Chapter 10
Relevance and Quality of Climate Planning for Large and Medium-Sized Cities of the Tropics

Maurizio Tiepolo

Abstract In the last seven years, the number of plans with climate measures for tropical cities has increased 2.3 times compared to the previous seven years as a result of the initiatives of central and local governments, multi-bilateral development aid and development banks. The plans matter in achieving the 11th United Nations' Sustainable development goal. Therefore, the objective of this chapter is to ascertain the relevance and quality of climate planning in large and medium-sized cities in the Tropics. The chapter proposes and applies the QCPI-Quality of Climate Plans Index, consisting of 10 indicators (characterization of climate, number, quantification, relevance, potential impact, cost, funding sources, timetable and responsibility of measures, implementation monitoring and reporting). It is revealed that 338 tropical cities currently have a local development, emergency, master, mitigation, adaptation, risk reduction plan or a resilience or smart city strategy. These tools were unquestionably more common in large cities, especially in OCDE and BRICS countries, while they were rare in Developing Countries. Local development plans (Municipal development, general, comprehensive) were the most common in medium-sized cities, along with those with the lowest quality, while stand-alone strategies and plans (resilience, mitigation, sustainable, adaptation), applied mostly in big cities, present much higher quality.

Keywords Climate change · Municipal development plan · Master plan · Emergency plan · Mitigation plan · Adaptation plan · Risk reduction plan · Resilience strategy · Smart city · Plan quality · Tropics

M. Tiepolo (✉)
DIST, Politecnico and University of Turin, Viale Mattioli 39, 10125 Turin, Italy
e-mail: maurizio.tiepolo@polito.it

M. Tiepolo et al. (eds.), *Renewing Local Planning to Face Climate Change in the Tropics*, Green Energy and Technology,
DOI 10.1007/978-3-319-59096-7_10

10.1 Introduction

Climate plans are used by a growing number of cities to reduce the emission of Green House Gases (GHG) into the atmosphere (mitigation, sustainable action plans) and the impacts of climate change (emergency, adaptation, risk reduction, resilience plans). Municipal development and master plans should also be considered among climate plans when they contain measures aimed at altering the urban spatial configuration, density, land cover and physical building characteristics, all factors that can modify the urban micro climate (Alcoforado and Matzarakis 2010).

In the Tropics, climate plans began to be developed in around 2003, based on the initiatives of several multilateral bodies (development banks, United Nations), bilateral aid, associations and movements of local governments (ICLEI-International Council for Local Environmental Initiatives, C40), certain foundations (Rockefeller, Bloomberg), and commitments made by individual countries within the framework of international agreements (UN Framework Conference for Climate Chance, Hyogo Framework for Action). These commitments are often converted into national laws that enforce local climate planning.

One of the recurring topics of the debate on climate planning is which tools to use to plan the reduction of GHG emissions and the impacts of CC on cities: stand-alone plans or mainstreaming of climate measures in existent plans (UN-Habitat 2009, 2011, 2015). According to Aylett (2014), climate planning is not achieved with isolated plans. This said, the mainstreaming of climate measures requires the existence of plans which, according to Fraser and Lima (2012), are absent in small towns.

A second topic is the quality of plans. Until a few years ago, according to the results of the surveys carried out by Wheeler (2008), Tang et al. (2010) and Preston et al. (2011), the quality was rather low. The first quality factor is the solidity of the preliminary analysis that precedes planning. According to Hunt and Watkiss (2011), it was very imbalanced in relation to flood risk. Another quality factor concerns measures. According to Buckley (2010) and Anguelowski and Carmin (2011), those for mitigation of emissions prevail over those for adaptation to impacts. Among the measures envisaged, those effectively applied are only the short-medium term ones, those that can be accomplished within the space of a mandate (Lethoko 2016). Wheeler (2008) then found that, in the United States, the measures envisaged by climate action plans were insufficient to significantly reduce GHG emissions.

The above information is taken from surveys with a rather varied reach: from a few case studies (Vergara 2005; UN Habitat 2015) to a few hundred cities (Carmin et al. 2012; CAI 2012; CDP 2014) without distinguishing between towns and mega cities, tropical, sub-tropical or boreal settlements, least-developed countries and wealthiest economies. Carried out in this way, these surveys do little to help identify the points on which to strengthen climate planning. To find a remedy for this absence, in 2015 we investigated two climatic zones (Sub-tropics and Tropics), a specific class of city (large), concentrating attention only on stand-alone plans (Tiepolo and Cristofori 2016). It turned out that climate planning was still rather scarce (24% of cities) despite being on the increase (+1.5 times in the last five years). Emergency, mitigation, adaptation and resilience plans were, in that order, the most widespread in big cities but quality was poor in 70% of cases. The results of that survey looked promising. This is why, in 2016, we extended the survey to medium-sized cities and to all the existing plans, but narrowed observation to the Tropics only, where there was a higher concentration of Developing Countries (DCs) and Least-Developed Countries (LDCs).

This chapter aims to ascertain (i) the relevance of climate planning and (ii) its quality. The methodology followed starts with the identification of the cities that are populated by over 0.1 million inhabitants (1388) in tropical zone and then, among these, those that have enforced climate a planning tool (338). This is followed by the download of the plans and the construction of the database. Lastly, the analysis: types of plans, their relevance (by class of city, by country and economy), and quality, through the specially conceived QCPI-Quality of Climate Plans Index. The following paragraphs are going to look at the methodology, the results (rise of climate planning in the Tropics, planning categories, quality), discussion, conclusions (focusing on possible improvements in climate planning and on recommendations to put them into practice).

10.2 Materials and Methods

This chapter is based on the results of a survey on climate plans in Chinese, English, French, Portuguese and Spanish, for cities with over 100,000 inhabitants, in 95 tropical countries. The survey covers 63% of tropical cities, while the remaining 37%, which belongs to countries from other linguistic areas (especially Philippines, Indonesia, Malaysia, Bangladesh and Viet-Nam), is covered on a limited basis by plans accessible in English. The term big cities refers to jurisdictions with over one million inhabitants. Medium-sized cities are administrative jurisdictions with a population of between 0.1 and 1 million people. Some big cities are split into municipalities. If these jurisdictions have over 100,000 inhabitants and have a plan, like those of Lima, Miami, Niamey, Phoenix, Port-au-Prince, Rio de Janeiro, Santo Domingo and Yaoundé, then they were considered.

The plans were identified on the websites of the municipalities. Unavailable open access plans were excluded from the survey.

The tropical zone was defined with Köeppen-Geiger's classification based on temperatures and rainfall observed over the period 1971–2000 (Rubel and Kottok 2010) on a 0.5° latitude/longitude regular grid, as presented on the website http://koeppen-geiger.wu-wien.ac.at/shifts.htm. Categories and subcategories were used according to Trewartha's classification (Belda et al. 2014), which is adopted by the FAO, the Joint Research Centre of the European Commission and by IPCC (www.fao.org/docrep006/ad6528/ad652e07.htm). The tropical zone includes the categories wet-tropical rain forest and tropical wet in dry called savanna. A city is considered tropical if at least part of it is included in the tropical climatic grid. For cities on the edges of the climatic zone of interest, the built-up area was recognized on Google Earth. In addition to the demographic class, cities with a climate plan were divided by economy: OECD (Australia, overseas French jurisdictions, Mexico and USA) and Singapore, BRICS (Brazil, India, China and South Africa), DC-Developing Countries (23 countries), LDC-Least Developed Countries (9 countries). All the measures for the reduction of emissions and adaptation to CC were registered (123 for medium-sized cities and 147 for big ones). When we had finished, we had created a database with 53,000 data items containing 355 types of information.

We created a specific QCPI-Quality of Climate Plans Index to assess the action driven nature and the potential impact of climatic plans. The index gathers 10 indicators (climate characterization, number, quantification, relevance, potential impact, cost, funding sources, timetable and responsibility for each measure, implementation monitoring and reporting) (Table 10.1). Every indicator is assigned an equal weight (1 point).

