



Urbanization and Global
Environmental Change

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**Urban Responses
to Climate Change**

a Focus on the Americas



IHDP

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of SUSTAINABILITY
ARIZONA STATE UNIVERSITY



Editorial

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The present and future of societies are intrinsically associated with the growth of their urban areas. Concerns about the well-being of current and future urban inhabitants have promoted approaches to balance urban growth. The Urbanization and Global Environmental Change project (UGEC) - a core project of the International Human Dimensions Programme on Global Environmental Change (IHDP), is a leader in the effort to expand knowledge and understanding of urban areas in the context of global environmental change. We believe that opportunities for urban sustainability in the 21st century need multidimensional approaches, looking beyond the local scale and integrating a dynamic perspective of the interactions between local, regional and global biophysical and social processes generated by and affecting urban areas.

UGEC sponsors and carries out research on the interactions between urban areas and global environmental changes, as well as other activities seeking to expand the knowledge on this topic. We also create forums where scholars and practitioners share knowledge and ideas in an effort to create integrate perspectives of the complex realities and dynamics of urban areas.

UGEC will be showcasing its integrative work in part through its new series of newsletters titled 'UGEC Viewpoints'. We are dedicating the first issue to the theme of the first flagship workshop of the project on the theme of 'Urban Responses to Climate Change: A focus on the Americas' with contributions by several participants of the workshop. The event took place in New York City in September of 2007 and was co-sponsored by IHDP, the CUNY Institute for Sustainable Cities at Hunter College and the Global Institute of Sustainability at ASU. The considerable recent international attention to climate change has highlighted the interactions between urban areas and global and regional biophysical processes. Provided with the opportunity to assist urban areas to react to the challenges of climate change, our workshop addressed the questions of how cities in the Americas respond, fail to respond, or could better respond to climate change.

The present issue has benefited immensely by the editorial assistance offered by Michelle Schwartz and Danielle Tomerlin at ASU's Global Institute of Sustainability; Lesley Patrick and Carina Molnar at the CUNY Institute for Sustainable Cities were also critical for the successful conclusion of the workshop that led to this publication.

We wish you an enjoyable reading!

Michail Fragkias
UGEC Executive Officer



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Introduction to the Issue

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Times Square, New York

Climate change has been recognized by a large number of international organizations (United Nations, European Union, OECD, World Bank), scientific bodies (IPCC, Millennium Ecosystem Assessment, IGBP, IHDP, START, IAI, APN, etc), business organizations, and many national, state, provincial, and local governments, as well as the international, national, and local mass media as a critical problem for the present and future of societies around the world. Although climate change has been identified as a major environmental challenge for some time, the current level of attention and consensus for action surpass previous considerations. Also remarkable is the recent recognition of the key role of urban areas in addressing the challenges created by climate change, both in terms of mitigation and adaptation. Previous attention to climate change studied a broad range of sectors (agriculture, energy, fisheries, forestry, biodiversity, health, institutions, etc.) and processes (deforestation, land use, natural disasters, etc.), but little attention was given to urban areas and most of that attention had focused on their role in the emission of greenhouse gases.

Human beings have always had an intimate relation with climate. The development and collapse of civilizations have a strong link with environmental management and, in particular, with climate management. Humankind has undergone several climate adaptation phases, particularly evidenced in the human settlements

(housing and urban space). Technological advances have gradually transformed the capacity for adaptation to adverse climate conditions in urban areas. Changes have been particularly dramatic in the last century, where the adoption of mechanical means has facilitated the prioritization of aesthetic aspects over functional aspects in urban design and adaptation to climate. Those changes have been based on significant energy costs (air conditioning, new materials), and new architectural and urban forms.

Attention to the bidirectional relation between urban areas and climate has mainly focused on the impacts of urban areas on climate change, in particular, the effects of green house gas emissions and the so-called heat island effect. Unfortunately, less attention has been provided to the impacts of climate change on urban areas. The increasing frequency and magnitude of climate related natural disasters in urban areas during the past decade are some of the clearest indicators of the magnitude and significance of those impacts. There is, however, a broad range of pathways through which climate change affects urban areas. These impacts depend on a number of factors, including the vulnerability of peoples and places and their capacity to adapt.

Urban areas have begun to be considered a central element in the responses to climate change during the last two years due to a combination of factors. The irreversible transition in the rate of urbanization led to more than half of the population of the world (3.2 billion people) living in urban areas since 2007, together with the projection that three-quarters of the population will be living in urban areas by 2030, particularly in poor countries, are clearly strong incentives to pay attention to urban areas. Equally important is the importance of urban areas for the international, regional, and national economies as key nodes of globalization processes, and the generation of wealth by urban activities. Urban areas occupy only a small percent of the planet's surface, but they constitute most of the international economy. A recent UN report states that the inhabitants of urban areas are responsible for the consumption of 75 percent of the planet's resources, including energy resources central in the emission of greenhouse gases and the demand of other resources that induce land use and land cover changes also associated with greenhouse emissions. It is clear that confronting climate change will depend on changes in consumption patterns of the urban inhabitants, new sources of energy, and more efficient urban functions and forms. Confronting climate change

also requires attention to the impacts of climate change. Natural disasters have had significant consequences in urban areas. Twenty two of the thirty major natural disasters between 1990–2004 were climate related disasters in urban areas. The impacts of climate change on urban areas are broader than natural disasters and will affect the health, social life, urban economy and function.

During the last few years, the bidirectional interactions between urban areas and climate change have fostered an impressive array of responses in urban areas. Initiatives such as the Mayors Alliance for Climate Protection in the U.S., the C40 Cities Climate Leadership Group and the Cities for Climate Protection illustrate major types of current responses – a diverse set of international, regional, national, and local initiatives. A large number of the current initiatives have been created and agreed upon in large cities of industrialized countries while medium sized and small cities have taken smaller steps. The Mayors Alliance for Climate Protection in the U.S. for example was created as an effort to foster local action to reduce greenhouse emissions, inspired in part as a reaction to the refusal of the U.S. Federal Government to be part of the Kyoto protocol and concerns about the impacts of climate change on urban areas. Created in 2001, the Alliance claims to have almost 700 members at the end of 2007, representing a diverse group of small, middle, and large urban areas. The C40 Climate Leadership Group represents some of the world's largest cities and is committed to tackling climate change. Originally sponsored by the Mayor of London in 2005 with the participation of 18 cities, the C40 initiative has expanded to the 40 largest cities in the world. The C40 cities have pledged to work together, to share best practice and to take action in reducing greenhouse gas emissions. In order to achieve this, the C40 entered into a partnership with the Clinton Climate Initiative to develop programs that would help cities fulfill their objectives.

Notwithstanding, there is still much to be learned about the ways cities respond to climate change in urban areas. There are many important questions still unanswered, ranging from: What urban areas have committed to respond to climate change? What are those responses? What actors are involved in those responses? What are the driving factors for those responses, and how many of them are rhetoric and how many tangible? What are their institutional settings? Are the major differences in the responses by size of the urban area and by country? Are these responses sustainable in the future? Are there conflicts and contradictions between mitigation and adaptation responses? Are there perceived consequences in terms of social equity? Can the experiences of

current responses be used to foster other urban areas to respond?

Understanding the characteristics, extend, dynamics, and sustainability of this process is relevant in assisting local urban communities to better address the challenges created by climate change. Many of the responses are fragmented and have not considered their interaction with other mitigation or adaptation actions or their potential consequences on other sectors. Well-intended fragmented actions create, in the best case, only partial solution to problems and can cause new problems or aggravate existing ones. Better understanding current responses to climate change will prevent causing more problems, it will also open new opportunities to improve and strengthen the operation of urban areas and the livelihoods of their inhabitants in the short and long-term. Crisis creates major challenges for societies, but they also open opportunities for rethinking current patterns of growth, confront deficiencies in planning, governance, and operation of urban areas, and reconsidering structural contradictions and inequalities in societies. Climate change is not only an environmental problem; it is a major challenge for development. The wide ramification of its consequences in urban areas are also an opportunity to search new way of understanding and conceptualizing local urban growth according to the new demands and conditions in the 21st century.

This newsletter offers a contribution in this direction. It considers some of the above questions in the context of the Americas and seeks to assist in constructing a dialogue leading to better responses in the urban areas of the Americas. The present product is the beginning of a series of steps that the UGEC project will be taking towards achieving that goal.



Global Environmental Change and the Sustainable Use of Space in “Second Half” Cities

George Martine

The significance of future urban growth and its probable ecological implications has received insufficient attention. Current projections suggest that all urban population growth which has occurred since the first towns of Mesopotamia will double in the next 40-plus years. This article focuses on the need to monitor and orient rapidly-changing events related to the use of space in this much compressed “Second Half” of the urban timeline.

The environmental consequences of future growth are critical since most will occur in the world’s poorest countries. Africa and Asia alone will experience 80% of all urban growth between 2000 and 2030, as the urban population of these two regions doubles from 1.7 to 3.4 billion in that span. Ongoing processes in today’s towns and cities represent only the better-known half of the equation in the trajectory of urban sustainability. Dealing with current issues – though extremely complex – may pale by comparison to the challenges still to come, given the dimension and characteristics of upcoming urban growth in developing regions, within the context of globalized development expectations and consumption aspirations.

Current policy discussions often overlook the enormous implications of massive urban growth in the context of poverty and the innate differences of development trajectories when discussing mitigation and adaptation challenges. Yet, much more can be done to influence policy in countries that have yet to begin their major urban transition. One specific issue that will affect sustainability is the use of urban space. Five questions come to the fore here: the importance of meeting the land and housing needs of the poor; the extent to which “rural” land is being converted to urban use; the location of urban growth by ecosystem; the relative importance of urban sprawl; and the significance of transportation modes for sustainability.

