

## Variations in approaches to urban climate adaptation

Anguelovski, Isabelle; Chu, Eric; Carmin, JoAnn

DOI:

[10.1016/j.gloenvcha.2014.05.010](https://doi.org/10.1016/j.gloenvcha.2014.05.010)

License:

Creative Commons: Attribution-NonCommercial-NoDerivs (CC BY-NC-ND)

*Document Version*

Peer reviewed version

*Citation for published version (Harvard):*

Anguelovski, I, Chu, E & Carmin, J 2014, 'Variations in approaches to urban climate adaptation: Experiences and experimentation from the global South', *Global Environmental Change*, vol. 27, pp. 156-167.  
<https://doi.org/10.1016/j.gloenvcha.2014.05.010>

[Link to publication on Research at Birmingham portal](#)

**Publisher Rights Statement:**

Published as above, final version of record available at <https://doi.org/10.1016/j.gloenvcha.2014.05.010>.

Checked 16/5/18

**General rights**

Unless a licence is specified above, all rights (including copyright and moral rights) in this document are retained by the authors and/or the copyright holders. The express permission of the copyright holder must be obtained for any use of this material other than for purposes permitted by law.

- Users may freely distribute the URL that is used to identify this publication.
- Users may download and/or print one copy of the publication from the University of Birmingham research portal for the purpose of private study or non-commercial research.
- User may use extracts from the document in line with the concept of 'fair dealing' under the Copyright, Designs and Patents Act 1988 (?)
- Users may not further distribute the material nor use it for the purposes of commercial gain.

Where a licence is displayed above, please note the terms and conditions of the licence govern your use of this document.

When citing, please reference the published version.

**Take down policy**

While the University of Birmingham exercises care and attention in making items available there are rare occasions when an item has been uploaded in error or has been deemed to be commercially or otherwise sensitive.

If you believe that this is the case for this document, please contact [UBIRA@lists.bham.ac.uk](mailto:UBIRA@lists.bham.ac.uk) providing details and we will remove access to the work immediately and investigate.

1 ABSTRACT

---

2  
3 In recent years, an increasing number of local governments are recognizing the impact of climate change  
4 on different urban sectors. This has led many to pursue climate adaptation planning, seeking to achieve  
5 preparedness through reducing vulnerability and enhancing resilience of populations, assets, and  
6 municipal operations. Although cities typically share these common goals, many are electing to pursue  
7 different planning approaches. In this paper, we examine three climate adaptation planning approaches in  
8 the cities of Quito (Ecuador), Surat (India), and Durban (South Africa) and analyze the trade-offs  
9 associated with different planning pathways and different forms of stakeholder involvement. We assess  
10 the potentials and limitations of these different approaches, including their implications for enhancing  
11 government integration and coordination, promoting participation and adaptive capacity of vulnerable  
12 groups, and facilitating overall urban resilience. We find that, in order to gain widespread commitment on  
13 adaptation, sustained political leadership from the top, departmental engagement, and continued  
14 involvement from a variety of stakeholders are integral to effective decision-making and institutionalization  
15 of programs in the long run. When climate adaptation is advanced with a focus on learning, awareness,  
16 and capacity building, the process will likely lead to more sustained, legitimate, and comprehensive  
17 adaptation plans and policies that enhance the resilience of the most affected urban areas and residents.

18  
19  
20 *Keywords:* Climate adaptation; cities; planning; experimentation; innovation; participation

---

## 1. Introduction

Planning for climate change adaptation is one of the most complex and intricate challenges that cities are currently facing. While adaptation policies are being developed at national and regional levels as centerpieces of adaptation governance arrangements directed toward lower levels (Bauer et al., 2012; Biesbroek et al., 2010), municipalities have a central and critical role to play in adaptation planning and implementation. As climate change will exert compounding effects on cities (da Silva et al., 2012), municipalities must effectively respond to these shifting climate factors and be proactive at multiple scales while, at the same time, maintaining basic urban infrastructure and service providing functions (Amundsen et al., 2010).

In vulnerable and growing cities, the challenges posed by climate change are even more acute. On top of addressing particular project climate impacts, planners and policy makers must also take into consideration the geographical spread, growth patterns, and the conditions and locations of the urban poor. In cities in the global South, climate impacts are compounded as these municipalities are often ill equipped for adaptation due to ineffective local governments and inadequate services, housing, and infrastructure provision (Satterthwaite et al., 2007). These cities often lack institutional capacity or have difficulty preventing conflicts among departments over scarce financial resources (Hardoy and Romero-Lankao, 2011). Despite such constraints, many local governments are increasingly being approached by different international organizations interested in testing and implementing urban adaptation programs through technical assistance (Ayers, 2009; Anguelovski and Carmin, 2011). Although external actors are often primary drivers for urban adaptation planning, the successful institutionalization of adaptation programs requires political leadership, ongoing resource dedication, and procedural legitimacy within city governments.

Over the past few years, more and more cities have developed internal plans, programs, and projects to address climate impacts. In this paper, we examine three municipalities in the global South – Quito, Surat, and Durban – that have been moving forward with climate adaptation action, but who have adopted quite different planning and institutionalization pathways. We illustrate these different approaches over time, assess the implications of each planning pathway for institutionalizing climate adaptation action, and unpack the trade-offs between approaches. Our key analytic framing questions are: How do municipalities in the South overcome existing obstacles to engage in adaptation planning action? What are the factors and conditions that help municipalities move forward? Are they paralyzed by resource and capacity constraints or do they actually transform them into opportunities for innovation and experimentation? The results show that when climate adaptation is planned in a way that generates initial learning, awareness, and integration into the city's development agenda while also building internal and external capacity, the process gives space to the development of comprehensive adaptation actions that eventually facilitate the resilience of the most affected areas and groups.

## 2. Theories of experimentation and innovation in urban climate adaptation

Many cities have begun to search for options and paths to best prepare for climate impacts and risks (Carmin et al., 2012; Romero-Lankao and Dodman, 2011). They often use existing data or commission assessments of future climatic conditions as a basis for identifying adaptation options and priorities (Hay and Mimura, 2006; Romero-Lankao and Qin, 2011; Smit and Wandel, 2006). Hazard-based approaches focus on applying climate change projections to the local scale in order to identify hazard impacts (Füssel, 2007), while vulnerability approaches examine the socioeconomic factors that determine the sensitivity and coping capacity of urban systems and societies (Miller et al., 2010). To an extent, the latter approach sees future climatic conditions as too uncertain to warrant interventions tied to particular climatic regimes. Cities work to strengthen existing systems while also managing a wide range of uncertain conditions (Tyler and Moench, 2012; da Silva et al., 2012).

Due to the relative novelty and uncertainties associated with different climate adaptation planning methodologies, experimentation, innovation, and creativity characterize the ways in which municipalities engage in adaptation on the ground (Anguelovski and Carmin, 2011). In some cases, cities benefit from the leadership of a local champion or a lead department working one-on-one with different actors to generate momentum and plan around climate adaptation. In other instances, adaptation is shared across offices such as public health or water and sanitation. In other instances still, the planning process is developed through a citywide integrated assessment, with focuses on developing general climate or adaptation plans, and then subsequently delegating mainstreaming and implementation responsibilities to municipal departments (Carmin et al., 2012). During the adaptation planning phase, some cities engage with international organizations that provide orientation, funding, and technical direction, although the most vulnerable urban groups often end up receiving the least amount of support (Ayers, 2009; Barrett 2013). These different approaches highlight a pattern of practicing inquiry, testing, and reflection that is particularly important in light of incomplete information on long-term climate impacts (Tshakaert and Dietrich, 2010).

Two issues that municipalities often consider when pursuing adaptation are issues of coordination and the prospects of integrating adaptation into ongoing work at the departmental level (Groven et al. 2012; van den Berg and Coenen, 2012). Capacities required for implementing climate adaptation are often constrained by economic (such as funding), institutional (such as unfriendly public policies or laws), political (such as relationships between municipal departments or the relative lack of visibility and power of environmental programs), and competing development considerations, which ultimately crowd out adaptation concerns from the overall planning agenda (Simon, 2012; Chuku, 2010; Mees and Driessen, 2011; Urwin and Jordan, 2008). Internal sectoral divides or an overly sectoral focus on adaptation, such as around key departments like water, also tend to limit a more sustained approach to adaptation planning and implementation (van den Berg and Coenen, 2012). Lastly, cities are devising strategies to mainstream adaptation into development and other urban agendas (Huq and Reid, 2004; Anguelovski

1 and Roberts, 2011; Smit and Wandel, 2006), which are meant to increase policy coherence, avoid  
2 duplication and contradictions between policies, and balance adaptation with other concerns (Kok and de  
3 Coninck, 2007).

4 Participation and partnership techniques are critical to the accountability and effectiveness of  
5 urban adaptation planning and implementation processes (Aylett, 2010; Kithiia and Dowling, 2010;  
6 Rosenzweig and Solecki, 2010; Anguelovski and Carmin, 2011). Processes that involve local  
7 stakeholders shape government decisions (Shackley and Deanwood, 2002) and promote strategies and  
8 policies best suited to local realities and experiences (van Aalst et al., 2008). For instance, participatory  
9 vulnerability assessments help identify feasible and practical adaptation strategies in local communities  
10 (Smit and Wandel, 2006). Many cities target local networks of stakeholder groups through the formation  
11 of climate action committees, task forces, and knowledge brokers (Anguelovski and Carmin, 2011; Lu,  
12 2011) and shape their adaptation planning and implementation methodologies according to their results  
13 and recommendations. Network governance contributes to raising awareness of the need for climate  
14 adaptation (Klausen et al., forthcoming). Others work with private sector companies to promote projects,  
15 such as green roofs in the context of urban stormwater management, and they show a high level of public  
16 responsibility in guiding the implementation of those projects (Mees et al., 2013).

17 Despite growing scholarship on climate adaptation, more attention needs to be given on  
18 unpacking and assessing the different approaches that urban governments take in adaptation planning.  
19 There is also a lack of understanding around how climate adaptation programs are eventually  
20 mainstreamed and institutionalized and what trajectories municipalities choose to take to accomplish this.  
21 In this paper, we highlight the experience of three cities in the global South to examine how adaptation  
22 approaches emerge and take root, the ways in which strategies develop over time, and how local actors  
23 and institutions affect the pathways through which adaptation is implemented and integrated into  
24 municipal structures. Finally, we draw lessons on these planning experiments and consider the strengths  
25 and challenges of each approach for enhancing the ability of urban actors, institutions, and infrastructures  
26 to cope with, recover from, and be resilient to future climate impacts (Tyler and Moench, 2012).

