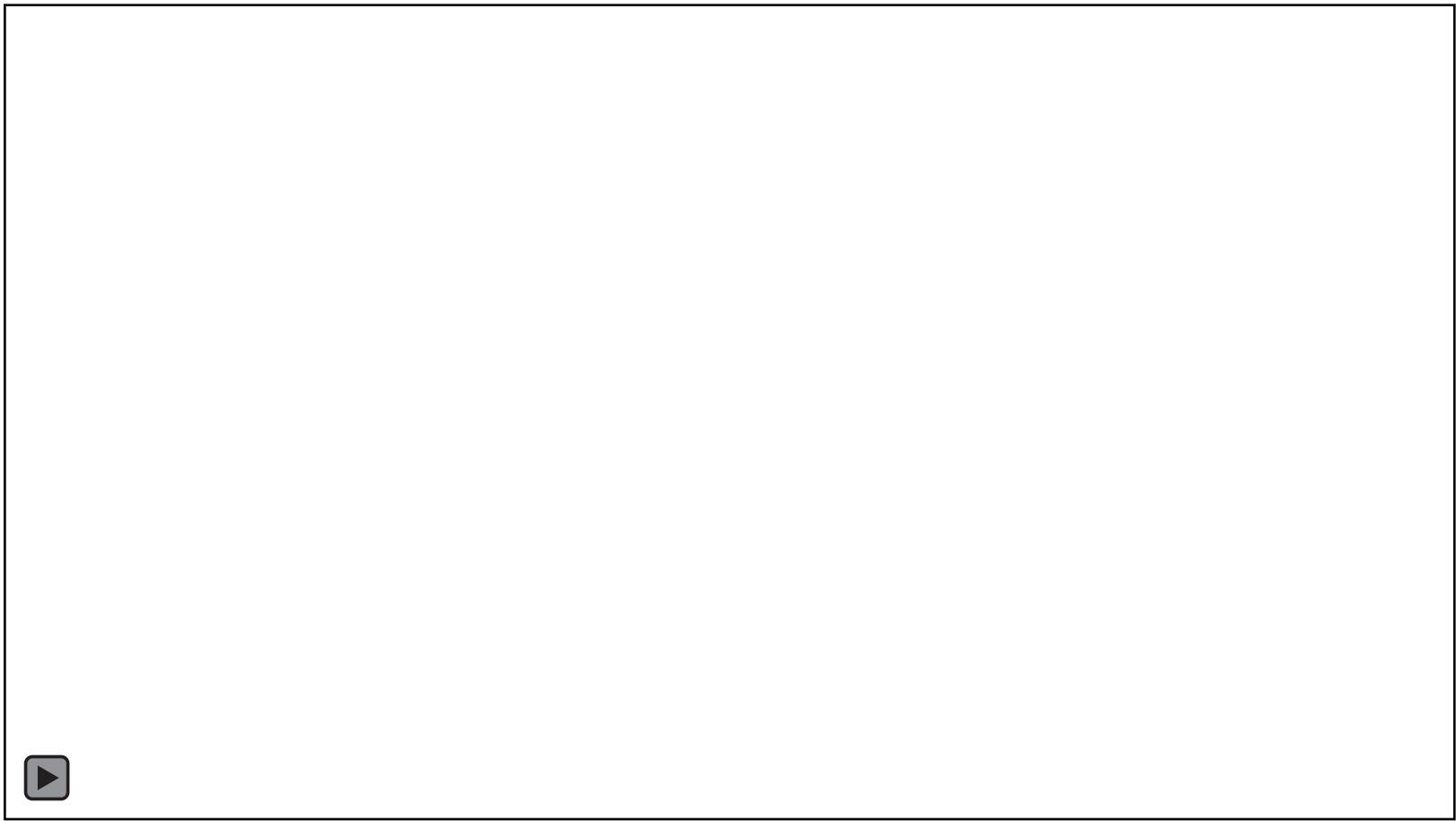


Professor Shlomo (Solly) Angel, Director, NYU Urban Expansion Program
Address at the Infrastructure New Zealand *Building Nations Conference 2018: Lifting Vision, Creating Value*, Auckland, New Zealand, 16-17 August 2018



Focus on expansion: Between 1800 and 2014, the population of Paris, France, increased 22-fold, while its area expanded 220-fold.

Outline:

Part I: The Dimensions of Global Urban Expansion, 1990-2014

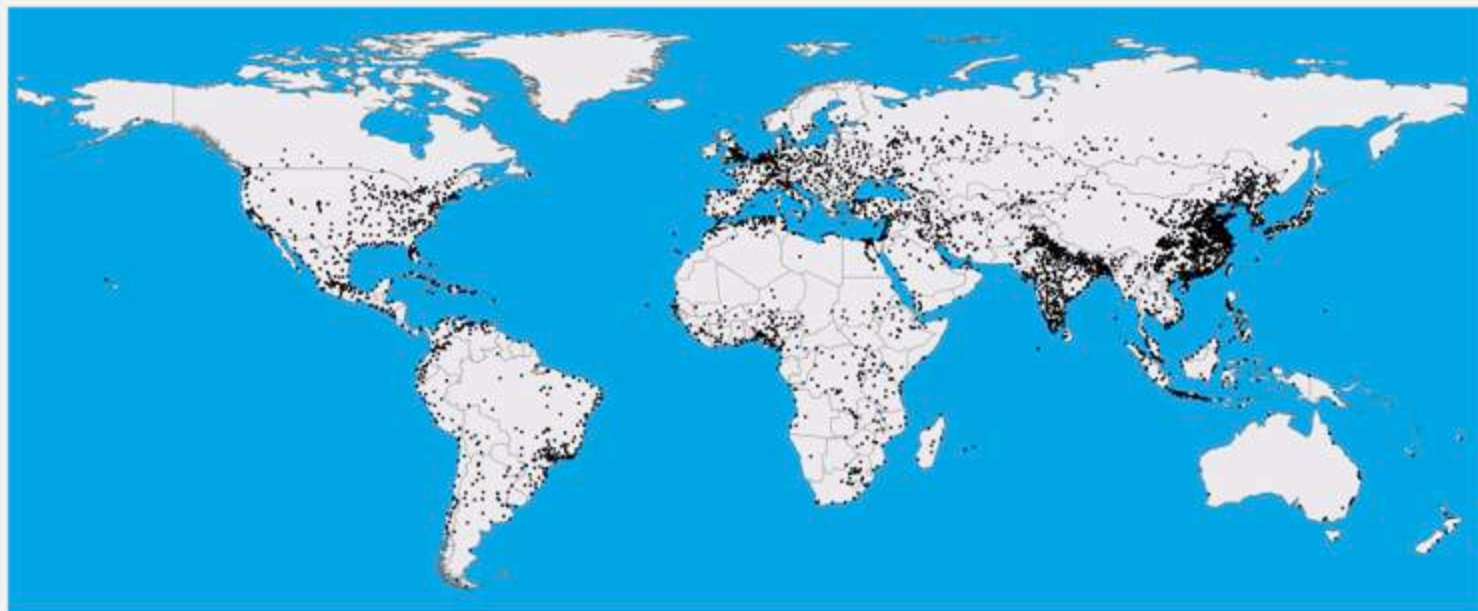
Part II: The Decline in the Quality of Urban Footprints, 1990-2014

