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INTRODUCTION: POPULATION-DEVELOPMENT-ENVIRONMENT DYNAMICS IN THE DEVELOPING WORLD

Alex de SHERBININ

Center for International Earth Science Information Network (CIESIN), The Earth Institute at Columbia University, and the Population-Environment Research Network (PERN) of the International Union for the Scientific Study of Population (IUSSP), and the International Human Dimensions Programme on Global Environmental Change (IHDP)

The world is rapidly urbanizing. The UN Population Division estimates that during this decade the world's population has shifted from being predominantly rural to predominantly urban. Cities are also the locus and drivers of most economic growth. As indicated by Redman and Jones (2005, p. 1):

> "[C]ities 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."

Urbanization is particularly rapid in the developing world, where globalization and major economic restructuring in countries like China and India, and the lack of rural employment opportunities in many African and Asian countries, is provoking an exodus from rural areas to towns and cities. Although much of the focus has been on the growth, infrastructural and environmental problems of megacities (those over 10 million in population), the reality is that most urbanization is taking place in the small to medium sized cities, and not just large or "primate" cities (de Sherbinin and Martine, 2007). This poses numerous challenges to the environment and human health, ranging from conversion of cropland, forest and wetlands to urban "built up" areas (and the consequent loss of ecosystem services); adequate provision of improved water and sanitation, particularly in informal settlements; waste removal; and air pollutant emissions from transportation and industry.

Viewed more positively, urbanization also presents a very real opportunity to reduce humanity's impact on the biosphere through economies of scale and concentration of environmental, transportation, sanitation and health services (Marcotullio *et al.*, forthcoming). They are also engines of economic growth and poverty alleviation (World Bank, 2009). According to Tannerfeldt and Ljung (2006, p. 5):

> "Our rapid conversion to an urban society presents large challenges everywhere, even if the symptoms take many different forms in different countries. Many view urbanization as negative and threatening, since it is easy to point to growing slum areas, environmental degradation and social gaps. But cities contribute to development, and urbanization is both a requirement for – and a result of – economic, cultural and social development. The aim is to promote sustainable cities where all citizens have opportunities to improve their living conditions."

Thus, developing country societies are confronted with both significant risks and great opportunities.

Out of a desire to explore these issues further, the Programme for International Research on the Interactions between Population, Development and Environment (PRIPODE) of the Committee for International Cooperation in National Research in Demography (CICRED), in partnership with the Center for International Earth Science Information Network (CIESIN) of Columbia University, the African Population and Health Research Centre (APHRC), and the Population-Environment Research Network (PERN) organized a workshop from

11-13 June 2007, in Nairobi, Kenya. A call for papers was issued in September 2006, and 71 abstracts were submitted. Ultimately papers from 19 researchers were accepted, and five more researchers served as invited experts, panelists, or discussants. The regional breakdown included ten from Africa, two from East Asia, four from South Asia, four from South America, one from Europe, and three from North America (see Appendix to this chapter for the agenda).[1] Given the rich mix of regional perspectives and research findings, there was lively discussion among presenters, panelists and other participants. The workshop also included site visits to APHRC projects in two of Nairobi's largest slums, Korogocho and Viwandani, where APHRC has been running demographic surveillance systems.

The overall purpose of the workshop was to better prepare for inevitable urban growth and to inform policy and programs to improve the situation of the urban poor as well as to protect the environment through a better understanding of urban population-development-environment (PDE) linkages. This meeting brought together scientists who have conducted research in individual cities (or in groups of cities) exploring these linkages, and who have offered concrete solutions to the problems of rapid urban growth in developing regions. The workshop sought to extract from the studies recommendations for improved urban management and governance, and hence one of the goals of this introduction is to tease out the policy implications that can be generalized from the individual studies.

This introduction includes a brief overview of issues confronting developing country cities, followed by synopses of the papers (out of the papers presented at the workshop, the editors chose nine for inclusion in this book) and their policy recommendations. This is followed by a brief conclusion.

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1. A number of Kenyan and international researchers were welcome guests during different portions of the workshop. For a complete set of papers presented at the workshop, please visit: http://www.cicred.org/Eng/Seminars/Details/Seminars/PDE2007/PDEpapers.htm.