### 27 28 29 **3. Methods**

30  
31 This paper is based on fieldwork conducted in the cities of Quito (Ecuador), Surat (India), and  
32 Durban (South Africa). We selected these three “early adaptor” cities because they have a history of  
33 anticipating climate risks and needs, initiating adaptation planning, and institutionalizing adaptation  
34 programs. The three cities all have strong international profiles in climate adaptation networks and have  
35 received much attention for their work. They are all situated in middle-income countries in the global  
36 South with acute developmental, fiscal, and capacity constraints. These cities also experience varying  
37 levels of reliance on donor, multilateral, and intergovernmental resource transfers. However, climate

1 adaptation goals and priorities were initially framed and pursued differently across each city. As a result,  
2 over time, the Surat, Quito, and Durban cases took on different forms of innovative methodologies for  
3 adaptation planning and institutionalization. Such commonalities and variations allow us to better  
4 understand the relationship between different adaptation planning processes, implementation approaches,  
5 and the levels of commitment across cities.

6 Data for this study was collected through semi-structured interviews with key informants recruited  
7 through snowball sampling from 2008 to 2013 (see Appendix for list of interviews), through participant  
8 observation of meetings and events related to climate adaptation, and through secondary data collection  
9 (including official city annual reviews, project reports, municipal budgets, local newspaper articles, and  
10 reports from international institutions). We analyzed our data through a thematic analysis based on the  
11 indicators outlined in Table 1, which seek to identify motivations, priorities, and approaches to public  
12 engagement. We then used these indicators to assess the current state of adaptation action and  
13 institutionalization across Quito, Surat, and Durban. As a methodological contribution to the literature,  
14 these indicators are critical for assessing urban climate adaptation processes because they shed light on  
15 the institutional contexts driving and enabling adaptation planning, the mechanisms through which  
16 adaptation plans were operationalized, and the relationship between adaptation and other urban planning  
17 and decision-making actors across different scales. The comparative assessment of the three cases will  
18 focus on the trade-offs associated with different adaptation planning pathways and different forms and  
19 degrees of stakeholder involvement.

20  
21 **[Insert Table 1 here]**

## 22 23 24 **4. Variations in approaches to urban climate adaptation**

### 25 26 **4.1. Quito: municipality-driven adaptation**

27  
28 Climate change is expected to intensify extreme weather events and rainfall in Quito, while  
29 decreasing annual precipitation by 8% (Zambrano-Barragán, 2012). As average temperatures have  
30 increased, the Antisana glacier around Quito, whose ecosystems supply a large portion of water to the  
31 city's 2.1 million inhabitants, has shrunk by 23% between 1993 and 2005 (Bradley et al., 2006; Maisincho  
32 et al., 2007). Climate impacts are likely to exacerbate landslides and mudslides across the city, stress the  
33 existing transportation infrastructure, affect biodiversity and food production, and endanger indigenous  
34 and migrant populations living on the city's hillsides and slopes (Dirección Metropolitana Ambiental y  
35 Fondo Ambiental, 2008; Zambrano-Barragán, 2012).

#### 36 37 **4.1.1. Building blocks for climate adaptation planning**

1  
2 No national laws or policies, international frameworks, or national funding schemes initially  
3 existed to guide and support Quito's efforts to prepare for the impacts of climate change. Early awareness  
4 of climate impacts stems from the combination of two related factors: the publication of scientific reports  
5 by renowned scientists in the mid-1990s (Semiond et al., 1998) and the exposure to extreme weather  
6 impacts. Growing sensitivity to the rate of glacial melt, along with information about the doubling of  
7 Quito's population by 2025, served as catalysts for the City Council and the General Manager of the  
8 EMAAP-Q (the Metropolitan Sewage and Drinking Water Authority) to start making provisions to secure  
9 the city's water supply. Back then, the vocabulary of adaptation was not used, but the EMAAP-Q  
10 managers became aware that they had to act quickly to address water scarcity. Additionally, floods,  
11 landslides, and forest fires increased in frequency and intensity over the 2000s, which helped bring  
12 climate change to the forefront of policy issues. For instance, in May 2006, intense rainfall provoked  
13 landslides in residential neighborhoods, damaging houses and obstructing roads (Sánchez, 2006). As the  
14 Director of Quito's Risk Management Unit (2009) explains:

15 "Rainfall is not normal... sudden storms [are becoming] more frequent. Houses are  
16 affected. So we became aware that climatic changes increased the vulnerability of at-risk  
17 areas and that we needed new management plans based on those different risks... we also  
18 needed a long-term vision for development."

19 Adaptation planning in Quito began when former Mayor Paco Moncayo and members of the  
20 Metropolitan Council hosted the *Clima Latino* Conference in October 2007. *Clima Latino* was a  
21 conference for the Andean Community of Nations meant to help governments identify appropriate climate  
22 change measures and to showcase existing adaptation action. Through the work of an Inter-Institutional  
23 Commission representing a variety of sectors and agencies throughout the Metropolitan Government of  
24 Quito (DMQ), a draft climate change strategy addressing both mitigation and adaptation was prepared in  
25 late 2007. The feedback on the draft document offered by public agencies revealed that planning for  
26 climate adaptation in Quito would not be a straightforward task, and that the staff from the Environmental  
27 Secretariat in charge of climate action planning in Quito needed to be both specific and flexible in the final  
28 *Quito Climate Strategy*. As a member in the Territorial Planning Office (2009) explains:

29 "Agencies in Quito did not formulate climate adaptation as a long-term vision, but as a  
30 solution to specific problems. Long-term planning is about the appropriate management of  
31 the environment—the rivers, the hillsides, and air pollution. We slowly incorporated, with  
32 greater detail, the idea of 'risks' into our work."

33 After further input from residents, the *Quito Strategy for Climate Change* (EQCC) was approved in  
34 October 2009, and has since become an official environmental policy and cross-institutional planning tool  
35 for the DMQ. The strength of the EQCC is that it harnesses citizen representation to form urban  
36 institutions that are flexible, progressive, and adaptable (Quito Distrito Metropolitano, 2009).

37 Quito's climate adaptation work builds on existing plans in the municipality. The EQCC is in line

1 with the *Metropolitan Development Plan 2012-2022*, which establishes climate adaptation as a strategic  
2 axis of action in the *Green Quito Objective*. Similarly, Quito's existing environmental programs planted the  
3 seeds for adaptation planning. For example, the Risk Management Unit developed a *Rain Plan* back in  
4 1999 to establish disaster response measures for extreme weather events. The EQCC, therefore, is  
5 building on the city's vision and existing priorities for sustainable development.

#### 7 4.1.2. *Internal operationalization, coordination, and institutionalization*

9 In order to operationalize the EQCC, in 2010 the municipality began to develop a *Climate Change*  
10 *Action Plan (2012-2016)*. The *Action Plan* emphasizes reducing social vulnerability to extreme climate  
11 events and combining tools and methods from land use and urban planning. Quito is implementing the  
12 *Action Plan's* climate vulnerability and risk reduction measures by relocating people, promoting  
13 sustainable land use planning, protecting slopes, improving the sewer system, creating an early warning  
14 system and climate monitoring, building capacity, and enhancing forest fire prevention and control.  
15 Coupled with these initiatives, the municipality designed ecological corridors, planned new green spaces,  
16 developed an Integrated Water Management System, and defined a Protected Area Sub-System in order  
17 to better protect local ecosystems. Lastly, 60 new gardens are being built every year and 1,000 people  
18 are being trained to participate in urban agriculture.

19 The development and implementation of Quito's *Climate Change Action Plan* reflects the holistic  
20 vision of decision-makers to maximize mitigation strategies that also contribute to adaptation and build  
21 resilience. Adopted actions have to create win-win results. For instance, some strategies combine  
22 benefits derived from reforestation, water conservation, and biodiversity. As the former Metropolitan  
23 Director of Environmental Policy and Planning explains (2012):

24 "Not only is there a highly urban Quito, there is also an urban/rural Quito. This forces the  
25 city to really think differently about how to address climate change related challenges. It  
26 also means that policy makers, academics, and other relevant stakeholders must have a  
27 holistic approach to addressing climate change related challenges and learn to prioritize  
28 climate change related issues."

29 As such, one of the main drivers for the institutionalization of climate adaptation action is the strong  
30 commitment of different municipal administrations to the issue of adaptation. In the face of political  
31 instability, they have worked to ensure that departments take ownership over these actions. A civil  
32 servant working on climate adaptation planning back in 2009 explains:

33 "The priority is how to incorporate climate adaptation in a way that is more grounded. What  
34 does adaptation mean for decision-makers, and in a context in which they need to confront  
35 many different necessities in the short term?"

36 Today, climate adaptation is being incorporated into local institutional practices as an added value to  
37 specific climate-related interventions, such as into existing forest fire prevention strategies. However,



1 adaptation is an issue that policy-makers are committed to not only because of Quito's vulnerability to  
2 climate impacts, but also because it entails political gains. Some interviewees mention that members of  
3 the Metropolitan Council see climate change as a way to raise their political profiles, which explains why  
4 the issue is, so far, guaranteed resources and support.

5 On the ground, the Environmental Secretariat is currently the focal point for climate adaptation  
6 work in Quito. Staff members from the Secretariat dedicate much effort to helping other sectors consider  
7 climate change not solely as an environmental issue. Climate change is one of the few domains that can  
8 be connected to different departments through an intra and inter-institutional articulation. As the former  
9 Metropolitan Director of Environmental Policy and Planning again explains (2013):

10 "Our role—everything. If the Secretariat stops talking about climate adaptation, no one will  
11 keep that work officially. They will keep implementing the projects because it is part of their  
12 planning processes but they won't focus on added value for adaptation [...]. Climate change  
13 is a topic that facilitates relationships with other institutions. It is crosscutting. We have  
14 established relationships with them."

15 As a result, an Inter-institutional Climate Change Metropolitan Committee has been created to help  
16 different departments interact with one another and monitor and evaluate climate actions.

