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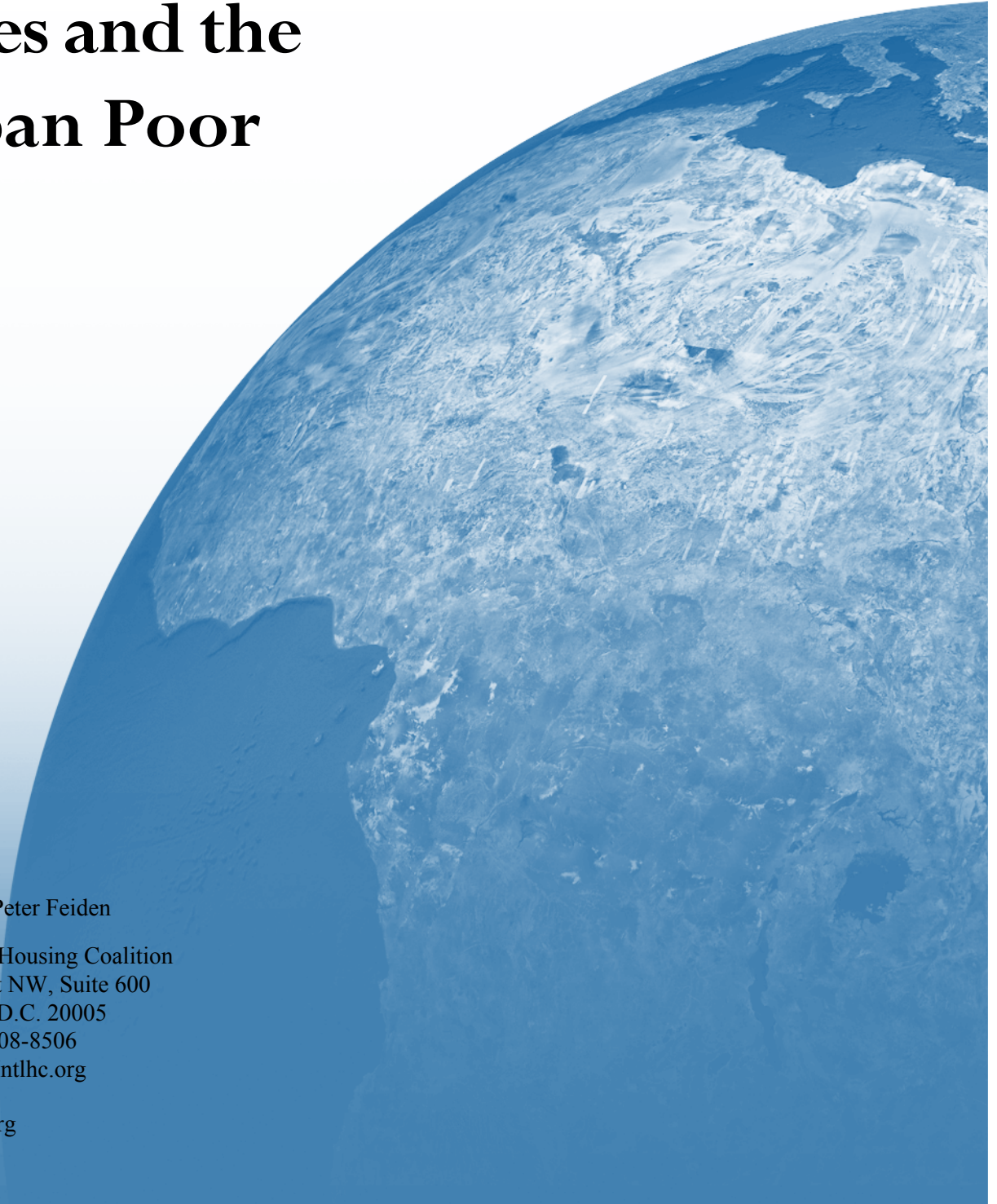
Housing for All

Adapting to Climate Change: Cities and the Urban Poor

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Executive Summary

Global climate change will have enormous impacts on urban areas in the developing world. The known and growing effects of climate change – increased temperatures, rising seas, and increased incidence of severe storms – will be especially significant for cities due to the location of many along the coast, the population and capital assets at risk, and the important role of port cities in national economies.

Within cities of the developing world, the poor are typically the most vulnerable. They tend to live in slum/informal settlements, often located in areas most exposed to the effects of global climate change, notably low-lying areas, steep slopes, and ravines. Little or no infrastructure exists to provide protection from storm events or to ensure mobility. Reflecting the low and unstable incomes of the residents, but exacerbated by poor land tenure characteristics, little or no building regulation, and lack of housing finance, housing quality is low and provides poor resistance to natural disasters. The inherent vulnerability of these settlements is amplified as the effects of global climate change become more pronounced.

This paper explores some of the emerging issues that cities in the developing world confront as they begin to develop plans and strategies to adapt to the effects of global climate change. The emphasis is on low-income populations, both those now settled in cities and those still to migrate from rural areas. In some instances, this migration is due to reduced agricultural productivity, itself a product of global climate change. The urban poor are vulnerable because of where they live and the condition of their shelter. Yet their low incomes, poor access to information, and lack of market alternatives limit their ability to move to safer environments.

Sustaining and improving human settlements in the face of ongoing global climate change should become an important lens for cities as they look to the future. Areas where the poor live will pose special challenges. Adapting to climate change will require many cities to substantially improve their capacity in precisely those areas where past deficiencies have resulted in the proliferation of informal settlements. These include land use planning and regulation, effective infrastructure investment, and legal and administrative systems that can support the development of efficient land markets and tenure arrangements. Governments will need to wrestle with complicated issues as they try to adapt to climate change impacts at the local level – equity in public expenditures; collaboration with private investors; the authority, role and capacity of local governments; and incorporating much long-range projections into plans and investments, to name a few.

Adapting to global climate change will impose large costs on many cities, particularly low-lying coastal cities. While the bulk of these resources will need to come from private sources, donors

have an important role to play in supporting the science and the development of effective practices and methodologies for countries to employ in policy and program formulation.

As an organization created to advocate for the housing and living conditions of the urban poor in developing countries, the International Housing Coalition (IHC) believes that the unique, potentially devastating impact of global climate change on the urban poor warrants much more attention at local and national levels. Integrating climate change adaptation into plans and policies will be critical in the years ahead. Yet the payoff can be substantial when measured in the cost of wasteful and ultimately unsustainable public and private investment that might be prevented. Ignoring adaptation issues will, for many cities, simply mean a further deterioration of urban conditions.

