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FOREST RECOVERY AND JUST SUSTAINABILITY

IN THE FLORIANÓPOLIS CITY-REGION

by

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ABSTRACT OF THE DISSERTATION

Forest Recovery and Just Sustainability in the Florianópolis City-Region

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This dissertation examines human-environment interactions in the Florianópolis city-region, Santa Catarina State, Brazil from a just sustainability perspective. I construct an in-depth historical narrative of social and landscape transformations and offer an account of the diverse origins of this expanding metropolis. This historical narrative provides the context for understanding contemporary demographic change, metropolitan land-use, forest-transition dynamics, sociospatial inequalities, legal-institutional reforms, and democratic practice. Employing a multiscalar methodological approach, I integrate documentary research, aerial photos, interviews, participant observation, and site visits. I analyze social and ecological data at nested spatial and organizational scales ranging from neighborhoods to national and global arenas. Results suggest that the Florianópolis city-region has experienced a forest transition from a period of net deforestation caused by extractive and agricultural activities to a period of net forest recovery. Forest recovery has resulted from tree planting with exotic species and the 'spontaneous' regeneration of secondary forests. Exotic tree monocultures have been planted since the 1960s. Much of the forest regeneration has occurred since the 1980s during a period characterized by decline in agricultural land use, real estate speculation, and the establishment of conservation units and other types of land-use restrictions. The environmental services and amenities associated with the protected-area network have contributed to the ongoing viability of local tourism development and rising real estate prices in well-located neighborhoods. Middle- and upper-income housing construction has accelerated since the 1990s, converting parcels to residential or commercial subdivisions in suburban and peri-urban landscapes. Low-income, self-provisioned, informal settlements have emerged and expanded on ‘marginal,’ ‘peripheral,’ and ‘precarious’ lands, often in locations legally defined as environmentally protected areas and that lack sanitation services. This process of urban dualization has resulted in socioenvironmental injustices by reinforcing and exacerbating differential access to life opportunities and environmental services as well as differential exposure to environmental hazards. I conclude with a discussion of land quality, uneven development, uneven valuation of ecosystems, participatory democracy, possible future scenarios, policy implications, unresolved issues, and suggestions for future research.

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DEDICATION

I dedicate this dissertation with love to my parents Maria Inês and Renato and to my grandparents Vó Espéria, Vô Monteiro, Vó Prazeres, and Vô Antônio.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1

INTRODUCTION

1.1 The Human Environment and Just Sustainability

Humanity has arguably reached a stage of unprecedented, broad-based awareness about the global problem of sustaining socioeconomic development while protecting ecological integrity and promoting lasting peace and human security. The critical question, however, is whether we can effectively harness our collective awareness, knowledge, institutions, skills, tools, energy, and political will to meet the major social and ecological challenges of our time. Many agree that the attainment and long-term maintenance of global environmental quality, economic prosperity, and security are at least to some degree dependent on levels of social inclusion and equity. Barbier (1987), Campbell (1996), and others have conceptualized sustainable development as a triangle formed by the goals of environmental protection, economic growth, and social equity and justice. In the introduction to *Just Sustainabilities: Development in an Unequal World,* authors Agyeman, Bullard, and Evans (2003: 2) contend that "…unless society strives for a greater level of social and economic equity, both within and between nations, the long term objective of a more sustainable world is unlikely to be secured."[1] Similarly, in a recent special issue of the journal *Geoforum,* organized around the theme "Geographies of Environmental Justice" (see Walker and Bulkeley 2006), Kitchen, Marsden, and Milbourne (2006: 832) refer to the idea of "inclusive ecological integrity."

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[1] For further reading on the concept of just sustainability see also Warner (2001), Agyeman and Warner (2002), Agyeman and Evans (2003), and Agyeman and Evans (2004).

Around the world, myriad individuals and organizations have demonstrated their commitment to address socioeconomic and environmental challenges in ways that not only proclaim fundamental human and civil rights, but also endeavor to protect them. Their enthusiasm, dedication, and accomplishments offer hope for overcoming difficult circumstances and encourage others to actively embrace the principles of ecological integrity, human well-being, dignity, freedom, equality, justice, citizenship, and democracy (e.g., Wolch 2007).

Following the adoption of the Millennium Declaration[2] by the United Nations (UN) General Assembly in September 2000, a number of efforts led by organizations of the UN system have produced global-scale assessments through the collaboration of thousands of leading experts. Authors of the Millennium Ecosystem Assessment (2005) focused on assessing the consequences of ecosystem change for human well-being and on identifying priorities for action to improve the management of ecosystem services and to guide future research and monitoring.[3] In the recent UN Human Settlements Programme publication *The Challenge of Slums: Global Report on Human Settlements 2003* (UN-Habitat 2003), authors drew attention to the "urbanization of poverty" and proposed the "Cities without Slums" initiative. Undertaken at a time when it was estimated that nearly one billion people lived in slums, representing about one-sixth of the world's total population and almost one-third of the world's urban population, the UN-Habitat study predicted that by the year 2030 the number of "slum dwellers" worldwide is likely to

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[2] The full text of the United Nations Millennium Declaration is available at <http://www.un.org/millennium/declaration/ares552e.htm>.

[3] Authors of the Millennium Ecosystem Assessment (2005) organize the Earth's ecosystem services into four major categories (i.e., provisioning, regulating, cultural, and supporting services), and outline how these ecosystem services are related to various aspects of human well-being as well as to direct and indirect drivers of change.

double to about two billion people, roughly one-quarter of the anticipated total global human population of eight billion.[4] The report cited several interrelated factors contributing to global urban poverty, arguing that slum development is a consequence of rapid urbanization in the developing world, which is in large part a result of rural-to-urban migration. The urbanization of poverty was further attributed to various failures of governance (UN-Habitat 2003: 1, 5-7). The report highlighted the inadequacies of urban planning and urban management policies and affirmed the need for new approaches to provide growing urban populations with employment, adequate income, education, affordable housing, infrastructure, and services.

Other viewpoints on this topic have been expressed. In the book *Planet of Slums*, urban historian Mike Davis (2006) provided an alternative analysis of the global problem of slum expansion. Alan Gilbert interrogated and critiqued the recent resuscitation of the terms slum and slum dwellers by UN-Habitat's "Cities without Slums" initiative and suggested, "If the key problem to be addressed is to improve the quality of people's housing, then a campaign entitled 'In search of better shelter' would be much more accurate and honest" (Gilbert 2007: 709).

Global-scale social and ecological assessments by UN organizations and others are important means for establishing common definitions, disseminating ideas and data, reaching consensus on issues, outlining agendas, and coordinating efforts. At the same time, innovative research and action at transnational, national, subnational, and local levels can and should play indispensable roles in the process of learning from the successes and failures of civil society, private enterprise, governance, policies, planning approaches, administrative practices, legislative measures, and academic pursuits.

[4] The 2003 UN-Habitat report estimated that there were 924 million slum dwellers worldwide in 2001.

Accordingly, this dissertation opens for discussion these intertwined human dimensions and their ecological circumstances in the Florianópolis city-region and offers some suggestions for future research and action. Broadly speaking, my intentions are both to engage with ecosystem managers whose decisions and activities directly impact metropolitan Florianópolis and to inform a more general audience of knowledge users interested in the social-ecological dynamics of rapidly expanding city-regions around the world, particularly in coastal zones, and in the intersecting set of issues that are relevant to just sustainability.

1.2 Statement of Purpose and Research Contributions

The purpose of this dissertation is twofold. First, I describe how the coastal landscape and ecosystems of metropolitan Florianópolis, located in the southern Brazilian state of Santa Catarina, have been transformed and reorganized by human agency over the long term. This includes an explanation of how the livelihood systems and the human communities that are active in this anthropogenic landscape have changed through time. I demonstrate that multiple facets of human history dating back through the past several centuries, and even millennia, continue to reverberate in the society and landscape of the late twentieth and early twenty-first century. Second, based on comprehensive knowledge of the study region's human ecological conditions, I discuss existing sustainable development challenges and envisage possibilities toward a more socially just and ecologically sustainable future. While focusing on the socioecological formation of a particular city-region during the contemporary era of globalization and rapid urbanization, the intent of this dissertation is to contribute to dialogues addressing global poverty reduction and ecosystem science. This research should be of interest to those concerned with social, economic, and ecological trends in Latin America (e.g., Zimmerer and Carter 2002; Swinton, Escobar, and Reardon 2003; Aide and Grau 2004; Armesto *et al.* 2007), and to participants in the effort to better understand human-induced global environmental change (e.g., Clark and Munn 1986; Turner *et al.* 1990; Meyer and Turner 1992; Turner 1997; Haberl, Batterbury, and Moran 2001; Lambin *et al.* 2001; Ramankutty, Foley, and Olejniczak 2002; Vadjunec, Schneider, and Turner 2002; Small and Nicholls 2003; Foley *et al.* 2005; Leichenko and Solecki 2005; Moran and Ostrom 2005; Musacchio *et al.* 2005; Rudel *et al.* 2005; DeFries, Asner, and Foley 2006; Young *et al.* 2006; de Sherbinin *et al.* 2007; Leichenko and O'Brien 2008).

In subdisciplinary terms, this research is positioned at the interfaces of economic geography, urban geography, cultural geography, political geography, human ecology, land-change science, cultural ecology, political ecology, landscape ecology, historical geography, and environmental history. Specifically, it aims to contribute to scholarship on sustainability, social justice, forest regeneration, forest transitions, metropolitan sociospatial dynamics, environmental governance, and globalization.

This dissertation makes three major contributions to the social science literature. First, it draws attention to the environmental history and the contemporary society of a fascinating Brazilian city-region that thus far has been largely ignored in the English-language academic and nonacademic literature on urban development or urban sustainability.[5] The largest Latin American metropolises (e.g., Mexico City, São Paulo, Buenos Aires, Rio de Janeiro)—megacities with human populations in the millions—tend

[5] Compared to the neighboring southern Brazilian cities of Curitiba and Porto Alegre, to date Florianópolis has received surprisingly limited attention by U.S.-based scholars.

to receive much more research attention by social scientists than the many fast-growing Latin American cities with several hundred-thousand to around one-million inhabitants. Indeed, this bias in urban research, toward studies of megacities, occurs throughout the world. Ideally, city-regions of varying demographic, economic, cultural, political, and ecological characteristics should be studied using research frameworks that elucidate the ways in which urban areas are interconnected, as well as how they are connected to nonurban landscapes (e.g., Beaverstock, Smith, and Taylor 2000; Scott 2001a, b; Scott and Storper 2003).

Second, this study serves as an empirical exploration of forest-transition theory by investigating whether or not, and if so, how the Florianópolis metropolitan region has experienced a reversal in forest-cover dynamics from a period of net deforestation driven by extractive and agricultural activities to a period of net forest expansion as the region has become increasingly urbanized and industrialized. This study is the first to explore the forest-transition model in the metropolitanizing setting.

Third, this dissertation helps to fill a gap in the literature by linking forest-transition theory to the idea of just sustainability. Human decisions, behaviors, and actions at individual and group levels lead to either beneficial or detrimental ecosystem modifications. Social inequities and environmental injustices—such as differential access to financial, political, and natural resources and differential exposure to environmental hazards—should be viewed as products of both historical and contemporary economic, political, cultural, and institutional systems.[6] Social scientists and others have long struggled with questions about how human systems induce, perpetuate, or exacerbate

[6] See, for instance, Baecker's (2001) discussion of the notion of systems as ways of communicating control, defining conditionalities during negotiations, establishing order, and producing exclusion.

income inequality, uneven development, and processes of social polarization such as excessive resource consumption among affluent segments of society and the simultaneous growth of informal employment, informal settlements, and poverty (e.g., Smith 1984; O'Loughlin and Friedrichs 1996; Marcuse 1997; Robinson 1999; Marcuse and van Kempen 2000; Heynen 2003; O'Brien and Leichenko 2003; Rodríguez and Swyngedouw 2003; UN-Habitat 2003; Mullard 2004; Pacione 2004; Leichenko and Solecki 2005; Neuwirth 2005; Davis 2006). While some researchers have begun to investigate forest-transition dynamics in the contexts of globalization and of urbanization patterns and trends in Latin America, to date very little has been written about forest-transition dynamics in relationship to social power structures and spatial configurations of socioeconomic inequality and poverty within Latin American city-regions.

1.3 Research Questions and Preliminary Answers

The central research questions explored by this dissertation are:

1. As population increase, economic expansion, and urbanization have occurred in metropolitan Florianópolis, what has happened to the city-region's landscape and ecosystems? Has a forest transition taken place in eastern Santa Catarina?
2. As population increase, economic expansion, urbanization, and landscape transformations have taken place, what has happened to the socioeconomic status of people in the region? In other words, how have demographic, economic, and environmental changes impacted the living conditions of different segments of society, from the poorest to the wealthiest in the region?

3. How have policies and institutions at multilateral, federal, state, and municipal levels influenced land-use patterns, environmental quality, and social equity/justice concerns?

In preliminary response to these questions, I suggest the following:

Question #1, Narrative of Social and Landscape Transformations. Around the world, changes in landscapes have reflected changes in livelihood patterns. Contemporary urban economies are often linked to sprawling patterns of development and have become increasingly service, consumer, information, and amenities oriented (e.g., Ley 1980; Mollenkopf and Castells 1991; Stewart 1999; Clark *et al.* 2002; Hutton 2004; Leichenko and Solecki 2005; Smith 2005; Gospodini 2006). Many of these transitions have been accompanied by rises in ecological awareness and environmentalism, processes addressed in the social science literature on ecological modernization (see Mol 1996, 2000; Buttel 2000). Florianópolis appears to be in the midst of a similar transition. Throughout eastern Santa Catarina, livelihood opportunities have changed dramatically since the 1960s as a result of industrialization and urbanization associated with profound economic restructuring and demographic changes at global, national, and subnational levels. Extensive deforestation and agricultural land use, primarily by smallholders, took place in the region over a 200-year period from the mid-eighteenth century to the mid-twentieth century. Forest-transition dynamics in Florianópolis may have started around the mid-1960s as a result of two processes: local responses to federal fiscal incentives for afforestation and reforestation; and transitioning by landowners and laborers into nonagricultural economic sectors (e.g., government, service, manufacturing, and construction) which resulted in the abandonment of many fields and pastures to successional processes. Since the 1970s, forest regeneration has continued alongside urban, suburban, and peri-urban development in metropolitan Florianópolis. Forest-transition dynamics have been sustained under a new set of socioeconomic and political conditions including rising ecological consciousness, advances in forest policy and environmental legislation, land speculation, real estate development, tourism development, and rapid in-migration. Despite rapid population growth and urban development, local forest expansion and maturation has occurred under these new conditions.

Question #2, Limits to Sustainability. Since the 1960s, the Florianópolis city-region has been attracting migrants, university students, tourists, entrepreneurs, and investors. Its desirability stems from a combination of urban and natural resource amenities. Public agencies, private developers, homeowners, and residents have become increasingly aware of the environmental amenities and ecosystem services associated with forests and other local ecosystems. This valuation of ecosystems and environmental amenities has provided some incentive to maintain and perhaps even restore vegetation cover associated with particular neighborhoods and properties. However, current ecosystem management and urban expansion trends are leading to uneven development and environmental injustices in the form of sociospatial inequalities and social exclusion. Over the long term, these socially polarizing and exclusionary trends, along with overall rising levels of resource consumption, are socially and environmentally unsustainable (e.g., Leichenko and Solecki 2005; Leichenko and O’Brien 2008).