#### 18 4.1.3. *Engaging relevant stakeholders and partners*

19  
20 As Quito made strides towards sustained and comprehensive climate action, the city became  
21 increasingly conscious of the importance of incorporating scientific expertise into climate adaptation and  
22 improving decision-makers' access to research. In 2010, the Quito Panel on Climate Change was created  
23 to commission scientific studies by leading Ecuadorian experts and scientists and to monitor climate  
24 impacts on the city. This decision demonstrates the willingness of a municipality to delegate tasks and  
25 develop a joint research agenda through an alliance between the public and the academic sectors.

26 The process of climate planning in Quito also reflects the longstanding commitment of public  
27 officials to ensure that residents are able to participate in decision-making and implementation of public  
28 policies that affect them. This is what the municipality calls "co-responsibility" and "participatory collective  
29 management." Since the adoption of the EQCC, a Youth Program has helped younger citizens develop  
30 their own climate action plan, frame recommendations to decision-makers, and raise the visibility of  
31 climate change throughout the city and country. As noted by the Environmental Secretary in 2011, this  
32 commitment is based on the recognition that:

33 "The local management of climate change requires a dynamic approach based on the  
34 concept of 'learning by doing' and on change towards a paradigm where nature is  
35 recognized as a subject of rights and human beings as part of it."

1 Towards this end, some adaptation strategies involve the rescue and valorization of traditional knowledge  
2 and practices, especially agricultural practices of vulnerable indigenous peoples living on the hillsides  
3 around the city.

4 One unique characteristic of Quito's climate adaptation work is the deep, constant, and proactive  
5 engagement with international networks. Former Mayor Paco Moncayo was active in international  
6 networks such as ICLEI-Local Governments for Sustainability and United Cities and Local Governments  
7 (UCLG) and became exposed to the importance and relevance of climate change through discussions  
8 with other cities. In 2007, when Quito organized *Clima Latino*, policy-makers not only wanted to show that  
9 they were good stewards and to gain a competitive advantage over other cities, but they also aimed at  
10 validating their climate initiatives through gaining legitimacy and support locally, nationally, and regionally  
11 for their actions. As a consultant for the EQCC recalls:

12 "The EQCC was a document that could be helpful for other climate change documents within  
13 and beyond the country. Quito showed leadership by being the first city to have a climate  
14 change strategy. It was a great demonstration for the country."

15 Quito's elected officials believed they would reinforce their position as an innovative city and that they  
16 would be imitated for their climate leadership and political capacity. Progress in adaptation also reflects  
17 competition between local political leaders and national leaders within ministries in charge of environment  
18 and climate change issues. Today, the DMQ is intent on remaining autonomous in its climate action from  
19 the national government and, at the same time, working towards a leadership role in climate adaptation  
20 beyond Ecuador. For example, Quito has cooperated closely with regional entities and centers working to  
21 combat glacier melting across the Antisana Glacier region.

22 Leaders in Quito are also catalysts of South-South collaboration. In November 2011, under  
23 Quito's leadership, more than 80 local authorities throughout Ecuador signed the *Quito Climate Pact*,  
24 which was an agreement meant to stimulate other municipalities to emulate Quito's experience and to  
25 enhance synergy. Today, Quito leads the Local Environmental Authorities Network through which tools  
26 and methodologies for vulnerability analysis, for designing climate change strategies, and for  
27 implementing joint adaptation activities are developed. Such a posture is seen as a win-win situation  
28 since, by acting as incubator on climate action, Quito's policy-makers are helping residents and agencies  
29 develop a stronger sense of ownership over climate actions in the city.

30 Since before the development of the EQCC, Quito has been collaboratively engaging with  
31 international funding agencies. Technical cooperation with international agencies remains entirely  
32 climate-focused, and Quito has collaborated with them under the city's own terms. This has been the  
33 case with the Climate and Development Knowledge Network (CDKN) and UK Department for  
34 International Development (DFID) in their contribution to the vulnerability assessment developed in 2012  
35 as part of the *Climate Change Action Plan*. As the former Metropolitan Director for Environmental Policy  
36 and Planning highlights (2013):

37 "We became the first city who managed to convince them to work with local governments

1 for technical cooperation. They did not give us money directly, but we decided what we  
2 wanted—to promote and create more knowledge from local governments, and not with  
3 firms like Price Waterhouse Cooper and their international consultants.”

4 Similarly, for the implementation of climate mitigation measures with adaptation components, Quito has  
5 been seeking internal funds rather than molding projects according to international funding demands.  
6

## 7

### 8 **4.2. Surat: internationally-driven adaptation**

#### 9

10 Surat, with a population of 4.5 million, is the eighth largest city in India. The city is particularly  
11 vulnerable to hazard events, such as urban flooding caused by the overflow of the Tapi River, and other  
12 slow-onset impacts, such as sea level rise, increasing monsoonal precipitation, and associated public  
13 health concerns (ACCCRN, 2011; Dutt et al., 2006). Despite Surat’s higher level of wealth relative to  
14 other local governments in India, climate vulnerabilities are nonetheless compounded by high levels of  
15 poverty, low human development indices across the city’s 400 slums, inadequate legal and governance  
16 mechanisms, and vulnerability to extreme weather events (Beg et al., 2002). For example, the 0.5 million  
17 slum dwellers across the city face high flood risks and high potentials for vector-borne diseases (Ghosh  
18 and Ahmad, 1996; Shah, 1997; Lobo and Prasad, 1998; Bhat et al., 2013).  
19

#### 20 *4.2.1. Building blocks for climate adaptation planning*

#### 21

22 Climate change planning is a nascent policy agenda in India. In 2008, the Government of India  
23 released the *National Action Plan on Climate Change* (NAPCC), which noted legislative responsibilities  
24 for the various state and local governments (Government of India, 2008). At the same time, many local  
25 and regional governments in India started to pursue climate adaptation and resilience planning. Surat’s  
26 climate planning process began in 2008, when the city was selected as one of the pilot cities for  
27 Rockefeller Foundation’s Asian Cities Climate Change Resilience Network (ACCCRN).

28 Even before the ACCCRN intervention in the city, Surat has had a long history of dealing with  
29 natural hazards. In 1994, a plague epidemic led to a series of reforms in the city’s health services sector  
30 and India’s first large-scale urban sanitation and public health program. In 2006, unusually high rainfall  
31 resulted in high discharges from the Ukai Dam, situated upstream from Surat on the Tapi River. This led  
32 to flooding across 75% of the city’s built-up area, which also provoked an explosion of gastrointestinal  
33 and vector-borne diseases. One municipal official describes this particular episode in 2010 as:

34 “We have no choice but to live with floods. It is bound to come, whether we like it or not,  
35 whether it rains or not. In 2006, there was not a drop of water falling from the sky. It was  
36 sunny, but the water was rising. Almost 70-80% of the city was under an average of  
37 three feet of water. Resilience is natural to the people... we came back in less than

1 three weeks' time.”

2 Because of the experience with such major disasters and impacts, Surat’s climate adaptation initiative is  
3 heavily focused on public health (controlling vector-borne diseases, in particular), flooding, water supply,  
4 rapid urbanization, poverty alleviation, and resilient economic and industrial development. The local  
5 government unit, the Surat Municipal Corporation (SMC), also maintains detailed records of each episode,  
6 continuously carries out citywide data collection and recording, and promotes citizen awareness over  
7 flooding, public health, and other hazard-related vulnerabilities. Complemented by high public  
8 consciousness of the socioeconomic effects of natural hazard events, these programs were brought  
9 together and institutionalized in 2008 under the auspices of the Rockefeller Foundation’s Asian Cities and  
10 Climate Change Resilience Network (ACCCRN) program.

11  
12 *4.2.2. Engaging relevant stakeholders and partners*

13  
14 Between 2009 and 2011, the Rockefeller Foundation, in partnership with local and international  
15 consultancies, assisted Surat with designing pilot projects and drafting a *City Resilience Strategy*. Since  
16 the process paid a great deal of attention to stakeholder engagement and vulnerability assessment,  
17 ACCCRN helped set up a City Advisory Committee (CAC) that conducted a 2030 visioning exercise for  
18 Surat and oversaw the drafting of different assessments and studies. The vision included plans for urban  
19 socioeconomic development and delineated the major climate challenges. Members of advisory  
20 committee came from key SMC departments, local academics and experts, and the South Gujarat  
21 Chamber of Commerce and Industry (SGCCI). Although not representative of all socioeconomic interests  
22 across the city, the 14 CAC members brought together critical political and scientific expertise to articulate  
23 the different sectoral climate risks and vulnerabilities. As noted by one SMC official, the benefits of this  
24 particular composition are that:

25 “The City Advisory Group has nothing to do with the individual sectors... they are all  
26 sectors. They are taking control of all sectors, whether they are going in the same  
27 direction, whether they are interacting or not, whether they are sharing data or not,  
28 whether the suggested projects are in line with the adaptation plan or not... the City  
29 Advisory Group does the review.”

30 This planning approach focused on gathering technical and scientific information rather than pursuing a  
31 broadly inclusive process that incorporated civil society actors and vulnerable communities throughout the  
32 decision-making process. Hazard risk assessments were mainly GIS-based and indicated areas of high  
33 climate risk while vulnerability analyses consisted mostly of surveys for socioeconomic and demographic  
34 data conducted in various neighborhoods across the city. Sector studies, similarly, were expert-led and  
35 focused on issues of environment, flood risk, health, energy, buildings/infrastructure, transportation, and  
36 water.

37 Upon the studies’ completion, the various ACCCRN partners proceeded to integrate all of the

1 information through a series of risk-to-resilience workshops, where both expert and community  
2 participants engaged in scenario planning and identified short- and medium-term resilience building  
3 activities (Kernaghan and da Silva, 2014). After brief consultations with community-level groups, action  
4 committees, and engaged citizens, the city published the *Surat City Resilience Strategy* (CRS) in April  
5 2011. The CRS advocated for building on current and planned municipal development activities, for  
6 building synergies with state and national level institutions, and stressed the importance of ensuring the  
7 resilience of the city's infrastructure, service delivery system, and poverty alleviation programs.

8 This phase of ACCCRN engagement resulted in three pilot projects. First, in 2010, the city  
9 initiated a national-level sustainable urban design competition that called for urban design entries  
10 proposing planning around flood risk in and around low-income neighborhoods. Second, the city created  
11 a short message service (SMS) enabled Urban Services Monitoring System (UrSMS). This allowed city  
12 officials to both access real-time data and evaluate the performance of the city's water delivery, solid  
13 waste collection, and other public service systems. Lastly, Surat created a vulnerable people's database,  
14 which was a web-based platform that combined socioeconomic vulnerability data with flood forecasts and  
15 risk maps.