Overview[2]

Globally, the demographic transition – the shift from high birth and death rates to low birth and death rates – has been intimately associated with the urban transition. The "urban transition" refers to a change from a predominantly rural to a predominantly urban population, but it is a lot more than that. It represents a fundamental transformation of society, affecting everything from culture to social relations, political systems, institutions, the economy, and the environment.

Population dynamics are radically altered by the urban transition. Newcomers to the city quickly find that the large families, of such importance to the household economy in rural areas, are a liability. Smaller housing and the costs of child rearing quickly put a brake on fertility, whereas better access to health care, piped water, and sanitation dramatically reduce infant and child mortality for most urban residents. Couples increasingly choose quality over quantity, investing in education for fewer children (Caldwell, 2005). Relations between the sexes often change as well, as the blending of work and family life on the farm gives way to paid employment outside the home. As the opportunity cost increases for women, more and more enter into paid employment (whether by necessity or choice) rather than staying home, increasing the incentive to lower fertility. Finally, poverty rates decrease with urbanization (see Figure 1).

The urban transition also has dramatic impacts on the environment. Firstly, without fossil fuels and the ready availability of cheap energy, the urban transition would not and could not have occurred at all (Ness and Golay, 1997). Yet, combustion of these same fossil fuels is having a growing impact on the global climate system, and is also a major contributor to urban air pollution with its attendant health effects. Secondly, as people leave largely rural-based agricultural jobs to join the industrial and service sector work forces, it affects a whole range of things that have direct or indirect impacts on the environment: housing, household sizes, income levels, diet, consumption patterns, energy use, values, and cultural preferences.

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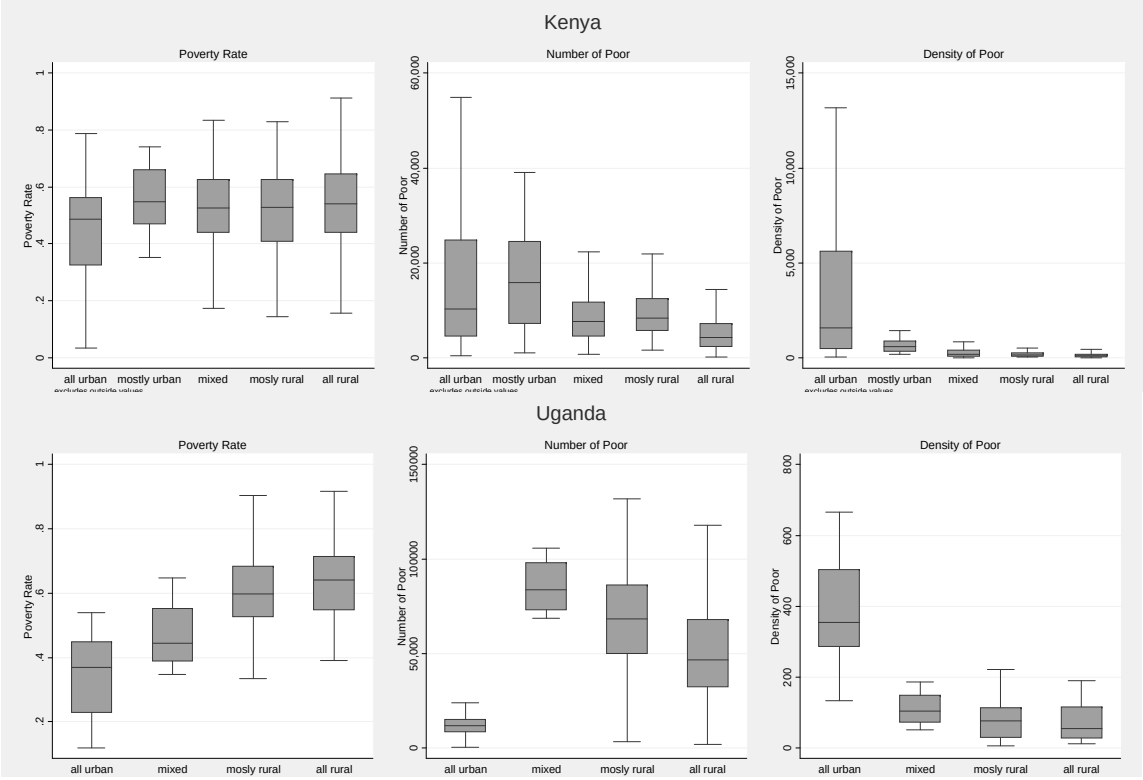
2. This overview is based in part on a paper prepared by the author and George Martine for the International Colloquium on Population, Development, and Environment in the South, held from 21-23 March 2007, at UNESCO headquarters in Paris, France. The colloquium and the paper were under the rubric of the PRIPODE project.