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The IHC believes that climate change will have significant impacts on cities in the developing world and particularly on the urban poor and slum dwellers. International donors and national and local governments in developing countries need to recognize the particular vulnerability of the urban poor to the effects of climate change.

The IHC is a non-profit advocacy and education organization located in Washington, D.C. that supports “housing for all” and seeks to raise the priority of housing on the international development agenda. The conditions of slums and the poor housing of slum dwellers are of particular concern. The IHC supports the basic principles of private property rights, secure tenure, effective title systems and efficient and equitable housing finance systems – all essential elements to economic growth, civic stability and democratic values. To learn more about the IHC, visit its website at www.intlhc.org.

I. INTRODUCTION

Significant climate change will occur in the century ahead regardless of the extent of future greenhouse gas reductions. The effects of climate change are apparent already; rising sea levels and increased global temperatures are well-documented. Although there will continue to be a substantial range in quantitative predictions for these and other effects of global climate change, the general trajectory of these effects is becoming clear. The effects are widespread, interconnected, and cumulative.

Cities in the developing world produce and consume at higher rates than rural areas per capita. They thereby account for a disproportionate share of greenhouse gas emissions. At the same time, with their concentration of economic activity and population, along with the coastal location of many cities, they are disproportionately vulnerable to the effects of climate change. In short, cities are at the heart of the problem both in terms of the source of the carbon emissions and in terms of the effect that global warming will have on human settlements.

The urban poor, and particularly those in informal settlements, are uniquely vulnerable. They are the most likely to live in low-lying areas, on steep slopes, in ravines, and in other risk prone areas.¹ The quality of their housing is poorest and least resistant to extreme weather events. They lack the resources, and often the information, to respond in ways to mitigate their increasingly precarious situations.

This paper is not exhaustive, nor does it seek to present new findings. Instead it is an overview of current knowledge, meant to highlight the amount of cross-sector research and programming that can and must be built from this basis of understanding.

Adaptation in Urban Settlements:

For urban settlements, the term adaptation refers to actions to make human settlement, capital, and productivity more resilient as the global climate continues to change. It might, depending on circumstances, include the following types of actions:

- Hardening of infrastructure to make it more resilient to extreme weather.
- Building seawalls to reduce the impact of rising seas and extreme weather.
- Improving housing quality to make it more resistant to storm events.
- Land filling to raise elevations for new development.
- Relocation to alternative settlement areas.
- Investment in cooling technologies to improve comfort as urban heat island effects take hold.
- Disaster planning to enable more effective evacuation based on improved early warning systems for storm events.
- Public health measures to address changes in disease vectors.
- Facilitating settlement of new urban migrants in more appropriate parts of the city and use of proper designs in new construction.
- Improved enforcement of critical building and land use regulations.

¹ Climate Change 2007: Impacts, Adaptation, and Vulnerability, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.

While the overall effects of global warming are becoming clear, the effects on particular regions, and from city to city within regions, will vary greatly. Extensive analysis on a region and city-specific level will be critical in the years ahead.

Adaptation to Climate Change

Practitioners often refer to adaptation and mitigation when talking about climate change. Adaptation is distinct from mitigation. The latter refers to actions to reduce the extent of climate change through measures to reduce net greenhouse gas emissions. Adaptation refers to steps to minimize the predicted *impacts* of climate change on humans and the ecosystems that support habitation. Mitigation necessarily refers to actions that have worldwide effects since carbon dioxide released into the environment becomes part of the worldwide ambient air, while the effects of adaptation measures, by contrast, are for the most part strictly limited by geography. Climate affects human systems in three principle ways. First, it provides the context for outdoor human activities, most notably agriculture. Second, climate affects the cost of maintaining controlled internal environments for human life and activities. For example, higher temperatures increase the cost of cooling and decrease the cost of heating. Third, climate interacts with other types of stresses on human systems. For example, drought can contribute to rural-urban migration, which, combined with population growth, increases stress on urban infrastructure and reduces socio-economic conditions.²

Poor communities tend to have more limited adaptive capacities as climate change affects human settlement. First, the poor cannot afford adaptive technologies, such as improved building materials. Second, their ability to relocate to a less stressed environment is often limited by political/cultural constraints and resources. Finally, they are more dependent on local water and food supplies, with less ability to tap other markets when these local sources become less productive.

Countries are now taking increased note of their particular impacts from climate change. This is an arduous and expensive process and is much further along in developed countries, particularly low-lying countries. For developing countries, the serious analysis of impacts is just beginning. This analysis is necessarily broad, and includes such disparate subjects as effects on agriculture, disease vectors, and current human settlements and the built infrastructure. Adaptation as a way to moderate impacts on the urban poor should be an urgent part of the adaptation agenda.

II. URBAN DIMENSIONS

The effects of climate change will have unique impacts on urban areas. While urban settlement is skewed toward coastal areas and will bear a larger brunt of any increase in storm activity and sea level rise, inland cities in the developing world also have vulnerabilities including extensive settlement on steep slopes and rapidly increasing heat island effects.

² Ibid.

The disproportionate impact on urban areas is notable in two respects. First, the extensive investment, both public and private, in cities dramatically raises the value of damage from storm activity. Second, the density of population can result in a concentration of suffering far exceeding that in other areas. These impacts take a disproportionate toll on the urban poor due to their settlement patterns *within* cities and the low durability of their housing.

Settlement in Low Elevation Coastal Zones

Many characteristics of human settlement and economic activity will ultimately be affected by climate change. Given the certainty of sea level rise in the coming century, settlement in low-lying areas is subject to the most specific and predictable effects. These areas are receiving increased attention, and in developed countries are the subject of intense analysis and long-term infrastructure planning.

It is estimated that 23 percent of the world's population lives within 60 miles of the coast and at less than 350 feet of elevation. Overall population densities in coastal regions are about three times higher than the global population density.³ Some 60 percent of the world's 39 metropolitan areas with more than five million people are located within 60 miles of the coast, including 12 of the world's 16 largest cities.

About one person in ten lives in the Low Elevation Coastal Zone (LECZ), defined as less than 10 meters (33 feet) elevation. Thirteen percent of the world's urban population, or 360 million people, live in the LECZ. For Asia and Africa these percentages are higher at 18 percent and 15 percent respectively. These averages hide a great deal of variation, however, with countries such as Bangladesh housing a majority of their entire populations in LECZs.⁴

Deltas, large sedimentary deposits, are widely recognized as highly vulnerable to the effects of climate change, particularly sea level rise and changes in runoff. They are also sensitive to the stresses imposed by human modification of catchment areas and delta plain land use. Many are already undergoing natural subsidence, increasing the rate of relative sea level rise. Many are also sensitive to the effects of ground water extraction. The largest and most vulnerable deltas and so-called mega-deltas are in the developing world, many of which are highly urbanized, and are already experiencing an increase in storm surges and seasonal river floods.