#### 16 17 4.2.3. *Internal operationalization, coordination, and institutionalization*

18  
19 By 2012, the City Advisory Committee (CAC) believed that planning for climate resilience was  
20 critical to the continued economic development of the city. Institutionalizing the ACCCRN-facilitated  
21 climate adaptation planning program became an important mechanism for preparing the burgeoning  
22 urban population against projected climate impacts and, at the same time, for raising the profile of Surat  
23 in the international arena. As a result, the CAC was transformed into the Surat Climate Change Trust  
24 (SCCT) in June 2012. The roles of the original CAC members were subsequently formalized into trustees  
25 of the SCCT. As the secretary of the SCCT noted in 2013:

26 "ACCCRN was working as a very informal body. There was nothing formal with regard to  
27 making it institutionalized. We decided to form a trust—an entity which can then take up  
28 this work. [At] the end of ACCCRN, what we wanted was something that keeps us going  
29 further. Now that was possible only if we had some kind of organizational mechanism in  
30 place."

31 One of the most important reasons behind the creation of the SCCT is to continue the momentum and  
32 legacy initiated by the ACCCRN program. In essence, the SCCT is an autonomous entity working side-  
33 by-side and receiving indirect support from city government, particular from the offices of water and  
34 sanitation, public health, slum and social services, and the office of the city engineer. The idea is that the  
35 SCCT would be able to bypass some of the bureaucratic constraints that come with situating the new  
36 program within the city government itself, such as an over-reliance on intergovernmental fiscal transfers  
37 and conditional grants. Furthermore, institutionalizing adaptation planning in the form of a legally

1 recognized public-private trust would increase the immunity of the adaptation agenda to any changes in  
2 political or administrative direction and would prevent the original objectives of the trust from being  
3 changed or redirected. As one of the SCCT trustees noted in 2013, the purpose of the original ACCCRN  
4 program supported by the Rockefeller Foundation has changed to a platform for dialogue or a possible  
5 source of specific support on the SCCT's own terms.

6 In June 2013, the SCCT embarked on three large projects. The first is a solar city project that  
7 primarily addresses urban mitigation issues. The project aims to achieve 10% renewable energy usage  
8 across the entire municipality within 5 years time. The second project is an End-to-End Early Warning  
9 System, which would allow the integration of existing hydrological, climate, and urban development and  
10 socioeconomic vulnerability models into one comprehensive database. This system also facilitated action  
11 on improving flood management along the Tapi River, where Surat, in collaboration with neighboring state  
12 and local authorities, invested in retrofitting water monitoring stations and streamlining information  
13 coordination mechanisms across different jurisdictions (Bhat et al., 2013). Third, the Urban Health and  
14 Climate Resilience Center (UHCRC) was launched in June 2013 to install an improved vector-borne  
15 disease surveillance system, steer an inter-disciplinary research team to steer and advise the city's  
16 actions towards managing the existing public health system in light of climate change, and start a  
17 community-wide outreach program.

18 Much like the ACCCRN-facilitated planning process between 2009 and 2010, the SCCT's agenda  
19 has been similarly dominated by a project-based approach. While projects succeed in targeting the city's  
20 key vulnerabilities, such as flooding and public health, city authorities have had trouble integrating  
21 discrete projects into the city's planning and decision-making processes. For example, the Chief Town  
22 Planner noted in 2013 that:

23 "Serious steps in the direction of making provisions in the development plan while  
24 keeping in mind climate change issue [have been made], but nobody is very clear  
25 [about] how it is going to reflect in the development plans or regional plans."

26 Furthermore, despite the forging ahead of the SCCCT's activities, the autonomous nature of the body has  
27 prevented the institutionalization of adaptation into the city's legal framework and into bureaucrat's day-to-  
28 day work plans. The Chief Town Planner also noted this conundrum in 2013:

29 "We do talk a lot about the climate change, what should be done... but ultimately one  
30 has to convert all these things into some parameter or has to frame them in form of rules  
31 or act [...] How can we control development keeping in mind the future flood situations  
32 or any other climate change factors? So, that should be taken care of and those  
33 amendments should be included in our development control regulations."

34 As these quotes show, Surat continues to grapple with the dilemmas of institutionalization and  
35 uncertainties around the merits of project-based implementation.

36 One of the main tasks of the SCCT has been to find ways to operationalize some of the projects  
37 in Surat's *City Resilience Strategy* (CRS) and to raise funds to support them. The funding challenges are

1 further highlighted as direct engagement by the Rockefeller Foundation is set to conclude by 2015. In  
2 early 2013, the city government adopted climate change as one of the line items included in their annual  
3 municipal budget. The line item earmarked 20 million rupees (approximately US\$300,000) per year for  
4 climate change related programs across the city. Within the city government, access to these specially  
5 earmarked, but limited, funds is channeled through the Office of the City Engineer, while other funds  
6 dedicated to infrastructure upgrades, service improvements, and other poverty alleviation programs are  
7 divided across respective departments. Furthermore, the SCCT has the ability to directly raise funds from  
8 citizens as a nonprofit institution and make use of any potential funds coming out of the newly created  
9 climate change line item in the municipal budget.

#### 11 **4.3. Durban: department-driven adaptation**

13 With a population of more than three million, Durban is the largest container port on the African  
14 continent. Despite this, Durban is South Africa's poorest large metropolitan area. Key climate  
15 vulnerabilities for Durban include sea-level rise, ecosystem degradation, and livelihoods sustainability.  
16 Various climate projections have found that, starting from 2070, the city will experience increasing  
17 number of extremely hot days, changing amount and distribution of rainfall (Anguelovski and Roberts,  
18 2011), and an average sea level rise of about 2.7cm each decade (Carmin et al., 2012). Urban residents  
19 are most vulnerable to extreme weather events, vector and water born diseases, food insecurity, and  
20 economic losses (CSIR NRE, 2006).

##### 22 **4.3.1. Building blocks for climate adaptation planning**

24 South Africa lacks strong climate adaptation leadership and associating mandates at the national  
25 level. Still, Durban's initial consideration of climate adaptation dates back from 1999, and the process has  
26 since been driven by champions, most notably the deputy head of the Environmental Planning and  
27 Climate Protection Department (EPCPD) (formerly called Environmental Management Department). A  
28 staff member from the Disaster Management Unit commented in 2009 on the EPCPD's capacity to  
29 engage others across the city:

30 "[The EPCPD] is hooking up with a variety of organizations [in the city] that are strong  
31 role players... [The EPCPD] is very good at presenting the facts in workshops and  
32 everybody listens and people like the materials. There is also a growing body of  
33 information from agencies [the EPCPD] works with and [the EPCPD] is able to introduce  
34 it to the city."

35 In 2004, the EPCPD commissioned a group of expert consultants to produce the first scientific study  
36 projecting and estimating climate impacts for the city. The resulting document, *Climatic Future for Durban*,  
37 was released in 2006. Even though the report did not succeed in bringing concrete outcomes for Durban,

1 it triggered the creation of key climate programs, including the Municipal Climate Protection Program  
2 within the Environmental Management Department.

3         Following this assessment report, the EPCPD published a *Headline Adaptation Strategy* in 2006  
4 to identify key municipal sectors that would be affected by climate change and to highlight appropriate  
5 and practicable adaptation options (Roberts and O'Donoghue, 2013). Unfortunately, the *Headline*  
6 *Adaptation Strategy* catalyzed very little cross-departmental action on climate adaptation, which was  
7 mainly attributed to the generic nature of the strategy, excessive existing staff workloads, and a lack of  
8 understanding of adaptation as an imminent development challenge. To move beyond paralysis, in 2008  
9 the EPCPD started coordinating detailed Municipal Adaptation Plans (MAPs) with individual departments,  
10 including water, health, and disaster management. The sectoral adaptation plans focused on the  
11 biodiversity, health, water, and disaster management sectors because of their vulnerability to projected  
12 climate impacts and their critical role in ensuring the development of the city (Roberts, 2010). The  
13 resulting 47 discrete adaptation options across these sectors were then prioritized through cost-benefit  
14 analyses (Roberts and O'Donoghue, 2013).

15         In parallel to this planning process, the municipality started developing a series of tools and  
16 concrete programs, most specifically in partnership with local communities. From 2007 to 2011, the  
17 municipality developed an Integrated Assessment Tool and, from 2008 to 2011, it implemented the  
18 Climate Smart Communities Pilot Project, which completed food trials for alternative crops, a rainwater  
19 harvesting assessment, and a community risk assessment in two local communities. Apart from a focus  
20 on community-based adaptation, the city government paid much attention to ecosystem-based adaptation,  
21 which primarily targeted the need to understand and respond to the implications of climate change for the  
22 design and management of the Durban Metropolitan Open Space System (D'MOSS) (Roberts and  
23 O'Donoghue, 2013).

#### 24 25 4.3.2. *Internal operationalization, coordination, and institutionalization*

26  
27         Durban has worked to mainstream climate projections within municipal operations. The EPCPD  
28 created a Climate Protection Branch and included a Municipal Climate Protection Programme as a  
29 deliverable in the city's key strategy planning document. Such integration aligns the *Municipal Adaptation*  
30 *Plan* with existing work streams and with the development of large-scale reforestation initiatives as part of  
31 the FIFA World Cup greening program back in 2010.

32         Still, climate adaptation is far from being at the center of municipal planning and decision-making.  
33 The lack of internal motivation for climate policy making and planning stems from the fact that Durban's  
34 politicians have continuously prioritized economic development over environmental issues, with which  
35 climate concerns are associated. Climate adaptation is perceived as anti-development by infrastructure  
36 developers, and the conversation in Durban is firmly fixed through the lens of "environment versus  
37 development." For instance, despite the fact that new large-scale transportation infrastructures between



1 the Port of Durban and South Africa's industrial hinterland are mandated to go through an environmental  
2 impact assessment process, none of the assessment criteria address climate adaptation or resilience  
3 requirements. This is particularly problematic since much of this new infrastructure will threaten coastal  
4 zones key to biodiversity conservation efforts. South Africa's high emissions and energy export economy  
5 also makes national policy makers very sensitive to climate language and policies. Not only is there little  
6 advocacy for climate action in Durban, there often is opposition and even incidences of climate change  
7 denial across various levels of government. This creates a challenging environment for local adaptation  
8 leaders to build internal legitimacy, buy-in, momentum, and commitment.

