

Governing Climate Change in Brazilian Coastal Cities: Risks and Strategies*

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Climate change is part of a new set of risks produced by the process of scientific and technological advance, qualitatively different from the risks of pre-industrial or industrial societies. These new post-industrial risks are characterized by their global reach, by incomplete understanding of their causes and consequences, by the fact of being incalculable, impossible to compensate and often invisible (requiring specialized knowledge to recognize and measure them), uncontrollable, difficult to identify responsibilities and often irreversible. From this perspective, this paper aims at reflecting on the challenges of climate change and the responses our society has built to this problem. The objective is to explore how climate change is being framed and how local governments in Brazilian coastal cities are responding to it in terms of policy strategies and instruments. From the institutional perspective, the fact that these governments are equipped in order to advance toward an internalization of sustainability indicators in their various dimensions is considered important. Nonetheless, the actions implemented are far from

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the concerns with global issues, such as climate change. Thus, the discussions about institutional and political indicators of sustainability in the cities and global changes gain crucial relevance upon the political agenda at the beginning of the 21st century.

Keywords: risk, climate change, cities, Brazil, governance

The recent fourth assessment report (AR4) of the Intergovernmental Panel on Climate Change (IPCC), established by the United Nations (UN) and the World Meteorological Organization (WMO), expressed agreement about global warming when they concluded with high confidence that climate change is unequivocal and the increase in average temperature of the earth's surface results from human activities combined with natural variation of the global climate system (IPCC, 2007).

This fact represents an advance in the debate since previous positions and arguments persisted defending, with some power of public persuasion, that the contemporary global warming had only natural causes resulting from biogeological cycles of the planet. According to such positions, for being a natural problem, there would be nothing to do about it except accepting it and coping with it. Of course, the scientific community recognizes that the earth's temperature is subject to long term cyclical variation; what it is argued is that it is possible to assess the contribution of human activities to the so-called "expanded greenhouse effect" and observe that the speed of this phenomenon has been verified since the advent and universalization of the industrial revolution and its life style, in more or less accelerated rhythms in several countries (Wilbanks & Kates, 1999; Beck, 2000; Pittock, 2005).

This increased modeling capacity in the assessment of the problem has produced reactions in the civil society, international bodies and institutions, governments and private sector in several countries that, for various reasons, are now more interested in the subject constituting a discursive field of proposals and practices that dispute the directions to address the problem in the way they judge to be the best forms to direct it (Giddens, 2009).

In this context, diverse alternatives have been proposed to address the problem under the international climate regime represented mainly by the United Nations Framework Convention on Climate Change (UNFCCC). This process seeks to reduce the harmful effects, risks and threats to life deriving from climate change. Building on these efforts, it is crucial to consider:

- (1) The economic and financial cost of mitigating climate change associated to its unequal distribution among nations;
- (2) The absence of international political institutions capable of regulating and managing the problem in its complexity;
- (3) The fragility of the nation-state when confronted by the alternatives proposed by market forces;
- (4) The persistence of the economic growth ideology;
- (5) The increased power of the scientific community and climate change experts;
- (6) The ethics and the environmental justice surrounding the climate change issue, including the division of labor and production worldwide involved in the relations among individuals, economic groups and blocks in both north and south.

Regarding the proposed alternatives, it is necessary to consider the proposals that calls for changes in energy sources—such as nuclear and biofuels energy—and the establishment of an international carbon market,

such as the one implemented by the Clean Development Mechanism (CDM), which is an important component of the Kyoto Protocol that ends in 2012.

This set of elements constitutes the complexity of the problem and raises questions and challenges to know whether the suggested responses to the global warming problem are efficient formulations, capable to produce the desired climatic stabilization or mere palliative that will end up maintaining the business as normal model that will not lead the mitigation of the global environmental problems, including climate change. In other words, are we really addressing the problem, with the seriousness, urgency and depth that it demands or are we only creating irresponsible escape routes for the future generations avoiding the necessary transformations?

In this direction, this paper aims at reflecting on the challenges posed by global warming and the responses that society has been building upon it, from a critical and comprehensive perspective. It seeks to contribute with the topic by analyzing how the coastal cities in the State of São Paulo have been formulating and implementing public policies and local and regional development strategies that can contribute for tackling the problem (Figure 1).

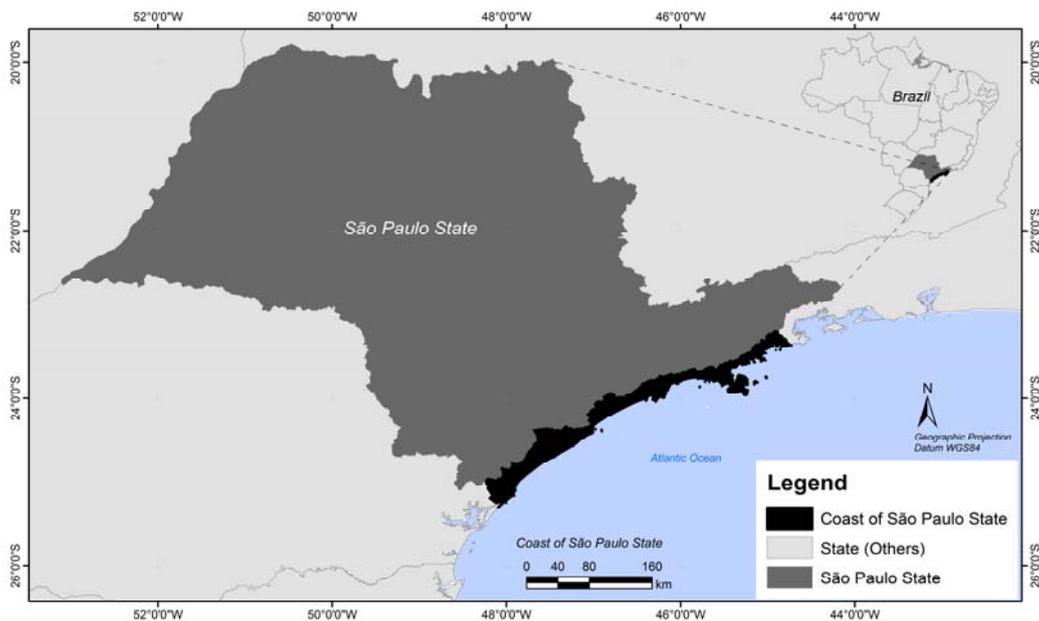


Figure 1. Coastal cities in the State of São Paulo, Brazil. Source: Hogan, 2009b.