The direct influences of sea level rise on freshwater resources come principally from sea water intrusion into surface water and coastal aquifers. Further encroachment of salt water into estuaries and coastal river systems, more extensive coastal inundation and higher levels of sea flooding, increase in the landward reach of sea waves and storm surges, and new or accelerated coastal erosion are among the effects being seen.

³ Ibid, Chapter 6.

⁴ "The Rising Tide: Assessing the Risks of Climate Change and Human Settlements in Low Elevation Coastal Zones." Gordon McGranahan, Deborah Balk and Bridget Anderson, 2007.

Highly Threatened Cities

Of immediate concern are cities with vast settlements within a few meters of sea level and in areas known for storm activity. For many of these cities, such as Dhaka, Bangladesh, recurrent severe storms with extensive loss of life have long occurred. Demographers have made less progress in establishing worldwide databases on very low-lying areas (for example, three meters or 10 feet), which for many countries would be a more useful standard for planning priority measures.

Population by elevation is a compelling measure of vulnerability to climate change effects. It is a static look that focuses on the size of the population whose lives and assets are immediately at risk to storm activity, and whose assets (or rented housing) will slowly become more vulnerable as seas rise.

The Organization for Economic Cooperation and Development (OECD) looked at the future vulnerability, based on current growth and development projections, of 136 port cities around the world in a recent study.⁵ Kolkata, India, heads the list of the top 10 cities at highest risk by 2070 in terms of population exposure to storm activity and sea level rise. Mumbai, India follows right behind, and Miami, Florida is the only city in the top 10 located in a developed country. The other cities listed are Dhaka, Bangladesh; Guangzhou, China; Ho Chi Minh City, Vietnam; Shanghai, China; Bangkok, Thailand; Rangoon, Myanmar; and Hai Phong, Vietnam respectively.

A more comprehensive view of vulnerability would take into account the level of public and private investment as well, along with the role of the city, or threatened part of the city, in the regional or national economy. Even further, one could consider community cohesion, or so-called social capital that would be at risk if a community is forced to disperse.

Global Climate Change Effects on Urban Areas

Global climate change will have profound and complicated effects on urban areas. Direct effects of climate change are those changes in the natural environment with immediate consequences for human habitation. Indirect effects are the results of these direct effects when mediated through the economy.

Evaluating Vulnerability of Cities:

A list of critical factors in evaluating overall vulnerability to climate change impacts might include the following:

- Population at low elevations. This would include data on population in the LECZ and population at lower elevation thresholds.
- Geologic and development conditions that can increase or reduce the rate of local sea level rise.
- Local storm patterns and anticipated changes or intensification with continual global climate change.
- Economic activity in low-lying areas
- The value of local infrastructure at risk
- The value of regional or national assets at risk (e.g. power plant, port facility)
- The value of human settlements at risk.
- Projected growth of at-risk areas.
- Planned investment at risk.

⁵ "A Global Ranking of Port Cities with High Exposure to Climate Extremes," Susan Hanson, Robert Nicholls, N. Ranger, S. Hallegatte, J. Corfee-Morlot, C. Herweijer, J. Chateau, 2007.

Direct Effects on Urban Areas

There are three dominant direct effects of global climate change on cities around the world:

Increased Temperature. Global surface temperatures have risen roughly 1.5° F over the past century. The rate of warming has accelerated rapidly in recent years. Since 1975, average global temperature has risen about 1° F. With further acceleration of warming anticipated, models now predict a total warming this century of from 3°F to 8°F.⁶

Temperature increase caused by carbon emissions is amplified in urban areas. The *urban heat island effect* causes a metropolitan area to be significantly warmer than its surrounding rural areas. The underlying cause of an urban heat island is modification of the land surface through development with materials that effectively retain heat. Waste heat generated by energy usage is a secondary contributor. As population centers grow they tend to modify greater areas of land and cause a corresponding increase in average temperature.⁷

Sea Level Rise. The rise in sea level is well-documented. For the past 150 years the increase has been roughly 10 inches. However the *rate* of this sea level rise is increasing dramatically, with the average rise since 1993 on the order of 1/8th inch per year.⁸ For a number of years the consensus prediction for cumulative sea level rise over the 21st century has been in the range of seven to 23 inches.⁹ A new consensus, however, is now emerging that this is likely an underestimate, with some analysts seeing the possibility of a full six feet of sea level rise over this century, an astounding rate of nearly ¾ inch per year.¹⁰

Extreme Weather Events. The scientific community agrees that a warmer earth makes for a more unstable atmosphere. The data on extreme weather events is less clear due to the nature of longer underlying weather cycles and difficulties in data collection. However, some scientists partially attribute such trends as increasing cyclone activity in the Pacific, increasing hurricane activity in the Atlantic, and increasing incidence of heat waves in Eurasia to global warming

Indirect Effects on Urban Areas

Some of the key indirect effects of global climate change are:

Reduced Productivity of Land. Many areas are expected to become more arid as a result of global climate change. The result will likely be greater stress on cities, whose populations are already growing at rates exceeding national population growth rates, consistent with historic patterns for developing

⁶ Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning (eds.)].

⁷ Glossary of Meteorology (2009).

⁸ Ibid.

⁹ OECD Intergovernmental Panel on Climate Change, 2007.

¹⁰ Sea level rise is not perfectly uniform around the world due to local geologic conditions, groundwater characteristics, and other factors.

countries. A city in a country beset by falling agricultural production would see an acceleration in this growth rate and a skewing of the city's demographic characteristics. In some cases, so-called "climate refugees" will cause a shift in the city's character as it becomes ever more populated with very poor residents that are less assimilated to urban living and urban livelihoods.

Reduced Access to Water. Many nations already face severe urban water stress due to reduced rainfall coupled with a rapid increase in demand. Due to population density and rising living standards, many cities already severely stress local watersheds, and even a small rise in sea levels will require massive additional investment just to sustain water and sewage service at current, often inadequate levels.

Reduced Air Quality. One particular urban concern is the increase in atmospheric ozone due to higher air temperatures. Cities naturally emit far greater volumes of ozone-causing pollutants, especially from transportation. Global warming, exacerbated by urban heat island effects, could significantly increase urban respiratory problems associated with ozone formation in the atmosphere.