The largest social category in the towns and cities of developing countries is often overlooked in the planning of urban space. Slums make up 41% of urban populations in developing countries, 72% of those in Sub-Saharan Africa, and 57% in Southern Asia – two regions that are expected to experience massive growth. Similarly, urban growth – whether from migration or natural increase – in developing countries is



Cape Town, South Africa

made up in large part of poor people. Yet the massive presence of poor people goes largely unseen in urban plans. This neglect is most blatant in the area of housing; the omission not only accentuates human misery but also contributes significantly to environmental degradation while affecting the very ability of a city to be competitive and to attract investments that will create jobs and financial resources.

Unable to settle elsewhere, the poor often occupy ecologically fragile areas and watersheds, thereby endangering the city’s water supply and other ecosystem services. Deforestation to clear spaces for housing results in flooding. The occupation of urban floodplains and wetlands endangers not only the lives and possessions of the poor, but also increases the probability of flood damages to other parts of the city. By the same token, the invasion of steep slopes and the removal of its tree cover increases the probability of landslides that buries residents and spills over into roads, tunnels, streets, and houses at lower levels.

The lack of access to water, sewage or solid waste management systems pollutes rivers, affecting air and water quality, public health, and the living conditions of the entire city. The sprawling haphazard settlements of the countless poor people make it difficult to build roads and streets, to implement effective mass transportation systems, and to install other

infrastructure. Improvisations to accommodate the increasing flow of people, vehicles, and animals not only consume enormous resources but also contribute to energy waste and contamination. Many of these associated difficulties would be relieved if national and local governments took proactive steps to deal with the land and housing needs of the rapidly-growing urban poor.

How important is the overall urban blot for global sustainability? Approximately half of the earth's population occupied, in 2000, an area between 0.4 and 2.8% of the Earth's surface, depending on how it is measured. Any number within this range does not, in itself, represent a critical threat to sustainability, particularly since the population living on this sliver of the planet's surface also accounts for an overwhelming proportion of all GDP. Yet, depending on their future spatial growth patterns, urban localities could expand drastically, both in dimension and in type of areas occupied in coming years.

A recent study (Angel et al, 2005) provides concrete evidence that urban land areas are growing faster than ever, not only because of their increase in absolute numbers of people, but also because of reduced average density. Should these recent patterns persist, the land occupied by cities having 100,000 people or more will increase by a factor of 2.75 between 2000 and 2030. But this is likely to be an understatement: recent trends to decreasing density will tend to increase with globalization. Moreover, the above estimates relate only to the built-up areas of cities having more than 100,000 inhabitants. Both decreasing density and size of urban areas will obviously change more rapidly in those countries and cities that are undergoing more intense growth. For instance, the metropolitan area of Shanghai is expected to grow by 150%, from 410km² to 1100km² in less than a decade (Martin, 2005).

In short, the land areas appropriated by towns and cities can be expected to increase at an ever faster rate. In developing countries, urban sprawl today is much more than just suburban residential development caused by changing values and lifestyles. The dominant form of urban expansion today is peri-urbanization, or the non-contiguous and patchwork form of urban expansion and leapfrog development which springs from land speculation, changing production modalities, and the spread of automobile transportation. Where and how this new land is incorporated into the urban makeup could have a huge impact on the social and environmental well-being of future populations. Virtually no attention has been paid to this

problem in developing countries, where most future growth will occur (Angel et al, 2005).

What types of rural land are being converted to urban use? Recent research shows that agricultural lands and ecologically-fragile areas are likely to have a higher proportion of urban settlements than other systems (McGranahan et al, 2005). As has been well documented, coastal areas are particularly critical for long-term sustainability. Their occupation and development can cause severe environmental damage, which in turn affects the urban quality of life.

How are different types of ecosystems likely to be affected by future urban growth, especially in Africa and Asia? These two regions, despite having the lowest proportions of their total populations living in urban areas, already have the highest urban density in all system types. By itself, this information might bode well for sustainability, indicating that sprawl is less prevalent. Yet, Africa (72%) and Asia (56%) may already have much too high a proportion of their urban populations living in coastal areas (McGranahan et al, 2005).

Will the rapid doubling of urban populations in these two regions occur in the same systems as in the past? Historical linkages and accumulated advantages of cities are evidently appreciated by investors in a liberal market economy. Yet, globalization is already shifting trade and production away from many traditional centers, favoring other localities that can demonstrate market advantage. In itself, this apparent ambiguity might allow some leeway for influencing these processes into more sustainable directions.

Will the structure and form of urban expansion matter? The debate on urban sprawl versus compact cities is a veritable minefield. Nevertheless, space and density cannot be simply ignored when discussing sustainability in those regions which will account for most future urban growth. An urban growth model based on individual housing and automobile transport does not seem feasible, practical or desirable for developing countries. The key question may not be sprawl versus compact but the degree of proactive concern with the sustainability of an urban configuration. Ultimately, an environmental, rather than a formal approach, is needed.

In this context, changing the transportation paradigm by financing public transportation projects and eliminating subsidies to automobile traffic seems essential. Private automobile use is both a cause and a consequence of sprawl in many countries. Less evident but even more important is the

role of transportation in equity. In developing countries, power elites prioritize private automobile transport to the detriment of other forms of transit and public transportation systems (Martin, 2005). For urban sustainability to have a chance in “The Second Half,” priorities will obviously have to be redefined within a more organic vision and better governance that incorporates social, spatial, environmental, and economic concerns.

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Urban Issues, Concerns and Responses to Climate Change in the Cities of the Americas: The view of the IPCC AR4

Monirul Mirza

In 2007, for the first time in human history, more than half of the world’s population lived in urban areas. Over the last few decades, urban populations have increased for a variety of reasons. Relative to rural or less populated areas, large urban centers offer greater employment opportunities, better infrastructure and broader access to services. Additionally, people move to urban centers because of globalization, economic development, and relief and protection from natural hazards and disasters. Rapid urbanization, together with natural hazards and disasters, creates pressures on available resources and facilities in urban centers around the world.

The last decade was full of extreme weather conditions for many urban centers in both developing and developed countries of the Americas. Most memorable was 2005’s Hurricane Katrina; New Orleans and other parts of the Gulf coast continue to recover from the storm and its aftermath. Hurricane Mitch in 1998 caused devastating economic and human losses to Honduras, Nicaragua, the Caribbean Sea, etc. The ice storm of 1998 inflicted C\$5 billion losses to Quebec and Ontario and left millions without power for weeks. From 2004 to 2006, droughts in Argentina and Brazil caused huge economic losses. In 2005, Hurricane Emily resulted in an economic loss of about US \$1 billion in Mexico.

Cities in the Americas: Climate Change and Urban Issues in the IPCC AR4

As population growth and development continue, urban areas will become the focal point of global climate change. The Intergovernmental Panel on Climate Change (IPCC) has recently released three working group reports as part of its fourth Assessment Report (AR4). This article discusses the findings of the reports from the following perspectives: vulnerability; impacts; adaptation responses; policy and divide between developed and developing countries.

Causes of Vulnerability

American Cities are Vulnerable to many Hazards:

Sea level rise: In North America, many urban centers located on large river deltas are below sea level; the cities of New Orleans on the Mississippi River and Richmond and Delta on the Fraser River are all below sea level. In Latin America, the cities of Buenos Aires, Rio de Janeiro and Recife are particularly vulnerable to sea level rise.

Land cover change, urban heat island effects: According to the AR4, urbanization appears to have negligible effects on continental and hemispheric average temperatures (WGI Ch 3), though we know it affects temperature and moisture storage of surface and near-surface air (WGI Ch7) and creates localized



Sector	Adaptation Options/Strategies	Policy
Water Supply/ Water Hazards	Improved water storage and conservation techniques; incentives for water conservation; water reuse; water recycling; desalination; increased water use efficiency; public education; flood risk mapping; public participation in flood adaptation and mitigation programs; greater investment in water supply systems; controlled use of urban and rural groundwater	Urban water policies and regionally integrated water resources management; water-related hazards management; integration of climate change into public policy; control of groundwater abstraction
Infrastructure/ Settlement (including cities in coastal zones)	Flushing of drainage systems and replacement of trunk sewer systems; encouraging infiltration and increased depression and street detention storage; redesigning structures; relocation; seawalls and storm surge barriers; dune reinforcement; land acquisition and creation of marshlands/wetlands as buffer zone against sea level rise and flooding; protection of existing natural barriers; introduction of programs like FireWise and FireSmart; maintaining defensible space around buildings and neighborhoods	Design standards and codes; regulations; integration of climate change considerations into design; land use policies; insurance; financial incentives; public education regarding risk of living in hazard-prone areas
Human Health	Heat-related public health action plans; access to public cooling centers; emergency medical services; improved climate-sensitive disease surveillance and control; access to safe water and improved sanitation; greater intergovernmental coordination and cross-boundary actions	Public health policies that recognize climate risk; strengthened health services; intergovernmental, regional and international cooperation; greater investment in health services
Tourism	Diversification of tourist attractions; investment in ski-lifts to higher altitudes; investment in artificial snow-making equipment	Integrated planning (e.g. carrying capacity; linkages with other sectors); financial incentives (e.g., subsidies and tax credits)
Urban Transport	Environmentally friendly transportation system; energy efficient cars; car pooling; efficient public transportation system; new design standards and planning for urban, roads, rail, etc. to cope with warming and drainage	Integrating climate change considerations into urban transport policy; investment in research and development; incentives for energy efficient car industry
Energy	Strengthening of overhead transmission and distribution lines; underground cabling for utilities; increasing energy efficiency; emphasizing renewable sources	Sustainable urban energy policies, regulations, and fiscal and financial incentives to encourage use of renewable energy; incorporation of climate change in design standards and codes



Chicago, IL

urban heat islands (Arnfield, 2003). A limitation of the general circulation models used to inform the AR4 is that small land cover changes that occur in urban areas are not simulated. Because many urban areas have experienced extreme weather events in recent years, the IPCC recommends more modeling work to estimate the change in risk for specific high-impact events, such as the occurrence of a series of very warm nights in an urban area such as Paris.