Thus, on the one hand, some conditionalities of the problem in the scope of global environmental changes will be discussed in complexity. On the other hand, the risks and fragilities of proposed mitigation alternatives by these policies in the local level—in the coastal cities of the State of São Paulo—will be evaluated, considering its relationships with other scales of the problem through a multilevel perspective.

In a country like Brazil, whose largest cities are located on a coastline of 8,000 km, the response of coastal regions to climate change is a major issue. The coast of São Paulo concentrates ecosystems and populations with great exposure and sensitivity to environmental risks resultant of or amplified by climate change, such as sea level rise, storms surges, floods, landslides and the widespread of vector-borne diseases, caused by extreme weather events, increasing temperatures and changes in rainfall patterns (Wilbanks et al., 2007). This region can be considered vulnerable to climate change and should be a priority for social and environmental policies that seek forms of mitigation and adaptation (Nicholls et al., 2007; Satterthwaite et al., 2007; Hunt & Watkiss,

2007; Hogan, 2009a).

Risk Society and Global Environmental Changes

In the context of climate change, there is a set of social, political, ideological, economic, technological, scientific and cultural elements that define its complexity and must, therefore, be considered for its understanding (Biermann et al., 2009). These dimensions are particularly evident in the search for solutions to climate change problems, once they involve high economic costs that are justified by research and investments to redirect the current non-renewable energy model; to preserve existing forests and natural resources; to create carbon markets; to adapt populations in risky areas in developing countries and to mitigate the effect of difficult or irreversible problems.

Another dilemma directly related to global environmental changes comes out from the absence or deficiency of international political institutions in promoting dialogue and regulation between and across nations and the private sectors. The UN and other transnational institutions, such as cities networks, are just a few political resources available that could be mobilized to address for this purpose. However, due to the power asymmetries and the challenges ahead worldwide, they have been clearly insufficient and present limited capacity to face them (Betsill & Bulkeley, 2007).

Global environmental change raises not only questions about asymmetries but also regarding inequalities, allocation, justice, ethics and political deterioration. It needs to be framed in terms of fairness and encompass a fair distribution of political and financial responsibilities between and with nations considering the causes and the impacts of global warming with all its implications. Bringing the problem to national level, the role of the state is crucial for mitigating emissions and regulating economic activities by individuals and private actors. Acknowledging the complex network of interaction between state and non-state actors and the persistence of an economic growth ideology in most developing countries that shapes mindsets, speeches and practices of enterprises, scholars, political leaders and policy makers, apart from the public opinion itself, is a fundamental step in this direction

However, the last decades have demonstrated that economic growth itself was insufficient in delivering social justice and sustainable development although still rooted in most of the developing countries as a way out of poverty. Satterthwaite and colleagues (2007, p. 8) highlighted that since 1950, development and economic growth driven by technical assistance had been advocated as the element that would reduce poverty and promote well-fare in Africa, Asia, Latin America and the Caribbean. However, more than five decades later, the number of people suffering from poverty, lack of access to natural resources and vulnerability to the impacts of environmental change is much larger than it was in the 1950s, leading the UN to launch the Millennium Development Goals (MDG) in 2000, precisely focusing attention to the unmet needs after decades of development.

These reflections about the above-mentioned problems are supported by the concept of risk coined by Ulrich Beck (1992, 1995) and approached by the work of Anthony Giddens (2009). Other references in environmental sociology and environmental politics are useful as they provide the important elements for a critical review of environmental problems, including its political dimensions as well as its roots, consequences, contradictions and possible alternatives (Biermann et al., 2009; Yearley, 1996, 2005; Ferreira, 2003, 2006). The theory of risk (Beck, 1992, 1995) brings important elements for understanding environmental issues in the advanced modernity, identifying new risks and its multiple social implications in contrast with epistemological,

institutional, political and legal constraints in the instituted social order. Also, it underlines possible ways to address these new socio-environmental issues and its relations with the market, the state and the civil society.

Among these risks, Beck (1992, 1995) included the ecological, chemical, nuclear and genetic risks, produced by industrialization, economically externalized, legally individualized, scientifically legitimated and politically minimized. More recently, other scholars have also incorporated the economic risks, such as the international financial crises (Leichenko et al., 2009). According to them, this set of risks would generate new forms of global and economic order, different types of society and a new form of personal life.

The theory of risk (Beck, 1992, 1995) is closely and directly related to the process of globalization, as the risks are universally democratic, affecting nations and social classes without respecting any type of borders. However, such risks are unevenly distributed, affecting social groups, countries and regions in different ways (O'Brien & Leichenko, 2003, 2008). Moreover, it supports the understanding on how modern post-industrial societies are closely related to the future. As Giddens (2009) pointed out: "... risk refers to misfortunes evaluated in relation to future possibilities". It is an idea that makes sense for future-oriented societies. Risk is the dynamics that mobilizes the societies that change, evolve and adapt. For example, Giddens (2009) distinguished between two types of risk: the external one, coming from the outside based on traditions or coming from the nature; and the manufactured risk, created by the impact of our increasing knowledge of the functioning of the world. The last one is related to the situations in which our society had little experience in confronting with. It is in this category that the author places the environmental risks posed by global warming. These risks are directly influenced by the pace of the globalization processes (Young et al., 2006; Leichenko & O'Brien, 2008; Biermann et al., 2009). This is the case of global environmental changes, including global warming. The scientific community has concentrated many efforts on projecting these risks and modeling the expected changes in different world regions; however, we cannot be absolutely certain about these events. Due to the fluid character of science (Bauman, 2001; Giddens, 2005; Yearley, 2005), there are barriers to accept scientific finding, particularly in these situations of manufactured risks.