Political Instability. Climate change coalesces with other stresses on urban settlements, including water scarcity and poor governance. Many of those most threatened by the direct effects of climate change already suffer from some combination of poorly managed growth, pervasive inequity, jurisdictional fragmentation, corruption, fiscal stress, and aging or inadequate infrastructure. In these settings, any additional stress can be a trigger, and form a unifying narrative for disruptive events and further political polarization.¹¹

The Special Vulnerability of the Urban Poor

In the cities of developing countries, the poor are largely relegated to informal slum areas. The development of these areas reflects both rapid urbanization and the inability of government institutions and the private sector to provide suitable shelter or effectively manage urban growth. The result is a marginal existence for a large segment of the population, who are often the core of the urban unskilled and semi-skilled work force.

The vulnerability of the poor springs from the informal settlements in which they live. Transience, or at least the anticipation of transience, is imbedded in informal settlements. The absence of official sanction for these settlements, the weak bargaining position of the poor with area landlords, the threat of higher value redevelopment of the land, and the underlying goal of many to move to a more formal settlement all reinforce a short planning horizon for residents in these settlements. In this context, a slow-developing phenomenon like global warming engenders little local concern in many places, and attendant threats to settlements are poorly internalized into market prices for land and housing. The urban poor are subject to the systemic threats of global warming as they share in the national economy. However their settlement patterns, minimal resources, and lessened political influence warrant them especially vulnerable. There are three aspects to their unique vulnerability:

¹¹ Climate Change 2007, op. cit.

Vulnerability due to ineffective or non-existent planning, and underinvestment in infrastructure

- Many informal settlements in coastal cities are in low-lying areas, making them more subject to the effects of increased storm activity in the immediate term. Over the longer term, they are the first areas affected by sea level rise.
- Informal settlement on steep slopes is common in many urban areas. Vulnerability to storm events is more pronounced with the anticipated rise in extreme weather.
- Informal settlements are far deficient in infrastructure, including roads, drainage, water, and sewerage. In the event of flooding, mobility is reduced, shelter is put at greater risk, and public health impacts are amplified, resulting in higher morbidity and mortality rates.

Vulnerability based on low quality housing with poor disaster resistance

- Much low-income housing is of poor quality, reflecting the lower incomes of the inhabitants. For informal settlements, investment is lower still due to extensive rental tenure, poor land titling, and inadequate housing finance.
- Even where actual investment in housing is significant, design, materials, and construction methods are often inappropriate given the increasing exposure to extreme weather and flooding.

Vulnerability based on low income and insufficient resources

- Ideally, the market should respond to the growing threat from climate change by depressing prices for vulnerable housing and increasing production of more appropriate affordable housing in safer areas. Due to poor land markets, ineffective governance, low incomes, and market monopoly characteristics, market responses are insufficient. For many of the urban poor the marketplace will offer little or no immediate settlement alternative as the impacts of global warming intensify.
- Low-income residents often have sparse information on vulnerability and market alternatives. Lacking information on the risks inherent in threatened informal settlements, they are uniquely subject to exploitation in the housing market.
- Given the costs of adaptation in urban areas, middle and upper income families can easily outbid the poor in the competition for public investment in infrastructure to adapt to climate change effects.
- Heat island effects, which accentuate temperature increase in urban areas, may make cooling technology that much more critical, an added cost of urban living that will be unaffordable to most.
- Poor urban residents typically lack the resources to respond effectively in a crisis creating greater dependency on the poorly funded public and non-profit sectors.

IV. THE CHALLENGE FOR CITIES

Local and national governments of the developing world are struggling to accommodate continuing, rapid urban population growth and provide a modicum of services for very low-income households. Global climate change can amplify this challenge to cities in two respects: 1) increasing the cost, along with the urgency, of upgrading infrastructure and improving shelter for threatened areas, while creating new more secure settlement areas, and 2) increasing the rate of the migration of low-income households from rural areas with reduced land fertility.

In some parts of the world, notably in areas of Africa, global climate change might be noted most for the stress of increased migration to cities. For large parts of coastal Asia, the immediate concern is the rising vulnerability of low-lying areas, and the cost and complication of any comprehensive strategy to resettle communities or sufficiently fortify existing settlements. In either case, greater demands are placed on typically weak local governments in the areas where they have proven so ineffective in the past: long-range planning, infrastructure development, and effective and transparent governance.

Global Climate Change as a New Lens for Urban Development

Cities of the developed world are much better positioned to deal with the effects of global warming than cities of the developing world. Cities in developed countries benefit from more resources, greater expertise, and much stronger governance systems. They also benefit from well-established practices of incorporating longer term risk into land use planning. For these cities, notwithstanding the enormous costs involved, adaptation is largely a matter of incorporating new data, technology, and practices into existing planning process, investments, and regulations.

The context for cities in developing countries is dramatically different. Here the challenges of adaptation to climate change mirror the deficiencies of current systems for accommodating rapid urbanization, including ineffective land use, inappropriate and poorly implemented regulatory systems, poor disaster resistance of the housing stock, ineffective infrastructure planning and funding, and poorly functioning land markets.

Therefore the challenge is to add urgency to the well-understood demand for increased urban investments and planning, which will allow a healthier and more sustainable urban environment to emerge. The critical ingredients are better information, expertise, and governance, along with increased resources for low-income and informal settlement areas.

Global warming can also be a new lens for some cities to rethink established dogma and re-set priorities. It is more than just a matter of doing the important work better and with more urgency. Global climate change creates a new opportunity to prioritize the important work of the city around a unifying goal of sustainability.

Organizing around a long-term goal of sustaining and improving productivity and living conditions in a city requires a far longer planning horizon. Data on predicted sea level rise, extreme weather incidence, and warming become core ingredients in setting policy and planning investments. Out of this approach a city might develop a typology along the following lines:

- Areas at sufficient elevation and reasonably resistant to extreme weather.
- Areas that are likely to become threatened in the 21st century and for which adaptive measures at a reasonable cost are feasible.
- Areas that are now vulnerable or will become so, but for which adaptive investments are too expensive or not feasible.

This kind of planning and follow through require a level of commitment to the urban poor that is rare. It has been this lack of political power of the poor that has spurred the development of informal settlements in the first place. A proper response to global climate change therefore would entail progress toward rectifying past public indifference to the settlement needs of poor urban migrants.

To date there have been few assessments on specific impacts, climate scenarios, and adaptation options for urban and peri-urban areas in developing countries.¹² Intensive work with threatened cities is urgently needed not only for its own value, but to develop practical methodologies that can be applied more widely.

Issues of Equity

Equity issues arise in several respects as governments ponder how to adapt to future climate change impacts on the urban poor. First, the poor generally bear a disproportionate burden of these impacts when measured against their responsibility for global warming, as greenhouse gas emissions are well correlated with income and wealth.

Second, the vulnerability of the urban poor is exacerbated by the way the market has responded to their needs for shelter in the absence of effective government intervention. Effective governance and public investment would have resulted in fewer informal settlements and less development in highly vulnerable parts of the city, along with more effective and durable infrastructure for sanctioned development areas.