Weather related diseases: Human diseases are affected by changes in weather. Cardiovascular and respiratory illnesses worsen due to heat waves or heavy air pollution. Hot temperatures are associated with increased hospital admissions for cardiovascular disease in many cities (at least 12) in North America. In Buenos Aires, roughly 10% of summer deaths may be associated with thermal stress caused by the heat island effect. The incidence of airborne infectious diseases varies seasonally and annually, due partly to climate variations. The strain of West Nile Virus that reached North America in 1999 requires warmer temperatures than other strains. Lyme disease incidence in North America is associated with temperature and precipitation. El Niño increases risk of malarial epidemic. Outbreak of diseases such as: dengue/dengue hemorrhagic fever, Hantavirus pulmonary syndrome, visceral leishmaniasis, leptospirosis and Carrion's disease have

been found to be related with climate and weather extremes in Latin America.

Infrastructure: North American cities are not climate-proof, as evidenced by the devastating effects of Hurricanes Ivan in 2004 and Katrina, Rita, and Wilma in 2005. The vulnerabilities of North American infrastructure and urban systems revealed by these storms illustrate that the infrastructure was either not designed or not maintained to adequate safety margins. The disproportionate impacts of Hurricane Katrina on the poor, infirm, elderly, and other dependent populations were amplified by inadequate public sector development and/or execution of evacuation and emergency services plans. In the past, hurricanes and flooding in Latin America left a trail of devastation of ruined infrastructure. In the future, vulnerability of infrastructure will depend on rate of warming, extreme weather events, replacement and retro-fitting of aging infrastructure and new design standards which take into account climate change.

Energy infrastructure: Energy infrastructure (especially transmission and distribution infrastructure) is vulnerable to extreme weather events such as wind, snow and ice storms, hurricanes and heat waves. Climate change is likely to lead to substantial increases in electricity demand for summer cooling in most North America. Meanwhile, low flows in the Columbia River could deteriorate energy supply to Vancouver, while in New York, supplying summer electricity demand could increase air pollution and associated health hazards. In 2001, a combination of increased energy demand and drought caused a virtual breakdown of hydroelectricity generation in most of Brazil which resulted a 2.1% GDP reduction.

Demographic pressure: About 75-80% of the population of the Americas lives in urban areas, and this number is on the rise especially due to migration. In North America, increases in urban population are creating pressure on urban services (hospitals, water supply, etc.). In Latin America, migration exceeds absorption capacity, resulting in widespread unemployment, overcrowding, and the spread of infectious diseases due to lack of adequate infrastructure and urban planning. There is a significant problem of urban poverty in areas where malnutrition, poor water quality and lack of sewage/sanitary services and education prevail.

Water supply and sanitation: Water supply is a major urban issue especially during the hot summer months. Many cities across North America (Las Vegas, California, Toronto, and others) impose summertime restrictions on water uses. Large cities' water supplies are usually dependent on sources that are hundreds of

kilometers away, making them vulnerable to extreme weather events. In the developing countries of the Americas, sanitation is particularly a problem, increasing vulnerability to climate and health related hazards.

Poverty and inequality: Financial status is a sort of 'measuring stick' of an individual's ability to adapt to and cope with hazards. A large section of populations in urban areas is below poverty line in both developed and developing countries of the Americas. During a hazard, these people are particularly vulnerable and absorb most of the effects, as was seen in New Orleans following Hurricane Katrina.

Urban flooding, drainage and landslides: Urban flooding has become a common phenomenon in recent times especially

in many cities in the Americas. The most common causes of flooding are: increased occurrences of heavy precipitation (WGI), inadequate drainage facilities, reduction of capacity for holding runoff, and haphazard planning and development.

Urban planning, design and development: In many cases, urban planning, design and development are not sustainable. Ill planning and insufficient capacity of infrastructure have created congestion which increases vulnerability to hazards.

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How Cities in Low- and Middle-Income Nations have Begun to Respond to the Challenges of Climate Change

Patricia Romero Lankao

Few studies examine how local authorities in cities from Latin America and other middle- and low-income nations address mitigation of and adaptation to climate change. Given that the institutional settings and governance structures of these cities are different from those prevailing in wealthy cities, this is a significant omission.

To develop a realistic expectation of future urban mitigation and adaptation responses to climate change, it is important to know how cities have historically responded in the context of the obstacles and opportunities these cities face. This article discusses mitigation and adaptation strategies of Latin American cities and cities from middle- and low-income countries.

A Rationalistic Approach to Climate Change Mitigation

In Mexico, Argentina, Chile, Peru, Ecuador, Colombia, and some Caribbean nations, interest in climate change emerged at the end of the 1990. This interest was driven mostly by academics from the natural sciences, whose research focuses little or not at all on the societal dimensions of mitigation and adaptation. As part of their mitigation strategies, twenty-six cities and municipalities in Latin America were (in 2006) members of the International

Council for Local Environmental Initiatives (ICLEI) and 18 are members of the Cities for Climate Protection (CCP) campaign. Notwithstanding its accomplishments, ICLEI tends to work under the assumption that increased knowledge and "objective, and balanced assessments" will lead to political change. In these countries, very little of the public discussion and policies on climate change addresses adaptation due to the vulnerability of urban areas.

Mitigation of Climate Change as a Social Problem

As in cities from high income countries, epistemic communities (academic groups), policy networks (e.g. ICLEI) and individuals have been key in launching a carbon and climate agenda at the urban level during recent years. In Mexico City for instance, the group led by Mario Molina, Claudia Scheinbaum, and ICLEI played a key role in shaping the city's carbon and climate agenda and facilitating a learning process.

A process of social learning regarding climate change has taken place in many Latin American cities. In comparison to cities in high-income nations, these urban centers are not big carbon emitters. Nevertheless, local authorities have targeted air quality as the main local concern and related it to climate

change. By reframing carbon emissions as the main area of local concern and revising their institutional structures accordingly, authorities made carbon emissions socially relevant by relating them to an existing local agenda.

Effects of Constraints on Policy Making

Management of policy issues includes not only identifying an environmental problem; it also includes reviewing various courses of action and their effects, ultimately choosing a specific course of action and pursuing it actively. Policy makers go beyond declarations of goodwill by specifying measures such as resource allocation to achieve the specified course of action.

Policy making on climate change is strongly constrained by the institutional capacity of regional environmental authorities who lack human resources, money, and influence over the key secretaries, ministries and offices that need to act for both mitigation and adaptation. In Latin American cities, policy making has historically been constrained by an institutional structure which lacks a culture of cooperation and a broadly-shared metropolitan vision. In Mexico City for example, the political decentralization which took place in the 1990's led to a lack of coordination and cooperation among the diverse commissions and programs created to deal at the city level with such relevant issues as urban planning, transportation and the environment. Further, the disparity in fiscal capacity at the federal, state and city levels led to a paradox: more responsibilities were delegated to local authorities, but they lacked the financial resources to implement effective policies.

Political decentralization in Mexico City led to the near disappearance of public services such as the Ruta-100 Buses, as the state moved away from an interventionist role. This contributed to three carbon-relevant processes: a) a growth in car ownership and use, from 91 passenger cars per 1000 persons in 1986 to 178 passenger cars per 1000 persons in 2000; b) a vacuum in the provision of high-capacity modes of transportation, as local authorities have not been successful in attracting private enterprises, nor in reorganizing an integrated system of public buses; c) a shift from Metro and buses to minibuses and other low capacity modes; and d) a paradox: private cars, which contribute 16.1% of the 29.5 vehicle trip segments daily made in the Mexico City Metropolitan Area, release 40.8% of CO₂ equivalent emissions, while public transport undertaking 83.8 percent of those trip segments emits 25.9%.

Adaptation to Climate Change

According to the background paper for the Rockefeller Foundation, hundreds of millions of urban dwellers in low- and middle-income nations are at risk from the direct and indirect impacts of climate change. Most of this risk is associated with development failures, especially the incapacity of local governments to provide for infrastructure and for disaster-risk reduction and disaster-preparedness. It also relates to government's refusal to do take action in 'illegal settlements.' Much of the urban population and most urban governments have a very low adaptive capacity to all environmental hazards, including low adaptive capacity for climate variability and climate change. While wealthier, better governed cities generally adapt easily, large sections of the urban population in low- and middle-income nations are vulnerable to any increase in the frequency or intensity of storms, increased incidence of disease, reductions in water supplies, or increases in food prices.

There are innovative policies and practices underway in Asia (India, Bangladesh), Africa (South Africa) and Latin America (as already mentioned) that demonstrate that adaptation can be achieved if linked to developmental concerns. The city of Durban in South Africa has a program which considers future climate impacts in three phases: a) developing an understanding of global and regional climate change science and the implications of climate change for Durban; b) developing a 'Headline Climate Change Adaptation Strategy' for the city to highlight how key sectors within the municipality should begin responding to unavoidable climate change; c) incorporating climate change into long-term city planning.

In Colombia, the city of Manizales has faced during the last decades high rates of population growth accompanied by social and environmental degradation. Lacking the resources to buy into the official land market, the poor increasingly settled spontaneously or bought land from illegal developers in many areas at risk from floods and landslides. Local authorities, universities, NGOs and communities worked together to develop programs aimed not only at reducing risks, but also at improving the living standards of people and at protecting and regenerating fragile ecological areas. Households were moved off the most dangerous sites and relocated nearby. Most of the evacuated sites were converted into eco-parks with strong environmental education components. This was part of a broader program to improve environmental quality and make resource use more

sustainable in ways that engaged and worked with citizens and community organizations.

In Ilo, Peru, seven consecutive terms of democratic mayors engaged in the process of creating community management committees to collectively improve living conditions and environmental quality through confrontations and negotiations with the state and the Southern Peru Copper Corporation. These actions improved the living conditions of the population in such areas as water, sanitation, electricity, waste collection, public space, reduced air pollution and extensive tree planting and street paving programs. Ilo's population increased fivefold during 1960-2000. Still, no land invasion or occupation of risk-prone areas by poor groups looking for housing has taken place, because local authorities implemented programs (e.g. acquisition of an urban expansion area) to accommodate Ilo's growth and to support the poor in their efforts to acquire decent housing conditions.

