BUILDINGS & CITIES

Urban expansion: theory, evidence and practice

SPECIAL COLLECTION: URBAN EXPANSION

EDITORIAL

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HIGHLIGHTS

Cities accommodate population growth both through the densification of their existing footprints and through their expansion into their rural peripheries. In recent decades, most population growth has been accommodated through urban expansion. In the Global South, where most urban population growth now takes place, urban expansion occurs in a haphazard, unplanned manner, making cities less productive, less inclusive, less resilient, and less sustainable. This editorial provides a non-technical introduction to the subject of urban expansion, providing the context for the articles in the special issue. The pace and dimensions of global urban expansion and the political contexts in which it occurs are explored and explained. The adverse consequences of unplanned urban expansion are considered, and a case is made for the public sector to assume a key role in preparing rapidly growing cities for their inevitable growth. Seven principles are provided for the public sector to guide planned urban expansion. A set of questions is presented that together form a comprehensive future research agenda on urban expansion.

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1. BACKGROUND

Urban expansion is a consequence of urban population growth because urban settlements consume land. Both urban densification and urban expansion can accommodate this growth.

This special issue of *Buildings & Cities* focuses on urban expansion in cities the world over. Urban expansion is defined simply as the physical extension of the geographical footprints of towns, cities, and metropolitan areas into the surrounding countryside, encompassing surrounding villages and towns in the process. What recent studies of urban expansion (*e.g.* Angel *et al.* 2012) have revealed is that this expansion process is initially fragmented and sometimes even leapfrogs over vacant open spaces, but these vacant open spaces on the urban fringe typically fill in gradually as outward expansion continues. Expansion on the urban periphery occurs at lower average densities than those of central cities (Clark 1951) because land on the urban periphery is cheaper than land in city centers (Alonso 1964).

As cities grow in population, they expand outwards, growing in area and converting more land to urban use. A study of 30 cities in all continents has shown that their areas expanded 16-fold or more between 1800 and 2014 (Angel *et al.* 2016). Paris, France, for example, increased its area 200-fold from 11 km^2 in 1800 to 2200 km^2 in 2014, while its population grew 22-fold, from 500,000 to 11 million (Figure 1).

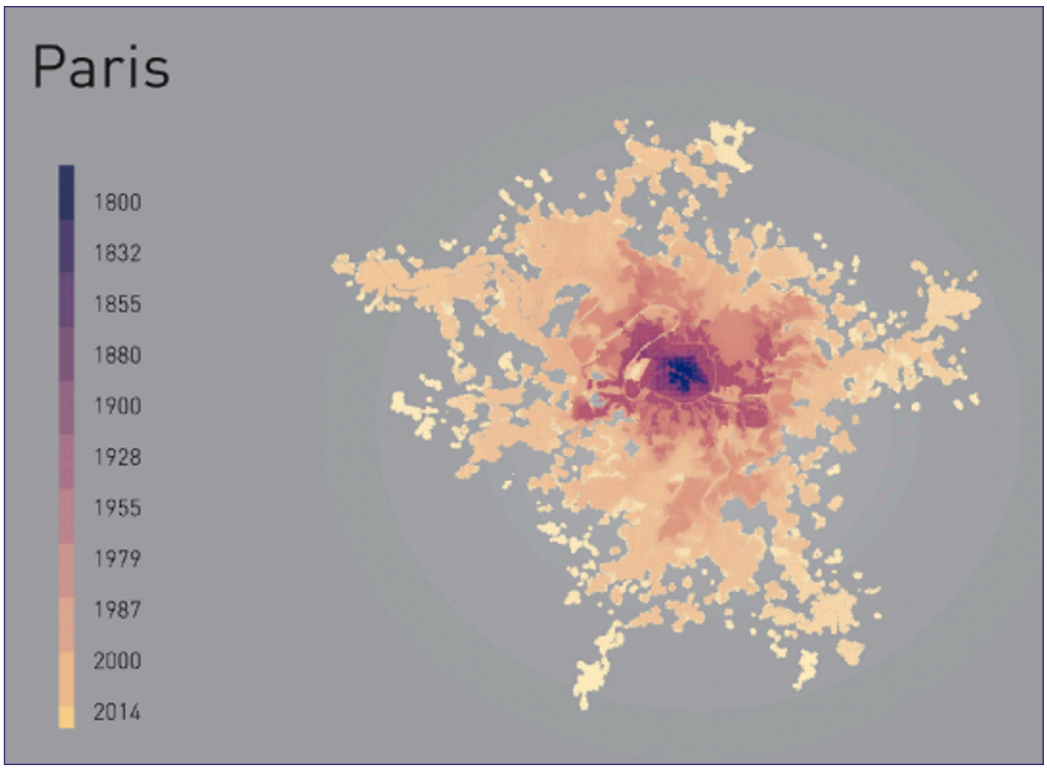

Figure 1: The expansion of Paris, France, 1800–2014.

