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# Addressing Conundrums for Urban Environmental Planning under Climate Change in Mexico City, Mexico and Rosario, Argentina

Eric Pasay
*Clark University*, eric.pasay@gmail.com

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# Addressing Conundrums for Urban Environmental Planning under Climate Change in Mexico City, Mexico and Rosario, Argentina

**Eric Pasay**

**May 2017**

**A Master's Paper**

**Submitted to the faculty of Clark University, Worcester, Massachusetts, in partial fulfillment of the requirements for the degree of Master of Science in the Department of International Development, Community, and Environment**

**And accepted on the recommendation of**

**Dr. Timothy Downs, Chief Instructor**

**Abstract**

**Addressing Conundrums for Urban Environmental Planning under Climate Change in Mexico City, Mexico and Rosario, Argentina**

**Eric Pasay**

Urban centers in Latin America are experiencing rapid growth and a host of intertwined environment and development problems related to climate change. In response, cities have started implementing sustainability initiatives and climate action plans. These plans generally target key sectors, ranging from transportation to water and sanitation, and focus on infrastructure improvements. Often, the objectives of sustainability plans are not met and tend to be mitigation-centric, despite explicit calls to address urban poverty. This paper analyses two case studies in Mexico City, Mexico and Rosario, Argentina to illustrate three risk conundrums that limit the success of sustainability initiatives in cities. Following this analysis, a six-domain (6D) framework is applied to create an alternative approach that includes indicators for contextually addressing risk conundrums throughout each stage of a project. The result is a social enterprise approach that is more equitable and focused on process as well as outcomes.

**Timothy J. Downs, D.Env.**

**Chief Instructor**

# ACADEMIC HISTORY

**Eric Pasay** **May 2017**

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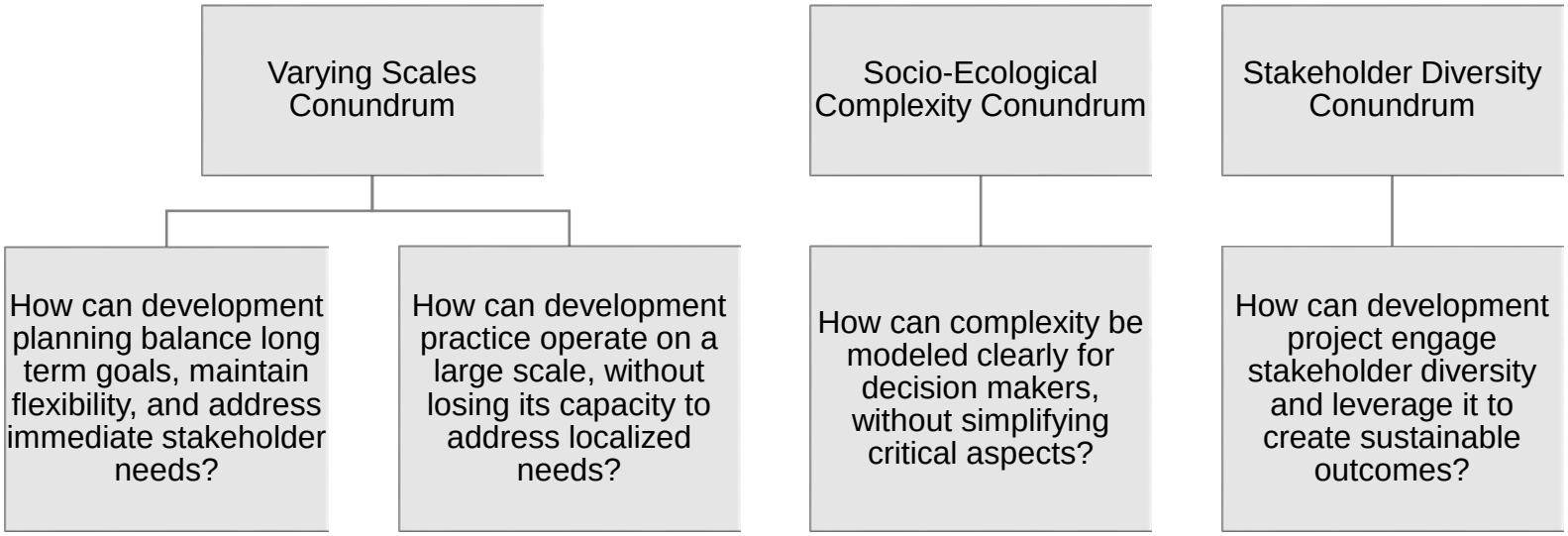


**Figure 3. Three risk conundrums and their guiding questions.**

**Table 1. Five stages of *Plan Verde* development, including critiques and alternative approaches.** Critiques drawn from Morris and Madero (2016).