Still, these examples are the exception, not the rule. Additionally, a shift from disaster-response to disaster-preparedness and risk reduction that has great implications for urban resilience to climate change but as yet, this has not influenced many city and national policies. There are nations where the competence, capacity and accountability of city and municipal governments have increased considerably, providing the needed adaptive capacity—though most are in middle-income nations. Even in these nations, it is difficult to get the attention of city and state governments to modify their urban policies and investments. Most have issues more pressing than adaptation to climate change, including large backlogs in provision for infrastructure and services and much of their population living in poor quality housing. Mitigation and adaptation strategies must continue to evolve in Latin America and other low- and middle-income nations. Understanding the history and context of these strategies can serve to inform the future.



Guanajuato, Mexico

All Climate Change is Local

George Martin

While climate change is a global phenomenon and the leading actors dealing with it are national governments and international non-governmental organizations (NGOs), its various impacts are localized. There is an analogy to politics. As Tip O'Neill, former Speaker of the US House of Representatives once quipped: "All politics are local." The Speaker's point was that even in statewide and national elections, outcomes are often determined by local issues and local candidates. With regard to climate change, as the authors of the UGEC Science Plan noted, "individual communities must find ways to maintain some control over their destinies to avoid becoming environmental sacrifice zones." Moreover, general progress in dealing with climate change will depend on the efficacy of local efforts.

The responses to climate change have been couched in an adaptation/mitigation dichotomy, in which adaptation is local (and regional) and aimed at preparing cities for potential climate change impacts such as rising sea level, and mitigation is national (and global) and aimed at limiting greenhouse gas emissions. This dichotomy may inhibit a robust response to climate change. It would seem shortsighted to discourage cities from addressing mitigation until adaptation catches up. One way to move adaptation to center stage may be to take advantage of the traction achieved by mitigation, as well as that previously gained by other environmental programs. Congestion pricing may be an example. While its *raison d'être* is to reduce inner-city road congestion, it also serves to limit emissions.

Perhaps congestion pricing can be part of building a broader local response to climate change, one that addresses adaptation as well. A more inclusive response would make it possible to assure that adaptation strategies (such as securing fresh water supplies) are carbon neutral.

Both mitigation and adaptation call for special support to poorer persons and cities can provide some of it. For example, in its congestion pricing scheme, London has invested its new revenues into improving bus service. The creation of a broad public climate change authority at the local level is one way to ensure that all subgroups (interest groups) can have their social justice claims aired.

Institutional Platforms. There are two general paths by which local and regional officials can create such an authority: Graft the task on to existing regulatory bodies or create dedicated

new bodies. Incremental accretion of the mission by existing bodies is fraught with the classical problems posed by coordinating bureaucracies and resolving turf issues. Alternatively, a piecemeal approach, perhaps through growing a congestion pricing agency, runs the risk of falling short of achieving the overall tasks. Thus, the challenge seems to call for a climate change dedicated body, perhaps on the model of a task force. Such a regime should have the public authority and resources to address climate change across the range of local-regional administration, and across the adaptation/mitigation boundary. Indeed, a principal advantage of a task force approach would be to treat adaptation/mitigation as a continuous (even simultaneous), rather than dichotomous, scale of climate change strategies.

Local areas have particular political institutional arrangements just as they have particular climate change profiles. For example, for New York City the salient political institutional context includes:

- A natural, economic, and demographic region that is divided politically among three states
- The existence of a potent regional organization: the Port Authority of New York and New Jersey (PANYNJ)



New York, NY

The PANYNJ exemplifies the kind of metropolitan quasi-public institution that can effectively cross local political boundaries. Such organizations exist in many metropolitan areas. Perhaps the best-known in environmental matters is the South Coast Air Quality Management District (SCAQMD), governing Los Angeles, Orange, Riverside, and San Bernardino Counties, which has repeatedly demonstrated its authority to deal with air pollution.

New York City as an Illustration

The first task of a local institutional response might be the scoping of potential risks arising from climate change. There is a list of general threats which have been identified and these have to be parsed for local areas. For example, prospective issues for New York City and its environs include:

- Threats to housing and public infrastructure which lie in flood plains
- Migration from low-lying areas
- Threats to water supply
- Impact on public health through changes in ambient air quality and temperature, including climate-released diseases such as the West Nile virus
- Intensified (in frequency and magnitude) hurricanes

New York City has just begun to address these problems in a systematic way with the publication of its PlaNYC (2007). It illustrates an effort to mainstream adaptation, which has been generally identified as a critical task facing local authorities.

Mainstreaming climate change adaptation into all relevant areas of public policy is a priority. It is a long-term process including awareness-raising, integration into sectoral planning and implementation of specific adaptation options (OECD 2007).

In addition to responding to the local issues posed by climate change, cities can be key units in the effort to limit aggregate emissions. In this respect, a task that is local in nature is to pinpoint the sectors with the most emissions impacts. In New York City the building stock is the single most important source, with vehicles a distant second. Thus, it is likely that the most important steps would be to enhance the efficiency of energy use in old build and to ensure it for new build, as well as to transition to low-emission energy sources in new build. An adaptation measure that might be integrated into such a program is ensuring that the sites and the structures of new build are “climate change

certified.” This would require regulations and monitoring of the profile of all build. A likely place to begin would be with government itself. In New York City, the public sector accounts for 6–7 percent of all emissions. Retro-fitting municipal buildings is a likely first step to take. It is already well underway with municipal vehicles. Globally, 80% of greenhouse gas emissions originate in cities, half of them from building stock, and one-fifth from transport (see Bigio 2007).

Local government can provide incentives to private sector enterprises through tax abatements and green certifications, and can motivate utilities to support household “climate change audits.” For example, material incentives for retail energy efficiency can be offered to consumers. A first step is to provide improved metering and monitoring schemes, as well as enhanced feedback to consumers. Re-zonings and brownfield development are other levers that local government can use. For example, a combination of the two can retard the development of within-city urban sprawl of single-family homes and auto-centered transport systems, which could address mitigation (i.e. emissions) and adaptation (i.e. freshwater use) tasks.

A related development in New York City in which local government has come to play a leading role is the upsurge in urban agriculture (UA), exemplified by a proliferation of community gardens created on abandoned lots owned by the City. There is the possibility of growing the emergent synergy among community gardens, school gardens, urban markets, organic produce, small producers, and local food. These could also play a role in brownfield development. As well as contributing to mitigation, UA is a potential vehicle for the development of adaptive-oriented community education and mobilization programs. Additionally, there is new momentum for the development of urban and peri-urban forestry (UPF) that focuses on the main elements of urban green structures: forests and greenbelts (see Konijnendijk et al. 2004).

Two important objectives can be furthered through UA/UPF: CO₂ sequestration (mitigation) and watershed protection (adaptation). UPF has a longer-term potential of providing local wood for construction and biomass for energy, both of which would be meaningful climate change assets. The UN Food and Agriculture Organization is involved in UPF development, and could be a substantial resource. Finally, urban agriculture and forestry are consistent with urban ecosystem or metabolism frameworks. Additionally, wetlands restoration and preservation can play a major role in adaptation to flooding threats.

Cities Working Together

To meet the tasks posed for them by climate change, cities will need mutual aid and action. The local efforts of cities can be bolstered by a regional/global alliance working towards mitigation and adaptation cooperation--as the United Nations Framework Convention on Climate Change has on the national level.

For this purpose, the creation of something like an urban "climate change coalition" seems appropriate. It could serve several purposes:

- A lobby to raise public awareness
- A data bank to share climate change indices, findings, etc.
- A skills bank to share researchers, organizers, managers, etc.

Perhaps the C40 group (www.c40cities.org/climatechange) can be a template. Begun with a meeting in London in 2005, followed up in 2007 in New York, it plans to meet in Seoul in 2009. Such a global alliance could have regional subgroups: There were 18 cities in the Americas represented at the meeting in New York. The pairing of the C40 group with the Clinton Foundation to create an initiative for improving energy efficiency of building stocks in 16 cities is an example of the way in which a city climate change coalition can work to limit emissions. This initiative is beginning with an energy audit of older municipal buildings.

At this point there is a need for "assessment" and "scoping" (from PlaNYC): the collection of baseline data leading to a climate change profile. A specific research effort might be to assess the present and potential contributions of UA/UPF to both carbon sequestration and wetlands sustainability. Such a project might do Life Cycle Assessments of the energy and material flows involved in all the components of UA/UPF--their supply chains, production, use, and waste retrieval phases.

In addition it might be useful to define the key determinants of potential community-based social change initiatives regarding climate change (leadership, sponsorship, education, resources, etc.), and to develop strategies for engaging individuals/households in adopting "climate change-conscious lifestyles." The task here is to translate "communities of place" into "communities of interest," with the use of both material and solidary incentives (both carrots and sticks). Community case studies are a potentially useful methodology: These involve working with community stakeholders on climate change schemes through on-going workshops and focus groups. The case studies also can serve as consciousness-



New York, NY

raising programs in communities. Such programs can be productive in adaptation efforts, as noted by a 2007 study of 6 cities. Several of the adaptation processes we studied included a strong communications and outreach strategy as part of the effort to build awareness of climate impacts and support for adaptation within government and among the public (Clean Air Partnership 2007).

Behavior change is already a well-developed strategy in limiting emissions; for example, the UK uses a model of Enable/Encourage/Engage/Exemplify, coupled with the application of "social marketing" (see <http://nsms.org.uk/public>). A potential ally in climate change risk assessment is the insurance industry: larger firms (e.g., AIG, Swiss Re) already offer an array of insurance products tied to climate change (see "A Flood of Claims," 2007).

Local research efforts can be supported through an institutionalized cooperative framework, perhaps along the lines of the Annex I Expert Group (AIXG), composed of experts from developed countries striving to meet Kyoto Protocol targets. This group met in Paris in March, 2007, with the theme, "Working Together to Respond to Climate Change" (www.oecd.org/document/31/0,3443,en2649_34359_1_1_1_0.html).

To conclude, we need to move away from demand-based and to management-based research and planning (see Robinson et al. 2006). Data indicate public opinion favors doing something collectively with regard to climate change.

