Planet of Cities

SHLOMO ANGEL

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Foreword

The science of cities is identifying and documenting common patterns of urban development across our planet, even though cities are often regarded as unique, and this volume contributes new research and illustrative evidence to this emergent discipline. Analysis of population and employment density, spatial development patterns, and travel behavior across cities has been underway for many years, but most urban empirical work has focused on the comparison of cities within individual countries because comparable data generally have been available only on a country-level basis. Such studies are normally based on census data for which national standards ensure that definitions of households, residential units, and urbanized areas are consistent across a country's cities and metropolitan areas. But national definitions, standards, and the timing of census data vary across countries, making it challenging to use such data to examine cities globally.

This volume takes on the challenge of rigorously comparing cities from a global perspective. It reports results from the analysis of a global sample of cities using data on land use obtained from satellite imagery and numerous other sources. Satellite data are defined consistently around the world, making it possible to compare land development patterns in all urban areas. Moreover, such data are accessible for all countries and for a common time period. Their availability is transforming empirical work on urban development patterns.

The analysis uses satellite imagery and other data to distinguish developed from undeveloped land, and it formulates a variety of metrics to define the extent of urbanized areas, the share of undeveloped land, and the shape and fragmentation of spatial growth experienced by a sample of 120 global cities with populations of 100,000 or more in 2000. It also combines the satellite images with census data to measure population density per unit of developed land and its change from 1990 to 2000. The analysis of satellite data is complemented by separate analyses of census tract data for 20 U.S. cities from 1910 to 2000, and of historic maps for 30 large global cities beginning as far back as 1800. The result is a compelling tour de force of empirical

information about urban development patterns that reveals some striking regularities across cities and over time. In particular, all of the data sets show that cities have been decentralizing and reducing population densities as they grow.

The striking historical and global regularities in the spatial development patterns of urban areas are then used as a basis for policy recommendations that address the massive expansion of urban populations forecast to occur in developing countries—where urban populations are expected to increase from 2 billion in 2000 to 5.5 billion in 2050. Historical regularities of urban growth and expansion indicate that a doubling of urban population will be accompanied by a tripling of developed urban land. A key recommendation of this volume is that urban management regimes must make adequate plans for this expansion, particularly by reserving rights-of-way in areas of future growth for transport, other networked urban infrastructure, and public open spaces.

The Lincoln Institute of Land Policy has supported Shlomo Angel's work for several years, but this book also builds on earlier research by the author and his colleagues. This earlier work was supported in part by the World Bank, the National Science Foundation, and the National Aeronautics and Space Administration. The Lincoln Institute's support led to the development of three working papers, the policy focus report titled *Making Room for a Planet of Cities* (2011c), and the companion book, *Atlas of Urban Expansion* (2012), all of which were coauthored by Shlomo Angel, Jason Parent, Daniel L. Civco, and Alejandro M. Blei.

In addition, the complete data sets comprising the U.S. Census data for 20 cities, the historic maps for 30 global cities, and the satellite data for the sample of 120 global cities in 1990 and 2000 and for 3,646 cities with populations over 100,000 in 2000 are all available on the Lincoln Institute website at *www.lincolninst.edu/subcenters/atlas-urban-expansion*. This *Planet of Cities* volume and the accompanying *Atlas of Urban Expansion* book and website clearly demonstrate the potential of satellite data to revolutionize the analysis of the spatial dimensions of urban growth.

Gregory K. Ingram
President and CEO
Lincoln Institute of Land Policy

Introduction and Four Propositions

The Streets

The streets of Buenos Aires
have become my very core.
Not the ravenous streets,
bustling with crowds and commotion,
but the neglected streets of the barrio,
which hide themselves from most people,
softened by twilight and sunset
and those ones farther out
knowing nothing of kind trees
where simple little houses,
overwhelmed by infinite distances,
scarcely dare to lose themselves in the far-reaching view
of skies and plains.
For the lonely one, they are a promise
because thousands of individual souls populate them,
each one unique before God and in time
and undeniably precious.
To the West, the North, and the South
the streets—they are also my country—have been unfurled:
May their colors come through
in the lines that I pen.

Jorge Luis Borges

Translated by Benjamin Ehrlich and Daniella Gitlin in 2012 from the collection of poems, *Fervor de Buenos Aires,* by Jorge Luis Borges (1969).

CHAPTER 1

Coming to Terms with Global Urban Expansion

There are nearly 4,000 cities on the planet today with populations of 100,000 or more. Every one of these cities is different. Every one of these cities is unique and one of a kind, just like you and I are unique and one of a kind. But if you are like me, when you fall ill, you prefer to have a common rather than a rare or unique disease. Suddenly, your wish to be unique disappears and you would really prefer to be just a common person with common symptoms seeking a common cure. Cities should be in the same predicament. They would be if more common knowledge about them were available, and if those who care for them renounced their insistence on their own city remaining so unique that what happens to other cities is irrelevant.

Modern medical science is founded on the proposition that while each of us is unique, many of us share common ailments that can only be understood and addressed effectively by studying them in sufficiently large groups of people. "Science," wrote Aldous Huxley (1958, 19), "may be defined as the reduction of multiplicity to unity. It seeks to explain the endlessly diverse phenomena of nature by ignoring the uniqueness of particular events, concentrating on what they have in common and finally abstracting some kind of 'law' in terms of which they make sense and can be effectively dealt with."