Part III: Making Room for Urban Expansion

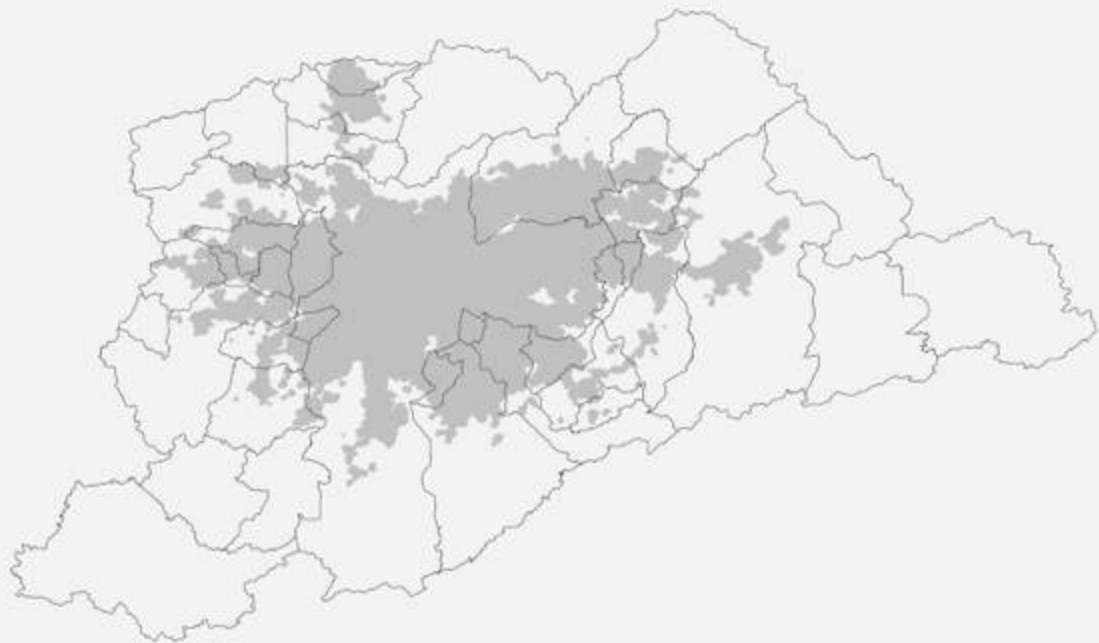


Part I: The Dimensions of Global Urban Expansion, 1990-2014

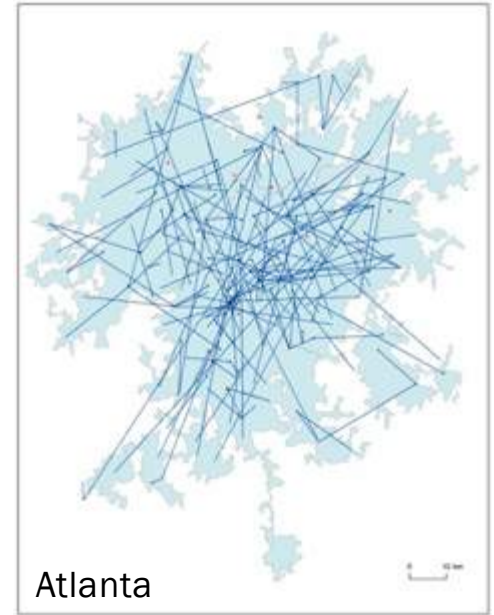
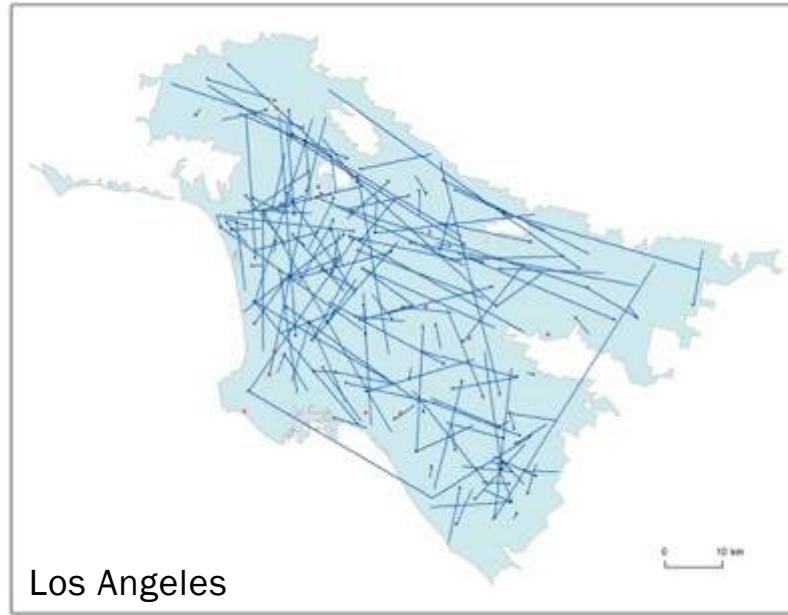
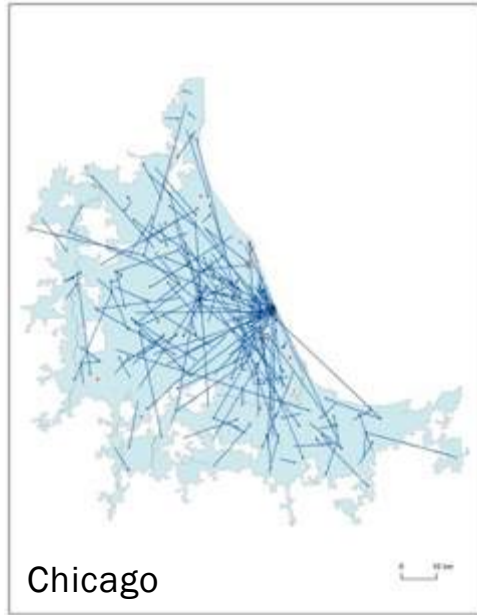




In 2010, there were 4,231 cities in the world with populations of 100,000 or more.