9 When climate issues do make it into the city's political agenda, adaptation is only considered if  
10 environmental impacts, particularly extreme weather events, threaten development goals. In speaking  
11 about sea level rise, a staff member from the Coastal, Stormwater and Catchment Management  
12 Department highlighted in 2010 how experience of storms in 2007, from which flooding and coastal  
13 erosion resulted in significant damages to 400 kilometers of coastline around Durban, created sensitivity  
14 to the ways in which the full range of climate impacts could undermine critical city development agendas:

15 "The question is: what could sea level rise mean for the coastline? Durban has strong  
16 [coastal] tourism activity and the economy is underpinned by the tourism issue. It is critical  
17 to know from an economic point of view what we are looking at [with climate change]."

18 Extreme events as evidenced by climate change emerged at the forefront of local policy and planning  
19 debates because of their potential impact on tourism development and other economic development  
20 needs and pressures.

21 One of the key challenges to Durban's climate adaptation planning process has been the lack of  
22 engagement of municipal departments. Although the EPCPD was able to generate some engagement  
23 with the health and water sectors, continued commitment has proven challenging. As the deputy head of  
24 the EPCPD noted in 2012:

25 "We realized that we would have to do a lot more handholding, that we were going to  
26 have to build institutional momentum and commitment to adaptation... And that we were  
27 going to have to choose a couple of pilot sectors and hand-hold them through this  
28 process, and actually develop something that they could more easily utilize and without  
29 fear of fuss drawn into their work stream. So it wasn't something new or burdensome."

30 The legitimacy and credibility of climate action has been undermined by a lack of institutional capacity  
31 and by the stress exerted on departments by large infrastructural backlogs, constant restructuring, and  
32 a loss of skills. Even though resources could not be easily redirected for climate adaptation efforts, the  
33 EPCPD was an important catalyst for pushing the adaptation agenda forward and creating and  
34 maintaining allies and individual champions with key sectors. In that process, as noted by an executive at  
35 the Durban Coastal Management Project in 2010, exploiting personal relationships within the municipality  
36 was vital:

1            “[M]ost of the guys that are heads of those departments I’ve had personal relationships  
2            for 20 years... Because I’ve been working with them, there’s that recognition and I think  
3            that actually helps a lot because I don’t have the institutional power to force them. But I  
4            think I’ve got a strong personal power to influence them. Essentially my job is 90%  
5            based on personal power.”

6            Since adaptation planning in Durban has prioritized building institutional champions within each sector,  
7            further cross-sectoral engagement, integration, and broad strategy development have become rather  
8            difficult. Each department works within its own silos and has little crosscutting activity. Therefore, one of  
9            the key objectives of the EPCPD has been to identify the “gatekeepers” for every function and then invite  
10           them into the overall adaptation conversation.

11           Durban’s experience has highlighted many challenges, particularly in building institutional allies,  
12           ensuring commitment through time, and in adequately framing the issues in a way that is synergistic with  
13           each department’s own mandate. Constant efforts and much creativity are required to move climate  
14           adaptation forward. As the deputy head of the EPCPD noted in 2012:

15           “How do I make sure that these guys keep moving? We’ve got the buy-in. It’s a much  
16           better process than we had up front... Clearly, I need to keep holding hands because  
17           that’s been a success in this process, so now we could. [...] How are we going to work  
18           with you on this? We wander off and we all do that and see what happens then, so we  
19           unpack it one step at a time.”

20           As a result of this fairly individualized and haphazard approach, Durban’s experience highlights the  
21           relevance of an innovative and experimental approach to the pursuit of an urban climate adaptation  
22           agenda. Although this strategy ensures a personalized approach to engaging different municipal  
23           department, it also risks further entrenching the “silo” mentality of sectoral operations.

24           More recently, the Durban city government has embarked on a series of institutional reorganizing  
25           efforts. The EPCPD is currently housed under the city’s planning department, which facilitates the  
26           department’s authority to interact with other city departments. The current reorganization efforts will either  
27           lead to the integration of EPCPD with the city’s mitigation efforts to form a larger climate change office or  
28           the EPCPD will be completely removed from under the planning department to form its own autonomous  
29           agency. If the latter occurs, the EPCPD’s capacity to interact and coordinate with other departments will  
30           be diminished, which will result in climate adaptation efforts being sidelined further.

31           In 2013, Durban took on an effort to draft a citywide *Climate Change Strategy*, whereby  
32           adaptation concerns would be integrated with city climate mitigation priorities to form a comprehensive  
33           policymaking action plan. The city departments originally involved in the sectoral municipal adaptation  
34           plans continue to be key participants in the *Durban Climate Change Strategy* drafting process. However,  
35           consistent engagement from public health officials has not been achieved due to a change of leadership  
36           in the public health department. During the visioning and public engagement processes, issues of solid

1 waste management became a key concern, with the public responding strongly to the importance of  
2 addressing waste and climate concerns simultaneously.

### 3 4 4.3.3. *Engaging relevant stakeholders and partners*

5  
6 While the EPCPD put much effort into making climate adaptation more concrete and streamlined  
7 throughout, the city has also become increasingly active and visible across South Africa as a whole. For  
8 instance, in 2009, Durban hosted the country's first public climate summit, which became the basis for a  
9 permanent Climate Change Partnership. This partnership promoted ongoing dialogue with business,  
10 academia, and civil society groups. In 2010, Durban led the creation of a South African cities network for  
11 the purpose of facilitating local coastal adaptation action plans. Since then, because of political fractures  
12 across different levels of government in South Africa, further efforts to engage other cities within the  
13 country have been stymied.

14 As noted earlier in this section, initial incentives for adaptation planning came from the city's  
15 exposure in international organization and networks, such as ICLEI-Local Governments for Sustainability.  
16 As part of ICLEI's Cities for Climate Protection (CCP) Program, and combined with a competitive  
17 atmosphere between large metropolitan cities in South Africa, Durban launched a series of programs  
18 aimed at both mitigation and adaptation. The CCP program was funded by the United States Agency for  
19 International Development (USAID), but very little of these resources were dedicated to cross-institutional  
20 learning and institution building. As a result, very few of these projects were ever implemented.

21 In 2011, Durban hosted the United Nation's Framework Convention on Climate Change COP17-  
22 CMP7. The key outcome of this convention was the *Durban Adaptation Charter*, which was signed by 107  
23 mayors worldwide. Charter signatories pledged to mainstream adaptation into all local government  
24 development planning projects and programs. This Charter also signals broad, worldwide political  
25 commitments to strengthen local resilience to climate change and to prepare and implement long-term  
26 adaptation strategies. The EPCPD has since continued to work with members of the original local  
27 government partnership, as well as a group of new international partners, to ensure the effective  
28 implementation of the *Durban Adaptation Charter* (Roberts and O'Donoghue, 2013). But, again,  
29 because of low staffing and resource capacities within the Durban city government, efforts to sustain  
30 engagement across different signatories of the *Durban Adaptation Charter* have been challenging.

## 31 32 33 **5. Comparative assessment of city approaches**

34  
35 As the experiences of Quito, Surat, and Durban highlight, processes of experimentation and  
36 innovation are key characteristics of how cities are approaching adaptation planning (Anguelovski and  
37 Carmin, 2011; Castán Broto and Bulkeley, 2012). From these cases, we see the trend of cities identifying

1 the best ways to mainstream and integrate adaptation into existing policies and ongoing departmental  
2 work (Huq and Reid, 2004; Smit and Wandel, 2006; Kok and de Coninck, 2007; Groven et al., 2012; van  
3 den Berg and Coenen, 2012; Moser and Boykoff, 2013), particularly in relation to existing urban  
4 development needs and the distribution of political power within local government. Throughout the course  
5 of adaptation planning and institutionalization, urban practitioners also rely on participation and  
6 partnerships to build and strengthen urban adaptation projects and programs (Aylett, 2010; Kithiia and  
7 Dowling, 2010; Rosenzweig and Solecki, 2010; Anguelovski and Carmin, 2011). The cases of Quito,  
8 Surat, and Durban present a snapshot of how cities in the global South, who are at the forefront of climate  
9 impacts, are approaching and institutionalizing adaptation planning, working with relevant partners and  
10 stakeholders, and how each approach is shaping local resilience outcomes. Table 2 compares each city's  
11 approach using the contextual, operational, and relationship indicators presented in Table 1.

12

13 **[Insert Table 2 here]**

14

15 Quito presents an inclusive approach to climate adaptation planning and implementation, where it  
16 is neither champion-driven (like in Durban) nor donor-driven (like in Surat). Climate adaptation planning  
17 was initiated and has since been sustained by city leaders across administrations. Also, building on the  
18 city's long tradition of participation in general urban policy-making, the adaptation planning process was  
19 further strengthened by widespread and continuous engagement of civil society and local research  
20 institutions. This process then resulted in a robust set of project activities and led to adaptation being  
21 integrated within and across city departments. Today, the *Climate Adaptation Plan* guides the  
22 development of adaptation initiatives in strategic areas that address Quito's different vulnerabilities—  
23 some projects are implemented by sector (i.e. water, housing) and others are flagship projects (i.e., green  
24 corridor). Quito's experimental approach to adaptation planning benefits from the local government's  
25 "learning by doing" mentality that values traditional knowledge, youth informants, and community  
26 ownership over the decision-making and implementation processes.

27 Adaptation has also been aligned with existing urban environmental sustainability priorities, which  
28 address adaptation in an integrated and holistic way, consider the needs of the most vulnerable groups,  
29 and encourage the development of programs with both mitigation and adaptation benefits. Although  
30 Quito's broadly inclusive approach generates adaptation, mitigation, and sustainable development co-  
31 benefits, this approach can result in the dilution of targeted adaptation benefits. In particular, this  
32 approach increases the difficulty of assessing the benefits of particular adaptation interventions and  
33 heightens the risk of overlooking important climate impacts that require a more targeted adaptation  
34 approach, such as in the case of public health.

35 Another strength in Quito's approach is that local leaders have engaged with international  
36 networks, agencies, and national policies on their own terms and with a strong sense of ownership. The  
37 absence of early national climate policies and continued competition between local and national political

1 actors have prompted Quito to take early leadership steps and to maintain and highlight this leadership  
2 over time. Local elected officials and planners stress that their autonomous adaptation innovations are  
3 independent of any national government interventions. The Quito case shows that when climate  
4 adaptation is implemented gradually, with initial learning, awareness, integration into the city's agenda  
5 and vision, and with internal and external capacity building, the results give rise to comprehensive  
6 adaptation actions that enhance resilience of the most affected areas and groups. That said, Quito's  
7 approach does entail the risk of having to redirect the course of climate adaptation action if national  
8 ministries decide to take a stronger hold of municipal climate work. The broad scope of its programs might  
9 also become jeopardized if budget priorities change in subsequent municipal administrations.