The current situation is analogous to the “Schelling principle” evolved from his analysis of the introduction of mandatory helmets for professional hockey players. While most players chose not to wear helmets, in secret ballots they favored a rule requiring them to be worn. The players wanted the protection but were fearful of jeopardizing their play (not wearing a helmet conferred a slight advantage in peripheral vision and in a fearless image). Without a rule, individually rational decisions led to a collectively irrational result (injuries). As James Surowiecki noted in *The New Yorker* (July 23, 2007) in an application of Schelling to fuel efficiency standards, “Sometimes, we need to save ourselves from ourselves.”

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The Responses of Urban Areas to Climate Change: Perspectives on Energy Efficiency in Megacities of Latin America

Ricardo Jordan F.

The year 2007 marks the beginning of an era in which, for the first time in history, more people will be living in cities than in rural areas. The world’s urban population, which has quadrupled since 1950, was predicted to reach an estimated 3.17 billion in 2005 out of a total population of 6.45 billion. The figures for urban dwellers are predicted to rise to 5 billion by 2030. Cities in the developing world will absorb 95% of urban growth in the next two decades, and by 2030, will be home to almost four billion people, or 80% of the world’s urban population. As approximately 60% of urban growth is due to an excess of urban fertility over urban mortality, the population of the world’s megacities is rising dramatically – and will continue to do so in the future. Some cities will reach inconceivable dimensions. Megacities – massive conurbations of more than

20 million people – are now gaining ground in Asia, Africa and Latin America.

As human activities shift to cities, the future of the world community depends more and more on urban sustainability. The scale, the speed of change, the growing mobilization of people, information, goods and capital, and the global connectedness of megacities all combine to create new physical, economic and social dynamics, a new complexity, and new dimensions of risk. This places cities at the centre of the challenges for global sustainable development.

Megacities are more than a concentration of people. They absorb worldwide resources, generate vast amounts of waste and sewage, and contribute considerably to the use of the environment as a sink. The quantity of resources consumed and urban residue

produced per capita tends to rise steadily with increased per capita income. Resource demands, measured in terms of the ecological footprint, show that cities take up less than 2% of the earth's surface, but use 75% of its resources. The growth and spread of cities has impacts on complex natural ecosystems and resource regimes on a global scale.

Notwithstanding their hunger for resources, megacities are in a position to contribute significantly to a more sustainable use, taking advantage of economies of scale. High density means low per capita costs for the provision of piped water, the collection and disposal of garbage or waste water treatment. The services provided could be both cost effective and environmentally sound. The concentration of production and consumption offers huge potential for the provision of public transport systems and the recycling of wastewater or solid waste.

However, while the scale, the velocity of change, the global connectedness and complexity of mega-urbanization pose fresh challenges for research, megacities are rarely explicitly, let alone systematically, taken up as a distinct category or focus of empirical research. These challenges require priorities that move research in three innovative directions:

1. Research should allow for the complexity of megacities, involving a comprehensive rather than a sectoral approach. This research approach adopts an integrative perspective on the megacity, attunes analysis to the mutual interdependence of processes, and provides a basis for modelling and scenario techniques.
2. Research must embrace a problem perspective, linking the generation of orientation knowledge with action-oriented knowledge and the implementation of solutions. This implicates context-specific investigation with the aim of moving governance in megacities "from response to action".
3. This kind of research needs to be transferred into both academic and professional education, and to local stakeholders.

Climate Change and Energy Efficiency of Buildings in Latin American Country (LAC) Cities

As one of the urban trends identified by the World Bank, cities are expected to play an important role in upcoming climate change programs. In some countries the majority of upcoming greenhouse gas emission reductions are expected to come from cities.

Similarly, the bulk of climate change impacts, such as increased storm severity, rising sea levels, and water scarcity, are expected to have disproportionately severe impacts on cities. Responding to the pending impacts of climate change, and recognizing the need for leadership, in June 2005, over 40 cities signed 'urban environmental accords' to reduce each city's total greenhouse gas (GHG) emissions by 25% by 2030. Environmental accords of this nature will likely increase, and cities will play an increasingly important role in their implementation. City indicators that could contribute to these accords are therefore important. City indicators will also need to track progress on national and international objectives.

While the buildings sector is receiving important attention in the development of overall energy efficiency policies, there is significant potential for cost-effective energy efficiency improvements to warrant the building sector receiving an even higher policy priority. There is a good mix of measures between regulations & standards, information, training and financial incentives. The legislative framework in LAC is almost inexistent while some experience is present in Brazil and Mexico. The LAC states are starting from a difficult position, with fewer human and financial resources than other world states. They also are burdened with the legacy of a large stock of poorly built housing and poor grid-based energy supply. On a positive note though,



Rio de Janeiro, Brazil

there are important networks of experts – both within and outside government – that have evolved over the past decade or more. These are important in transferring know-how and exchanging experiences.

A Path to Action

There is a need for strong monitoring of the implementation period of norms in energy performance of buildings. Energy certification of buildings has to be seen, not as an end in itself but as a means to an end. Certification needs to be implemented in parallel with effective information campaigns to explain to the wider public (particularly those buying or looking) and should be promoted through real estate agencies and possibly the insurance industry. Governments need to find appropriate incentives (not only financial) in order to encourage building owners and users to implement the recommendations provided in the building energy certificates. Government-private sector partnerships in promoting energy efficiency in buildings should be promoted and expanded. Better end-use analysis needs to be undertaken in order to know what progress is being made on improving the energy efficiency of buildings. An energy certification programme should be designed to help construct and maintain end-use databases to help in the policy analysis. There is a need for a long-term commitment from LAC states to promote energy efficiency in buildings. Governments need to set an example in their own buildings by making sure that they not only meet the minimum requirements under the various buildings-related directives but also implement best-practice measures and set targets that are both achievable and ambitious for their own building stock. States need to be closely monitored and supported to ensure that timetables are met and that they have the necessary capacity – human and financial – in order to meet the challenging obligations. A network of experts (government and non-government) from the LAC states should meet at regular intervals to discuss implementation issues related, not only to the energy performance of buildings, but to the broader approaches to energy efficiency in buildings.

Major Barriers

Obstacles to Economic Pricing of Energy

Since the 1980s, there have been virtually no regulations on pricing. The market is the determining factor, except in areas where there are monopolies. But, with liberalization of both

the electricity and gas markets in Europe, the market is even more central in determining price. This, however, is causing some problems because prices in some countries are falling dramatically. Cogeneration, renewable energy and energy efficiency are all particularly vulnerable and there is the need for some countervailing policies, if they are to remain policy priorities.

Externalities Such as Environment, Energy Security, Social Policy and Employment

There is still a major issue concerning how to internalize the costs of externalities such as environmental damage. LAC states should impose environmental taxes to finance measures to protect the environment (such as investments in energy efficiency) as well as to introduce price signals that will influence consumers. Several of these taxes are directed towards reducing carbon dioxide and other GHG emissions. With the high dependence on imports, energy security remains an important policy objective. Energy efficiency has been identified as one of the major policy options to reduce risk. As a secondary benefit, energy efficiency programmes create employment and the LAC states should fund a study showing the employment effects of the various policy measures. Energy efficiency is generally more labor intensive than many other energy policy options. In LAC are interested in implementing new energy efficiency measures if they increase employment. Such jobs are frequently local, semi-skilled and cost-effective.

Lack of Information and Technical Skills

Each end-use sector has its own requirements for information and skills, both technical and general. Consumers need good information and so do the energy service sector, architects, distributors, decision-makers. Studies noted particular problems for small and medium sized companies in obtaining standardised information. There were problems also in the residential sector because of the great diversity of building types, heating and lighting systems and so on. Sources of information include distributors, utilities and governments via newspapers, internet, and points of sale. Sometimes information can be conflicting and confuse consumers. The credibility and reliability of information is essential, but difficult to guarantee. Therefore, labelling programmes for appliances need to rely on rigorous measurements in order to ensure accuracy.

There have been major efforts to improve the quality

of information and the information flow. According to most analysts, there is still a great need for more information on cost-effective opportunities such as: how improved energy efficiency can contribute to reducing greenhouse gas emissions, the impact of new emerging technologies and innovative financing approaches (such as third-party financing). Many countries have improved their training schemes and introduced energy management into higher education.

Invisibility of Energy Consumption and Conservation

One of the problems with energy efficiency is that it is often hard to appreciate its effects. Adding insulation to a building does not immediately translate into reduced heating bills if energy prices are rising or if residents change their behavior (for example, increase the thermostat setting). Also, often the energy bill is received weeks or months after consumption and the feedback is too distant to motivate consumers. This is improving somewhat by direct debit mechanisms, but feedback is still often poor. There has been some progress but the problem generally persists. The increased usage of energy management systems improves feedback but they are only starting to increase market penetration in the residential sector. Labeling programmes are helpful in informing purchasers of the expected consumption.

Confidence

There has traditionally been skepticism about predictions on the benefits of new technology. Some skeptics are concerned that new technologies would lack performance and reliability. In some cases, early equipment was substandard and bad reports traveled from consumer to consumer quickly. Consumers are understandably wary of any new products, not just energy-using equipment. They often look for guarantees or assurance that the products they buy will achieve the promised results. Demonstration projects, grant programmes and a variety of other measures have been used to gain experience to show that the equipment lives up to its promises. Despite significant progress, the confidence problem is an on-going concern when any new technology comes to the marketplace. Solutions depend on the maturity of the market. Governments can support industry, or industry can do it alone. Often, the public looks for independent advice, and this may mean government needs to develop measures accordingly. The best approach is often government working in partnership with industry or utilities to gain the trust of consumers. Involvement of consumers' groups should also not

be overlooked.

Separation of Expenditure and Benefit

Frequently the person who uses energy is not the one who pays directly for the energy uses, or in other cases, such as tenants, the consumer pays for his energy but does not own the equipment to invest in better efficiency. Many governments have tried to address the problem of separation between the user and the energy-use decision-maker. There are now rental agreements where the consumer directly pays for energy consumption.