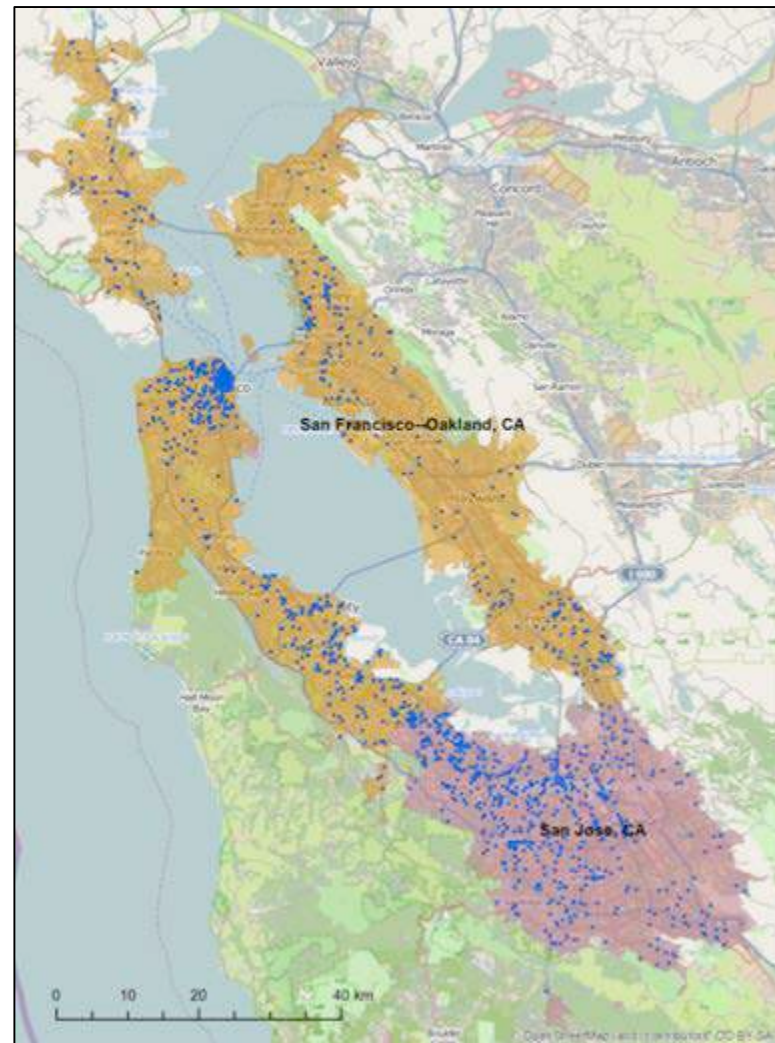


We define cities in the universe as contiguous built-up areas that can span numerous municipalities. The urban extent of São Paulo (grey) extended across as many 31 municipalities.



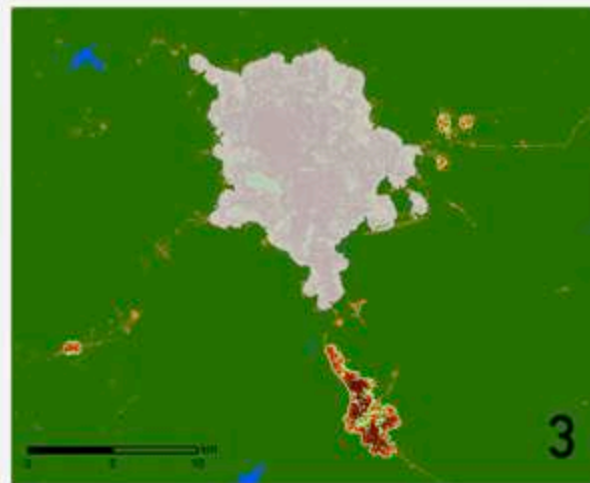
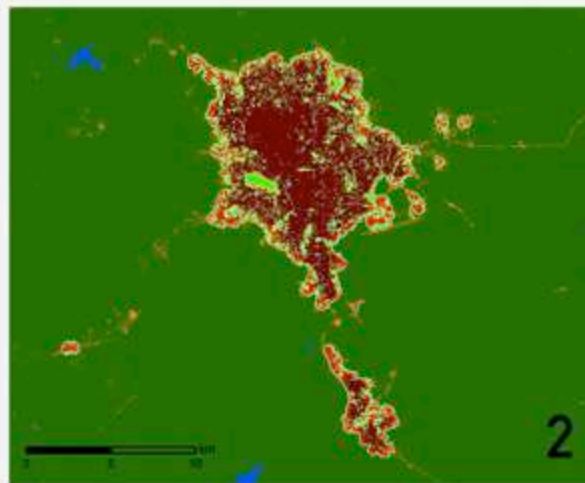
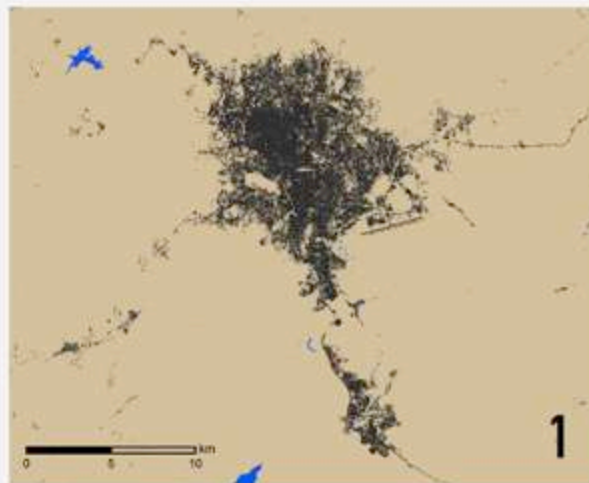
Focus on urban agglomerations: Contemporary cities are integrated metropolitan labor markets: People live everywhere and work everywhere.

Silicon Valley is not a valley. It spreads throughout the San Francisco Bay Area.



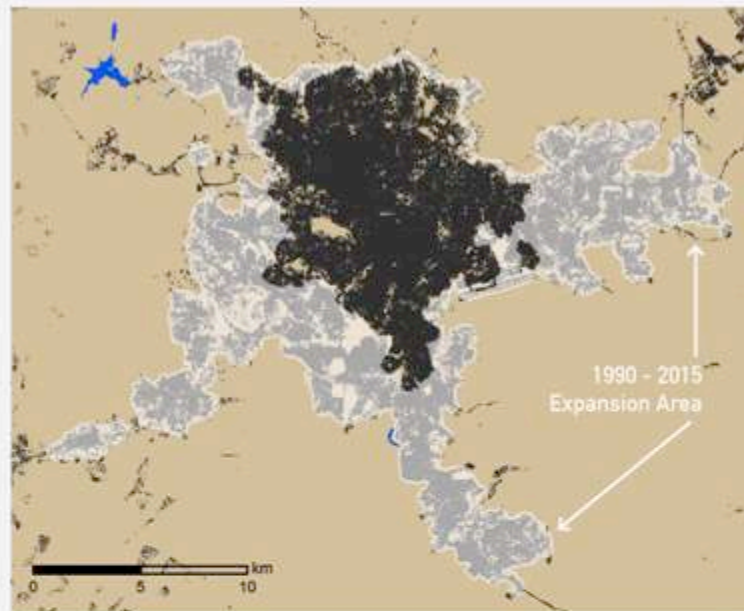
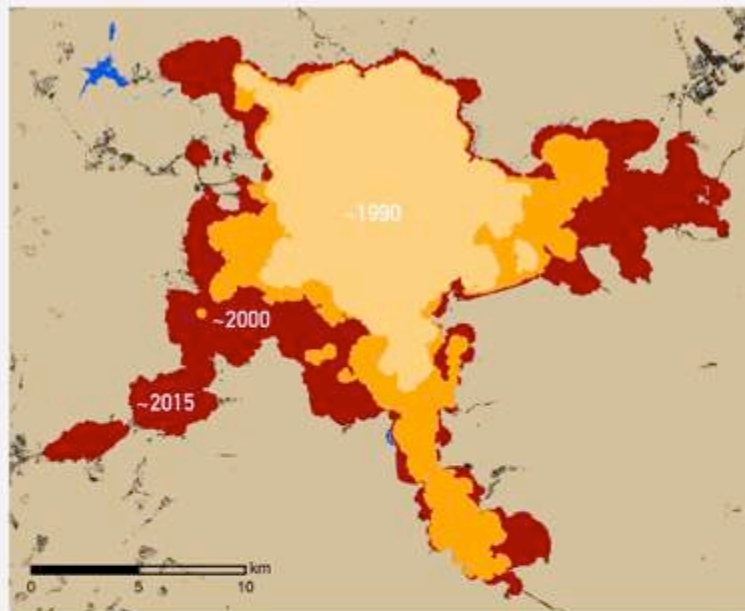


We can map and measure the spatial attributes of cities in a stratified global sample of 200 cities that is representative of the universe of cities.