This book is a modest contribution toward a science of cities, based on the study of sufficiently large numbers of cities, to help government officials, academics, activists, or interested citizens identify and address their common ailments and seek common cures. As it turns out, the only things we know about the 4,000 cities in the world today are their names, exact locations, and approximate populations (figure 1.1). There is very little common and comparable knowledge about these cities, and none of the available information can be described as scientific.

My interest in the scientific study of cities is not driven by a thirst for pure knowledge, but is a practical one—making realistic yet adequate preparations for future

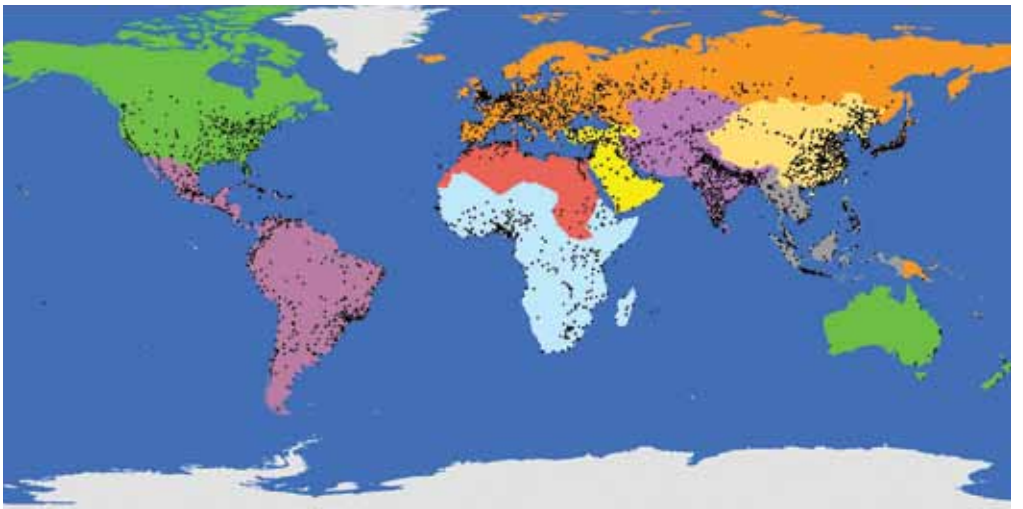
urban expansion in cities everywhere. These preparations are needed to make our cities efficient, livable, and equitable, and to keep our planet sustainable. They are needed now, when the urbanization of our planet is still in full swing, and the sooner we attend to them the more effective and the more economical they are likely to be.

A RELUCTANCE TO ENGAGE WITH URBAN EXPANSION

Much to my chagrin, I have detected great reluctance to engage with the prospects of urban expansion, for reasons that may be perfectly understandable. This reluctance tends to keep such prospects rather obscure and even somewhat frightening, and prevents us from addressing them in a clear and forthright manner. We can observe the reluctance to come to terms with urban expansion in the positions and attitudes of four groups of people: established residents of cities, municipal officials, homeowners, and environmentalists.

For many of their more vociferous established residents, cities are already threateningly large. Allowing them to become even larger is nonsensical and unacceptable. Newcomers—be they new immigrants from distant shores or new migrants from other parts of the state or country—are therefore unwelcome. They are typically seen as nuisances rather than as assets—more mouths to feed, more children to educate, threats to jobs, and more congestion on the roads. They are not seen as energetic new cadres of workers and citizens generating new demands for goods and services and enriching the diversity that fuels our creativity. If indeed these newcomers are considered nuisances, why should they be welcomed? Maybe if they are not welcomed, fewer of them will come.

FIGURE 1.1
Locations of 3,646 Cities with Populations of 100,000 or More in the Year 2000



Source: City location data from Angel et al. (2012 online).

A family of immigrants disembarks at Ellis Island, New York City, in the early 1900s on its way to settling in one of America's rapidly growing cities.

Millions of rural migrants with no residence permits (hukous) have come to work in Chinese cities since 1978: Migrant workers on a lunch break outside a construction site in Beijing.

Of course, when established residents are pitted against others who have yet to arrive or are yet to be born, only those residents can have their say. If they could, the more radical among them would effectively subvert all thoughts of coming to terms with urban expansion or doing what it takes to guide and tame it. Their position may be irrational, but it is understandable. Why should they be concerned about the expansion of cities when they live in a city that is barely functional and barely livable? Why not just leave things alone, conserving and improving what they already have? Never mind that they comfortably forget that they themselves, their parents or grandparents, and definitely their ancestors, were once newcomers to the city as well.

Activists in Portland, Oregon, rally to support immigrants in 2011.

In any event, what makes a city inviting is not a colorful welcome sign on the road that residents can simply remove. It is the economic opportunities the city offers and the quality of life it promises that make it attractive, and both are qualities that established residents would be unwilling to part with just to make their city unattractive to newcomers. Still, even though their reasoning may be in error, many of them may be reluctant to engage with the prospects of urban expansion.