Access to Capital

Availability of capital is a major constraint. First, financial institutions have less experience with energy efficient equipment and are not willing to provide financing. Second, innovative ways of financing have not been introduced, such as third-party financing and energy service companies. There are some problems with financing because many energy efficiency investments are relatively small and financial institutions are reluctant to provide funding, due to high transaction costs relative to the total cost of the investments.

There is still a problem for certain segments of society (aged, poor) and those countries with such problems are trying to address them. In other cases, investment support is provided, not because of a lack of capital, but to improve the financial viability of a project, to make it more appealing to the consumer.

Barriers to Technology Development

There were two major technology concerns in the 1980s. There was industrial fragmentation that meant that no single company was large enough to undertake significant research, development and demonstration. Fragmentation was particularly a problem in the building sector and there was little incentive for innovation. Secondly, the private sector was not willing to undertake the risk associated with long-term research. In both cases, some governments have been active, increasingly through public/private partnerships. Technology development related to energy efficiency is now seldom seen as a discrete activity but integrated into other such development. More and more, an integrated approach is evolving to ensure that energy efficiency concepts are incorporated throughout the entire product cycle.

Institutional Barriers

Too often, existing laws or practices hinder improvements in energy efficiency. Often this is a result of bias in favour of

increased energy supply, rather than improved energy efficiency, particularly by industry. Governments generally take a more “hands off” approach to energy supply. The literature and players involved in energy efficiency indicate a consensus that institutional barriers remain a major concern. For example, several institutional barriers have been identified in the deployment of combined heat and power systems, such as the negative attitude of utilities, problems of access to the grid in the absence of interconnections standards, unfair charges for back-up power, the need for new codes since cogeneration is fairly new, need for more simplified permitting, transparency of transport tariffs, and so on.



Mexico City, Mexico

Urbanization and Global Climate Change: The Case of Bogotá, Colombia

Andrea Lampis

The city, officially named Bogotá, D.C. (D.C. for “Distrito Capital”, which means “Capital District”), is the capital of Colombia, as well as the largest and by far the most populous city in the country with 6,776,009 inhabitants (2005 census). Bogotá and its metropolitan area, which includes municipalities such as Chía, Cota, Soacha, Cajicá and La Calera, had an estimated population of 7,881,156 according to the 2005 census.

The city’s population has grown rapidly to the effect that there exists now increased pressure on the capacity of its urban institutions to respond to climate change. The city’s growth rate is still impressive with an increase from 5,440,401 inhabitants in 1993 to the above mentioned 6,776,009, not counting the limiting municipalities. This is the result of three main driving forces, namely, natural city growth, economic migration and internal displacement.

Socio-Economic Variables: Poverty, Employment and Inequality

Undoubtedly, Bogotá’s transformation over the last decade is astounding: from the astonishing fourfold decrease in the homicide rate and violence, up to public space and transport system development, or a Mayor winning the elections with the slogan “Bogotá without Indifference”, centering most of its action on hunger and social exclusion. For brevity, I present only recent indicators and historical trends on poverty. Low-income and marginal groups are likely those who will bear the harshest impact of GEC in many cities, together with other social groups like the elderly or the ill.

From 2001 income poverty has been officially decreasing in Bogotá. Still, official data is under scrutiny and debate for a recent methodological change in the basket of goods and services used for calculation that was deemed a political operation to artificially reduce poverty by a number of critics. An overview of the city shows that poverty is spatially concentrated. The areas south-west

and south-east of the city, mostly on the outskirt belt concentrate the highest number of income poor, with levels as high as 70%, whereas the central and well-off locality of Chapinero has an incidence that does not reach above 18.8%. In 2001 the greatest incidence of poverty tended to concentrate on the outskirts of the city in those localities that where the poorest ones also in 1985, that is the localities of the south, south-west and west. In 2003 the local administration estimated that the city had at least 3.5 millions of people under the poverty line and 1 million below the extreme poverty line. There still is an important gap, certainly in Colombia, in the understanding of how the dynamics of poverty at the micro-level can determine the exposition of households to the risk of falling into a situation of poverty.

Employment and income are not only traditionally strictly linked variables, but also extremely sensitive to the interrelations existing between the global and local dynamics of the economy, politics and policy. The overall picture of Bogota shows a very marked loss in real purchasing power and sets the context for a better understanding of the magnitude of the impacts of the crisis on the quality of life and human development of all social groups, but particularly of those with low-incomes and those in a situation of vulnerability due to their assets base and limited capacity to successfully face the crisis.

It is known that albeit the pace of the increase in unemployment and under-employment rates are not very different among the different groups, there are still significant differences in terms of magnitude and potential social impacts. There is a positive association between unemployment and poverty over the years, although the non-poor group is the most comparatively affected. If one does not only look at the overall percentage but calculates the real magnitude of the increase, the differences among the three groups become more clear, being that over the whole 1990-2003 period the unemployment rate increased by 66.5%, 73.2% and 75.4%, respectively for the extremely poor, the poor and the non-poor.

As far as the poor and the extremely poor are concerned, between 1990 and 1993, unemployment and under-employment fall for all considered groups. However, from 1994 there is a raise in unemployment and under-employment rates, which becomes sharper from 1996 to 2000, showing only a marginal decrease from 2001 onwards. Time-trends are also consistent with the data presented in the previous section about the poverty line. Both for a vulnerability and livelihoods analysis, it is important to underline that the magnitude of underemployment for the poor

in 1997-8 had already almost doubled the levels of 1990, while in 2003 it had already reached a level well beyond that threshold.

As for under-employment, the most striking data is the tremendous increase starting rightly in 2000, at the same time employment rates began to register a mild decrease, showing that the partial economic recuperation implies, as analysts have pointed out, a society characterized (both at national and at the Bogotá's level) by greater job insecurity, a key insight for what the results of the fieldwork analysis indicate in terms of the importance of the income generation factor within the dynamic of vulnerability for poor groups in the city. More informal and precarious jobs mean less access to legal health provision, less security, a lesser access to pension schemes.

Climate Change Trends

The average temperature on the 'sabana' is 14.0°C (57°F), varying from -8°C (18°F) to 20°C (68°F). Dry and rainy seasons alternate throughout the year. The driest months are December, January, February and March; the rainiest are April, May, September, October and November. June and July are usually rainy periods and August is sunny with high winds. Frost usually occurs in dry season. During this period, the temperature falls below 0°C. The lowest temperature ever recorded was -8°C (17°F) inside the city and -10°C (14°F) in the nearby towns of the sabana. Climatic



Bogotá, Colombia

conditions are irregular and quite variable due to the El Niño and La Niña climatic phenomena, which occur in and around the Pacific basin and are responsible for very pronounced climatic changes. Recent research on climate change in Colombia concentrates on issues also researched at the international level. In particular, the intensification of the extreme meteorological phenomena of 'El Niño' and 'La Niña', which respectively refer to periods of extreme draught and precipitations. Key topics on the local research agenda also are the general study of rainfall trends, glaciers melting and temperature and sea level increase.

Global climate change as an aspect of global environmental change processes, although a global phenomenon, is experienced by different regions with specific intensities and consequences. In spite of local progresses in research on climate change, that for instance estimated the range of temperature increase from the city between 1 and 2 C° per decade over the next century using the IPCC model, to establish mechanisms of adaptation capable to respond to the impact of changes. It is important to establish a better system of modeling regards of the scenarios of climate change for the city as a whole, but even more for specific areas of it.

There are three main research lines about how climate change impacts upon cities and its areas: these are the contribution of the city to the processes that determine climate change, (for instance, the emissions of greenhouse gases), the impact this process has on the socio-economic dynamics, and the counter action that can originate from appropriate public policy.

Data on Bogotá suggest the main impacts will be in terms of temperature increase and rainfall. Corresponding side-effects are a greater increase in dehydration, the insurgence of illnesses previously unknown at the height of Bogotá over sea level, which is 2600 metres; as well as a steep increase in energy consumption for refrigeration.

The increase of extreme weather conditions, such as storms and strong winds are likely to worsen the already impressing tragedy of low-intensity disasters that cause the loss of part or even all assets to a number of households ranging from 3 to 20 every time the rain falls heavily on the city. Policies to prevent this from happening have progressed a lot in terms of methodological understanding and capacity to act, but fall short of funds and institutional capacity and thus often fall back into important but less impacting post-disaster humanitarian assistance.

A research capable of linking data between poverty and assets to the exposure from environmental changing or extreme

conditions is a missing point for the city. Since interdisciplinary research is still moving its first steps on the topic, the potential is great because advancements from disciplinary approaches are worth mentioning. Creating indicators that show effects of climate change on the city or showing that the city has the capacity to research and gather precise data on these issues is important. This key research issue on the agenda must be the desegregation of this data to smaller territorial units, to be able to overlap climate and, more broadly, environmental indicators, with those concerning the use of the soil and prevailing socio-economic and demographic trends.

There are three elements of El Niño and La Niña worth being pointed out. The first one is the extreme variation of temperature and rainfall that reaches very high peaks. The second one is that due to the variety of thermal floors the country presents both extremes under either one of the phenomena. The third element is that in the areas of greatest variation there are cities that will be most likely hit in the future from environmental changes related to climate change but also environmental transformations such as water scarcity due to glaciers melting.

Final Considerations

According to my knowledge and expertise on Bogotá, a realistic expectation of responses (mitigation and adaptation) to climate change in this city during the next five years and during the next decade is complex. There are many elements to consider: First, Colombia does not have a governmental or State policy on the effect on global environmental issues or climate changes. After the great improvements of the mid-nineties, with the creation of the Ministry of Environment and the promulgation of Law 99 of 1993 that took on board many of the insights coming from the Rio de Janeiro UN conference, the country suffered a setback under the presidency of Pastrana and even more Uribe, who actually eliminated the Ministry of Environment merging its function with those of the recently created Ministry of Environment, Housing and Local Development (EHLA). The web site of the government has a "climate" section that links up with institutions researching climate but really does not say much about related policy guidelines. Still the Ministry of EHLA, signed on behalf of the Colombian government a number of bi-lateral agreements, mostly related to the implementation of the Kyoto protocol, such as the one with the Dutch Ministry of Environment that states:

"The objective of this memorandum is to facilitate the development and implementation of greenhouse gas emission

reduction project activities in Colombia and the transfer to the Netherlands of the agreed part of the certified emission reductions resulting from those project activities in accordance with article 12 of the Kyoto Protocol.” This is undoubtedly good news since technical cooperation is needed to transfer know-how and resources to improve and foster local programs.