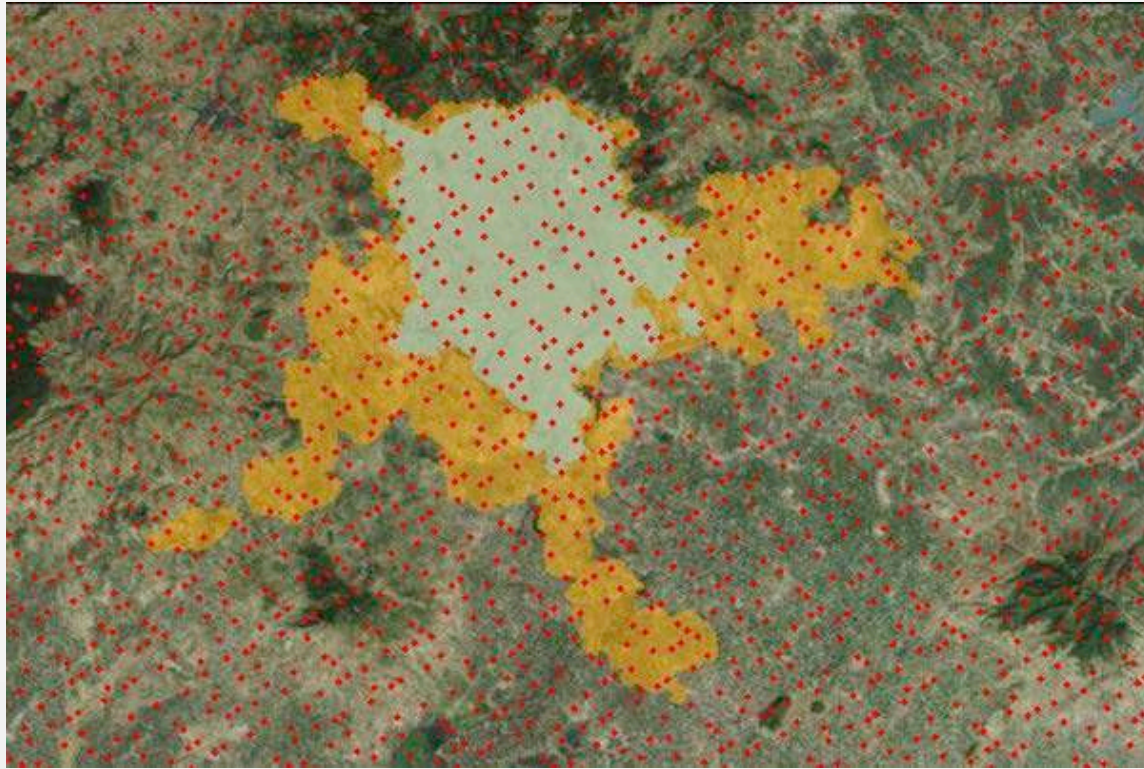
METHOD

1. Collect imagery and identify built-up areas, open space, and water.
2. Analyze built-up area and open space to obtain urban clusters.
3. Determine the city's urban extent using an inclusion rule.



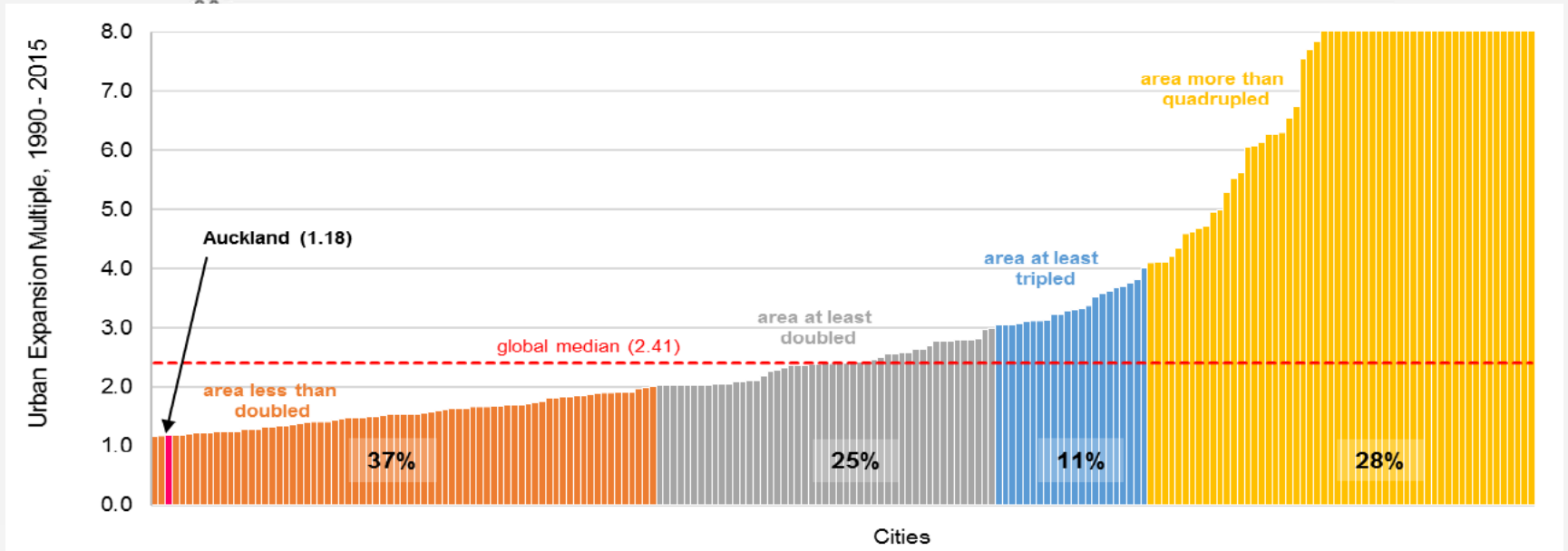
METHOD

Repeating this process over time, we obtain the urban extent at three periods, circa 1990, circa 2000, and circa 2015. A city's expansion area is determined by subtracting its 1990 extent from its 2015 extent.