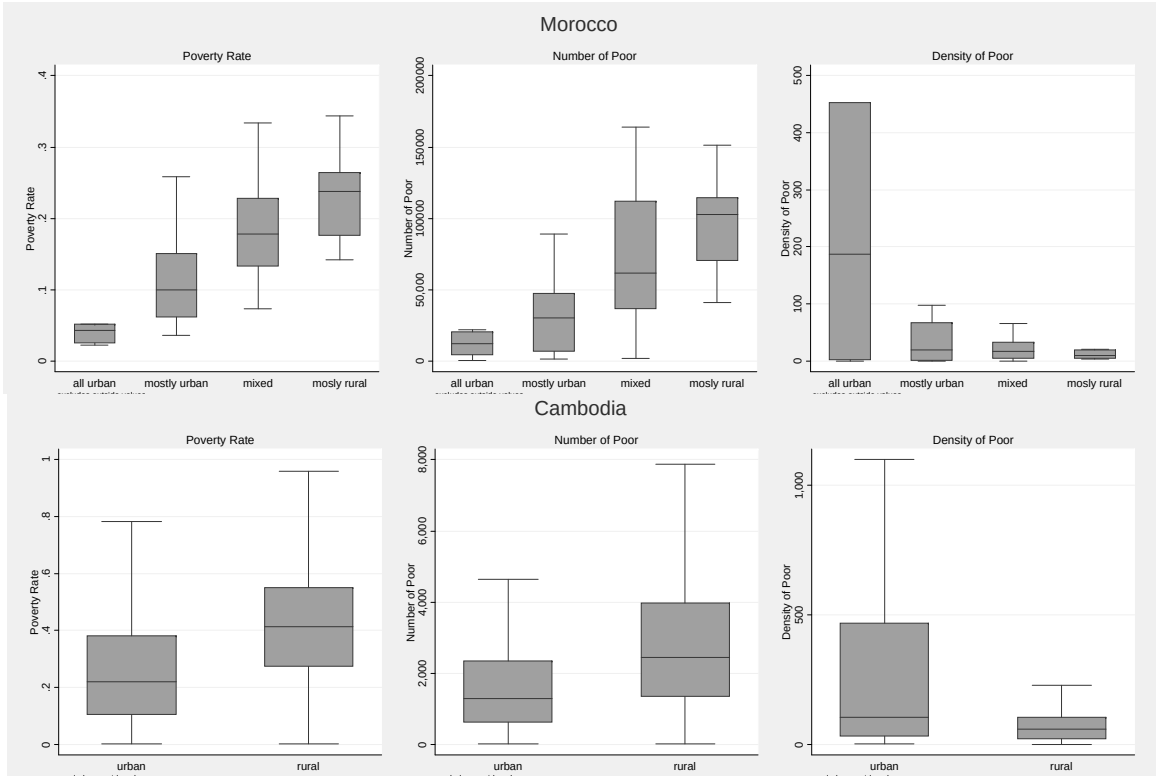
Thus, to speak of "urban population, development, and the environment" is no small matter. The topic concerns one of the fundamental transformations of society, one that began more than two centuries ago but which has assumed a much more critical role today. It can be argued that global economic, social, demographic and environmental outcomes will hinge, to a large extent, on what happens in the cities of the developing world during coming decades.