Question #3, Policy and Institutional Reforms: from Modernization to Neoliberalism. The policies and institutions of economic developmentism, economic globalization, and neoliberal reforms have shaped urban regions and urban networks in Brazil (e.g., Fernandes and Negreiros 2001). Accessing credit from multilateral and bilateral financial institutions, the Brazilian federal government has been involved in financing and regulating the development of a variety of extractive and agricultural enterprises and in investing in transportation, communication, urban, and industrial infrastructure and services. Regional and local elites have further shaped landscape change through state- and municipal-level land-use policies and practices. Policy decisions made at international, national, state, and municipal scales have consequences for the housing, employment, transportation, educational, and health care options of low-, middle-, and high-income residents. In urbanizing municipalities, pro-growth, slow-growth, smart-growth, and conservation coalitions are formed by local and nonlocal actors to influence policy decisions and institutional reforms as well as to access fiscal incentives (e.g., Molotch 1976; Warner and Molotch 2000; Rudel 2007; Schmidt 2008). Notwithstanding the many positive dimensions of democratic and participatory governance at the municipal level, the success of local civil society organizations emphasizing middle-class quality-of-life concerns and advocating growth management may have exclusionary consequences at the regional spatial scale (e.g., Schmidt 2008). Given high rates of unemployment, underemployment, and economic informality combined with the lack of affordable housing options available to a very large number of poor Brazilians, low-income, self-provisioned, informal settlements often emerge and expand on so-called marginal, peripheral, and precarious lands such as hillslopes and mangroves (e.g., Miller

2003; O'Hare and Barke 2002).[7] This type of urban expansion often occurs in areas that are legally protected under environmental legislation and that lack sanitation services.

In addition to the above overarching research questions, my investigation of the Florianópolis city-region is further guided by the following four sets of subsidiary research questions:

1. *Demographic Growth, Urbanization, and Planning for Sustainability*. Which actors, social institutions, and governance systems have played significant roles in fostering industrial and urban expansion in the city-region? When, how, to what extent, and at what rate? How are their activities linked to local and regional planning efforts—or the lack thereof—to accommodate anticipated demographic growth and continued urbanization? What are the dominant ideologies and politics of public expenditures, how have they been challenged, and by whom? To what extent are leaders consciously designing, implementing, adapting, and innovating sustainability strategies to reconfigure spatial arrangements in the landscape, to guide city-region development, and to control industrial and urban growth? To what extent is urbanization happening in a "haphazard" or "spontaneous" fashion? What, if any, progress has been made toward metropolitan sustainability goals in policy and in practice?

2. *Ecosystem Management: Past and Present.* To date, how have public authorities, nongovernmental organizations (NGOs), private sector actors, and citizens been involved in managing forests and other ecosystems? Which actors, social institutions, and

[7] Miller (2003: 253) wrote, "By the mid–twentieth century, the rural poor began pouring into Brazil's cities, often faster than they could be housed. The migrants were forced to build shanties on land to which nobody important made claim. Many went up to the picturesque hillside favelas; others have been forced down into what remained of the mangroves, onto the tidal no-man's-land."

governance systems have played a role in fostering forest protection and reforestation since the mid-twentieth century? How, why, to what extent, and with what consequences?

3. *Migration Trends and Lifestyles.* Why have people been migrating to the Florianópolis city-region since the 1960s? From where and in what numbers have migrants originated? Are there distinct phases of in-migration? What impacts have different migrant groups had on metropolitan life? What are the consequences of these migration patterns for the landscape of the city-region, for the urban agglomeration as an entity, for surrounding nonurban communities, for people active in either urban or nonurban settings, and for people who are active within a range of human environments? What are the consequences for the interconnected ecosystems upon which they all depend? What cultures, knowledge, skills, technologies, behaviors, attitudes, values, preferences, and aspirations have recent migrants and tourists brought to the social matrix, and how have these introduced human elements changed those of previously settled populations? How have they changed the landscape?

4. *Displacement, Social Polarization, Socioeconomic Segregation, and Social Exclusion*. In recent decades, how have structural reorganizations, landscape transformations, and the resulting sociospatial patterns impacted different social groups in the Florianópolis city-region? How have processes of displacement, social polarization, socioeconomic segregation, and social exclusion changed over time? How many people in the city-region currently live in low-income, informal settlements; where, and in what conditions?

How does this compare to poverty and informality in this city-region in past time periods? How does this compare to poverty and informality in other Brazilian city-regions, both past and present? Do social groups share access to public resources, government services, ecosystem services, and environmental amenities equitably or are certain social groups disproportionately excluded from these benefits? What important lessons can be learned from this case regarding issues of just sustainability? Which efforts towards just sustainability goals have been successful, and how can they be strengthened? Where have efforts fallen short of these goals, and what mistakes have been made?

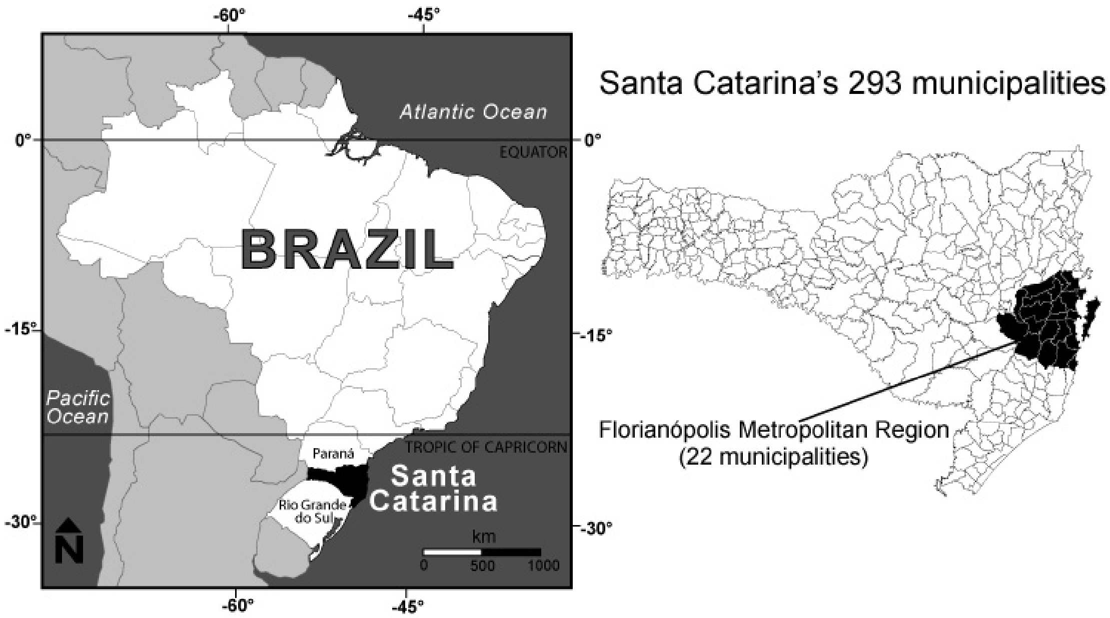
1.4 Research Setting

Brazil, with a national territory of about 8.51 million km², comprises nearly half of South America and is the world's fifth largest country. Conventionally, Brazil's twenty-six states and its Federal District, Brasília, are grouped into five major regions: North; Northeast; Center-West; Southeast; and South. Brazil's southern region is formed by the three states of Paraná, Santa Catarina, and Rio Grande do Sul (Figure 1.1).

At the time of Brazil's first national demographic census in 1872, almost 10 million people were counted, of which about 160,000 people reportedly resided in Santa Catarina (IBGE 1990b).[8] By 1900, Brazil's population had grown to about 17.4 million people of which 320,289 individuals were counted in Santa Catarina, and the city of

[8] In 1872, Brazil's first demographic census enumerated 9,938,478 people in the entire country and 159,802 people in Santa Catarina (IBGE 1990b). At that time, Santa Catarina was a province under a monarchical system. It later became a state with the establishment of Brazil's First Republic in 1889. Coincidentally, *Eucalyptus* seeds, transported from Paris, were introduced to Brazil in 1872, arriving at Rio de Janeiro's Botanical Garden (Fanzeres 2005).

Figure 1.1 The Florianópolis Metropolitan Region, Santa Catarina, Brazil.



Florianópolis, with 32,229 inhabitants, had about 10 percent of the state's population (IBGE 1990b). A century later in 2000, Brazilian demographic census results indicated that in a country of close to 170 million people, the southern region had a population of about 25.11 million, Santa Catarina had more than 5.35 million inhabitants, and the municipality of Florianópolis alone had 342,315 residents (IBGE 2001; see Table 1.1).[9]

Table 1.1 Area, total population, and population density of southern Brazil, 2000. *Source:* IBGE (2001).

	Area	*Population*	
	(km^2)	total	per km^2
Paraná	199 281.7	9 563 458	48
Santa Catarina	95 285.1	5 356 360	56
Rio Grande do Sul	281 734.0	10 187 798	36
TOTAL	576 300.8	25 107 616	44

[9] At present, Brazil has a population of approximately 187 million people (IBGE <http://www.ibge.gov.br>).

In 2005, Brazil's 4.78 million km² of forest covered about 56 percent of the country's total land area (8.46 million km²) and accounted for 12 percent of the world's total forest area (39.52 million km²) (FAO 2007). Brazil appears to have lost 31,030 km² of forest between 2000 and 2005, and, in 2005, Brazil was the country with the ninth largest planted forest area (53,840 km²) (FAO 2007). Most of Brazil's old-growth forests are presently found in the Amazon Basin. Santa Catarina, however, is located within the Atlantic Forest "biodiversity hotspot" (Cincotta, Wisnewski, and Engelman 2000; Myers *et al.* 2000; Brooks *et al.* 2006). Researchers and others have mobilized around the general premise that South America's original Atlantic Forest once covered 1 to 1.5 million km² and that as little as 6–10 percent of this forest remains today in fragments as a result of human activity (e.g., Galindo-Leal and Câmara 2003a; Tabarelli *et al.* 2005; Zurita *et al.* 2006).[10]

The original extent of the Brazilian Atlantic Forest (*Mata Atlântica*) has been cited as approximately 1.3 million km², and although the *Mata Atlântica* is often classified into two major vegetation types, i.e., coastal evergreen rain forest and interior semideciduous forest, ecological heterogeneity within this vast territory is much more complex (Morellato and Haddad 2000, Brannstrom 2002, Webb *et al.* 2005). Scudeller, Martins, and Shepherd (2001) have discussed the inconsistencies of phytogeographic divisions and the difficulty of defining the geographical limits of the Atlantic Forest domain and its constituent vegetation formations. Emphasizing historical, political, and institutional considerations, Brannstrom (2002) has called into question the invention of a monolithic Atlantic Forest. Brannstrom's (2002) focus on the early twentieth century in a

[10] For an illustration of the South American Atlantic Forest's estimated original extent and its remaining area at the start of the twenty-first century, see Galindo-Leal and Câmara (2003b: 4).

region of western São Paulo at a *Mata Atlântica–Cerrado* (i.e., forest–tropical savanna) ecotone represents a landscape mosaic distinct from that of the region of eastern Santa Catarina described in this dissertation. Nevertheless, like Brannstrom's (2002) case, my analysis provides empirical detail and regional specificity. That is, by using a multiscale historical approach to examine the Florianópolis city-region, I describe dynamic vegetation cover in a subregion of the heterogeneous territory currently generalized as the Atlantic Forest.

Today, Brazil's Atlantic Forest ecoregion is inhabited by over 110 million people, many of whom live in large metropolitan centers and expanding small- and medium-sized cities. Researchers employing remote sensing and geoprocessing techniques recently determined that in 2005, eight Brazilian states contained 97,906 km² of Atlantic Forest remnants including: 92,402 km² of old-growth and advanced secondary forests; 4,634 km² of *restinga* vegetation which includes herbaceous, scrub, and arboreal formations covering beaches, dunes, and sandy coastal plains; and 870 km² of mangroves (Fundação SOS Mata Atlântica and INPE 2006). Based on this study, during 2000-05 period, forest cover alone decreased by ~951 km² with 454 km² (48 percent) of this loss having occurred in Santa Catarina.[11] Findings suggest an overall drop in the rate of forest loss due to reduced rates in Rio de Janeiro, São Paulo, Espírito Santo, and Rio Grande do Sul, states that have already experienced severe deforestation, even as Santa Catarina and Goiás, states with larger proportions of remaining forest cover, suffered relatively rapid rates of forest loss (Fundação SOS Mata Atlântica, INPE, and ISA 1998, Fundação SOS Mata Atlântica and INPE 2002, 2006). Knowledge of these and other differences among

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[11] Santa Catarina is one of three Brazilian states situated entirely within the Atlantic Forest ecoregion, the other two being the states of Rio de Janeiro and Espírito Santo (IBGE 2004a, b).

Brazilian states containing Atlantic Forest remnants presents valuable opportunities to study the variability and complexity of land-use and land-cover dynamics within this ecoregion.

Santa Catarina's northern border, with Paraná, extends over about 750 km. Its southern limit with Rio Grande do Sul is about 1,014 km long, and its western border with Argentina stretches for about 211 km. The length of Santa Catarina's coastline is about 560 km corresponding to about 7 percent of the entire Brazilian coastline.[12] Santa Catarina's area of 95,285 km² is larger than that of Portugal (92,152 km²). Presently, Santa Catarina is subdivided administratively into 293 *municípios* (i.e., municipalities) (IBGE 2001, 2006; see Figure 1.1). The state contains six major economic regions: (1) the southern region is primarily industrial, including mineral and coal extraction and ceramic production; (2) the northeastern region is highly industrialized producing electrical, metal, and mechanical products; (3) the Itajaí River Valley is the core of the state's textile industry; (4) timber extraction and agricultural production dominated by cattle and crops are characteristic of the northern and central plain regions; (5) the western portion of the state is primarily agricultural with industrial agricultural operations producing poultry and swine, and (6) state and federal administrative functions are concentrated in the coastal zone along with fishing/mariculture activities and an expanding tourism/leisure economy (Lago 2000).

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[12] The length of the Brazilian shoreline has been reported as 7,400 km by Couto, Silveira, and Rocha (2003: 328) and as 8,000 km by Ab′Sáber and Holmquist (2003: 9). Ab′Sáber and Holmquist (2003) divide it into six major sectors: (1) the Amazonian equatorial coast, (2) the septentrional northeastern coast, (3) the oriental northeastern coast, (4) the eastern coast, (5) the southeastern coast, and (6) the southern coast. In this classification, Brazil's southern coast stretches from the border between the states of Paraná and Santa Catarina to the border between the state of Rio Grande do Sul and Uruguay (Ab′Sáber and Holmquist 2003: 252).

Nearly one million people reside in the 22 *municípios* of the Florianópolis Metropolitan Region (FMR), an area of approximately 7,100 km² (IBGE 2007*a*; see Figure 1.1). Centered on Santa Catarina's capital city of Florianópolis, the FMR (27º14'–28°01' S, 48°20'–49º20' W) encompasses urban, industrial, suburban, peri-urban, rural, and conservation areas. Reflecting broad-scale spatial patterns of socioeconomic interdependencies, Brazil's metropolitan regions are defined by state governments to facilitate management and planning (Metrodata 2007). To clarify, the terms metropolitan region and city-region are often interchangeable in this dissertation; however, city-region denotes a more loosely-defined functional entity that lacks fixed administrative borders, whereas metropolitan region denotes an area bounded by municipal boundaries and provides a way to operationalize the city-region concept in analyses of quantitative municipal-level data.

Santa Catarina Island (SCI) represents about 97 percent of the total area of Florianópolis. SCI is a 424 km² continental island located in the middle of Santa Catarina's coastal zone. Elongated with a NNE–SSW orientation parallel to continental coastline, SCI has a length of about 54 km and a maximum width of about 18 km. Its coastline, which includes 42 sandy beaches, measures about 172 km. Along the oceanside, SCI's beaches are interspersed with several rocky shores, while on the bayside, in addition to many beaches, there are four distinct mangrove areas. In addition to the insular territory, the municipality of Florianópolis includes a 12 km² area on the mainland, located directly across from the island's highly urbanized Central City District and easily accessed by bridge or boat. The continental portion of Florianópolis is bordered by the highly urbanized municipalities of São José to the east, Biguaçu to the north, and Palhoça to the south.[13] Today, these four municipalities have a combined population of about 800,000 inhabitants, making this area one of southern Brazil's largest urban agglomerations.