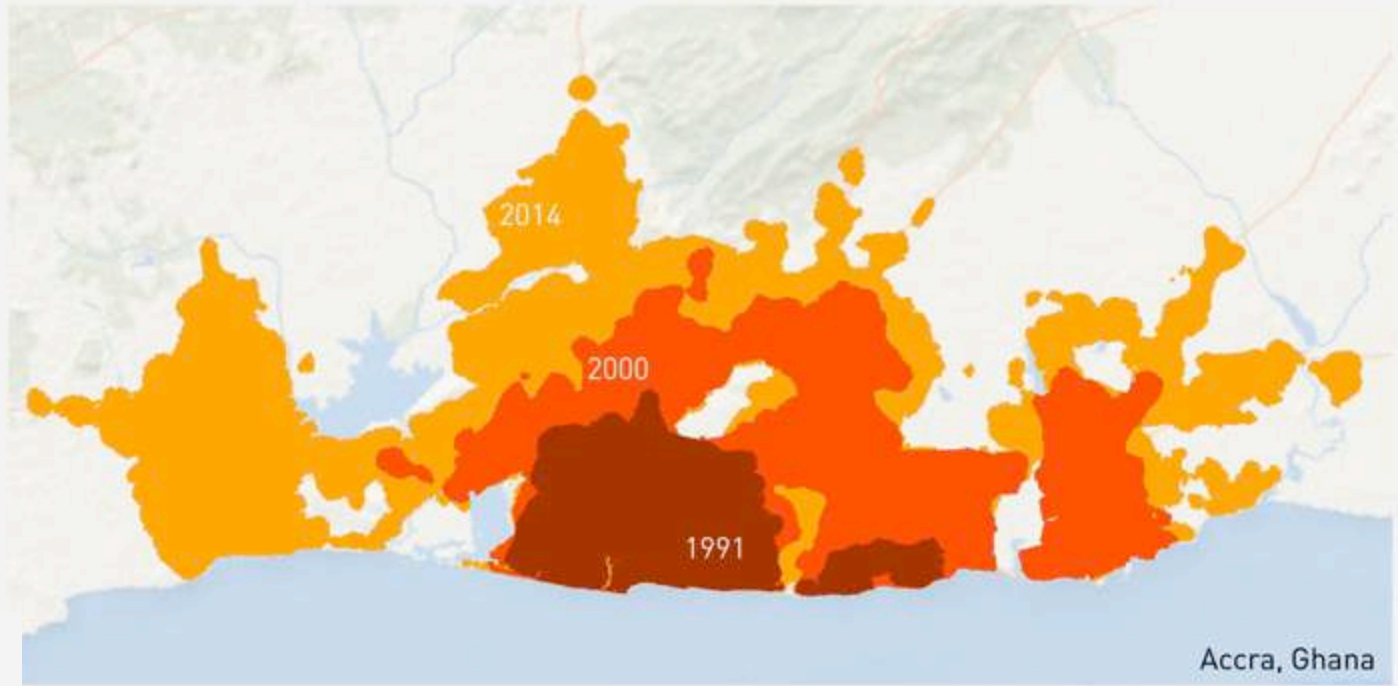


METHOD:

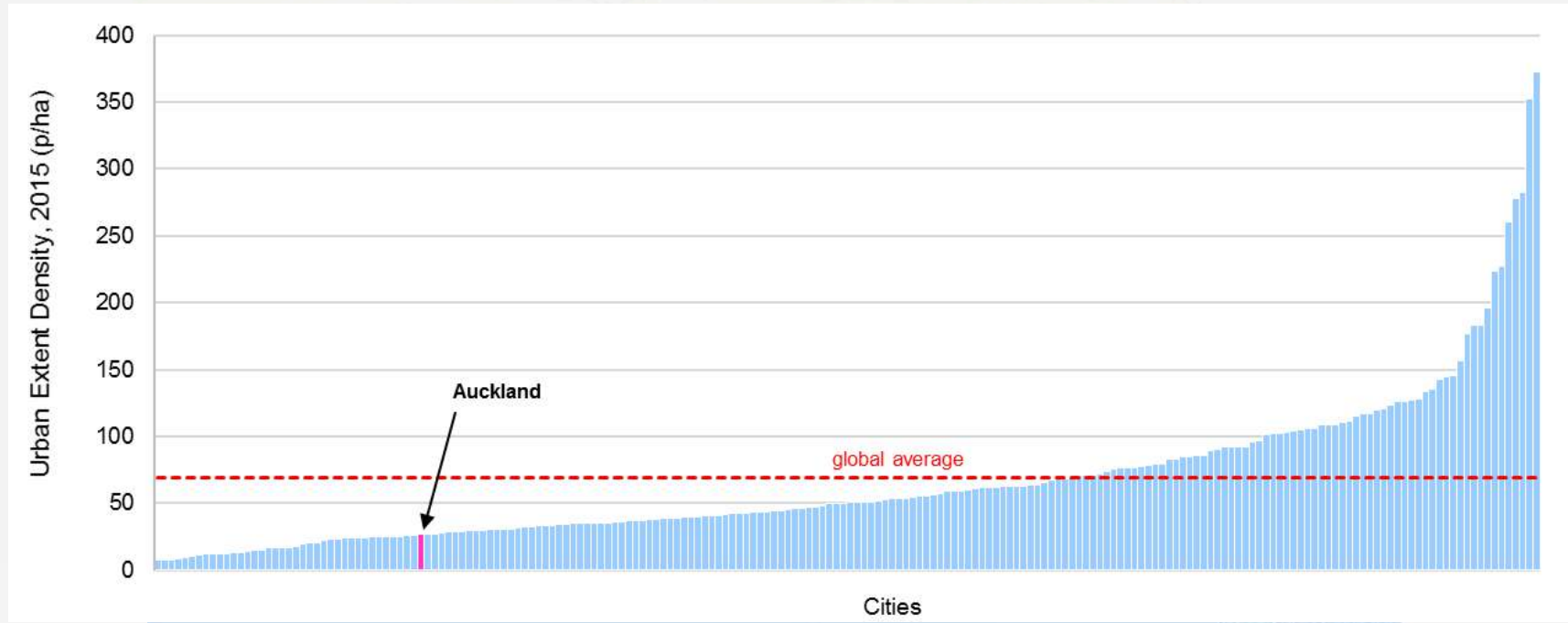
We can study changes in urban layouts using high-resolution satellite imagery by the quasi-random placement of 10-hectare locales: Potential locales in Addis Ababa, Ethiopia.



