Urban Responses to Climate Change
a focus on the Americas

A Workshop Report

Urbanization and Global Environmental Change
An IHDP core project

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FOREWORD

The Urban Responses to Climate Change in the Americas UGEC workshop held in New York City on September of 2007 was divided in several sessions with different discussion themes. First, the participants discussed ways through which cities – entities identified as prime spaces for responses to the challenges of global environmental change - are currently responding to climate change. An increasing number of cities mentioned by the participants were deemed as responsive to the issue of climate change. Responsive actions are drawn from a limited set of possible reactions and are evident in a limited number of cities. Some preliminary discussion on factors of why these cities are responsive took place. The consensus was that we can expect further response of cities to climate change in the near future in the Americas. Benefits to local communities from those responses, and the costs of a lack of response, were discussed in the context of specific examples brought to the table by the participants who included Toronto, Canada; Boston, USA; Mexico City, Mexico; Ilo, Peru; Sao Paulo, Brazil; Bogota and Manizales, Colombia and others.

A second discussion theme focused on what the driving responses to climate change are. Increasingly more cities in the Americas have established mitigation actions to reduce their impact on climate change; but fewer cities have created comprehensive responses to climate change adaptation issues and combined mitigation and adaptation issues. The discussion on what is driving current responses to climate change was reformulated as an analysis of drivers and mechanisms of responses (the latter being the ways through which drivers of response are translated into action); apart from identifying the above, the discussion included elements such as the direct or indirect nature of the drivers of responses, as well as the creation of metrics regarding the feasibility or effectiveness of the mechanisms through which responses are put into actions. Actors and some institutional dimensions (private/public/social sectors) in those responses were identified but further discussion followed later in the workshop.

An additional discussion focused on the topic of building better responses to climate change. The theme asked the question of whether mitigation and adaptation can be part of local strategies to climate change and how local decisions are made in the selection of mitigation or adaptation actions. While the responses were positive, discussions centered on the difficulties posed by the time horizon of each strategy and action and the importance of the roles of private and public sectors (among other parameters). The participants also discussed critical or instrumental elements for the compatibility and coherence of mitigation and adaptation actions with the local urban development agenda, and elements also crucial beyond the platform of agendas. Discussion on steps that need to be taken

to foster urban sustainability through responses to climate change included an emphasis on the monitoring of vulnerabilities and impacts and several specific entry points on knowledge provision, action plans, and environmental impact assessments.

The discussion then moved on to the major theme of this workshop, the role of institutions in responses to climate change. This theme was broken down into two sessions: the first covered the major deficiencies and resistance of institutions to respond to climate change as well as the windows of opportunity to modify those obstacles. The second session focused on the strengths of current institutions to respond to climate change. Discussions revolved around institutions that can take a leading role in those responses, and emphasis was placed on the high degree of cooperation that should exist among institutions operating at different administrative and political levels (local, state, national, international). This session also provided a segue to the "forward looking" discussion on achievable actions, supplementing the recommendations on how to fight obstacles and promoting institutions with a better fit.

Participants then arrived at the planned synthesis sessions on building better local responses to climate change in cities which provided a more solid perspective on the Americas. These sessions focused on potential actions and products on which to focus in more detail: these included reviews of sector policies, aimed at mainstreaming climate change considerations in various related sectors beyond the environment, such as housing, transport, energy, land-use planning and so on; city assessments of urban vulnerability to climate change impacts, resilience, and opportunities for GHG abatement in the various above mentioned sectors; pilot projects to be conducted in partnership between cities of North and South America on updating codes, bylaws and regulations to incorporate climate change and several others. A common realization was that several desired products approximate concrete research projects that need to be undertaken by research groups – a discussion that will be revisited among the members of the UGEC SSC and the participants of the workshop.

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INTRODUCTION

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[1]. 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.

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[2]. 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. 22 of the 30 major natural disasters between 1990-2004 were climate related disasters in urban areas.

[1] IPCC. (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

[2] UN. (2004). World urbanization prospects: the 2003 revision. New York: UN Press.

The impacts of climate change on urban areas are broader than natural disasters and will affect the health, social life, urban economy and function.

The bidirectional interactions between urban areas and climate change have fostered an impressive array of responses in urban areas during the last years. A review of those responses shows diverse international, regional, national, and local initiatives. A large number of them have been created in large cities of industrialized countries. The Mayors Alliance for Climate Protection in the U.S. illustrates these type of responses. The Alliance 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. Another example is the C40, a group of the world's largest cities committed to tackling climate change. Originally sponsored by the Mayor of London in 2005 with the participation of 18 cities, the C 40 initiative has expanded to the 40 largest cities in the world[3]. It is interesting to note the difference in approach followed by Europe cities compared to those in the U.S. The European Community emphasizes a joint approach focusing on mitigation as well as adaptation. The heat wave of 2003 and floods in Europe have fostered attention to climate impacts on society. In the U.S., attention has centered in mitigation actions seeking to reduce the emission of greenhouse gases with little attention up to now on adaptation at the local level. Other cities in the Americas are slowly beginning to respond to climate change. Those responses are mostly concentrated in large urban areas while middle and small centered cities are still distant from the discussion of climate change.

While cities are subject to urban pathologies and crises, such as unemployment, environmental degradation, deficiencies in urban services and adequate housing, deterioration of existing infrastructure, lack of access to key resources, violence and social exclusion and crises[4], they are also places of economic growth and social well-being, important nodes for today's globalization, the nexus of production, commerce and gateways to the world's economy, potentially efficient users of infrastructure and resources, spaces for intervention to change production and consumption patterns to reduce their adverse effects on GEC, and favorable to local action with global effects[5,6].

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[3] 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 arrangement with the Clinton Climate Initiative to develop programs that would help cities fulfill their objectives. The C 40 initiative is supported by the Clinton Foundation and the International Council for Local Environmental Initiatives (ICLEI) (http://www.c40cities.org/).

[4] Davis, M. (2006). *Planet of slums*. London ; New York: Verso.

[5] Kahn, M. E. (2006). *Green cities: urban growth and the environment*. Washington, D.C.: Brookings Institution Press.

MAIN POINT
Cities can play a critical role in solutions to problems posed by climate change.

There is still much to be learned from the growing responses 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 those 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 report seeks to make a contribution in this direction. It considers some of the questions mentioned above and seeks to construct a dialogue leading to assist better responses in the urban areas of the Americas. The report is divided in two major sections. The first one considers how urban areas are responding to climate change, the type of their response, and their type of characteristics. The second section focuses on the current role of institutions in those responses and the opportunities for institutional change. The last section summarizes major conclusions and identifies areas for further action.

How urban areas are responding to climate change in the Americas

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[6] Sánchez-Rodríguez, R., Seto, K. C., Simon, D., Solecki, W. D., Kraas, F., & Laumann, G. (2005). *Science Plan: Urbanization and Global Environmental Change* (No. 15). Bonn Germany: IHDP.

Urban areas in the Americas have diverse levels of participation in responding to climate change. The largest number of cities that fall into this category are located in the U.S. The Mayors Alliance for Climate Protection represents a national initiative that brings together small, middle, and large cities. Created under the initiative of the Mayor from Seattle in 2005 through the U.S. Mayors' Climate Protection Agreement, participating cities strive to meet or exceed the Kyoto protocol targets in their communities (see Table 1). The Alliance has expanded rapidly during the last three years and there is a broad diversity of actions that cities across the U.S. have taken to reduce greenhouse emissions. . The actions either directly or indirectly focused on energy use and demand. Most of these actions can be grouped in the following categories:

Savings in energy use: These actions cover a broad range of options, from green buildings (LEED), building retrofits, new consumer goods, to replace incandescent spotlight with more efficient LED lights. For example, Chicago will charge builders for homes that are not highly energy efficient and offer cash rewards for houses that are at least 45 percent more energy efficient than the code requires. Portland and Chicago will apply a carbon fee rule beginning 2010[7].

Renewable energy resources: These actions include efforts to increasingly utilize and rely on renewable energy resources including wind, nuclear and solar power

Public transportation: Efforts in this category focus on the promotion of fuel-efficient vehicles through different actions, from transforming entire public transportation fleet, to small actions promoting fuel-efficient vehicles through eliminating parking fees for them. Other cities are promoting the use of bicycles or more pedestrian areas. Also, using clean fuels for publicly owned vehicles.

Infrastructure design: The most broad ranging topic, infrastructure and design can range from the greening of buildings, to green roofs, to rain water harvesting, to multiuse spaces, to transportation routes etc

Greenhouse gases inventory tracking: As amount of greenhouse gases emitted to or removed from the atmosphere over a specific period of time, policy makers use greenhouse gas inventories to track emission trends, develop strategies and policies and assess progress. Scientists use greenhouse gas inventories as inputs to atmospheric and economic models.