Mayors, urban planners, city engineers, and other municipal officials are in a difficult predicament when it comes to confronting urban expansion. In some parts of the world they are accountable to current residents and must abide by their desires lest they get booted out of office. If these residents refuse to plan for expansion, they must be obeyed unless they can be persuaded otherwise. But persuading a stubborn electorate is not the only problem officials face. Making preparations for urban expansion is costly and requires the acquisition of substantial amounts of land for public use. It also requires expensive new infrastructure—the extension of roads and streets and the construction of sewer lines, sewage treatment plants, water reservoirs, and water mains. What is more worrisome, it requires thinking about the future and attending to future needs now, while other burning issues are demanding the officials' attention and meager resources.

These preparations may indeed be essential if the city is to grow and flourish and if it is to remain efficient and productive, as well as equitable and livable, for many years to come. But such farsighted considerations, important as they may be, too often give way to putting out the fires that are erupting every day. Pragmatic as it may be, succumbing to this view of managing cities is shortsighted. Some activities require municipal officials to engage in true long-term planning, while most others do not. With urban expansion, it is critically important to secure the rights-of-way for arterial

roads and to protect selected open spaces before urban development takes place, preferably before rural lands even begin to be subdivided for urban use. In their report, *A Major Traffic Street Plan for Los Angeles*, for example, Olmsted, Bartholomew, and Cheney (1924) argued for acquiring the rights-of-way for roads in advance of future development. Pushing an arterial road through a built-up area is nearly impossible, and creating public open spaces in densely built neighborhoods is a pipe dream. Urban expansion must be prepared for in advance or not at all.

Homeowners, often a majority in many cities, also may perceive an economic interest in curtailing urban expansion. If land for new development on the urban periphery is easy to come by and new houses are easy and cheap to build, then housing values are likely to remain stable and affordable throughout the city. But if land is in short supply and demand for housing is strong, the value of existing houses goes up and homeowners become better off without ever having lifted a finger. The fact that the children of these homeowners will no longer be able to afford a house nearby may be of less concern since they may eventually inherit a valuable property. This is a rather cynical position on the part of homeowners, but clearly a rational one insofar as it protects their property values. William Fischel (2005, 320), who coined the term *homevoters* (homeowners who vote), noted that growth controls in American cities "seem to act more like a cartel for those already in possession of suburban homes than as a rationalizer of metropolitan development patterns."

Finally, committed environmentalists who are concerned with protecting the farmlands, forests, pastures, or sensitive wetlands on the periphery of cities from being invaded by urban development tend to see urban expansion, uniformly decried as sprawl, as anathema to global sustainability. They claim that converting farmlands to urban use destroys food supplies and exacerbates an already serious global food crisis. It also destroys forests and diminishes the diversity of flora and fauna. Moreover, the

Activists protest urban expansion in Surrey, England, in 2009.

more expansive and spread out the city is, the more energy it consumes in transport or in heating and cooling processes, exacerbating an already visible energy crisis. This energy requires the burning of fossil fuels that release carbon dioxide and other greenhouse gases into the air, trap heat, and exacerbate an undeniable global warming crisis. Denser and more compact cities encourage more walking and cycling, thereby contributing a much-needed check on an awkwardly visible obesity crisis.

It is not difficult for avid environmentalists to conclude that cities now occupy enough land and have no real need for expansion. Their idea is that cities should simply be contained and enclosed by greenbelts or impenetrable urban growth boundaries. If populations grow, some observers firmly believe, everyone can be accommodated within the existing confines of cities, through the infill of vacant lands, intensification of land use, densification and revitalization of old neighborhoods, conversion of single-family homes to multifamily dwellings, or mixed use of urban land.

When we focus attention on where most urban development is likely to take place in the coming decades—namely in the cities of developing countries—this rather purist vision of cities can be described as uninformed or utopian because it puts sustainability as an absolute end that then justifies all means to attain it. Other goals, such as full employment, the quality of urban life, the satisfaction of basic human needs, or the expression of personal or political preferences for this or that lifestyle, are readily sacrificed. This vision is also quite pessimistic when it comes to solving the global sustainability problem by other means, such as through progress in science and technology, and is quite oblivious to the cost of curbing urban expansion in comparison with the cost of other possible solutions for keeping our planet sustainable. It also

Denser and more compact cities are not always the answer: Air pollution shrouds the city of Cairo, Egypt, despite its relatively high residential densities.

assumes that existing cities can simply be densified and made more compact, despite a growing body of evidence that residents actively and effectively resist proposals that may change the character of their neighborhoods (Jenks, Burton, and Williams 1996; Vallance, Perkins, and Moore 2005).

When all of these stakeholders—established residents, municipal officials, homeowners, and environmentalists—come together, they can and often do form formidable coalitions that seek to limit urban expansion by advocating the strict containment of cities within their current footprints and incorporating all new population growth into more compact urban environments. Indeed, "since the world adoption of sustainability objectives in the early 1990s . . . promotion of the compact city—in terms of higher density development, mixed uses, and reuse of brownfield sites—is now enshrined in land use planning in many countries" (Burton 2002, 219). The costs and benefits of containment are uncertain, its potential contribution questionable, and broad political support for it may still be lacking. But despite these uncertainties, this agenda has already erected a significant barrier than can effectively block efforts to make realistic plans for urban expansion.