The value of the QCPI can, therefore, vary between 0 and 10. In identifying the indicators, we referred to previous works which had examined plan quality (Baer 1997; Norton 2008) and reduced the number of indicators to effectively succeed in measuring them in a high number of plans often very different from one another. The indicator of potential impact refers the existence in every plan of at least one of the mitigation measures susceptible for significantly reducing emissions of CO_2 or for reducing the hydro-climatic risk according the mitigations plans of Belo Horizonte, Fortaleza, Miami and Phoenix (Table 10.2). It is not possible to appreciate the degree of implementation of the plans through this survey, as the municipalities rarely publish annual monitoring reports on this matter.

Table 10.1 Description of the indicators used for the QCPI

Indicators	Concept
1. Climate characterization	Local climate trends and changes expected over the next 20 years
2. Number of measures	Plans with over 10 climatic measures
3. Quantification of measures	Specification of the quantity of each measure
4. Relevance of measures	At least one measure that would significantly reduce CO_2 emissions or risk
5. Potential impact	Estimated impact of any measure on emissions or risk
6. Cost of measures	Estimated cost of each measure
7. Funding	Specification of the funding sources for each measure
8. Responsible	Specification of the structure responsible for implementing each measure
9. Monitoring & Reporting	Description of the monitoring and reporting system
10. Timetable	Distribution of measures over time

Table 10.2 Soundness of measures in climate plans for big and medium-sized tropical cities

Sector	Measure	Potential reduction of CO_2 emissions %
Mitigation	Less polluting fuels	0.9–7.5
	Bike/car sharing	1
	LED street lighting	2
	Green roof	3
	LEED Certification	2–3
	RRR waste	1–2.1
	Solar in buildings	5.3
	Subway	4
	BRT	5.7–8
	Methane capture (landfill)	20
	Renewable energy	33
	Waste water reuse	33
Adaptation	Resettlement	100

10.3 Results

10.3.1 Relevance of Climate Planning in the Tropics

Reducing the impact of CC entails (i) reducing the causes, (ii) protecting the population and assets exposed both before and (iii) during a hydro-meteorological or climate-related disaster.

Usually, the local governments plan these activities as the application of specific national or regional laws, as in the case of Colombia, Mexico, Niger, Philippines, etc. In the remaining cases, they do so after signing the US Conference of Mayors' Climate Protection Agreement (2005), the C40 or other unilateral initiatives to reduce the risk.

In the Tropics, today, at least 338 cities in 41 countries have a climate plan (Table 10.3; Figs. 10.1 and 10.2). This is almost a quarter of the cities. The highest number (79%) is in the OCDE countries, followed by BRICS (49%), LCDs (35%) and DCs (just 22%).

Since 2010, the number of climate plans has increased 2.3 times the number produced during the previous seven years (Fig. 10.3). In 2012, climate plans

Table 10.3 Tropical cities provided with climate plan

Tropical cities (class)	a	b	a/b * 100
	with climate plan	all	
Big, > 1MP	65	166	39
Medium, 0,1–1 MP	273	1222	22
Big and medium	338	1388	24

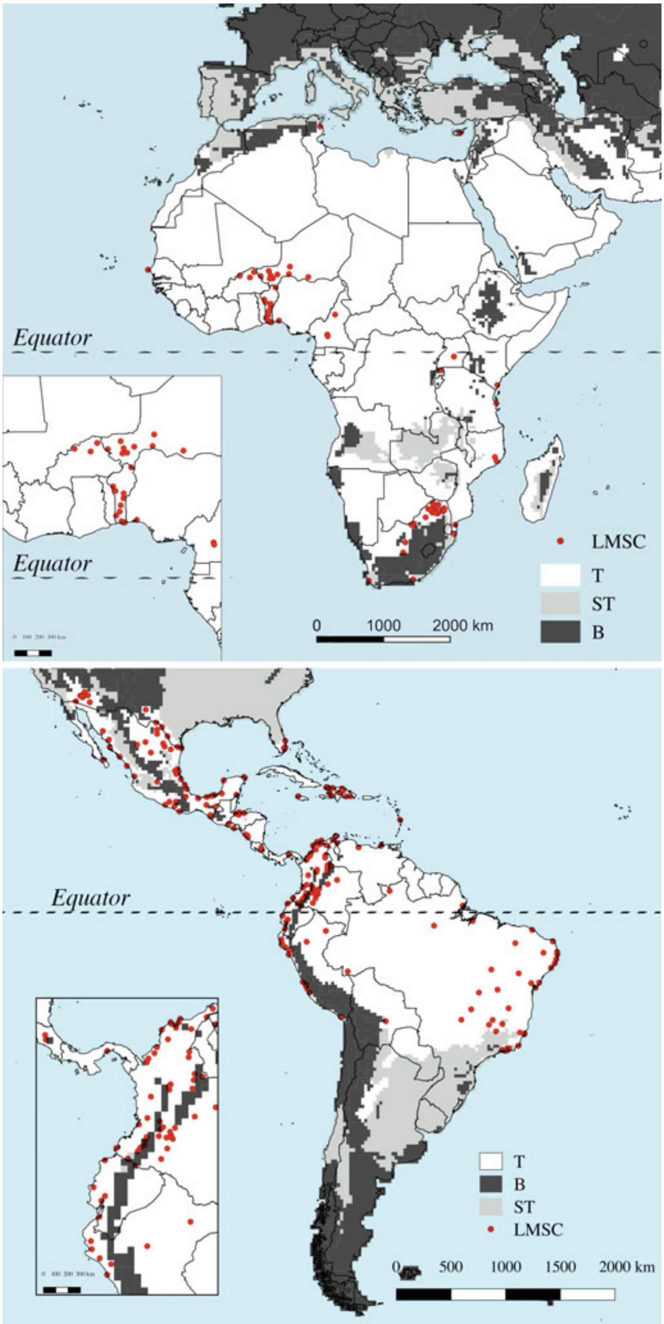

Fig. 10.1 Big and medium-sized cities of Tropical (*T*) Africa an Latin America provided with climate plan

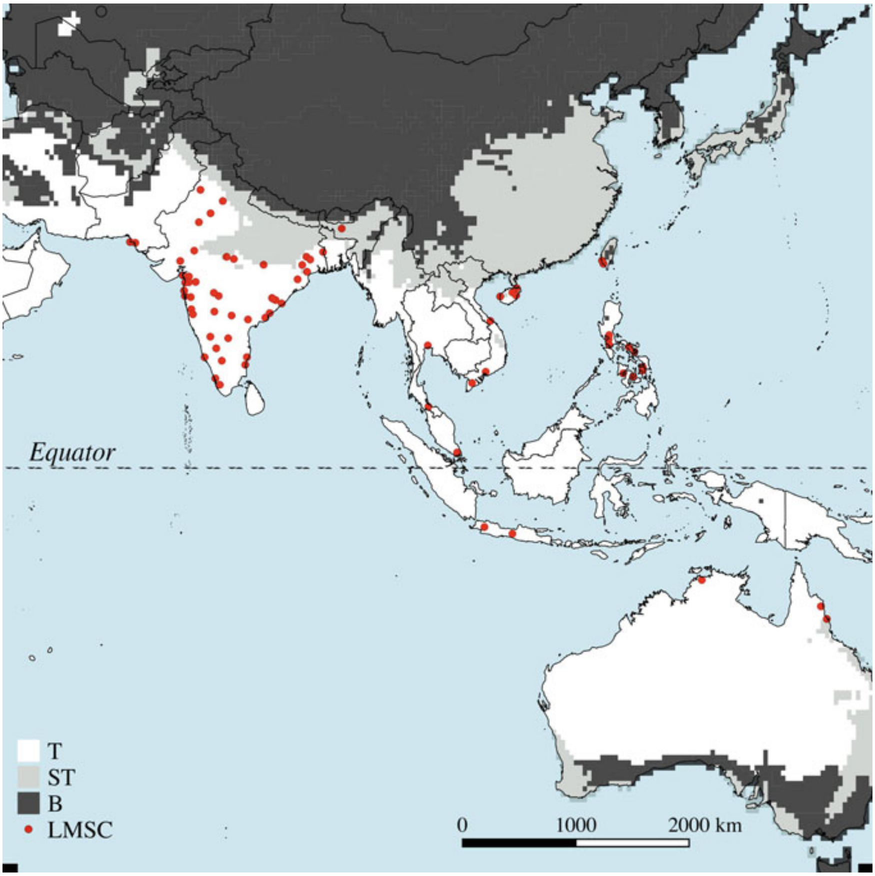

Fig. 10.2 Big and medium-sized cities of Tropical (*T*) Asia provided with climate plan

suddenly increased, following the entry into force of national legislations (Colombia and Mexico) which required the consideration of risk in municipal development plans (MDPs). Nevertheless, cities with climate plans in the Tropics are half those in the Sub-Tropics (Tiepolo and Cristofori 2016).