Source: Angel *et al.* (2016).

The increased availability of freely accessible satellite imagery has made it possible to map and measure this expansion in all cities large and small in all world regions, more precisely than before. This has indeed given an impetus to the academic study of urban expansion, a field that has come of age only at the beginning of this century. According to Google Books Ngram viewer, between 2005—the year that saw the publication of *The Dynamics of Global Urban Expansion* (Angel *et al.* 2005)—and 2019, the frequency of use of the term 'urban sprawl' declined by 13%, while the frequency of use of the term 'urban expansion' increased by 26%. While the latter term was only one-third as frequently used as the former term in 2005, by 2019 it was used more than half as frequently. Research and planning for urban expansion, as this special issue plainly demonstrates, has come into its own. The outward expansion of cities the world over is now taken as a serious global phenomenon that requires serious attention.

Urbanization and its concomitant urban population growth and urban expansion has accelerated towards the end of the 18th century and has been all but unstoppable during the 19th and 20th centuries. Yet, contrary to common perceptions, the rate of growth of urban populations has been slowing for decades in all world regions. In the world at large, the urban population doubled in the 25 years between 1953 and 1978. It then doubled again in 29 years between 1978 and 2006, and it is projected to double again in the 44 years to 2050 (UN Population Division 2018). It is not expected to double again after that, but to level off by the end of the century. In fact, the 'urbanization project' is slowly coming to an end. The growth of urban populations in the Global North has slowed to a trickle. It is now projected to grow by only 12% between 2020 and 2050, adding 120 million people to the 1 billion inhabiting its cities in 2020. And while urbanization in the Global South has slowed as well, its urban population is now expected to grow by two-thirds by between 2020 and 2050, adding 2.2 billion to the 3.4 billion already inhabiting its cities. For every additional person that will need to be accommodated in cities in the Global North, 18 additional persons will need to be accommodated in cities in the Global South.

One of the key findings of recent studies of urban expansion is that urban land consumption per capita has been increasing over time. This accompanies economic development. As people become better off, they consume more: more housing, more workspace, more facilities. This increased demand often translates into more land consumption. Cheaper transport makes more distant lands more accessible, allowing both residences and workplaces to move away from dense city centers. A meta-analysis of 326 studies in 2011 concluded that:

> [a]cross all regions and for all three decades, urban land expansion rates are higher than or equal to urban population growth rates, suggesting that urban growth is becoming more expansive than compact. (Seto *et al.* 2011)

This can be clearly seen in Accra, the capital of Ghana. In a span of 23 years (1991–2014), its population grew by a factor of 3.3, from 1.3 million to 4.4 million people. During that same period, its urban footprint expanded by a factor of 6.5, from 133 to 872 km^2.

As urban expansion accompanies urban population growth, efforts to contain it have typically failed just as efforts to limit urban population growth have failed again and again. Seto *et al.* (2012) predicted that:

> [i]f current trends in population density continue and all areas with high probabilities of urban expansion undergo change, then by 2030, urban land cover will increase by 1.2 million km^2, nearly tripling the global urban land area circa 2000.

Angel *et al.* (2011, tab. 6.2, 98) projected that:

> urban land cover in developing countries will increase from 300,000 km^2 in 2000 to 770,000 km^2 in 2030 and to 1,200,000 km^2 in 2050.

However, urban expansion is not universally accepted, let alone welcomed. It is often resisted both by citizens groups and by the municipalities that represent them. The most common result of this resistance is that cities do not prepare adequate lands for expansion, as an act of denial, *e.g.* "if we don't built it, they will not come". A typical claim of those resistant to urban expansion is that urban population growth can be accommodated by the densification of the existing footprints of cities, not requiring any incursion into the rural periphery to convert new lands to urban use. This contention does not hold up in the face of recent empirical evidence that demonstrated that in a global sample of 200 cities, the average share of the increase in population during the period 1990–2014 that was accommodated by the densification of the existing footprints in 1990 was 23%, while the remaining 77% was accommodated in expansion areas built during the same period (Angel *et al.* 2022). Urban expansion is the principal mechanism by which cities accommodate their population growth.