The second element, is related to a key environmental debate and discussions on development and political science. Colombia is not a big greenhouse gas (GHG) producer. It rather produces 0.001% of the world total emissions, but still is very much affected by the consequences of the emissions, which are being flagged as global, but have a clear western source and

Institutions and Climate Change

This section faces the key question concerning what is being done in Bogotá and, more broadly, in Colombia, to understand and take action to mitigate and adapt to the effects of climate change. We list below the main institutions and agencies in Bogotá involved in researching and devising actions in the face of global climate change at the local level:

DAMA: Departamento Técnico Administrativo del Medio Ambiente (Technical and Administrative Department for Environment)

It administrates the SIAC (Environmental System of the Capital District). This consists of the set of orientations, norms, activities, resources, programs and institutions that regulate the environmental management of the Capital District. The purpose of the system is to coordinate all governmental activities of the local government with the objectives of its environmental policy, including: planning, urban and regional development, public services provision, public works, environmental as well as sanitary control and management, civic education and culture, impact prevention and mitigation. DAMA is also in charge of the formulation of the Environmental Management Plan, the policy framework in Bogotá. It sets city level objectives and goals, defines scenarios for regulation as well as the institutional tools to be applied to each of them. The institution is also in charge of the Environmental Observatory of Bogotá. Its goal is to manage, consolidate, generate and divulgate knowledge about elements and actors that constitute and transform Bogotá's environment.

Cruz Roja Colombiana (Colombian Red Cross)

It participates in the national group of climatic change (along with the Javeriana University, the Colombian Red Cross, the IDEAM, Maloka and the Institute Agustín Codazzi): It tries to develop a process of creating an understanding of the implications of the climatic change in the national, regional and local levels and in addition to create joint spaces between different sectors to implement actions on policies, community development and scientific research. It is involved in the program for National Adaptation based on three axes: adaptation, risk reduction and health. It is involved in local projects for climatic change: to increase understanding and resilience of communities against the effects of the climatic change and in the management of the risk

IDEAM: Instituto de Hidrología, Meteorología y Estudios Ambientales (Institute of Hydrology, Meteorology and Environmental Studies)

Responsible for Integrated National Adaptation Pilot Project (INAP): To support the formulation of programs of adaptation to the effects of climatic change in the ecosystems of high mountain, insular areas of the Caribbean Colombian and in the human health; as well as to incorporate the expected impacts of climate change in the sectorial policies of the country.

DPAE : Dirección de Prevención y Atención de Emergencias de Bogotá (Bogotá's Directorate for Prevention and Attention to Emergencies)

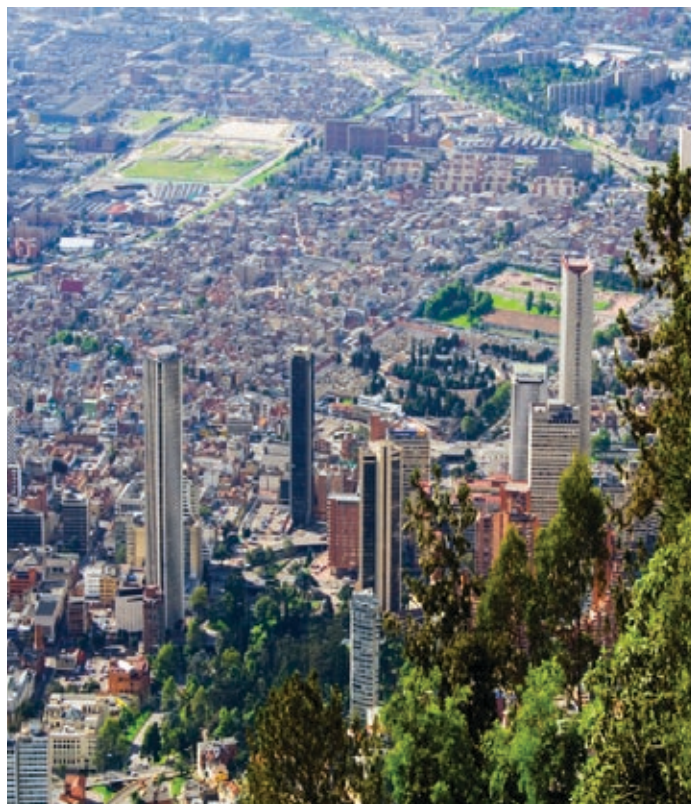
It is the assigned governmental office to the Secretariat of Government of the Greater Mayorship of Bogotá; it defines the policies and integrates the actions of monitoring and prevention of risks. It promotes actions required for the reduction of risks due to natural and human causes and of guaranteeing the effective handling of the emergency situations diminishing the negative effects on the population of Bogotá through its system of prevention and monitoring of emergencies.

industrial roots, as shown by the recent WWF Living Planet report clearly showing where the worst and widest ecological footprints belong. Hence Colombia has – like Brazil for the Amazon basin – other priorities according to many more pressing issues than facing climate change, an key issue considering impact and new courses of action in developing countries. Additionally complex questions about who pays for these changes or why plan long-term interventions when we have to face hunger and death or even just the fact that the country does not have a decent infrastructure to mobilise people around, need to be addressed with a stronger and more obvious argument than the worldwide threat of an incoming planetary disaster.

Furthermore, there are still no real responses beyond academic research in the policy domain on climate change and the environment. Additionally, climate change is considered as vaguely global issue riddled with uncertainties, and at times, even far away in terms of perceived local impacts, especially from the point of view of the economic cost, one of the prime factors that prompt politicians to act.

Unless GEC and UGEC issues become a pressing priority in Colombia due to some really catastrophic effect, it seems likely that no action will be undertaken. Therefore, the path of adapting the legal frameworks to broaden the type of events and social groups protected seems like one of the most promising ways of acting, together with local pilot projects strengthening the resilience of local groups under the threat of relevant risks, to show how much can be done with little resources.

The major obstacle Colombia has to generate those initial responses is the visibility of the problem. Climate change starts to show up in the newspapers but, also for the reasons mentioned above, does not impact the policy agenda as a priority. Furthermore, being a conflict ridden country, Colombia tends to heavily look inwards and has a reduced perception of how it fits into the international web of interlocking effects. This comprehension of course exists, especially among academics, but even if one looks at the proportion of funding studying local issues rather than comparative ones, it reveals how the country shows such little awareness of the importance of regional and global perspectives. Nonetheless, changes are taking place as an effect of GEC and this will, sadly enough, soon provide the catalyst for some action.



Downtown Bogotá

There also exist capacities for institutional (formal and informal) responses within Colombia: UGEC issues, like environmental disasters, should be explored in terms of participative interventions with and within local communities. Participatory interventions are not a panacea, and in many cases the rhetoric attached to them largely overcomes what they can really offer. Still, lots of activities in terms of adaptation and mitigation are low cost and can be done with people of local communities as co-coordinators. Some positions like that of the local Red Cross are also good subjects of discussion because they seem to point to individual actions as a response. While individual behavior can impact solutions it is questionable whether major results can be achieved without considering industrial, technological and natural resource policies.

Total Urban Water Management in São Paulo, Brazil: A Case of Ongoing Experiences on Applied Research and Public Policy

Ricardo Silva Toledo

This article – based on the author's experience of integrated water resources management and urban development in the Metropolitan Region of São Paulo, Brazil -- addresses sustainable water use focusing not only on the effects of global climate change, but also on the impacts of urban expansion.

The term “Total Urban Water Management” (TUWM) has been coined by a few scholars and institutions, mostly in Latin America, to describe a comprehensive approach to water and urban processes. This approach has been explored in the Metropolitan Region of São Paulo by State University of São Paulo professors Benedicto Braga and Monica Porto of the Department of Hydraulics and Sanitary Engineering at the Polytechnic School, in association with this author, of the Center of Urban Information Studies at the School of Architecture and Urban Studies. The following notes on TUWM, except those provided as institutional background, were extracted from an article by these three authors, recently published in *Water Resources Management*. The new prospects of institutional response to climate change associated with urban water management will be discussed under the heading Strategic considerations on water demand management (WDM) in the context of TUWM.

Institutional Background on Water Resources Planning

Water planning and management has been a key issue for economic and social growth worldwide. Stakeholders have always disputed water uses for irrigation, hydropower, urban supply, flood control, navigation, and recreation, despite the existence of any arbitrating authority formally empowered to solve these disputes. Water resources planning has evolved as a specific branch of applied research and public policy since the pioneering experience of Tennessee Valley Authority in the 1930's, when the competing uses of resources were treated collectively in order to maximize the net benefit to stakeholders.

Since the beginning of the 20th Century, Brazil's electricity generation has been predominantly hydro-based, while at the same time extensive irrigation is required for agriculture. Multiple resources planning has since the 1940s been Brazil's preferred approach to establishing the regulatory and operational frameworks of national and regional policies, with a clear hegemony of hydropower logic. This hegemony was growingly

questioned as other uses evolved in the urban economy, namely urban water supply, industrial uses, flood control, and sewage disposal. Socio-environmental organizations made strong pressure to establish an absolute priority for urban uses in the new institutional framework that organized the Brazilian water resources policy since the mid 1990's. Under this new institutional framework, integrated water resources planning and management has evolved, giving raise to broader planning boundaries, not only regarding the water resources themselves, but the whole complex of land and water uses that determine the quantitative and qualitative conditions of water uses. In this prospect, the combination of structural and non structural measures regarding most of the water uses became an all-pervading feature of water resources planning and management, including the land uses connected to them.