The climate in the FMR is mesothermic, humid subtropical with hot summers and lacking a dry season (Köppen *Cfa* climate classification; Köppen 1918). Mean annual temperature is ~18°C and the mean annual precipitation is ~1,700 mm (Santa Catarina 2003).The altitude varies from coastal lowlands at <30 m above sea level (a.s.l.) to inland areas at 400–1,200 m a.s.l. (Santa Catarina 2000). The major ecosystems include: dense broadleaf forest that predominates in the coastal zone in association with mangrove forest and *restinga*; upland mixed broadleaf forest containing the conifer *Araucaria angustifolia*; and high-altitude grasslands (Klein 1978; Hodge, Queiroz, and Reis 1997; Falkenberg 1999; IBGE 2004b; Bonnet and Queiroz 2006; Bonnet, Queiroz, and Lavoranti 2007).

1.5 Primary Objectives and Methodology

1.5.1 Research Design and Field Strategy: An Integrated Approach

To answer the dissertation's central research questions, my research design and field strategy reflect the following primary research objectives:

- to construct an in-depth historical narrative of social and landscape transformations that can serve as the foundation for future work on an

[13] The mainland portion of Florianópolis comprises eleven neighborhoods: Abraão, Balneário, Bom Abrigo, Canto, Capoeiras, Coloninha, Coqueiros, Estreito, Itaguaçú, Jardim Atlântico, and Monte Cristo (IPUF 2000). SCI is connected to the continental coast by three bridges at the 500-meter-wide strait that connects the North and South Bays; the canal at this point is about 28 m deep. *Ponte Hercílio Luz*, a suspension bridge built in 1926, has been closed to traffic since the 1980s due to structural instability, but is preserved as an historic landmark. The presently functioning bridges, constructed in the 1980s, are *Ponte Governador Pedro Ivo Campos* and *Ponte Colombo Machado Salles*.

environmental history of Florianópolis and on forest transition theory in the Brazilian context;

- to gather empirical evidence of current social, economic, political, and ecological challenges as well as of existing and potential ways of fostering just sustainability in the Florianópolis city-region; and
- to organize and analyze information about global-to-local policies and institutions that are relevant to this case (i.e., policies and institutions addressing land use, environmental issues, and the principles of social equity and social justice).

By describing not only *how* but also *why* human roles in nature have changed over time, historical geographic narratives and environmental histories help to elucidate the present conditions of particular places and societies. This foundation of knowledge and understanding of the past and present can then support one to imagine possible futures. In the process of narrative construction, I have developed in-depth knowledge of the study region's complex history. To organize and analyze historical information from hundreds of sources and spanning millennia, I created a detailed timeline. I sought to trace changes in human-ecological relationships in the study region from its precolonial past through the colonial period, the era of modernization, and the current stage of globalization. I aimed to identify when major ecological, economic, political, and cultural shifts occurred and what precipitated, accompanied, and followed these shifts. In Chapter 4, I provide a longer discussion of my logic in constructing this historical narrative for metropolitan Florianópolis.

Concerned with shaping long-term sustainability strategies, innovative researchers have been pushing the frontiers of the social and biogeophysical sciences to study human-modified ecosystems. Since the 1990s, they have been advocating for, designing, implementing, and evaluating interdisciplinary scientific research approaches that integrate study of human-environment dynamics at multiple spatial, organizational, and temporal scales (e.g., Force and Machlis 1997; Grove and Burch 1997; Machlis, Force, and Burch 1997; Pickett *et al.* 1997; Liverman 1999; Niemelä 1999; Rosa 1999; Cash and Moser 2000; Gibson, Ostrom, and Ahn 2000; Grimm *et al.* 2000; Gallopín *et al.* 2001; Kates *et al.* 2001; Kinzig 2001; Pickett *et al.* 2001; Turner *et al.* 2001; Evans and Moran 2002; Turner 2002; Grau *et al.* 2003; Lambin, Geist, and Lepers 2003; Barbosa *et al.* 2004; Bawa *et al.* 2004; Gallopín 2004; Redman, Grove, and Kuby 2004; Rindfuss *et al.* 2004; Moran and Ostrom 2005; Musacchio *et al.* 2005; Yli-Pelkonen and Niemelä 2005; Cash *et al.* 2006; Dooling, Simon, and Yocom 2006; Haberl *et al.* 2006; Kim 2006; Pickett and Cadenasso 2006; Armesto *et al.* 2007; Carpenter and Turner 2007).

Influenced by these evolving collaborative and synthetic frameworks, in this dissertation I employed a multiscalar methodological approach to the empirical study of human-environment interactions and social-ecological systems (Berkes and Folke 1998; Berkes, Colding, and Folke 2003; Folke 2006). More specifically, I gathered, organized, contextualized, and integrated social and ecological data using nested spatial scales of analysis ranging from neighborhoods and submunicipal districts to the municipality, metropolitan region, state, subnational regional levels (e.g., southern Brazil and Brazilian Atlantic Forest), transnational regional levels (e.g., the political-economic context of Southern Cone nations and the ecological context of the South American Atlantic Forest), and, finally, to national and global arenas (e.g., changing legislative and institutional frameworks and novel approaches to governance and natural resource management).

The methodological approach of this dissertation is distinct from progressive contextualization (Vayda 1983) and event ecology (Vayda and Walters 1999) in several ways. While I have investigated land-use change using nested spatial scales, I have not done so by strictly “work[ing] backward in time and outward in space” as advocated by Vayda and Walters (1999: 169). Rather, I have deliberately considered social and ecological dynamics and feedbacks occurring across multiple spatial and temporal scales. Furthermore, the purpose of this study has not been limited to the explanation of environmental changes as events. I have explored causal chains to help explain land-use changes occurring within the landscape of the Florianópolis city-region (e.g., deforestation, agricultural use, forest recovery, conservation, urbanization, and socioeconomic segregation) and their interrelationships. However, in this study, I have also examined the causes of multiple social changes and the effects that these social changes have had on the living conditions of different social groups. Therefore, one of the explicit research priorities of this project has been to analyze the social injustices associated with differential access to land, environmental services, infrastructure, and political power. I began this project with the recognition that social relations are affected by structures and political-economic processes that have historical origins and that are discernible across the range of spatial scales from global to local. One avenue for studying these social dynamics is to consider how policies and institutions have influenced land use, environmental quality, and the political-economic status of social groups. Moreover, in my view, it is essential to critically examine the political and economic determinants not only of access to various environmental and social assets, but also of disproportionate exposure and vulnerability to environmental hazards and of the denial of basic human rights. Thus, my research perspective is suited to the frameworks of environmental justice, political ecology, and environmental history.

To examine the validity of forest transition theory in the context of just sustainability, I focus on the city-region (i.e., metropolitan) scale and place analytical emphasis on processes that have: (1) converted old-growth native forests to non-forest land covers such as cropland, pasture, and various types of built features; (2) modified remaining native forests; (3) resulted in the introduction of non-native species, particularly tree species; (4) allowed forest regeneration which increasingly proceeds through successional stages containing both native and non-native species; and (5) resulted in income inequality, uneven development, displacement, social polarization, socioeconomic segregation, and social exclusion.

1.5.2 Research Activities and Sources of Evidence

My visits to the Florianópolis city-region took place over a period of just over four years from early 2000 to mid-2004. The first several visits, during preparation of my research proposal, ranged from periods of two weeks to two months. I carried out the bulk of my field research from September 2003 through July 2004. The extended stay gave me the opportunity to observe important seasonal economic and social shifts between the peak summer tourism period from December to February and the calmer, cooler months from March to November. I was initially based in the Campeche District of Florianópolis during my short-term visits and later resided in the Lagoa da Conceição District during my longer stay. Centrally located on SCI, Lagoa da Conceição provided a convenient base for frequent trips to the city center of Florianópolis (*Centro*), to the *Universidade*

Federal de Santa Catarina (UFSC; Federal University of Santa Catarina), to Campeche District, and for trips to many other locations on the island and the mainland.

My research methods included: (1) bibliographic and documentary research; (2) acquisition and visual comparison of time-series aerial photographs (i.e., site-specific qualitative analysis of sequential historic aerial photographs); (3) semi-structured and informal interviews; (4) participant observation; and (5) direct observation and photography during site visits. The first three methods provided longitudinal data on social and landscape changes, i.e., processes such as agricultural land use, agricultural abandonment, urban expansion, forest regeneration, tree planting, and the creation of protected areas, while the last three methods captured current information about social-ecological systems. To create several of the figures in this dissertation, I scanned a selection of maps found in secondary sources and aerial photographs to serve as base maps and utilized the software Adobe Illustrator for graphic design.

For the bibliographic and documentary component of this project—carried out before, during, and after field research periods—I have consulted Brazilian demographic and agricultural censuses as well as relevant books, master's theses, doctoral dissertations, consultants' reports, maps, journal articles, unpublished research papers presented at meetings, local newspaper clippings, magazine articles, and various online documents (e.g., historical documents, Brazilian legislation, research papers and reports produced by government agencies and NGOs). I regularly monitored the newspapers *Diário Catarinense*, Santa Catarina's major newspaper, and a local Florianópolis newspaper called *Notícias do Campeche e Sul da Ilha*. Noteworthy magazine articles were primarily found in the popular Brazilian magazine *Veja.*

Much of the available research on the study region is in Portuguese with limited dissemination outside Brazil. Therefore, I prioritized review of the Portuguese-language literature and obtained copies of many publications that are unavailable in the United States. The main libraries I utilized in Florianópolis were those of UFSC, the *Instituto de Planejamento Urbano de Florianópolis* (IPUF; Urban Planning Institute of Florianópolis), and the *Instituto Brasileiro de Geografia e Estatística* (IBGE; Brazilian Institute of Geography and Statistics). Books by Virgílio Várzea (1985 [original edition 1900]), Fernando H. Cardoso and Octávio Ianni (1960), Oswaldo R. Cabral (1970), Walter Piazza (1988), Mariléa M. L. Caruso (1990), and Paulo F. Lago (2000)—rich in historical information—deserve special mention, as does *Geosul,* a journal based at the UFSC Geosciences and Geography Department. Books by Mara Lago (1996) and Márcia Fantin (2000) provide important contemporary ethnographies. While, most of the quantitative data presented in this dissertation comes from Brazilian demographic and agricultural censuses, I have also consulted global data compilations by the Population Reference Bureau (2007) and the UN Food and Agricultural Organization (FAO 2005, 2006, 2007). Santa Catarina's municipal-boundary base map is available as a vector file in CorelDRAW format at the state's government website (Santa Catarina 2002).

To gather time-series data for forest, *restinga*, mangrove, cropland, pasture, fallow, and built areas on SCI, I assembled a collection of sequential historic aerial photographs prioritizing coverage of the Campeche District. Aerial photographs, available at local public archives for the years 1938, 1957, 1977, 1979, 1994, 1998, and 2001, offered a sixty-year, visual record of human-induced landscape modifications on SCI, and therefore, allowed for qualitative time-series visual comparisons of land-use/cover since the late 1930s. Aerial photographs for the years 1957 to 2001 were available at the IPUF library, and aerial photographs for the year 1938 were available at Santa Catarina's *Secretaria de Estado do Planejamento, Orçamento, e Gestão* (Santa Catarina State Office of Planning, Budget, and Management). The air photos served multiple purposes as both research and communication tools. I viewed and reviewed them throughout the field research period and afterwards during the write-up stage. I also used them to guide site visits and to enrich several interviews. With the support of the other methods employed and complementary information sources, I have endeavored to trace the visual changes detectable in these images to their causes—to determine what took place during intervals between snapshots and to better understand the snapshots themselves.

Participant observation and interviews revealed important facts and insights. My personal experiences and observations often pointed me in unforeseen directions. Over time, I became increasingly aware of the local environment, the human systems embedded in that environment, and the possibilities and constraints within local human-ecological systems. By integrating myself into the city's social and economic systems, I learned first hand what life was like there, gaining an understanding of its advantages and difficulties. Through interactions with people of diverse backgrounds and in a variety of circumstances I learned the stories of people's aspirations, doubts, decisions, achievements, anxieties, disappointments, hardships, crises, and resiliencies. Conversations clarified many of the struggles and limitations faced in quests for success and well-being, the opportunities identified during these journeys, and the reasons behind many decisions (e.g., how to earn a living, where to build, buy, or rent a home, whether to stay in Florianópolis or to seek livelihood opportunities elsewhere, and how to raise and educate children).

Semi-structured interviews with open-ended questions and informal conversations supported construction of the social and landscape change narrative and often provided leads for further inquiry. The questionnaire used for semi-structured interviews is provided in Appendix B. The questions are listed in Portuguese with English translations. I took notes to record the participants' responses. During both semi-structured interviews and informal interviews, I sometimes asked participants to view aerial photographs and discuss their observations. Participants represented a variety of origins, ages, occupations, levels of formal education, income levels, experiences, and perspectives. They included: *nativos* (native-born) of the Florianópolis city-region, *catarinenses* from other parts of Santa Catarina, migrants from the Brazilian states of São Paulo, Paraná, Rio Grande do Sul, Rio de Janeiro, and Minas Gerais, and migrants from Argentina, Paraguay, Mozambique, and the United States. For work-related or personal reasons, several respondents were highly mobile within Brazil's southern and southeastern regions. In a number of cases, I maintained contact with interview participants over multiple years. In addition to following the lives of individuals, as a participant observer immersed in the daily life of the city-region for an extended period of time, I observed dynamics within and among groups of people.

To identify participants for semi-structured and informal interviews, I used a non-probabilistic sampling strategy that combined purposive, snowball, and convenience sampling. Using purposive and snowball sampling, I targeted people who possessed professional expertise or some other type of experience that was relevant to the central themes of this study (e.g., traditional culture and livelihood practices, land-use change, zoning and land-use restrictions, protected area management, property rights, real estate development, and tourism). I identified native-born residents and migrants from diverse origins using purposive, snowball, and convenience sampling. Fifty participants were interviewed. This was a small sample and sampling procedures were unrepresentative and therefore sources of selection bias. However, on a limited budget and with the additional constraint of being the sole interviewer, these interviews provided valuable preliminary qualitative data with the potential to inform the future design of a probability sampling strategy to obtain a larger sample for qualitative and quantitative data collection.

Site visits to ecosystems, protected areas, residential neighborhoods, and commercial zones in the city-region provided diverse opportunities for direct observation of social-ecological features, processes, systems, and dynamics (e.g., soils, hydrology, vegetation, housing, infrastructure). In photographs, I tried to capture the character of places and, whenever possible, evidence of transformation in progress. These snapshots have served as important reminders during the writing stage. On days when the weather permitted—and often during times when libraries and archives were closed or interview plans fell through—I picked a new place to visit. This involved many interesting bus, bicycle, and car rides as well as long walks and hikes, at times taken alone and at other times with colleagues and friends. The time I spent waiting for and traveling on buses almost always gave me the opportunity to meet new people and chat with them informally about a variety of topics including the changes the city-region had undergone and their impression of where it was headed. I sought out these same kinds of conversations with the owners, employees, and customers of small businesses such as restaurants, cafés, refreshment stands, shops, markets, and beauty salons.

1.6 Organization of the Dissertation

The dissertation is organized into seven chapters including this introduction. Chapter 2 presents the project's conceptual and theoretical framework in greater depth. Chapter 3 describes the study region's biogeophysical composition, illustrating local ecological heterogeneity and identifying the main human activities that have modified native ecosystems.