A third aspect of equity arises from the malfunction of the land market. Since the supply of land is nearly fixed and its value set by its highest potential use at any one time, the absence of effective government policy, planning, regulation, and strategic land market intervention has meant that only the most marginal and distant land, for which current potential returns are low, is still available to house the poor.

¹² Concept Note, Fifth Urban Research Symposium, World Bank, 2009.

Stimulating shelter upgrading for disaster resistant purposes would serve to compensate for past underinvestment in informal settlements due to high rates of rental tenure, poor information on best practices, the weak bargaining position of the urban poor, and lack of appropriate low-cost technology. This type of “low-cost, high-return” investment might be well justified on a cost-benefit basis while addressing past inequities for which the public sector is partly responsible.

Implications for Governance

Global climate change poses a historic challenge to governance systems of the developing world. Government institutions will need to play a significant role given the centrality of land use regulation, infrastructure investment, and settlement planning in responding to urban impacts. A proper long-term response by government would effectively direct private investment to where it can be most productive over the longer term. As with virtually any large-scale settlement policy, the bulk of housing investment will be from private sources.

Local governments will continue to have a critical role in responding to climate change impacts within their boundaries. But the national government has an obvious and critical interest, as well. Many of the cities facing the greatest impacts over the coming years are also port cities that are central to national economies. The critical work force for a vibrant port city is itself threatened by global climate change. Port facilities will eventually require additional investment due to rising seas and weather changes.

On a more practical level, it is unreasonable to expect a city in the developing world to have anywhere near the resources required for adaptation. Most cities have weak tax bases and have little established capacity for effectively carrying out larger-scale infrastructure projects. Funds from national level governments, with their more robust sources of revenue, including donor and international sources, will be required.

Responding to climate change impacts will require a broad acceptance of emerging data about the vulnerability of communities. It will also require acceptance of predictions of how climate change will affect particular cities and incorporation of response into policies. It will require a much longer planning horizon than now employed in virtually any city. Finally, it will require public flexibility and tolerance for uncertainty given the fact that predicted local effects of global climate change will always lack precision. Instead public officials must work with a fairly broad predicted range of the extent of any impact, with predictions naturally becoming less certain the longer the planning horizon.

The following matrix identifies the general types of adaptation responses – both public and private sectors – for low-income urban areas for several local effects of climate change:

SUMMARY MATRIX OF CLIMATE-RELATED THREATS AND POTENTIAL PUBLIC AND PRIVATE RESPONSES

Threat	Directly Impacted Areas	Public Adaptive Investment		Private Adaptive Investment	
		Short-term	Longer term	Short-term	Longer term
Increased storm activity in coastal areas	<ul style="list-style-type: none"> - Low-lying settlements - Settlements on steep slopes - Settlements in ravines 	<ul style="list-style-type: none"> - Improving early warning systems - Improving evacuation systems - Improving systems for emergency distributions of food, etc. 	<ul style="list-style-type: none"> - Hardening of infrastructure to improve survivability 	<ul style="list-style-type: none"> - Low-cost upgrading (e.g. roof tie downs) 	<ul style="list-style-type: none"> - More substantial upgrading that might require home improvement lending and incentive systems for landlords
Rising sea levels	<ul style="list-style-type: none"> - Low-lying settlements 	<ul style="list-style-type: none"> - Sandbagging and similar stop-gap measures for immediate protection of most vulnerable areas 	<ul style="list-style-type: none"> - Seawalls and landfill where possible - Upgrading of infrastructure to adapt to higher water tables, salt-water infiltration, etc. 	<ul style="list-style-type: none"> - Community-based emergency measures 	
Increased temperature	<ul style="list-style-type: none"> - All urban residents 		<ul style="list-style-type: none"> - Tree planting and the like to reduce urban heat island effects 	<ul style="list-style-type: none"> - Modest opportunities to improve natural cooling of existing construction 	<ul style="list-style-type: none"> - Retrofitting construction to improve natural cooling systems - Improving building standards for new construction
Increased air pollution	<ul style="list-style-type: none"> - All urban residents, though possibly more severe for those near polluting industry and transportation 	<ul style="list-style-type: none"> - Controlling motor vehicle use - Increase use of existing mass transit systems 	<ul style="list-style-type: none"> - More stringent emissions standards and regulations - Expansion of mass transit systems 	<ul style="list-style-type: none"> - Tighten structures to keep children indoors on extreme pollution days 	<ul style="list-style-type: none"> - Improved construction to allow for improved ventilation systems

V. LONG-TERM ISSUES AND CHALLENGES IN RESETTLEMENT

Over time a growing number of low-income settlements and an increasing population of the urban poor will become vulnerable to the effects of global climate change. This is inevitable. Although the *pace* of change to the environment occasioned by climate change is and will remain less precise than one would want for planning purposes, there is near certainty that these impacts will occur. A growing amount of inhabited urban land in many cities will simply not be able to sustain current settlement, much less the continued growth through densification and expansion. Resettlement will have to be part of a long-term strategy for many cities in order to effectively adapt to global climate change impacts.¹³

Threatened residential areas include areas settled by all economic classes. However, when viewed in terms of the number of affected families, lower income families are the overwhelming group. Absent any public action, uninhabitable areas will be abandoned over time as a natural human ecological process. Areas will be destroyed by storm action or inundation and residents who survive will vacate and move on. This climate change-induced depopulation is reportedly just beginning to occur in a few places. Yet gradual relocation is insufficient and inefficient, and can leave vast populations exposed to tremendous risk.

For humanitarian and political reasons, governments will be expected to do better for their citizens than to simply allow a chaotic reshuffling of populated areas. Despite the obvious need for local and national governments to be proactive in their response, the slow-moving nature of global climate change may make it easy for governments to delay and to deflect pressure to act.

Responding to the massive need for resettlement will be one of the key challenges for many cities and countries in the developing world during the 21st century. Among the many issues that will arise as this process begins to play out are the following:

Cost-Benefit Assessment. Cost-benefit analysis will be essential to direct public investment toward the greatest net benefit. The costs of resettlement will include the value of new land and required infrastructure. Additional investment – either public or private – will be required for housing. The benefits will be much harder to tally in weighing which areas are of highest priority. Some questions to consider include: how

¹³ Notwithstanding the long-term need of many cities to relocate populations as global warming impacts become more severe, it should be noted that resettlement policies can and have been easily abused for political reasons, to favor certain groups, to displace and destabilize poor communities, and to make land available for alternative uses for quick profit.

are the risks of a lower probability catastrophic storm to be measured against the more certain but containable public health risks associated with deteriorating sanitation as water tables rise? How is the value of a healthier workforce to be calculated? Who should cover the costs of lost assets? How does a landlord and his investment figure into the equation? Should the fact that settlements have been “illegal” be a consideration?