When a conscientious mayor of a city, large or small, is asked what she is doing to prepare for urban expansion, she may well retort that she has no desire, nor do her staff or her constituents, to allow for expansion. They believe the city consumes enough land as it is, and all future construction should take place within its current boundaries. She will oppose expansion so the planet can remain sustainable, people can walk and cycle at their leisure, municipal budgets are not unduly burdened, decaying central cities can thrive again, and precious cultivated lands on the urban fringe are not laid to waste. In other words, given the vociferous rhetoric objecting to urban expansion, she would face both criticism and ridicule if she even indulged in ideas about urban expansion, let alone committed public resources to facilitate it.

GATHERING DATA ON URBAN EXPANSION

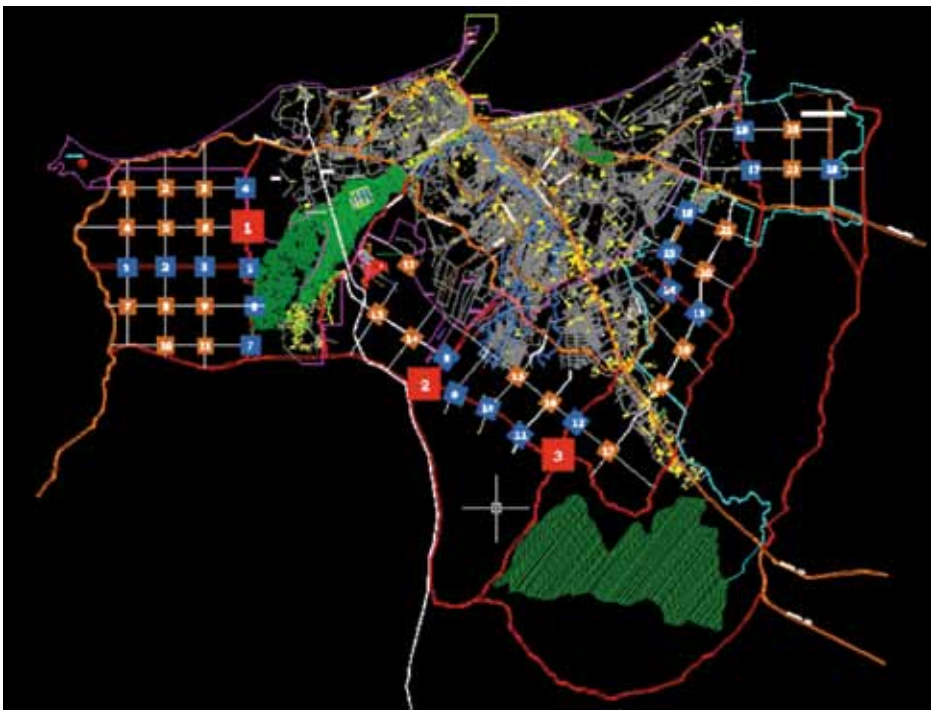
I began to realize in 2002 that the only way for me to engage with this reluctance to confront continuing urban expansion was to assemble solid empirical data on expansion and its key attributes in cities around the world over long periods of time. Such data, I had hoped and still believe, could demonstrate the extent to which cities have expanded in the distant and recent pasts, and suggest how and by how much they are likely to grow further in the future. Coupled with theories that could explain the underlying forces that propel and shape urban expansion, the data could also provide the evidence needed to demonstrate various concerns: that it would be very difficult, if not futile, to resist expansion; that ignoring or denying it in the hope that it will not occur will simply allow it to take place unhindered and in a more costly and destructive way; that acquiring a better understanding of it will make it less formidable and more

manageable; and that making minimal yet effective preparations for it is the right way, and certainly the only responsible way, to proceed.

I thus embarked on a study of global urban expansion that has taken almost a decade to complete. From a research perspective, this was a very satisfying journey, but from a practical perspective of assisting real cities to prepare for their expansion, it was more frustrating. For example, I helped organize the municipal administrations of five secondary cities in Ecuador to prepare for their expansion (figure 1.2). The project was ready to begin when it was upended by the newly elected president of Ecuador, for reasons that had nothing to do with the merits of the project. He simply canceled the project because it had financial support from the World Bank, and he wanted the bank out of the country. An attempt to revive the project two years later with funds from the Rockefeller Foundation was short-lived, too, when the foundation lost a substantial share of its portfolio in the financial crisis of 2008 and the project was removed from its budget. New efforts to engage cities in planning for their expansion are now in the making, but have not yet borne fruit.