Departing from the assumption that knowledge of historical processes and contingencies is essential to informed understanding of contemporary social and ecological dynamics, Chapters 4 and 5 document past human-environment interactions in the study region, linking the history of southern Brazil to broader political and economic circumstances at national and international levels. Chapter 4 covers the study region's environmental history from the time of its first known human settlements through the nineteenth century. It integrates discussion of: human migration and settlement histories and related ecological disturbances; major socioeconomic and political changes since the earliest encounters among Amerindians, Europeans, and Africans in the sixteenth century; the continuities and discontinuities of various aspects of social relations and social inequalities in contemporary Brazilian society; and the emergence of Brazilian national and subnational identities. Emphasizing the major political and economic changes that took place during the period from 1930 to the present, Chapter 5 focuses on the history of modernization, environmental governance, and urban reforms in Brazil. It examines legislation, policies, and institutions influencing federal, state, and municipal environmental and urban governance and management. It also identifies patterns and trends in formal real estate development and in self-provisioned low-income informal settlements in Brazil. Thus it situates the recent social and land-use changes that have occurred in metropolitan Florianópolis in the context of urban Brazil and globalization.

Next, Chapter 6 continues to consider processes of urbanization, suburbanization, and peri-urbanization in metropolitan Florianópolis by focusing on a particular post-agricultural landscape—a submunicipal area in Florianópolis that has undergone profound social change and extensive land-use and ecosystem modification over the past half century. It also examines recent social mobilizations to maintain and improve living conditions through local participatory planning and governance. Lastly, Chapter 7 revisits the central research questions, summarizes the study's major findings, discusses the implications of these results, identifies unresolved issues, and closes with suggestions for future research.

CHAPTER 2

METROPOLITAN LAND CHANGE SCIENCE: THEORETICAL CONSIDERATIONS

2.1 Overview

This study departs from the premise that the present-day environment and landscape of metropolitan Florianópolis and their interactions with society are best understood by developing a long-term, multiscalar perspective on the site's social and ecological transformations, transitions, and trajectories (e.g., Batterbury, Forsyth, and Thomson 1997). My research approach is strongly influenced by the contributions of environmental and urban historians (e.g., Morse 1974; Cronon 1983, 1991, 1992; Totman 1989; Davis 1990; Whitney 1994; Dean 1995; Matlack 1997; Molotch, Freudenburg, and Paulsen 2000; Rolnik 2001a; Gandy 2002). In addition, I engage with: sensitizing concepts posited in structuration theory (Giddens 1984); the concept of social-ecological systems (SESs) and ideas about hierarchy, panarchy, complexity, nested ontology, nonlinearity, variability, feedbacks, resilience, and adaptive capacity (e.g., Holling 1973, 2001; Berkes and Folke 1998; Adger 2000; Gunderson 2000; Kinzig 2001; Gunderson and Holling 2002; Berkes, Colding, and Folke 2003; Folke 2006; Ostrom 2007, 2008; Perz 2008); and the literature on risk, reflexive modernization, and reflexivity (e.g., Beck 1992, 1999, 2006; Beck, Giddens, and Lash 1994; Mol 1996; Batterbury, Forsyth, and Thomson 1997; Lynch 2000; Beck, Bonss, and Lau 2003; Lash 2003). To develop a multidimensional analytical perspective on the social and landscape reconfigurations that have occurred in present-day metropolitan Florianópolis, I construct a regional narrative that begins to bridge evolving knowledge of Brazil's precolonial past, colonial and imperial periods, and era of modernization to ongoing discussions about: globalization (e.g., Appadurai 1996; Brenner 1999; Sheppard 2002; Beck 2006; Hecht *et al.* 2006; Young *et al.* 2006; Leichenko and Solecki 2005; Leichenko and O'Brien 2008); peripheralization (e.g., Fernandes and Negreiros 2001; Jenkins, Robson, and Cain 2002); global city-regions (e.g., Scott 2001a, b; Scott and Storper 2003); advanced capitalism; neoliberalism (e.g., Ong 2006; Roberts and Portes 2006; Brand 2007; Kull, Ibrahim, and Meredith 2007; Purcell 2007); empire (Hardt and Negri 2000); postindustrial development and restructuring (e.g., Bell 1973, 1976; Coppack 1988; Mather 2001); high modernity (Giddens 1990, 1991); postmodernity (Harvey 1989, 1998, 2005); second modernity (Beck 1999, 2006; Beck, Bonss, and Lau 2003); and liquid modernity (Bauman 2000).

As an empirical case study of the determinants and consequences of land-use/cover change in a subtropical region of the largest and most populous country in South America, this dissertation aims to: (1) enrich previous theoretical contributions derived from historical studies of forest transitions manifested in several of today's advanced industrialized, newly emerging, and developing nations; and (2) advance theoretical work addressing the intertwined social-environmental challenges and opportunities associated with contemporary political and economic systems, particularly in urban regions. Section 2.2 situates forest transition theory within a broader research agenda to develop a theory of land change. It then traces the history of forest transition theory and comments on the extent to which forest transition theory has been addressed by analysts studying areas in Brazil. Section 2.3 defines the city-region concept and, through a discussion of Brazilian urban growth processes and patterns, it addresses the interrelated themes of globalization, metropolitan dynamics, and growth management. Section 2.4 presents the just sustainability perspective of the dissertation's theoretical framework which defines urban dualization as a type of environmental injustice. Finally, section 2.5 calls attention to theories and debates about competing economic and environmental discourses, social mobilization, and collective action.

2.2 Land Change Science and Forest Transition Theory

2.2.1 Global Environmental Change Research and Land Change Science

Forest transition theory (FTT) proposes a general model of forest change in which a given land unit undergoes a period of usually extensive (perhaps moderate) deforestation, then the remaining total forest area in that territory eventually stabilizes, reaching a turning point which marks the onset of a period of net forest expansion (e.g., Mather 1992; Grainger 1995; Mather and Needle 1998; Mather, Needle, and Fairbairn 1999; Rudel 1998; Mather 2001; Rudel 2005; Rudel *et al.* 2005; Perz 2007, 2008; Walker 2008).[14] Investigators pursuing this line of inquiry examine historical trajectories and contemporary trends in forest losses and gains for particular places (e.g., countries, subnational regions, states, and municipalities) aiming to identify the drivers of these processes and to distinguish causal factors and causal factor interactions from intervening socioeconomic and biophysical variables (and subvariables) that may either accelerate,

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[14] Mather, Needle, and Fairbairn (1999) referred to such forest recovery pathways as environmental Kuznets-type trends or E*f*KCs (see also Koop and Tole 1999; Ehrhardt-Martinez, Crenshaw, and Jenkins 2002). Environmental Kuznets curves (EKCs) model the theory that environmental conditions initially worsen (i.e., environmental degradation increases) then, as development proceeds and incomes rise, environmental conditions improve (see Beckerman 1992; Stern, Common, and Barbier 1996; Barbier 1997; Bowman 1997). The EKC hypothesis is an adaptation of Simon Kuznets' (1955) income distribution theory of an inverted-U relationship between income inequality and the level of income. Kuznets suggested that income inequality initially increases with economic growth, reaches a maximum, and then declines as economic growth continues.

obstruct, or reverse forest transition trajectories. Therefore, by investigating complex social and land-use/cover dynamics in diverse spatial, temporal, and organizational settings, forest transition research represents an important component of the broader interdisciplinary research effort in land change science to understand human-induced global environmental change (e.g., Houghton 1994; Meyer and Turner 1994; Ojima, Galvin, and Turner 1994; Lambin, Geist, and Lepers 2003; Rindfuss *et al.* 2004; Lambin and Geist 2006; Turner, Lambin, and Reenberg 2007; Ostrom 2008). In other words, the refinement of FTT based on empirical research serves to strengthen our understanding of the multiple drivers and processes of global forest change, their interactions, and their outcomes (e.g., Mather 1998; Mather and Needle 2000; Geist and Lambin 2001, 2002, 2003; Rudel 2005; Rudel *et al.* 2005).

Efforts are underway in the environmental change research community to develop an overarching theory of land change. Towards reaching this goal of the Land-Use and Land-Cover Change (LUCC) project of the International Geosphere-Biosphere Programme (IGBP) and International Human Dimensions Programme on Global Environmental Change (IHDP), land change scientists have proposed that an overarching land-change theory: (1) "engage both the behavior of people and society (agency and structure) and the uses to which land units are put, as well as feedbacks from one to the other"; (2) "be multi-level with respect to both people and pixels, recognizing that they can combine in ways that affects their behaviors, as a single unit or collectivity"; (3) "incorporate the extent to which people and pixels are connected to the broader world in which they exist, both currently and in the past"; and (4) "incorporate time, both past time (history) and the future" (Lambin, Geist, and Rindfuss 2006: 7–8).

2.2.2 Forest Transition Theory

The variant of FTT explored in this dissertation is the following. In the process of modern economic development, societies transform frontier and settled landscapes sequentially first by clearing forests and converting lands to agricultural uses. Later, as agricultural modernization makes agriculture more capital and technology intensive and less labor intensive, farmers abandon marginal agricultural lands and concentrate their resources and activities on the most suitable agricultural lands. Meanwhile, economic growth and urbanization create life opportunities and living conditions that attract people to cities such as employment opportunities in the secondary, tertiary, and quaternary sectors, educational opportunities, and health care services. Growing urban populations increase demands for forest products such as timber and paper. Forest gains occur either by spontaneous regeneration (i.e., secondary succession) on abandoned or managed rural lands or by active tree planting of native species or mono-specific stands of fast-growing exotic species. [15] As cities develop legislation, executive policies, infrastructure, and services, a variety of environmental governance institutions evolve and implement conservation strategies that serve to maintain and sometimes expedite forest recovery in places of particular ecological value, aesthetic value, and/or that are less suitable for agricultural or urban use. My intention in articulating this generalized linear land change pathway is not to espouse an uncritical rigidly positivist version of (ecological)

[15] Secondary forests and other types of successional ecosystems, while different from their original biotic communities due to the loss of native species and the introduction of non-native species, provide multiple ecosystem services (e.g., soil conservation, flood control, carbon sequestration, aesthetic value, opportunities for leisure and recreation) and may often contain substantial levels of biological diversity (see Kammesheidt 2002). The biological diversity of certain types of secondary forests may exceed that of highly degraded and isolated old-growth forest fragments. Furthermore, successional ecosystems often offer the potential for further restoration. Even when dominated by exotic tree species, planted forests can provide several regulating ecosystem services, and if managed sustainably, they have the potential to help conserve biodiversity while providing society with timber and other forest products (see Carnus *et al.* 2006).

modernization theory or a panacea for the problem of global forest loss.[16] Rather, it is presented here as a simplified conceptual and theoretical model, open to rigorous critique and debate, but that nonetheless has assisted me in empirical study of landscape fragmentation and dynamic land-use mosaics (e.g., Forman 1995; Nagendra, Munroe, and Southworth 2004; Pickett, Cadenasso, and Grove 2004), land-based interest mosaics (Molotch 1976: 310–318); social-ecological complexity and nonlinearities (e.g., Perz and Skole 2003; Perz 2007, 2008), co-existing contradictory logics and spatio-temporal differentiation (see Robbins and Fraser 2003), and multilevel systems (see Lambin, Geist, and Rindfuss 2006).

Forest recovery following deforestation and agricultural abandonment or afforestation have been documented at varying spatial scales within highly-industrialized, newly-industrial, and developing countries (e.g., Hart 1968; Foster 1992; Mather and Thomson 1995; Matlack 1997; Mather and Needle 1998; Mather, Needle, and Coull 1998; Staaland *et al.* 1998; Mather, Fairbairn, and Needle 1999; Mather and Fairbairn 2000; Mather and Needle 2000; Rudel 2001; Foster and Rosenzweig 2003; Benjamin, Domon, and Bouchard 2005; Flinn, Vellend, and Marks 2005; Xu, Ai, and Deng 2005; Nagendra 2007; Meyfroidt and Lambin 2008). To date researchers investigating land-use/cover histories in Latin America and the Caribbean have reported forest recovery at various spatial scales in Puerto Rico (e.g., Thomlinson *et al.* 1996, Rudel, Perez-Lugo, and Zichal 2000; Grau *et al.* 2003; Aide and Grau 2004), Honduras (Southworth and Tucker 2001), Ecuador (Rudel, Bates, and Machinguiashi 2002), Mexico (Klooster 2003;

[16] See papers by Joseph Murphy (2000: 1–8) and F.H. Buttel (2000: 57–65) in *Geoforum* for discussions of the emergence and development of ecological modernization theory. In the same issue, Arthur P.J. Mol (2000: 45–56) addresses the process of ecological modernization in relation to transformations of the modern environmental movements of Europe and the United States.

Bray and Klepeis 2005), Brazil (e.g., Perz and Skole 2003; Baptista and Rudel 2006), the Dominican Republic (Aide and Grau 2004), Costa Rica (Arroyo-Mora *et al.* 2005, Kull, Ibrahim, and Meredith 2007), El Salvador (Hecht *et al.* 2006), and Argentina (Grau *et al.* 2008). Contemplating future global land-change scenarios, analysts have begun to discuss the possibility of reversing global deforestation trends at some point in the future (e.g., Mather and Needle 2000; Kates and Parris 2003; Mather 2005; Rudel *et al.* 2005; Kauppi *et al.* 2006; Wright and Muller-Landau 2006) and initiating a transition toward "a great restoration of forests" (Waggoner and Ausubel 2001: 253).

The forest transition concept was introduced to the geographical literature by Alexander S. Mather (1990, 1992) in reference not only to several national experiences of net forest expansion, but also in a wider sense to describe forest cover changes taking place within "the developed world as a whole" (1992: 371).[17] In addition to adopting the term forest transition as coined by Mather in these seminal works, authors have since used other similar expressions to refer to the shift from a period of net forest loss to a period of net forest gain including forest turnaround (Rudel 1998; Rudel *et al.* 2005), forest recovery (Perz and Skole 2003), and forest resurgence (Hecht *et al.* 2006). Following Mather (1992), a number of studies have continued to address the role that variations in land quality play in relation to patterns of intensified agricultural land use and selective agricultural abandonment. In an agricultural context, land quality refers to relative geographical advantages or disadvantages which can be enhanced or

[17] Following Sedjo (1984, 1986, 1987), Mather (1992: 367) acknowledged that the Neolithic Revolution (beginning about 10,000 years BP) represents an earlier type of 'forest transition' in the course of human history when societies in different parts of the world shifted from hunter-gatherer forest management regimes to predominantly agrarian modes of production. The populations of these transformed societies increasingly lived in permanent settlements, managing tracts of old growth, secondary, and planted forests to sustain supplies of forest resources such as timber, fuelwood, and hunting grounds.

compensated for by technological advances generating higher yields and by investments in infrastructure facilitating production and transport (i.e., through agricultural modernization). In turn, agricultural modernization combined with increases in non-farm employment opportunities and stabilizing demands for agricultural products can significantly reduce the pressure of agricultural expansion on standing forests and simultaneously allow marginal agricultural lands to revert to forest (Mather and Needle 2000). Following up on brief mention by Mather (1992: 373), Mather and Needle (1998) offered an extended discussion of human adjustment to land quality in locating different forms of rural production and the consequences of this social learning process for forests. Over time, processes of human adjustment tend to place crop cultivation, livestock rearing, and plantation forestry in arrangements that maximize output per unit area. In a subsequent article, Mather (2004: 94) pointed out that agricultural expansion and forest expansion can sometimes occur simultaneously in a given land unit, for example, in a period limiting international trade and demanding greater self-sufficiency thus leading to the endogenous provisioning of agricultural products and timber.

Clearly, multiple factors should be considered to adequately explain observations of agricultural contraction and forest expansion. Using census data to investigate land-use change in 31 states of the eastern United States between 1910 and 1959, John Fraser Hart (1968) demonstrated a fine-tuned appreciation for varying local conditions and the complexity of land-use conversions within a study region. He concluded that poor land quality resulted in greater losses of cleared farm land than urban expansion which he found occurring primarily at metropolitan fringes. He also identified strip mining activities and the loss of a locally dominant crop as important factors in some areas.