Urban expansion and the densification of existing urban footprints are the two complementary ways of making room in cities. The larger the share of the population accommodated through

densification, the lower the share that needs to be accommodated through expansion, and vice versa. When insufficient room is made available through densification and no natural or regulatory restrictions on expansion exist, then room is inevitably created through expansion. Conversely, if natural or imposed barriers to expansion exist and there are no regulatory, NIMBYist, financial, or technological restrictions imposed on densification, then more room is created through densification. Densification, where possible, is thought to be better for the environment than expansion. Higher densities have been associated with lower transport energy use. The higher the average density of a city, the shorter the distance between random locations, public transit becomes more feasible, and so do cycling and walking, which help to reduce greenhouse gas emissions.

It is indisputable that cities need a two-pronged approach to climate-sensitive accommodation of the urban population in the Global South, an approach that can deliver both densification *and* expansion—with a view to 'greening' urban expansion. An earlier special issue of *Buildings & Cities*[1] focused on urban densification (Teller 2021), and the present special issue focuses on expansion and, more specifically, on planning and preparing for urban expansion in rapidly growing cities, cities that are, almost without exception, located in the Global South.

In the Global South, urban populations are still growing rapidly, and zoning and land-use regulations are more difficult to enforce. The failure to prepare lands for expansion typically results in a series of problems:

- disorderly and unplanned settlement of the urban periphery
- overcrowding and unaffordable housing
- the proliferation of informal settlements without proper layout and inadequate lands for streets, drainage works, and public facilities
- the shortage of arterial roads that connect the periphery to the urban job market
- the occupation of areas with high environmental risk that should be kept free of development
- the shortage of public open spaces

2. ADVERSE CONSEQUENCES OF UNPLANNED URBAN EXPANSION

As a city grows in population, how can it capture the benefits of urbanization? Failing to plan for urban growth will compromise the ability of a city to grow in a productive, inclusive, and sustainable manner. Several adverse consequences can arise from an inability to properly accommodate urban growth:

- *Low-density sprawl*

  Low-density sprawl is the result of regulations that mandate large plots, that forbid multi-family housing, or that prescribe low floor area ratios that prevent transit-oriented densification along arterial roads (Figure 2). This results in low-density sprawl that increases travel distances and hence greenhouse gas emissions as well.

- *Shortage of arterial roads*

  Unplanned urban expansion, or the informal conversion of rural plots to urban use by subdividing and selling them, typically results in large expanses of built-up areas with narrow lanes and an inadequate supply of arterial roads that can carry public transport and trunk infrastructure (utilities, drainage, *etc.*), and that connect the urban periphery to the urban job market with public transport, reducing the reliance on cars. The absence of arterial roads compromises the ability of the urban periphery to develop higher density, mixed-use areas along them, compromising their ability to contribute to mitigating climate change.

- *Costly community infrastructure*

  The occupation of the urban periphery by informal settlements (where lands are not properly subdivided into small blocks of plots with four-way street intersections, leaving

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adequate rights-of-way for streets, public works, and public open spaces) makes the later provision of public services more difficult and considerably more expensive than laying out communities properly before they are occupied. It also makes neighborhoods less walkable and less safe.

- *Occupation of hazardous sites*

  Unplanned and unregulated urban expansion often results in the occupation of hazardous sites, *e.g.* steep slopes in danger of landslides or riparian areas in danger of floods. This increases the risk of harm from natural hazards, both for the inhabitants of such sites and the city as a whole. For example, wider flooding can occur if drainage channels are blocked by landslides.

- *Inadequate provision of public open spaces*

  Unplanned expansion typically results in continuous built-up areas that, over time, occupy all the available space (Figure 3). This leaves little area for public open spaces, especially for small community open spaces that are a high priority for women and children.

- *Inadequate protection of ecological assets*

  Unplanned urban expansion also results in the destruction of ecological assets: coastal lagoons, riverbeds, wetlands, and other high-quality green spaces. These must be kept free of development.

- *Overcrowding and unaffordable housing*

  The inadequate provision of lands for the construction of affordable housing restricts the supply of land for housing. This makes housing unaffordable and results in overcrowding or in the construction of housing in areas with difficult access to urban jobs and amenities.

- *Adverse impacts on rural livelihoods*

  Unplanned and unregulated urban expansion results in harms to the livelihood and lifestyles of rural households on the urban periphery that have no power to stop the conversion of their lands to urban use and often lack the resources to quickly respond to the changes confronting them.