Rapid urbanization in the poorest countries is straining the capacity of governments and the private sector to provide basic amenities or to manage waste streams. This degrades the quality of life and impoverishes the environment. Although the same strains on quality of life, health, and the environment were evident in the earlier urban transition in the industrialized world, there are significant differences between the two transitions. Firstly, the sheer numbers of people taking part in it are of a dramatically different scale. Secondly, owing to complex changes in the global economy, the prospects for economic development among the least developed countries are not nearly as bright as the situation faced by today's industrialized countries 150 years ago. This was true before the recent economic downturn, but is even truer today. Lastly, the global environmental context has changed dramatically, and today there is real concern about the impacts of further industrial development in the face of climate change and the rapid loss of ecosystems. Unfortunately, instead of bringing economic dynamism, improved health, tougher environmental standards, better education, and growing democratization, urbanization in some of the least developed countries is accompanied by economic stagnation, negligible health gains, lax environmental standards, low education levels, crime and social instability. As indicated earlier, this need not necessarily be the case; urbanization is perhaps one of the best hopes for development and environmental stewardship for low-income countries.

As discussed, population dynamics are intimately bound up with the urban transition and urban economic development. In terms of population connections to the economy, the most direct factors are the contribution that the economically active population makes to a city's labor pool, and the large consumer demand (or markets) represented by urban populations. Secondly, economic development, and particularly changes in urban land markets, when coupled with population trends, has tended to lead to a process of urban spatial expansion into peri-urban areas, bringing increased population density to previously

Figure 1. Poverty rates, numbers of poor people, and densities (in persons per sq. km) along the rural-urban continuum





The charts above are constructed using distinct urban and rural poverty lines. They illustrate considerable variation in the poverty rates and numbers of people living in poverty. Poverty rates generally increase along the urban-to-rural continuum, though the differences are not very significant in Kenya when compared to Uganda, Morocco, and Cambodia. Source: Maria Muñiz, CIESIN, Columbia University.

rural areas. Thus settlement extends and fills in gaps in the urban tissue. This process has sometimes led to settlement in hazard-prone areas – areas characterized by steep slopes, high flood risk, or proximity to industrial facilities.

The relationship between population and the environment in developing country cities ranges from local environmental health concerns to issues of regional or global concern – such as habitat loss, changes to the hydrological cycle, urban consumption "footprints" on distant areas, and greenhouse emissions from transportation and industry. It has been pointed out elsewhere, however, that these environmental problems may be associated with urbanization, but they are not necessarily *caused* by urbanization (Marcotullio *et al.*, forthcoming). The same population spread out over a much wider area at lower densities would not necessarily yield lower environmental impacts; in fact, it is probable that the impacts would be worse (Martine, 2001). Furthermore, all of these environmental outcomes associated with urban areas can be attenuated by improved technologies and good governance.

Another connection between population dynamics and the urban environment is the health effects of exposure to pollutants and toxins – the so-called environmental burden of disease (WHO, 2007). These can lead to morbidity and excess mortality. Ness (2000, p. 249) notes:

> "Health provides an important tracer to indicate the quality of the population-environment relationship. High levels of human health, implying low levels of morbidity and mortality, signify a positive relationship; low levels of health imply some form of stress in the relationship."

The primary environmental challenges facing developing country urban areas are provision of adequate water and sanitation; adequate waste removal; slum and informal settlements in environmentally sensitive or risk-prone areas; and air pollution. A worrying sign in recent years is that the "health dividend" found in developing country cities – the lower morbidity and mortality rates found in urban as compared to rural areas – has begun to erode in some cities (Montgomery *et al.*, 2003; Brockerhoff and Brennan, 1997).

The papers

The papers presented at the Nairobi workshop illustrate a number of the issues described in this brief overview. In this section I briefly describe the issues raised in the papers, touching on the major policy conclusions. The focus was mostly on individual cities, though the thematic topics covered a range of issues, including slum settlements, peri-urbanization and "sprawl," cities in largely rural areas, urban health, and environmental perceptions. Approaches taken by the authors include more theoretical and conceptual approaches (for the South American studies), to more data intensive papers using methods such as spatial approaches (using remote sensing and geographic information systems), community surveys, and statistical analysis of census and survey data. Given this diversity, and lacking a clear-cut logical schema for grouping the papers, I have simply chosen to group the papers by continent, and then present them in alphabetical order by author's last name.