10 In Surat, the interventions initiated by the Rockefeller Foundation since 2008 have clearly  
11 facilitated the drafting of the *City Resilience Strategy*, the implementation of the various pilot projects, and  
12 contributed to the founding of the Surat Climate Change Trust (SCCT). In fact, the successful  
13 institutionalization of climate adaptation and resilience planning in Surat can be primarily attributed to the  
14 "hand-holding" by the various ACCCRN partners working in the city. Still, the ability of the ACCCRN  
15 program to take root in Surat depended on a number of crucial local political factors, such as existing  
16 policy experience in dealing with natural hazards and public health emergencies, a receptive municipal  
17 government with a strong focus on good governance, transparency, and pro-activeness, and a strong  
18 private sector engaged in facilitating public participation and providing institutional strategies of sustaining  
19 adaptation planning beyond ACCCRN engagement.

20 Still, compared to Quito, adaptation planning in Surat has resulted in projects and programs that  
21 continue to be institutionally distinct from the rest of the city's development and planning processes. This  
22 approach has also prompted the sidelining of further participatory programs that specifically target issues  
23 of poverty reduction, access to basic urban services, local livelihoods security, and overarching social  
24 justice and equity concerns. The inability to institutionalize a broadly inclusive approach has confined  
25 adaptation decision-making to a few experts in local government and in the SCCT, prevented awareness  
26 generation across poor and vulnerable sections of society, and has reduced the overall legitimacy of the  
27 adaptation planning process. As the SCCT gradually takes hold, climate adaptation planning in Surat will  
28 continue its project-based approach, with a simultaneous focus on advocating and supporting climate  
29 adaptive action across different departments within city government. Although the SCCT provides an  
30 institutional home of the urban adaptation agenda, it remains unclear how this approach can be expanded  
31 in the future to include more stakeholder voices, to achieve less project-oriented interventions, and to  
32 insert adaptation objectives into existing urban development programs.

33 For Durban, the city's sustained engagement and action in climate protection has resulted in an  
34 important international profile. Many of the early success of the Durban experience can be attributed to  
35 strong dedication of the EPCPD leadership, which led to the various assessments, municipal and sectoral  
36 adaptation strategies, and community- and ecosystem-based adaptation projects. The EPCPD has  
37 dedicated efforts to bring climate adaptation to the forefront of the city's agenda and departmental work,

1 often through experimenting, working with gatekeepers, and learning by doing. While this approach  
2 fosters creativity and flexibility, it also weakens possibilities for institutionalizing and mainstreaming  
3 climate adaptation at the municipal level and for considering vulnerability and resilience in a broad,  
4 holistic manner. Compared to Quito and Surat, Durban's adaptation planning process is most heavily  
5 driven by institutional champions. Although this approach facilitates targeted inter-departmental linkages  
6 that are based on specific institutional interests and personal relationships, this approach also inhibits  
7 broad inclusive and representative planning process and further enables siloed departmental mentalities.

8 Lastly, the fact that climate adaptation is perceived in Durban's municipality as an environmental  
9 problem distinct from the national priorities of economic growth and development limits opportunities for  
10 legitimizing the climate adaptation agenda, securing dedicated resources, and integrating departmental  
11 responsibilities. Relationships with expert and civil society stakeholders remain ad hoc and engagements  
12 with international networks and donors continue to be haphazard despite continued efforts by the head of  
13 the EPCPD. Such constraints are thus limiting the comprehensive development of climate measures,  
14 cross-sectoral integration, and long-term actions to increase resilience.

## 17 **6. Conclusion**

18  
19 Our comparison of adaptation approaches in Quito, Surat, and Durban reveals that different  
20 planning pathways based on a city's prior and existing priorities, programs, and policy-making processes  
21 may be important elements during initial phases. But, in order to gain widespread commitment within local  
22 government, strong political leadership, departmental engagement, municipality-wide institutionalization,  
23 and continued stakeholder involvement are integral to sustaining adaptation planning and decision-  
24 making programs in the long run.

25 More specifically, although local politics, histories, and institutional biases often shape the  
26 contexts within which adaptation plans and strategies are conceived, adaptation experiments that seek to  
27 generate climate and development co-benefits and promote local ownership are more likely to succeed  
28 and be institutionalized. This point is particularly poignant when comparing the progress between Quito  
29 and Durban—adaptation actions should not be built only in one sector or domain, but should consider  
30 cities holistically as systems. This is particularly important because little guidance, best practices, or  
31 extensive local capacities exist to help growing and vulnerable cities in the global South adapt to  
32 projected climate impacts. Therefore, as we have highlight in this paper, when climate adaptation is  
33 planned in a way that generates initial learning, awareness, integration in the city's agenda and vision,  
34 and builds internal and external capacity, the process gives space to the development of comprehensive  
35 strategic adaptation actions that can eventually enhance the resilience of the most affected areas and  
36 groups.

37

1 **Appendix: List of Interviews**

2

3 Coastal, Stormwater and Catchment Management Department, eThekweni Municipality. 2010. Interview  
4 with representative. January 20: Durban, South Africa.

5 Disaster Management Unit, eThekweni Municipality. 2009. Interview with department representative. April  
6 14: Durban, South Africa.

7 ECOLEX. 2009. Interview with NGO representative. January 13: Quito, Ecuador.

8 EMAAP-Q, Quito Municipal Water and Sewage Corporation. 2009. Interview with representative. January  
9 12: Quito, Ecuador.

10 Environmental Office, Metropolitan District of Quito. 2009. Interview with representative. January 20:  
11 Quito, Ecuador.

12 Environmental Planning and Climate Protection Department, eThekweni Municipality. 2011. Interview with  
13 Deputy Head. April 20: Bellagio, Italy.

14 Environmental Planning and Climate Protection Department, eThekweni Municipality. 2012. Interview with  
15 Deputy Head. January 29: Durban, South Africa.

16 Environmental Planning and Climate Protection Department, eThekweni Municipality. 2014. Interview with  
17 Deputy Head. February 2: Cambridge, USA.

18 Environmental Secretariat, Metropolitan District of Quito. 2010. Interview with Metropolitan Director of  
19 Environmental Policy and Planning. February 22: Quito, Ecuador.

20 Environmental Secretariat, Metropolitan District of Quito. 2011. Interview with Metropolitan Director of  
21 Environmental Policy and Planning. April 21: Bellagio, Italy.

22 Environmental Secretariat, Metropolitan District of Quito. 2013. Interview with Metropolitan Director of  
23 Environmental Policy and Planning. February 7: Quito, Ecuador.

- 1 eThekweni Municipality. 2010. Interview with city manager. January 19: Durban, South Africa
- 2 Office for Citizens' Security, Metropolitan District of Quito. 2009. Interview with representative of the Risk  
3 Management Unit. January 15: Quito, Ecuador
- 4 Office of the City Engineer, Surat Municipal Corporation. 2013. Interview with Chief Engineer. June 12:  
5 Surat, India.
- 6 Office for Territorial Planning, Metropolitan District of Quito. 2009. Interview with representative. January  
7 15: Quito, Ecuador.
- 8 South Gujarat Chamber of Commerce and Industry. 2011. Interview with vice-president. January 10:  
9 Surat, India.
- 10 South Gujarat Chamber of Commerce and Industry. 2013. Interview with president and secretary of the  
11 Surat Climate Change Trust. January 25: Surat, India.
- 12 Surat Urban Development Authority. 2013. Interview with Chief Town Planner. January 28: Surat, India.
- 13 Town Planning Department, Surat Municipal Corporation. 2011. Interview with town planner. January 17:  
14 Surat, India.
- 15 Urban Health and Climate Resilience Centre. 2013. Interview with director. January 26: Surat, India.
- 16 Urban Social Health Advocacy Alliance. 2011. Interview with Technical Director. January 11: Surat, India.
- 17 Water Treatment Authority, Surat Municipal Corporation. 2011. Interview with representation. January 12:  
18 Surat, India.
- 19



1 **List of Tables**

2

**Contextual indicators**

---

<i>Actors</i>	Key actors and institutional drivers
<i>Motivators</i>	Primary planning impetus, such as experience of impacts or external interventions
<i>Enablers</i>	Existing policies, legislations, laws, and institutions
<i>Legitimacy</i>	Presence of internal political support and institutional authority
<i>Information</i>	Climate knowledge and availability of impact, exposure, and vulnerability assessments

**Operational indicators**

---

<i>Approaches</i>	Decision-making structures and implementation pathways
<i>Deliverables</i>	Specific adaptation policies, strategies, action plans, and hard/soft projects
<i>Integration</i>	Mainstreaming into existing city sectoral, development, and spatial plans and policies
<i>Institutionalization</i>	Linkage to existing urban planning, decision-making, and governance arrangements
<i>Resources</i>	Presence of human, institutional, and financial support

**Relational indicators**

---

<i>Civil society</i>	Involvement of civic sphere stakeholders, including academics, CBOs, NGOs, etc.
<i>Private</i>	Engagement with local private businesses, industries, and entrepreneurs
<i>Government</i>	Relationship to higher levels of government, including national and regional bureaucracies
<i>Networks</i>	Engagement with international partnerships and peer-to-peer learning mechanisms
<i>Other external</i>	Relationship to multi-/bi-lateral aid, philanthropic, and development assistance institutions

3

4 **Table 1:** Indicators for assessing urban climate adaptation planning processes