Figure 2: Low-density sprawl mandated by zoning and land subdivision regulations.

Photo: David Shankbone.

Figure 3: Large areas of São Paulo, Brazil, were built with no community open spaces.

Source: Google Earth.

3. CONTRIBUTIONS IN THIS SPECIAL ISSUE

This special issue on urban expansion contains eight articles covering a range of research issues (Table 1). Both Richter & Bixler and Cruz-Bello *et al.* examine the drivers of urban expansion. These articles move our understanding forward by including more explanatory variables in linear regression models with the rates of expansion as independent variables, thus making the explanations about the drivers of urban expansion more inclusive. They make a further contribution by differentiating the types of expansion and seeking to explain each type separately.

AUTHORS	TITLE	DOI
S. Angel	Urban expansion: theory, evidence and practice (Editorial)	https://doi.org/10.5334/348
S. M. Richter & R. P. Bixler	Complexifying urban expansion: an exploratory, gradient-based approach	https://doi.org/10.5334/bc.226
G. M. Cruz-Bello, J. M. Galeana-Pizaña & S. González-Arellano	Urban growth in peri-urban, rural and urban areas: Mexico City	https://doi.org/10.5334/bc.230
M. H. Andreasen, J. Agergaard, R. Y. Kofie, L. Møller-Jensen & M. Oteng-Ababio	Urban encroachment in ecologically sensitive areas: drivers, impediments and consequences	https://doi.org/10.5334/bc.210
G. Gullette, P. Thebpanya & S. Singto	Socioeconomic and livelihood impacts within Bangkok's expanding metropolitan region	https://doi.org/10.5334/bc.233
M. M. Salazar Tamayo & J. D. Julio Estrada	Planning gaps: unexpected urban expansion in five Colombian metropolitan areas	https://doi.org/10.5334/bc.240
B. Oyalowo	Implications of urban expansion: land, planning and housing in Lagos	https://doi.org/10.5334/bc.243
F. Bentlin	The urban expansion of Berlin, 1862–1900: Hobrecht's Plan	https://doi.org/10.5334/bc.242
P. Lamson-Hall & R. Martin	The Ethiopia Urban Expansion Initiative and knowledge exchange	https://doi.org/10.5334/bc.247

Table 1: Articles in this special issue 'Urban Expansion', *Buildings & Cities* (2023), guest editor Shlomo Angel.

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Richter and Bixler explore the expansion of 379 out of 384 US metropolitan statistical areas (MSAs) during two time periods, 2001–11 and 2011–16, and report on the significant decline in the rate of urban expansion during the second period. They introduce a large number of independent variables to explain the rate of expansion beyond those mentioned above: the share of the foreign-born population, household size, the share of the labor force working from home, workers with over one-hour commutes, and the saturation of urban footprints, to name a few, all of which are found to have significant effects on rates of expansion. The authors distinguish between three types of expansion: the infill of existing urban footprints, expansion within the immediate urban periphery, and ex-urban expansion that leapfrogs beyond 3 miles from existing urban footprints. They then model rates of expansion in all three zones. Their models are robust, explaining 70–85% of the variations in rates of expansion among US metropolitan areas.

Cruz-Bello *et al*. focus on a fast-growing region west of Mexico City, Mexico, again distinguishing between three zones, in their case the urban, the peri-urban, and the rural. The urban and rural zones are defined by the national statistical agency, INEGI, while the peri-urban is defined by the authors as an area with a diversity of urban and rural land uses. Again, the authors introduce a large number of drivers of urban expansion, many of which are found to be significant in explaining rates of expansion in these three zones. These include, for example, distance to previously developed land, population density, distance to roads, and the percentage of dependent population, to name a few.

Four articles examine the adverse consequences of unplanned or under-planned urban expansion in four complementary ways: the destruction of environmental assets, the imposition of costs on rural livelihoods on the urban periphery, the inadequate areas for planned expansion, and the exclusion of low-income households from areas of planned expansion.

Andreasen *et al*. describe the encroachment on ecologically sensitive areas in the expansion of Accra, Ghana, by landfilling, channeling of streams, and construction of barriers, resulting in intensifying flood hazards. They note that encroachment is universal and not necessarily associated with poverty. They also explain the impediments to preventing it with good governance.

Gullette *et al*. focus on the impact of the rapid expansion of metropolitan Bangkok, Thailand. Adverse social and economic impacts affect the livelihoods of rural families inhabiting its urban fringe.