Incentives to reduce use of private vehicles: Carpool and vanpool options are highly advertised and subsidized to increase user base. The increasing cost to purchase gasoline is an economic incentive as well to choose alternate options over private transportation. Generally, implementing schemes to reduce traffic, utilizing congestion charges

[7] http://blog.oregonlive.com/pdxgreen/2007/11/portland_leaders_unveil_carbon.html

Land use planning, zoning and building codes: Many cities are rezoning areas for multiuse, so many services and activities can be performed in common spaces. Building codes can lead to more energy efficient buildings

Solid waste diversion: Recycling programs, reuse and conserve programs, reduction of packaging and bags, and many other programs are in place to reduce the amount of waste being dumped into landfills.

Green procurement programs: Actions towards the purchase of environmentally preferable products and services – many times in accordance with federally-mandated 'green' procurement preference programs.

The growing number of actions in cities across the United States illustrates the importance of local actions to climate change. However, it is important to highlight the major characteristics of those responses.

Local urban responses to climate change in the U.S. have focused predominantly on mitigation actions. There are very few examples of adaptation to climate change at the local urban level in the United States. Only a handful of cities (New York, Seattle, Portland), and states (Washington State and Oregon) incorporate adaptation and mitigation objectives as part of their responses to climate change. Other cities have begun to identify adaptation as part of their responses to climate change but without clear activities in place[8]. Despite the impressive growth in the number of cities creating responses to climate change during the last three years, those responses continue to focus on mitigation. There are several issues that help understand the focus on mitigation activities compared with adaptation.

There is a strong need for balance between the efforts of mitigation and adaptation for many reasons. Obviously, we need to adapt today to the short-term impacts of current changes in climate resulting from inertia in the climate system. At the same time, unmitigated climate change would, in the long term, be likely to exceed the capacity of natural, managed and human systems to adapt[9]. However the strongest reason to have both types of responses is the reaction time and the sustainability of the efforts. Adaptation requires a larger effort by the public sector in terms of planning and resource mobilization; while, mitigation requires regulatory framework and incentives for the private sector to pick up the investments. While adaptation is short term and logistically effective, there are several drawbacks. Adaptation projects are difficult because of a wide range of factors:

[8] See for example: http://www.usatoday.com/printedition/news/20080218/a_keene18.art.htm

[9] IPCC. (2007). Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

- Time scale /lifecycle of the project – have to conduct cost-benefit and risk analysis to show which projects are best or which issues require immediate attention – how to define them for climate change.
- Lack of information – scientific understanding of how climate change will impact the cities
- Cities are already preoccupied with floods, water scarcity and other "risks" resulting from development "failures" which can be aggravated by climate change[10]. Complex social issues, e.g. poverty, environmental equity, social empowerment are difficult to address. Mitigation does not involve inequity as much (but this is a debatable point considering different plans and the tax incidence they imply). Interventions that address issues of adaptation also address issues of equity and as a result are more controversial.
- Success measurement difficulty – It is more difficult to measure adaptation success while easier to measure mitigation success – e.g. GHG reduction. Mitigation is therefore more appealing and accessible. One can define a measurable product/outcome.
- Limited institutional capacity - Local governments need the capacity to address questions of risk management and risks faced by the citizens of the city.
- Disconnect between adaptation strategies and everyday decisions-making - People need to have access to the decision making process that affects their own livelihood. Adaptation strategies in some cities do not take into account this condition. People may not be well incentivized unless they are involved in the solution.
- Lack of specificity between short-term and long-term response - What is a short-term response and what is a long-term? Often time issues that seem to be long-term are not addressed/pushed off to future.
- Focus on mitigation - Focus on mitigation has slowed the adaptation response to climate change in some cities because individuals feel that mitigation actions significantly address the climate change issue .
- Competition with other pressing urban issues - There a host of other immediate problems and climate change competes for a higher position in the hierarchy[11].
- Need to integrate physical, social and applied science – Adaptation strategies require an incorporation of cutting edge science approaches from a variety of disciplines and perspectives.

[10] Satterthwaite, D., Huq, S., Pelling, M., Reid, A. and Romero-Lankao, P. 2007. *Building Climate Change Resilience in Urban Areas and among Urban Populations in Low- and Middle-income Nations,* commissioned by the Rockefeller Foundation, International Institute for Environment and Development (IIED) Research Report.

[11] E.g. for Latin American cities, the lack of access to infrastructure and urban services.

MAIN POINT
Simultaneous climate change mitigation and adaptation actions require coordination. Adaptation is potentially a more complicated issue to measure, resolve and actualize than mitigation. A need exists to pursue more adaptation strategies in short-term.

The Alliance for Climate Protection was created as a response to the lack of commitment from the federal government to the Kyoto Protocol and to international efforts to reduce the emission of greenhouse gases. The International Council for Local Environmental Initiatives (ICLEI) is a major promoter of local actions for climate protection in the U.S., Canada and other countries. ICLEI has been very successful promoting cuts in the emission of greenhouse gases in U.S. cities through its Climate Protection Campaign and it has persuaded mayors from small, middle and large cities to become engage in its campaign. The Clinton Foundation has also become a dynamic supporter of mitigation actions for climate change in the U.S. in recent years. ICLEI recently began activities on adaptation-to climate change while the Clinton Foundation has not identified adaptation as part of their priorities.

Mitigation activities are easier to identify and have clear targets. There is also a broad range of activities easy to implement on the short-term that fall under this category.

Reducing emissions of greenhouse gases and energy consumption from conventional sources are popular actions identified with efforts to address critical environmental problems (climate change, air pollution, sound use of natural resources) that benefits the commons good. These are highly visible actions that attract attention from the mass media and support from local constituencies. Their visibility and appeal provides them a political value attractive to local decision-makers and stakeholders.

There is an economic benefit associated with a large number of mitigation activities (energy efficient devices, green buildings, carbon markets, etc.), which have economic dimension that provide extra incentives for their implementation (the generation of new markets for new technologies, and new consumer goods).

The focus on mitigation is also influenced by the deficient attention to the impacts of climate change on urban areas. The study of climate change in the U.S. during the last 25 years has produced a number of national and regional studies on the impact of climate change on fisheries, agriculture, water, health, and other sectors, but very few studies have addressed the potential consequences in urban areas. Extreme climatic events have had serious consequences in a number of urban areas along the U.S. The vivid memory of the devastating consequences of Hurricane Katrina in New Orleans and other parts of the Southeast, together with periodical problems associated with climatic events in other urban areas, have not

brought enough attention to adapting to climate change yet. Only a few cities have identified adaptation as part of their climate change plans. Attention to natural hazards is addressed by Hazards Mitigation Plans under the Federal Emergency Management Agency (FEMA). Although attention to natural hazards potentially benefit adaptation to climate change, FEMA's focus on emergency preparedness and response does not address the comprehensive analysis needed to understand vulnerability and risk to extreme climatic events or other potential consequences of the impacts of climate change beyond natural disasters.

In contrast to mitigation, adaptation to climate change has different characteristics that make it more difficult to address. It requires detailed studies of climate scenarios and their negative impacts and the vulnerability and risk to those impacts in order to identify concrete actions and adapt to them. The economic dimension of adaptation actions is less evident than in mitigation actions, particularly in the short-term. Many adaptation actions will focus on specific social groups or geographical areas and do not create an image of actions in favor of the common good. Most adaptation responses focus currently on natural disasters and the construction of infrastructure to adapt to extreme climatic events, water supply, distribution, conservation, and quality, land use planning, environmental health.

The imbalance attention between mitigation and adaptations in cities along the U.S. can create contradictions and conflicts in their responses to climate change. Actions focusing on mitigation can have negative consequences for adaptation and vice versa. Some of those conflicts might be easy to identify, like expanding the use of conventional air conditioning to adapt to higher extreme temperatures in cities would aggravate the demand of energy and the emission of greenhouse gases. But other conflicts and contradictions might be difficult to detect, creating negatives social, economic, and environmental consequences and limiting the intended benefits in terms of adaptation or mitigation. There are also concerns about the unintended consequences on equity of mitigation and adaptation policies and actions that have begun to be addressed by scholars.

Cities would benefit from integrated plans in their responses to climate change that would help achieve a better balance between adaptation and mitigation and reduce unintended negative consequences of those actions. Those plans should be revised periodically. Responding to climate change is a learning process that requires periodical revisions in order to assess benefits and problems during their implementation, including unintended consequences on other responses to climate change, urban development programs and equity considerations.

Responses to climate change in Canada have similar process to the U.S., except for the support that the Canadian federal government offers to cities to respond to climate change. Most of those responses are concentrated in large cities and they have focused on mitigation actions seeking to reduce the emission of greenhouse gases. The Federation of Canadian Municipalities and ICLEI created the Partner

for Climate Protection network that brings together 165 Canadian municipal governments (as of June of 2008) committed to reducing emissions of greenhouse gases and action on climate change. Most actions target energy efficiency upgrades leading to cuts in the emission of greenhouse gases and savings in energy costs[12].

Some municipalities have even begun including adaptation as part of an integrated element in their responses to climate change (Toronto), while other focus on general suggestions for adapting to the impacts of climate change on health and natural disasters (Regional Halifax Municipality). Although there likely will be other municipalities and cities including adaptation in their responses to climate change in the future, there has been up to now, little attention to this issue, particularly from an integrated point of view that incorporates actions in a broad range of sectors through policies, plans, and actions.

