

Climate Hazards and Adaptation to Climate Change in Metropolitan Florianópolis

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Abstract: Rapidly expanding, intermediate size cities in the coastal zones of developing countries face the linked challenges of managing accelerated urban growth, maintaining ecosystem services, preparing for climate hazards, and adapting to climate change. This poster initiates an investigation into climate hazards and the potential for adaptation to climate change in metropolitan Florianópolis, a dynamic globalizing coastal city-region in southern Brazil. In recent years, metropolitan Florianópolis has experienced both ecosystem degradation and ecosystem recovery as interacting demographic, socioeconomic, land-use, and institutional changes have occurred. Accelerated urbanization in metropolitan Florianópolis is linked to sociospatial inequalities. The dualization of human settlement patterns and other associated forms of inequality have created conditions that leave poor communities in urban, suburban, and peri-urban areas highly vulnerable to climate hazards and that impede them from adequately adapting to climate change. Ongoing efforts in Brazilian cities to formulate participatory municipal master plans have the potential to provide important institutional mechanisms for sustainable development planning, successful adaptation to climatic change, and fostering more equitable outcomes.

Introduction: In 2000, over 13 million people were living in Brazil's low elevation coastal zone (LECZ) at less than 10 m of elevation (PLACE II). The 2000 Brazilian demographic census carried out by IBGE (*Instituto Brasileiro de Geografia e Estatística*), the Brazilian Institute of Geography and Statistics, reported that at least 1.8 million Brazilians inhabited the 33 administrative units (*municípios*) that form the coastal zone of Santa Catarina State. Combined these 33 *municípios* occupy a land area of roughly 8,300 km², ~9% of the state's total area of 95,285 km² (Figs. 1 & 2). Today, the coastal population of Santa Catarina is estimated to be >2 million, representing about one-third of Santa Catarina's total population. The *municípios* of Santa Catarina's LECZ encompass urban, industrial, suburban, peri-urban, rural and conservation landscapes. To successfully manage land resources, sustain livelihoods, and reduce social inequities, complex landscapes such as these and the drivers of particular land-use transitions must be better understood. Herein, I begin to explore the following questions by examining metropolitan Florianópolis: (1) How is adaptation to climate change taking place in this part of Brazil's LECZ? (2) How many and which coastal communities in Santa Catarina are acting to reduce their vulnerabilities to climate hazards and to adapt to climate change? (3) Is the process of adaptation leading toward sustainable development pathways and successful outcomes? (4) What appear to be the major barriers to successful adaptation to climate change in this region?

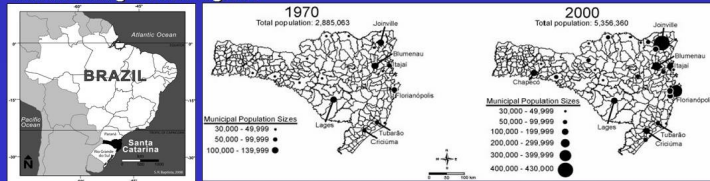


Fig. 1 Distribution of *municípios* in Santa Catarina State with over 30,000 inhabitants in 1970 and 2000. Source: IBGE.

Objectives: The proposed research is guided by the following objectives: (1) to assess climate hazards and vulnerabilities to climate change in metropolitan Florianópolis; (2) to identify local institutions and approaches to governance for mitigating and adapting to climate change in this dynamic globalizing coastal city-region; and (3) to better understand the variability of both land use and climate change in Santa Catarina State.

Research Setting: The coastline of Santa Catarina State, Brazil stretches over more than 550 km. There are several cities as well as many smaller human settlements situated along this coastline. The coastal city of Florianópolis is the state capital of Santa Catarina. It is the urban center of one of southern Brazil's largest urban agglomerations. Between 1991 and 2000, the combined human population of Florianópolis, São José, Palhoça, Biguaçu, and Governador Celso Ramos (Fig. 2) increased from about 506,000 to about 678,000 people. The populations of these five coastal *municípios* have continued to increase since 2000. Currently, there are approximately 800,000 people living in this coastal land area of roughly 1,360 km². The climate in this region is mesothermic, humid subtropical with hot summers and lacking a dry season (Köppen *Cfa* climate classification). The major terrestrial ecosystems found in the low elevation coastal zone are: mangrove forest, coastal plain *restinga* vegetation, and dense broadleaf forest. Conversions to cropland and pasture accelerated after the mid-eighteenth century. Since the middle of the twentieth century, many formerly rural and agricultural lands have become urbanized while other lands have reverted to an array of successional communities including regenerating forests. Environmental legislation and institutions at the national and local levels have facilitated ecosystem recovery.