Salazar-Tamayo and Julio-Estrada compare the planned expansion areas and the actual expansion areas in five metropolitan regions in Colombia. This research finds that planners underestimated the areas needed for expansion, and that local authorities lack the capabilities to properly manage urban growth.

Oyalowo focuses on formal mechanisms and planned expansion in Lagos, Nigeria, leading to the proliferation of higher end real estate development and the exclusion of lower income families from planned areas.

As these articles make clear, urban expansion proceeds whether or not it is properly planned. Adverse consequences from lack of planning arise for people, for businesses, for neighborhoods, and for the city as a whole. This raises the issue of what needs to be done to improve the process of expansion, the subject of the next section of this introductory article.

Two articles describe plans for urban expansion that adhere to many of the principles discussed here. Bentlin focuses on Hobrecht's 1862 expansion plan for Berlin, Germany. Hobrecht created an expansion plan at scale, expanding the city in all directions. He provided for roads 26 m wide throughout the expansion area, as well as for a hierarchy of public open spaces, while respecting property lines to the extent possible. It is important to note that Hobrecht was later criticized for the overcrowding of the tenements constructed within the blocks created by the street network, even though there were no planning mechanisms for restricting density available during his tenure.

Lamson-Hall and Martin consider the Ethiopia urban expansion initiative, undertaken by New York University in collaboration with the Ministry of Urban Development and Construction in the period 2012–16. The Ethiopia urban expansion initiative focused on capacity-building in four regional capitals in Ethiopia, where local officials prepared their own plans, acquired rights-of-way for lands and paid compensation, recovered the cost from the auction of residential plots, and opened a large number of arterial road segments in their expansion areas.

4. PRINCIPLES GUIDING PLANNED URBAN EXPANSION

What can cities do to anticipate and plan for their expansion? Seven principles based on research, personal experience, and observation are provided:

- *Plan for expansion* is simply the need to prepare lands for expansion, even in cities with a high commitment to accommodate all their growth by the densification of their existing urban footprints. Densification and expansion must be planned together. Starting to plan for urban expansion only *after* exhausting the potential for densification could lead to growth that is gender unequal, environmentally destructive, poorly planned, and poorly serviced.
- *Create municipal planning capacity* calls for training and supporting local officials so that they could plan and manage expansion on their own. Expansion plans must be created and owned by local officials if they are to be realized. This means plans must not be prepared by distant outside consultants who 'deliver' a plan document and then leave. Instead, plans require local champions who then stay to see the plan through (Figure 4). The most valuable assistance to municipalities in preparing for and undertaking urban expansion is in the form of simple lessons, simple tools, and simple exercises that increase both their capacity and their confidence in making and implementing such plans at the necessary scale, *i.e.* the entire expansion area of their city in the coming 30 years.
- *Expansion at scale* calls for estimating the amount of land that will likely be needed during the next 30 years, given population and density projections, and then preparing all that land for expansion on the urban periphery. The underlying logic of this principle is that planning for expansion in limited, self-contained, exclusive projects will simply create a zone of formal expansion, while informal expansion will most likely continue in unplanned areas. Planning for urban expansion at scale, by being inclusive, seeks to ensure that the public sector determines the rules and character of the expansion area and does not simply follow in the footsteps of private sector initiatives. It also aims to ensure that land speculation is minimized, because it cannot thrive when the entire periphery is planned for expansion. If there are low, medium, and high projections of land needs, this principle suggests opting for the high projections because the risk of the undersupply of lands is greater than the risk of oversupply. If too little land is planned for expansion, then large areas would be left for informal unregulated expansion. When too much land is slated for expansion, as long as the cost of preparing this land for expansion is minimized, it would simply mean that some lands are left undeveloped.
- *Green urban expansion* identifies lands with ecological risks and assets. This principle seeks to prevent or minimize urban development in areas that should remain open (*i.e.* undeveloped). It calls for properly identifying and protecting areas of high environmental risk, drainage channels, and high-value natural assets. It also calls for identifying a hierarchy of large and small public open spaces that are needed to support the built-up areas of cities, and finding ways to protect them from development, while developing them into usable spaces and securing them for public use.
- *Create an arterial road grid* must, of necessity, be simple and minimalistic (Figure 5). Beyond the attention to open space referred to in the previous principle, the only planning action necessary in the expansion areas of rapidly growing cities is the creation of an arterial road grid throughout the expansion area that will provide access to the urban labor market. To

accommodate urban expansion, an arterial grid in the expansion must have six essential properties:

  - Total coverage: The grid must cover the entire area designated for expansion in the next 20–30 years and not just a segment of that area.
  - Connectivity: The arterial grid should be a mesh of long, continuous roads that crisscross the expansion area and connect it to the existing road network.
  - 1 km spacing: To ensure that public transport is within walking distance, these roads should be spaced no more than 1 km apart.
  - Wide right-of-way: The width of the roads should be around 25–30 m. This enables designated bus lanes, bike paths, a median, and several lanes to carry intra-city traffic.
  - Use existing roads and property lines: Design the arterial grid to take advantage of existing roads and property lines.
  - Progressive improvement: Initially, municipal authorities only need to acquire rights-of-way for the grid. Selected segments should then be improved over the years, but only as demand requires and as budgets become available.

- *Create value capture mechanisms* for financing infrastructure. The conversion of lands from rural to urban use and the provision of such lands with infrastructure (*e.g.* roads, water supply, sewerage, drainage, and electricity) increases the value of these lands several-fold without any investment in improvements on the part of landowners. The public sector is thus justified in capturing a share of this increased value to finance these infrastructure improvements. Municipalities in Chile, Colombia, and Ecuador used special assessments to capture part of the added property value along new road segments. Town planning schemes in India (*e.g.* Ahmedabad) pool lands, subdivide them, provide them with infrastructure, and reallocate them among owners, using the added value of lands to finance both the land and the cost of public works (Mahadevia *et al.* 2018).
- *Create planning mechanisms for laying out green and gender-equal neighborhoods* (Figure 6). The proper design of macroblocks—the areas enclosed within the 1 km grid of arterial roads—can make cities greener and more gender-equal if it adheres to the following six principles:
  - Mixed land and building uses: Integrate residential and non-residential land uses, mix living and working quarters, and bring neighborhood origins and destinations closer to each other.
  - No density restrictions: Remove density and setback restrictions that would prevent adjacent multi-storey structures along arterial roads or small residential plots.
  - Small neighborhood green spaces: Neighborhood open spaces should be green and permeable, open to be public, well maintained, and accessible to women, children, and the handicapped. Streets should be treelined whenever possible as well.
  - Small blocks: Residential land subdivisions should be planned with walkability in mind—and, more specifically, walkability for women. Blocks should be small, preferably 1 ha or less in area.
  - Adequate land in streets: Land subdivision should allow for adequate land in streets, preferably with treelined sidewalks.
  - Land subdivision before occupation: Infrastructure is much cheaper and property values increase faster if residential areas are properly subdivided before they are occupied.

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Figure 4: Officials from the city of Bahir Dar, Ethiopia, drafting an expansion plan for their city at a workshop conducted by New York University in Addis Ababa in 2014.

Source: NYU Marron Institute.