Other cities in the Americas have also begun to respond to climate change, yet the number of cities is smaller compared to the U.S. and Canada. However, many of the responses to climate change in the Latin American countries have concentrated in the country response prepared by the national governments for the United Nations Climate Change Convention. The National responses include mitigation and adaptation actions for a broad diversity of sectors and have created offices dedicated to climate change. Although the responses addresses sectors related to urban areas (health, water, infrastructure), few of them actually identify policies and actions specific for them. While there appears to be some coordination between the national responses and responses to climate change generated by local urban areas, urban areas design most of their own responses.

Most urban areas have focused on the mitigation of climate change at least in the early stages of their responses. For example, Rio de Janeiro, one of the first cities to create an inventory of greenhouse gases and mitigation actions to climate change provides little attention to adaptation in its Climate Change Protocol, despite potential negative consequences from sea level rise and other impacts. Some cities have created programs that qualify under mitigation actions but have not been presented as mitigation to climate change. Some of the most evident examples are the famous public transportation system in Curitiba, Brazil and later in Bogota (the transmilenio system). Those actions were developed as a solution to critical urban problems. A few years later, Mexico City adopted a similar model (metrobus), however, it presented the system not only as an effort to alleviate the crisis in its public transportation system but also to mitigate climate change. Mexico City has incorporated a portfolio of mitigation activities (solid waste, afforestation, green roofs, building retrofits and other programs for energy saving and the reduction of greenhouse gases), but only very recently has begun to incorporate adaptation as part of its responses to climate change. It is interesting to note that ICLEI and its campaign Cities for Climate Protection have had a more

[12] http://www.sustainablecommunities.fcm.ca/partners-for-climate-protection/

limited success in Latin America than in the U.S. and Canada. Buenos Aires, Porto Alegre, Rio de Janeiro, Sao Paulo, and Mexico City are among the cities listed by ICLEI as part of the campaign. They also list 11 other cities, six of them in Mexico where mitigation actions are, up to now, more symbolic than real.

Responses to climate change in Latin America are mostly concentrated in large cities (Buenos Aires, Sao Paulo, Rio de Janeiro, Porto Allegre, Curitiba, Mexico City, Quito, Bogota, Montevideo) and mostly addressing mitigation. However, some of those cities have begun to include adaptation as part of their responses. Mexico City is seeking to add specific adaptation programs to its Plan Verde (water supply, natural disasters), Sao Paulo focuses on some impacts from extreme climatic events (floods), Caracas focuses on natural disasters, Quito on water supply, and Montevideo on sea level rise and floods. It is interesting to note that only a few middle size cities have considered climate change as part of their planning, management strategies and programs. Some of the most interesting responses related to adaptation to climate change are in middle size cities in Colombia. Manizales has a management program for natural disasters and risk reduction. The program includes an analysis of vulnerability and concrete adaptation actions to climate related and other natural disasters. The Universidad Nacional de Colombia and the local municipality developed that program. Cartagena and San Andres de Tumaco are two middle size cities on the Caribbean and Pacific cost of Colombia with adaptation programs to climate change (sea level rise). The program is sponsored by the Netherlands Climate Assistant Program and developed and implemented by the Instituto de Investigaciones Marinas y Costeras, associated to the Colombia Ministry of the Environment and Housing, and an international NGO.

MAIN POINT
Small and medium sized cities have responded in limited fashion or have yet to respond.

The review of cities responses to climate change in the Americas shows that the process is in its early stages. However, there are some useful considerations that can be extracted.

Although there are a growing number of urban areas responding to climate change in the continent, there is little understanding and information on this process. The large number of cities in the U.S. and Canada listed under ICLEI's Cities for Climate Protection program, and /or part of the Mayors Alliance for Climate Protection in the U.S., focus by design on mitigation with only a handful of cities also addressing adaptation. Latin America has fewer cities responding to climate change but there is an increasing trend to balance mitigation and adaptation. The amount of international attention provided to climate change in 2007 has had an impact in this regard. The huge coverage of the IPCC fourth report and the subsequent actions taken by the United Nations and other

international organizations highlighting the importance of promoting not only mitigation but also adaptation actions, has apparently pulled the attention of local urban governments in the Americas. However, some of the local officials interviewed for this paper stress the difficulty to address adaptation and identify concrete actions. The last section of the paper presents some considerations in this direction.

Local efforts to confront climate change are valuable and should be encouraged. There is, however, little information about them and how effective they are. Many of the actions listed as responses to climate change help alleviate current local urban and environmental problems and make perfect sense to be part of short and long-term actions addressing climate change. Many also have an economic dimension making them attractive to decision-makers and investors. Unfortunately, there is no system in place to assess their effectiveness and real contribution to help urban areas mitigate or adapt to climate change. ICLEI encourages the creation of local greenhouse gases inventories and a number of cities in the Americas have developed them, however little attention is paid to monitoring emissions.

The way local responses to climate change have evolved and their effectiveness in the Americas is also a point of concern. Most of the responses have been defined and implemented outside an integrated framework that would facilitate identifying their effectiveness, as well as potential conflicts and contradictions with other responses to climate change, local development programs, and equity considerations. Well-intended isolated and fragmented responses can create more harm than benefits from these type of processes. Only a few cities appear to have a coherent plan to respond to climate change. There is little evidence of clear criteria in the selection of responses to climate change, particularly in mitigation actions. Actions appear to be selected on an ad hoc basis according to the feasibility to implement on a short-term visible actions and programs rather than clear criteria of priorities to obtain effective results in coherence with current local urban and environmental problems and financial, technical, and human local resources. Those actions are encouraged in part by a genuine interest to respond to climate change, but also attracted by the political benefit of responding to a problem highly visible in the mass media and the constituencies of local urban authorities. There is a risk that isolated and fragmented responses to climate change in urban areas would create an image of comprehensive responses based on the number of cities participating in national and international alliances and programs not matched by the limited benefits obtained on the ground by those isolated actions.

MAIN POINT
Climate change should not be solely linked to the environment. It is a multi-sectoral, dimensional issue; it should be more strongly linked with the question of development.

The strong leadership of local mayors has been a key element in the creation of local responses to climate change. They provide the political capital critical in attracting the interest and support of stakeholders. In some cases, mayors have been the direct driving force to confront climate change. In other situations, they have been convinced by other actors about the importance of addressing climate change. In both cases, it is clear that mayors are key actors in these processes. But there are a number of other local, national and international actors with also important roles in creating responses to climate change. ICLEI has been a dynamic actor promoting cuts in greenhouse emissions in local urban responses in North America. Their participation in the Mayors Alliance to Climate Protection in the U.S. and the Partner for Climate Protection network in Canada has positioned ICLEI as a highly visible actor in that region. In contrast, it has had a much more limited role in Latin America where academic institutions and funding agencies have been leading actors in responding to climate change.

Local urban responses to climate change are considered basically environmental actions. Although Climate change is considered an environmental problem closely associated to the discussion of sustainability, it is also essentially a structural development problem. This distinction is important in the creation of responses to climate change in urban areas. It emphasizes the need of multidimensional approaches to address those responses; development programs and actions to have a higher priority than sectoral programs, particularly environmental ones; it facilitates integrating responses to climate change with current local urban, economic, social, and environmental problems.

Figure 1. North and Central American cities with population of greater than 750,000 people