Total urban water management came up as a specific approach to densely urbanized basins, under this broader framework of integrated water resources planning, industrial uses, flood control, and sewage disposal. Socio-environmental organizations made strong pressure to establish an absolute priority for urban uses in the new institutional framework that organized the Brazilian water resources policy since the mid 1990's. Under this new institutional framework, integrated water resources planning and management has evolved, giving raise to broader planning boundaries, not only regarding the water resources themselves, but the whole complex of land and water uses that determine the quantitative and qualitative conditions of water uses. In this prospect, the combination of structural and non structural measures regarding most of the water uses became an all-pervading feature of water resources planning and management, including the land uses connected to them.

Total urban water management came up as a specific approach to densely urbanized basins, under this broader framework of integrated water resources planning. The Metropolitan Region of São Paulo, with an area about 8000 square kilometers, houses 19.5 million inhabitants in 39 municipalities. It is practically contained in a single hydrographic unit at the upstreams of Tietê river, whose plan was developed by the University team by commitment of the São Paulo State Water Council. It was the experience of developing that plan, from 1999

to 2002, and a further cooperative process in interdisciplinary research in water resources planning and urban studies that gave raise to the approach here discussed.

Total Urban Water Management in the Metropolitan Region of São Paulo

From an institutional point of view the situation in the MRSP is very complex because the municipality is in charge of the land-use planning, urban housing and transportation, while the state is responsible for water resources management. Fortunately, during the last decade the government was very receptive to advice from the professionals in the sector. As a result, the municipality today passes construction codes that require coping with floods at the lot level. At the same time the state is investing massively in the Tiete project to improve the river's water quality.

The pioneering experience of legislation to protect water sources in the Metropolitan Region of São Paulo, carried out within EMPLASA (Metropolitan Planning Agency) during the 1970s, was an essential step for the integration between the water resources management and urban/metropolitan planning systems. Even if the water resources management system was not formalized then as it is today, the institutional communication and development of instruments intended to protect metropolitan sources was considered a great innovation.

The main institutional constraint faced by the water source protection laws of the 1970's was the total independence of the municipalities about land-use decisions. The independent municipalities showed little interest in cooperation with the rest of the region. However, this normative system brought together for the first time in Brazil a strategy for environmental protection with a strongly anticipatory character and moderate spending of public funds. It also launched the basis for intergovernmental cooperation on regulation of land use. These fundamentals were accepted by the new state legislation, of 1997, to protect sources, in which most of the advocated measures are non-structural in nature, in the sense that they work with preventing pollution, not correcting it. Actions to discipline environmental quality, in the local plans are based on a strategy of interventions in basin areas such as: restricted occupation, oriented occupation and environmental restoration.

Integration between the water resources management systems and metropolitan planning is required, as far as the strict local view on local planning, when applied to urbanized basins, leads to questionable priorities from the standpoint of the



São Paulo, Brazil

whole basin. The management of sectorial systems, based on a predominantly local logic, creates the illusion that since they are different sectors converging on a restricted geographical unit, it promotes integration between sectors. However, this is not true if analyzed in the light of functionality of sectorial systems as a whole (and not in segments).

Emerging Instruments for Total Urban Water Management

The Upper Tiete Basin Plan (FUSP, 2002) was developed according to objectives of an integrated view of management, in which water quality and quantity are dimensions that are understood to be common objects. This results in the need for effective coordination among the different water uses. In practice, this has proved to be a much more difficult task than it seemed to be when the general principles on multiple uses were first proposed. If quality and quantity are seen as functions of a same development and preservation policy, actions in the fields of source protection, sanitary sewerage (inside and outside the protected areas) and urban drainage, can no longer be treated as completely separate sectorial elements.

The integrating view proposed in the general objectives of the Plan challenges the underlying institutional organization of planning and management systems. On the one hand territorial communication involves different municipalities, or jurisdictions, and on the other hand there is the functional process, involving sectors that are based on specific planning, regulation, financing

and operations. Both these integrating dimensions—territorial/jurisdictional and functional/sectorial—are equally important to achieve the proposed objectives. The institutional system for water resources planning and management will, in this sense, face four sets of challenges to integration.

- Integration between systems/activities directly related to water use in the river basin area, in particular water supply, wastewater treatment, flood control, irrigation, industrial use, energy use or other systems with a direct impact on the sources, such as that of solid waste, considering the perspective of a joint management of quality and quantity.
- Territorial/jurisdictional integration with instances of urban planning and management—the municipalities and the metropolitan planning system—considering the implementation of preventive measures for the urbanization process, avoiding excessive demands on the quantities and qualities of existing resources, including flood events.
- Regulating communication with sectorial systems that are not direct users of the water resources, such as housing and urban transport, considering the creation of real alternatives to the process of occupying source protection areas and floodplains, and also making it possible to have urban development patterns that, as a whole, will not worsen the impervious conditions of the urban land and pollution throughout the basin.
- Communication with the neighboring basins, in order to establish stable agreements on the current and future conditions of flows and export of water used in the basin. This type of communication will tend to become decisive and extremely complex in the future, given that all options to increase water offers to the MRSP, involve importing flows from other neighboring basins.

All these are complex challenges and they cannot be fully met within the specific competencies of the water resources management system. The three former challenges require strong institutional communication with the environmental systems and metropolitan planning, as well as the relationship that may be established with the municipal governments involved, while the latter involves communication with the management systems of neighboring basins.

Conservation and Rational Water Use

A broader view of the conservation and rational water use programs and actions is needed as an essential element for an integrated concept of basin management systems and metropolitan planning. This type of program, largely based on demand management actions, is not always well understood with regard to its scope and extent.

The management of water demand in a basin with scarcity problems such as the upper Tiete is an essential measure to extend the relative offer, in the sense of increasing the number of users covered appropriately by the public supply system, maintaining the same water supply sources and flow. The water service operators are well informed concerning the specific programs to control losses in the network and on performing operational improvement to reduce loss of income. These actions are important and, in the case of reducing physical losses, imply effective gains of water availability in the basin. However, there are other actions to improve demand management that include reduced consumption, which as a rule are not included in the strategic planning of systems. Except for critical situations of scarcity and very high marginal costs to exploit new sources, momentarily below the maximum prices that can be practiced in the tariff system, it is not the job of the water service to promote stable programs for management of demand.

In this context the PURA Program of SABESP is a positive exception due to the fact that it supports initiatives to improve constructive systems and sanitary education, which may lead to reducing demand. But it is not reasonable, in a strategic concept of demand management in the basin, to concentrate all of the responsibility of demand management within the scope of the provider of the supply service.

A stable program for demand management, in the terms of the strategic principles of the Upper Tiete Basin Plan, requires a decision and managerial structure independent from the water supply company, although nothing will prevent the latter from continuing to hold the executive system and playing a central role in defining the specific priorities.

The range of appropriate activities to establish a steady policy for conservation and rational water use involves, besides measures directly related to the reduction of losses and abusive uses, several possibilities of interaction with the municipalities and the metropolitan planning system. Measures such as the limited use of 'water brooms' and washing vehicles, or the adoption of good practices to design and construct buildings systems, inclusive

rebating of low-consumption fixtures, are only implemented with the help of municipal government and through a metropolitan policy directed specifically to these objectives.

The structure of a metropolitan program for water conservation and rational use must be based on active managerial competence, which can clearly measure the costs and benefits associated with each of the levels of action advocated. Thus, different levels of advance and complexity of demand management actions may be rationally defined and compared with the costs and benefits of increasing the offer. This strategic vision of management of demand is not only applied to exploring new sources (in the sense of ensuring that the cost of recovered flow is not greater than the new source to be exploited) but also with respect to the operational regimes of each reservoir considering

the hydrologic risks of failure. The institutional competency to implement a program with these characteristics appears to accrue naturally to the basin management system, more specifically to the Basin Agency. However, the communications with broader urban and housing actions once again lead to the need for communicating with an active metropolitan agency.

Citations/Resources

FUSP (Fundação Universidade de São Paulo) (2002). Plano de Bacia do Alto-Tietê, Relatório final, versão 2.0. São Paulo: Comitê da Bacia Hidrográfica do Alto-Tietê, setembro.

Strategic Considerations on Water Demand Management (WDM) in the Context of TUWM

Aggregation and Complexity

Aggregation (functionally, territorially)

- Water conservation in the basin
- Loss control in the water supply system
- Water economy on the consumption points

Complexity

- Basic
- Intermediate
- Advanced

Main Actors and Stakeholders on WDM

Water conservation in the basin

- Environmental policy, regulation and control
- Water resources planning and management
- Sector planning of urban uses, electricity, etc.
- Regional and metropolitan planning system

Loss control in the water supply system

- Water purveyors and sewerage services
- Sectorial regulation

Water economy on the consumption points

- Final users
- Suppliers and designers of building systems and plumbing fixtures
- Quality management systems, certification and technical standards

Main Lines of Action

Water conservation in the basin

- Structural measures
 - Construction works
 - Operation of hydraulic structures
- Non structural measures
 - Planning and management of multiple uses

Loss control in the water supply system

- Control of physical losses
- Control of non-physical losses

Water economy on the consumption points

- Low-consuming fixtures
- Quality management
- Users behavior campaigns

Propensity of Stakeholders to Support Water Conservation/Economy Outside their Original Jurisdictions

- Built-in incentives
- Regulatory enforcement

Sponsors



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IHDP announces that the 7th International Science Conference on the Human Dimensions of Global Environmental Change (Open Meeting), "Social Challenges of Global Change" originally scheduled for 15-19 October 2008, will take place from April 26-30 2009 in Bonn, Germany. The new venue will be the former German Parliament premises (World Conference Center Bonn) at the United Nations Campus.

As previously announced, coinciding economic developments forced our decision to relocate the Open Meeting originally planned in New Delhi. (For more information about the postponement visit the postponement notice) After an in-depth search for alternative venues, and following negotiations with the German authorities and the UN, IHDP arrived at the conclusion to retreat to our headquarters. This will be the best way to fulfill our goal of bringing together a significant number of scholars, including early career and developing-country colleagues at a reasonable price. Participants already registered for New Delhi and facing hardship are kindly requested to contact the IHDP Secretariat at openmeeting@ihdp.unu.edu.

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