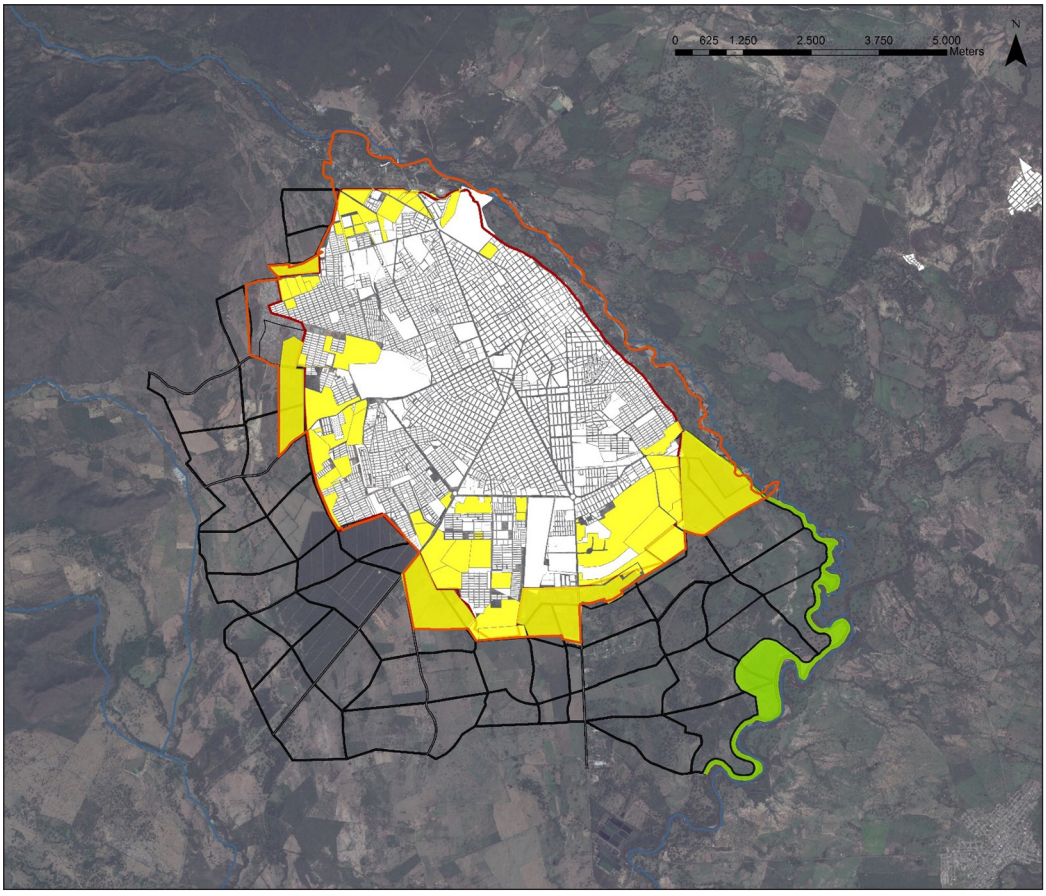

Figure 5: The expansion plan for the city of Valledupar, Colombia, with an arterial road grid that was designed along existing property lines.

Source: NYU Marron Institute.

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Figure 6: The district of Surco in Lima, Peru, was planned with a dense and relatively even distribution of public open spaces, most of them small, all of them highly accessible.

Source: Google Earth, © 2023 Maxar Technologies.

5. A PROPOSED RESEARCH AGENDA

Although this introductory article is not a review of the state-of-the-art of research on urban expansion, it can posit the many interesting questions that are being explored in the emerging literature on urban expansion. These questions can be usefully divided into the five categories listed below. Taken together, they form what I consider to be the research agenda on urban expansion in the coming years.

Theoretical questions:

- What are the determinants of the area of urban footprints of cities?
- What are the determinants of the shape of the urban footprints of cities?
- What are the drivers of urban expansion?
- What is the role of informal transit in shaping the location decisions of informal settlements on the urban periphery?
- What are the factors that explain socio-economic differences among different expansion zones on the urban periphery?
- Are higher residential densities a precondition for higher levels of transit use or is the relationship reversed, *i.e.* better transit results in higher densities?
- Why are the urban peripheries in some cities more gridded than in others?
- Do regulations inhibit higher density mixed-use development on the urban periphery?

Methodological issues:

- How can the terms 'urban,' 'urban extents,' or 'urban footprints,' and 'urban expansion' be defined in a manner that makes it possible to study them?
- How can cities be delineated for the purpose of mapping and measuring their expansion?
- What are the advantages and limitations of different satellite data sets for studying urban expansion?

- What are the advantages and limitations of different population data sets for studying urban expansion?
- How can population and area data be used to measure average density or land consumption per capita, its reciprocal?
- How can telephone data be used to measure the extent of cities and their corresponding labor markets?

Gathering evidence and discovering recurrent patterns:

- How do the average densities of cities or their land consumption per capita change over time and why?
- Are peripheral densities lower than central city densities and, if so, why?
- Are peripheral areas settled by recently arrived migrants or by long-term residents of cities?
- Are the built-up areas in newly settled areas on the urban periphery more fragmented by open spaces and vacant lands than areas closer to the city center and, if so, why?
- Are blocks on the urban periphery smaller or larger than blocks in existing urban footprints? Are more areas gridded? Is there a larger share of the land in streets?
- What characterizes the location decisions of new or recent informal settlements on the urban periphery?
- How do densities and levels of fragmentation on the urban periphery change over time?
- What are the economic, social, cultural, and environmental impacts of urban expansion on rural households on the urban periphery?
- What is the impact of urban expansion on natural ecosystems on the urban periphery?
- What are the impacts of urban expansion on biomass loss and how can they be ameliorated?
- What is the impact of urban expansion on transit use and on vehicle-km traveled (VKT)?
- What is the likely long-term effect of remote work and hybrid work on outward urban expansion and, more specifically, on the expansion of urban labor markets?
- Has the recent COVID pandemic weakened urban coalitions that promote higher densities and empowered urban coalitions that promote outward expansion at lower densities?
- What forms of urban expansion promote inequality and socio-economic segregation and what form promote equality and socio-economic integration?