| Stage | Mexico City Critique | Alternative Approach |
|---|---|---|
| 1. Conceptual, design | Goal to transform Mexico City into the 'sustainability leader' of Latin America. Designed in top-down fashion by the *Secretaría de Medio Ambiente* (SMA) and other government departments. Sustainability actions targeted seven topics (e.g. climate change and energy) and primarily focused on greenhouse gas mitigation. *Plan Verde* did not consult all government ministries and local governments. Public opinion largely represented by NGOs and SMA on the Board. Pre-launch public participation questions irrelevant and not taken seriously. | Reframes *Plan Verde* and climate adaptation program as social enterprise. Emphasizes inclusiveness and transparency, and values citizen participation and diverse forms of knowledge. Focuses on linkages among key sectors. Addresses conundrums and coordinates widespread public support. Depoliticizes implementation. Participation of the 24 city departments involved in the design stage is sustained throughout the remaining project stages. |
| 2. Assessment | Centered on greenhouse gas mitigation and infrastructure improvements. Did not include all jurisdictions within the *Zona Metropolitana del Valle de México* (ZMVM). Needs framed around infrastructure. Weak horizontal communication among government department, undermining environmental assessments and weakening the connection with conceptual and planning stages. | Shifts needs from GHG mitigation to vulnerability reduction, redefines spatial scale. Strengthens horizontal and vertical modes of collaboration to make assessment more inclusive and transparent. Knowledge network created and shared by diverse stakeholders. |
| 3. Planning | Top-down planning, only 5.4 % of citizenship considered. Not enough time to build a participative community or allow citizens to adjust to modes of participation. SMA not devoted to fostering participation. Driven by SMA, participation from other departments not required. | Grounds action at the grassroots level to withstand political turnover. Creates legally binding plan that spans multiple ministries and ZMVM jurisdictions. Transparent and inclusive. Tightly linked with assessment stage, and emphasizes flexibility. |
| 4. Implementation | Board members' attendance dropped from 95% to 10%. Horizontal fragmentation and political turnover rate threatened project longevity (p. 1741). Information primarily shared online, though only small portion of population use internet. Meeting records not available to the public. Multi-lateral participation threatened by: socioeconomic diversity; low education levels; socio-ecological complexity; stakeholder inequity, and a population unused to democratic participation (p. 1742). | Focuses on capacity building and collaboration across scales. Fosters transparency and effective modes of sharing information among all stakeholders. Activities leverage linkages among stakeholders and key sectors. Flexible to diversity and non-prescriptive. |

| | | |
|---|---|---|
| 5. Monitoring | Performance indicators did not represent reality and were not comparable or detailed, undermining needed programmatic changes. Data and criteria were unclear. *Plan Verde* and website largely abandoned after change in administration. Lack of empirical data to measure social-ecological impacts of strategies, weak connection with implementation. Not enough time for Board members to analyze pre-meeting progress reports. | Monitoring responsibilities are shared equitably. Performance indicators measure socio-economic impacts and are comparable to baseline data. Internal and external evaluations performed regularly. Funding is monitored closely to restrict corruption. Adaptive to indicators and other stages. Board member participation is incentivized and sustained. |

**Table 2. List of *Plan Verde* stakeholders, their level of influence and type of involvement.** Not a comprehensive list**.** Drawn from Madero and Morris (2016), and Gallucci (2010).

| Category | Name | Level of Influence | Major Involvement |
|---|---|---|---|
| Governmental | City Government and Departments | High | Primary stakeholder of *Plan* Verde. 13 city departments directly involved, 11 indirectly involved. |
| | Mayor Marcelo Ebrard | High | Primary public representative of *Plan Verde*. Mayor from 2006-2012. |
| | *Secretaría del Medio Ambiente* (SMA) | High | City department predominately responsible for *Plan Verde* and public engagement. |
| | *Delegaciones* | Medium | 16 *delegaciones* in ZMVM. Some developed local green plans in their immediate jurisdiction (e.g., *Miguel Hidalgo, Coyoacán*) |
| | States and Local Authorities | Low | Responsible for local planning. Local participation in *Plan Verde* was absent. |
| International Recognition | C40 Cities | High | Mexico City is a C40 partner and hosted the 2016 Mayors Summit. C40 gave multiple sustainability awards to Mexico City. |
| | ICLEI (Local Governments for Sustainability) | High | Mexico City is a ICLEI member. ICLEI facilitates local sustainability agreements for cities. |
| | Harvard Roy Family | Low | Gave Mexico City the Award for Environmental Partnership (2009). |
| | Institute for Transportation and Development Policy | Low | Gave Mexico City the Sustainable Transport Award (2013). |
| Academia and NGOs | *Presencia Cuidadana A.C* | High | Environmental NGO that participated on CESPV. |
| | *Muévete por tu Ciudad* | High | Human mobility NGO that participated on CESPV. |
| | *Naturalia* | High | Leading conservation NGO that participated on CESPV. |
| | Environmental academic experts | Medium-High | Participated on CESPV and *Plan Verde* research. |
| Civil Society | Public citizens | Low | Participated in pre-launch survey (*Consulta Verde*) and post-launch outreach campaigns. |
| | *Cibercentros* | Low | Free computer centers for the public to access the internet and participate in *Plan Verde.* |
| Donors | Clinton Global Initiative | High | Proposed $200 million for *Plan Verde* in 2010. |

**Table 3. Five stages of environmental planning in Rosario, Argentina, including critiques and alternative approaches.** Critiques drawn from Hardoy and Ruete (2013).