Interestingly, Hart (1968) reported that in many areas of the eastern United States change from cleared farm land to farm woodland was a precursor to either agricultural abandonment or to a transition into nonfarm ownership, indicating that an intermediate period of increasing underuse may precede complete abandonment or passage to some form of nonfarm use. He differentiated active loss of farm land from passive loss of farm land, pointing out that active agricultural contraction includes conversion to other land uses such as housing developments, highways, airports, reservoirs, military reservations, and forests under public management, whereas passive loss of farmland occurs in former fields or pastures that revert to forest spontaneously. Similarly, Mather, Fairbairn, and Needle (1999) wrote that forest transitions have resulted both from the influence of passive facilitators and active drivers of the process; for example, they identified the availability of alternative fuels, declining trends in rural population, and rising trends in agricultural yields as passive (or permissive) factors as opposed to active drivers.

Citing research by Conrad Totman, Mather (1992: 370, 372) highlighted Japan as one of humanity's earliest cases of the forest transition. Totman (1986, 1987, 1989) described the societal "shift from exploitative to regenerative forestry" that occurred in Japan during the seventeenth, eighteenth, and nineteenth centuries. Totman explained that rapid population growth, extensive urbanization, and associated economic transformations in Japan beginning in the seventeenth century resulted in increased exploitation of forests to meet growing demands for a variety of forest products. The flooding, soil erosion, and forest product scarcities experienced as consequences of the deforestation occurring throughout the archipelago led to the perception of environmental crisis within early modern Japanese society and, thus, a change in values and forestry practices. In the late seventeenth century, Japanese authorities initially responded to this crisis by intensifying management and regulating use of remaining forests. Over the course of the eighteenth century, diverse approaches were developed to encourage afforestation including the development of plantation silviculture which, by shifting production from multiple-use to single-use forestry in chosen areas, served to maximize yields and accelerate forest output to meet the needs of expanding urban markets. During the eighteenth and nineteenth centuries, both government and private rural producers established plantations in areas of Japan where topographic, climatic, and market conditions were most favorable. Despite continued population growth, by the late twentieth century about two-thirds of Japan's land area (approximately 246,000 km^2) was reportedly covered by forests.[18]

Building on this awareness of Japan's history of social and forest change, Mather (1992) began to explore mounting evidence of net forestation occurring during the nineteenth and twentieth centuries in several industrialized countries. This research direction seemed especially worthwhile considering the global downward trend in forest area over the same time period.[19] He pointed out that, over the past two centuries, several European countries, including France, Scotland, Britain, Hungary, the Netherlands, Denmark, Switzerland, Italy, and Bulgaria, experienced forest transitions after long periods of deforestation beginning in the fifteenth, sixteenth, seventeenth, and eighteen

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[18] Over the century from 1900 to 2000, Japan's population grew from ~43.8 to ~126.9 million people (SBJ available at <http://www.stat.go.jp/English/data>).

[19] According to the 2005 Global Forest Resources Assessment (FRA 2005) coordinated by the FAO (2006), global forest extent continues to diminish although the net loss of forest area is slowing down as a result of afforestation and natural regeneration in some regions. Global forest area in 2005 was estimated at 3.95 billion ha, and the global deforestation rate was estimated at about 13 million ha annually during the period 1990–2005. The rate of *net* forest loss appears to have decreased by about 18 percent from ~8.9 million ha annually during the period 1990–2000 to ~7.3 million ha annually during the period 2000–2005. It is relevant to note that the FRA 2005 reports a correlation between negative forest resource trends and the size of rural poor populations.

centuries.[20] In his earlier writings, Mather drew a distinction between modern 'low-latitude' and 'higher-latitude' countries framing the members of the former group as having yet to undergo the process of forest transition that was already evident in many cases within the latter group. Later, however, Mather (2004: 93) questioned the validity of drawing a sharp distinction between tropical forest and temperate forest countries when addressing the topic of forest transitions.

In addition, based on comparison of European histories with the more recent example of the United States, Mather (1992) optimistically suggested the possibility that forest-area transitions may occur at an earlier stage of the deforestation process and more abruptly in some lower-latitude countries. He attributed this possibility, in part, to changing demographic trends around the world and to forest recovery in more developed countries. Mather (1992) also identified mass media and supra-governmental institutions as pivotal factors due to their widespread influences on environmental values, perceptions, and policies. In contrast, he tempered this optimistic perspective by forecasting tremendous losses of biodiversity resulting from continued net deforestation in developing tropical countries, concluding that the near depletion of native forests over the course of economic development in many higher-latitude cases prior to their forest transitions may be repeated at lower latitudes. In the years since, others have continued this line of inquiry into the timing of forest transitions and the expected degree of forest depletion when the turnaround toward forest recovery occurs.

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[20] The land areas of France (~545,630 km²), Japan (~373,500 km²), Italy (~294,000 km²), the United Kingdom (~241,590 km²), and Bulgaria (~110,550 km²) are all larger than the land area of Santa Catarina State (~95,285 km²). Santa Catarina, however, is larger than Hungary (~92,340 km²), Denmark (~42,370 km²), Switzerland (~39,770 km²), and the Netherlands (~33,900 km²).

The hypothesis that overall forest area shrinks to somewhere between 10 to 50 percent of the area originally under forest before transitioning to a period of net forest expansion (Grainger 1995) was contested by Perz and Skole (2003) with evidence of rapid and extensive forest regrowth in a settled subregion of the Brazilian Amazon. The findings of Perz and Skole (2003) suggested the possibility that, in certain tropical developing country contexts, overall forest area at the time of a forest transition may be significantly higher than 50 percent of the forest's former areal extent, i.e., secondary forests may expand rapidly after moderate levels of old-growth deforestation. Based on an analysis of satellite and census data for the late 1980s and early 1990s, Perz and Skole (2003) compared forest-cover dynamics in three distinct Amazonian subregions: settled, frontier, and remote. These three subregions served as proxies for distinct stages along the forest transition. The settled land-use category represented the most advanced stage along the Amazon's forest transition pathway; it contained the highest proportion of deforested land and successional forests. Perz and Skole (2003) estimated that by 1992, of the observed settled area originally under forest (79,800 km²), primary forest still covered 40 percent while secondary forest had regenerated to cover 32 percent, for an overall forest cover of about 72 percent. The remaining settled land area of about 28 percent was reported as deforested.[21] These authors concluded that, in the Brazilian Amazon, forest-transition dynamics seem to occur at relatively early stages in the deforestation process. Therefore, although both overall and primary forest areas have

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[21] Since most of the deforestation in the Brazilian Amazon has taken place only since the 1960s as a result of multiple interrelated causes (see Laurance *et al.* 2001), comparison of the figures for the three subregions provides a sense of how rapidly and extensively cleared Amazonian forests can regenerate. In 1992, the total standing forest in the observed frontier area (1,431,500 km²) was estimated at 89.4 percent of which 85.5 percent was primary forest and only 3.9 percent was secondary forest, while the total standing forest in the observed remote area (1,782,000 km²) was estimated at 99.1 percent of which 98.0 percent was primary forest and 1.1 percent was secondary forest (Perz and Skole 2003).

continued to decline in the Brazilian Amazon in recent years, there may be some reason to expect that a forest transition there might occur earlier and with higher levels of overall forest cover than in previous cases around the world. Perz and Skole (2003) have provided important preliminary work that can serve as a baseline for future research on forest change in the Brazilian Amazon. As they correctly emphasized, in order to adequately grasp case-by-case variation, it is essential to examine land-cover dynamics at different spatial and temporal scales within a hierarchical framework. In other words, hierarchy theory offers a way to integrate analyses of short and medium-run time scales with analyses of the long-run time scales most often addressed by FTT. Given that the assessment by Perz and Skole (2003) focused on a short-term time scale of six years (i.e., land change between 1986 and 1992), researchers should continue integrating the best available data sources to monitor forest cover, urbanization, agricultural, political, and demographic trends in this region over diverse spatial and temporal scales. Moreover, as emphasized by Perz and Skole (2003: 280), refinement of FTT necessitates more research on subnational units within non-Organization for Economic Cooperation and Development (non-OECD) countries.

Others have published research challenging prior assumptions about the stage of the deforestation process at which forest transitions begin and the expected proportion of forested land at the time of the turning point. Based on an assessment of global-scale data, Rudel *et al.* (2005) proposed the notion of variable forest transitions. They reported that while in earlier cases (e.g., Scotland and Denmark) forest transitions did not take place until forest areas were nearly depleted, in some of the more recent cases (including New Zealand, South Korea, the United States, and Costa Rica) forest transitions occurred with significantly larger proportions of remaining forest. These authors argued that the widened range in the proportion of forested land at the onset of the turnaround may indicate increased variability in physical settings as well as changes in social, economic, and political forces. Thus, while some aspects of forest transitions can be generalized and past experiences can certainly provide valuable lessons, evidence suggests that future forest transitions are likely to follow diverse trajectories reflecting unique historical contingencies and distinct contemporary circumstances.

Depending on the particular temporal scale, characteristics, and circumstances of the unit of land under investigation, assemblages of processes broadly referred to as economic development can operate as drivers of either forest gains or losses. In other words, it is important to recognize that forest transitions are neither inevitable nor irreversible as economic development proceeds (e.g., Rudel 1998; Foster and Rosenzweig 2003; Klooster 2003; Perz and Skole 2003). Regenerating successional and mature forests may be degraded or cleared by human action. Actively planted forests may be depleted without renewal. Several empirical examples help to illustrate these points. Totman (1982: 418), for instance, found forest-cover fluctuations in early modern Japan writing that "there appears to have been a continual ebb and flow of local and government interest in forestry, with spates of vigorous reforestation followed by periods of quiescence, until a new demand for lumber or fuel revealed a shortage of supply that led to renewed calls for the planting and nurturing of appropriate trees." Mather (1992) pointed out that the United States experienced short-term fluctuations in forest cover during the late twentieth century, decades after its forest transition in the early twentieth century; a net loss of forested land in the United States during the 1970s was followed by a phase of forest resurgence in the 1980s. More recently in the United States, MacDonald and Rudel (2005) described forest losses in some affluent areas of the state of New Jersey from 1986 to 1995 where expansion of suburban real estate development, in proximity to the New York metropolitan area, accelerated deforestation.

Over the years, many studies have discredited oversimplified neo-Malthusian assumptions about population as a driver of forest loss (e.g., Rudel 1989a, 2005; Mather 1992; Batterbury, Forsyth, and Thomson 1997; Rudel and Roper 1997; Leach and Fairhead 2000; Mather and Needle 2000; Geist and Lambin 2001, 2002, 2003; Hecht *et al.* 2006). While conceding that declining population growth rates may contribute to forest transitions, Mather (1992) argued that stabilizations of forest area are actually likely to *precede* stabilizations of population citing the examples of Denmark, Britain, France, and the United States. Mather and Needle (2000) pointed out that in many industrialized countries the relationship between forest area and total population changed from an inverse to a direct relationship, and based on macro-scale modeling, they predicted that the stabilization of global forest area will occur before the middle of the twenty-first century even while the total global human population continues to increase, albeit at a declining rate. Further, Mather and Needle (2000) criticized analysts who link population to forest trends without carefully examining underlying socioeconomic conditions, and they suggest that, in addition to magnitudes and rates of population growth, other demographic trends should be considered, such as changes in population distributions. In a recent analysis of 103 countries that used per capita gross domestic product (GDP) as an index of economic development, Ewers (2006) found that the effect that a nation’s total amount of forest cover has on forest-cover change is dependent on economic development, i.e., countries with high per capita GDP and low forest cover were found to have the highest rates of afforestation whereas countries with low per capita GDP and low forest cover were found to have higher rates of deforestation than countries with low per capita GDP and large amounts of forest. Previously, in an analysis of 48 developing countries, Koop and Tole (2001) investigated the role of distributional factors in mediating the effects of economic growth and concluded that deforestation rates are lower in countries with more egalitarian distributional profiles whereas countries with high levels of social inequality tend to have higher deforestation rates. Therefore, they found evidence to support the hypothesis that, "Deforestation…would be expected to be higher in countries like Brazil and the Philippines, where growth has not been accompanied by the eradication of poverty and/or inequality to any significant degree" (Koop and Tole 2001: 198).

2.2.3 The Relevance of Forest Transition Theory for Brazil

Notwithstanding evidence of significant secondary forest expansion and/or forest planting in certain subregions of Brazil, to date few publications have directly addressed FTT in the Brazilian context (Perz and Skole 2003; Baptista and Rudel 2006; Baptista 2008). However, a number of authors have discussed forest recovery on land units in Brazil in relation to several of the major themes that appear in the forest transition literature, e.g., urbanization, industrialization, agricultural modernization, rural exodus, agricultural abandonment, environmental protection, and the valuation of environmental amenities. This dissertation synthesizes the knowledge and insights of these two previously disconnected bodies of literature.

Mariléa M. L. Caruso's (1990) analysis of long-run forest-cover change on Santa Catarina Island, first published in 1983, is based on research carried out during the late 1970s and early 1980s, thus preceding the emergence of FTT. More recently, Marcelino, Conceição, and Adami (2003), Vibrans (2003), and Vibrans, Pellerin, and Refosco (2005) reported forest recovery in several of eastern Santa Catarina's municipalities (*municípios*). In the case of São Paulo State, reports of forest cover gains in 85 *municípios* during the period from 1990 to 1995 and in 131 *municípios* during the period from 1995 to 2000 (Fundação SOS Mata Atlântica, INPE, and ISA 1998; Fundação SOS Mata Atlântica and INPE 2002) prompted Eduardo Ehlers (2007) to investigate the drivers of forest recovery.

2.3 Globalization, Metropolitan Dynamics, and Growth Management

2.3.1 City-Regions

The growth of human populations in city-regions is a major component of global demographic, socioeconomic, cultural, political, institutional, and environmental change (e.g., Satterthwaite 1997; Miller and Small 2003; Foley *et al.* 2005; DeFries, Asner, and Foley 2006; de Sherbinin *et al.* 2007). The world's forests and urban regions exist within complex human-environment systems (e.g., Innes and Booher 1999; Holling 2001; Allen 2003; Urry 2003; Batty 2005; Rudel 2005). Contemporary metropolitan landscapes are ecologically and socially heterogeneous, often containing diverse types of protected areas within matrices spanning the range of land use from highly urbanized to mostly rural (e.g., Pickett, Cadenasso, and Grove 2004; Forman 2008). Although a few large intact forests persist in relatively remote areas, largely unaffected by metropolitan systems, over the next century this situation is likely to change as the proportion of the human population inhabiting metropolitan regions increases, new metropolitan regions develop around today's expanding small- and medium-sized cities, and transportation and communication infrastructures continue to advance into remaining frontiers (e.g., Beaverstock, Smith, and Taylor 2000; Miller and Small 2003; Small and Nicholls 2003).

In this dissertation, the terms metropolitan region, city-region, and urban region all designate a type of coupled human-environment system (see Turner *et al.* 2003; Turner, Lambin, and Reenberg 2007). However, the labels city-region and urban region denote a sort of "kaleidoscoping landscape" (Young and Aspinall 2006), i.e., a complex, porous spatial entity encompassing an ever-changing mosaic of forms, functions, processes, and meanings, whereas metropolitan region denotes an area delineated by municipal boundaries as defined by institutions of governance during a specific time period and thus provides a way to operationalize the city-region concept for data collection, organization, and spatial analyses (e.g., Baptista 2008).). Ramos and Silva (2007) have used spatial statistics and spatial modeling to define metropolitan regions in Portugal. Others have begun to explore the potential of night-time lights detected with satellite imagery for mapping the spatial distribution of human settlements and measuring urban extents (Amaral *et al.* 2005; Small, Pozzi, and Elvidge 2005).