In 13 countries, climate planning is practiced by over half the cities (Table 10.4).

10.3.2 Plan Categories

Climate plans unite numerous tools, which sometimes have no equivalents in countries belonging to different linguistic areas (Table 10.5).

Municipal development plans are the most common tools (44%), followed by master plans (13%), emergency plans (12%), sustainable action and mitigation

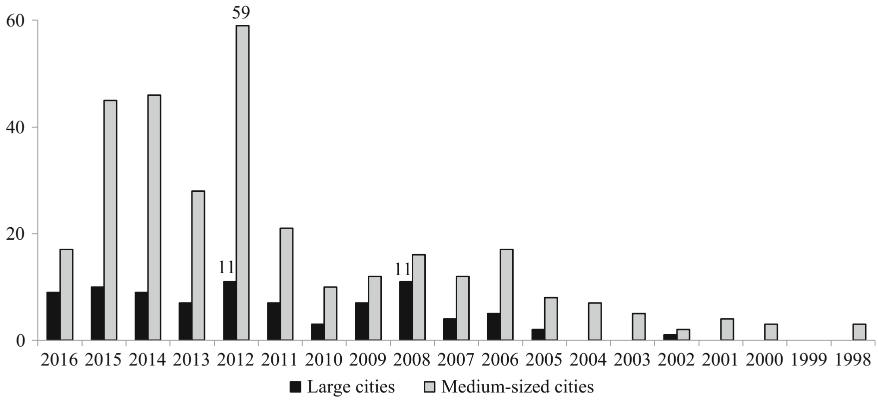

Fig. 10.3 Climate plans for big and medium-sized tropical cities by year of implementation

Table 10.4 Countries with greater relevance of climatic planning in the tropical zone

Country	Big cities		Medium-sized cities				Big-medium-sized cities		
	Total	With plan	Total		With plan		Total	With plan	
	#	#	%	#	#	%	#	#	%
Australia	0	0	0	3	3	100	3	3	100
Benin	0	0	–	8	8	100	8	8	100
Costa Rica	0	0	0	2	2	100	2	2	100
Honduras	1	1	100	5	5	100	6	6	100
Peru	2	2	100	13	13	100	15	15	100
Rwanda	1	1	100	0	0	0	1	1	100
Singapore	1	1	100	0	0	0	1	1	100
USA	2	2	100	20	20	100	22	22	100
South Africa	0	0	0	29	28	97	29	27	97
Colombia	5	5	100	45	38	84	50	43	86
Brazil	14	11	79	42	31	74	56	42	75
Mexico	1	0	0	60	45	73	61	45	74
Nicaragua	1	1	100	6	3	50	7	4	57
Taiwan	2	2	100	2	0	0	4	2	50

plans (12%), risk reduction plans (8%), smart city proposals (4%), adaptation plans (3%), resilience strategies (2%) and other types of plans (2%) (Table 10.6).

Sixteen cities have both a mitigation/adaptation or resilience plan, as well as an emergency or risk reduction plan.

Big cities use a broad range of tools: municipal development plans (21%), mitigation plans (17%), emergency plans (13%) and smart city proposals (13%) and

Table 10.5 How to say climate plan in English, Spanish, French and Portuguese speaking countries. Asteriscs show long term plans

English	Spanish	French	Portuguese
Comprehensive development* Integrated development* General plan*	P. desarollo communal/municipal/local concertado, P. territorial desarollo integral	P. développement communal, P. investissement communal, P. développement strategique	
Contingency p. Emergency p. Crisis management p.	P. contingencia P. emergencia, PLEC	P. contingence	P. contingência
Climate action p.	Plan accion climatica municipal	Plan climat energie territoire	Ação e metas para a redução de Gases de Efeito Estufa
Smart city			
Recovery & rehabilitation			
Sustainable action p. S. development strategy			P. ação sustentável
Resilience action p.			
Disaster management p.	P. municipal gestión riesgo desastre		P. municipal de redução do risco
Adaptation p.			
Green print	Estrategico		
Environment resources management			
Master p. City p.	P. directeur d'urbanisme, P. local d'urbanisme		P. diretor
Land use p.			P. de ordenamiento territorial

* Long term plans

emergency plans (13%). Medium-sized cities, on the other hand, use municipal development plans (50%), master plans (15%) or risk reduction plans (9%).

Municipal Development, General and Compehensive Plans

These are the most popular plans (44%). They organize the measures for every area of jurisdiction of local administration: transportation, infrastructure, housing, land use, conservation, economic development, education, healthcare. Municipal Development Plans (MDP) are medium term tools, that define actions within the space of a mandate (4–5 years). General and comprehensive plans, common in the

Table 10.6 Types of climate plan for big and medium-sized tropical cities

Type of plan	Climate plans for cities					
	Big/medium-sized		Big		Medium-sized	
	n.	%	n.	%	n.	%
Municipal development	164	44	13	21	151	50
Master plan	48	13	4	7	44	15
Emergency	45	12	10	13	35	12
Risk reduction	29	8	2	3	27	9
Sustainable	25	7	6	5	19	6
Mitigation	23	6	13	17	10	3
Adaptation	11	3	7	9	4	1
Smart city	15	4	10	13	5	2
Resilience	6	2	4	5	2	1
Other	10	3	5	7	5	2
Total	376	100	74	100	302	100

USA, are long term tools that define policies for the next 20 years. A diagnosis (participated) of the shortcomings precedes planning of measures. The most accurate plans spread measures over time, defining the cost and the sources of funding, the body responsible and the system of monitoring and evaluation. The MDP was born to promote local development, not to respond to CC, so it does not characterize the local climate, unless obliged by law to do so (Niger). However, different measures fall between those that are typical for mitigation (tree planting, pedestrian and cycle mobility, waste reducing/reusing/recycling) or adaptation (storm water drainage, resettlement from hazard prone areas). In the Tropics, MDPs are the first tools to contain measures for adaptation to CC: Djougou and Malanville, Benin (2003 and 2004), La Ceiba, Honduras (2005), Estelí, Nicaragua (2005), Thane (2005) and Mysore (2006), India. MDPs with climate measures have been generalized in Colombia, India, Mexico and other tropical countries since 2012. Odessa and Laredo are the first medium-sized cities to adopt a comprehensive plan (1988 and 1991). Glendele and Honolulu are the first to have a general plan (2002).

Master Plans

Master plans (13%) are the second most widespread tools. They first started to be implement in big cities (Belo Horizonte 1996, Kigali 2004, São Luís 2005) and then in medium-sized cities (Petrolina, São João Meriti, Uberlandia 2006). These plans are medium-long term and don't just define land use, but also transportation, water and sanitation, waste, economic and social development (education, health, access to housing, tourism) and environment, without, however, specifying the costs of the measures or their distribution over time, and without foreseeing the impacts or a device for monitoring and reporting (M&R).