| Stage | Rosario Critique | Alternative Approach |
|---|---|---|
| 1. Conceptual, design | Goal of integrating climate change adaptation into urban development planning. No GHG inventory and local authorities view adaptation as diffuse issue. Connection among various government departments presents opportunity to address climate change. Mostly focused on mitigation actions. Some orientation towards social services, capacity building and emergency management systems. Uniformed public hinders participation. | Develops a social enterprise approach to adaptation planning. Continues to integrate climate change policy into existing development schemes. Diversifies funding sources and establish baseline data needed secure funding. Uses third-party groups to facilitate meetings and public participation. Garners national support. |
| 2. Assessment | Adaptation strategies linked to extreme weather and flood-related risks. Investments in infrastructural defenses, sustainable water and land management, and early warning systems. Conflicts with powerful stakeholders and landowners have emerged. Citizen participation not fully realized. Inadequate baseline data limits mitigation and adaption planning. | Formulates baseline data on climate change vulnerability and impacts. Uses diverse knowledge sources to create a more integrative approach. Assesses needs across multiple socio-ecological scales. Prioritizes needs using socio-ecological models co-developed by all stakeholders. |
| 3. Planning | Slow to integrate adaptation into urban planning, as well as develop adequate governance mechanisms. Sub-secretariat for the Environment coordinates regularly with different secretariats and departments. New modes of coordination among secretariats (through GIS) established. Strained relationship with national government. Lack of capacity to facilitate effective participation with all stakeholders, especially citizens. | Develops transparent mechanisms to channel funding to local governments. Continues to establish tools to encourage multi-stakeholder enterprise. Balances top-down and bottom-up planning. Establishes inclusive processes that embolden grassroots adaptation and collective action. Grounds planning in resource reality. |
| 4. Implementation | Adoption of new norms slow and requires time and resources. Sub-Secretariat of the Environment is underfunded and depends on other areas for implementation (p. 351). The environment is not a cross cutting issue. Implementation and local policy changes not grounded in reality; based on unrealistic planning. Participation mostly involved formal groups and organizations. Unrealistic planning discouraged the Board, which stopped meeting. | Leverages linkages among key sectors and stakeholders. Focuses on inclusiveness and transparency. Integrative adaptation planning bridges diverse activities and scales, and is respondent to emerging needs. Adaptation becomes engrained in existing policies and urban development planning. |
| 5. Monitoring | Lack of funds and staff to implement and monitor projects. Not integrated with implementation and assessment stages. | Establishes integrative monitoring systems to track success and secure future funding. Encourages participatory evaluation methodologies. |

**Table 4. List of Rosario climate planning stakeholders, their level of influence and type of involvement.** Not a comprehensive list**.** Drawn from Hardoy and Ruete (2013).

| Category | Name | Level of Influence | Major Involvement |
|---|---|---|---|
| Governmental | National Government | Medium | Provides funding to provincial and city governments. |
| | Provincial Government | Medium | Channels funding and services to city government. |
| | City Government | High | Predominately responsible for urban development and services . |
| | Mayor and Socialist Party | High | Continued socialist leadership spanning multiple administrations. |
| | Local Municipal Governments | Medium | Implements adaptation strategies. Provides services. |
| | Public Health Sector | Medium | Takes up 25% of the municipal budget. |
| | Agricultural Sector | Medium | Major sector that has historically determined development patterns. |
| | Sub-Secretariat of the Environment | High | Contributed to the creation of the city's climate strategy. |
| | *Servicio Público de la Vivienda* | High | Provides housing services and programs. |
| | Construction Chamber | High | Powerful group heavily involved in urban development. History of conflict with other groups. |
| | Municipal Civil Defense | High | Provides emergency response services and training. |
| | Department of Water Management | High | Develops flood risk thresholds and construction regulations. |
| Donors | *Rosario Hábitat programe* | High | Major development funding source that ended in 2012. |
| | *Programa de Mejoarmento de Barrios* | High | New development funding source. |
| | Inter-American Development Bank | Medium | Major development donor for Rosario. |
| Academia and NGOs | University of Rosario | High | Develops flood risk thresholds and construction regulations. |
| | *Universidad Tecnológica Nacional* | High | Helped create climate strategy. |
| | School of Architects | High | Actor heavily involved in urban development. History of conflict with other groups. |
| | Taller Ecologist | High | NGO that helped create the city's climate strategy. |
| | NGOs (general) | Medium | Often represents civil society in planning meetings. |
| Civil Society | Informal Settlements | Low-medium | Growing and most vulnerable to climate change impacts. |
| | Rosarinos | Low | Interests often in direct conflict with private sector. |
| Private Sector | Construction Companies | High | Actor heavily involved in urban development. History of conflict with other groups. |

## LIST OF MAPS

**Figure 1. Mexico City, Mexico**

**Figure 2. Rosario, Argentina**

## 1.0 INTRODUCTION

The global urban population grew from 746 million people in 1950 to 2.9 billion people in 2014 (UN, 2014). This growth is expected to continue well into the future as the number of megacities, characterized as ten million people or more, will nearly double from twenty-eight in 2014 to forty-one in 2030 (ibid). Rapid urban growth has posed a number of challenges for city planners and sustainable development (SD) practitioners, notably in less industrialized countries where infrastructure and policies are not in place to promote social and environmental equity. In these countries, rapid urbanization has contributed to an increase in informal settlements where vulnerable communities are at risk from extreme weather events (Revi et al., 2014). This risk is often exacerbated by a changing global climate and a lack of government services that are needed to respond to social crises within the city.

In recent years, academics, international agencies and development organizations have started to focus on city-level assessments of climate change impacts and responses (Hunt and Watkiss, 2011). Cities are highly vulnerable to climate change impacts, which place strain on infrastructure, governments, civic society, and the environment (UN Habitat, 2012; Revi et al., 2014). It is widely accepted that those most affected by climate change are the urban poor, and that climate change undermines human security by reducing access to natural

resources and undermining states' ability to provide services (UN Habitat, 2012; Barnett and Adger, 2007).

Cities have begun to form partnerships comprised of both local and international urban organizations aimed at developing climate change mitigation and adaptation strategies (Bestsill and Buckeley, 2007). Perhaps the most well known is C40 Cities, a partnership of 86 cities and mayors that have adopted 10,000 actions in response to climate change (C40 Cities, 2016). Partnerships like C40 have positioned cities as the leaders of climate change governance while also introducing intervention by non-state actors that are traditionally absent from urban governance systems. As Broto and Buckeley (2013) point out, the increased importance of non-governmental actors in urban climate change governance has blurred, and by some accounts extended, local forms of authority. Changes in urban governance structures are evidenced by a relatively recent surge in city-wide environmental policies, such as sustainability plans and climate action plans.