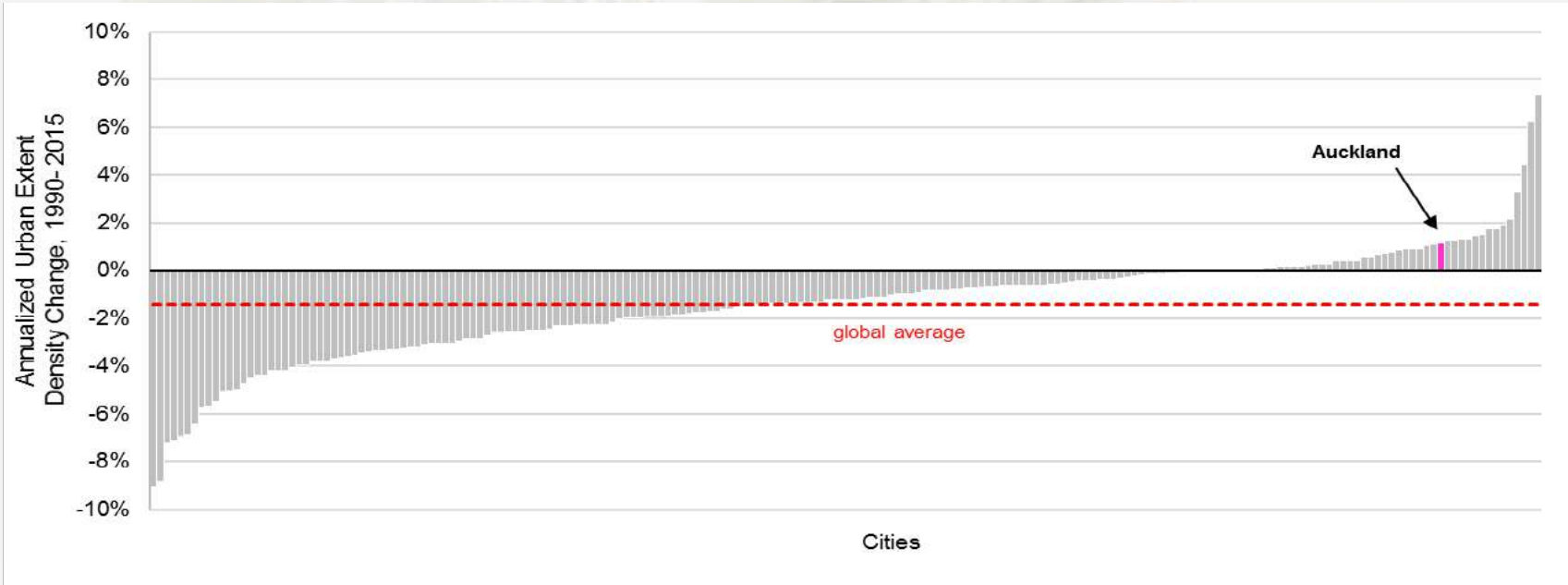
Cities are expanding at different rates. 62% of the cities in the global sample at least doubled their area between 1990 and 2014. 28% of cities have at least quadrupled their areas (Auckland's area increased by a factor of 1.18).



On average, cities are expanding at a faster rate than their populations. The population of Accra, for example, grew by a factor of 3.4 between 1991 and 2014; its urban footprint grew by factor of 6.5.

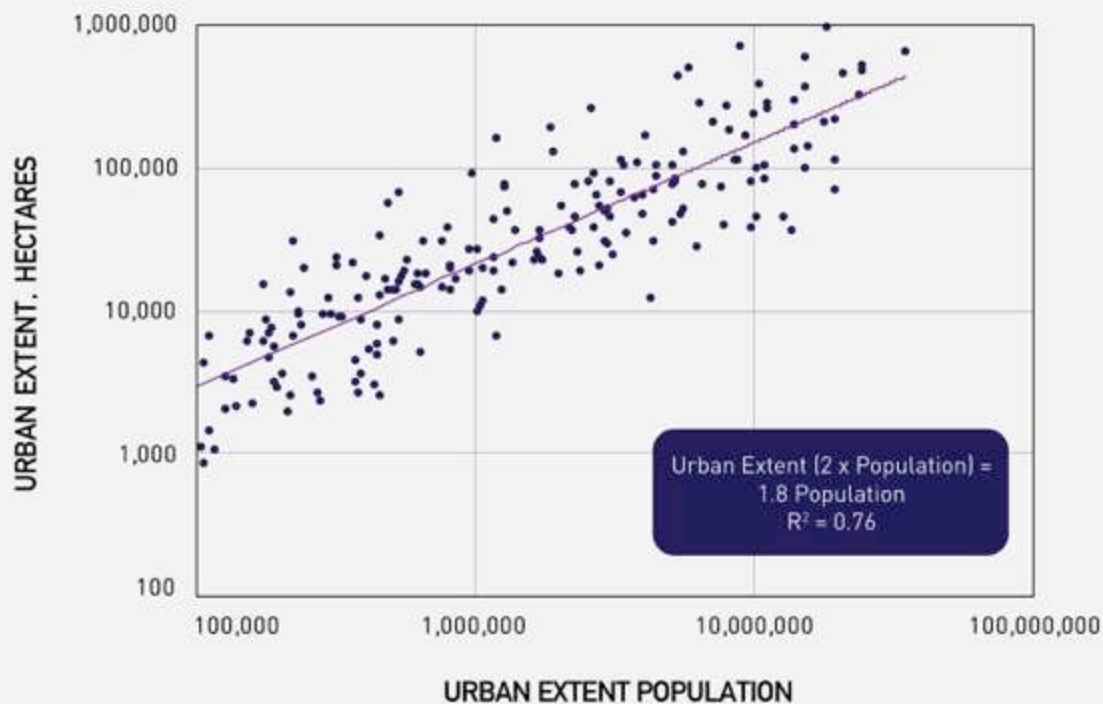


Population densities in the urban extents of cities in the global sample of cities in 2014 varied from 7 persons per hectare to 372 persons per hectare with a global average of 67 persons per hectare (Auckland's was 27 p/ha).

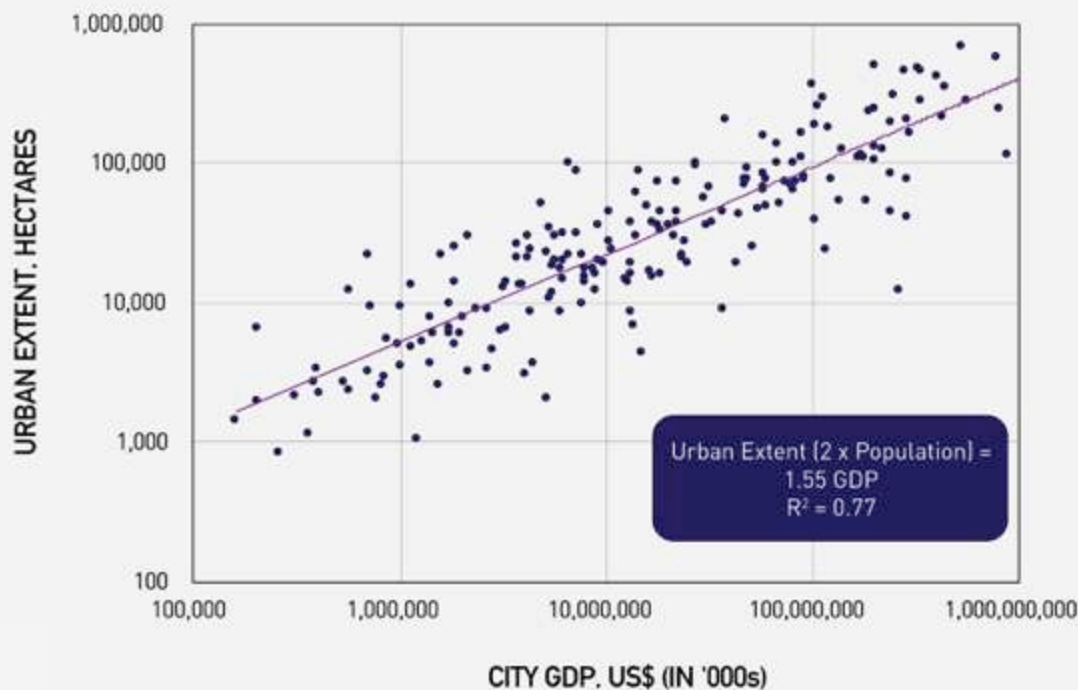


Population densities in the global sample of 200 cities declined, on average, by 1.4% per year during 1990-2014. Densities increased in 45 of the 200 cities, at an average rate of 1.1% per year (Auckland registered an increase of 1.1% per year).