Emergency Plans

This group (12%) is especially common in South America but not in tropical Africa. 61% of plans traced have been drawn up over the past three years.

There are two types of plan: those that specify the arrangements a local government must make to become operative in the event of a disaster (La Esperanza, Sincelejo), and those that are operational (Santiago de Cali), describing the sequence of established operations that the various actors are called upon to implement in order to respond to the emergency. These plans are, at times, limited to one hazard only (heat in Ahmedabad, drought in Campinas, floods in Machala). Though they do not solely refer to CC-related disasters, they overlap mitigation/adaptation plans in relation to the definition of zones that are either exposed or at risk. In cities that have both an emergency plan and an adaptation plan, the two tools refer to different bodies, specifically civil defence or fire brigade in the first case, city council/environmental sector in the second.

The plan is implemented after an early warning. The warning should be strategically communicated to areas that are exposed to the hazard, especially in the event of floods. This only occurs in 30% of cases. However, only 18% of plans define the early warning threshold. Barely 20% define hazard prone areas and only in half the cases do they make use of maps. Emergency or contingency plans “analyse specific potential events or emerging situations that might threaten society or the environment, and establish arrangements in advance to enable timely, effective and appropriate responses to such events and situations” (UNISDR 2009: 7). Once again, a national law envisages the disaster prevention device (Colombia, India, Philippines, etc.) or civil defence (Brazil), and subsequently the creation of municipal emergency committees to draw up dedicated plans. In other cases (Texas), the contingency plan is drawn up in compliance with rules defined by state commissions. The first medium-sized cities to implement an emergency plan were El Progreso, Honduras (1998), Granada, Nicaragua (2005), San Andres de Tumaco, Colombia (2006) and Tacna, Peru (2007), followed by two big cities: Tegucigalpa, Honduras (2007) and Hyderabad, Pakistan (2008).

Risk Reduction Plans

These scarcely used plans (8%), contain structural and non-structural measures described in detail (costs and methods of financing), which respond to the hazards to which the city is exposed. Sometimes these plans lack climate characterization. Risk reduction plans are in place in Brazil, Cameroun, Colombia, Nicaragua and Philippines. One of the first medium-sized cities to adopt these plans is Granada, Nicaragua (2005), followed, among the big cities, by Maçeio and Vitoria, Brazil (2007).

Mitigation Plans

This group collects 6% of the planning tools traced. These plans focus on the need “to reduce the sources or enhance the sinks of greenhouse gases” (IPCC 2014: 19). Mitigation plans comprise the emission inventory, GHG reduction goals and measures. The most detailed plans estimate the expected reduction of emissions, the risks resulting from CC, the cost, funding sources and the timing of every measure. The capability assessment, which considers the technical and political ability to implement the measures, is rarely carried out. The first mitigation plans for big tropical cities were prepared for Bangkok, Thailand (2007) and Miami, USA

(2008), and authentic climate plans, with numerous measures, for medium-sized cities are those of Cairns and Darwin, Australia (2009 and 2010).

Sustainable Action Plans

These plans (6%) were introduced by the Inter-American Development Bank starting in 2012. They contain mitigation measures (tree planting, pedestrian and cycle mobility) and adaptation measures (early warning and stormwater drainage) effective in the midterm. Their greatest limit is that they are stand-alone plans, not envisaged by law, which the cities are not required to set up.

Smart City Proposals

Smart city proposals are the ultimate planning tool. Employed in India (in about twenty cities) and in Indonesia (Bogor 2015), these tools are still little used in the Tropics (4%). They are based on broad consultation and, in general, concern one or just a few parts of the city. The accent is on technological innovation (for example, sensors which tell you when trash bins are full, etc.) more than tackling big urban problems (slum upgrading and informal settlement regularization, poverty and risk reduction). However, they also contain measures for mitigation (reduction of vehicle traffic) and adaptation (storm water drainage), which are not deriving from climate characterization or from risk assessment.

Adaptation Plans

Adaptation planning focuses on "the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (UNISDR 2009). Plans include non-structural measures (e.g. early warning, flood drills) and structural measures (flood barriers, stormwater drainage, and resettlement of inhabitants from flood-prone areas). In the latter case, if local adaptation plans are not expressly envisaged by the general environment protection law or by a specific national law (Philippines 2007), they are implicit in the Local Government Act of various countries (Australia 1999) when council functions are specified and often extended to "protect its area from natural hazards and to mitigate the effects of such hazards." In other cases, the individual cities implement the specific national commitments made at the United Nations Framework Convention for Climate Change (UNFCCC). Adaptation planning is funded by dedicated programmes, but is still scarcely practised (3%) as it has not been able to be implemented on the same global mobilisation levels as GHG mitigation. The first examples of adaptation plans are those of Darwin (2010) for medium-sized cities and of Semarang (2010) for big cities.

Resilience Strategies

Resilience strategies (2%) are common in Asia only. The target of these strategies is to strengthen planning, organisational and management skills in view of a disaster, rather than implementing structural measures. Aside from structural measures, they define many actions based on the accumulation of information (databases on hazards, hazard prone area identification), management (establishing a CC coordination office), training and awareness. The most accurate resilience strategies identify vulnerabilities, list the actions required to reduce them, define implementation phases and the relevant financial mechanism. Since 2010, UNISDR has supported local resilience strategies, especially partnered in Asia by the Rockefeller foundation. Can Tho (Viet Nam) was one of the first big cities to implement a Resilience plan (2010), with Sorsogon (Philippines) being one of the first medium-sized cities to do so (2010).

10.3.3 Quality of Climate Planning

Several parameters, such as internal consistency between objectives, priorities and measures (Baer 1997; Norton 2008; Baker et al. 2012), or between climate characterization and measures, can be considered to assess the quality of plans. In our case, we are interested in assessing whether the currently formulated plans are able to guide the implementation of measures that reduce the impact of CC, and whether the measures they propose are really appropriate to reduce GHG emissions and impacts of CC. The focus will then be on 10 indicators: climate characterization, number, quantification, relevance, expected impact, cost, funding sources, timetable and responsibility for each measure, monitoring plan implementation and reporting, brought together in the QCPI, which can theoretically reach the maximum value of 10.

Tropical cities have a QCPI of 2.5. Such a low score is due to the fact that just 2% of the plans specify the impact that the measures are expected to have, 6% characterize local climate, 18% quantify each measure, 20% of the plans indicate the cost of the measures and include a timetable for implementation, 22% have more than 10 climate measures and 24% specify the source of funding (Table 10.7).

Table 10.7 Frequency of indicators used in the QCPI according to tropical city size

Indicator	Climate plans according city' size					
	Big		Medium		Big and medium-sized	
	#	%	#	%	#	%
1. Climate characterization	9	14	11	4	20	6
2. Number of measures	24	36	42	19	76	22
3. Quantification of measures	11	17	50	18	61	18
4. Relevance of measures	49	74	109	39	158	46
5. Potential impact	3	5	4	1	7	2
6. Measure cost	25	38	118	42	143	42
7. Measure funds	15	23	69	25	84	24
8. Measure responsible	14	21	56	30	70	20
9. Monitoring and reporting	5	8	86	31	91	26
10. Time table	17	26	122	44	70	20
Plan considered #	66	100	280	100	346	100

Table 10.8 QCPI in tropical cities according to city size and plan category

Climate plan categories	City size		
	Big QCPI	Medium QCPI	Big and medium QCPI
Resilience	4.8	3.3	4.0
Sustainable action	1.0	3.7	3.4
Mitigation	3.2	4.0	3.5
Sustainable action	1.0	3.7	3.4
Adaptation	2.8	5.0	3.1
Smart city	2.7	3.2	2.9
General	–	2.9	2.9
Municipal development	2.9	2.7	2.7
Risk reduction	1.0	1.8	1.8
Comprehensive	–	1.6	1.6
Master	1.1	1.0	1.0
All	2.7	2.2	2.5

However, the QCPI varies depending on the size of the cities. Big cities have higher quality plans (QCPI 2.7) than those of medium-sized cities (QCPI 2.2) (Table 10.8). This is due to the greater frequency in the former of resilience strategies, mitigation, adaptation plans, tools which present the highest QCPI (4.8, 3.2 and 2.8 and 2.7 respectively). Medium-sized cities on the other hand are characterized by municipal developments and master plans, which have a low QCPI (2.7 and 1.0). Although the average QCPI values are fairly low, certain categories of plans have some high quality tools such as Cairns' mitigation plan (QCPI = 8), the MDPs of Concepcion de la Vega and Tanout, the resilience plan of Semarang, the risk reduction plans of Palmira and Puerto Plata (QCPI = 7).