African case studies

The paper by A. Thompson Adeboyejo and Olajoke Abolade focuses on the medium-sized city of **Ogbomoso** in Southwest Nigeria, with a population of 800,000. The paper is interesting in that it presents the extent and dynamics of growth using historical maps and current remote sensing imagery of a "typical" medium-sized city in the developing world, and thus tracks a dynamic that is happening in many regions, yet one that is under-researched. In addition, the authors used a combination of structured questionnaires and focus group discussions to learn about household land holdings and livelihood strategies at the urban-rural fringe and perceptions of changes that have taken place in the past decades. The results suggest that many of the changes – from predominantly rural to urban-centric strategies such as trading – have been difficult for residents in these areas. Although incomes have gone up slightly, the average size of landholdings has declined, and the benefits of being part of a larger urban area – in terms of access to social services – have not yet been realized. The authors recommend government strategies to preserve agricultural lands at the urban fringe and farm input subsidies to help small farmers, and that conversely farmers organize themselves to lobby for appropriate pric-

ing of farm products. They expect that effort to restrict expansion will lead to greater vertical development of the urban area.

Just southwest of Ogbomoso, Tunde Agbola and Elijah Agunbiade write about slum development in **Lagos**, Nigeria, a mega-city of more than 10 million inhabitants. Their chapter follows a similar pattern, presenting the results of a spatial analysis of slum distribution and growth, and then analyzing a survey of 583 slum households. An estimated two-thirds of Lagos residents live in slums, with most new migrants settling in these areas. Environmental sanitation issues are numerous in the slum areas – including open garbage tips, lack of piped water, and inadequate toilet facilities. Many of the problems of slum improvement find their roots in the lack of secure tenure. Threat of forced eviction predisposes residents to short-term thinking about environmental improvements. Insecurity of tenure deters investment, since the residents do not have access to mortgage facilities from banks because of lack of collateral. The interplay of all these factors has perpetually kept these groups of people in a vicious circle of poverty. Unfortunately, the existing land registration process, which requires fee payments, extensive documentation, and the engagement of professionals, is too time consuming and expensive for most residents. The situation is complicated by ambiguous land ownership – with some families claiming ownership and selling plots. The authors recommend the development of a land information system for the planning and servicing of the community. They also suggest that an automated registration scheme should be implemented so that the land information forms the basis for any registration or titling program.

Esther Dungumaro investigates gender differentials in access to water and sanitation in the **urban areas of South Africa** using data from the 2002 South Africa General Household Survey (GHS). Her research finds that socieoconomic status is a better predictor of availability of adequate water and sanitation, and that the wealth of households and access to water and sanitation were not very different for female versus male headed households (though the differences were statistically significant). She suggests that the limited differences may either be due to the sample in the GHS, or to the fact that household poverty status in urban areas of South Africa is not much affected by the gender of household head, this notwithstanding the fact that female headed households tend to be larger. As a result, she cautions against over-generalizations concerning the feminization of poverty,

and recommends a more site-specific approach to planning water and sanitation interventions, since female headed households in rural areas do indeed have significantly less access to water and sanitation than their male headed counterparts.

Using a survey of 1,817 slum residents in **Nairobi**, Adam Konseiga tests the hypothesis that children who are raised in the slums are at greater risk of morbidity than those who are left with their mothers or other family members "upcountry" (in the rural areas). Konseiga views the decision to jointly migrate with children as a choice, albeit a choice that is constrained by the social networks and wealth of migrating households. Typically it is the poorer households with limited social networks that move with their children to the slum areas. Once there, environmental conditions (polluted water, inadequate sanitation, lack of waste removal) and limited access to formal health care, along with the absence of family support and competing demands on the mother's time, result in 39% higher morbidity among the children in slums when compared to children who are left upcountry. Konseiga suggests that child health interventions are needed in the slum areas to address the welfare needs of jointly migrating families and their children.