Living in a global society means facing multiple risks shaped by multiple stressors, as there are great uncertainties in terms of what the world will be like in 20, 30 or 40 years. It is only possible to mention probabilities and possible scenarios. Based on that, the high modernity society is involved with the challenge of managing these risks. In response to climate change, this type of management is the competence of not only, but, mainly the governments (national, provincial and local), which play an important role in setting regulations, institutions and appropriate modes of governance for confronting these risks (Bulkeley & Kern, 2006; Alber & Kern, 2008; Newell & Bulkeley, 2010).

Despite the global nature of climate change, the impacts to be felt and large part of the proposed solutions are taking place at the local level, since many of the human activities that contribute to global warming and global environmental changes, in general, happen at this level. Thus, it is necessary to look at cities and municipalities as critical arenas where climate change governance must take place (Wilbank & Kates, 1999; Betsill & Bulkeley, 2007; Satterthwaite, 2008; Bulkeley et al., 2009). This recognition has led to an increasing interest in framing climate change as an urban problem, and the debate on cities and climate change has received increased attention from the international scientific community (Bulkeley & Betsill, 2003; Bulkeley & Kern, 2006; Betsill & Bulkeley, 2007; Lankao, 2007a, 2007b; Dodman, 2009).

Local Governments and Climate Change

Since most of human activities take place in the cities, the issue about the routes of urban development has called the attention of governments, funding agencies, civil society organizations and experts from various areas of knowledge (Ferreira, 2001). The increasing concentration of population in cities is followed by the deterioration of the quality of life, together with environmental degradation and infrastructure deadlocks in urban centers, especially in Latin America, Africa and Asia.

Power at the municipal level has several legal and institutional mechanisms to face the process of socio-environmental degradation (Ferreira, 1992, 1999; Jacobi, 2006; Hogan; 2001). However, according to Ferreira (2003), some governments are not well prepared yet to face local environmental problems and global environmental changes. Discussions about sustainability have been intensified in the last 30 years, leaving restricted academic and policy circles to be mainstreamed into society. However, despite the existence of these debates and all intellectual and scientific effort around environmental issues, it is observed an enormous difficulty in implementing concrete policies and actions in order to guide current development practices in urban areas, since these processes are strongly dependent on the economic and political intervention of the powerful actors.

A considerable amount of scholarship on the climate change governance literature analyze the global and regional levels of governance prioritizing the development and implementation of an international climate regime that includes principles, norms, rules and decision processes (Okereke et al., 2009). However, the topic has an important local dimension, since many of the human activities that drive to global warming and global environmental changes, in general, take place at the local level (Collier, 1997; DeAngelo & Harvey, 1998; Wilbanks & Kates, 1999; Storbjörk, 2007; Puppim de Oliveira, 2009; Bulkeley et al., 2009).

Therefore, cities are closely connected to an important share of the global environmental change problem, since they are high energy consumers and locate great portions of greenhouse gases emissions¹ (Lankao, 2007a, 2007b, 2009; Dodman, 2009). About 60%-90% of the cities' emissions come from the use of fossil fuel in energy generation and transportation (Metz et al., 2007). There are still great greenhouse gases emissions associated with solid waste.

However, cities are also part of the solution when taking actions and measures that affect citizens' life, when allowing the exchange of information, public participation and the involvement of main stakeholders (Robinson & Gore, 2005). Moreover, cities have great potential for small and medium scale projects that can reduce greenhouse gases emissions (for example, through eligible CDM projects and other mechanisms such as REDD). Several local governments in Latin America have been relatively successful in implementing programs and actions to address climate change. The city of Bogota in Colombia, for instance, had reduced its greenhouse gases emissions by 40% with the Bus Rapid Transit (BRT), a public transportation system that uses exclusive lanes for its buses. Copenhagen, in Denmark, reduced about 90,000 tons of CO₂ emissions per year after investing in bicycle lanes (Macedo, 2000).

The cities, especially those with rapid growth are vulnerable to the impacts of climate change (Wilbanks et

¹ The greenhouse effect is a natural and fundamental phenomenon for species survival in the planet. Its intensification, due to human action, is in debate. The Kyoto Protocol establishes seven greenhouse gases whose emissions must be reduced: CO₂ (carbon dioxide), N₂O (nitrous oxide), CH₄ (methane), CFCs (chlorofluorocarbons), HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) and SF₆ (sulphur hexafluoride). Amongst the greenhouse gases that are increasing in concentration, the most important are: CO₂, CH₄ and N₂O. For details on global warming and the climate science, see Solomon et al. (2007).

al., 2007; Hunt & Watkiss, 2007; Satterthwaite et al., 2007; Bicknell et al., 2009). Thus, the challenge that has been placed is how to implement policies that avoid dangerous climate change, since the future is uncertain in this direction. As some of these risks posed by climate change are new and society does not have experience in coping with them, it is necessary to take precautionary measures before it is too late and the hazards materializes. This challenge ahead follows what Giddens (2009) has called the “Giddens’ paradox”, which states that since dangers posed by global warming are not tangible, immediate or visible in everyday life, many will sit on their hands and do very little of a concrete nature. However, waiting until they become visible and concrete in order to take serious actions will be too late. The required political action and intervention at the international, national and local levels will have a decisive effect on setting the boundaries to avoid dangerous global warming and support adaptation efforts that are already underway in many developed countries (Parry et al., 2008; Parry, 2009).

Methodology

As an interdisciplinary research project, the applied methodology is composed by different methodological aspects that are interconnected. The first step, object of this paper, is an assessment and characterization of the region in terms of socio-environmental features in order to identify and map its main challenges. It considers its ecological and social characteristics and the impacts of these patterns on biodiversity considering some human dimensions of sustainability, such as socio-environmental conflicts as well as political and institutional responses to the climate change.