Recent conceptualizations and theorizations of the city-region are provoking interesting discussions and debates (see Scott 2001a, b; Brenner 2002; Scott and Storper 2003; Friedmann 2007; Harding 2007; Jonas and Ward 2007a, b; Krueger and Savage 2007; McCann 2007; McGuirk 2007; Purcell 2007). Emphasizing the idea that the world's large city-regions are shaped by the conditions of economic globalization and that they respond to global political-economic conditions by reinforcing, securing, and enhancing their local competitive advantages, Scott (2001a: 813) defined the "global city-region" as "an emerging political-economic unit with increasing autonomy of action on the national and world stages." Wary of "new city regionalisms" that appear to define city-regions too narrowly as autonomous political-economic agents or "the building blocks" of the global economy, Jonas and Ward (2007a) called attention to political and economic contestations and struggles occurring at diverse scales around issues of social (re)production, governance, citizenship, political participation, and sustainability. McGuirk (2007) highlighted the notion of contingency in ongoing, multiscalar processes of city-regionalization.

The literature on city-regions and closely related themes is informed by evolving understandings of the global economic system and of world cities (Hall 1966; Friedmann and Wolff 1982; Friedmann 1986; Meyer 1986; Beaverstock, Taylor, and Smith 1999), global cities (Sassen 1991; Abu-Lughod 1999) and globalizing cities (Marcuse and van Kempen 2000; Bunnell, Barter, and Morshidi 2002; Short 2004a, b) within that system. Scholars have analyzed the characteristics, structures, and degrees of intercity or intermetropolitan linkages at global, regional, and national scales, exploring urban hierarchies and the diverse ways in which large cities function as centers of innovation, production, consumption, exchange, control, coordination, and communication (e.g., Eberstein and Frisbie 1982; Meyer 1984, 1986; Knox and Taylor 1995; Castells 1996; Chen 1996; Taylor 1997; Hewitt 1999; Esparza and Krmenec 2000; Sheppard 2002; Taylor *et al.* 2002; Urban 2002; Pereira and Lemos 2003; Mulligan and Crampton 2005; Rossi and Taylor 2005; Borck 2007; Limtanakool, Dijst, and Schwanen 2007). Smith and

Timberlake (1995), for instance, argued that systematic economic, cultural, political, and social linkages among cities are likely to reveal the spatial organization of the world-system and that this global-level spatial organization can be understood through formal network analysis. Discussing cosmopolitanism, flows, linkages, and relations, Beaverstock, Smith, and Taylor (2000) focused on the concept of a world city network and the integration of the "world-space of settlements" visible from space with "metageography". Concerned with forecasting land-use transitions, Pumain (2000: 85) developed a theory of human "settlement systems" from an evolutionary perspective, concluding that, "There is no optimal urban system, there are just systems which continue to adapt."

Papers reflecting on human-environment interactions and SESs add another set of perspectives to the broader dialogue on urban regions (see Ostrom 2007, 2008). Haberl, Batterbury, and Moran (2001), for example, suggested that researchers studying long-term land-use/cover change adopt "social metabolism" as an integrative conceptual framework which captures human systems of production and patterns of consumption. Subsequent to contributions addressing the social and ecological resilience of ecosystems, communities, and institutions (e.g., Berkes and Folke 1998; Berkes, Colding, and Folke 2003), Andersson (2006) approached "urban ecology from a landscape perspective" commenting on the need "to maintain resilient cityscapes with the ability to adapt to future needs". Forman (2008: 252–253) has urged "landscape ecologists and allied experts" to concentrate their efforts on urban regions, suggesting the objective: "Mold the land so nature and people both thrive longterm."

2.3.2 Brazilian Urbanization, Segregation, and Amenity Migration

Geographers and others interested in Brazilian social and territorial dynamics in the capitalist world economy and under other conditions of globalization have begun to examine domestic and transnational relationships involving Brazilian cities (e.g., Fernandes and Negreiros 2001; Fernandes and Valença 2001; Santos and Silveira 2001; Rossi and Taylor 2005). Among the distinctive social phenomena within these complex sociospatial dynamics is the recent demographic trend of migration away from Brazil's megacities to medium-sized cities to 'escape' social, economic, and environmental problems in search of better life conditions and opportunities.[22] The recently accelerated growth of Florianópolis represents a dramatic example of this broader demographic trend as the city-region has experienced a boom in popularity among many Brazilian and some non-Brazilian tourists, migrants, and developers. Consideration of these migration dynamics also raises questions about the nature of interurban competition among global and Latin American city-regions for financial and social capital amidst the fears, anxieties, insecurities, and hazards experienced in contemporary urban society.[23]

The literatures on the partitioning of urban space in cities around the world (e.g., Mollenkopf and Castells 1991; Fainstein, Gordon, and Harloe 1992; Marcuse 1997; Marcuse and van Kempen 2002), Brazilian urbanization in general (e.g., Santos 1993; Rolnik 2001a) and Brazilian urban dualization in particular (e.g., Portes 1979; Ribeiro and Telles 2000; Rolnik 2001b; Roberts and Portes 2006) offer critical insights into the

[22] For readings analyzing the demographic, economic, and social dynamics of Brazilian medium-sized cities since the 1970s and 1980s, see Andrade and Serra (2001). See also work by Pereira and Lemos (2003) toward constructing a typology of medium-sized cities in Brazil using principal component analysis, and Chomitz *et al.* (2005) on Brazilian secondary cities in relationship to the country's regional inequalities and the spatial dynamics of its labor markets.

[23] These types of questions are points of entry for analyses linking this study, grounded in southern Brazil, to global-scale social issues as raised by Ulrich Beck and others (e.g., Beck 1992, 1999, 2006; Beck, Giddens, and Lash 1994) in discussions of risk and reflexive modernization.

location-specific processes and patterns of metropolitan growth and 'sprawl' development in the Florianópolis city-region.[24] For instance, in an analysis of demographic census data gathered in 1980 for 40 Brazilian metropolitan areas with populations greater than 200,000 inhabitants, Edward Telles (1995) found that while more-industrialized areas had lower income inequality than less-industrialized areas and thus lower segregation, the extent of urbanization explained most of the variation in segregation with the population size of the metropolitan area being the best predictor of segregation. In other words, the levels of segregation were highest in the largest Brazilian cities.

Over the last quarter of the twentieth century, in the cities of São Paulo and Rio de Janeiro, Brazil's two largest metropolises, urban living conditions deteriorated and demographic growth rates declined (Lloyd-Sherlock 1997; Souza 2001). During this period, as low-income informal urban settlements (*favelas*) expanded (see Lloyd-Sherlock 1997 for the case of São Paulo; and O'Hare and Barke 2002 for the case of Rio de Janeiro) and levels of crime, violence, and pollution increased in Brazil's largest cities, middle- and upper-income groups self-segregated into exclusionary spaces such as luxury residential high-rise buildings and gated communities of single-family homes (i.e., *condomínios exclusivos* or *condomínios fechados*) (e.g., Oliveira 1999; Caldeira 2000; Ribeiro and Telles 2000; Rolnik 2001b; Souza 2001; Schiffer 2002; Coy 2006; Irazábal 2006; Roberts and Portes 2006).

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[24] Rolnik (2001b: 471) discusses the production of a "dual built environment" in contemporary Brazilian cities characterized by "one landscape produced by private entrepreneurs and contained within the framework of detailed urban legislation, and another, three times greater, that is self-produced by the poor and situated in an intermediate zone between the legal and the illegal."

In the context of the socio-political fragmentation of urban space that occurred in metropolitan São Paulo and Rio de Janeiro after the mid-1970s, Marcelo Souza (2001) identified the processes of metropolitan deconcentration and extended suburbanization whereby Brazilian urban elites responded to declining urban conditions in megacities by moving much further away than they had in the past and increasingly self-segregating in secondary cities, the so-called new metropolises, i.e., dynamic medium-sized cities characterized by economic growth and/or growth potential. In sum, Souza (2001) explained that Brazilian upper-class escapism from the urban poverty and violence of its largest cities had extended beyond the exclusionary enclaves adjacent to poor and working-class urban neighborhoods. Developers increasingly constructed privileged safe havens away from city centers. Over time, these developers and the households that occupied the new middle- and upper-income housing stocks transformed many older 'traditional' rural landscapes into peri-urban amenity environments (e.g., Coppack 1988; Tyrväinen and Miettinen 2000) and consumption landscapes (e.g., Walker and Fortmann 2003) designed to attract occupants in the wealthiest segments of the real estate market, thus creating elite landscapes (e.g., Duncan and Duncan 2001).[25] A social consequence of extended suburbanization has been the displacement and impoverishment of many 'traditional' smallholder populations, communities that typically have insecure land tenure and rely heavily on subsistence livelihood strategies. Diegues (1999: 201) highlighted this injustice in Brazilian coastal areas where traditional communities of

[25] Tyrväinen and Miettinen (2000: 216) found that in the housing market of the Salo District in Finland "buyers have to pay 4.9 percent more to obtain a dwelling with a forest view" and that "proximity to the nearest forested park was found to have a significant positive effect on house prices" when a forested park is within walking distance from a residence. Duncan and Duncan (2001) described the production of an elite landscape in Bedford, Westchester County (New York State, United States) located in the metropolitan region of New York City near the Connecticut border.

caiçaras, açorianos, and *jangadeiros* have suffered disruption and displacement to expanding low-income areas of risky urbanization, places Rolnik (2001b) refers to as "precarious peripheries."

2.3.3 Land-Use Planning and Growth Management: A Framework for the Study of Brazil's New Metropolises

Research on Brazil's new metropolises, e.g., on urban growth processes and patterns, land-use policies, and the political-institutional basis for urban and regional planning, can contribute to comparative analyses of: urban pro-growth coalitions; 'slow-growth' or 'smart-growth' counter-coalitions formed by environmentalists, government officials, and communities; growth control strategies and measures (e.g., land-use restrictions and municipal zoning rules); and the distributional outcomes of competing land-use interests and agendas (Molotch 1976; Baldassare and Protash 1982; Mollenkopf 1983; Logan and Molotch 1987; Logan and Zhou 1989; Rudel 1989b; Pfeffer and Lapping 1994; Warner and Molotch 1995, 2000; Logan, Whaley, and Crowder 1997; MacLoed and Goodwin 1999; Nelson 1999; Molotch, Freudenburg, and Paulsen 2000; Warner 2001; Schmidt 2008). In the 'dynamic' new metropolises of Brazil, at least three social agents of environmental and landscape change should be considered: (1) elite entrepreneurs in alliance with multilevel government authorities acting to advance pro-growth strategies and activities; (2) middle- and upper-income groups with access to the benefits of urban infrastructure and services and characterized by high levels of consumption and waste production; and (3) low-income residents (originating from local 'traditional' communities, from rural areas, or from other cities), who have been priced out of the formal housing market and, as a result, either occupy more affordable lands on the outskirts of the city or other 'available' areas that are often zoned for ecological protection such as hillsides and mangroves located within or close to the central city (i.e., many steep or poorly-drained locations become sites of illegal occupation). Together, these diverse social actors drive urbanization and transform the metropolitan environment and landscape in ways that have consequences for ecosystems and human health.[26] The first two sets of social actors predominantly drive land-use planning and implementation of plans that result in the creation of residential subdivisions (e.g., gated communities), commercial subdivisions (e.g., small stripmalls), major shopping centers, industrial clusters, ports, infrastructure to accommodate motor vehicles and aircraft, and protected areas for the provision of ecosystem services. Thus they act as agents of sociospatial segregation (i.e., urban dualization and peripheralization of poor communities) and exclusionary conservation (e.g., Bates and Rudel 2000; Schmidt 2008). Low-income residents, concentrated in informal settlements located in precarious areas of the metropolitan periphery or in smaller precarious sites within the central urban agglomeration, are largely excluded from the process of formal urban and regional planning and hence from its beneficial outcomes; they disproportionately participate in the informal economy and often bear the brunt of human health costs associated with the environmental externalities that result from middle- and upper-class production and consumption. These informal settlements continue to expand without adequate provision of safe drinking and cooking water supplies, sanitation and drainage systems to handle

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[26] For readings on ecosystem approaches to human health or EcoHealth approaches, see Silva *et al.* (2005) on rural populations living near protected areas in the municipality of Santa Teresa, Espirito Santo State (Brazil) and Xu *et al.* (2008) on the critical linkages between land-use transition and human health in the Himalayan region.

sewage and storm water, or solid waste collection and disposal services (e.g., Satterthwaite 1997).

2.4 Urban Dualization and Peripheralization as Environmental Injustice

Urban dualization is a process that produces middle-class and elite landscapes which are used by people who are well integrated into legal-political institutions and the formal economy, and simultaneously creates socioeconomic conditions in which self-help irregular settlements expand to accommodate growing numbers of poor people whose livelihoods depend on the informal economy. In this sense, research that integrates FTT with an understanding of urban dualization and peripheralization in Brazil and in other settings might address some of the central concerns articulated by Robbins and Fraser (2003: 103, 115) who characterized rebounding forest cover and associated land change on the Scottish Highlands and elsewhere as "the spatial product of schizophrenic capitalist ecology" and the outcome of "simultaneity of competing management regimes."

Linking the concepts of urban dualization and peripheralization to ideas about just sustainability, I raise the following questions: What roles do different social actors play in either promoting or countering urban dualization/peripheralization in Brazil? How might Brazil's new metropolises "manage to growth with environmental justice" (Warner 2001)? How might the coexisting social groups of emerging Brazilian city-regions interact, mobilize, make decisions, and carry out plans to manage economic growth, extend basic public infrastructure and services into underserved areas, regularize land use, and achieve and maintain high levels of environmental quality in ways that maximize benefits, minimize costs, and mitigate risks with more equitable and just outcomes? Local communities of all socioeconomic classes, their elected officials at all levels, private entrepreneurs, planners, researchers, and other professionals would likely need to cooperate and communicate first to *define* their environmental problems and then to devise appropriate and effective strategies for addressing the detrimental socio-ecological consequences of past and current patterns of land use. This might be accomplished through democratic institutional approaches to land-use policy, planning, and implementation that seek to prevent the reproduction of uneven metropolitan landscapes and uneven urban environments (see Heynen 2003) already proven to be detrimental to the environment and society (i.e., unsustainable) by creating "unequal environmental quality" (Pedlowski *et al.* 2002: 18).[27] It would also be important to identify and strategically support past ('traditional') and current patterns of land use, modes of production, and coping mechanisms that have had beneficial and sustainable social and environmental outcomes.

2.5 Competing Discourses, Social Mobilization, and Collective Action

In diverse settings and at multiple organizational levels, scholars and practitioners have examined the significance of competing economic development and environmental discourses/metaphors and how hegemonic and counter-hegemonic discourses translate into perceptions, policies, decisions, actions, and outcomes (e.g., Escobar 1995; Hajer 1995; Wilson 1996; Fischer and Hajer 1999; Parnwell 2005). For example, in an edited

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[27] In an investigation of ten neighborhoods in the city of Campos dos Goytacazes (Rio de Janeiro State), Pedlowski *et al.* (2002: 18) found "that wealthier neighborhoods that already have access to better public and private infrastructure also have an advantage in term of the environmental amenities provided by trees" and that environmental inequalities with respect to access to the benefits of urban forests "result from policy decisions made by the local government."

collection entitled *Livable Cities? Urban Struggles for Livelihood and Sustainability* a number of authors explored the notion of 'urban livability' by analyzing local livelihood struggles, ecological sustainability, social mobilizations, coalitions of social actors, and collective action in various 'developing' and 'transitional' urban regions (Evans 2002). In another recent collaboration, an international coalition of 20 professionals (based in Argentina, Bolivia, Brazil, Chile, Cuba, India, Indonesia, Mexico, the United States, Uruguay, and Venezuela) offered a critical perspective on international conservation policy tools such as the strategy to protect 'biodiversity hotspots' and presented an alternative view of biodiversity conservation discourse and practice (Rodríguez *et al.* 2007: 755). They advocated support of "independent local institutions (e.g., civil society organizations, universities, and local government agencies)" and emphasized the value of local leadership and local capacity, pointing out that centralized "top-down approaches [dictated by large international NGOs] can fail to link agendas of a broad constituency of local communities, scientists, conservation practitioners, and policy-makers" (Rodríguez *et al.* 2007: 755–756).