In short, stand-alone plans (resilience, mitigation, sustainable action, adaptation, smart city) have higher QCPI than the general plans (municipal development, general, comprehensive, master plans), regardless of the size of the city.

The relevance indicator can, however, be misleading. When climate planning is carried out, not all cities start from the same baseline. For example, separate glass, metal, paper and food waste and recycling programs or the use of LED bulbs for street lighting can be innovative measures in one city, while they are so consolidated in another that they need not even be mentioned among the measures established by the plan. Hence, the absence of certain measures does not always indicate lack of detail or visionary planning.

The 346 climate plans of tropical cities traced (the remaining are emergency plans with no measures and other plans with little detailed measures), concern the main jurisdiction only, with the sole exception of Miami, where the whole metropolitan area was considered. Planning on a metropolitan scale stems from the need to harmonise the measures of many jurisdictions and authorities (water, etc.), whose consent is required (Revi et al. 2014: 44).

Plans for metropolitan areas include building awareness, studies and assessments to ensure that mitigation/adaptation measures become rooted in each jurisdiction,

Table 10.9 Aim of measures in 271 climate plans for tropical cities

Measure goal	Measures for Big and medium sized tropical cities	
	N°	%
Adaptation	96	62
Mitigation	47	31
Adaptation & mitigation	11	7
All	154	100

Table 10.10 Structural and non-structural measures in 271 climate plans for tropical cities

Measure nature	Big and medium-sized cities		Big cities		Medium-sized cities	
	N°	%	N°	%	N°	%
Structural	886	61	245	66	650	61
Non-structural	256	39	125	34	420	39
Total	1142	100	370	100	1070	100

and fundraising initiatives. Municipal plans focus instead on direct impact, especially on municipal facilities (offices, transportation, employees), and on sectors in which the Municipality has regulatory authority (private construction works, road systems, waste, education, etc.).

10.3.4 Climate Measures

As regards measures, there are two aspects of interest: knowing the main aims of the measures (mitigation or adaptation) and checking their nature (structural or non-structural). The survey of 346 climatic plans ascertained that adaptation prevails (62%) over mitigation (Table 10.9).

Secondly, structural measures (e.g.: tree planting, storm water drainage, cycle lanes, resettlement) prevail (61%) over those of a non-structural nature (e.g.: early warning system, emergency plan, risk maps, air quality monitoring, etc.) (39%) and this prevalence is valid for both big and medium-sized cities (Table 10.10).

10.4 Discussion

The survey on climate plans in the Tropics has allowed in-depth understanding of the intentions of cities to tackle climate change. Its results belie all previous knowledge. Firstly, climate planning in the Tropics has risen considerably in the past seven years, and now concerns a fourth of all cities.

The option between stand-alone and existing plans (UN-Habitat 2015) is soon unravelled. Three quarters of climate-action is carried out using existing tools: MDPs and master plans, especially in medium-sized cities. Stand-alone plans are used only by big cities. The mainstreaming of climate measures in the existing tools has several advantages in theory (UN-Habitat 2015; Revi et al. 2014; Basset and Shandas 2010): decrease of hazard exposure (prohibition of building on hazard prone areas), increased chances of implementation (MDP), mitigation burden shared with private sector (mitigation imposed upon developers), cost reduction (measures already funded in other sectors), reduced contribution to CC (regulations on building materials). In practice, we have found that mainstreaming presents several limitations compared to stand-alone plans. Specifically, in the case of municipal development plans, we notice very few climatic measures (an average of 4). In the case of master plans other limitations include lack of characterisation of the hazard, prevalence of measures that only concern land use (setback to be complied with during construction works, and land use allowed), lack of priority and scheduling, no reference to the potential impact of works, rare monitoring and reporting of the plan implementation.

Secondly, previous knowledge of climate measures is belied. In the Tropics, the focus isn't on flood (Hunt and Watkiss 2011). It is on air quality (47 measures), drought, heat, fire, landslide and wind (28 measures), with flood coming last (16 measures). The equivalent measures aren't related to mitigation (Buckley 2010; Anguelowsky and Carmin 2011) but to adaptation. Lastly, contrary to the claims made by Wamsler et al. (2013), the measures are not always the same in the different contexts with a prevalence of non-structural measures. They depend on the economy to which the city belongs (OECD, BRICS, DC, LDCs) and on the size of the city, and are mainly structural.

Thirdly, the QCPI confirms the observations of Wheeler (2008), Tang et al. (2010) and Preston et al. (2011) on smaller contexts: plan-quality is still low. Climate plans are not particularly action driven and their measures are inadequate to significantly reduce GHG emissions and the impacts of CC.

The existing plans, in which to carry out the mainstreaming of climate measures, present the lowest quality, regardless of the size of the city and the economy to which it belongs. Mainstreaming requires a considerable amount of work to raise the quality of MDPs, MPs and RMPs.

Our survey has two main limits. The first is that it considers no plans other than those accessible in Chinese, English, French, Spanish and Portuguese. Secondly, the QCPI can be misleading in relation to the relevance of measures: the absence of measures in some sectors (LED, drainage) can mean that the city in question is already sufficiently well-equipped.

10.5 Conclusion

This chapter aimed to characterize climate planning (dissemination and trend) and to ascertain its quality in a homogeneous context: the big and medium-sized cities of the Tropics. The survey of 338 tropical cities (Table 10.11) identified two important trends. First, strong growth of climate plans, especially in big cities. Second, dissemination of climatic measures mainly in MDPs.

The assessment of the quality of plans using the QCPI made it possible to identify the weaknesses that could be eliminated in the second-generation plans.

Local climate characterization (temperature, precipitations, sea level rise) is absent in all classes of city, as are indications on its future trend: it is paradoxical that 84% of plans define climate measures without knowing the local impacts of the climate and the trends expected for the next 20 years.

The potential impacts of the measures are estimated by just 2% of plans.

A measure which could significantly reduce emissions and impacts is present in just 46% of plans. For example, in relation to buildings, we have found that measures rarely make the construction of carbon-neutral structures compulsory.

Only 26% of climate plans describe the monitoring and reporting system and 22% of plans for medium-sized cities envisage more than 10 climate measures.

These considerations should sound as a recommendation for the multi-bilateral bodies that finance local climate plans, for the NGOs that accompany their formation, for the local governments that approve them and for the central governments that draw up the guidelines for their preparation.

This survey can be furthered in three ways: (i) passing from the occasional survey to tracking, (ii) checking whether the second-generation plans have overcome the weaknesses highlighted by the ten indicators of the QCPI, (iii) passing from the survey on the plan quality to that on plan implementation. Sometimes, the absence of details in planning is a choice made by local governments, to ensure long life to the plans for instance.