	QUITO	SURAT	DURBAN
<b>Adaptation building blocks</b>			
<i>Core driver</i>	Municipality driven	Donor driven	Champion and department driven
<i>Origins and motivations climate adaptation action</i>	Municipal policymakers supported by local experts and international networks and acting autonomously from national government	Assessment commissioned by international institution combined with existing disaster experience	Leader and expert in environmental department constrained by local and national economic development priorities
<i>Internal legitimacy</i>	Strong: Mayor and Metropolitan Council as champion and motor for adaptation planning and local residents encouraged to develop a sense of ownership	Strong: Municipal Commissioner has been a key supporter of the planning process led by the City Engineer, with the authority to coordinate across sectoral departments	Moderate: Single champion in a sectoral department. Strong support from within EPCPD and some support from partner departments.
<i>Climate vulnerability assessments</i>	Implicit work throughout from mid-1990s to end of 2000s. Now, formally integrated in the <i>Climate Adaptation Plan</i>	Explicit vulnerability and hazard assessments between 2008 and 2011	Explicit scientific evaluation prior to climate planning
<b>Municipal integration, operationalization, and coordination</b>			
<i>Implementation approach</i>	Climate Action Planning in Strategic Areas taking into consideration a variety of vulnerabilities	Project-based approach led by donor (2008 to 2012) then institutionalized in Surat Climate Change Trust (2012 onwards)	Some specific experimental projects in some sectors (biodiversity conservation, coastal)
<i>Concrete climate adaptation projects</i>	Extensive mitigation programs, sustainable natural resources management, risk assessment and response plans	Infrastructure upgrading and service delivery improvement projects around water, sanitation, public health, and social services	Community-based projects, engagement with local leaders and civil society groups, pilot projects
<i>Linkage to existing goals and plans</i>	Strong: planning linked to sustainable development and risks in vulnerable areas	Moderate: adaptation is seen as an addition to existing urban development planning	Weak: climate adaptation seen as environmental problem separate from socio-economic development priorities
<i>Municipal Institutionalization</i>	From general climate policy (EQCC) to specific Climate Action Plan and city-wide mainstreaming	From <i>City Resilience Strategy</i> (2011) to Surat Climate Change Trust	Action in specific individual sectors, but difficulty to implement cross-integration
<i>Commitment of human and material resources for climate adaptation</i>	Strong: Dedicated climate adaptation staff within the municipality with budget line and trust fund. So far \$180 million invested in climate actions	Strong: Surat Climate Change Trust has authority to autonomously generate funds. The city has a dedicated municipal budget line item.	Weak to uncertain: Part-time environmental manager in charge of climate adaptation work
<b>Internal and external engagement</b>			
<i>Engagement with Stakeholders (academia and civil society)</i>	Strong: Throughout the planning and implementation process	Ad hoc: through pilot projects at the beginning, but increasingly focused within an expert group during later phases	Ad hoc: through pilot and punctual projects, especially early on in climate adaptation
<i>Participation in international networks / external legitimation</i>	Strong: climate strategy showcased in several national and international instances	Strong: climate strategy internationally renowned and being replicated in India and other countries	Moderate: Adaptation work at times presented in conferences and workshops. Leads <i>Durban Adaptation Charter</i> .
<i>Relation with international donor community</i>	Strong to moderate: Engagement under Quito's own terms and needs	Strong: engagement with international donor (Rockefeller and DFID in particular)	Moderate: engagement through local leader/expert based in environmental Department

1

2 **Table 2:** Summary comparison climate adaptation approaches in Quito, Surat, and Durban

## 1 **References**

2

3 ACCCRN (2011) Surat City Resilience Strategy. Surat, India: Asian Cities Climate Change Resilience  
4 Network (ACCCRN) and TARU-Leading Edge.

5 Amundsen, H., Berglund, F., and Westskog, H. (2010) Overcoming barriers to climate change adaptation:  
6 a question of multilevel governance? *Environmental Planning C* 28(2), 276-289.  
7 doi:10.1068/c0941

8 Anguelovski, I. and Carmin, J. (2011) Something borrowed, everything new: innovation and  
9 institutionalization in urban climate governance. *Current Opinion in Environmental Sustainability*  
10 3(3), 169-175. doi:10.1016/j.cosust.2010.12.017

11 Anguelovski, I. and Roberts, D. (2011) Spatial (in)justice in urban climate policy: A multi-scale analysis of  
12 climate impacts in Durban, in: Carmin, J., Agyeman, J. (Eds.), *Environmental Inequalities Beyond  
13 Borders: Local Perspectives on Global Injustices*. MIT Press, Cambridge.

14 Atteridge, A., Shrivastava, M.K., Pahuja, N., and Upadhyay, H. (2012) Climate policy in India: what  
15 shapes international, national and state policy? *Ambio* 41, 68–77. doi:10.1007/s13280-011-0242-  
16 5

17 Ayers, J. (2009) International funding to support urban adaptation to climate change. *Environment and  
18 Urbanization* 21, 225-240. doi:10.1177/0956247809103021

19 Aylett, A. (2010) Conflict, collaboration and climate change: participatory democracy and urban  
20 environmental struggles in Durban, South Africa. *International Journal of Urban and Regional  
21 Research* 34, 478-479. doi:10.1111/j.1468-2427.2010.00964.x

22 Barrett, S. (2013) The necessity of a multiscalar analysis of climate justice. *Progress in Human  
23 Geography* 37, 215-233. doi:10.1177/0309132512448270

24 Bauer, A., Feichtinger, J., and Steurer, R. (2012) The governance of climate change adaptation in 10  
25 OECD countries: challenges and approaches. *Journal of Environmental Policy and Planning*  
26 14(3), 279-304. doi: 10.3763/cdev.2010.0040

27 Beg, N., Corfee Morlot, J., Davidson, O., Afrane-Okesse, Y., Tyani, L., Denton, F., Sokona, Y., Thomas,  
28 J.P., La Rovere, E.L., Parikh, J.K., Parikh, K., and Rahman, A.A. (2002) Linkages between

1 climate change and sustainable development. *Climate Policy* 2(2), 129–144.  
2 doi:10.3763/cpol.2002.0216

3 Betsill, M. and Bulkeley, H. (2006) Cities and the multilevel governance of global climate change. *Global*  
4 *Governance* 12(2), 141-159.

5 Bhat, G. K., Karanth, A., Dashora, L., Rajasekar, U. (2013) Addressing flooding in the city of Surat  
6 beyond its boundaries. *Environment and Urbanization* 25(2), 429-441.  
7 doi:10.1177/0956247813495002

8 Bradley, R. S., Vuille, M., Diaz, H.F., and Vergara, W. (2006) Threats to water supplies in the tropical  
9 Andes. *Science* 312(5781), 1755-1756. doi:10.1126/science.1128087

10 Biesbroek, G. Swart, R., Carter, R.J., Cowan, C., Henrichs, T., Mela, H., Morecroft, M. and Rey, D. (2010)  
11 Europe adapts to climate change: Comparing National Adaptation Strategies. *Global*  
12 *Environmental Change* 20(3), 440-450. doi:10.1016/j.gloenvcha.2010.03.005

13 Bulkeley, H. and Betsill, M. (2005) Rethinking sustainable cities: multilevel governance and the “urban”  
14 politics of climate change. *Environmental Politics* 14, 42-63. doi:10.1080/0964401042000310178

15 Castán Broto, V. and Bulkeley, H. (2012) A survey of urban climate change experiments in 100 cities.  
16 *Global Environmental Change* 23(1), 92-102. doi:10.1016/j.gloenvcha.2012.07.005

17 Carmin, J., Anguelovski, I., and Roberts, D. (2012) Urban Climate Adaptation in the Global South:  
18 Planning in an Emerging Policy Domain. *Journal of Planning Education and Research* 32, 18-32.  
19 doi:10.1177/0739456X11430951

20 Carmin, J., Nadkarni, N., and Rhie, C. (2012) Progress and Challenges in Urban Climate Adaptation  
21 Planning: Results of a Global Survey. Cambridge, MA: DUSP/MIT.

22 Chuku, C.A. (2010) Pursuing an integrated development and climate policy framework in Africa: options  
23 for mainstreaming. *Mitigation and Adaptation Strategies for Global Change* 15(1), 41-52.  
24 doi:10.1007/s11027-009-9203-8

25 CSIR NRE (2006) Climatic Future for Durban. Durban: CSIR

26 da Silva, J., Kernaghan, S., and Luque, A. (2012) A systems approach to meeting the challenges of urban  
27 climate change. *International Journal of Urban Sustainable Development* 4(2), 125-145.  
28 doi:10.1080/19463138.2012.718279

- 1 Dubash, N.K. (2012a) "Climate Politics in India: Three Narratives." Pp. 197–207 in Handbook of Climate  
2 Change and India: Development, Politics and Governance, edited by Dubash, N.K.. London and  
3 New York: Earthscan.
- 4 Dubash, N.K. (2012b) "Introduction." Pp. 1–25 in Handbook of Climate Change and India: Development,  
5 Politics and Governance, edited by Dubash, N.K. London and New York: Earthscan.
- 6 Dutt, A.K., Akhtar, R., and McVeigh, M. (2006) Surat Plague of 1994 Re-Examined. Southeast Asian  
7 Journal of Tropical Medicine and Public Health 37(4), 755–760.
- 8 Füssel, H.-M. (2007) Adaptation planning for climate change: concepts, assessment approaches, and key  
9 lessons. Sustainability Science 2, 265-275. doi:10.1007/s11625-007-0032-y
- 10 Gadgil, M. and Guha, R. (1994) Ecological Conflicts and the Environmental Movement in India.  
11 Development and Change 25(1), 101–136. doi:10.1111/j.1467-7660.1994.tb00511.x
- 12 Ghosh, A. and Ahmad, S.S. (1996) Plague in Surat: Crisis in Urban Governance. New Delhi, India:  
13 Concept Publishing Company.
- 14 Government of India (2008) National Action Plan on Climate Change. New Delhi, India: Prime Minister's  
15 Council on Climate Change, Government of India.
- 16 Groven, K., Aall, C., van den Berg, M., Carlsson-Kanyama, A., and Coenen, F. (2012) Integrating climate  
17 change adaptation into civil protection: comparative lessons from Norway, Sweden and the  
18 Netherlands. Local Environment 12 (6-7), 679-694. doi:10.1080/13549839.2012.665859
- 19 Guha, R. (1988) Ideological Trends in Indian Environmentalism. Economic and Political Weekly 23(49),  
20 2578–2581.
- 21 Hardoy, J. and Romero Lankao, P. (2011) Latin American cities and climate change: challenges and  
22 options to mitigation and adaptation responses. Current Opinion in Environmental Sustainability  
23 3(3), 158-163. doi:10.1016/j.cosust.2011.01.004
- 24 Hay, J. and Mimura, N. (2006) Supporting climate change vulnerability and adaptation assessments in  
25 the Asia-Pacific Region: an example of sustainability science. Sustainability Science 1(1), 23-35.  
26 doi:10.1007/s11625-006-0011-8
- 27 Haynes, D.E. (1991) Rhetoric and Ritual in Colonial India: The Shaping of a Public Culture in Surat City,  
28 1852-1928. Berkeley and Los Angeles: University of California Press.