The Role of Communities. Many informal settlements rely on community organization and cohesion to improve living conditions. Rural communities might have established urban satellite communities along village or familial lines, or the community might have developed more spontaneously over time. Engagement with the community will be critical to successful development and implementation of any adaptation strategy. This will be particularly vital where relocation becomes necessary.

Bearing the Cost of Resettlement. Much has already been debated about who should bear the cost of adapting to global climate change. The bulk of carbon emissions to date have come from developed countries, suggesting that they should bear a serious financial burden for adaptation. On the other hand, carbon emissions have been a byproduct of economic development that also benefits developing countries. Looking forward, a greater share of the carbon emissions will come from developing and transitional countries themselves as energy use increases, modern transportation modes become dominant, and consumption patterns change.

Local and National Government Roles. Threatened cities of the developing world will not have the resources needed to undertake major adaptation work as more settlement areas are threatened. Further, global climate change effects in a city are likely to have consequences for the national economy. Clearly there is an important role for national governments to play as resettlement becomes necessary.

Implied Tenure Rights in Informal Settlements. Many threatened settlements have been in existence for decades. Despite the lack of formal tenure, social and political systems may recognize an informal use right akin to a *de facto* tenure status. The legal system might need to accommodate these rights and some form of compensation may be expected in the course of resettlement.

The Role of Secondary Cities. For many countries the major port cities are the most threatened by climate change effects. The same physical characteristics that make them vulnerable today – low elevation and easy, safe access to the sea – are those that have made them dominant in the nation’s economy. Now secondary cities under less immediate threat, and perhaps further inland, will need to take up more of the burden of

population growth. A more comprehensive regional growth strategy to direct settlement and jobs to cities less threatened by storm activity will be warranted.

Creating a Market Response. The low incomes of urban residents in threatened areas create a challenge in a number of respects. First, poverty can undermine the effort of a resident to find other sustainable housing options on his own. Second, given the limited market options, current living conditions, notwithstanding the threat posed by climate change, could well be perceived as the best option, particularly if proximate to employment. Third, the lack of personal assets might limit the ability to reduce immediate climate-related threats through upgrading of present housing.

The Cost of Delay. As a slow-moving disaster, the costs of delay in responding will be difficult to predict. For example, it might be possible to anticipate the rising costs of adaptation measures, such as building seawalls, if settlement is not better regulated. On the other hand, given the complexity and uncertainty about the pace of climate changes, it will be difficult to know the extent to which the economy itself will be undermined if necessary resettlement is put off for the short to medium term, and the productivity of the workforce and social cohesion decline as a result.

VI. OPPORTUNITIES FOR SUPPORTING URBAN ADAPTATION TO GLOBAL CLIMATE CHANGE

Broad, substantial, and ongoing support from development agencies to support multiple aspects of adaptation to climate change is likely to occur in the years ahead. It is far from clear, however, how the parameters for this support by sector and country are likely to play out as needs become more pronounced. Adaptation touches on virtually all development sectors and competition for scarce resources, from donor and other sources alike, is certain to intensify, while private sector flows are likely to far outstrip donor support in the long term.

Further clouding the issue is the ongoing debate about how, in general, to incorporate climate change into development assistance. One school of thought believes that climate change needs to be incorporated as a critical design factor in virtually all development projects. Another view believes that climate change will come to occupy a central position in building sustainable national economies of the future. It would then follow that development interventions should be designed with specific climate change adaptation goals in mind.

How adaptation funding to support poor urban communities fits into this mix is far from certain. To date very little work has been done on the potential impacts of climate change

on poor and informal urban settlements in low and middle income countries.¹⁴ Along with a stronger baseline on local conditions and projected impacts from climate change, new methodologies for cost-benefit analysis specific to urban conditions are needed.

Development agencies should incorporate climate change adaptation in broad development policies and strategies. Such strategies frame donor funding and, as importantly, the underlying issues and development opportunities that animate international collaboration. Organizational capacity of development agencies would also adjust over time to increased attention to climate change adaptation.

Coincidence of Interest with Long-Standing Urban Development Assistance.

As pointed out earlier, global climate change amplifies a host of development themes in the urban sector. It then follows that a recommitment to these themes is itself an adaptive response. Among the most obvious of these areas of coincidence of interest are:

Disaster-Resistant Housing. This has long been a concern in coastal areas, particularly in Asia. The value of home improvement investment will bring greater returns in the 21st century as such improvements might well be critical for survival.

Secondary City Development. To the extent that growth policies effectively shift future settlement toward secondary cities, they are often shifting investment to more sustainable cities. The

primary city is likely to have exhausted prime land for residential use and further growth of low-income populations is only achieved through greater density in vulnerable areas.

Equitable Development of Infrastructure. The imbalance in infrastructure between low and higher income areas within a city is a defining characteristic of a city beset by informal slum development. To the extent that international agencies can support a re-

Broader international assistance could be provided in a host of areas that improve the capacity of the country to protect the urban poor while developing practices that might be replicated elsewhere:

- Improving the legal environment for land use planning, public acquisition of land, and regulatory systems for development controls.
- Setting up systems to map and develop the databases to identify and delineate settlements according to threat level from climate change impacts.
- Low-cost settlement schemes as an alternative to further growth or densification of current settlements in highly vulnerable areas.
- Community-based programs to engage local residents on the longer term issues associated with adapting to global climate change.
- Research and promotion of alternative building and infrastructure designs and materials.
- Emergency response systems for storm events.
- Information-sharing networks for cities facing similar adaptation challenges in the years ahead.
- Pilot programs to create incentives for relocation of unsustainable settlements through market forces.

¹⁴ “Adapting to Climate Change: Water Management for Urban Resilience,” Mike Muller, 2007.

balancing of infrastructure investment with more resources going to lower income areas, the effect will be a hardening of those low-income areas against climate change effects.

Urban Water and Sewerage. With the anticipated fall and increased variability of precipitation, particularly in Africa, water-stressed cities will come under increased pressure to raise water sector investments. These investments in primary systems have the potential to benefit even the most underserved residents.

Current U.S. Government Funding for Urban Adaptation

Coming out of the 2009 Conference of the Parties of the UN Framework Convention on Climate Change, the Copenhagen Accord represents the latest substantial international commitment to adaptation funding. Nations are providing so-called *fast start* funding for climate-related activities, for which world-wide commitments total \$30 billion. The U.S. provided approximately \$1 billion in funding in 2010 through USAID, the Treasury Department, and the State Department using a range of mechanisms. Some funds are provided through multilateral finance institutions.