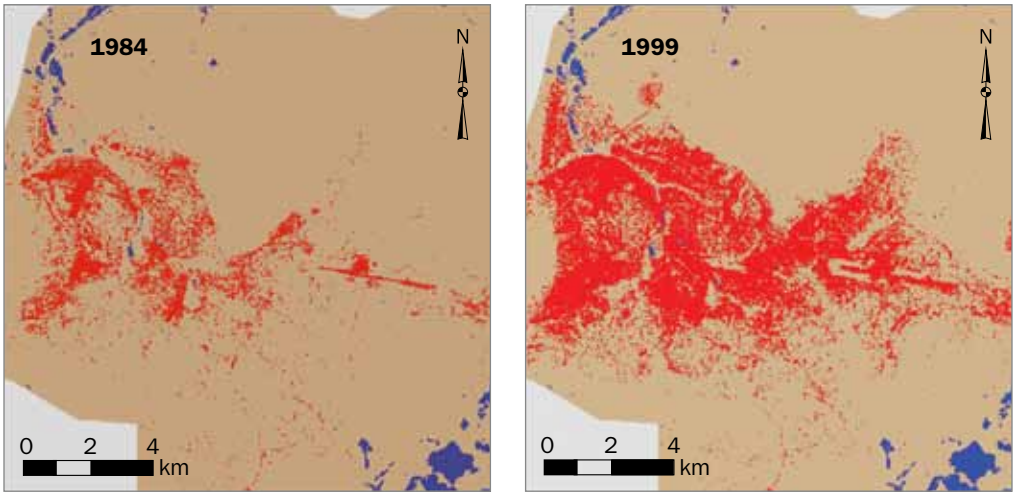
In contrast, it was considerably easier to organize funding for research on global urban expansion. I had stumbled upon a new research frontier that, apart from a few

FIGURE 1.2
The Expansion Plan for Manta, Ecuador, 2007



Note: The expansion plan shows the proposed arterial road grid and plots of 1 hectare each at intersections to be acquired for future public use.
Source: Provided to the author by the Department of City Planning, Municipality of Manta, Ecuador.

FIGURE 1.3
Satellite Imagery Used to Map the Expansion of Kigali, Rwanda, 1984 and 1999



Source: Redrawn from Angel et al. (2012, 120).

empirical studies of sprawl in the United States, has been left as virgin territory for my colleagues and me to explore. Our studies of global urban expansion have been made possible by recent technological advances in global satellite imagery and the software required to analyze it (figure 1.3); by the recent creation of global databases by international organizations, academic institutions, and civil society associations; and by the accelerating ease of global communications made possible by the Internet. I consider myself fortunate to have formulated a question that these new troves of information could help answer: How and why do real cities expand?

When I embarked on the study of global urban expansion, this was the only question that occupied me. Soon thereafter, however, new questions presented themselves as I became more familiar with urban expansion and began to understand, measure, and analyze its specific attributes and manifestations. I strongly believe that coming to terms with urban expansion and its reality in cities everywhere—and especially in cities where urbanization is still occurring—will make it easier to manage in a pragmatic and responsible manner, something that denying it, rejecting it for ideological reasons, or simply neglecting it will not allow us to do.

This book provides rigorous as well as partial answers to seven sets of questions that, taken together, present a coherent view of global urban expansion.

1. What are the extents of urban areas, how fast are they expanding over time, why, and why should it matter?
2. How dense are urban areas, how are urban densities changing over time, why, and why should it matter?

3. How centralized are the residences and workplaces in cities, do they tend to disperse to the periphery over time, and if so, why, and why should it matter?
4. How fragmented are the built-up areas of cities, how are levels of fragmentation changing over time, why, and why should it matter?
5. How compact are the shapes of urban footprints, how are their levels of compactness changing over time, why, and why should it matter?
6. How much land will urban areas require in the future, why, and why should it matter?
7. How much cultivated land will be consumed by expanding urban areas, why, and why should it matter?

Seeking to use these new sources of data to answer these questions, I faced a fourfold challenge: first, to obtain the human and financial resources to assemble and organize the data into a set of digital maps of a large number of cities, preferably a global sample of cities; second, to articulate a set of simple metrics that would summarize key attributes of these maps, making it possible to compare them to each other as well as to compare their changes over time; third, to assemble a body of theory that could explain urban expansion and its attributes in a systematic and rigorous fashion; and fourth, to draw some practical policy lessons based on these various findings.

DISTINCT EXPANSION ISSUES IN DEVELOPED AND DEVELOPING COUNTRIES

My primary policy concern was, and still is, that in the absence of ample and accessible land for expansion on the urban periphery, artificial shortages of residential lands will quickly extinguish any hope that housing will remain affordable, especially for the urban poor—the majority of the future inhabitants of burgeoning cities in developing countries. Such artificial shortages and the resulting house-price inflation may be of less concern in cities in the more developed countries because they are now fully or almost fully urbanized and their expansion is rarely accompanied by urban population growth. The demand for plots on the urban periphery of these cities may be low enough to be matched by a relatively limited supply, keeping land and house prices under control. There is still a need to ensure an adequate supply of land on the fringe of these cities, of course, to keep residential prices stable, but the quantities of land are relatively modest.

Because of this modest demand for land, other more magnanimous concerns have now taken hold: the preservation of farmland, the protection of nature, the conservation of energy, the rejuvenation of town centers, or the curtailment of carbon emissions. Those concerns sometimes trump the more mundane concern with affordable housing.