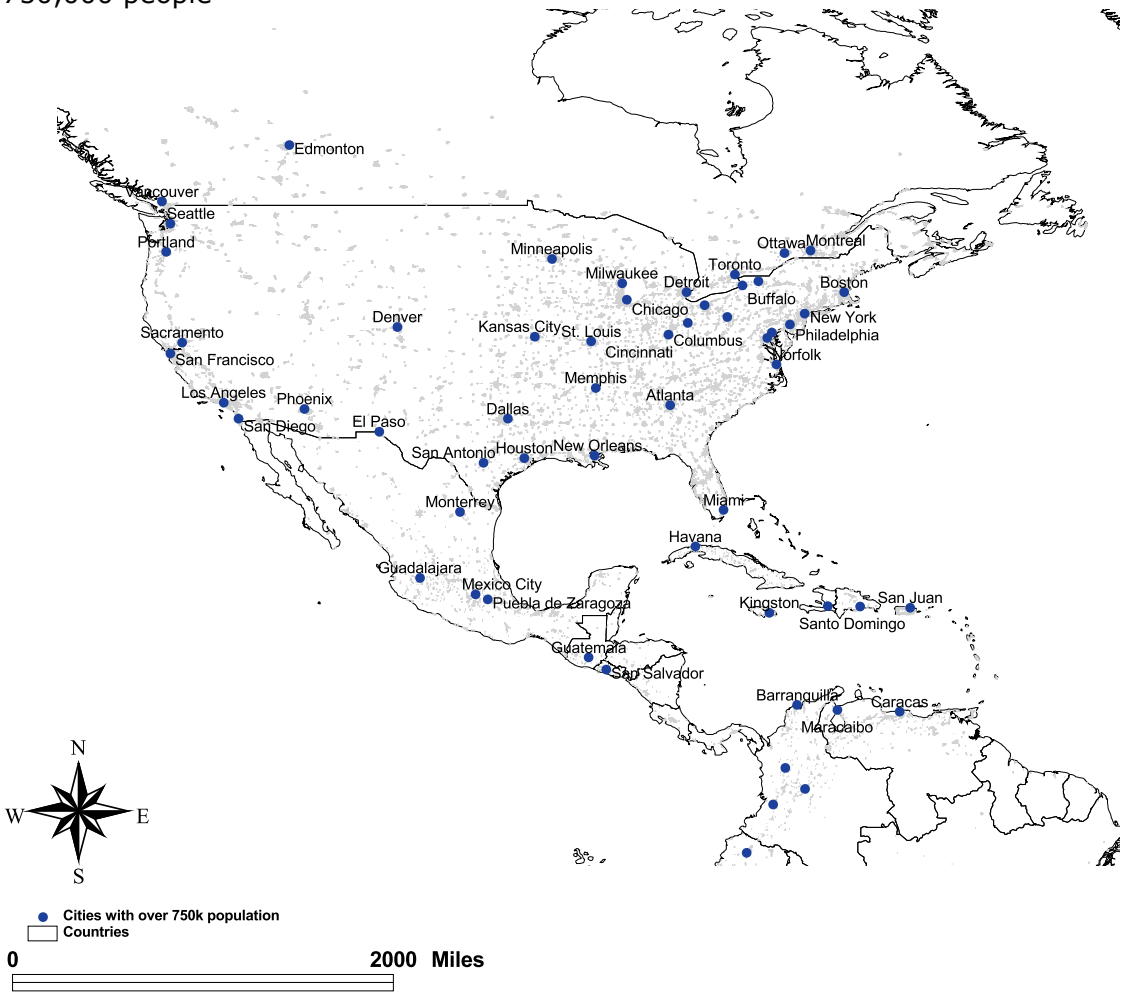

Figure 2. South American cities with population of greater than 750,000 people

Table 1. International response mechanisms to climate change for the 50 largest metropolitan areas in the Americas

Rank in Americas	City Center	Country	Metropolitan Area Name	Population circa 2008	Responses to Climate Change (mechanisms)
1	New York City	United States	New York Metropolitan Area	22,981,510	C40, CCP, MCPA
2	Mexico City	Mexico	Greater Mexico City	22,968,205	C40, CCP, CAP (Estrategia Local de Accion Climatica)
3	São Paulo	Brazil	Greater São Paulo	20,218,868	C40, CCP
4	Los Angeles	United States	Greater Los Angeles	17,863,050	C40, CCP, MCPA
5	Buenos Aires	Argentina	Greater Buenos Aires	14,197,085	C40, CCP
6	Rio de Janeiro	Brazil	Greater Rio de Janeiro	11,975,998	CCP
7	Chicago	United States	Chicago Metropolitan Area/Chicagoland	9,549,897	C40, CCP, MCPA
8	Washington-Baltimore	United States	Baltimore-Washington Metropolitan Area	8,281,142	MCPA (full metro)
9	Bogotá	Colombia	Metropolitan Area of Bogotá	8,148,808	C40
10	Lima	Peru	Lima Metropolitan Area	7,804,611	C40
11	San Francisco	United States	San Francisco Bay Area	7,661,241	Affiliated C40, CCP, MCPA
12	Dallas-Fort Worth	United States	Dallas/Fort Worth Metroplex	6,439,838	MCPA
13	Toronto-Hamilton	Canada	Greater Toronto Area	6,324,456	C40, CCP
14	Philadelphia	United States	Delaware Valley	6,293,136	C40, CCP
15	Boston	United States	Greater Boston	6,143,886	CCP, CAP (http://www.cityofboston.gov/climate/)
16	Detroit-Windsor	United States/Canada	Windsor-Detroit	5,854,397	-
17	Houston	United States	Greater Houston	5,620,461	C40
18	Belo Horizonte	Brazil	-	5,395,601	-
19	Atlanta	United States	Atlanta Metropolitan Area	5,289,322	CCP
20	Santiago	Chile	-	5,090,824	-
21	San Diego-Tijuana	United States/Mexico	San Diego-Tijuana Metropolitan Area	4,945,410	CCP (full metro), MCPA, CAP (http://www.sandiego.gov/environmental-services/sustainable/pdf/action_plan_07_05.pdf)
22	Miami	United States	South Florida	4,940,907	CCP, MCPA
23	Phoenix	United States	Phoenix Metropolitan Area	4,305,157	MCPA
24	Caracas	Venezuela	-	4,259,737	-
25	Guadalajara	Mexico	-	4,149,804	-
26	Porto Alegre	Brazil	-	3,971,158	CCP

27	Seattle	United States	Seattle Metropolitan Area	3,947,414	Affiliated C40, CCP, MCPA, CAP (http://www.seattle.gov/climate/)
28	Monterrey	Mexico	-	3,868,493	-
29	Montreal	Canada	Greater Montreal Area	3,763,715	-
30	Recife	Brazil	-	3,738,978	-
31	Salvador	Brazil	-	3,703,722	-
32	Fortaleza	Brazil	-	3,371,858	-
33	Curitiba	Brazil	-	3,359,490	Affiliated C40
34	Santo Domingo	Dominican Republic	Greater Santo Domingo	3,338,850	-
35	Guatemala City	Guatemala	Guatemala Metropolitan Area	3,293,168	-
36	Medellín	Colombia	-	3,284,894	-
37	Minneapolis-Saint Paul	United States	Minneapolis-Saint Paul	3,260,454	CCP (full metro), MCPA
38	Cleveland	United States	Greater Cleveland	2,947,262	MCPA
39	Puebla	Mexico	-	2,848,282	-
40	Denver	United States	Denver-Aurora Metropolitan Area	2,741,624	CCP, MCPA, CAP (http://www.groundworkdenver.org/climate.htm)
41	Tampa	United States	Tampa Bay Area	2,692,877	CCP, MCPA
42	St. Louis	United States	Greater St. Louis	2,662,989	MCPA
43	Cali	Colombia	-	2,635,017	-
44	Portland	United States	Portland Metropolitan Area	2,617,282	Affiliated C40, MCPA
45	Havana	Cuba	-	2,599,655	-
46	Maracaibo	Venezuela	-	2,406,719	-
47	Brasília	Brazil	-	2,406,478	-
48	Belém	Brazil	-	2,401,954	-
49	Ciudad Juárez-El Paso	Mexico/United States	-	2,397,732	CCP (CJ)
50	Pittsburgh	United States	Pittsburgh Metropolitan Area	2,313,214	MCPA

Sources:

Rank within Americas, Cities, Country, Metro Area Names and Population from World Gazetteer - America: metropolitan areas, accessed March 13, 2008.

C40: C40 Cities Climate Leadership Group members (http://www.c40cities.org/cities/)

CCP: Cities for Climate Protection Initiative (http://www.iclei.org/index.php?id=809) - As of April 2008: 268 CCP participants in N. America, 18 CCP participants in L. America

CAP: Climate Action Plan

MCPA: US Mayors Climate Protection Agreement (U.S.-specific, 839 cities signed on as of April 25th, 2008, http://usmayors.org/climateprotection/)

Drivers, mechanisms and indicators of responses of cities to climate change

During the workshop participants identified many drivers which influence the response of cities to climate change that affect both mitigation or adaptation actions. These drivers include and are not limited to:

- UNFCCC and the Kyoto Protocol, as well as other international environmental agreements
- Public pressures and the role of media
- Education and awareness of problem (policy makers and public)
- Nongovernmental agencies, non-profits, and the scientific community
- Student organizations
- Good urban governance - increased sense of responsibility by city officials Several incentive programs to promote response and capacity to respond (institutional, capital, human resources)
- The increasing cost of energy, e.g., $120 per barrel of oil, which promotes energy efficiency and GHG mitigation, and the privatizing utilities for economic efficiency
- The increasing number and severity of natural disasters – awareness of natural disasters and impact of role during crisis

Driver and mechanism distinctions in the responses of urban areas to climate change are sometimes blurry. Mechanisms are usually the methods of how the responses influenced by drivers are translated into action. Below is a short list of mechanisms or actions that have been created from drivers:

- C40 Large Cities Climate Leadership Group, an association of large cities dedicated to tackling climate change—to develop and implement a range of actions that will accelerate greenhouse gas emissions reductions (http://www.clintonfoundation.org/cf-pgm-cci-home.htm)
- Associating responses to climate change with the UN millennium development goals (http://www.un.org/millenniumgoals/).
- Urban laboratories- institutionalizing the study of and the issues of climate change
- Natural scientists have led the studies on climate change focusing on what is happening, technological innovation, and a degree of social dimensions.
- Representative democracy - Political representatives have to face their electorate involved in process
- Cost factors - The average person being affected directly and taking action personally (carpooling, etc)
- Scaling our understanding of ecological footprints and impacts to match territorial/metropolitan responses
- Scholars working as government officials- the role of emerging science, collaboration.