Many urban policies that combat climate change are predominately focused on greenhouse gas (GHG) mitigation strategies, e.g. energy efficiency or improved public transportation. Only recently has adaptation been given more focus within the urban climate change governance arena (Hunt and Watkiss, 2011). The Fifth Assessment Report (AR5) released by the Intergovernmental Panel on Climate Change (IPCC) defines adaptation as an "the process of adjustment to actual or expected climate and its effects…adaptation seeks to moderate or avoid harm or exploit beneficial opportunities" (IPCC, 2014). Adaptation takes many forms,

ranging from infrastructure improvements (most common) to social vulnerability reduction. Unlike mitigation, however, adaptation is largely unappealing to politicians who operate on short timeframes with fixed budgets (De Sherbinin et al., 2007). Adaptation becomes even more challenging when it moves from actions focused on the built environment to actions within complex social systems. Inherent to this shift in focus are the issues of justice, health, equity, livelihoods, race and vulnerability. Overall, most adaptation work to date has focused on reducing the impacts of climate change rather than the underlying causes of vulnerability to the impacts (Schipper, 2007). Vulnerability largely stems from pre-existing conditions unrelated to climate change, such as poverty (Klein et al, 2005; Schipper, 2007).

Many Latin American cities have released sustainability plans aimed at curbing greenhouse gas emissions and adapting to projected climate change impacts. However, some argue that the effectiveness of climate action plans (and environmental policy in general) in Latin America is undermined by the region's neoliberal history and business-as-usual (BAU) approach to urban development (Valenzuela-Aguilera, 2001; Hardoy and Pandiella, 2009). Urban expansion in Latin America has primarily taken place in areas lacking infrastructure and services, and that are subject to extreme weather events (Hardoy and Pandiella, 2009). This has resulted in densely populated, informal settlements comprised of highly venerable groups that lack the capacity to plan for and respond to disasters (ibid).

Addressing the concerns of poverty and inequality are necessary first steps to climate change adaptation in Latin America (Klein et al., 2005; Schipper, 2007; Magrin et al., 2014). As a result, climate change policy and development goals aimed at reducing poverty are tightly linked, and can thus be paired together to generate multiple benefits (Klien et al. 2005; Hardoy and Pandiella, 2009). While the mixing of climate change policy and development is exciting, synergistic policies that simultaneously address these topics may be counterproductive compared to an approach that addresses them separately (Schipper, 2007). Some scholars warn that, by mixing development and climate change policy, power elites can bolster the influence of hard core development agencies, such as the World Bank. This, in turn, may promote the continuation of business-as-usual development schemes that exploit resources, as well as create barriers to innovation by magnifying inequities of power within governments and society (Valenzuela-Aguilera, 2011; Downs and Mazari, 2017). Furthermore, climate change policies in Latin America are continually constrained by prohibitive governance structures, lack of resources, and conflicts between environmental and development goals at the local scale (Conde, 2000). Thus, sustainable development planners and policy makers must be able to identify and react to risks that threaten to undermine the sustainability of environmental projects and policies, especially ones at the nexus of climate change and development.

This paper compares two case studies of urban environmental planning under climate change in Mexico City, Mexico, and Rosario, Argentina. The

objective is to synthesize the limitations and opportunities of both policy approaches using three risk conundrums and a six-domain framework defined in section 3.0. Following this synthesis, an alternative, social enterprise approach to project development is presented.

## 2.0 BACKGROUND

### 2.1 MEXICO CITY

Mexico City has been frequently recognized as the leader when it comes to combating climate change in Latin America (Figure 1). In December 2016, the city hosted the sixth biennial C40 Mayors Summit to advance urban solutions to climate change (C40 Cities, 2016). Mexico City's recognition started early on with the creation of *Plan Verde*, an ambitious green plan launched in 2007 by the city's then-Mayor Marcelo Ebrard. *Plan Verde* targeted various sectors and aimed at reducing GHG emissions, water shortages, and air pollution, among other things. This highly politicized project was touted as an international success story, though it has largely dropped from the public eye since Mayor Ebrard lost re-election in 2012. The only piece of *Plan Verde* that remains truly active is the Climate Action Program, a second version of which was released in 2014 by the *Secretaría del Medio Ambiente* (SMA) and the Mario-Molina Center (PACCM 2014-2020) (Velasco Rodríguez et al., 2014). Other, more localized climate action plans and

environmental policies also exist in Mexico City, though they have not generated the same international recognition as *Plan Verde* (see Sosa-Rodriquez, 2014 for a detailed history of climate change policy in Mexico City).

Mexico City faces a number of climate change impacts, many of which can be observed at present. The city is expected to face more intense tropical cyclones, intense rainfall and flooding, outbreaks in human and animal disease, increased temperatures, heat stress, and greater land subsidence (World Bank Knowledge Portal 2.0, 2016; Downs and Mazari, 2017). Mexico City is located 2,200 meters above sea-level and enclosed within a mountain range (Lankao, 2010). As a result, the city regularly experiences temperature inversions and poor air quality. Problems with water quality, quantity, and access also typify city life. Mexico City is overexploiting its water resources by between 19.1 and 22.2 cubic meters per second, resulting in major land subsidence and greater vulnerability to climate change (ibid). Meanwhile, the sanitation and drainage systems of the city are frequently overwhelmed during strong precipitation events, due in part to poor maintenance. This has created a variety of public health issues and hazards (ibid). There are approximately 20 million people and over four million vehicles within the Mexico City Metropolitan Area (MCMA) (Eugenia-Ibarrán, 2011).