The demand for land in the rapidly growing cities of developing countries—cities that are still in the midst of the urbanization process and where the bulk of urban expansion is now likely to take place—is certainly not modest, and artificial restrictions of the supply of land on the urban fringe are likely to have quite dire consequences for families struggling to meet their basic needs. To put the expected demand for plots on the urban periphery in numerical perspective, consider these statistics. Between 2010 and 2050, the urban population of the more developed countries will increase by a mere 170 million people, growing at a rate of 0.6 percent per year. During that same period, the urban population of the less developed countries will increase by 2.6 billion people, 15 times that of the more developed countries, and at a rate of 2.4 percent per year, which is 4 times faster than that of the more developed countries (United Nations Population Division 2012, file 3).

In quantitative terms, cities in the developing countries, especially those in rapidly urbanizing ones, face quite a different predicament than cities in the more developed countries. They need to create vast supplies of residential land on the urban periphery to match the vast demand for land to house their growing populations. These places cannot be expected to attend to loftier conservation and sustainability concerns before they satisfy their basic needs, including shelter.

It is therefore worrisome that most, though by no means all, prescriptions for cities in our globalized world originate in the more developed countries, especially in the United States and to a lesser extent in the European Union. This is to be expected, of course, because these countries have the best data; conduct the best cutting-edge research; publish the best journals that report on this research; welcome the best students to study abroad; have regulatory environments that can best apply the latest research findings; have private firms that are well equipped to take advantage of these findings; and have civic groups that are best organized to make use of the data in championing their causes.

The presumption, of course, is that if the best and the latest prescriptions for cities are good enough for the United States and Europe, then surely they must be good enough for the rest of the world. No one seems to mind that cities in the United States, for example, may be quite different from cities in other regions; that the extent of their sprawl and their high levels of greenhouse gas emissions may be quite unique; and that cures will tend to make them more like cities in the developing world rather than the other way around. No one seems to be complaining that American and European prescriptions for non-American and non-European cities are irrelevant or inappropriate, or if they are complaining, the complaints are not loud enough to matter.

On the contrary, the language of U.S. sprawl and its containment is now readily borrowed and applied in studies and policy prescriptions for cities in developing countries as if it were self-evident that sprawl is, indeed, a universal phenomenon requiring

a universal response. An example from a recent study of Beijing, China, states (Zhao, Lu, and Roo 2010, 144):

> The empirical evaluation of containment strategies has already been widely investigated in North America and Europe, and it is now necessary that this becomes the focus of the debate in developing countries, given the emergence in these countries of sprawling urban development.

The presumption that American and European prescriptions for cities are transferable often leads to quite absurd results. The following example was related to me by Rodolfo Cordoba, a respected land developer in San Pedro Sula, the second-largest city in Honduras. One day the city planning department in the municipality decided to require environmental impact assessments for all residential land subdivisions. Environmental impact assessments, they must have figured, are "good things" because if they are good for large urban projects in the United States and Europe, they must be good for small projects like land subdivisions in San Pedro Sula as well. Faced with this new requirement, Cordoba decided to invite professional squatters to "invade" his land because, once his land was invaded, he no longer needed to comply with municipal regulations. He figured that he would make more money more quickly, thus saving himself the uncertainty, time, and expenses involved in obtaining the necessary environmental clearances for a full-fledged land subdivision. When I visited his subdivision, *Lotificadora*

Low-density sprawl has been the predominant form of urban expansion in the United States for a century or more.

***Lotificadora Monterrey*, an illegal subdivision on the fringe in San Pedro Sula, Honduras, was a well-established residential community by 2012.**

Monterrey, in 2002 he was preparing 360 small plots for sale in the informal market. Plots were provided with minimal services (unpaved roads, water, sewerage, and electricity) and measured 9 by 15 meters. A plot sold for US$2,500, with US$100 down and the rest payable in 120 monthly installments of $20, which most families in San Pedro Sula could afford.

When it comes to prescriptions, context matters. While many prescriptions are invented, tested, and applied successfully in the metropolitan centers around the world, they do not necessarily travel well, nor are they universal in their application. Prescriptions for rich megacities in industrialized countries cannot be the same as prescriptions for poor towns in developing ones, just as prescriptions for obesity cannot be the same as prescriptions for malnutrition. There are, no doubt, medical norms that apply to us all. Blood pressure, sugar levels, and body weight, for example, must remain within certain ranges to keep us in good health. When it comes to cities, we can speak of norms that apply to all cities, too. Workers must be able to get to work within a reasonable time, say, half an hour; households can spend only a certain share of their income on housing, say, one-quarter; and a significant share of urban land must be devoted to transport, say, one-fifth.