Metrics (or indicators) are also useful in measuring responses. It is also important to indicate when responses are not adequate or there are no responses in place to reduce vulnerability to a problem. The following are a few useful metric indicators:

- Talk vs. action (knowledge can be a powerful when used for action)
- Money put into the issue, the dollars expended is a good metric of commitment[13].
- Amount of legislation on the books, and how many of the rules are implemented.
- Climate change action plans including mitigation AND adaptation in those plans.

MAIN POINT
There are a multitude of drivers and mechanisms that influence decision-making regarding the responses to climate change at the urban level.

[13] In Mexico City for example the influence of the group led by Mario Molina, Claudia Scheinbaum, and ICLEI at shaping a climate change agenda has not been enough to go beyond a lip service interest and allocate money and decision making power to address the issue. See Romero Lankao, P. 2007: "How do Local Governments in Mexico City Manage Global Warming?" *Local Environment* May-August 2007, 12:5, pp. 519-535

THE ROLE OF INSTITUTIONS

Over the time period perceived relevant to global environmental change (and climate change processes in particular), responses to the (perceived) adverse effects of associated phenomena can come about through three primary means: technology, institutional development and change, behavioral as well as belief changes[14]. Our workshop findings point to the need for an increased attention to institutional change within metropolitan areas, since it is identified as a critical factor for an urban response to GEC; institutional change is also very strongly interrelated with changes in beliefs.

Today, across every society on the planet, established sets of formal and informal institutions (such as rules, regulations and traditional forms of interaction) shape interactions among members and collective decision-making at the different political levels (from small settlements, to cities and states). These institutions are important drivers of the observed short-run and long-run societal, economic and political outcomes, as well as environmental change. Political institutions are central to the existing collection of institutions. It is increasingly understood that in a globalized world of important economic aspects of human-environment interactions, the political aspects of these interactions are at least equally important (and in particular, ones at the local level).

Formal and informal institutions (formal rules and informal constraints) affect strongly or weakly, directly and indirectly our everyday behavior and choices in market and non-market settings[15]. Basic examples of formal institutions include the laws and organizations of a country (federal, state or municipal), governmental decrees or the Constitution of a country; examples of informal institutions include behavioral norms at the level of society (such as traditions and conventions), or bureaucratic norms at the level of politics (or even, corruption). Institutions have deservedly won the name "the rules of the game" as they are also the mechanisms of application and enforcement of the rules as well as the punishment mechanisms of those who do not follow the "rules". Institutions present themselves in different flavors across the world and not all societies pick a set of institutions favorable to economic wellbeing.

A very useful framework for thinking about social institutions and their interactions with the environment is provided by the framework proposed by the

[14] Wilbanks, T. J., Kirshen, P., Quattrochi, D., Romero-Lankao, P., Rosenzweig, C., Ruth, M., et al. (2007). *Effects of global change on human settlements*.Unpublished manuscript.

[15] North, D. C. (1990). *Institutions, institutional change, and economic performance*. Cambridge ; New York: Cambridge University Press.

IHDP 'Institutional Dimensions of Global Environmental Change (IDGEC)' core project. The framework revolves around three distinct concepts: **fit**, **scale** and **interplay** - interlinkages among distinct institutional arrangements at the same and across levels of social organization[16]. The idea of fit regards the quality of the match of characteristics of interacting institutions and biogeophysical systems as the measure of the effectiveness of the social institutions[17]. The idea of interplay revolves around the fact that although "*no institution operates in a vacuum*" and although institutions (like other phenomena) can be analyzed in isolation "*[t]he effectiveness of specific institutions often depends not only on their own features but also on their interactions with other institutions*"[18]. Thus, although the study of institutions on a case-by-case basis makes the task analytically feasible, a considerable amount of information is hidden in interactions between institutions. The idea of scale is widespread in natural sciences and is increasingly gaining importance in social sciences. Scaling up or down findings on the role of institutions is not a trivial process. Scaling up spatially is very similar to the exception fallacy problem: results derived from a micro-scale system focus may not be directly applicable to larger meso- or macro-scale systems. Scaling down spatially is very similar to the problem of ecological fallacy – knowledge of the large scale system processes may not be representative or explain well processes at the meso- or micro-scale systems[19]. The problem of scale is, for example, of particular importance when trying to identify "*whether and to what extent the causal mechanisms through which institutions affect behavior at one level of social organization, such as small scale or micro-level societies, also play key roles at other levels of social organization, including national (meso-level) societies and international (macro-level) society and vice versa.*"[20].

As a requirement for exploring possibilities for institutional responses to global environmental change, we need to better understand the bidirectional relationship of local urban institutional structures and global environmental change. The strong interrelationship of global environmental change and political institutions cannot be underemphasized. In 2005 the city of New Orleans was partially destroyed by the passage of Hurricane Katrina. We do not know and maybe will never know if this particular catastrophe was wholly or partly attributable to anthropogenic GEC processes. But what we can observe with certainty is the potentially destructive effects of inadequate or conflicting national and local political institutions manifested themselves in the case of the worst natural catastrophe ever experienced in the USA.

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[16] Young, O. R. (2005). *Science Plan: Institutional Dimentions of Global Environmental Change* (Updated report (original 1999) No. 16). Bonn, Germany: International Human Dimensions Programme on Global Environmental Change.

[17] Ibid, p. 57

[18] Ibid, p. 60-61

[19] Ibid, p. 64-65

[20] Ibid, p. 66

To that effect, we make the case that not only do local socio-political institutions indirectly affect and alter the effects of GEC but GEC can lead to the adoption of new policies and institutions at the local level. Local socio-political institutions may have primarily indirect but very important effects on GEC, as compared for example to the direct effects of natural resource management institutions or international environmental agreements (IEAs), but GEC has direct effects on local socio-political institutions. This topic requires substantial research through comparative institutional analysis since there are important implications of fit, interplay and scale, in the choice of local/urban social institutions, differing substantially across the world's urban areas, for global environmental change processes.

Urban institutional responses to climate change and favorable current practices

On the side of mitigation, it is critical to look at how institutions help shape interacting urban growth forms and functions that in turn affect carbon emissions. Sprawling urban growth is a dominant form in larger agglomerations and is closely connected to the choice of transportation modes. Opportunities for mitigation of greenhouse gas emissions present themselves in different urban sectors such as land use planning, transportation (the issue of mobility in Latin America cities is critical given the rise in use of private vehicles in many countries), building energy efficiency, water supply and treatment, solid waste, combined heat and power generation (cogeneration), etc[21]. Still, there is a need for better scientific understanding of the effects of different urban forms and functions on GHG emissions. Mexico City for instance experienced during the last two decades a polycentric urban expansion of first and second-order urban localities sprawling along major highways and functionally linked to the main city[22]. Especially when it is not accompanied by public transportation policies, the polycentric pathway of urbanization is associated with carbon relevant consequences: passengers' commuting distance and travel times have increased during recent years[23].

On the side of adaptation, cities can focus on the dimensions of (i) institutional capacity (building awareness, knowledge, political commitment, preparedness; better (adaptive) management practices and use of resources; the formation of new institutions and the process of institutional change), (ii) land use planning (avoiding future investments in areas at risk, identifying and reducing urban social vulnerability to extreme events related to climate variability and

[21] Empirical evidence is available in studies such as: Romero Lankao, P. 2007: "Are we missing the point? Particularities of urbanization, sustainability and carbon emissions in Latin American cities", Environment and Urbanization, 19, (1), 159-175.

[22] Aguilar and Ward. 2003. Globalization, regional development, and mega-city expansion in Latin America: Analyzing Mexico City's peri-urban hinterland: *Cities*, Vol.20.No.1: pp.3-21

[23] OECD (2004) *OECD Territorial Reviews. Mexico City*, OECD.

climate change. (iii) infrastructure investments (such as levees, seabarriers, dikes, drainage systems, hardening or relocation of infrastructure and utilities etc.). These dimensions have distinct presence depending on whether the discussion is focused on the short-, medium- or long-term. Furthermore, special attention should be given to the understanding the relationships between mitigation and adaptation actions in an effort to avoid conflicts between those actions.

Institutional changes as an adaptation option involves among other things, assuring effective governance, providing financial mechanisms to increase resiliency, improving structures for coordinating among multiple jurisdictions, targeting assistance programs for the impacted, and adopting sustainable community development practices[24]. Changes in formal institutions range from deeper "structural" changes in governance structure to micro adjustments in policy tools. In understanding the effects of structural changes, one has to ask what is the relative performance of local political governance structure such as different forms of executive and legislative branches of local government that affect urban growth location, form and function and consequently global environmental change. For example, what are the effects of an executive branch that employs a mayor vs. a city manager or both simultaneously; what is the effect of a type of legislative branch, such as a city council.