In Ghana, Michael White and his colleagues take an eclectic approach to examining urban PDE linkages in the **urbanizing coastal zone of Ghana**, examining nutrient concentrations in several coastal lagoons in relation to surrounding population densities, fertility change in urban areas, and the environmental attitudes of urban residents. They find a strong positive correlation between nutrient levels and population density, most likely reflecting the lack of sewage treatment facilities. In terms of fertility, controlling for a number of demographic factors known to affect fertility rates they find that urban residents have an 11% lower probability of childbearing. Regarding environmental awareness, they found that 96% of respondents had a concern about environmental conditions, and that this high percentage did not vary significantly between recent migrants and long-time residents. Overall, they take a positive view on the relations among the PDE variables, concluding that rapid rates of urban population growth are a natural phenomenon for hitherto largely rural societies in Africa, that urbanization is accompanied by declining fertility, and that rising incomes associated with urbanization are likely to result in greater demands for environmental regulation (as they have in developed countries).

Asian case studies

From Africa, we move to the demographic giants of India and China, both of which have experienced dramatic growth in urban areas while simultaneously harboring large rural populations. Atiqur Rahman and colleagues look at a range of urban environmental issues in **Delhi** with the aid of remote sensing and GIS. Looking at changes in land use and land cover from 1992-2004, they find a significant decline in agricultural lands in the Delhi metropolitan area and a 122% increase in dense residential areas. Preliminary evidence from satellite thermal infrared images suggest that the city may have grown warmer as a result of the heat-island effect. And a GIS analysis of garbage tips that were recorded using global positioning systems (GPS) finds that open dumping sites are a particular hazard in the 3rd and 1st most densely settled portions of the city (East and Northeast Districts), but are relatively less of a problem in the 2nd most densely settled area, Central District, which is more affluent. The authors recommend the use of geospatial data to improve urban environmental management and planning, warning that if problems are not dealt with appropriately in cities like Delhi, it will not only result in an increasing health burden, but will also result in economic losses as private firms look elsewhere to site new facilities.

Yu Zhu and colleagues examine new forms of urbanization and the blurring of the distinction between rural and urban in the rapidly growing coastal city of **Quanzhou**, in Fujian Province, China, with particular focus on so-called *in situ* urbanization. This is a process of urbanization at the fringes of large cities in China, but it is distinct from the peri-urbanization in Nigeria in that its economic underpinnings are the Township and Village Enterprises (TVEs) – small to medium sized firms that were formed out of collectives following the economic reforms of the 1980s. Although as in Nigeria, the share of the agricultural labor force has declined in these formerly rural areas, the key to their urbanization lies in the economic dynamism of the TVEs and their well developed transportation links to large cities. The density of many of these transitional areas is as high as the urban population density of many U.S. cities, but not nearly as high as the urban core. Zhu and his colleagues argue that *in situ* urbanization – the accumulation of urban elements in previously rural areas – is critical to understanding the overall urbanization process in China, and that it is a

pattern of long-lasting significance. Analyzing data on discharges of industrial waste water, exhaust, and solid waste, the authors were not able to detect a clear signal concerning the relative environmental impact of this form of urbanization when compared to the urban core. This is partly owing to deficiencies in the data. The authors call for new theoretical and planning frameworks to address this new form of urbanization. Ultimately, they recommend that more concentrated development be promoted so that there will be a more efficient administration of enterprises, land and infrastructure uses, and control on environmental problems.

Latin American case studies

Turning to Latin America, Alisson Barbieri and colleagues address interesting new forms of **urbanization in the Amazon** of Brazil and Ecuador with a particular focus on the articulations with rural areas of this vast frontier. Borrowing on previous work that questions universally applicable labels of "rural" and "urban", the authors argue for a more context-specific approach that recognizes infrastructure services, patterns of human settlement and the socioeconomic organization of the territory, as well as political definitions. Examples of forms of urbanization in otherwise rural areas include vacation resorts, agro-industrial complexes, and isolated power and industrial plants (especially those associated with extractive activities). In the Ecuadorian Amazon, urbanization has been associated with declining rural plot sizes owing to population growth and land fragmentation, leading many households to diversify portfolios by sending family members to rural towns for off-farm employment. This trend is reinforced by soil depletion and the volatility in the price received for cash crops, and by a simultaneous growth in the oil industry. Brazil, by contrast, took a more statist approach to development of urban areas as part of its agenda of populating the Amazon, creating urban nuclei as bases for economic activity. In both Brazil and Ecuador the growth of urban settlements has not generally been accompanied by a concomitant increase in water and sanitation infrastructure, resulting in growing public health problems. The authors argue that what is needed is not urban planning, but regional planning that takes into account the frequent dual residence and diversified strategies of farm households. In addition, they argue for policies to better protect what is left of the tropical

forests and for improved access to family planning to meet existing demand for fertility limitation.