Table 10.11 Big and medium-sized cities of the Tropics provided with A-Adaptation, CD-City Development, C-Comprehensive, Ci-City, DM-Disaster management, E-Emergency, G-General, ID-Integrated development, M-Mitigation, MI-Municipal Investment, M-Master, R-Resilience, RR-Risk reduction, SAP-Sustainable Action, S-Strategic, SC-Smart city plans

City	Country ISO 3166-1	Population million	Plan type	Year
Big				
Agra	IND	1.6	MDP	2006
Ahmedabad	IND	6.3	E, SC	2015, 16
Aurangabad	IND	1.1	MDP	2012
Bangalore	IND	8.4	MDP, O	2011, 2015
Bangkok	THA	8.2	M	2007
Barranquilla	COL	1.2	A	2012
Belem	BRA	1.4	MP	2008
Belo Horizonte	BRA	2.5	MP, M	1996, 2013
Bhopal	IND	2.8	MDP	2006
Bogor	IDN	1.0	SC	2015
Brasilia	BRA	2.6	MP	2009
Bucaramanga	COL	1.0	MDP	2016
Can Tho	VNM	1.2	R	2010
Cartagena das Indias	COL	1.0	A, MDP	2012, 13
Cebu City	PHL	2.5	M	2013
Chennai	IND	4.2	SC	2015
Coimbatore	IND	1.6	MDP	2002
Dakar	SEN	2.5	MP	2010
Delhi	IND	16.8	E, SC	2015
Dubai	UAE	1.8	M	2014
Fortaleza	BRA	2.6	MP, M	2009, 2012
Goiania	BRA	1.3	SAP, RR	2012
Guayaquil	ECU	2.3	A	2012
Haikou	CHN	2.2	E, M	2014, 2015
Ho Chi Minh City	VNM	8.2	R	2013
Hyderabad	IND	6.8	E	2013
Hyderabad	PAK	1.1	E	2003
Indore	IND	2.0	R	2015
Jabalapur	IND	1.1	SC	2015
Jaipur	IND	3.3	SC	2012
Kampala	UGA	1.7	Other	2014
Kaoshiung	TWN	3.0	M	2011, 2014
Karachi	PAK	23.0	A	2013
Kigali	RWA	1.1	MP	2004
Lagos	NGA	9.0	A	2013
Lima	PER	8.5	E	2011

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Ludhiana	IND	1.4	SC	2015
Maçeio	BRA	1.0	RR	2007
Managua	NIC	1.3	MDP	2013
Manaus	BRA	2.0	MP	2014
Maracaibo	VEN	2.0	MDP	2005
Miami	USA	2.6	M	2008
Mombasa	TZA	1.1	MDP	2013
Montería	COL	1.0	M	2011
Nagpur	IND	2		
Phoenix City	USA	1.5	M	2009
Pimpri Chinchwad	IND	1.7	MDP	2006
Puducherry	IND	1.2	MDP	2013
Pune	IND	5.1	SC	2015
Raipur	IND	1.4	MDP	2014
Recife	BRA	1.6	MDP, SAP	2008, 2014
Rio de Janeiro	BRA	6.5	MP, M	2011, 2014
Salvador de Bahia	BRA	2.9	E, MP	2015, 2016
San Juan Lurigancho	PER	1.1	MDP	2011
Santa Cruz de la Sierra	BOL	2.5	MDP	2016
Santiago de Cali	COL	2.1	E	2009
São Luís	BRA	1.0	MP	2006
Semarang	IDN	1.6	R	2010
Singapore	SGP	3.8	M	2012
Surat	IND	4.8	R	2011
Tainan	CHN	1.9	A, E	2010
Tegucigalpa	HND	1.2	E	2007
Thane	IND	1.3	MDP	2005
Vasai Virar	IND	1.2	MDP	2009
Visakapatnam	IND	2.0	SC	2016
Medium-sized				
Abomey Calavi	BEN	0.7	MDP	2005
Acapulco	MEX	0.7	MDP	2012
Acuña	MEX	0.2	MDP	2014
Aganang	ZAF	0.1	ID, DM	2009, 2012
Agartala	IND	0.4	DP	2011
Agglomération centrale Martinique	MTQ	0.2	M	2012
Altamira	MEX	0.2	MDP	2011
Ananindeua	BRA	0.5	MP	2006

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Anapolis	BRA	0.4	MP	2016
Apartado	COL	0.2	MDP	2012
Aracaju	BRA	0.6	MP	2010
Armenia	COL	0.3	MP	2009
Asansol	IND	0.6	MDP	2006
Babahoyo	ECU	0.1	E	2009
Bacolod	PHL	0.5	A	2013
Ba-Phalaborwa	ZAF	0.2	DM, IDP	2012, 2015
Barrancabermeja	COL	0.3	MDP	2012
Belagavi	IND	0.5	SC	2016
Bello	COL	0.4	MDP	2012
Berhampur	IND	0.4	CDP	2011
Betim	BRA	0.4	MP	2007
Blouberg	ZAF	0.2	MDP	2015
Boa Vista (Roirama)	BRA	0.3	MP	2006
Bohicon	BEN	0.1	MDP	2008
Buenaventura	COL	0.4	MP	2001
Cairns	AUS	0.2	M	2010
Campeche	MEX	0.9	SAP	2015
Campina Grande	BRA	0.4	MP	2006
Campo Goyatacazes	BRA	0.5	MP	2007
Campos	BRA	0.5	MP	2007
Cancun	MEX	0.7	MDP	2014
Cariacica	BRA	0.4	MP	2007
Carmen	MEX	0.1	MDP	2012
Carrefour	HTI	0.5	MIP	2011
Cartago	COL	0.2	MP	2000
Chandler, AZ	USA	0.3	E, GP	2006, 2008
Chetumal see Othon P. Blanco	MEX	0.2	MDP	2013
Chiclayo	PER	0.5	MDP	2015
Chilón	MEX	0.1	MDP	2012
Choloma	HND	0.2	MDP	2003
Cienaga	COL	0,1	MDP	2012
Ciudad Madero	MEX	0.2	MDP	2013
Ciudad Valles	MEX	0.2	MDP	2004
Concepción de la Vega	DOM	0.2	MDP	2016
Contagem	BRA	0.6	RR	2007
Coral Springs	USA	0.2	CP	2008

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Cordoba	MEX	0.1	MDP	2014
Cotonou	BEN	0.8	MDP	2008
Cuiabá	BRA	0.6	MP	2008
Cumana	VEN	0.8	PAS	2015
Dargol	NER	0.1	MDP	2013
Darwin	AUS	0.1	M, S	2011, 2012
Davanagere	IND	0.4	SC	2016
Ding'an	CHN	0.3	M	2016
Dioundiou	NER	0.1	MDP	2009
Ditsobotla	ZAF	0.2	IDP	2015
Djougou	BEN	0.3	MDP	2003
Dongfang	CHN	0.4	E	2015
Dori	BFA	0.1	MDP	2008
Dos Quebradas	COL	0.2	E	2011
Duque de Caxias	BRA	0.9	RR	–
El Porvenir	PER	0.1	MDP	2014
El Progreso	HND	0.2	E	1998
Envigado	COL	0.2	MP	2011
Ephraim Mogale	ZAF	0.1	IDP	2015
Esmeraldas	ECU	0.5	E	2012
Estelí	NIC	0.1	MDP, A	2005, 12
Feira de Santana	BRA	0.6	MP	2013
Florencia	COL	0.2	E	2013
Floridablanca	COL	0.2	MDP	2012
Fort Lauerdale	USA	0.2	E, CP	2008, 2015
Frances Baard	ZAF	0.4	DM, IDP	2006, 2015
Fusagasugà	COL	0.1	MP	2001
Gilbert	USA	0.2	GP	2012
Glazoué	BEN	0.1	MDP	2014
Glendale, AZ	USA	0.2	GP	2002
Gomez Palacio	MEX	0.3	MDP	2010
Granada	NIC	0.1	E	2005, 09
General Escobedo	MEX	0.4	MDP	2010
Greater Giyani	ZAF	0.2	IDP, DM	2012, 2013
Greater Letaba	ZAF	0.2	E, IDP	2012, 2015
Greater Tubatse	ZAF	0.3	MDP	2016
Greater Tzaneen	ZAF	0.4	DMP, IDP	2012, 2013
Guadalajara de Buga	COL	0.1	MP	2000