At the level of (micro) policy interventions, several policy instruments can be and in a few cases are employed for adaptation to climate change such as zoning, building and design codes, terms of financing and early warning systems but possible institutional responses to GEC from municipal and metropolitan governments extend further to land use and transportation planning, creation of green infrastructure etc[25]. Zoning is a widely utilized tool for city governments (with the primary goal of protecting public health, safety and welfare) but not the only tool available to local governments targeting the regulation of land use addressing issues of pollution, GHG emissions and energy consumption among other problems. Interestingly enough, in the U.S., the large scale adoption of the zoning tool originates in the 1920s as one of the responses in an effort to address urban overcrowding[26]. Sub-national (local, county and state) governments control land use through land subdivision; building codes; regulation of wetlands and floodplains, land use and growth controls such as moratoria on development, designation of historical districts; state enabling acts and home rule authority,

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[24] Wilbanks, T. J., Kirshen, P., Quattrochi, D., Romero-Lankao, P., Rosenzweig, C., Ruth, M., et al. (2007). *Effects of global change on human settlements*.Unpublished manuscript.

[25] Kirshen, P., Ruth, M., & Anderson, W. (2006). Climate's long-term impacts on urban infrastructures and services: The case of metro Boston. In M. Ruth, K. Donaghy & P. Kirshen (Eds.), *Climate Change and Variability: Impacts and Responses* (pp. 190-252). Cheltenham, UK: Edward Elgar.

[26] Platt, R. H. (2004). *Land use and society : geography, law, and public policy* (Rev. ed.). Washington, DC: Island Press.

buying or acquiring through eminent domain land and property; tax incentives and other devices.

It is important to note that one has to connect the discussion on urban institutional responses to climate change to an integrated contemporary perspective about the relationship of urban areas and the "natural" environments at a local, regional, and global scale. Important dimensions acting independently, or more often, in parallel with the institutional setting of cities are: (i) the urban economy (cities in less developed countries face reduced financial resources, technical capacity and institutional resilience), (ii) demographic changes, (iii) ecosystem factors (cities in highly impacted regions such as coastal areas, island states, flood prone areas and water-stressed countries), (iv) urban form (spatial structure) and function. Also, there exists a need for further study of institutions (social and economic) that potentially affect livelihoods in the socioeconomic sphere of cities providing the foundation for an analysis of economic development of cities and possible social and natural limits to their economic growth, the implications of technological and institutional change for urban ecosystems, and social (collective) choice problems at several local government levels[27].

Obstacles / Barriers / Policy mismatches

Climate change is treated as an environmental management issue, but policy makers in environmental ministries or departments in cities are isolated from other sectors such as energy and transportation, creating a "silo"-type problem. There may be ways to address this effect. Environment agencies can collaborate with transportation agencies, for example, through target-setting for fuel standards, air quality levels, etc. Presently, environmental agencies have the least clout; they are often populated with newcomers, and have small budgets, to improve these conditions, partnerships are vital.

Time span is also a special problem. The span for planning parties is not compatible with long term prospects of climate change. A related issue is the lack of accountability on part of institutions, there is an asymmetry between top staff that may be oriented to public opinion, whereas the middle level is more inward/operational looking.

Coordination is another special problem. Compartmentalization is the logic of government activities. The holistic approach is advisable, but day to day demands make it impossible. For example, in Mexico City, agency coordination is not experienced because of a top-down government framework ("the tier problem"). There is also political partisanship/ parties to consider, as well as a high turnover in bureaucracy, which limits the learning process. Furthermore,

[27] Gamble, A., Payne, A., Dietrich, M., Hoogvelt, A., & Kenny, M. (1996). Editorial: New Political Economy. *New Political Economy, 1*(1).

there is a "federation" of three levels (federal, state, local) which is the basis of competing interests. One antidote to this is making intra-governmental funding compulsory by law in order to by-pass political influence. This also addresses another obstacle, the lack of human and financial resources needed to respond to climate change.

Resistance of Institutions

Often, we are faced with a perplexing phenomenon of the resistance of institutions to change paths. While the capacity to change foci is always present, many institutions persist. This may be due to:

- Uncertainty over the unknown; unwillingness of operating beyond traditional ways and just doing what has been done in the past
- Following the way instead of leading the way; a crisis becomes the only motivating factor
- Organizational inertia in planning issues
- Turf protection, democratic electoral cycles and timing issues
- Lack of knowledge, human resources and training - not a good understanding over best policies
- Following legacy of past institutions, decision making process is top down
- Lack of accountability, privatization, neo-liberal policies, limited role of the state
- Embracing issues that are safe and avoiding the more difficult ones.
- Institutional constraints including highly disaggregated agencies and bureaus
- Behavioral change is a very complex and slow moving process

Institutional Formation and Change under Uncertainty

The increased awareness and understanding of the underlying causes of global environmental change (as well as experiencing its dire effects) will provide societies with opportunities for institutional change (institutional change moments). Unfortunately, challenges such as the immense complexity of social and environmental systems will be ever present as climate change has been described as the "perfect problem" – a problem that cuts across so many facets of human life which has not generated a widespread agreement on possible actions to resolve it. It is thus worthwhile to consider what shape this institutional change may possibly take. How will societies choose between different flavors of institutions and mechanisms for their enforcement in response to global environmental change? Research has shown that if urban societies are sufficiently risk averse and manifestations of GEC are sufficiently random within each society, those societies will arrive at institutions that account for uncertainty over the

future state of the environment rather than uncertainty about endowments[28].

Uncertainty is a basic theme in any discussion on the formation of institutions. Normative views of formation emphasize choice under uncertainty over personal endowments of the deliberators. But in reality, once everyone realizes their unique position ex post, issues of implementation, enforcement, defection, punishment and renegotiation come into play. Actual formal institutions are in reality the result of such interactions. We know that individuals act in a self-interested manner and strategic manner in their everyday lives and can expect that they will pursue the changes in formal institutions that leave them better off. Thus, even if institutional choices are made under a Rawlsian veil of ignorance, we cannot trust that powerful economic and political actors will not act strategically ex post in order to alter the institutional choice to their advantage. In the end, the normative concept of a Rawlsian veil of ignorance is not as useful for the description of the evolution of formal institutions.

In reality, uncertainty affecting institutional choice may be primarily that of uncertainty regarding future opportunities rather than that of personal endowments. Being aware of the present distribution of endowments allows the weight of the choice to be placed on uncertainty regarding the future.

Two powerful issues have to be considered. First, the so called *status quo bias* suggests that efforts for reforms can be simply defeated due to ignorance regarding who gains or looses – even if the sum of gains is larger than the sum of losses [29]. This bias can possibly be defeated by better processes of identification of gainers and losers from a choice of an institution - which, note, is something that is a main focus of the vulnerability literature[30]. Thus, the more positive non-Rawlsian veil of ignorance approach although compatible with the notion of an emphasis on discovering vulnerabilities/risks to populations from GEC poses a challenge to the framework in the need for an understanding of a diametrically opposite state; that of potential for gains. Utilizing vulnerability analysis, a better balance of (short-term) losers and gainers of global environmental change can be achieved.

Second, the *preference drift* is founded on the understanding that the present value of a decision is discounted for both risk and time[31]. Although an institutional deliberator may be aware today of the sets of institutions that are inline with his or

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[28] Shepsle, K. A. (2006). Old questions and new answers about institutions: the Riker Objection revisited. In B. R. Weingast & D. A. Wittman (Eds.), *The Oxford handbook of political economy*. Oxford: Oxford University Press.

[29] Fernandez, R., & Rodrik, D. (1991). Resistance to reform: status quo bias in the presence of individual-specific uncertainty. *American Economic Review, 81*, 1146-1155.

[30] Adger, 2006

[31] Messner, M., & Polborn, M. K. (2004). Voting on majority rules. *Review of Economic Studies, 71*, 115-132.

her interests, it is difficult to know which will be the relevant ones in the future due to random shocks. Thus, today's institutional decision is discounted across time for the effects of the set of institutions on interests acknowledging alternative future scenarios and probabilities of those scenarios coming about. A political economy view of a choice of institutions today given future uncertainties requires an increased attention to future projections of vulnerability (contrasted with existing/current vulnerabilities and the identification of adaptation mechanisms – fundamental topics of discussion in the vulnerability, adaptation and resilience literature[32]. The non-Rawlsian veil of ignorance view of institutional choice also supports the notion of reducing uncertainty about impacts of GEC.

Knowing that GEC affects in fundamentally different ways rich and poor populations (within and across countries), with differing capacities of access to political decision-makers, we need to better understand the role of different types of uncertainty in institutional choice. Using a climate change related example and assuming that populations that do not show willingness to respond to change are not plainly blissfully ignorant regarding the presence or potential effects of climate change but are smart calculating individuals, a process of institutional choice will have to be sensitive to the problems of status quo bias and preference drift.

Urban governance

With globalization "changing the roles and responsibilities of governments at all levels through decentralization" and a parallel democratization there has been a greater emphasis on the role and abilities of cities to self-govern which at least theoretically allows for better informed social choices and more effective use of local resources [33],[34]. Effective governance has been identified as key to urban-environmental sustainability; given the complex interactions between urbanization and the local, regional and global environment. Effective governance is a primary issue upon which a comprehensive urban sustainability research agenda should focus (Redman and Jones 2005). In particular, they argue that "[f]or benefits to outweigh the risks of continuing rapid urbanization and at the same time, for those benefits to be widely shared and to maintain valued aspects of the environment requires governmental institutions and policies that are adaptive, participatory, and effective." (*ibid*., 2005). Several policy suggestions that could promote good urban governance have been suggested, sometimes with strong debates following. These include factors such as the protection of key ecosystem

[32] van der Leeuw, S. (2001). 'Vulnerability' and the integrated study of socio-natural phenomena. Bonn, Germany: IHDP.