U.S. global warming assistance generally falls under three “pillars,” 1) adaptation, 2) clean energy, and 3) sustainable landscapes. Within adaptation, USAID has undertaken a few projects that are geared toward reducing the vulnerability of urban settlements to the effects of global climate change. Recent examples include an urban drainage and land management project in Honduras and a water resources project in South Africa. Both projects focused on long-standing local issues, which are exacerbated by global warming impacts. USAID has also funded various water projects under the Paul Simon Water for the Poor Act to improve urban water supply. Some of these projects result in reduced vulnerability of a city’s water supply in the event of persistent reduced rainfall. A broader systemic approach to reducing the vulnerability of cities, and particularly of the most vulnerable informal settlements within those cities, to the anticipated effects of global warming has not been developed by USAID.

ANNEX I. CURRENT INTERNATIONAL SUPPORT FOR URBAN CLIMATE CHANGE ADAPTATION

Introduction

The difficulty in separating adaptation from development has complicated efforts to estimate adaptation costs in developing countries.¹⁵ A 2007 United Nations Development Programme (UNDP) estimate pegged the cost at \$87 billion per year, but estimates vary dramatically. This is especially the case for the urban poor and under-housed whose needs are already immense without the additional stresses brought by climate change. Current funding for adaptation is very modest and virtually none of these funds have been applied to capital projects.

There are two broad categories of international support for climate change adaptation. The first is a result of the Kyoto Protocols and subsequent agreements. The second are donor-funded programs, notably that of the World Bank, often in partnership with regional development banks. Neither, however, has provided much support for adaptation activities specifically geared to the evolving needs of the urban poor and under-housed.

United Nations Framework Convention on Climate Change (UNFCCC).

UNFCCC sponsors three funds specifically for adaptation purposes:

- *Least Developed Country Fund.* Supports preparation and implementation of National Adaptation Plans of Action.
- *Special Climate Change Fund.* Focuses on development, with activities integrated into national poverty reduction strategies.
- *Global Environment Facility (GEF) Trust Fund Special Priority on Adaptation.* Supports adaptation activities that also generate global environmental benefits.

These are partially supported by the flexibility provision under the Clean Development Mechanism (CDM) established under the Kyoto Protocols. This provision allows industrialized countries to invest in emissions reductions wherever it is cheapest around the globe. The reduced emissions achieved overseas through funded projects are subtracted from the hypothetical baseline of carbon emissions in the home country of the investor. The CDM is subject to a two percent levy dedicated to adaptation. This levy is intended to be the main source of income for the UNFCCC funds. Actual funding for

¹⁵ “Financing Adaptation: Opportunities for Innovation and Experimentation,” World Resources Institute Conference Paper, Manish Bapna, Heather McGray. November, 2008.

projects has moved slowly and the first project was not approved until 2010. GEF, an intergovernmental organization created in 1991, manages these funds.

Under the program, an adaptation project is defined as “a set of activities aimed at addressing the adverse impacts of and risks posed by climate change.”¹⁶ Adaptation projects can be implemented at the community, national, and trans-boundary level. The immediate promise of this program for urban areas is quite limited due to the modest funding to date and the breadth of eligible activities.

Funds are also provided for developing National Adaptation Plans of Action (NAPAs). These plans focus on urgent and immediate needs – those for which further delay could increase vulnerability or lead to increased costs at a later stage. NAPAs are based on existing information rather than new research, and are meant to be action-oriented and flexible.

Multilateral Donors – Climate Investment Fund

The World Bank has developed its own set of global climate change resources – the Climate Investment Fund (CIF). Resources are disbursed through the various multilateral development banks to support effective and flexible implementation of country-led programs and investments. The funds are intended to fill financing gaps in supporting efforts aimed at climate mitigation or strengthening resilience to climate change impacts. The funds are intended to complement existing bilateral and multilateral financing mechanisms and to be coordinated with the programs of other financial institutions.

There are a number of discrete funds operated under the CIF. The one that could best support urban needs is the Pilot Program for Climate Resilience. This program aims to demonstrate ways to integrate climate risk and resilience into core development planning, while complementing other activities. Ten countries and two regions were initially selected to participate. In late 2010, the sub-committee managing the program endorsed its first Strategic Programs for Climate Resilience for three countries, Bangladesh, Niger, and Tajikistan. The Bangladesh Program has a significant urban focus, reflecting the high vulnerability of large coastal settlements in the low-lying Country.

Carbon Finance and Market Innovation Funds

The World Bank Group also manages ten funds and two facilities, with US\$2.3 billion in committed funds, of which more than US\$1.9 billion is tied to emission reductions purchase agreements. The new facilities, the Forest Carbon Partnership Facility

¹⁶ Adaptation Fund, Operational Guidelines, 2011.

(FCPF)—for reduced emissions from deforestation and forest degradation (REDD)—and the Carbon Partnership Facility (CPF)—for programmatic and sector-wide intervention—are further broadening the scale and duration of carbon finance for developing countries.

The World Bank Treasury supports the flow of innovative financing for “climate smart” investments, including through “*Uridashi* WB Cool Bonds.” The bonds consist of five-year, US\$-denominated notes tied to Certified Emission Reductions (CERs) generated by specified Green House Gas (GHG) reducing projects in China and Malaysia, Green Bonds (US\$665 million through two issuances for adaptation and mitigation projects); and Eco-3-Plus Notes (US\$390 million in three transactions for “green” activities). A number of these facilities might one day be significant sources of funds for adaptation activities to meet the needs of the urban poor. The Bank has in fact completed one sale of CERs for the UN Adaptation Fund in May 2009 and June 2009, raising US\$20.2 million.

Networking Projects

Several organizations have funded activities to building learning networks among cities facing similar challenges in the face of global climate change. Among these are:

- The Rockefeller Foundation has initiated its Asian Cities Climate Change Resilience Network (ACCCRN), which aims to “catalyze attention, funding, and action on building climate change resilience for poor and vulnerable people by creating robust models and methodologies...” Interventions under the program would span health, infrastructure, water, disaster planning, and urban planning/development issues. The program foresees leveraging policy incentives and investment funds to improve infrastructure, services, disaster management, and preparedness strategies.
- The UN-Habitat Cities and Climate Change Initiative is designed to promote policy dialogue, development tools, and implement pilot activities in the cities of Sorsogon (Philippines), Esmeraldas (Ecuador), Maputo (Mozambique), and Kampala (Uganda). A number of other organizations, such as Cities Alliance, are partners in this effort. Funding comes from the Government of Norway and UNDP.
- The International Council for Local Environmental Initiatives (ICLEI), through its Cities for Climate Protection Campaign, provides a framework to enable local governments to integrate climate protection policies with actions that address immediate municipal concerns. This is a broad movement with 546 local governments in 27 countries. USAID has provided support to this effort.

