

The Environmental, Social, and Health Dimensions of Urban Expansion

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In the coming decades, the world's rapid urbanization will be one of the greatest challenges to ensuring human welfare and a viable global environment. According to current estimates, cities occupy 4% or less of the world's terrestrial surface, yet they are home to almost half the global population, consume close to three-quarters of the world's natural resources, and generate three-quarters of its pollution and wastes. Moreover, the UN estimates that virtually all net global population and economic growth over the next 30 years will occur in cities, leading to a doubling of current populations. This growth will require unprecedented investment in new infrastructure and create undreamed of challenges for political and social institutions.

Nowhere are the opportunities more promising or challenges to sustainability more daunting than in the rapidly urbanizing regions of the world. These transforming cities represent the engines of growth for the developing world and, in all regions, will continue to be the centers of innovation, culture, and the arts. These same cities, however, are the loci of increasing poverty, pollution, disease, political instability, and social inequality. The transformation of surrounding land due to urban expansion and urban dwellers ever-increasing demand for energy, food, goods, and other resources is behind the degradation of local and regional environments, threatening basic ecosystem services and global biodiversity.

This cyberseminar focuses upon the environmental, social, and health dimensions of urban expansion. Our goal is to compare and contrast the processes of urban expansion and transformation in developing and developed countries. We expect a research agenda to emerge that will foster understanding of the processes, contexts, and outcomes of urbanization, as well as the understanding that will ultimately contribute to policy solutions. Hopefully, this discussion will benefit from, and contribute to, parallel projects being developed by IHDP Urbanization Science Project, the IUSSP Urbanizations and Health Working Group, the US National Academies' Panel on Urban Population Dynamics, the US National Academies' Roundtable on Science and Technology for Sustainability's Task Force on Rapid Urbanization, The Millennium Ecosystem Assessment, the World Bank's Cities Alliance and Cities in Transition, and other initiatives that cyberseminar participants will bring to our attention.

BACKGROUND

In 1800, only one city in the world had a population over 1 million (Peking); in 1900, there were 16; and by 2000, there were over 400 (UNCHS 2002). The current list includes 19 “megacities” with over 10 million, 22 cities with 5-10 million, 370 cities with 1-5 million, and 433 cities with 0.5-1 million (an estimated 150 of which will pass the 1-million mark by 2015). The world is rapidly urbanizing: 30% of the global population lived in urban areas in 1957, 47% in 2000, and an estimated 60% are projected to live in cities by 2030 (UN Population Division 2002). The developed countries of the world are well ahead of the curve, with 75% of their population residing in cities and an estimated 83% by the year 2030. Yet, in the coming decades, the greatest growth in urban population is expected to occur in the developing countries (Figure 1).

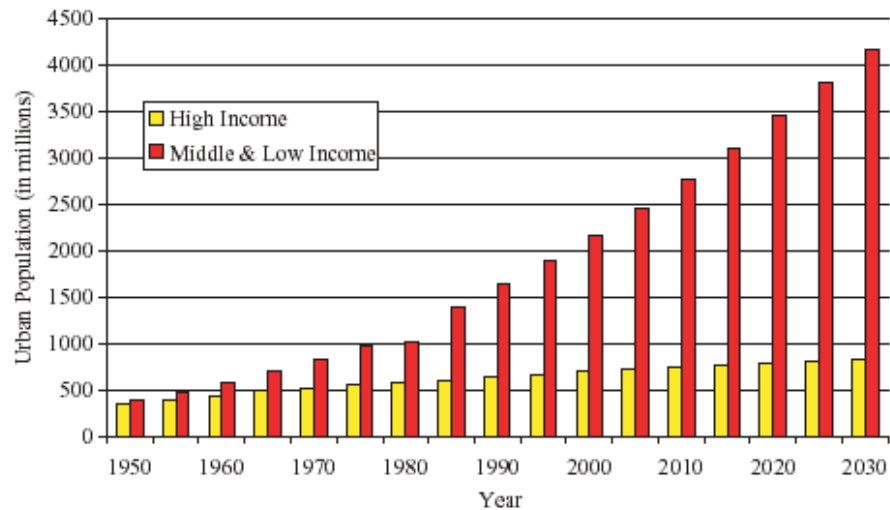


Figure 1. Growth of urban population, 1950-2030, Source: Cohen (2004), United Nations (2002).