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Guadalupe	MEX	0.7	MDP, MP	2005, 2016
Guntur	IND	0.5	CDP	2006
Guwahati	IND	0.8	SC	2016
Hat Yai	THA	0.2	A	2016
Heredia	CRI	0.1	MDP	2014
Hermosillo	MEX	0.8	MP	2015
Hialeah	USA	0.2	CP	2007
Honolulu	USA	0.3	GP, E, M	2002, 2008, 2014
Hoshanghad	IND	0.1	MDP	2011
Hué	VNM	0.3	A	2014
Ibagué	COL	0.5	E, MDP	2011, 2016
Iguala	MEX	0.1	MDP	2015
Iloilo city	PHL	0.4	A	2014
Indipendencia	PER	0.2	MDP	2011
Iquitos	PER	0.4	MP	2011
Itagui	COL	0.2	E, MDP	2012, 2016
Jaboatão de Guararapes	BRA	0.7	MP	2008
Jamshedpur	IND	0.7	MDP	2006
Jean Rabel	HTI	0.1	MDP	2013
Jiutepec	MEX	0.2	MDP	2016
João Pessoa	BRA	0.8	MP, SAP	2008, -
Jozini	ZAF	0.2	IDP	2013
Kagisano-Molopo	ZAF	0.1	IDP	2005
Kakinada	IND	0.3	MP	2016
Kalfou	NER	0.1	MDP	2014
Klouékanmè	BEN	0.1	MDP	2010
Kochi	IND	0.6	SC	2016
Kollam	IND	0.4	CDP	2014
La Ceiba	HND	0.2	MDP	2005
La Esperanza	PER	0.1	E	2015
La Paz	MEX	0.2	M	2012
Lepelle-Nkumpi	ZAF	0.2	IDP	2016
Lephalale	ZAF	0.1	DMP, IDP	2012, 2015
Limassol	CYP	0.1	M	2013
Los Mochis	MEX	0.3	MP	2014
Machala	ECU	0.2	E	2009
Magangué	COL	0.2	MDP	2012

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Makhado	ZAR	0.5	IDP, RR	2012, 2014
Makhuduthamaga	ZAR	0.3	IDP, DMP	2010, 2013
Malambo	COL	0.1	MDP	2012
Malanville	BEN	0.1	MDP	2004
Managua districts	NIC	0.3	MP	2013
Manzanillo	MEX	0.2	MDP	2015
Matamoros	MEX	0.5	MP	2005
Matola	MOZ	0.9	E	2015
Mazatlan	MEX	0.4	MDP	2014
Merida	MEX	0.8	MDP	2015
Mesa	USA	0.4	E, GP	2009, 2014
Mexicali	MEX	0.7	MDP	2014
Miami City	USA	0.4	CP	2015
Miami Gardens	USA	0.1	CP	2006
Miniatitlan	MEX	0.4	MDP	2014
Moca	DOM	0.2	MDP	2012
Mogalakwena	ZAF	0.3	DMP, IDP	2012, 2014
Molemole	ZAF	0.1	DMP, IDP	2010, 2014
Molina (La)	PER	0.1	MDP	2012
Monclova	MEX	0.2	MP	2012
St. James-Montego Bay	JAM	0.1	PAS	2015
Moretele	ZAF	0.2	IDP	2015
Moses Kotane	ZAF	0.2	IDP	2014
Muntinlupa	PHL	0.5	R	2014
Muriaé	BRA	0.1	RR	2010
Mysore	IND	0.9	CDP	2006
Naga	PHI	0.2	E	2013
Nampula	MOZ	0.5	M	2015
Nanded	IND	0.4	MP	2006
Natal	BRZ	0.8	MP, RR	2007, 2008
Natitingou	BEN	0.1	MDP	2004
Navojoa	MEX	0.2	MDP	2016
Neiva	COL	0.3	MP	2009
Ngaoundere	CMR	0.2	MDP	2014
Niamey1	NER	0.2	MDP	2012
Niamey4	NER	0.1	MDP	2014
Niamey5	NER	0.1	MDP	2013

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Nicosia	CYP	0.1	M	2014
Niteroi	BRA	0.5	MP	2004
Noumea	NCL	0.1	MP	2014
Nova Iguaçu	BRA	0.8	MP	2008
Nueva Laredo	MEX	0.4	MDP	2014
Ocaña	COL	0.1	RR	2012
Odessa	USA	0.1	CP	2008, 11, 15
Olinda	BRA	0.4	RRP	2004
Ouahigouya	BFA	0.1	MDP	2009
Ouessé	BEN	0.1	MDP	2011
Palmas	BRA	0.3	PAS	2015
Palmira	COL	0.3	E, RR	2012
Panama	PAN	0.9	PAS	2015
Parakou	BEN	0.2	MDP	2007
Pembroke Pines, FL	USA	0.2	CP	2013
Peoria	USA	0.2	E, SAP, GP	2003, 2009, 2013
Pereira	COL	0.5	MDP, PAS	2012, 15
Petrolina	BRA	0.3	MP	2006
Petropolis	BRA	0.3	RR	2007
Piedecusta	COL	0.1	MDP	2016
Piedras Negras	MEX	0.2	MDP	2014
Pissila	BFA	0.1	MDP	2008
Piura	PER	0.4	MDP	2014
Polokwane	ZAF	0.6	IDP, DMP	2012, 2013
Popayan	COL	0.3	MDP	2016
Porto Novo	BEN	0.3	MDP	2005
Porto Viejo	ECU	0.3	E	2008
Poza Rica	MEX	0.2	MDP	2014
Puerto Cortés	HND	0.1	MDP	2013
Quibdó	COL	0.1	RR	2012
Qiunghai	CHN	0.5	E	2015
Rajpur Sonarpur	IND	0.3	DP	2007
Ranchi	IND	0.8	MDP	2016
Ratlam	IND	0.3	CDP	2010
Ratlou	ZAF	0.1	IDP	2016
Resende	BRA	0.1	E	2014
Reynosa Tamaulipas	MEX	0.6	MDP	2012

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Ribeirão das Neves	BRA	0.3	RR	2009
Rio Branco	BRA	0.4	E	2016
Rio Hacha	COL	0.2	MDP	2011
Rourkela	IND	0.3	MDP	2015
Rustenburg	ZAR	0.5	IDP	2012
Saint Louis du Nord	HTI	0.1	MDP	2012
Saint Marc	HTI	0.2	MIP	2011
Saltillo	MEX	0.7	MDP	2014
San Andrés de Tumaco	COL	0.2	E	2004
San Diego	VEN	0.1	MDP	2014
San Felipe Puerto Plata	DOM	0.2	RRP	2013
San José	CRI	0.3	MDP	2012
San José de Cucuta	COL	0.6	MP	2001
San Jose del Monte	PHL	0.4	E	2014
San Juan Maguana	DOM	0.2	MDP	2012
San Luis Rio Colorado	MEX	0.2	MP	2013
San Pedro Garza Garcia	MEX	0.1	MDP	2012
San Pedro Macorís	DOM	0.2	MDP	2013
San Pedro Sula	HND	0.5	MDP	2015
Santa Ana	SLV	0.2	PAS	2012
Santa Marta	COL	0,4	PAS	2012
Santiago de los Caballeros	DOM	0.7	PAS	2015
Santiago de Surco	PER	0.3	MDP	2009
Santo Domingo Este	DOM	0.9	MDP	2015
Sanya	CHN	0.7	E	2014
São João Meriti	BRA	0.5	MP	2006
Scottsdale	USA	0.2	GP	2014
Sincelejo	COL	0.2	MDP	2012
Solarpur	IND	0.9	MDP	2015
Soledad	COL	0.5	MDP	2012
Sol Plaatje	ZAF	0.2	IDP	2012
Sorsogon	PHL	0.2	R	2010
Sousse	TUN	0.2	MDP	2014
Tacloban	PHL	0.2	RR	2014
Tacna	PER	0.2	E	2007
Tanout	NER	0.1	MDP	2005
Tapachula	MEX	0.2	MDP	2005
Tarapoto	PER	0.1	MDP	2012
Taytay	PHL	0.3	R	2015