[33] Linares, C. A. (2003). Institutions and the Urban Environment in Developing Countries: Challenges, Trends, and Transitions. New Haven, CT: Yale School of Forestry & Environmental Studies.

[34] Redman, C. L., & Jones, N. S. (2005). The environmental, social, and health dimensions of urban expansion. *Population and Environment, 26*(6), 505-520.

services, the reduction of private transport, the minimization of air pollution, protection of fragile lands from market forces, densification and verticalization, acceptance of continued migration and internal growth, and covering the land and infrastructure needs of the poor.

The authors (*ibid.*, 2005) provide examples of three views/visions of urban governance (from three distinct entities, the US NAS Panel on Population and Environment, the World Bank and the Resilience Alliance) that is needed to attain sustainability related objectives in the future: (i) The U.S. National Academies' Panel on Population and Environment pinpoints five dimensions of the urban-governance challenge: a local government's ability to provide adequate public services to their citizens (capacity), to raise and manage sufficient revenue (financial), to cope with the variation, fragmentation and inequity within cities (diversity), to deal with rising urban violence and crime (security) and to deal with increasing complexity in managing the jurisdictional mosaic as cities grow in population and extent (authority); (ii) The World Bank's World Development Report focuses on three issues regarding good urban governance: responsibility sharing and coordination for the empowerment and linking of actors in different levels of government, (responsibility sharing and coordination), wide participation in strategizing for understanding and consensus building, motivating action and efforts for progress assessment (participatory governance) and networks for communications and capacity-building among practitioners and stakeholders (network building); (iii) the Resilience Alliance group promotes the idea of participatory urban governance using adaptive and resilience-building management approaches; in particular, the group favors flexible, open to learning management that can build resilience avoiding rigidities that could result in the breakdown of socioeconomic systems; learning can occur through structured scenarios and active adaptive management. This can lead to institutional structures that match ecological and social processes operating at different scales and that are responsive to the interlinkages between the scales.

Good urban governance for mitigation and adaptation also requires a more realistic conceptualization of politicians and government as purely non benevolent actors and identifying possible government failures. Good governance in general requires a balanced view of government, a government that operates under the market failure correction framework but that also addresses government failures[35]. Good urban governance has the prerequisite of a thorough awareness of the nexus of relationships and opportunities for strategic interaction between all actors and stakeholders existing in the sphere of urban and environmental policy. Especially of interest is the relationship between non-elected bureaucrats (e.g. urban and environmental planners) and elected city politicians (local governance actors that should not be aggregated into a single category).

[35] Besley, T. (2006). Principled agents?: The political economy of good government. Oxford: Oxford University Press.

Several issues affect capacities for good urban governance. These include:

- Uncertainty, doubt or ignorance about the science in governmental circles
- Role and obligations of city government in absence of national government leadership
- Political party differences, decentralization, long tern vs. short term politicians
- Span of government from Federal, regional, and local, organizational turfs and inertia
- Complex, costly problem with no direct near term feedback, economic concerns
- Lack of human resources, leadership, policy, interest, experience, education, training
- Government only react to crisis—have to do something (windows of opportunity)
- Equality issues always arise, have vs. have nots, some rule by self-interest
- Isolating issues within departments, the "silo effect"
- Climate change and sustainability: From react to disaster, to avoid disaster
- Prospective planning
- Climate change framing - As looming, to drive change or unmanageable, "super" framing

Effects and cross-scale effects of national political institutions

The potential effects of national political institutional form, in their interplay with local institutions or in isolation, on the environment are still largely unknown. Across the globe we observe a variation in political systems: democratic versus autocratic regimes, weak versus strong states, and unitary/centralized versus decentralized states. This variation potentially drives in part the environmental outcomes we observe and the interplay of national formal institutions and local urban or regional formal and informal institutions has to be examined in further detail. In trying to understand the environmental consequences of different types of political systems, past research has asked whether democratic polities are more environmentally benign than autocratic/authoritarian polities and the answers are not simple; although a favorable tendency exists for democratic states, the relationships are complex in nature[36].

Clearly we need to identify the effects of the interplay between urban or local institutions with national and international institutions, an interplay that can be critically affected by the national institutional forms described above. These interactions range substantially in scope: from periods of shifting the balance of power in tasks traditionally considered as the turf of local governments towards

[36] Young, O. R. (2005). *Science Plan: Institutional Dimensions of Global Environmental Change* (Updated report (original 1999) No. 16). Bonn, Germany: International Human Dimensions Programme on Global Environmental Change.

higher levels of government to underlying political motives (or a lack of good governance structure can play a huge role[37]. For instance mayors who belong to opposition parties may not receive support from the central government in developing world settings[38]. The task is complex, and there is a need for global case studies revealing the relationships between a "tapestry of governments" at the local level and the national interacting institutions[39].

[37] In Mexico City and Ilo Peru actions have been constrained by a centralized fiscal system. Local and state tax revenues "account for only 0.5% of GDP in Mexico City, whereas for other federal countries the figures range from 6.4% (Australia) up to 17.4 % of GDP (Canada)" (OECD (2004: 78)

[38] Linares, C. A. (2003). *Institutions and the Urban Environment in Developing Countries: Challenges, Trends, and Transitions*. New Haven, CT: Yale School of Forestry & Environmental Studies.

[39] Platt, R. H. (2004). *Land use and society : geography, law, and public policy* (Rev. ed.). Washington, DC: Island Press.

OPPORTUNITIES FOR ACTION AND INSTITUTIONAL CHANGE

Need for classification of cities and their responses

The workshop participants debated extensively whether a common strategy to assist cities in addressing climate change can be adopted for North and South America, given the significant differences in terms of economic and social development that exist. While the process of urbanization of North America appears to be complete, the poverty issues and the informality of very large parts of cities in the Southern continent pose very different challenges in terms of priorities and urban development. A more nuanced regrouping of countries was considered helpful by the group, consisting of a) industrial or post-industrial countries (USA and Canada); b) higher middle-income and emerging economies (Brazil, Mexico, Chile and Argentina); and c) other middle-income and low-income countries. Taking into account the above differences, the group agreed that the new challenges of climate change will affect differently the cities of the region, but that there are strong commonalities in the themes to be addressed, and value in the development of common approaches and frameworks. These will however inevitably have to be adapted to the differing regional and local circumstances.

Maintenance of institutions and institutional robustness

The question of maintenance of institutions in light of shocks or even gradual changes in an urban system falls partly on the domain of political economy. "Institutions are robust if they still support the same equilibrating behavior despite the changed circumstances"[40]. Non-robust institutions are those that within a changed environment may not only cause a change in strategic behavior but the institution itself (a change in the rules of the game). Note that this political economy definition is connected to the concept of fit, springing from the coupled human-environment interactions approach (Young 2005): the level of fit of an institution defines its robustness.

Of particular importance is the fact that institutions can (and sometimes do) "possess self-referential mechanisms of adaptation and reformation"[41]. Those

[40] Shepsle, K. A. (2006). Old questions and new answers about institutions: the Riker Objection revisited. In B. R. Weingast & D. A. Wittman (Eds.), *The Oxford handbook of political economy*. Oxford: Oxford University Press.

[41] Ibid., (2006)

mechanisms address surprises – as clarified by the concept of self-confirming equilibrium: "*If an equilibrium is founded on incomplete awareness about inconsistent beliefs by the parties concerned, but is made transparent by unfolding events, then it will very probably fall apart*"[42] . Since this must be the case in many instances, how are institutions maintained in the presence of surprises? The answer lies to the reversion features of institutions.

Understanding the capacity for response originating from cities to GEC, requires the identification of examples of robust and non-robust urban institutions and the role they play in shaping outcomes that lead to GEC. For example, are land use policies, zoning regulations, and building codes, adaptive and if not, can they be modified to be part of an adaptive management toolbox? The issue of maintenance of institutions (as well as the previous topic of choice of institutions) provides a good framework for establishing connections between the 'vulnerability, adaptation and resilience' framework with modern political economy.