Finally, Ricardo Ojima and Daniel Hogan compare the morphology of urban growth in the major **cities of Brazil**, with particular reference to the phenomenon of "urban sprawl." Presenting a series of schematic types of urban development, from concentrated, to dispersed, to polycentric, the authors then proceed to construct an index of urban sprawl based on factors such as density, fragmentation, orientation, and integration, and to rank Brazilian urban agglomerations according to these criteria. The hypothesis is that urban space, which is socially built and reflects competing interests and social actions, has differentiated consequences for urban life, and that it can result in very different environmental impacts, depending on the existence of green space and the resulting demand for automotive transport, among other factors. They concluded that there is considerable consensus on the environmental and social benefits of urban morphologies which maximize access to services while minimizing environmental impact, but that moving beyond such generalizations to arrive at policies which effectively direct city growth is a significant challenge.

Conclusion

The heightened interest in urbanization in low income countries, its potential for poverty alleviation, and its impacts on the environment is reflected in the number of recent works that address either local environmental impacts (for those cities at the early stages of the urban environmental transition) or the more far-reaching consequences of urbanization for climate change and consumption "footprints" (for those cities in the later stages of the environmental transition) (Bicknell *et al.*, 2009; World Bank, 2009; UNFPA, 2008; Martine *et al.*, 2008; Worldwatch Institute, 2007; Tannerfeldt and Ljung, 2006; McGranahan *et al.*, 2001). This publication contributes to this literature, with a particular reference to the cities at the earliest stages of the urban environmental transition. Recommendations by the case study authors call for government intervention in a number of areas – from better cadastral surveys, to improved waste management, to more attention to spatial planning. They also suggest the use of better spatial data information systems to facilitate such planning. This points to the need to

build the capacity of city managers, and to increase the resources at their disposal, so as to be able to better address the environmental health challenges facing the poorest residents, while recognizing that the forms of urbanization that take place today can contribute to environmental impacts tomorrow. Although the challenges in the poorest cities such as Lagos and Nairobi are immense, there is little choice but to confront those challenges head-on. The lives and wellbeing of too many urban residents are at stake.

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Appendix. Workshop agenda

11-13 June 2007
Nairobi, Kenya

Monday, 11 June

Welcome session

9:00-10:30 Welcomes by:
Alex Ezeh, Director of APHRC
Alex de Sherbinin, CIESIN and PERN
Christophe Guilmoto, CICRED

Round of introductions

Opening address:
Cities transformed: Demographic change and its implications in the developing world
Dr. Mark Montgomery, The Population Council, New York, USA

Q&A and discussion

Session 1. Urban Population Growth and the Environment: Evidence from Africa

11:00-12:30 Chair: Christophe Guilmoto, CICRED

Urban growth and the environment in Kampala, Uganda
J.B. Nyakaana, Department of Geography, Makerere University, Kampala, Uganda (PRIPODE Project UG4)

Urbanization, slum development and security of tenure: The challenges of meeting Millennium Development Goal (MDG) 7 in Metropolitan Lagos, Nigeria
Babatunde Agbola, Department of Urban and Regional Planning, University of Ibadan, Nigeria

Brazzaville: Urban growth and environmental problems
Gaston Samba and Patrice Moundza, Centre de Recherches sur les Tropiques Humides et Institut Supérieur de Gestion, Université M. Ngouabi, Congo (PRIPODE Project CG1) [unable to attend]

Population and spatial growth: Diagnosis and implications for urban management of Bangui, Central African Republic
Cyriaque-Rufin Nguimalet, Département de Géographie, Faculté des Lettres et Sciences Humaines, Université de Bangui, Central African Republic [unable to attend]

Discussant: Eliya Zulu, APHRC

Session 2. Urban Population Growth and the Environment: Evidence from Asia

14:00-15:45 Chair: Yazoume Ye, APHRC

Urbanisation, environment, development and urban policies in Ho Chi Minh City, Viet Nam
Le Van Than, Institute of Economic Research (IER), Viet Nam (PRIPODE Project VN5)