(continued)

Table 10.11 (continued)

City	Country ISO 3166-1	Population million	Plan type	Year
Tempe	USA	0.2	GP	2013
Tepic	MEX	03	MP	2010
Teresina	BRA	0.8	MP	2015
Triruvananthapuram	IND	0.8	MP	2012
Thulamela	ZAF	0.6	IDP, DMP	2012, 2013
Tierralta	COL	0.1	RR	2012
Torreon	MEX	0.6	MDP	2014
Townsville	AUS	0.2	A, E, GP	2013, 2015
Trinidad	COL		MDP	2012
Trujillo	PER	0.8	MP	2013
Tswaing	ZAF	0.1	IDP	2014
Tucson	USA	0.5	E	2014
Tuluá	COL	0.2	MP	2000
Tuxtepec	MEX	0.1	MDP	2011
Tuxtla Gutierrez	MEX	0.4	MDP	2012
Uberlandia	BRA	0.7	MP	2006
Ujjain	IND	0.5	MDP	2010
uMhlabuyalingana	ZAF	0.2	IDP	2016
uPhongolo	ZAF	0.1	IDP	2008
Urapan	MEX	0.3	MDP	2015
Uribia	COL	0.1	MDP	2012
Valledupar	COL	0.4	PAS	2015
Veracruz	MEX	0.6	MP	2008
Victoria	MEX	0.3	MDP	2013
Villa Alvarez	MEX	0.1	MDP	2014
Villa el Salvador	PER	0.4	MDP	2001
Villa Hermosa	MEX	0.6	MDP	2012
Villa Maria Triunfo	PER	0.4	MDP	2007
Villavicencio	COL	0.4	MP	2015
Vitoria (Espirito Santo)	BRA	0.4	PAS	2015
Vitoria da Conquista (Bahia)	BRA	0.4	MP	2006
Warangal	IND	0.8	MDP	2012
Wengcheng Town	CHN	0.2	M	2015
West Palm Beach	USA	0.1	CP	2008
Xalapa	MEX	01	SAP	2015
Yaoundé 1	CMR	0.3	MDP	2012
Yaoundé 6	CMR	0.3	RR	2014
Yopal	COL	0.1	MP	2013
Zipaquira	COL	0.1	MP	2003

References

Alcoforado, M.-J., and A. Matzarakis. 2010. Planning with urban climate in different climatic zones. *Geographicalia* 57: 5–39.

Anguelowsky, I., and J.A. Carmin. 2011. Something borrowed, everything new: Innovation and institutionalization in urban climate governance. *Climate Opinions in Environmental Sustainability* 3: 1–7. doi:10.1016/j.cosust.2010.12.017.

Aylett, A. 2014. *Progress and challenges in the urban governance of climate change: Results of a global survey*. Cambridge, MA: MIT.

Baer, W.C. 1997. General plan evaluation criteria: An approach to making better plans. *JAPA* 63 (3): 329–344. doi:10.1080/01944369708975926.

Baker, I., A. Peterson, G. Brown, and C. McAlpine. 2012. Local government response to the impacts of climate change: An evaluation of local climate adaptation plans. *Landscape and Urban Planning* 107: 127–136. doi:10.1016/j.landurbplan.2012.05.009.

Basset, E., and V. Shandas. 2010. Innovation and climate action planning. Perspectives from municipal plans. *Journal of the American Planning Association* 76 (4): 435–450. doi:10.1080/01944363.2010.509703.

Belda, M., E. Holtanová, T. Holenka, and J. Kalvová. 2014. Climate classification revisited: From Köeppen to Trewartha. *Climate Research* 59 (1): 1–13. doi:10.3354/cr01204.

Buckley, H. 2010. Cities and the governing of climate change. *Annual Review of Environment and Resources* 35: 229–259. doi:10.1146/annurev-environ-072809-101747.

CAI-Clean air initiative and Cities development initiative for Asia. 2012. *Climate Change Plans and Infrastructure in Asian Citis*. Pasig city: CAI and CDIA.

CDP-Carbon Disclosure Project. 2014. *CDP Cities 2013. Summary Report on 110 Global Cities*. London: CDP.

Carmin, J.A., N. Nadkami, and C. Rhie. 2012. *Progress and Challenges in Urban Climate Adaptation Planning. Results of a Global Survey*. Cambridge, MA: MIT.

Fraser, A., and D.V. Lima. 2012. Regional technical assistance initiative on climate adaptation planning in LAC cities. Survey results report.

Hunt, A., and P. Watkiss. 2011. Climate change impacts and adaptation in cities: A review of the literature. *Climatic Change* 104 (1): 13–49. doi:10.1007/s10584-010-9975-6.

IPCC-International Panel on Climate Change. 2014. Annex II: Glossary. In *Climate change 2014: Synthesis report. Contribution of working groups I, II and III to the fifth assessmeny report of the Intergovernmental panel on climate change*, IPCC. Geneva: IPCC.

Lethoko. 2016. Inclusion of climate change strategies in municipal integrated development plans: A case from seven municipalities in Limpopo province, South Africa. *Jàmbá-Journal od Disaster Risk Studies* 8 (3). doi:10.4102/jamba.v8i3.245.

Norton, R.K. 2008. Using content analysis to evaluate local master plans and zonng codes. *Land Use Policy* 25: 432–454. doi:10.1016/j.landusepol.2007.10.006.

Preston, B.L., R.M. Westaway, and E.J. Yuen. 2011. Climate adaptation planning in practice: An evaluation of adaptation plans for three developed nations. *Mitig Adapt Strateg Glob Change* 16: 407–438. doi:10.1007/s11027-010-9270-x.

Revi, A. et al. 2014. Urban areas. In *Assessment report 5*, IPCC-WGII, 1–113.

Rubel, F., and M. Kottok. 2010. Observed and projected climate shifts 1901–2100 depicted by world maps of the Köppen-Geiger climate classification. *Meteorol. Zeitschrift* 19 (2): 135–141. doi:10.1127/0941-2948/2010/0430.

Tang, Z., S.D. Brody, C. Quinn, L. Chang, and T. Wei. 2010. Moving from agenda to action: evaluating local climate change actions plans. *Journal of Environmental Planning and Management* 53 (1): 41–62. doi:10.1080/09640560903399777.

Tiepolo, M., and E. Cristofori. 2016. Climate change characterisation and planning in large tropical and subtropical cities. In *Planning to cope with tropical and subtropical climate change*, ed. M. Tiepolo, E. Ponte, and E. Cristofori, 6–41. Berlin: De Gruyter Open. doi:10.1515/9783110480795-003.

UN-Habitat. 2009. *Climate change. The role of cities. Involvement, influence, implementation*. UN-Habitat and UNEP-United Nations Environmental Program.

UN-Habitat. 2011. *Cities and climate change. Global report on human settlements 2011*. London-Washington, DC: Earthscan.

UN-Habitat. 2015. *Integrating climate change into city development strategies. Climate change and strategic planning*. Nairobi: UN-Habitat.

UNISDR. 2009. *2009 UNISDR terminology on disaster risk reduction*. Geneva: UNISDR- United Nations.

Vergara, W. 2005. *Adapting to climate change. Lessons learned, work in progress, and proposed next steps for the World Bank in Latin America*. The World Bank.

Wamsler, C., E. Brink, and C. Rivera. 2013. Planning for climate change in urban areas: From theory to practice. *Journal of Cleaner Production* 50 (1): 68–81. doi: 10.1016/j.jclepro.2012.12.008 .

Wheeler, S.M. 2008. State and municipal climate change plans. *Journal of the American Planning Association* 74 (4): 482–496. doi:10.1080/01944360802377973.