The variations in the urban extent of cities—the areas they occupy—are largely functions of their population and their level of economic development.



A city with double the population of another one can be expected to have an urban extent that is 80% larger than the other city.

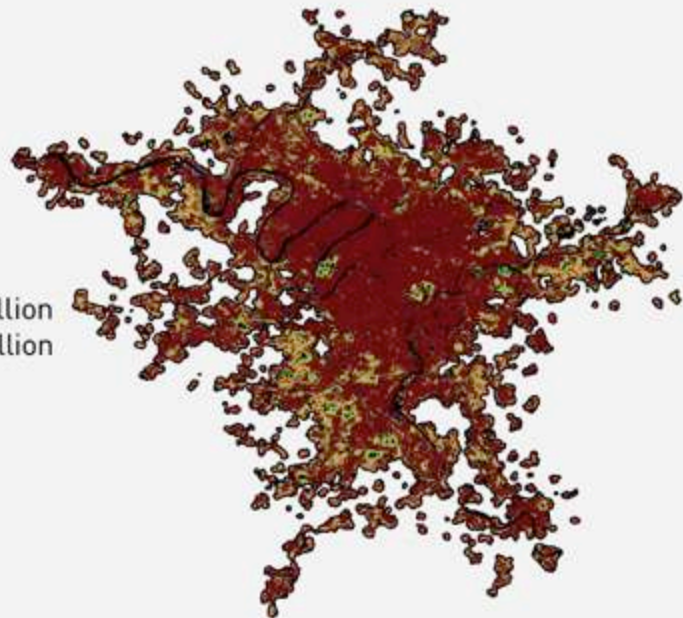


A city with double the Gross Domestic Product of another one can be expected to have an urban extent that is one-half larger than the other city.

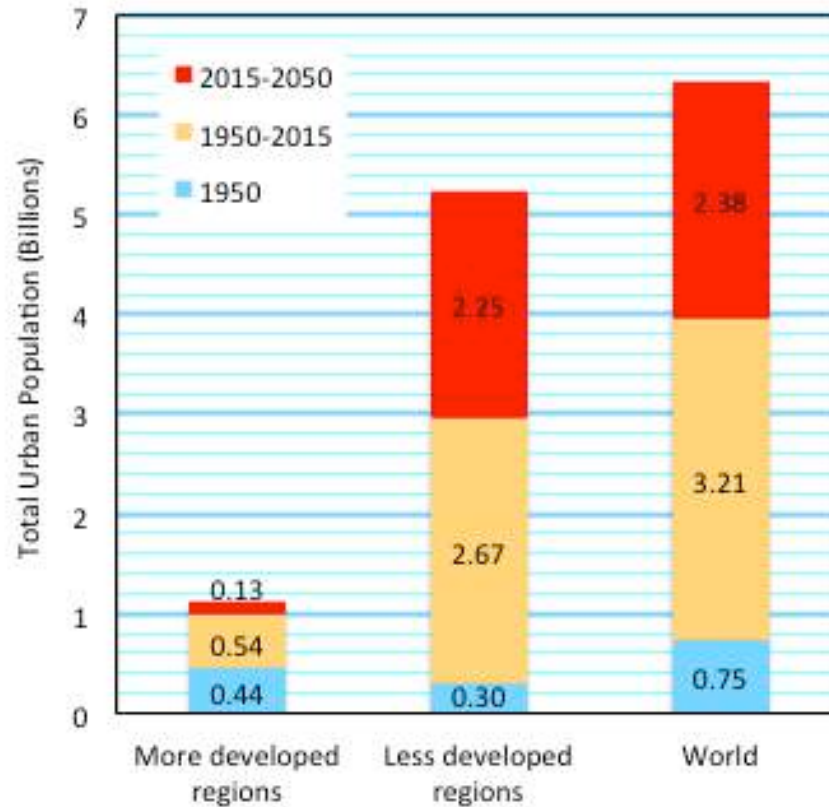
Lagos, Nigeria, 2015
Population: 11.4 million
City GDP: US\$58 billion




Paris, France, 2015
Population: 11.2 million
City GDP: US\$557 billion



In 2015, Paris had almost the same population but 10 times the GDP as that of Lagos. As a consequence Paris had 3.5 times the urban extent of Lagos.



Between 2015 and 2050, 18 persons will be added to cities in less developed countries for every 1 person added to cities in more developed countries.



At the current rate of increase in land consumption, the extent of cities in Less Developed Countries is expected to more than triple between 2015 and 2050; in More Developed Countries, the extent of cities is expected to increase by 90%.

Part II: The Decline in the Quality of Urban Footprints, 1990-2014



The share of the built-up area in roads less than 4-meters wide increased significantly during the 1990-2014 period. It was higher in new urban peripheries ($28\pm2\%$), on average, than in older parts of cities ($20\pm2\%$).



Average block size increased significantly during the 1990-2014 period. It was higher in new urban peripheries (5.4 ± 0.3 hectares), on average, than in older parts of cities (3.7 ± 0.2 hectares).



The share **intersections that were 4-way** decreased significantly during the 1990-2014 period. It was lower in new urban peripheries ($10\pm1\%$), on average, than in older parts of cities ($15\pm1\%$).



The share of the **area within walking distance of arterial roads** (16-meters +) decreased significantly during the 1990-2014 period. It was lower in new urban peripheries ($69\pm 2\%$), on average, than in older parts of cities ($83\pm 2\%$).



The share residential areas that were not laid out before they were occupied increased significantly during the 1990-2014 period. It was higher in new urban peripheries ($31\pm3\%$), on average, than in older parts of cities ($22\pm3\%$).



The share residential areas in **informal land subdivisions** increased significantly during the 1990-2014 period. It was higher in new urban peripheries ($29\pm4\%$), on average, than in older parts of cities ($17\pm3\%$).



The share of **residential areas that were gridded** was very small and still decreased significantly during the 1990-2014 period. It was lower in new urban peripheries ($2\pm1\%$), on average, than in older parts of cities ($7\pm2\%$).



Part III: Making Room for Urban Expansion



A pragmatic action program for orderly urban expansion

I PROJECT REALISTIC 30-YEAR LAND NEEDS: Identify the lands needed for a realistic 30-year urban expansion;

II PREPARE AN ARTERIAL ROAD GRID: Secure the rights-of-way for an arterial infrastructure grid in the entire expansion area;

III PROTECT PUBLIC OPEN SPACES: Protect open spaces and areas of high environmental risk from development; and

IV IMPROVE LAND SUBDIVISION PRACTICES: Reform land subdivision regulations and improve the practices of informal actors.