Urban Risk Assessment Programs

An important area for international expertise and collaboration is assessing near and longer term risks associated with climate change. Some risks are broadly predictable but with substantial margin of error on the anticipated pace of change. An example is sea level rise. Others, such as increased storm activity, are region-specific and based on long-term probabilities of occurrence that are increasingly being questioned. Methodologies specific to the urban context will need to take into account, particularly for large and capital cities, the potential externalities of disasters (such as systemic damage to the economy and public administration). They also need to account for the substantial build up of capital in urban areas.

In partnership with The United Nations Environment Programme (UNEP) and UN-HABITAT, and with the support of Cities Alliance, the World Bank is developing a standardized, cost-effective tool to carry out an urban risk assessment. It is intended to harmonize how information is gathered and analyzed in relation to disasters and climate risk at the city level, and to identify areas and populations that are most vulnerable. The Urban Risk Assessment will provide a methodological framework for both qualitative and quantitative assessments, which will enhance a local government's capacity to do the following:

- Identify primary and secondary hazards arising from disaster and climate change risks.
- Assess relative exposure and vulnerability of specific city assets and populations.
- Analyze institutional capacities and data availability.
- Quantify city vulnerabilities through the application of a baseline-benchmarking approach to assess progress over time and space.

The tool will also provide a mapping capability for slum areas in order to identify populations at greatest risk and prioritize adaptation measures.

ANNEX II. EXAMPLES OF URBAN ADAPTATION PLANNING

Cochin, India

The area in and around Cochin, India has long hosted large populations and plays an important role in the regional economy. Construction, port and harbor operations, dredging and mining, and pollution discharges have all affected the local environment. The region has a history of flooding and droughts. Climate change is now beginning to increase the likelihood of these events, whose impact on the local economy grows as the region develops.¹⁷

In response to these issues, a coastal zone management plan was drafted. The plan includes a Coastal Regulatory Zone (CRZ). As a result of a designated CRZ, there is now a heightened level of awareness of the need for coastal regional conservation. The precepts of the CRZ affect the introduction of planned development, the recognition of the rights of fishermen, the regulation of industrialization and unplanned growth, the control over pollution discharges, and the increased attention to the protection of life and property from natural hazards.

The plan did elicit opposition due to its ban on housing in selected “no-development” zones, reduction in certain infrastructure development in designated coastal areas, the possible acceleration of slum development in frontage areas of existing buildings, the misinterpretation of provisions of the local authorities, the blanket ban on industries in some areas, and the total ban on reclamation and ground water extraction.

The focus on the Cochin areas resulted from use of the so-called Driving force – Pressure- State – Impact – Response (DPSIR) to prioritize high impact areas. A Peoples’ Planning Program (PPP) was initiated in Cochin to channel public participation in the planning process. The PPP is administered through very short term action plans of two weeks to two months, and distinct short, medium, and long-term activities.

The use of GIS was an important tool to focus experts and community participants alike on a common data base. This dramatically showed the extent of development of the last quarter century, the reduction of forest cover, the conversion of barren land to mixed crops, and the significant reduction in paddy cultivation.

¹⁷ “Management Strategies for Urban Coastal Zones: Integrating DPSIR Concepts with GIS Tools I People’s Participatory Programs,” Alungal N. Balchand, Mooleparambil S. Madhusoodhanan, And C. Reghunathan.

Durban, South Africa

Prior to South Africa's democratic transition in 1994, environmental management at the local level received scant attention. Since then the process of democratization and the development of new local government structures included a much revised development agenda that sought to address basic needs.

The first serious discussions on climate change started a few years after the democratic transition in a charged political context and amidst rapid urbanization.¹⁸ Led by the City's Environmental Branch, Durban joined the USAID-funded Cities for Climate Protection Campaign in 2000. The municipality's first greenhouse gas emissions inventory was soon undertaken, followed by other mitigation activities, including a landfill gas-to-electricity initiative. These technical undertakings were concerned with the city's contribution to the global greenhouse gases but were not related to the needs of Durban's residents and their pressing development agenda. As a result little discussion and enthusiasm ensued.

From the perspective of the city government, the extent to which climate change could garner broader support and enthusiasm was related to how successfully the issue could be institutionalized in day-to-day operations, planning and decision-making. Accordingly, Durban revised its approach to climate change in 2004, focusing on adaptation rather than mitigation. An adaptation strategy was developed that clarified the relevance of climate change to virtually all departments and agencies within the municipal government:

- **Health.** Some impacts are direct, such as warming exacerbated by heat island effects. Others arise through disturbances to ecological processes, for example the distribution of infectious diseases, freshwater supplies, and food availability. Certain groups, including the elderly, children, and low-income and immune-compromised individuals, are especially vulnerable. Out of this assessment and recognition, certain responses were delineated, such as education, ensuring continued electricity supplies, promoting shade tree planting, securing improved water resources, and developing early warning systems.
- **Water and Sanitation.** Increased variability of rainfall will put added stress on storage facilities. Integrated water resources management can be applied to adapt to hydrological impacts of climate change to reduce vulnerabilities. Other responses, such as differential pricing, public awareness campaigns, and

¹⁸ "Thinking Globally, Action Locally: Institutionalizing Climate Change with Durban's Local Government," Cities Alliance, June 2010.

improved statutory requirements regarding household technology and water use, were found to be important.

- **Coastal Zone.** The planning process reinforced the need to invest heavily in protecting the coastline in advance of rising seas. Based on new mapping of 50 and 100-year flood plains, the most vulnerable communities, as well as areas in which to avoid future development, have been identified.
- **Key Infrastructure at Risk.** As infrastructure design is generally based on past climactic conditions, they are no longer necessarily accurate for purposes of planning, maintenance and upgrading. The process began to point to revise road construction standards and routes at high risk for flooding, based on projected effects of climate change in the 21st century.
- **Disaster Risk Reduction.** Durban's disaster management emphasis had been on technological disasters, given that the metropolitan area is an important industrial center. They were not synchronized with citywide health emergency plans required in response to climate change. Based on the work of the committee, the scope of disaster risk reduction is expanding with more emphasis on enhancing early warning systems, improving resilience in construction and infrastructure, relocating people and infrastructure away from high risk areas, and planning new development in less vulnerable areas. In the next phase an urban integrated assessment framework will be developed. This framework will facilitate evaluation and comparison of development options and policies within the context of climate change.