Various scholars have pointed out the limitations of climate change policy in Mexico City, which largely stem from problematic governance structures and top-down, technocratic policy making (Lankao, 2007; Valenzuela-Aguilera, 2011; Sosa-Rodriquez, 2014). This has made informed public participation almost non-

existent. As Lankao points out, the governance structure of Mexico City does not fit the function and boundaries of the city and imposes institutional and fiscal constraints on local governments and authorities. This problem is exacerbated by poor access to information, a lack of transparency and incompatibilities among federal and city initiatives to combat climate change (Lankao, 2007 and Sosa-Rodriquez, 2014). In addition, urban growth and development has historically been prioritized before climate change, creating an ongoing tension between the two that results in the favoring of short-term economic gain (Lankao, 2013).

Misguided adaptation strategies have also contributed to less successful climate policies in the city. Adaptation has focused primarily on early warning systems and technology-based approaches, rather than reductions in vulnerability. Meanwhile, Mexican authorities lack the resources or the incentives to communicate climate policy to the public, nor have they seriously considered the public during the policy and decision making process (Sosa-Rodriquez, 2014). This has maintained the elite status of climate change policy in the city, making participation accessible only to those who have some sort of political influence. As Valenzuela-Aguilera (2011) has argued:

> "…sustainability in Mexico has been extensively used to justify political agendas that have maintained traditional authoritarian rule and preserved the prevalent socioeconomic structure. Interestingly, this approach has been used by both the right-wing federal government in Mexico and the left-wing government of the capital city, since public policies at each levels still ground their legitimacy on the social control of the population… In the case

of Mexico City, local communities are often deprived of their right to participate democratically in the decision-making process of defining what kind of environment and lifestyle they wish to pursue. This authoritarian rule replicates the “civilizatory practices” of the nineteenth century, which supposedly brought “barbaric” cultures into the path of (sustainable) development and progress.”

## 2.2 ROSARIO, ARGENTINA

Climate change policy in Rosario, Argentina does not hold the same degree of international recognition as Mexico City. This is due in part to the city’s smaller size, lack of resources, as well as the highly politicized nature of Mexico City’s climate change policies in both the domestic and international spheres. The under-recognition of Rosario’s climate change polices is mirrored in the academic literature. Most scholarly articles, of which there are few, are focused primarily on urban-agriculture within a SD context (Spiaggi, 2005; CDKN, 2014).

Rosario is the third largest city in the country with a population of roughly one million people (Hardoy and Ruete, 2013) (Figure 2). It has a considerable degree of institutional stability which is attributable to its political roots in socialism. Multiple, consecutive socialist administrations have led to the city’s relative autonomy and its focus on social policies, decentralization, accountability, and urban planning reforms (many of which include environmental components). Socialism in Rosario, however, has also created tension with the provincial and

federal governments through which it receives much of its funding (ibid, see Hardoy and Reute (2013) for more information).

Rosario faces many of the same climate change impacts and underlying socioeconomic disparities as Mexico City. Rosario's streams and stormwater systems are frequently overwhelmed by heavy precipitation events, which are expected to intensify in the future, making flood risk management an important component of adaptation planning (ibid). Spatial inequalities in the city also exist, despite government decentralization initiatives that have increased services in impoverished areas and informal settlements (ibid). These areas are particularly vulnerable to extreme weather events. Countrywide impacts from climate change include an average temperature increase of 0.5 C from 1901-2012, an increased number and intensity of heat waves, an increased number of hot nights, increased average precipitation, more frequent flood events, and changes in seasonal river flow rates due to glacial melt (Barros et al., 2013). These impacts may cause adverse changes to Argentina's agricultural system, which the nation's economy relies heavily on. Barros et al. (2013) suggests a few major adaption measures that Argentina can take to mitigate the impacts of climate change: 1) reducing public vulnerability to heat waves and extreme weather events and 2) reducing the agricultural sector's vulnerability.

## 3.0 METHODS

The analysis is guided by three common challenges - hereby referred to as *conundrums* (Figure 3) - that tend to systematically undermine the sustainability of policies and projects (Downs et al. 2017, Downs and Mazari 2017) (Figure 3). The first is the *Socio-Ecological Complexity Conundrum*, which arises when stakeholders either oversimplify or undersimplify complex socio-ecological systems, resulting in an unclear and limited decision-making process. The second is the *Varying Temporal/Spatial Scale Conundrum*. This conundrum occurs when stakeholders fail to balance long-term and short-term goals, and when projects fail to operate at overlapping smaller and larger spatial scales. The third conundrum is the *Stakeholder Diversity Conundrum*, which arises when project stakeholders fail to reconcile competing needs or when the participatory process is not inclusive or representative of each stakeholder group. To analyze the cases, and to help address conundrums and systematic gaps in practice we apply an integrative, empirically based framework of *six domains* (6-D) (Downs et al. 2017): 1) project framing, concept and design; 2) development topics and sectors (including gateway topics/sectors that resonate with stakeholders); 3) stakeholder interests, relationships and capacities; 4) knowledge types, disciplines, models and methods; 5) temporal and spatial scales; and 6) socio-technical capacities and networks, including education, information, policy, technology and enterprise development. We apply this framework and its insights as a means for logically critiquing each operational stage of the two cases: 1) conceptual; 2) assessment; 3) planning; 4) implementation; and 5) monitoring. For each stage we: a) describe

existing practice; and b) suggest improvements. We then describe the need to re-frame and re-design development as a socio-technical capacity building enterprise.

The first case study chosen for this analysis are the participatory processes underlying Mexico City's 2007 sustainability plan, *Plan Verde* (Morris and Madero, 2016). This case study was chosen because of the highly politicized nature of *Plan Verde*, as well as the socio-environmental complexities related to Mexico City's status as a megacity (20+ million inhabitants). The second case study chosen is the urban development/climate change adaptation planning process in Rosario, Argentina (Hardoy and Ruete, 2013). This case study was chosen because Rosario faces many of the same climate change impacts as Mexico City. In addition, the small size of Rosario (approx. 1 million inhabitants) relative to Mexico City provided an interesting comparison and served to highlight the strength and versatility of the integrative framework.