The Ethiopia Urban Expansion Initiative: Municipal officials preparing draft expansion plans for Bahir Dar, Ethiopia in 2014.



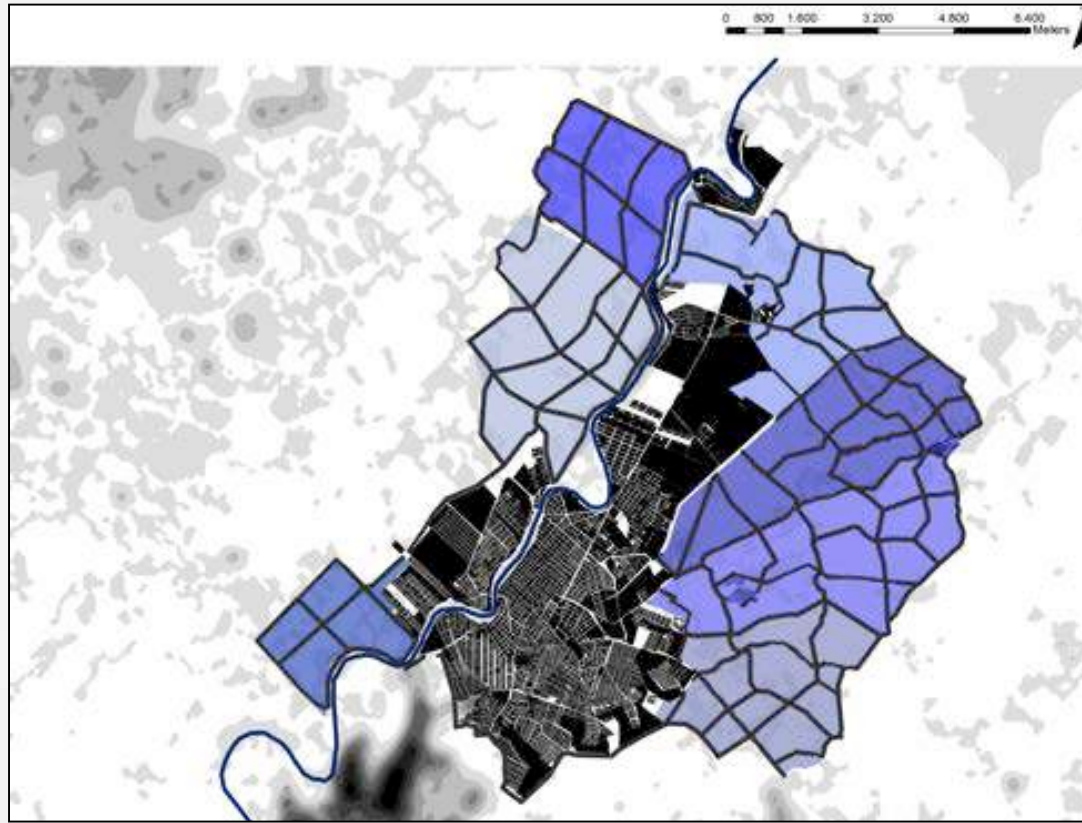
The Ethiopia Urban Expansion Initiative: A survey team laying out arterial roads in Hawassa, where 60+ kms of roads have been surveyed.



The Ethiopia Urban Expansion Initiative: A new arterial road in an area that was occupied by informal settlements, created through plot reconstitution.



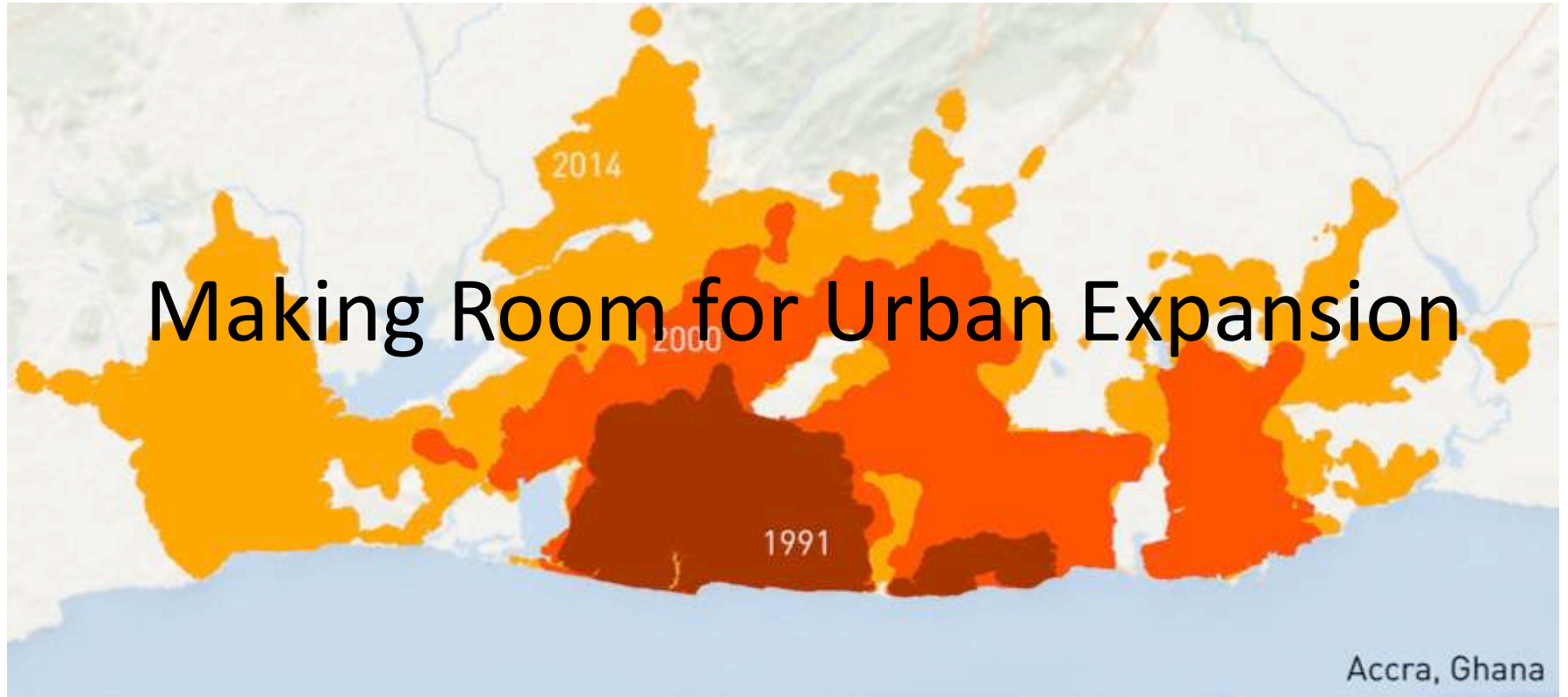
The Colombia Urban Expansion Initiative: Municipal officials preparing draft expansion plans for Valledupar in 2014.



The Colombia Urban Expansion Initiative: The 2015 arterial grid plan of Montería covers its projected 30-year expansion area.



The Colombia Urban Expansion Initiative: Children planting trees along the sidewalks of a future arterial road in Valledupar, 2016.



Thank you!