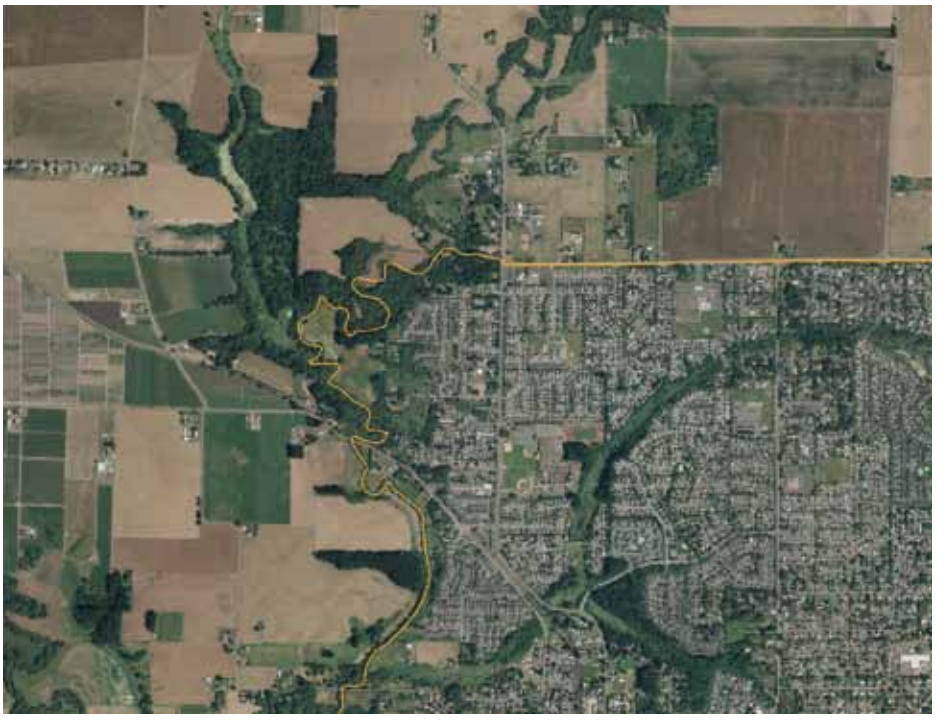
Then there are norms and standards that apply only to those who can afford them. In 1990, for example, infrastructure expenditures per capita in Helsinki, Finland, were more than 1,000 times those in Dar es Salaam, Tanzania (Angel 2000b). Helsinki now has a network of underground pipes that provides district heating to more than 90 percent of its inhabitants (Robbs 2009). What can Dar es Salaam possibly learn from Helsinki about infrastructure investment?

In another example, Portland, Oregon, adopted its much-celebrated urban growth boundary in 1979. It was designed to delimit the area where urban development was admissible in order to prevent unwanted sprawl and keep a pristine countryside in close proximity to its inhabitants (figure 1.4). Between 1980 and 2010, the population within that boundary grew from slightly less than 1 million to some 1.5 million at the average rate of 1.7 percent per year (Metro 2012a). During the same period, the population of Shenzhen, China, grew from 58,000 to 9 million, at the average rate of 16.8 percent per year (United Nations Population Division 2012, file 2), or 10 times faster than Portland. What can Shenzhen possibly learn from Portland about containing urban expansion?

ABOUT THIS BOOK

This book seeks to broaden our perspective by shifting our gaze away from a small number of cities in the developed countries and focusing it instead on a large number of cities the world over. To examine urban expansion without bias, I eliminated the artificial distinction between cities in more developed countries and cities in less developed ones, opting to study our planet of cities as a whole. To engage in this pursuit in an effective and persuasive manner, I embarked on a quest to measure urban expansion

FIGURE 1.4
Expansion to the Edge of Portland, Oregon's Urban Growth Boundary, 2011



Source: Metro (2012b).

Recent graduates look for work at a job fair in Shenzhen, China, currently one of the world's fastest-growing cities.

and its attributes everywhere, in order to understand them at a deeper level. My colleagues and I spent a number of years carefully collecting new comparative data for cities in all world regions and studying all these cities using a common analytical framework.

This book, then, is about the past, present, and future expansion of cities in the broadest and most global sense of the word. While telling numerous instructive stories about the expansion of particular cities in different parts of the world, I seek to make the study of urban expansion more scientific by moving from persuasive storytelling to the examination of large numbers of maps of the built-up areas of cities and the patterns that these maps reveal, and to the measurement of useful metrics associated with these patterns. I also want to shift from descriptive measurement of these metrics to the examination of statistical models that explain variations among them both over time and among cities in different places; from explaining past data to projecting it into the future; and from explanation and projection toward policy prescriptions that are better grounded in empirical realities.

As we move together from storytelling to measurement, from measurement to statistical modeling, from statistical modeling to prediction, and from prediction to policy prescriptions, the demands for precision increase. Reaching a global consensus that could guide our actions in the coming years—a consensus grounded in reliable measurement and solid understanding of the realities now facing cities everywhere—is likely to be very difficult. That should not surprise us, nor should it prevent us from participating

in pushing the envelope further, taking chances, and laying the foundations for a robust yet exciting science of cities where all cities are studied together. This book is my invitation to join this fascinating and highly satisfying pursuit.

The core of the book has two main parts following the five introductory chapters. In part one, consisting of three chapters, I focus on what I have termed the urbanization project—the massive shift of the world population to cities—and I examine the most basic features of our planet of cities. In chapter 6, I relate urban history as a three-period narrative. The first period extends from the formation of the first cities to the onset of rapid urbanization circa 1800; the second period came to an end in 2010, when half the world population lived in cities; and the third period is expected to end late in this century, when most people who want to live in cities will have moved into them.