## 4.0 FINDINGS AND DISCUSSION

### 4.1 MEXICO CITY CASE

In the first case, Valery Madero and Nina Morris analyze *Plan Verde* in the context of participation and public engagement (2016). The objective of their study was to understand how *Plan Verde* used various participation mechanisms to

involve stakeholders from all levels of society in the plan's development. Using interviews of the *Plan Verde* Monitoring and Assessment Board (Spanish abbreviation "CESPV") and documentary material, the authors describe the impacts of *Plan Verde* and argue that it failed to effectively engage citizens.

Ineffective public participation, as well as inadequate participation from CESPV members in meetings, are a symptom of the *conundrums* described in section 3.0. The *conundrums* undermined the longevity of *Plan Verde* throughout each stage of the project's development (Table 1). In particular, the technocratic, top-down nature of *Plan Verde* magnified the *Stakeholder Diversity Conundrum*. *Plan Verde* was largely an infrastructure project designed by SMA in collaboration with other city-level secretariats and the Mayor. There were seven targets within *Plan Verde*: land conservation; habitability and public spaces; water; mobility; air; solid wastes; and climate change and energy. Each of these seven targets were comprised of objectives, as well as strategies and activities for meeting objectives. The majority of strategies and activities were technology based, and needs were framed around improvements to the city's built environment. *Plan Verde*'s Climate Action Plan, for example, was focused on mitigation strategies and early warning systems, and less on building both social and technical adaptive capacity to climate change impacts.

Workshops and public awareness campaigns were the main modes of public participation throughout *Plan Verde*. Prior to *Plan Verde*'s inception, SMA distributed pre-launch surveys to address public concerns. However, the survey

questions were viewed as irrelevant to project development, and were distributed only to a small portion of the city's population. Public interests were primarily represented by non-governmental organizations (NGOs) post-launch, which created some tension among CESPV Board members who thought NGOs did not adequately represent the public. Not all secretariats, ministries, and local governments were consulted throughout each stage of the project, nor were key documents made publically available. Poor transparency, top-down planning, and ineffective participatory mechanisms created an uninformed public and weakened the capacity of diverse stakeholders, including those from government, to participate meaningfully.

**Table 2** outlines some of the major stakeholders involved in *Plan Verde*. At the highest level, the organizations most involved were governmental, including SMA and the Mayor's Office. The monitoring Board held a large degree of power over *Plan Verde. CESPV* was responsible for monitoring the progress of *Plan Verde* and was comprised of individuals from government, the public and private sectors, academia, and three NGOs. CESPV met three times annually, though Board member participation in meetings dropped dramatically because the participants felt it was unnecessary, and because they believed that *Plan Verde*'s goals were unrealistic. The diverse backgrounds of Board members were supposed to encourage different viewpoints concerning *Plan Verde's* progress. Instead, Board members started to only attend meetings that they thought were pertinent to their careers.

The *Varying Scales and Socio-ecological Complexity Conundrums* played out in a number of ways. Some CESPV interviewees suggested that the spatial scope of *Plan Verde* should have included all of the jurisdictions in the *Zona Metropolitana del Valle de México* (ZMVM). This would have made the plan harder to abandon during a change in administration. Varying timescales also seemed to have plagued the project's success. Citizens were not given enough time to adjust to participatory instruments, and high political turnover rates favored short-termism rather than the longer sustainability view. Additionally, *Plan Verde* did not have an adequate monitoring system in place to gauge its impacts, and there was not enough data during the assessment stage to understand the socio-ecological complexities of the city. Simply, there were either no data, lack of funds to collect them, or the indicators used to describe complexities were ineffective (ibid).

## 4.2 ROSARIO CASE

In the second case, Jorgelina Hardoy and Regina Ruete analyze urban development and climate change strategies in Rosario, Argentina (2013). They use in depth descriptions of Rosario's socioeconomic, political, and urban planning contexts - combined with interviews of environmental officials – to outline the opportunity and constraints to building adaptation plans and programs. Their paper frames sustainability within the city's history of urban development, suggesting

ways to further incorporate climate change adaptation into future development plans.

The *Stakeholder Diversity Conundrum* in Rosario can be distilled into three problems, and is illustrated in **Table 3**. First, citizens lacked the knowledge, information, and capacity to actively participate in climate change adaption planning. Additionally, the Sub-Secretariat lack the funds and capacity to facilitate citizen engagement. This hindered inclusive participation and allowed elite groups to leverage their power. Second, private groups, NGOs, academic institutions, and government agencies had competing interests. This undermined project success by making it difficult for diverse stakeholders to form agreements based on shared values. Third, discussions about adaptation were not grounded in local reality, i.e. plans were not implementable. This caused stakeholders to lose interest and faith in the climate change adaptation strategy.

**Table 4** lists the major stakeholders involved with climate change adaptation planning in Rosario. Those with the most power included government agencies (primarily at the city-level), academia, NGOs, and private sector construction companies. Organizations and companies historically involved in urban development (e.g. the Chamber of Construction) have the most influence and financial investment, and are often the source of conflict. Civil society groups are generally the least powerful, yet development has had the most profound impact on the livelihoods of civil society compared to other stakeholders.

The *Varying Scales Conundrum* and, to a lesser extent, *the Socio-ecological Complexity Conundrum* also constrained Rosario's climate change strategy. In terms of size, the major constraints to environmental planning in Rosario stem from lack of funding and communication across different levels of government. Those interviewed in the case study indicated that the scope of adaptation development was too large given the existing levels of funding and the limited number of staff. This contributed to an overall sense of frustration and the abandonment of initiatives. The case study also revealed that planners had trouble upscaling city planning initiatives in order to align with national development policy. Thus, communication was strained and the opportunity for mutual support across different levels of government was lost. Time also appeared to be an issue, as the adoption of adaptation norms within urban development projects required precious time and resources that were limiting.