The UN estimates that the world’s urban population will increase by 2.12 billion between 2000 and 2030 while rural population will increase by only 0.10 billion (UN 2002). These rates strongly contrast with an earlier generation (1950-1975), when global population growth in urban and rural areas was roughly equal (Cohen 2004; UN 2002). Although the growth of urbanized regions will be a major challenge in the coming decades, the *rate* of urbanization is not accelerating. In fact, urbanization rates were higher in the past decades than projected for in the coming years yet, because of their increasing population base, the absolute numbers of new urbanites is enormous (Cohen 2004).

In many middle- and low-income countries, the largest city, often the capital, is far larger than other cities (termed an “urban-primate” pattern) and contains a significant proportion of the country’s population. This phenomenon, most common in Latin America, is also prevalent in Africa and Asia. That primate cities serve as the node in global financial and commercial networks should not be underestimated, but there is a widespread misunderstanding that most of the world’s population will soon be living in megacities (Cohen 2004). Due to their extraordinary population size, a great deal of attention is devoted to megacities. However, it

should be noted that the fastest rate of urban growth over the next 25 years will be in the medium-sized cities of 1 to 5 million and that most people will live in smaller cities of less than 1 million. Hence, to understand the impact of new urbanization on the environment and people, it is crucial to examine these processes in medium and small cities and not restrict our inquiries to the largest and most often-studied megacities.

Urban growth relates to four basic processes:

1. **Rural to urban migration** has been key source of urban growth since the origin of cities. Varied factors such as perceived economic opportunity, climatic or economic problems in the countryside, political programs of resettlement, insecurity in the countryside, and perceived “excitement” of city life drive rural-to-urban migration. The migration rate varies over time and space and, in the developed world, may be balanced by reverse migration.
2. **Natural increase** due to the combination of increased fertility and decreased mortality is probably the greatest numeric contributor to urban growth. The dramatic increase in global life expectancy from 46 to 66 years over the past 50 years reflects major reductions in infant mortality and extensions of the normal life span. The recent decrease in female fertility rate, especially in cities where more women are educated and enter the workforce, somewhat balances this figure.
3. **Cross-border immigration** impacts urban growth in the developed and semideveloped world. Economic opportunities and perceived lifestyle improvements are major attractors for these migrants as are push factors of local unemployment or underemployment, environmental degradation, civil strife, and political instability.
4. **Reclassification of land from rural to urban categories** is both a real process of urbanization and a record-keeping shift that may or may not reflect current reality. Many cities are rapidly growing at their fringes, engulfing former villages and farmlands, transforming them into dense, industrial areas, shantytowns, or less-dense suburban developments. The other process, which can take the form of annexing rural lands to insure control when they become urbanized in the future or redefining what constitutes urban communities by national census takers, does not reflect the same demographic reality, complicating the comparative databases we all use.

FIVE KEY RESEARCH DOMAINS

The enormous complexity of the urban phenomenon and its environmental impacts defies a simple investigative approach. Therefore we recommend five sets of issues upon which to focus our research agenda:

I. Integrated Conceptual Framework and Operational Models for Investigating Urban Growth

A broad range of experts, including demographers, political scientists, sociologists, anthropologists, economists, ecologists, hydrologists, engineers, planners, health practitioners, financiers, and city managers define urban problems and potential solutions using their own

vocabulary and with models aligned to their discipline's assumptions and objectives. As reported in the National Research Council's *Our Common Journey* (NRC 1999):

Cities are very complex places. The knowledge and know-how required to expand and manage them are diffused across a broad range of disciplines, practitioners, and institutions....An extensive literature related to each is available. Lacking however, is the knowledge and know-how for sustainable cities that brings these goals together.