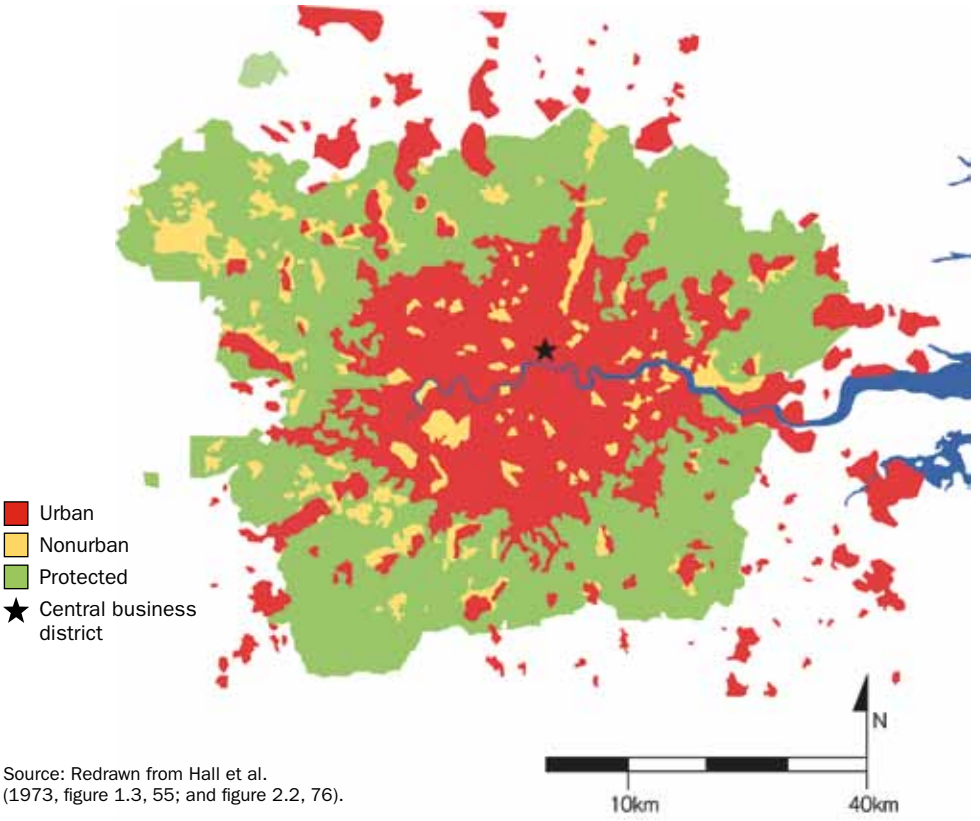
Chapter 7 examines the geography of world urbanization, focusing on where urban population growth has taken place in the past and where it will take place in the future. In chapter 8, I introduce the global hierarchy of cities with a view to examining why cities come in different sizes rather than having one optimal size; whether larger cities are growing at a faster or a slower rate than smaller ones; and whether cities the world over are distributed randomly or uniformly in geographic space.

In part two, I narrow the focus to the study of urban expansion and its attributes in cities of all sizes in all geographic regions and in two time periods: the last decade of the twentieth century (1990–2000) and the last two centuries of the second millennium (1800–2000). After introducing the new data sources and the metrics used to analyze them, I devote one chapter to each of the seven questions listed earlier.

The central policy prescription of this book demands a fundamental change of hearts and minds. It puts into question the main tenets of the familiar Containment Paradigm, also known as smart growth, urban growth management, or compact city, which is designed to combat boundless urban expansion. This paradigm can be traced back to the London Greenbelt Act of 1938 (figure 1.5) and the British Town and Country Planning Act of 1947 (Munton 1983). I examine this paradigm in a broader global perspective and show it to be deficient and next to useless in addressing the central questions now facing expanding cities outside the United States and Europe. In its place I propose to revive an alternative Making Room Paradigm that seeks to come to terms with the expected expansion of cities, particularly in the rapidly urbanizing countries in Asia and Africa, and to make the minimally necessary preparations for such expansion instead of seeking to contain it. I say "revive" because this paradigm guided the expansion of a number of cities in the nineteenth and early twentieth centuries: New York, Barcelona, Berlin, and Buenos Aires are a few important examples.

The Making Room Paradigm rests on four propositions that need to be introduced and discussed before delving into the core parts of the book. These propositions form

FIGURE 1.5
The Containment of Urban England: The London Greenbelt, 1973



Source: Redrawn from Hall et al. (1973, figure 1.3, 55; and figure 2.2, 76).

the spine of my understanding of cities. They are simple conclusions that are grounded in my studies of cities and in my personal experiences living and working in cities throughout the world.

1. The Inevitable Expansion Proposition: The expansion of cities that urban population growth entails cannot be contained. Instead we must make adequate room to accommodate it.
2. The Sustainable Densities Proposition: City densities must remain within a sustainable range. If density is too low, it must be allowed to increase, and if it is too high, it must be allowed to decline.
3. The Decent Housing Proposition: Strict containment of urban expansion destroys the homes of the poor and puts new housing out of reach for most people. Decent housing for all can be ensured only if urban land is in ample supply.
4. The Public Works Proposition: As cities expand, the necessary land for public streets, public infrastructure networks, and public open spaces must be secured in advance of development.