It is well understood that urban climate change adaptation planning is a complex topic, and finding a balance between simplicity and complexity can be quite difficult when creating models. In the case of Rosario, planners had difficulty addressing the complex nature of adaptation primarily because they lacked basic data to model reality, including a GHG emission inventory. This may have contributed to poor communication across agencies.

## 4.3 CASE STUDY COMPARISON

Mexico City is approximately twenty times larger than Rosario. Comparing how the *Stakeholder Diversity Conundrum* manifested in each case suggests that it may be the modes and mechanisms of participation that limit success rather than the size of the population itself. Subsequently, strengthening modes of participation may be more beneficial than broadening the stakeholder pool. This has important implications for sustainable development (SD) facilitators, who must wrestle with trying to both mediate stakeholder conflicts and promote their own agenda (Campbell, 1996). Unchecked, the latter has the potential to further disrupt participatory processes.

The difference in governance structures and political influence created a number of different advantages and disadvantages for each city. In Mexico City, *Plan Verde* was highly politicized and given prestigious international recognition. This put pressure on city officials to meet objectives, and likely helped the city secure money from a diverse funding pool. On the other hand, the highly politicized nature of *Plan Verde* made it vulnerable to political turnover, as well as prescriptive indicators that ineffectively measured project success. Mexico City's government is centralized, and suffers from horizontal fragmentation which limited the scope of *Plan Verde* and hindered collaboration among government ministries (Lankao, 2013).

Rosario's roots in socialism have created the opportunity to weave climate change adaptation planning into existing urban development schemes. This is because of the city's relatively decentralized governance structure, which has

given local governments more power and a higher degree of autonomy to implement adaptation plans. However, socialism in Rosario has strained the city's relationship with the provincial and national governments, resulting in less funding and publicity compared to Mexico City. While vertical government relationships are strained, horizontal relationships between city-level secretariats are improving. Geographic information systems (GIS), for example, have been used a tool for coordination and collaboration among secretariats (Hardoy and Ruete, 2013). In both cases, the lack of funding and human resources limited project success.

Both case studies show a need for a more inclusive, participatory process that leverages local action and strengthens horizontal collaboration among government agencies. Trust between civil society, NGOs, and state actors has the potential to lead to sustainable, multi-stakeholder adaptation while building a sense of unity and collective action within communities (Hardoy and Pandiella, 2009; Adger, 2010). Community level engagement can be fostered by clear risk communication and the adoption of strategies that empower locals and reframe them as people capable of disaster response, rather than passive victims (Kelly and Adger, 2005; O'Brien et al., 2008). However, local action on the ground is often mis-aligned with climate change policy discourse at higher levels of government (Betsill and Buckeley, 2007). This gap in public knowledge is particularly alarming and raises the question of whether or not policy makers are fully considering the needs of their constituents (Rhodes et al., 2014). Public perception is critically important, as it can either foster or constrain decision

making processes that address certain risks regarding climate change (Leiserowitz, 2006)

The main difference between environmental planning in Mexico City and Rosario is the degree to which each city is capable of combining sustainability initiatives and urban development. According to the authors of the Rosario case study, Rosario's capacity to integrate adaptation planning and preexisting urban development plans is high (Hardoy and Ruete, 2013). This is useful because mitigation and adaptation strategies that are separate from urban planning are often not politically acceptable (Viguié and Hallegatte, 2012). In many cases, adaptation is already a part of city-wide planning priorities, but does not have strict guidelines, allowing leaders to create synergies that firmly establish the integration of adaptation planning (Carmin et al., 2012). In other cases, the combination of climate change policy and urban development pose a number of different risks (see section 1.0).

## 4.4 AN ALTERNATIVE APPROACH

The alternative approaches outlined in **Tables 1** and **3** provide specific suggestions for each case study throughout the five stages of project development. The alternative approach addresses the need to move away from traditional sustainable development, which focuses on physical adjustments to the

city landscape, and instead moves towards improved planning tools and governance structures (Birkmann et al., 2010). Improved planning tools and governance structures lead to the integration of diverse forms of knowledge, sectors, spatial and temporal scales, and social and technological aspects of a project (ibid). Overall, projects should be reframed to emphasize transparency and inclusiveness, and focus on the integration of the five stages of project development.

The conceptual design stage is perhaps the most significant stage for addressing the three risk conundrums. This stage drives the rest of the stages by setting a precedent for how stakeholders will be engaged, as well as outlining the overarching needs and scales of the project. Stakeholder networks, needs, and capacities should be defined at this stage and relevant parties should be contacted for partnerships. External facilitators, perhaps from academia, may be needed to lead initial meetings among stakeholders and establish guidelines for inclusive participation. Efforts to publicize plans should balance both the domestic and international spheres (Table 1), as public support and a receptive community are critical to the initial decision to plan, as well as the project's outcomes (Bassett and Shandas, 2010).

The assessment stage grounds the project in reality, providing critical baseline data and defining current capacity, needs, and indicators for assessment. It is crucial that this stage is co-created by stakeholders and includes a third party environmental impact assessment (Downs and Mazari, 2017). Needs should be

assessed across multiple scales and used to strengthen vertical and horizontal communication among city agencies (Table 1). GIS assessment, for example, was a useful tool for strengthening horizontal collaboration in Rosario (Hardoy and Ruete, 2013). High-priority areas for reducing vulnerability should be co-prioritized by stakeholders, and monitoring systems must be put in place to regularly evaluate project impacts (Table 3).