- 1 Huq, S. and Reid, H. (2004) Mainstreaming Adaptation in Development. Institute for Environment and  
2 Development Bulletin 35(3), 15-24. doi:10.1111/j.1759-5436.2004.tb00129.x
- 3 Kantor, P., Rani, U., and Unni, J. (2006) Deficits Decent Work Informal Economy: Case of Surat.  
4 Economic and Political Weekly 41(21), 2089–2097.
- 5 Kashyap, S.P. and Tiwari, R. (1984) Diamond Shaping Industry in Surat: Characteristics of Firms by Size.  
6 Economic and Political Weekly 19(34), M99–M103.
- 7 Kernaghan, S., da Silva, J. (2014) Initiating and sustaining action: Experiences building resilience to  
8 climate change in Asian cities. Urban Climate 7, 47–63. doi:10.1016/j.uclim.2013.10.008
- 9 Kithiia, J. and Dowling, R. (2010) An integrated city-level planning process to address the impacts of  
10 climate change in Kenya: the case of Mombasa. Cities 27, 466-475.  
11 doi:10.1016/j.cities.2010.08.001
- 12 Klausen, J.E., Saglie, I.L., Stokke, K.B., and Winsvold, M. (forthcoming) Planning for climate change  
13 adaptation in urban areas. In: O'Brien, K. and Selboe, E. (eds), The Adaptive Challenge of  
14 Climate Change. Cambridge: Cambridge University Press.
- 15 Kok, M. and De Coninck, H. (2007) Widening the scope of policies to address climate change: directions  
16 for mainstreaming. Environmental Science and Policy 10, 587-599.  
17 doi:10.1016/j.envsci.2007.07.003
- 18 Lobo, L. and Prasad, P. (1998) Ethnography of Malaria in Surat District Putting: People on the Agenda.  
19 Economic and Political Weekly 33(24), 1444–1446.
- 20 Lu, X. (2011) Provisions of climate information for adaptation to climate change. Climate Research 47,  
21 83-94. doi:10.3354/cr00950
- 22 Maloni, R. (2002) Surat to Bombay: Transfer of Commercial Power. Itinerario 26(1), 61–73.  
23 doi:10.1017/S0165115300004940
- 24 Mathy, S. and Guivarch, C. (2010) Climate policies in a second-best world—A case study on India.  
25 Energy Policy 38(3), 1519–1528. doi:10.1016/j.enpol.2009.11.035
- 26 Mees, H.-L.P. and Driessen, P.P. (2011) Adaptation to climate change in urban areas: climate-greening  
27 London, Rotterdam, and Toronto. Climate Law 2, 251-280. doi: 10.1080/1523908X.2012.707407

- 1 Mees, H.L., Driessen, P.P., Runhaar, H.A., and Stamatelos, J. (2013) Who governs climate adaptation?  
2 Getting green roofs for stormwater retention off the ground. *Journal of Environmental Planning*  
3 *and Management* 56(6), 802-825. doi:10.1080/09640568.2012.706600
- 4 Mejia, R. (2009) The challenge of environmental regulation in India. *Environmental Science and*  
5 *Technology* 43(23), 8714–5. doi:10.1021/es903239b
- 6 Menning, G. (1997) Trust, Entrepreneurship and Development in Surat City, India. *Ethnos* 62(1-2), 59–90.  
7 doi:10.1080/00141844.1997.9981544
- 8 Miller, F., Osbahr, H., Boyd, E., Thomalla, F., Bharwani, S., Ziervogel, G., Walker, B., Birkmann, J., van  
9 der Leeuw, S., Rockström, J., Hinkel, J., Downing, T., Folke, C., and Nelson, D. (2010) Resilience  
10 and vulnerability: complementary or conflicting concepts? *Ecology and Society* 15(3), 11.
- 11 Moser, S. C. and Boykoff, M. T. (Eds.) (2013) *Successful Adaptation to Climate Change: Linking Science*  
12 *and Policy in a Rapidly Changing World*. Routledge.
- 13 Mukhopadhyay, P. and Revi, A. (2012) “Climate Change and Urbanization in India.” Pp. 303–316 in  
14 *Handbook of Climate Change and India: Development, Politics and Governance*, edited by  
15 Navroz K. Dubash. London and New York: Earthscan.
- 16 Narsiah, S. and Ahmed, W. (2012) The Neoliberalization of the Water and Energy Sectors in South Africa  
17 and India. *Journal of Asian and African Studies* 47(6), 679–694. doi:10.1177/0021909611429922
- 18 Quito Distrito Metropolitano (2010) *Estrategia Quiteña ante el Cambio Climático*. Dirección Metropolitana  
19 de Medio Ambiente and Fondo Ambiental, Quito, Ecuador.
- 20 Ravindranath, N.H. and Murthy, I.K. (2010) Greening India Mission. *Current Science* 99(4), 444–449.
- 21 Revi, A. (2008) Climate change risk: an adaptation and mitigation agenda for Indian cities. *Environment*  
22 *and Urbanization* 20(1), 207–229. doi:10.1177/0956247808089157
- 23 Roberts, D. (2008) Thinking globally, acting locally- institutionalizing climate change at the local  
24 government level in Durban, South Africa. *Environment and Urbanization* 20(2), 521–537.  
25 doi:10.1177/0956247808096126
- 26 Roberts, D. (2010) Prioritizing Climate Change Adaptation and Local Level Resilience in Durban, South  
27 Africa. *Environment and Urbanization* 22(2), 397–413. doi:10.1177/0956247810379948

- 1 Roberts, D. and O'Donoghue, S. (2013) Urban Environmental Challenges and Climate Change Action in  
2 Durban, South Africa. *Environment and Urbanization* 25(2), 299–319.  
3 doi:10.1177/0956247813500904
- 4 Romero-Lankao, P. and Dodman, D. (2011) Cities in transition: transforming urban centers from hotbeds  
5 of GHG emissions and vulnerability to seedbeds of sustainability and resilience: introduction and  
6 editorial review. *Current Opinion in Environmental Sustainability* 3(3), 113-120.  
7 doi:10.1016/j.cosust.2011.02.002
- 8 Romero-Lankao, P. and Qin, H. (2011) Conceptualizing urban vulnerability to global climate and  
9 environmental change. *Current Opinion in Environmental Sustainability* 3(3), 142-149.  
10 doi:10.1016/j.cosust.2010.12.016
- 11 Rosenzweig, C., Solecki, W., Hammer, S., and Mehrotra, S. (2011) *Climate Change and Cities: First*  
12 *Assessment Report of the Urban Climate Change Research Network*. Cambridge, Cambridge  
13 University Press.
- 14 Satterthwaite, D., Huq, S., Reid, H., Pelling, M., and Romero-Lankao, P. (2007) *Adapting to Climate*  
15 *Change in Urban Areas: The Possibilities and Constraints in Low-and Middle-Income Nations*.  
16 London, UK: International Institute for Environment and Development (IIED).
- 17 Secretaría de Ambiente - Municipio del Distrito Metropolitano de Quito (2012) *Plan de Acción Climático*  
18 *de Quito*. Quito Distrito Metropolitano, Quito, Ecuador.
- 19 Shackley, S. and Deanwood, R. (2002) Stakeholder perceptions of climate change impacts at the  
20 regional scale: implications for the effectiveness of regional and local responses. *Journal of*  
21 *Environmental Planning and Management* 45, 381-402. doi:10.1080/09640560220133414
- 22 Shah, G. (1997) Bureaucracy and Urban Development: Can It Made to Last? Post-Plague Scenario in  
23 Surat. *Economic and Political Weekly* 32(12), 607–613.
- 24 Shah, G. (1994) Economy and Civic Authority in Surat. *Economic and Political Weekly* 29(41), 2671–  
25 2676.
- 26 Sharma, D. and Tomar, S. (2010) Mainstreaming Climate Change Adaptation in Indian Cities.  
27 *Environment and Urbanization* 22(2), 451–465. doi:10.1177/0956247810377390



- 1 Simon, D. (2012) Reconciling development with the challenges of climate change: business as usual or a  
2 new paradigm? In *The Political Economy of Environment and Development in a Globalised World*,  
3 D. Kjosavik and P. Vedeld (eds.). Tapir Akademisk Forlag, Oslo, Norway. 195-217.
- 4 Smit, B. and Wandel, J. (2006) Adaptation, adaptive capacity and vulnerability. *Global Environmental*  
5 *Change* 16(3), 282-292. doi:10.1016/j.gloenvcha.2006.03.008
- 6 Subramanian, L. (1985) Capital and Crowd in a Declining Asian Port City: The Anglo-Bania Order and the  
7 Surat Riots of 1795. *Modern Asian Studies* 19(2), 205–237.
- 8 Torri, M. (1990) Ethnicity and trade in Surat during the dual government era: 1759-1800. *Indian Economic*  
9 *and Social History Review* 27(4), 377–404. doi:10.1177/001946469002700401
- 10 Tschakert, P. and Dietrich, K.A. (2010) Anticipatory learning for climate change adaptation and resilience.  
11 *Ecology and Society* 15(2), 11.
- 12 Tyler, S. and Moench, M. (2012) A framework for urban climate resilience. *Climate and Development* 4(4),  
13 311-326. doi:10.1080/17565529.2012.745389
- 14 Urwin K. and Jordan, A. (2008) Does public policy support or undermine climate change adaptation?  
15 Exploring policy interplay across different scales of governance. *Global Environmental Change* 18,  
16 180-191. doi:10.1016/j.gloenvcha.2007.08.002
- 17 van Aalst, M.K., Cannon, T., and Burton, I. (2008) Community level participation to climate change: the  
18 potential role of participatory community risk assessment. *Global Environmental Change* 18, 165-  
19 179. doi:10.1016/j.gloenvcha.2007.06.002
- 20 van den Berg, M. and Coenen, F. (2012) Integrating climate change adaptation into Dutch local policies  
21 and the role of contextual factors. *Local Environment* 17(4), 441-460.  
22 doi:10.1080/13549839.2012.678313
- 23 Zambrano-Barragán, C. (2012) *Quito's Climate Change Strategy: Lessons and opportunities*. Quito  
24 Distrito Metropolitano, Quito, Ecuador.