In the scope of this paper, preliminary data collected in terms of the political and institutional aspects of local governments in the coast of São Paulo were prioritized, focusing on the analysis and understanding of to what extent the local governments are somehow prepared to deal with the challenges posed by climate change.

Later on, official documents will be analyzed, including laws, regulations, norms, decrees and official programs as well as policy papers published by non-governmental organizations (NGOs) and community organizations that will be organized in a database. Primary and secondary sources of data will be collected during field research in the studied cities engaged with researchers carrying out research activities in the region. During the field research, semi-structured interviews will be conducted with policy makers, political leaders, mayors, civil society activists as well as other relevant stakeholders.

Empirical Analysis: Governing Climate Change in the Coast of the State of São Paulo

In Brazil, where major cities are located in coastal zones, climate change is an extremely relevant issue. Coastal areas are considered particularly vulnerable to climate change; at the same time, they concentrate an expressive contingent of world’s population, and are development centers of the worldwide economy due to their infrastructure and natural resources (Adger, 1999; Nicholls et al., 2007; McGranahan et al., 2007).

The ports of Santos and São Sebastião, respectively the biggest port in South America and the main distribution center for Brazilian inland oil, along with the industrial district of Cubatão and the tourism industry widespread in the region make the coast of the State of São Paulo an important region for the economic and regional development of the country. Moreover, such region is considered relevant for environmental preservation for containing the most important remnants of Atlantic Forest, location of rich biodiversity and important ecosystems that are threatened by tourism increasing activities, modern transportation infrastructures, natural gas extraction and illegal exploitation of natural resources (Borelli, 2006). Little or almost no attention

has been given to the possibilities of and opportunities for mitigation and adaptation to specific vulnerability and to the capacity of small and medium-sized cities facing climate change in Brazil. Great part of the available research in the country and internationally focus on mega-cities, that is, those with a population over 10 million inhabitants. However, data from the Brazilian Institute of Geography and Statistics (IBGE in Portuguese) show that 66% of Brazilians live in cities with less than 500,000 inhabitants (IBGE, 2000).

This gap in empirical research and academic and scientific debates makes it possible to reflect on the impacts of climate change in small and medium-sized cities and their capacity to respond to the posed risks. Thus, do they suffer from smaller climate change problems and impacts when compared to larger Brazilian cities? In this direction, would it be easier to cope with such impacts in these small and medium-sized cities? Or for being smaller and with fewer resources they have less response capacity for adaptation? Although this work does not present conclusive answers to these questions, they open opportunities and guidance for the research on the possibilities and the coping and adaptive capacities of these region in terms of ongoing climate change despite the great scientific uncertainty on the local impacts of these changes and the absence of relevant research findings that could monitor and observe changes in this region.

São Paulo coast has about 700 km of extension comprising 16 coastal cities with complex ecosystems with the presence of estuaries, mangroves, sandbanks, caves, rivers, rocky shores and about 150 islands (SMA, 2005). Moreover, it has several protected areas. In terms of regional and socioeconomic aspects, the northern coast is currently the target of a series of interventions and expressive investments in infrastructure, especially in the area that corresponds to the cities of Caraguatatuba and São Sebastião (Hogan, 2009b). It is expected the construction of:

- (1) A road bypass connecting the cities of São Sebastião and Caraguatatuba;
- (2) A regional landfill to minimize the chaotic situation of solid waste in the region;
- (3) A prison facility in Caraguatatuba;
- (4) A natural gas treatment plant (already under advanced stage of construction).

Other projects are under discussion, such as the expansion of the port of São Sebastião and the expansion of the Tamoio highway that connects the city of São José dos Campos to Caraguatatuba.² Great part of these initiatives, understood as basic for the region, is concentrated on an area near the limits of the State Park Serra do Mar, especially near the Caraguatatuba Unit.³ Thus, the coast of São Paulo is important in such a way for its economic role, due to the current infrastructures and the ones under construction in these localities, as well as for the presence of environmental protected areas rich in biodiversity and ecosystem services. Despite the absence of consolidated data, it is expected that this region will be hardly impacted by climate change, as well as by the ongoing interventions and projects, whose results might lead to a second phase of disruptive urban growth and expansion with consequences that could be dramatic for the integrity of the Atlantic Forest and for different social groups, especially the local population that live in the area (Borelli, 2006; Hogan, 2009b).

In this context, it is appropriate to consider how climate change affects this area and the interlinkages

² Information collected on March 10th, 2010 during a conversation with Leonardo Teixeira, chief of the regional office of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) to the northern coast and Paraíba Valley in the State of São Paulo. IBAMA is responsible for environmental licenses of several of these interventions and investments.

³ The State Park of Serra do Mar comprehends an area over 315,000 hectares that corresponds to the limit of the State of São Paulo with the State of Rio de Janeiro until the South of the State of São Paulo. The park, which has the largest preserved area of the Atlantic Forest in Brazil, is divided in nine administrative units under the responsibility of the Forestry Institute, part of the State Environment Secretary of São Paulo.

between these processes. What could be the impact of climate change and urban expansion for the vulnerability of this region in terms of urban infrastructure, social groups and ecosystems? Far from finding exhausting answers, we take as a starting point the mapping of public agencies, municipal bodies and specific institutions whose main focus is to act in environmental issues in order to verify the existence of installed capacity in these localities.

According to Guimarães (2000) and Viola (1997), environmental policy making is recent in Brazil. In this context, the State of São Paulo is considered as a pioneer in environmental-oriented actions (Ferreira, 1992). At the municipal level, an impressive increase in actions focusing on the environment has been observed since 1988, supported by the democratization of country and the decentralization of governance policy making driven by the new Federal Constitution after more than two decades of military administration.

The Organic Laws have introduced and guided the design and implementation of environmental policies in local governments' agendas that started to face environmental degradation at the local level in the country mobilizing and using different legal and political instruments. Ferreira (2001) highlighted the relevance of environmental assessments in these processes of formulation and implementation of public policies based on socio-environmental aspects in some of the largest Brazilian cities such as Belo Horizonte (MG), Curitiba (PR), Porto Alegre (RS), Rio de Janeiro (RJ) and São Paulo (SP).