We challenge participants in this cyberseminar to put forward published and tentative formulations and opinions on:

- A. **The state-of-knowledge and practice in your discipline** as it relates to urban growth and its impacts. What are the major gaps in knowledge and in applying knowledge to practice?
- B. **Patterns and processes within rapidly urbanizing regions** with attention paid to avoiding negative, unintended consequences and legacies that excessively constrain future options.
- C. **Alternate growth trajectories** for rapidly urbanizing regions that improve our ability to generalize and construct future scenarios and functionality models.
- D. **New urban models** that relate the complexity of economic, social, and environmental factors. Many of these models focus on population and land-use projections, but we would welcome examination of alternate urban forms, resource use, consumption patterns and waste streams. In addition, we seek frameworks that encourage exploration of ways to maintain or even enhance local identity and values in the face of globalization pressures and rapid urbanization.

II. Gaps and Weakness in Urban Data Acquisition

Although there is tremendous investment in urban data acquisition, using this information in a comparative analysis, exposes serious inadequacies. Often the delineation between rural and urban is arbitrary, and several definitions of inclusion may be employed for a given city. We must address incompleteness, narrow scope, insufficient archiving, lack of metadata, and the usual gulf between those who collect urban versus environmental data.

We challenge participants in this cyberseminar to put forward published and tentative formulations and their opinions on:

- A. **Definitions of urban and rural land use** can be widely applied and serve diverse needs of academics and practitioners. Currently, the best data source for current and projected urban trends is the UN, who relies on data from individual countries with varying definitions of urbanism. Not only do these definitions use differing quantitative measures, but some depend upon population size or density, while others rely upon administrative titles or proportion of workforce engaged in nonagricultural activities.

- B. **New approaches to collecting consistently defined data** over wide geographic areas on urban form, size, and population. Efforts are underway using administrative units (Tobler et al. 1997; UNEP 2002), satellite data (Dobson et al. 2000), and the distribution of nighttime lights (Elvidge et al. 1997; Pozzi et al. 2003). For example, CIESIN's Global Urban-Rural Mapping Project has developed a globally consistent map of urban extents (polygons) and urban populations for cities with populations greater than 5,000 (Reference).
- C. **Gridded, or city-by-city, data collection** of flows and stocks of materials and components of air and water. Mass balances of carbon or nitrogen, of energy or building materials, or of food stocks for individual urban regions and comparisons of regions could form the basis of more integrated models.
- D. **Ecological monitoring of urban and peri-urban locations.** A simplistic dichotomy between urban and "natural" environment is implicit in ecological research, but does not reflect the reality of pervasive human influence. Urban environments contain substantial biodiversity and perform ecosystem functions, but how are these patterns and processes altered, and in what ways do they contribute to or detract from global sustainability? The establishment of NSF's two urban Long Term Ecological Research projects in Phoenix (Grimm and Redman 2004) and Baltimore (Pickett et al. 2003) and other high-profile projects are reversing the tendency of ecologists to avoid urbanized regions.
- E. Is there a **recursive relationship** between global environmental change and the shape of the built and social environment of cities (Sánchez-Rodríguez et al. 2004)? Do differing patterns of the built environment of a city and the form of institutions that guide the activities of its citizens differentially impact global environmental change? Conversely, how will expected global environmental changes differentially impact urbanized regions that have organized themselves along different patterns? How can we monitor, conceptualize, and report on changing social and ecological conditions in ways that will guide us toward sustainability in the face of a changing world (Lucht 2002; Clark and Dickson 2003)?

III. Impacts of Economic Transformations and Urban Poverty

From earliest times, economic opportunity has been one of the main attractions of urban centers, leading to their long-term growth. Among the advantages to siting industry and commerce in densely settled cities, cities serve as centers for education, often leading to a better-educated workforce and a larger potential customer base. Although cities continue to be the foci for economic activity in the developed world and engines for economic growth in the developing world, they are also the scene of a growing disparity in household wealth, with differences most extreme in the developing world. Urban poverty and associated ills define many rapidly urbanizing cities of the world. More than half the families in developing world cities now live in poverty, and the proportion appears to be growing.