Political and institutional issues:

- What are instances of government taking of lands without due process and adequate compensation for urban expansion?
- What are instances of violent conflict resulting from government taking of lands without due process and adequate compensation for urban expansion?
- What are instances of government taking of lands with due process and adequate compensation for urban expansion?
- What are instances of local governments investing in expansion in response to private sector initiatives?
- What are the political coalitions favoring or resisting expansion and how do they manage their struggles?
- How effective are containment strategies designed to limit urban expansion?
- Why and how do urban containment strategies succeed or fail?

- Does successful containment or urban expansion lead to house price escalation?
- How is urban expansion managed in metropolitan areas with multiple jurisdictions?
- How is urban containment managed in metropolitan areas with multiple jurisdictions?
- Are master plans prepared by outside consultants for cities in the Global South effective, and if not, why not?
- Is there enough professional capacity in cities in the Global South to manage their expansion, and are these professionally trained to properly manage urban expansion?
- Why are some municipalities able to enforce zoning, land use, land subdivision, and building code regulations on the urban periphery while others are not?

Practical planning and public finance questions:

- How can urban land needs be projected into the future, for cities, countries, regions, and the world at large?
- Do long-range land-use plans allocate sufficient lands for expansion and, if not, why not?
- How do we model and predict which areas on the urban periphery are likely to be settled, and when?
- What are the principles underlying planned urban expansion?
- What is the difference in resource use between compact development and business-as-usual urban expansion?
- What are historical examples of successfully planned urban expansion?
- To what extent are city planners in the Global South affected by ideas and assumptions imported from the Global North?
- Are new towns on the urban periphery effective in absorbing the growing populations of cities in the Global South?
- What can city officials do to discourage urban expansion into areas of high climate risk or into areas that increase the city's vulnerability to climate events?
- What can city officials do to encourage landowners on the urban periphery to lay out their lands, leaving adequate areas for streets and public spaces, before selling plots?
- Where has large-scale land pooling and readjustment in the expansion areas of cities been successful, and why?
- How does favoritism manifest itself in infrastructure investments on the urban periphery and what can be done to minimize it?
- What are good examples of capturing the increased value of lands in expansion areas to help finance their infrastructure?

These questions are only a preliminary list. This list can lead researchers to many more new and possibly more interesting questions that can truly advance our understanding of urban expansion, its prospects, its pitfalls, and its challenges in the coming years.

6. CONCLUSIONS

Research on urban expansion during the past two decades, aided enormously by the availability of free satellite imagery, has made it possible to demonstrate the scale of urban expansion—certainly since 1990—thus making it more difficult to intentionally underestimate it in territorial planning exercises. It has also demonstrated that expansion is ubiquitous, that the rate of urban expansion is generally higher than the rate of urban population growth, and that expansion areas—rather than existing urban footprints—absorb the greatest share of the increasing populations of cities.

Prospective urban population growth in the Global South requires preparing cities to accommodate many more people and to ensure that they live productive, healthy, and satisfying lives. And this must be done now. There is a window of opportunity currently that allows cities in the Global South to guide and shape their form—making them more productive, more inclusive, and greener—while cities are still growing. Preparing for urban expansion with climate change in mind can ensure that expansion is not car-centric and that expansion areas are planned with broader Sustainable Development Goals (SDGs) in mind.

Making room for accommodating growth in cities is a two-pronged strategy: facilitating and promoting densification while, at the same time, preparing lands at scale for green urban expansion. Even those who would prefer densification to expansion as a climate-sensitive strategy understand that it would be a mistake to gamble on densification as the sole strategy for making room, postponing planning for expansion until they are convinced that densification efforts have failed. The most probable result of such a strategy would be unplanned urban expansion. Instead, the more sensible strategy is to prepare lands for expansion, and to prepare them with climate change in mind. That, as this special issue makes clear, involves planning for expansion by focusing on simple strategic measures (*e.g.* arterial roads, removing obstacles to transit-oriented densification along these arterial roads, facilitating land subdivision with small blocks, an adequate amount of land in streets in both formal and informal neighborhoods, protecting areas of high environmental risks as well as ecological assets from development, and ensuring the creation of a hierarchy of green public open spaces). Urban expansion should not be perceived as an unpleasant burden to be avoided, resisted, or ignored. Instead, it is an opportunity and a challenge, with multiple benefits to be realized in coming decades if done correctly.

NOTE

1 See https://www.buildingsandcities.org/journal-content/special-issues/urban-densification2.html/.

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