Operational / Empirical Issues

New knowledge generation

The participants generated many proposals, ranging from the knowledge products to be distributed via outreach and dissemination conduits, to specific technical outputs that would be city-specific in nature. They included:

- Reviews of sector policies, aimed at mainstreaming climate change considerations in various related sectors beyond the environment, such as housing, transport, energy, land-use planning and so on. Also, adding climate change preparedness to building codes, environmental impact statements (ie "institutionalizing" climate change)
- City assessments of urban vulnerability to climate change impacts, resilience, and opportunities for GHG abatement in the various above mentioned sectors
- Pilot projects to be conducted in partnership between cities of North and South America on updating codes, bylaws and regulations to incorporate climate change
- Circulation of regional and international best practice case studies
- New approaches to low-carbon housing and urban development, considered of particular relevance for those countries where further urban growth is expected
- Approaches to retrofitting buildings and urban infrastructure in order to increase resilience and reduce GHG emissions

[42] Ibid., (2006)

Networking, training

Networking is about making significant contacts and connections to ongoing activities, events or groups. Being able to network increases individual capacities, making resources shared and efforts collaborative. Networking has many positive outcomes:

- Engage in the local communities effecting impacts and distributions
- Facilitate actions of climate change within the local agenda with decision makers
- Bridge links in the different functions of separate capacities
- Improves knowledge, education and awareness, best practices for common approaches
- Utilization of shared resources and available knowledge
- Integrated response planning into existing hazard response plans.
- Integrated climate change mitigation and adaptation planning into environmental impact assessment statements
- Private sector needs a institutional environment in which to operate and be responsive to the public sector

Levels of entry in local governments (mayor, middle management)

The participants of the workshop also discussed the possible ways of reaching out directly to and collaborating with local government officials, providing a more hands-on support in assisting cities in the region addressing the challenges of climate change; the following ideas were discussed:

- Small and medium-sized cities were put forth as more likely partners than megacities, on account of the complexity of the challenges they are facing and of the multi-jurisdictional nature of their urban environmental management
- A small group of cities could be selected by the UGEC research network for a more direct intervention and support
- Collaborations with "corporaciones urbanas" , or dedicated urban development agencies, which have been created in many Latin American Country (LAC) cities and that are project-oriented
- Technical assistance programs could be provided on issues related to climate change
- Positions of scientists to be embedded into the local governments as advisors could be financed
- Mid-level officials, in charge of managing technical departments, should be targeted in these efforts, in addition to policy and decision makers

The science/practice interface

Successful and sustainable local policies and adaptation and mitigation actions as a response to climate change require joint discussion, design and development by local practitioners and scholars. The UGEC project supports processes of development of those responses across different world regions. Workshops and capacity development events are the first step to make local practitioners and scholars aware of the problem and help them build analytical skills to construct their own responses to climate change. The train–the-trainer approach will help disseminate that knowledge and information in other urban areas in the region.

The question of what is the most effective path to the enhancement of the science-policy interface is essential to any action related to the responses of cities to climate change. Any planned action has to be very sensitive to the issue of research knowledge utilization. How scientific knowledge can be more effectively utilized in the process of policy formation is a topic that is still being theorized (multiple approaches to the question exists). Supported by the available research on the topic, the workshop participants concluded a need for continuous effort for engagement of relevant parties; this constant exchange of viewpoints can create the space for making sense of the complex interactions that create and obstruct effective responses to global environmental change. At a very practical level, the involvement of policymakers in the formation of a research agenda or a new network is a critical step to a closer connection of science to policy. Listening to the views and suggestions of policymakers and practitioners at early stages of implementation of the plans are viewed as being crucial for enhancing the science/policy interface. Thus, an important outcome is the increased understanding by scientists of how policy makers perceive the knowledge scientists generate through research; in particular, how they perceive the research through the specific decision making frameworks they operate with in. Furthermore, the practitioner should target a better awareness of the perceptions of scientists regarding their own research and any presupposition about how this research is, or should be, used by a policy maker. Communicating these beliefs between the disciplines and challenging preconceived notions is crucial for a successful engagement on the science policy interface that targets progress towards a better link between science and policy.

At the research level, work needs to be done to develop common concepts and sound theoretical approaches, bridging the various theoretical constructs, e.g., multi-actor models, sustainable livelihoods, and vulnerability methods. Researchers also can establish a dialogue with practitioners and local administrators and civil servants to create synergy.

MAIN POINT
A pressing need exists for the identification of entry points for science to influence policy. Different entry points will apply for different cities. Networking, training, and research are viewed as important entry points.

The interwoven roles of the public, social and private sectors

The public sector has the ability to work with local decision-makers about issues relevant for small and medium sized cities, create alliances with international organizations, link climate change with ongoing public policy questions – to promote synergies, redesign projects to address climate change, follow-up and follow-through with middle level managers, establish bridges with NGOs, create critical links between scientists and government officials and institutions. Public sectors also have the ability to act as the first intervention with training, network institutions, flow of ideas and what the best practices are. Public sectors also have the ability to help institutions write codes, model codes, and use best practice sectoral codes, create opportunities for institutional reform, give models to smaller and mid-sized cities. However, there is no great example of a city's response to climate change.

Adaptation will be more pronounced if it coincides with sustainable development goals[43]. Partnerships and collaboration is a positive way to get more accomplished with fewer resources. Many Nongovernmental Organizations have resources of not only labor but knowledge and financial support. These non government and non profit organizations have a huge influence and are able to contribute to mitigation and adaptation efforts.

The roles of private sectors are very important and sometimes forgotten in the aspect of responses to climate change. Entry points for climate change adaptation in the private sector are the insurance industries, builders of infrastructure such as sea walls and barriers; quality control and product innovation; and conditional concessions. Climate change can be incorporated into the regulatory framework to guide private sector involvement.

MAIN POINT
The private sector will play a critical role in adaptation efforts; sometimes often in collaboration with the public sector for mitigating actions too. The importance of social institutions and individual agencies has to be emphasized. The interaction role of formal and informal institutions, e.g., family and local networks also has an important role.

Engagement of International Organizations

Growing awareness at the international level fostered by developing countries has prompted international agencies to bring adaptation into their agendas. Funding mechanisms include GEF Adaptation Fund, CDM allocations for adaptation, UK DIVD, Environmental Transformation Fund, OECD IDA15,

[43] Wilbanks, T. J., Kirshen, P., Quattrochi, D., Romero-Lankao, P., Rosenzweig, C., Ruth, M., et al. (2007). *Effects of global change on human settlements*.Unpublished manuscript.

and multilateral banks. There are some structures in place, such as the World Bank Cities Alliance Program, that deal directly with supporting city initiatives.

With the purpose of identifying appropriate mechanisms to increase the opportunities for outreach and dissemination of scientific knowledge towards the cities, policymakers and practitioners, the participants discussed the following available "conduits" and dissemination mechanisms

- Important regional and international conferences: Urban Age[44] of the London School of Economics and Political Science to take place in Sao Paulo in December of 2008, and the Nanjing UNCHS World Urban Forum of October 2008 (UGEC is present in the latter)
- The yearly continental Conference of Mayors
- The International (UCLG and Metropolis) and regional associations of municipalities
- Regional training and capacity building programs supported by IEA, UNDP, UNCHS, WBI, National Science Foundation
- The National associations of municipalities with their own training programs
- City dialogues could be organized to establish a two-way exchange
- University teaching and research programs that prepare the new generations
- Multilateral and national development banks that assist cities with investments

[44] Urban Age website: http://www.urban-age.net/

APPENDICES

APPENDIX A

List of Acronyms

APN	Asia Pacific Network
C40	Clinton Climate Initiative
CC	Climate Change
CDM	Clean Development Mechanism (under the Kyoto Protocal)
FEMA	Federal Emergency Management Agency
GEC	Global Environmental Change
GEF	Global Environment Facility
GHG	Greenhouse gasses
IAI	Inter-American Institute for Global Change Research (http://www.iai.int/)
ICLEI	International Council for Local Environmental Initiatives
IDGEC	Institutional Dimensions of Global Environmental Change
IEA	International Environmental Agreements
IGBP	International Geosphere-Biosphere Programme
IHDP	International Human Dimensions Program
IPCC	Intergovernmental Panel on Climate Change
LAC	Latin American Country
LED	Light-Emitting Diode
LEED	Leadership in Energy and Environmental Design
NGO	Non-Governmental Organization
NSF	National Science Foundation
OECD	Organisation for Economic Co-operation and Development
IDA	International Development Association
SSC	Scientific Steering Committee
START	Global Change System for Analysis, Research, and Training (http://www.start.org/)
UCLG	United Cities and Local Governments
UGEC	Urbanization and Global Environmental Change Project
UK DIVD	United Kingdom
UN	United Nations
UNCHS	United Nations Center for human settlement
UNDP	United Nations Development Program
WBI	World Bank Institute

APPENDIX B

List of participants

- **Anthony Bigio**, WorldBank, Urban Specialist, EDI Urban Team Coordinator
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- **Ricardo Jordan**, UN-ECLAC, Division de Desarrollo Sostenible y Asentamientos Humanos/ Sustainable Development and Human Settlements Division
- **Paul Kirshen**, Research Professor, Civil and Environmental Engineering Department, Tufts University
- **Andrea Lampis**, Assistant Professor at the University of Los Andes
- **Peter Marcotullio**, Research Fellow managing the Urban Programme, United Nations University
  George Martin, Professor, Department of Sociology, Montclair St. University
  George Martine, Consultant, UNFPA
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- **Cynthia Rosenzweig**, Research Scientist at NASA
- **Roberto Sanchez**, Director of UC Mexus, University of California, Riverside
- **Bill Solecki**, Professor and Chairperson, Department of Geography, Hunter College, CUNY
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