We challenge participants in this cyberseminar to put forward published and tentative formulations and their opinions on:

- A. **The potential risks and benefits of globalization.** As the economies of the world become more interconnected, what are the impacts of relative urban growth? Some argue that this is the most recent chapter in a long-term process of establishing a hierarchy of cities and their functions within particular regions and across the globe. In this competition for the fruits of globalization, it appears that African cities have fared poorly while many Asian cities have benefited.
- B. The economic activity and accumulation of wealth in the growing cities of the world means that **cities rely upon resources well beyond their own boundaries.** For example, urban populations in the Netherlands depend upon access to environmental goods and services from an area 15 times larger than the country itself. The consumption of food, wood, paper and fibers by 29 Baltic cities requires a total area 200 times larger than the combined area of the 29 cities (McMichael 2000; Folke et al. 1996).
- C. The competition of cities and regions in the new economic reality has led to the **marginalization of some cities** and, more commonly, the marginalization of small towns and rural areas, especially in developing countries. This competition reinforces patterns of poverty and leads residents to exact a heavier cost on their local landscapes through overintensive agriculture and extraction of natural resources.
- D. **A similar pattern prevails over entire regions and countries** in the underdeveloped world where their main source of international capital is the sale of natural resources such as timber or minerals. With prices for these commodities relatively low, the extraction rate must be kept unsustainably high, leading to further environmental degradation.
- E. **Rural-to-urban migration** motivated by perceived economic opportunity and diminished economic potential of agrarian landscapes has had the environmentally salutary effect of depopulating some countrysides, allowing them to revert to forests and other more “natural” conditions (van der Leeuw 1998). In the US, 105 acres an hour of farmlands are transforming into other uses, half of which is to open space or other less-intensive uses (USDA 2001).

IV. Health Impacts of Continuing Urbanization

The early cities of the world shared major responsibility for evolving and spreading a series of infectious diseases that led to widespread morbidity throughout history (Cohen 1989; Redman 1999). Under the pressure of industrialization, poverty, urban crowding, and the breakdown of traditional life ways, 19th-century Western European cities were well known as gateways for infectious diseases and in leading the way in public-health interventions (McMichael 2000). The densely packed neighborhoods of cities combined with poor sanitary conditions and inadequate solid-waste removal to create the elements necessary for the spread of infectious diseases. This pattern continues today with the poor in cities of developing and developed countries disproportionately ravaged by infectious and chronic diseases.

We challenge participants in this cyberseminar to put forward published and tentative formulations and opinions on:

- A. The dramatic **increase in life expectancy** from 46 to 66 years over the past 50 years reflects reductions in infant and child mortality and morbidity for which immunization, improved water, sanitation, and nutrition have played major roles (Kates and Parris 2003). However these benefits are not universally shared; in developing countries infant mortality is typically four or more times higher in poorer segments of the urban population, with similarly large differences in the incidence of environmentally related infectious diseases such as tuberculosis, typhoid, and cholera (McMichael 2000).
- B. With the extension of life span, **the nature of diseases shifts** from infectious diseases characteristic of the developing world to chronic diseases of the industrialized countries (Kates and Parris 2003). However, McMichael, in the Bulletin of the World Health Organization, reports that chronic disease is also increasing dramatically in the developing world in association with rapid urbanization and changing lifespans and lifestyles (McMichael 2002). Once again, chronic diseases disproportionately affect the poor and can exacerbate susceptibility to infectious diseases.
- C. Compounding industrialization, crowding, waste generation, and dense transport systems of the modern city is a **periurban poverty** surrounding many cities in developing countries **and the poverty of inner urban areas** in the developed world. This complex of factors exacerbates environmental respiratory health hazards such as asthma and increases the frequency of road trauma (Schell 1991; McMichael 2000). Few who have visited a megacity in the developing world such as Mexico City are not immediately struck with the severity of the air pollution (diminished, but similar experiences may occur when visiting some US cities as well; see PERN's December 2003 Cyberseminar on Air Pollution and Health.)
- D. Given the new contacts between animals and humans prompted by the spread of cities into former agrarian and undeveloped lands, it should not be surprising that there is a **reemergence of old, and the evolution of new, infectious diseases**, such as HIV, tuberculosis, yellow fever, lyme disease, and dengue fever (Barrett et al. 1998). These new threats are due, in part, to the combined factors of increased global trade and mobility, as well as antimicrobial resistance (McMichael 2000).
- E. A new threat that accompanies the density and interconnections within today's cities is their **susceptibility to bioterrorism**. Microbes introduced into a city whose citizenry has not been formerly exposed to this disease and hence has not developed natural resistance could lead to its rapid spread throughout the urbanized region. The introduction through municipal water supplies, airborne dispersion, infected travelers, or even a letters sent in the mail has given rise to a new category of **fears among urban dwellers**.

V. Effective Governance as Key to Urban-Environmental Sustainability

For benefits to outweigh the risks of continuing rapid urbanization and, at the same time, for those benefits to be widely shared and to maintain valued aspects of the environment requires governmental institutions and policies that are adaptive, participatory, and effective. Ironically, globalization itself is changing the roles and responsibilities of governments at all levels through decentralization. There is a growing emphasis upon financial deregulation, free trade, and

removal of protectionist trade barriers, thereby weakening the power of nation states (Sassan 1996; Cohen 2004). This transformation has allowed individual cities to assume greater authority for their own destiny and to break away from the fate of their national economies. This decentralization of responsibilities and resources to the municipal level is an opportunity to design and implement locally relevant policy (World Bank 2000).

We challenge participants in this cyberseminar to put forward published and tentative formulations and opinions on:

- A. The US National Academies' Panel on Population and Environment identified five **dimensions of the urban-governance challenge** (National Academies Press 2003):
 - 1) capacity—the ability of local governments to provide adequate public services to its citizens;
 - 2) financial—the ability of local governments to raise and manage sufficient revenue;
 - 3) diversity—the ability of government to cope with the extraordinary internal variation within cities and address attendant issues of fragmentation and inequity;
 - 4) security—the ability of government to deal with rising urban violence and crime;
 - and 5) authority—the increasing complexity of managing the jurisdictional mosaic as large cities grow in population and extent.

- B. The World Development Report (2003) identifies three factors needed to ensure **good governance of urban issues**:
 - 1) a structure of responsibility sharing and coordination that links community, local, regional, and national levels of government and empowers the appropriate actors to address problems at each level;
 - 2) a forum for wide participation in strategic thinking, to enable common understanding and consensus, motivate actions, and assess progress;
 - and 3) networks for communications and capacity-building among practitioners and stakeholders.

- C. Members of the Resilience Alliance (Folke et al. 2002) advocate **participatory governance using adaptive-management approaches**:
 - 1) management can diminish or build resilience. Rigid control mechanisms that seek stability tend to erode resilience and facilitate breakdown of socioeconomic systems;
 - 2) resilience-building management needs to be flexible and open to learning. Two useful tools for building resilience are structured scenarios and active adaptive management;
 - and 3) management's challenge is to develop institutional structures that match ecological and social processes operating at different spatial and temporal scales and address linkages between those scales.