In terms of specific climate change action, the debate is even more recent nationally as well as internationally. It is only in recent years that it is possible to identify research activities that analyze such processes explicitly, taking into account the hazards, risks and strategies for mitigation and adaptation to climate change (Collier, 1997; DeAngelo & Harvey, 1998; Robinson & Gore, 2005; Sanchez-Rodriguez et al., 2005, 2008; Satterthwaite et al., 2007; Lankao, 2007a, 2007b, 2008; Bicknell et al., 2009).

The quality of local government has an important role in coping with climate change risks. Currently, many local governments in developing countries present low institutional and response capacity in dealing with the several problems that affect the quality of life of these populations, especially the poorest that present less coping capacity and weak ties in social protection networks (Satterthwaite et al., 2007; Tanner et al., 2008). However, climate change does not reach only the poor and its impacts affect different sectors of society, the public sphere and the market (Wilbanks et al., 2007; Satterthwaite et al., 2007; Tanner et al., 2008; Satterthwaite, 2008; Bartlett et al., 2009). Local governments are considered as critical elements to address many of the causes and consequences arising from climate change, as they are close to wherein these activities and events take place (Wilbanks & Kates, 1999; Robinson & Gore, 2005; Satterthwaite et al., 2007; Puppim de Oliveira, 2009).

Table 1 presents a summary of some local and state governments' responsibilities in areas related to climate change and risk management and reduction that are critical components of adaptation to climate change. Usually local governments are responsible for:

- (1) Finance: financial and accounting management of municipal budget; taxes collection and management, licenses and fees;
- (2) Engineering and public construction: construction and maintenance of the public space;
- (3) Urban/local development: land use regulation, urban zoning, real state registration and urban planning;
- (4) Health and public hygiene: collection, distribution and treatment of drinking water, pollution control, collection and treatment of solid waste, sanitary hygiene, public areas cleaning, medical and ambulatory services;
- (5) Social urban policies: housing, schools, day-care centers, youth, elderly, etc.;

(6) Civil defense and emergency response: disasters relief, fire brigade, ambulance services and rescue;

(7) Public administration and human resources: various administrative tasks and responsibilities including human resources management.

Table 1

Role of Local Governments in Areas With Effects on Climate Change

Local government's role	Long-term planning	Prevention of disasters	Response to extreme events	Reconstruction
Build environment				
Construction code	High	n.d.	High	High
Land use regulation and real estate registration	High	Low	n.d.	High
Maintenance and construction of building and public space	High	Low	n.d.	High
Urban planning and zoning	High	n.d.	High	High
Infrastructure				
Water treatment	High	Low	High	High
Wastewater treatment	High	Low	High	High
Drainage system	High	Low	High	High
Streets, avenues, bridges	High	n.d.	High	High
Electricity	High	Low	High	High
Landfill	High	Low	n.d.	High
Services				
Protection against fire	High	Low	High	Low
Public order, police	Average	High	High	Low
Solid waste collection	High	High	High	High
Education	Average	Average	n.d.	n.d.
Health and public hygiene	Average	Average	High	High
Public transportation	Average	High	High	High
Social welfare	Average	High	High	High
Responses to disasters and civil defense	n.d.	n.d.	High	High

Note. Source: Adapted from Satterthwaite, 2008, p. 26.

In Brazil, the city of São Paulo was pioneer in approving a specific law to deal with climate change. The city of São Paulo Climate Change Policy (Law N. 14.933) was a complete agreement approved by the City Council on June 5th, 2009, after one year of public debate. The law establishes reduction of 30% in total greenhouse gases emissions of the city. It enforces public transportation priority, gradual reduction in fossil fuel consumption and dependence, compulsory recycling program and reduction of solid waste altogether with energy efficiency criteria combined with eco-building to prevent flooding resulting from more intense and frequent rainfalls.

Some months after this approval, the State of São Paulo also approved its law, becoming the second Brazilian state to approve such law (the first one was the State of Amazonas in 2007), which also presents concrete mitigation targets. The so-called State Climate Change Policy projects reductions of at least 20% up to 2020 in total CO₂ emissions in relation to the 2005 level. Every five years, until 2020, the government will be able to set intermediate targets to reach the 20% goal.

In spite of being considered substantial advances to address the problem, these laws rely on a network of political-institutional structures and governance arrangements in order to be effectively applied (see Table 1).

Thus, it is fundamental to investigate these structures in these coastal cities of the State of São Paulo as inherent part of our research agenda. Hence, a preliminary mapping was carried out through these cities, aiming at finding the presence of governmental bodies and institutions interlinked with sectors and policy with some level of effect and jurisdiction to address climate change.

Table 2

Political-Institutional Structures in Coastal Cities of the State of São Paulo

Area of action*	List of cities	Number of cities
Economic development: Secretariats; authorities (agriculture; fishery; industry; commerce; science; technology)	Cananéia, Caraguatatuba, Cubatão, Guarujá, Ilha Comprida, Itanhaém, Mongaguá, Peruíbe, Santos, São Sebastião, São Vicente, Ubatuba.	12
Social development: Secretariats; authorities (social action; social promotion; social assistance; citizenship)	Bertioga, Cananéia, Caraguatatuba, Cubatão, Guarujá, Ilhabela, Ilha Comprida, Itanhaém, Mongaguá, Peruíbe, Praia Grande, Santos, São Vicente, Ubatuba.	14
Urban development: Secretariats; authorities (housing; public construction; public services; infrastructure)	Bertioga, Cananéia, Caraguatatuba, Cubatão, Guarujá, Iguape, Ilhabela, Ilha Comprida, Itanhaém, Mongaguá, Peruíbe, Praia Grande, Santos, São Vicente, São Sebastião, Ubatuba.	16
Environment: Secretariats; authorities	Bertioga, Cananéia, Caraguatatuba, Cubatão, Guarujá, Iguape, Ilha Bela, Itanhaém, Mongaguá, Peruíbe, Praia Grande, Santos, São Sebastião, São Vicente, Ubatuba.	15
Planning (management): Secretariats; authorities	Caraguatatuba, Cubatão, Guarujá, Ilha Comprida, Itanhaém, Mongaguá, Peruíbe, Santos, São Vicente, Ubatuba.	10
Health: Secretariats; authorities	Bertioga, Cananéia, Caraguatatuba, Cubatão, Guarujá, Iguape, Ilha Bela, Ilha Comprida, Itanhaém, Mongaguá, Peruíbe, Praia Grande, Santos, São Sebastião, São Vicente, Ubatuba.	16
Security: Secretariats; authorities; directories (public security; urban security; social defense; civil defense)	Caraguatatuba, Guarujá, Itanhaém, Mongaguá, Peruíbe, Santos, São Sebastião, São Vicente, Ubatuba.	9
Transport: Secretariats; authorities	Caraguatatuba, Iguape, Itanhaém, Mongaguá, São Vicente.	5