More than a decade ago, Batterbury, Forsyth, and Thomson (1997) suggested the development of 'reflexive institutions' and 'local governance structures' that would be capable of representing local agendas while still utilizing 'global environmental knowledge.' They argued that, "Establishing democratic identification of environmental problems, and effective management of externally-real biophysical processes…is neither an exclusive top-down process from state and science, nor an optimistic bottom-up faith in local knowledge and social movements" (Batterbury, Forsyth, and Thomson 1997: 129). Two southern Brazilian cities, Porto Alegre in the state of Rio Grande do Sul and

Curitiba in the state of Paraná, have attracted worldwide attention from urban planners, environmentalists, and others for their innovative approaches to democratic local governance and integrated urban environmental management (e.g., see Menegat 2002 on Porto Alegre; and Rabinovitch 1992 on Curitiba). In particular, local institutions and processes for participatory planning and participatory budgeting have received global attention. With these and other examples in mind, I consider the institutions, policies, competing discourses, social mobilizations, governance structures, and collective actions that have shaped the city of Florianópolis.

CHAPTER 3

PHYSICAL GEOGRAPHY AND ECOLOGY

3.1 Overview

This chapter serves two purposes. First, it describes the study region's biogeophysical environment, presenting information about climate, geomorphology, topography, hydrology, and ecological diversity within the broader contexts of Brazil's Atlantic Forest ecoregion. Second, it introduces several key ecological concepts—including biodiversity hotspots, habitat heterogeneity, successional dynamics, ecological gradients, and ecological plasticity—to help clarify relationships between landscape components and to provide a foundation for understanding the interconnected socioeconomic, environmental, cultural, and policy issues addressed in subsequent chapters.

3.2 Climate

The modern climate of Santa Catarina State is predominantly subtropical with mean annual temperatures ranging from 13°C (55.4°F) to 25°C (77°F) (Nimer 1989; Santa Catarina State <http://www.sc.gov.br>).[28] According to the Köppen climate classification system, the Florianópolis metropolitan region is a type *Cfa*, meaning it is characterized by a mesothermic humid climate with hot summers and without a dry season (Köppen 1918; Noble 1967; Fairbridge 1976; Neto 1997).[29] The mean annual temperature for the metropolitan region is about 18°C (64.4°F) and the mean annual precipitation is about 1,700 mm (Santa Catarina 2003). The mean annual temperature for Santa Catarina Island

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[28] Based on recent analyses of pollen records, researchers estimate that the modern climatic conditions found in southern and central Brazil have existed for roughly the past 2,500 years (Ledru *et al.* 1998).
[29] The categories of the Köppen climatic scheme are based primarily on annual and monthly averages of temperature and precipitation, recognizing five major climatic types (A, B, C, D, and E). The Köppen system also uses vegetation groups to aid in classification.

(hereafter referred to as SCI) is 20.4°C (68.72°F); the hottest summer month (January) has a mean temperature of 24.4°C (75.92°F), while the mean temperature during the coldest winter month (July) is 16.5°C (61.7°F) (Herrmann *et al.* 1987; Santos *et al.* 1989; Caruso 1990; Hauff 1997; Cruz 1998). SCI's mean annual precipitation is about 1,500 mm, and its monthly precipitation is above 70 mm throughout the year with heaviest rainfall occurring during the austral spring and summer months; the wettest month (January) averages about 172 mm and the driest month (July) averages about 74 mm (Herrmann *et al.* 1987; Santos *et al.* 1989; Caruso 1990).

The local wind regime in Florianópolis consists of alternating and interacting Atlantic moist tropical and Antarctic polar air masses. Winds from the east-northeast prevail year-round, but are most frequent during the summer when northeasterly winds contribute to heavy rainfall. Short-term polar Atlantic cold fronts from the south and southeast can occur year-round, but are more frequent during the fall and winter months (May to September) bringing strong winds, rainfall, and reducing temperatures as low as –3°C (26.6°F) (Fairbridge 1976; Nimer 1989; Caruso 1990; Hastenrath 1991; Behling 1998; Cruz 1998; Ledru *et al.* 1998; Oliveira and Herrmann 2001; Marengo *et al.* 2002; Bigarella *et al.* 2005). Periodically, the El Niño Southern Oscillation contributes to intense rains (McGlone, Kershaw, and Markgraf 1992; Martin *et al.* 1993; Oliveira and Herrmann 2001).

3.3 Geomorphology and Topography

The mountain ranges and escarpments of eastern Santa Catarina State belong to two distinct formations—the Serra do Mar and the Serra Geral (Noble 1967; Behling 1998). The Serra do Mar extends for about 1,500 km from the state of Espírito Santo in southeastern Brazil through the northeastern sector of Santa Catarina with average altitudes between 900 and 1,000 m a.s.l. and a maximum summit of 2,787 m a.s.l. at *Pico das Agulhas Negras* (Black Needles Peak) in Itatiaia National Park which is located in an area bordering the states of Rio de Janeiro and Minas Gerais. The highest altitudes found in Santa Catarina, however, are located in southern Brazil's Serra Geral which possesses average altitudes of 1,200 to 1,400 m a.s.l. (Behling 1995).[30]

Extending 54 km in length and 18 km at its maximum width, today SCI possesses a total area of 424.4 km² (Almeida 2004). The island is subdivided into two major sectors—southern and central-northern. The Precambrian crystalline hills (*morros* or *maciços*) of SCI cover 192.5 km² reaching a maximum elevation of 532 m a.s.l. at the summit of Morro do Ribeirão located in the island's southern sector (Cruz 1998: 22; Almeida 2004; PMF <http://www.pmf.sc.gov.br>).[31] Mostly composed of granite (Almeida 2004; Veado 2004b), these hills have a NNE-SSW orientation running parallel to the continental Serra do Mar. They are part of the Serra do Tabuleiro which is in turn part of a larger geological system called Serras do Leste Catarinense (Santa Catarina's Eastern Mountain Ranges) (Veado 1998, 2004b; Luiz 2004a).[32] SCI is separated from the continental coastline by the North and South Bays which are linked by a narrow channel of about 500 m (see Figure 3.1). The main island is surrounded by more than 30 islets (Zeferino and Fernandes 2004: 56–57) which provide important habitat areas for marine life and avifauna.

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[30] The highest summits of the Serra Geral are at Morro da Boa Vista (1,827 m a.s.l.) located between Santa Catarina's municipalities of Bom Retiro and Urubici, Morro da Bela Vista do Guizoni (1,823 m a.s.l.) in Bom Retiro, and Morro da Igreja (1,822 m a.s.l.) between Bom Jardim da Serra, Orleans, and Urubici (Santa Catarina State <http://www.sc.gov.br>).

[31] In the island's central-northern sector, the highest elevations are found at Morro da Lagoa (493 m a.s.l.) and Morro da Costa da Lagoa (492 m a.s.l.) (Almeida 2004).

[32] Santa Catarina's Eastern Mountain Ranges include the Mar de Morros, the Serra do Tabuleiro, and part of the Serra do Mar (Veado 1998, 2004b).

The Quaternary sandy plains connecting the island's hills presently cover 202.5 km² (Almeida 2004). These plains have served as crop land for pre-colonial inhabitants and as both crop land and pasture for colonial settlers and their descendants. In recent decades, these areas have become the site of land speculation followed by accelerated residential and commercial real estate development. The Campeche sedimentary coastal plain, which is the focus of the submunicipal study in this dissertation (Chapter 6), is located in the southern sector commonly referred to as the *Sul da Ilha*.

During the Late Quaternary, sea-level fluctuations associated with geoidal surface, oceanic, and climatic changes shaped many features observable along southern and southeastern Brazil's present coastline and continental shelf (Suguío *et al.* 1985; Suguío 1999; Ab′Sáber and Holmquist 2003). These littoral dynamics formed many coastal sandy plains, long continental sandy beaches, peninsulas, elongated continental islands, bays, coastal lagoons, sand dune systems, and offshore sandbars (Cordazzo and Seeliger 1988; Caruso, Suguio, and Nakamura 2000; Oliveira and Herrmann 2001; Kindel and Garay 2002; Ab′Sáber and Holmquist 2003). During an early submergence, dated at about 120,000 years before the present (BP), relative sea level was approximately 8 m above the present level (Suguío 1999).[33] Interpretation of geological, biological, and cultural evidence has begun to allow for more detailed reconstruction of relative sea levels during the Holocene epoch, delineating distinct relative sea level curves for different sectors of the Brazilian coastline (Martin, Suguío, and Flexor 1984,

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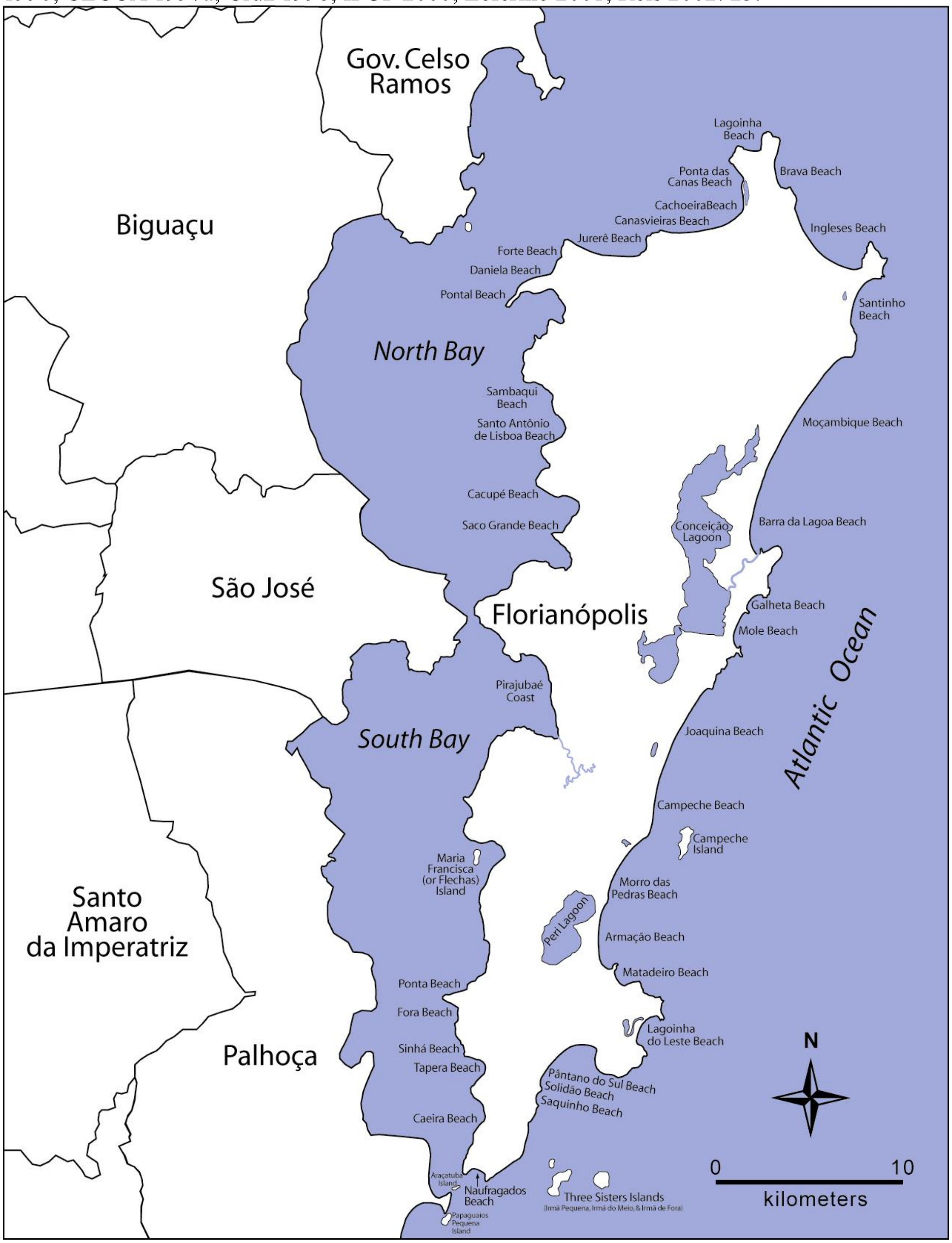
[33] Recent investigations using a variety of paleo indicators at multiple sites, including Bahia, Rio de Janeiro, and São Paulo, indicate another rise in relative sea level c. 5,100 BP (Angulo *et al.* 1999; Martin, Suguío, and Flexor 1984; Suguío *et al.* 1985). There has been widespread acceptance of the theory that this submergence was followed by an emergence with two short submergence periods (occurring between 4,100 and 3,800 BP and between 3,000 and 2,700 BP); however, the findings of Angulo *et al.* (1999) appear to contradict this hypothesis.

1986; Martin, Dominguez, and Suguío 1986; Martin *et al.* 1996; Angulo and Lessa 1997; Angulo *et al.* 1999). For instance, some evidence suggests that the maximum elevation of the relative sea level during the Holocene in southern Brazil may have been lower than that observed along most of the Brazilian coast. Study of the sector spanning the Santa Catarina coastline from Itajaí to Laguna indicates that 5,150 BP relative sea level was about 3.5 m above the present level; the sea level position reconstructed for SCI specifically indicates that at about 3,600 BP relative sea level was about 2.6 m above the present level (Suguío *et al.* 1985).

It is thought that during high sea-level episodes, SCI's hill range and rocky promontories formed an archipelago of about twenty islands; over the course of the Holocene (the past 10,000 years), as relative sea-level dropped, the islands of the archipelago were joined by marine, eolian, and alluvial sedimentary deposits which eventually formed the modern continental island's sandy coastal plains, lagoons, dune fields, and beaches (Fairbridge 1976; Bresolin 1979; Suguío *et al.* 1985; Herrmann *et al.* 1987; Caruso 1990; CECCA 1997a; Caruso, Suguio, and Nakamura 2000; Oliveira and Herrmann 2001: 155; Almeida 2004; Luiz 2004a; Veado 2004b; Zeferino and Fernandes 2004).[34]

[34] Dillehay (1999: 209) provides a brief summary of South America's climate history from 30,000 to 10,000 BP, explaining that sea-level rise associated with the melting of continental ice sheets during a temperature increase between 15,000 and 14,000 BP led to the flooding of the Atlantic shelf between 13,000 and 10,000 BP.

Figure 3.1 Santa Catarina Island and vicinity. *Sources:* Pereira 1978; Santos *et al.* 1989; Caruso 1990; CECCA 1997a; Cruz 1998; IPUF 2000; Zeferino 2001; Reis 2002: 23.



3.4 Hydrological Features

SCI possesses six major watersheds. From north to south, they are the drainage basins of Ratones, Saco Grande, Conceição Lagoon, Itacorubi, Rio Tavares, and Peri Lagoon. The island's two main aquifers are the southeastern Campeche Aquifer which holds an estimated volume of 105 billion m^3 and the northeastern Ingleses-Rio Vermelho Aquifer which holds an estimated volume of 286 billion m^3 (Bastos 2004). The island's surface water is managed in a system of eight units, all of which are treated with sodium hypochlorite and fluoride (Bastos 2004). Lagoons and rivers cover 29.4 km^2, making up nearly 7 percent of the island's 424.4 km^2 surface area (Bastos 2004).