The evolution of China's *in situ* urbanization and its planning and environmental implications
Yu Zhu, Centre for Population and Development Research, Fujian Normal University, China

Economy, population and urban sprawl: A comparative study of urban agglomerations of Bangalore and Hyderabad, India, using remote sensing and GIS techniques
Neelakantan Krishna Iyer, National Remote Sensing Agency, Department of Space, Government of India

An assessment of urban environmental issues using remote sensing and GIS techniques: an integrated approach. A case study of Delhi, India
Atiqur Rahman, Jamia Millia Islamia University, India

Discussant: Alex de Sherbinin, CIESIN, Columbia University

Session 3. Urban Population, Water and Sanitation

16:15-17:45 Chair: Michael White, Brown University

Population, household structures and domestic water and sanitation in households: A gender perspective using survey data
Esther Dungumaro, University of KwaZulu-Natal, School of Development Studies

Health and livelihood implications of marginalization of slum dwellers in provision of water and sanitation services in Nairobi City
Chi-Chi Undie, APHRC, Kenya

Role of water supply and sanitation for hill area development using remote sensing and GIS techniques
Aparesh Patra, International Institute for Population Sciences, India

Discussant: Alex Ezeh, APHRC

Tuesday 12 June

Session 4. Urban Population, Environment and Health

9:00-10:45 Chair: Prof. Obeiro, University of Nairobi (invited)

Correlation between pollutants emission and inhabitants' morbidity
Gheisa Roberta Telles Esteves, Universidade de Campinas, Brazil

Rural-urban migration, poverty and sustainable environment: The case of Lagos
Peter Okuneye, University of Agriculture, Nigeria (PRIPODE Project NG1)

Intra-urban transportation, gender and psychological distress in developing countries: Nigeria
Abidemi Asiyanbola, Olabisi Onabanjo University, Nigeria

Discussant: Christophe Guilmoto, CICRED

Session 5. Periurbanization, Informal Settlements and Environmental Consequences (I)

11:15-12:45 Chair: Jean-Christophe Fotso, APHRC

Family migration: A vehicle of child morbidity in the informal settlements of Nairobi city, Kenya?
Ousmane Faye, APHRC, Kenya

Household response to urban encroachment on rural hinterland in the Ogbomoso urban fringe
Aina Thompson Adeboyejo, Ladoke Akintola University of Technology, Nigeria

Towns in the jungle: Urbanization in the Amazon
Alisson Barbieri, Department of Demography and CEDEPLAR, Federal University of Minas Gerais, Brazil

Discussant: Mark Montgomery, The Population Council

14:00-17:00 **Visits to APHRC projects**: Visits to two Nairobi slum settlements (Korogocho and Viwandani) where APHRC has been running demographic surveillance systems.

Wednesday, 13 June

Session 6. Periurbanization, Informal Settlements and Environmental Consequences (II)

Chair: Alisson Barbieri, CEDEPLAR

9:00-11:00 **Mobility, urban sprawl and environmental risks in Brazilian urban agglomerations. Challenges for the urban sustainability in a developing country**
Ricardo Ojima, Population Research Center, Universidade de Campinas, Brazil

Mumbai after 26/7 deluge: Some issues and concerns in regional planning
Mohua Guha, International Institute for Population Sciences, India

Urbanization and environmental quality: Insights from Ghana on sustainable policies
Michael White, Brown University, USA

Forecasting city population growth in developing countries
Mark Montgomery, Population Council, New York, USA

Session 7. Round Table on Policy Implications

11:30-13:00 Eduardo Moreno, Global Urban Observatory, UN-HABITAT
Alex Ezeh, APHRC
Julie Touber, Center for Sustainable Urban Development, Columbia University

Session 8. Spatial Data Integration for Urban Studies

14:00-16:00 This session will provide a rapid introduction to using spatial data for urban PDE studies.

- Brief introduction, Alex de Sherbinin
- Poverty data sources and mapping, Alex de Sherbinin
- Health data sources and mapping, Yazoume Ye
- Environmental data sources and mapping, Neelakantan Krishna Iyer
- Integration of survey and spatial data, Alisson Barbieri

17:00-18:00 Scientific Committee Meeting