Note. * Some secretariats, authorities or directories have a specific area of intervention (for example, planning, environment, etc.), whilst others act in more than one area at the same time (planning and environment, for example).

Our mapping exercise focused on the executive and the legislative municipal bodies as well as on the presence of secretariats, departments, other public agencies, and City Council commissions. Despite recognizing that this exercise is not exhaustive and that the presence of these structures and institutions does not guarantee neither the effectiveness nor the adequate response to climate change. It is the first step and a starting point for understanding the capacity of these cities in terms of the ability they possess to formulate and implement their strategies.

Table 2 shows that a great part of the investigated cities presents political-institutional structures that could be mobilized to address climate change, especially in terms of specific secretariats, governmental agencies and departments. Our survey highlights the presence of structures dedicated to social, economic and urban development areas, besides environment and health.

Regarding the legislative body, most of the analyzed City Councils presents commissions whose interest will be able to intervene and govern by authority, basically through legislation, such as the ones approved in the city and in the State of São Paulo, which aim at mitigating greenhouse gases emissions, as well as creating and mobilizing the necessary conditions and resources for adaptation strategies.

The area of planning and management does not possess specific structure in some of the analyzed cities,

which might cause problems for coordinating inter-sectoral and multidimensional actions. In the case of transport, only five cities directly manage the public transport of their localities. In the other cities, it is indirectly administrated through autarchies and public companies. In many cities, the transport sector is one of the main sources of greenhouse gases emission; thus, having forms of governing this sector is fundamental for mitigation actions (Collier, 1997; Robinson & Gore, 2005; Bulkeley et al., 2009). In terms of environmental policies at the local level, only the city of Ilha Comprida does not possess a specific structure to deal with this area, although it can be incorporated in its urban development department.

An institutional approach and reading on these data may suggest that the studied local governments present the first steps for internalizing the climate change issue in their government agendas. Despite the presence of such structures and institutions being considered important, the implemented of actions up to now are far from the necessary ones in order to face the challenge that is expected from the scenarios projected by the scientific community (IPCC, 2007; Parry et al., 2008; Parry, 2009). The discussions on the political and institutional dimensions of climate change are still in early stages. According to Dovers and Hezri (2010), this debate, although extremely important, is marked by the lack of conceptual clarity and the use of different nomenclatures that make the dialogue difficult and confusing among different disciplines and research activities.

However, as the authors go on, the focus on political-institutional mechanisms is necessary and there is still a lot of work to do in order to advance the understanding of these processes. The involvement with this debate will need to get into unknown territories for many in this field, which are the administrative structures and the policy cycles that become extremely relevant in the local and sub-national policy agenda in the 21st century (Dovers & Hezri, 2010).

Final Comments

According to Beck (1992, 1995), climate change is part of a new set of risks. The implementation of public agencies and departments to deal with environment issues and formulate environmental policies is recent in Brazil (Guimarães, 2000; Viola, 1997). In this context, the State of São Paulo is pioneer in actions focusing on the environment (Ferreira, 1992). At the municipal level, great part of the movement towards environmental action is a result of the recent legal and institutional framework brought by the Federal Constitution of 1988.

In terms of climate change policies, the debate in Brazil is still in its early stages and there are a number of issues to be worked in the coming years. Despite being a new subject in the political arena, there are legislations that have been approved since 2007 at the national, state and municipal level that aim at mitigating greenhouse gases emissions and coordinating adaptation efforts combined with risk management and disaster risk reduction.

This paper has been first attempt to investigate some of the political-institutional structures that have some effect on relevant areas for intervention in terms of climate change at the local level in the 16 coastal cities of the State of São Paulo, including Cubatão. Such analysis (see Table 2) shows that these cities present secretariats, departments, directories and other types of governmental bodies that will have to be mobilized in climate change actions.

We have argued that the existing structures and the alternatives that have been proposed up until now by these institutions are far from sufficient to respond effectively to the magnitude and complexity of the problem. If we consider that we are debating and deciding on the future—even though the future has been made present—and the quality of the life in the planet, not only for humans but also for diverse ecosystems depend on

actions and measures taken now, then the socio-environmental (in)justice that devastates millions raises ethical dilemmas. Emerging from this debate, there are reasonable arguments to defend the engagement in collective and political dialogues, negotiation and proposals that could enhance the response capacity to the challenges are posed so that these responses would not be palliative responses that go towards the social and economic maintenance of the status quo, the political interests and unsustainable patterns of human development.

We search, thus, to give a first step and a modest contribution to the Brazilian scientific community towards understanding the capacity that these specific cities will have to deal with the climate change impacts building upon some existing political-institutional structures. However, some questions still remain unanswered and will have to be approached in future works. How do local and regional actors react upon climate change issues? To what extent do local political actors have a complete view of the changes that will happen or are already in course? What makes some cities better prepared to respond to this challenge than others? These are some of the questions that we will lean over during the presented research period.