The planning stage should be highly interconnected with the assessment stage and is critical for defining the scope of the project, as well as defining how stakeholders will contribute to the project's implementation and monitoring. It is essential that civil society is included in this stage, and that plans are developed in accordance with the needs described in the conceptual and assessment stages. Climate adaptation planning should continue to be integrated into existing development schemes, particularly in the case of Rosario (Table 3). A balance between bottom-up and top-down planning is suggested to make projects more resilient to political turnover and resource deficiencies (Tables 1 and 3). Diverse forms of funding and public participation at this stage may also spread risk and bolster inclusiveness, respectively. The *Varying Scales Conundrum* is particularly relevant during the planning process and should be closely addressed. As shown in the Mexico City case, *Plan Verde* would have benefited by including all ZMVM jurisdictions - i.e., a larger spatial scale - making it legally binding and less vulnerable political transition (Table 1) (Morris and Madero, 2016)

The implementation stage and monitoring stages should occur simultaneously to ensure that the project is adaptable to changing needs and unintended consequences. In both cases, project implementation was primarily top-down and unrealistic, partially because of inadequate assessment data and resources (Tables 1 and 3). Implementation was also seen as somewhat prescriptive, particularly in the case of *Plan Verde.* Alternative implementation should instead focus on adaptive management. Implementation Boards, such as CESPV, play a critical role in assessing project activities and making programmatic changes that foster social and environmental wellbeing (Table 1). Therefore, maintaining and encouraging Board participation is essential for making SD projects flexible.

A monitoring and evaluation (M&E) system should be established early on by both internal and external evaluators, who meet regularly to collaborate and share findings with decision makers. The choice of evaluation methods will be largely dependent on the desired outcomes of the project. Participatory evaluation, for example, may be a useful tool for engaging various stakeholders in the decision making process. M&E systems should be designed so that data are assessable to all stakeholders, and so that M&E responsibilities are gradually and equitably transferred to all stakeholders. Monitoring data should build on data collected during the assessment stage and should include indicators that measure environmental health and human wellbeing.

## 5.0 CONCLUSION

A social enterprise approach to SD relies heavily on robust stakeholder participation in the assessment, planning, and implementation stages of project development (Tables 1 and 3). Participation must span multiple scales of government and society and be rooted in collective citizen action that aims to improve human and environmental wellbeing. Project longevity is highly dependent on sustained participation from project Board members, as well as adaptive management. Shifting needs away from infrastructure and GHG mitigation can help government officials focus on vulnerability reduction and community capacity building. Strong M&E systems can also help to promote project longevity by providing the information necessary to secure future donor contributions.

Based on the findings for the two cases, and the integrative approach, future work should design programs that combine climate change planning with urban development, and how to mitigate barriers to this type of integration. Given that stakeholder diversity – especially the modes of engagement - appeared to be the greatest barrier to innovation in both case studies, future work should undertake more detailed stakeholder profiles (more detailed versions of Tables 2 and 4) to describe the needs, influence, and capacity of different groups. This will be particularly useful at the conceptual/design stage of projects and help mitigate conflict among stakeholder groups.

Creating an urban environmental plan and managing stakeholder diversity is highly dependent on dialogue and negotiation processes. Each stakeholder group, if approached in an inclusive way, should be allowed to advocate for its position and contribute to a shared project design. At the international scale, climate change negotiations are moderated by chairs, whose duty is to facilitate meetings to achieve an agreement. We also need unbiased moderators to facilitate environmental planning negotiations at the city-level, and to create regular spaces for stakeholders to participate in meetings.

The integrative 6-domain framework can help practitioners address persistent, inherent conundrums of scale, stakeholder diversity, and socioecological complexity throughout the various stages of a project's development. It is intended to offer an integrative perspective on process, rather than a step-by-step guide for the practitioner to follow. It avoids prescriptive solutions to complex issues so as to be more flexible to place-specific contexts, trading specificity for flexibility.

## 6.0 RECOMMENDATIONS

- The 6D framework is useful for designing environmental plans and climate change adaptations that are sensitive to socio-ecological dynamics.
- Needs should be shifted from GHG mitigation to vulnerability reduction. Hard infrastructure adaptation should be balanced with human adaptation.

- Decentralizing governance structures, diversifying funding pools, and partnership building across scales can help secure resources and build requisite capacity.
- Independent third-party facilitators should facilitate meetings and negotiations, and help enable stakeholder participation.
- Planning should leverage jurisdictional law and grassroots action to make projects more resilient to political turnover.
- Adequate baseline data and indicators that are responsive to stakeholder interests are needed to give plans a strong sense of shared purpose and ownership.
- M&E systems should be designed to be used collaboratively in order to track and adapt programs. GIS should be used to facilitate collaborations that are information and capacity centered.
- Human vulnerability can be reduced by reducing poverty, fostering collective security, and preserving common property management (Kelly and Adger, 2000).
- Strengthening and diversifying modes of participation may contribute more to a project's relative sustainability than increasing the size of the stakeholder pool.
- Detailed and transparent stakeholder profiles are critical for inclusive participation and needs assessment. Different profiles are needed for different scales and should be specific to project activities.

## Glossary

1. 6-D: six-domain
2. AR5: Fifth Assessment Report
3. BAU: business-as-usual
4. CESPV: *Plan Verde* monitoring Board (Spanish abbreviation)
5. GHG: greenhouse gases
6. GIS: geographic information systems
7. MCMA: Mexico City Metropolitan Area
8. M&E: monitoring and evaluation
9. NGO: non-governmental organization
10. IPCC: Intergovernmental Panel on Climate Change
11. SD: sustainable development
12. ZMVM: *Zona Metropolitana del Valle de México*

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