Methodological Approach: This research on vulnerabilities to climate hazards and adaptation to climatic change is, in part, derived from the author's dissertation research on long-term human-environment dynamics in the Florianópolis city-region using a multiscalar and interdisciplinary framework to integrate data obtained from documentary research, aerial photos, interviews, participant observation, and site visits (Baptista 2008). Thus, previous work addressing land-use transitions and metropolitan sociospatial inequalities informs the present research design which seeks to identify and study the public, private, and third sector institutions (local, national, and international) with potential for supporting hazard preparedness, disaster response capacity, social learning, and successful adaptation to changing climate.

Discussion: When the South Atlantic tropical cyclone Catarina made landfall on the coast of southern Brazil in late March 2004, scientists, government authorities and the general public took notice. The occurrence of this unprecedented extreme weather event, its severe socioeconomic impacts in localities such as Passo de Torres, Balneário Gaivota and Balneário Arroio do Silva (Marcelino *et al.* 2005), and other extreme weather events in the region led to increased mobilization of social actors concerned with protecting human well-being, economic interests, and ecological integrity. There are opportunities to support improved communication and coordination between communities of researchers with expertise on natural hazards and people participating in the formulation of master plans for Brazilian cities.

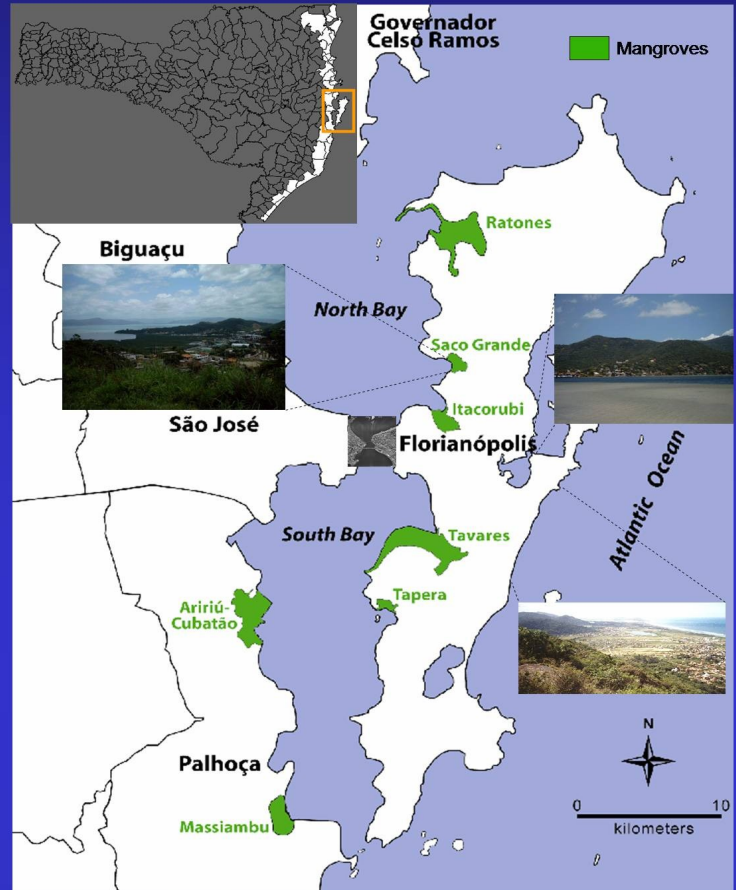


Fig. 2 Examples of coastal human settlements in metropolitan Florianópolis. Sources: The air photo (center) of the central city, captured on Sept. 1998 (1:15000) by Centrais Elétricas de Santa Catarina (CELESC) is available for public use at the library of the Instituto de Planejamento Urbano de Florianópolis (IPUF); the surrounding photos were taken by S. Baptista (2003 and 2004).

Future Research: Further research will follow social mobilizations and the activities of civil society organizations dedicated to shaping legislation, institutions, and land-use planning. Future work will also examine the variability of land-use dynamics in Santa Catarina State, with emphasis on dynamics within metropolitan regions. This research goal will be accomplished by carrying out the following tasks: (1) producing a series of thematic land-use/cover maps for the period from 1980 to the present using remotely-sensed satellite data; (2) quantifying land uses/covers for this series, and (3) by mapping and quantifying land-use/cover changes over time.

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