References

- Adger, W. N. (1999). Social vulnerability to climate change and extremes in coastal Vietnam. *World Development*, 27(2), 249-269.
- Alber, G., & Kern, K. (2008, October 9-10). Governing climate change in cities: Modes of urban climate governance in multi-level systems. *2nd Annual Meeting of the OECD Roundtable Strategy for Urban Development*, Milan.
- Bauman, Z. (2001). *Liquid modernity*. Rio de Janeiro: Jorge Zahar Press.
- Bartlett, S., Dodman, D., Hardoy, J., Satterthwaite, D., & Tacoli, C. (2009). Social aspects of climate change in urban areas in low and middle income countries. *44th World Bank Urban Research Symposium*, Marseille.
- Beck, U. (1992). *Risk society*. Beverly Hills: SAGE.
- Beck, U. (1995). *Ecological politics in an age of risk*. Cambridge: Cambridge University Press.
- Beck, U. (2000). *What is globalization?* Cambridge: Polity Press.
- Betsill, M., & Bulkeley, H. (2007). Looking back and thinking ahead: A decade of cities and climate change research. *Local Governments*, 12(5), 447-456.
- Bicknell, J., Dodman, D., & Satterthwaite, D. (Orgs.). (2009). *Adapting cities to climate change: Understanding and addressing the development challenges* (p. 397). London: Earthscan.
- Biermann, F., Betsill, M. M., Gupta, J., Kanie, N., Lebel, L., Liverman, D., ... Siebenhüner, B. (2009). *Earth system governance: People, places and the planet*. Science and Implementation Plan of the Earth System Governance Project. Earth System Governance Report 1, IHDP Report 20. Bonn, IHDP: The Earth System Governance Project.
- Borelli, E. (2006). City and nature: Analisis of the environmental management of the São Paulo State north coast (Ph.D. thesis in Social Sciences, Catholic University of São Paulo).
- Bulkeley, H., & Betsill, M. (2003). *Cities and climate change: Urban sustainability and global environmental governance* (1st ed.). London: Routledge.
- Bulkeley, H., & Kern, K. (2006). Local government and the governing of climate change in Germany and UK. *Urban Studies*, 43(12), 2237-2259.
- Bulkeley, H., Schroeder, H., Janda, K., ZHAO, J., Armstrong, A., CHU, S. Y., & Ghosh, S. (2009). Cities and climate change: The role of institutions, governance and urban planning. *92nd World Bank Urban Research Symposium*, Marseille.
- Collier, U. (1997). Local authorities and climate protection in the European Union: Putting subsidiary into practice? *Local Environment*, 2(1), 39-57.
- Deangelo, B., & Harvey, D. (1998). The jurisdictional framework for municipal action to reduce greenhouse gas emissions: Case studies from Canada, USA and Germany. *Local Environment*, 3(2), 111-136.
- Dodman, D. (2009). Blaming cities for climate change? An analysis of urban greenhouse gases emissions inventories. *Environment and Urbanization*, 21(1), 185-201.
- Dovers, S., & Hezri, A. A. (2010). Institutions and policy processes: The means to the ends of adaptation. *Wiley Interdisciplinary Reviews: Climate Change*, 1(2), 212-231.
- Ferreira, L. C. (1992). State and ecology: New dilemmas and challenges (The environmental policy of the São Paulo State) (Ph.D.

- thesis, University of Campinas).
- Ferreira, L. C. (1999). The search for sustainable alternatives in local level. In A. Zicarrdi & S. Juan (Eds.), *Latin American cities: Modernization and poverty*. Mexico City: University of Mexico.
- Ferreira, L. C. (2001). Local policies and global environmental change. In J. H. Hogan & M. Tomasquim (Eds.), *Human dimensions of global environmental change: Brazilian perspectives*. Rio de Janeiro: Academia Brasileira de Ciências.
- Ferreira, L. C. (2003). *The environmental issue in Brazil: Sustainability and public policies in Brazil* (2nd ed.). São Paulo: Boitempo Press.
- Ferreira, L. C. (2006). *Ideas for a sociology of the environmental issue in Brazil*. São Paulo: Annablume Press.
- Giddens, A. (2005). *Runaway world: What globalization is doing to us*. Rio de Janeiro: Record Press.
- Giddens, A. (2009). *The politics of climate change*. Cambridge: Polity Press.
- Guimaraes, R. (2000). Brazil and global environmental politics: Same wine in new bottles? Paper presented at *International Sociological Association Conference*, Rio de Janeiro.
- Hogan, D. J. (2001). Demographic aspects of global environmental change: What is Brazil's contribution? In J. H. Hogan, & M. Tomasquim (Eds.), *Human dimensions of environmental change: Brazilian perspectives*. Rio de Janeiro: Academia Brasileira de Ciências.
- Hogan, D. J. (2009a). Population and global environmental change. In D. J. Hogan, & E. Marandola Jr (Orgs.). *Population and climate change: Human dimensions of global environmental change* (pp. 11-24). Campinas: UNICAMP (Ed.).
- Hogan, D. J. (Coord.) (2009b). *Urban growth, vulnerability and adaptation: Social and ecological dimensions of climate change on the Coast of São Paulo*. Research project sent to the Global Climate Change of Fapesp (São Paulo Research Foundation).
- Hunt, A., & Watkiss, P. (2007). *Literature review on climate change impacts on urban city centres: Initial findings*. Organization for Economic Co-operation and Development (OECD), ENV/EPOC/GSP (2007)10/FINAL, OECD Publishing.
- IBGE (Brazilian Institute of Geography and Estatsistics). (2000). *Demographic census: Brazil, 2000*. Rio de Janeiro: IBGE.
- IPCC (Intergovernmental Panel on Climate Change). (2007). *Climate change 2007: Impacts, adaptation and vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the International Panel on Climate Change. Cambridge: Cambridge University Press.
- Jacobi, P. (2006). *City and environment: Perceptions and practices in São Paulo* (2nd ed.). São Paulo: Annablume Press.
- Lankao, P. R. (2007a). How do local governments in Mexico City manage global warming? *Local Environment*, 12(5), 519-535.
- Lankao, P. R. (2007b). Are we missing the point? Particularities of urbanization, sustainability and carbon emissions in Latin American cities. *Environment and Urbanization*, 19, 159-175.
- Lankao, P. R. (2008). *Urban areas and climate change: Review of current issues and trends*. Issue paper prepared for Cities and Climate Change: Global Report on Human Settlement 2011. UN-Habitat and Rockefeller Foundation.
- Lankao, P. R. (2009). Carbon and climate governance. *IHDP Update*, 3, 14-19.
- Leichenko, R. M., & O'Brien, K. L. (2008). *Environmental change and globalization: Double exposures*. New York: Oxford University Press.
- Leichenko, R. M., O'Brien, K. L., & Solecki, W. (2009). Climate change and the global financial crisis. *IHDP Update*, (2), 25-28.
- Macedo, L. V. (2000). *Towards sustainable public transportation in the great Sao Paulo area: An experience of environmental policy in the nineties*. Master's thesis. University of Sao Paulo, PROCAM/USP.
- McGranahan, G., Balk, D., & Anderson, B. (2007). The rising tide: Assessing the risks of climate change and human settlements in low elevation coastal zones. *Environment & Urbanization*, 19(1), 17-37.
- Metz, B. et al. (Orgs.). (2007). *Climate change 2007: Mitigation of climate change*. Contribution of Working Group III to the Fourth Assessment Report of the IPCC. Cambridge: Cambridge University Press.
- Newell, P., & Bulkeley, H. (2010). *Governing climate change*. New York: Routledge.
- Nicholls, R. et al. (2007). Coastal systems and low-lying areas. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. Van Der Linden, & C. E. Hanson (Orgs.). *Climate change 2007: Impacts, adaptation and vulnerability* (pp. 315-357). Contribution of Working Group II to the Fourth Assessment Report of the International Panel on Climate Change. Cambridge: Cambridge University Press.
- O'Brien, K. L., & Leichenko, R. M. (2003). Winners and losers in the context of global environmental change. *Annals of the Association of American Geographers*, 93(1), 89-103.
- Okereke, C., Bulkeley, H., & Schroeder, H. (2009). Conceptualizing climate governance beyond the international regime. *Global Environmental Politics*, 9(1), 58-78.
- Parry, M. L. (2009). Climate change is a development issue, and only sustainable development can confront the challenge.