A FRAMEWORK FOR GETTING STARTED

Before turning this inquiry over to others, we propose that, although cities share many patterns and processes in each of the five domains described above, there are significant differences in the challenges cities face and the priorities they have for investigation. Without belittling the tremendous variability within each regional category, we believe that priorities and processes can be more effectively addressed if we divide the discussion of the five urban issues and their potential solutions into three groupings:

- A. **North American cities** exhibit considerable variability, but their relative prosperity, cultural connections, and uniform legal system allow them to be considered as a group.
- a. Rapidly growing Sunbelt cities are concerned with absorbing new citizens, providing affordable housing, developing a sense of place, and expanding their infrastructure, educational, and medical systems to meet a growing population.
 - b. Steady-population Eastern and Midwestern cities are transforming their economic base, replacing aging infrastructure, attempting to revitalize core areas, and acclimating to the rise in political power of ethnic minority groups that comprise most of their population.
 - c. Due to their spatial expansion, select cities in all regions are concerned with the cultural and environmental impact of “urban sprawl.” The post-WWII period witnessed the emergence of suburbs at the fringe of old cities, and post 1970 has seen the further decentralization of employment and population to the fringe of cities, transforming former farmlands and open space.
 - d. Cities are competing as sites for growth industries, particularly components of the new knowledge economy. This competition often leads to investments in educating workforce, building attractive infrastructure, and developing amenities that contribute to a perceived high quality of life.
 - e. Many cities are experiencing both legal and illegal immigration from Mexico, Latin America, and other parts of the world, leading to a transformation in their ethnic and cultural composition. How will this play out in attitudes toward the environment and ultimate wresting of political power?
 - f. In the past few years the threat of terrorism has become real and is an important element in urban planning, infrastructure design, patterning of human interactions and probably will become a force in determining future residential relocation decisions.
- B. **European cities** share characteristics with those of North America, but their longer history and political/cultural diversity favors their consideration as a separate grouping.
- a. Major contrast between the relative economic success of Western Europe and the pockets of economic depression in Eastern Europe. This has led to a flow of population to the West and capital to the East.
 - b. Historic preservation in urban cores and historical patterns such as building height or narrow-street limitations put heavy constraints on urban planning decisions especially with respect to transportation options.
 - c. Many European cities are experiencing their own pattern of spatial expansion analogous to their North American counterparts’ urban sprawl. As many European cities have expanded, they have absorbed neighboring towns and villages that formerly were built around agricultural needs and now have to reorient toward new industry and commuting urbanites.
 - d. Large areas of older industrial cities are now underused or abandoned, giving rise to “brownfields” that are perceived as an urban blight.
 - e. Many cities (and countries) are facing declining population and aging workforce due to low birth rates. Continued migration from countryside and small towns as

well as large immigration from North Africa, the Middle East, and other parts of the world serves to maintain these urban populations

- f. The immigration of “guest workers” is creating new tensions in many European cities and will eventually lead to a redesign of the social and political fabric of these cities.
- C. **Cities in the developing world** exhibit a wide range of patterns and priority issues that were the focus of this essay. To recapitulate:
- a. Majority of the world’s population lives in poverty
 - b. Social and economic differentiation within and between cities is great and growing
 - c. Inadequate clean water and sanitation facilities
 - d. Inadequate transportation systems
 - e. Security concerns, especially in poorer neighborhoods (29% of cities in the developing world have areas considered as inaccessible or dangerous for the police) (UNEP 2002)
 - f. Competition for investment and participation in the global economy may lead to deferred improvements in aspects of infrastructure and enlargement of other aspects that may be hazardous to health.
 - g. Cities in the developing world are experiencing the most rapid spatial expansion of all regions. Sometimes, this growth takes the form of upper-class suburbs with large, well-spaced homes, a pattern that resembles the urban sprawl of North American cities. Other localities witness the establishment of shantytowns spreading out from the fringes of the city or from localities that otherwise are not settled due to undesirability or legal restrictions. Often, these newer developments are situated on choice farmland and lead to other problems in countries with at-risk food supplies.

The enormous complexity of the urban phenomenon and its environmental impacts defies a simple investigative approach. This background paper has suggested five research domains, each of which could be a productive area of inquiry for cyberseminar participants. Hopefully, the participants will proffer additional ideas, data, and approaches to the study of the environmental, social, and health dimensions of rapid urbanization.

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