- Climate and Development*, 1(1), 5-9.
- Parry, M. L., Palutikof, J., Hanson, C., & Lowe, J. (2008). Squaring up to reality. *Nature Reports Climate Change*, 2, 68-70.
- Pittock, A. B. (2005). *Climate change: Turning up the heat* (p. 316). London: Earthscan.
- Puppim de Oliveira, J. A. (2009). The implementation of climate change related policies at the subnational level: An analysis of three countries. *Habitat International*, 33, 253-259.
- Robinson, P. J., & Gore, C. D. (2005). Barriers to Canadian municipal response to climate change. *Canadian Journal of Urban Research*, 14(1), 102-120.
- Sanchez-Rodriguez, R., Seto, K. C., Simon, D., Solecki, W. D., Kraas, F., & Laumann, G. (2005). Science plan: Urbanization and global environmental change. *IHDP Report*, (15).
- Sanchez-Rodriguez, R., Solecki, W., & Fragkias, M. (2008). Introduction to the issue urban responses to climate change. *UGEC View Points*, 1, 4-5.
- Satterthwaite, D. (2008). Climate change and urbanization: Effects and implications for urban governance. *United Nations Expert Group Meeting on Population Distribution, Urbanization, Internal Migration and Development*, UN/POP/EGM-URB/2008/16, New York.
- Satterthwaite, D., Huq, S., Pelling, M., Reid, H., & Lankao, P. R. (2007). *Adapting to climate change in urban areas: The possibilities and constraints in low- and middle-income nations*. 107 f. discussion paper No.1, International Institute for Environment and Development (IIED), London.
- Secretaria de Meio Ambiente (SMA). (2005). *Environmental planning. ecological-economic planning—North coast*. São Paulo: State Secretary of Environment SMA/CPLEA.
- Solomon, S. et al. (Orgs.). (2007). *Climate change 2007: The physical science basis*. Contribution of Working Group I to the Fourth Assessment Report of the IPCC. Cambridge: Cambridge University Press.
- Storbjork, S. (2007). Governing climate adaptation in the local Arena: Challenges of risk management and planning in Sweden. *Local Environment*, 12(5), 457-469.
- Tanner, T. M., Mitchell, T., Polack, E., & Guenther, B. (2008). Urban governance for adaptation: Assessing climate change resilience in ten Asian cities. 47 f. IDS working paper 315, Institute for Development Studies (IDS), Brighton.
- Viola, E. (1997). Globalization, sustainability and democratic governability in Brazil. In A. Trindade & M. Castro (Orgs.). *The democratic society of the end of the century*. Brasília: Paralelo 15 Press.
- Wilbanks, T., & Kates, R. W. (1999). Global change in local places: How scales matters. *Climatic Change*, 43, 601-628.
- Wilbanks, T., Lankao, P. R., BAO, M., Berkhout, F., Cairncross, S., Ceron, J.-P., & Zapata-Marti, R. (2007). Industry, settlements and society. In M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. Van Der Linden, & C. E. Hanson (Orgs.), *Climate change 2007: Impacts, adaptation and vulnerability*. Contribution of Working Group II to the Fourth Assessment Report of the International Panel on Climate Change. Cambridge: Cambridge University Press.
- Yearley, S. (1996). *Sociology, environmentalism and globalization*. London: Sage.
- Yearley, S. (2005). *Making sense of science: Understanding the social study of science*. London: Sage.
- Young, O., Berkhout, F., Gallopin, G. C., Janssen, M. A., Ostrom, E., & Van Der Leeuw, S. (2006). The globalization of socio-ecological systems: An agenda for scientific research. *Global Environmental Change*, 16, 304-316.