Of the island's two major surface water bodies, the largest is Conceição Lagoon (*Lagoa da Conceição*), a brackish lagoon covering about 20 km^2 with a length of about 13.5 km, widths ranging from 0.15 to 2.5 km, and average depths of 2 to 6 m (Cruz 1998; Caruso 1990; Costa and Fonseca 2000). To the east, Conceição Lagoon is connected to the Atlantic Ocean by a meandering canal (2 km long; 20 to 40 m wide) that passes through Barra da Lagoa District. Since the early 1980s, the canal has been modified to maintain boat access between the lagoon and ocean. In addition to a number of increasingly populated urban areas that have negatively impacted its water quality, Conceição Lagoon is also surrounded by several protected areas that serve to restrict urban expansion and thus help to mitigate environmental degradation. To the east lies the municipal park Dunes of Conceição Lagoon (*Dunas da Lagoa da Conceição*) (563 ha), Galheta Municipal Park (*Parque Municipal da Galheta*) (149.3 ha), and Rio Vermelho State Forest (*Parque Florestal do Rio Vermelho*) (1,110 ha) (CECCA 1997b; Queiroz *et al.* 2002). Costa da Lagoa (965.5 ha), a traditional neighborhood accessible only by boat or pedestrian trails, lies on the lagoon's western bank and adjacent lowland; it has protected status as a municipal historical reserve. In compliance with the Brazilian Federal Forest Code (*Código Florestal Brasileiro*—CFB) (Federal Law No. 4771/1965, Article 2), the forested hillslopes to the west are zoned as Permanent Preservation Areas (*Áreas de Preservação Permanente*—APPs). The Maciço da Costeira Municipal Park (*Parque Municipal Maciço da Costeira*) (14.53 km²) occupies the hillslopes to the south (CECCA 1997b). Chapter 5 provides further information about the CFB and the protected areas in the study region.

The second large surface water body on the island is Peri Lagoon (*Lagoa do Peri*) located in the southern sector which has an area of about 5 km², average depths of 2 to 4 m, and a maximum depth of about 11 m. Situated about 3 m a.s.l., it is contained within the Peri Lagoon Municipal Park (*Parque Municipal da Lagoa do Peri*) (20.30 km²) and is the largest source of fresh potable surface water on the island (IPUF 1978; Santos *et al.* 1989; Caruso 1990; CECCA 1997a, b; Cruz 1998; CASAN [Companhia Catarinense de Águas e Saneamento] <http://www.casan.com.br>). In addition, there are several much smaller brackish water lagoons distributed throughout the island including Lagoa Pequena and Lagoinha da Chica in Campeche District and Lagoinha do Leste in Pântano do Sul District (Bastos 2004).

3.5 Ecological Diversity within Brazil

Occupying about 8.5 million km², Brazil possesses tremendous biological diversity harbored by six major terrestrial biomes: *Amazônia*; *Caatinga*; *Cerrado*; *Mata Atlântica*;

Pampa; and *Pantanal* (see IBGE 2004a).[35] Furthermore, its coastal habitats are also among the Earth's most diverse in marine life (Moraes 1999; Couto, Silveira, and Rocha 2003). According to recent efforts by the Brazilian Ministry of the Environment (*Ministério do Meio Ambiente*—MMA) and the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*—IBGE) to calculate and map the estimated extents of each of the biomes as they existed prior to European colonization, northern Brazil's Amazonian Forest occupied the largest area (about 4.2 million km^2; 49 percent of the national territory); central Brazil's *Cerrado*, often described as neo-tropical savanna (e.g., Eiten 1982, 1983; Nogueira-Neto 1991; Ratter, Ribeiro, and Bridgewater 1997; Oliveira and Marquis 2002; Jepson 2005), ranked second covering about 2 million km^2 (24 percent); the eastern Atlantic Forest (*Mata Atlântica*) once covered about 1.1 million km^2 (13 percent); the *Caatinga*, a semi-arid region in the northeast, occupied about 844,500 km^2 (nearly 10 percent); southern grasslands, known as the *Pampa*, in the present state of Rio Grande do Sul covered about 176,500 km^2 (2 percent); and the southwestern *Pantanal* made up the remaining area of about 150,000 km^2 (1.8 percent) (IBGE 2004a).[36]

Estimated to contain about 13 percent of the world's biota, Brazil is among the world's 'megadiverse' countries (Mittermeier *et al.* 1997; MMA 2003a, b; FAO 2005;

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[35] As defined in Article 2 of the Convention on Biological Diversity (CBD; <http://www.biodiv.org/convention/convention.shtml>), *biological diversity* is "the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."

[36] For historical background on earlier efforts to describe Brazil's phytogeography, see Sampaio (1945), Magnanini (1961), Rizzini (1963, 1979, 1997), Romariz (1974, 1986), Rizzini, Coimbra-Filho, and Houaiss (1988), and Veloso, Rangel-Filho, and Lima (1991). Por, Imperatriz-Fonseca, and Neto (2005) offer a different scheme for classifying Brazil's natural environment which distinguishes eight Brazilian terrestrial biomes (Atlantic Rainforest, Domain of *Araucaria*, *Cerrado* Savannas, *Pantanal*, Mountain Shrubs, *Caatinga*, *Amazonia*, and Mangrove Forests).

Lewinsohn and Prado 2005). According to Lewinsohn and Prado (2005), the estimated recorded biota in Brazil is in the range of 170,000 to 210,000 species, while its actual total biota is likely to be about ten times greater at an estimated 1.8 million species. Subdividing their results into taxonomic groups, Lewinsohn and Prado (2005) report that 16 to 18 percent of the world's recorded plant species, 8 to 10 percent of the world's recorded invertebrates, and about 12 percent of the world's recorded vertebrates occur in Brazil. They report 40,000 to 45,000 known angiosperm (flowering plant) species in Brazil representing 17 to 18 percent of the world's total. Among the known vertebrates, they report estimates for Brazil of 687 amphibian species (~12.5 percent of the world's total), 633 reptilian species (~7.75 percent of the world's total), 1,696 avian species (~17 percent of the world's total), and 541 mammalian species (~10 percent of the world's total).

According to the IUCN (International Union for Conservation of Nature and Natural Resources) Red List of Threatened Species (IUCN 2006), 382 of Brazil's plant species are currently threatened (46 of these species are listed as 'critically endangered,' 117 are listed as 'endangered,' and 219 species are considered 'vulnerable'). The variety of vegetation types that comprise the six generalized biomes have been modified and reduced by human action over the past several centuries. While the land-use histories of some regions have been fairly well documented, technological advancements made in recent decades have greatly improved the ability of analysts to measure and monitor land-cover change nationwide. In the case of forests, between 1990 and 2005, Brazil's total old-growth forest area was estimated to have declined from about 4.6 to 4.2 million km^2; during the same period, the estimated area of altered natural forests increased from

544,440 to 564,240 km², and the estimated area of plantation forests increased from 50,705 to 53,837 km² (FAO 2005). Overall, over this fifteen-year period, Brazil's total forest area appears to have diminished from about 5.2 to 4.8 million km² (FAO 2005).

To date, the total number of described Brazilian native tree species is in the range of 8,700 to 9,900 (FAO 2005: 38).[37] More than half of these species are located in the Amazonian Forest (~56 percent), followed by the Atlantic Forest (~46 percent), *Cerrado* (~20 percent), *Caatinga* (~10 percent), *Pantanal* (~5 percent), and *Pampa* (~4 percent) (FAO 2005: 39).

3.6 The Atlantic Forest[38]

The Atlantic Forest occurs in three South American countries, having formations in eastern Brazil, southeastern Paraguay, and northeastern Argentina (Galindo-Leal and Câmara 2003a).[39] It is often classified into two generalized ecoregions—one coastal, the other interior. Approximately 20 percent of the entire biome consists of Brazil's littoral vegetation and coastal evergreen moist forests found at low to medium elevations of up to 1,000 m and reaching up to 150 km inland. Semi-deciduous forests occupy much of the interior highlands (*Planalto*) ranging in elevation from about 600 to 2,000 m a.s.l. and

[37] For a recent listing of threatened tree species in Brazil, i.e. those that are considered 'critically endangered,' 'endangered,' and 'vulnerable' by the IUCN, see FAO (2005: 66–75).
[38] The earliest published denomination of what is now called the Atlantic Forest biome is attributed to nineteenth century German botanist and explorer Carl F.P. von Martius (1794–1868) who in 1840 began calling these eastern South American forests *Dryades*; Azevedo (1950) has been credited with coining the term *Mata Atlântica* which was subsequently adopted by Schnell (1978) and many others since (Diegues 1995; Küchler 1982; Oliveira-Filho and Fontes 2000; Scudeller *et al.* 2001).
[39] Over 90 percent of the original Atlantic Forest existed in what is today Brazilian territory (Tabarelli *et al.* 2005). The Atlantic Forest of Paraguay is estimated to have diminished from a pre-colonial extent of about 80,000 km² to a present extent of about 20,000 km² (Barboza, Pinazzo, and Fracchia 1997; Cartes 2003). In the case of Argentina's Misiones Province, the pre-colonial estimate of about 25,700 km² appears to have been reduced to between 11,000 km² and 17,000 km² (Giraudo *et al.* 2003; Laclau 1994; Morello and Matteucci 1999; Perucca and Ligier 2000).

extending up to 700 km inland into Paraguay and Argentina (Oliveira-Filho and Fontes 2000; Morellato and Haddad 2000).

Brazil's Atlantic Forest (*Mata Atlântica*) once extended from the country's northeast (~4°S latitude) to its southern region (~32°S latitude) along approximately 3,300 km of the Atlantic coast (Tabarelli *et al.* 2005).[40] Ecological gradients along the latitudinal span of the biome, along its elevational gradient from sea level to over 2,500 m a.s.l., and spanning inland as well as coastal communities all contribute to the Atlantic Forest's extraordinary environmental variation and biological diversity which in some locations has been found to surpass that of many Amazonian forest areas (Brown and Brown 1992; Morellato and Haddad 2000; Morellato *et al.* 2000).

The Atlantic Forest Biosphere Reserve (*Reserva da Biosfera da Mata Atlântica*—RBMA) was established in the early 1990s (Lino 1992; Diegues 1995; Lino *et al.* 2003; UNESCO 2006).[41] The Atlantic Forest region was declared National Patrimony in Brazil's Federal Constitution of 1988 and soon after became legally defined in Brazilian legislation with the passing of Federal Decree No. 750 in 1993 (CONAMA 2000; Capobianco 2001).[42]

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[40] The pre-colonial extent of the Atlantic Forest encompassed all or part of the following 17 Brazilian states: Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Mato Grosso do Sul, Goiás, Minas Gerais, Rio de Janeiro, Espírito Santo, Bahia, Sergipe, Alagoas, Pernambuco, Paraíba, Rio Grande do Norte, Ceará, and Piauí (Galindo-Leal and Câmara 2003a). Maps displaying pre-colonial and current extents of the Atlantic Forest are available in Galindo-Leal and Câmara (2003b: 4) as well as on various websites such as those maintained by the *Conselho Nacional da Reserva da Biosfera da Mata Atlântica* <http://www.rbma.org.br/anuario/mata_02_dma.asp> and *Fundação SOS Mata Atlântica* <http://www.sosmatatlantica.org.br>.

[41] In its initial phase in 1991, the RBMA included a few areas in the states of São Paulo, Paraná, and Rio de Janeiro; between 1992 and 2002, the reserve was expanded in four additional phases to include a total of 15 states (Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia, Minas Gerais, Espírito Santo, Rio de Janeiro, São Paulo, Mato Grosso do Sul, Paraná, Santa Catarina, and Rio Grande do Sul) for a total area of 350,000 km² which was subdivided into core, buffer, and transition zones (Lino *et al.* 2003; UNESCO 2006; RBMA <http://www.rbma.org.br>).

[42] For a map of the Atlantic Forest domain as defined by Brazilian Federal Decree No. 750/93, see Fundação Mata Atlântica and INPE (2002).

According to the NGO *Fundação SOS Mata Atlântica* and the Brazilian National Institute for Space Research (*Instituto Nacional de Pesquisas Espaciais*—INPE) (2002), about 1,350,000 km² of the Brazilian territory was once occupied by Atlantic Forest formations—an area larger than the 1,100,000 km² suggested by IBGE (2004a). A wide array of human activities over the past five centuries has resulted in tremendous habitat alteration and loss in this biome (Dean 1995; Young 2003). Deforestation in the southeastern and southern regions of Brazil occurred at a particularly rapid pace during the period from the late-nineteenth to mid-twentieth century. Now supporting a human population of over 100 million inhabitants, Brazil's highly threatened Atlantic Forest persists in a severely reduced and fragmented state, occupying between 5 and 10 percent of its pre-colonial extent (Fonseca 1985; Albuquerque 1995; Turner 1996; Viana and Tabanez 1996; Fundação SOS Mata Atlântica, INPE, and ISA 1998; Ranta *et al.* 1998; Morellato and Haddad 2000; Oliveira-Filho and Fontes 2000; Scarano 2002; Galindo-Leal and Câmara 2003a; Tabarelli *et al.* 2005; Webb *et al.* 2005). Given its severely threatened status as well as its high levels of species richness and endemism, the Atlantic Forest is frequently cited as one of the world's leading biodiversity 'hotspots' (Mori, Boom, and Prance 1981; Myers 1988, 1990; Mittermeier *et al.* 1998; Reid 1998; Cincotta, Wisnewski, and Engelman 2000; Myers *et al.* 2000; Critical Ecosystem Partnership Fund 2001; Tabarelli *et al.* 2003; Tabarelli *et al.* 2005; Webb *et al.* 2005).

There is some uncertainty surrounding estimates of the remaining area of Atlantic Forest in Brazil today. However, most of the recent publications assert that old-growth and advanced secondary forests combined fall in the range of 80,000 to 95,000 km².[43] An

[43] A few authors have described the present-day Atlantic Forest as covering only 60,000 km² (Brown and Brown 1992; Naka *et al.* 2002).

assessment carried out by Fundação SOS Mata Atlântica, INPE, and ISA (1998) based on multi-temporal satellite imagery covering nine Brazilian states (Minas Gerais, Goiás, Mato Grosso do Sul, São Paulo, Rio de Janeiro, Espírito Santo, Paraná, Santa Catarina, and Rio Grande do Sul) reported that in 1990 the combined remnants of Brazil's Atlantic Forest in these states alone covered about 86,824 km². The same assessment found a forest loss of about 5,003 km² for the period between 1990 and 1995, reporting total forest area in 1995 for the same nine states to be about 81,821 km².

Subsequent assessments coordinated by the Fundação SOS Mata Atlântica with technical expertise provided by INPE have been carried out at five-year intervals using data at progressively finer spatial resolutions (Hirota 2003, 2005); while initial mapping efforts in the late 1980s (Fundação SOS Mata Atlântica, INPE, and IBAMA 1990) were carried out at a spatial scale of 1:1,000,000, follow-up studies published in 1993 and 1998 analyzing the 1985−1990 and 1990−1995 periods respectively were conducted at a scale of 1:250,000 (Fundação Mata Atlântica and INPE 1993; Fundação SOS Mata Atlântica, INPE, and ISA 1998), followed by the 2002 report for the 1995−2000 period at a scale of 1:50,000 allowing the minimum unit of classification to be 10 ha (Fundação Mata Atlântica and INPE 2002). Total forest cover for eight states (excluding Bahia and Santa Catarina) was estimated at 160,392 km² in 2000 and a loss of about 4,000 km² was measured for the 1995−2000 period (Fundação SOS Mata Atlântica and INPE 2002). Impeded by cloud cover in the 1995−96 satellite images, forest cover for the state of Bahia could not be measured. The 2002 report also cites ongoing evaluation of data for Santa Catarina.[44] The 2002 report did provide measurements for both Bahia (26,232 km²)

[44] Previously, Fundação SOS Mata Atlântica, INPE, and ISA (1998) reported that in Santa Catarina, forest cover declined from 18,320 km² in 1985 to 17,292 km² in 1990, and 16,662 km² in 1995.

and Santa Catarina (30,000 km²) for the year 2000 resulting in an estimate of 216,624 km² for the ten states investigated.

To clarify the pronounced increase in the figures presented above from estimates during the 1990s of about 87,000 km² and 82,000 km² to a much higher estimate of over 216,000 km² in the early 2000s, it is important to point out methodological changes which reflect advancements both in the legislative-institutional realm and in ecological monitoring capabilities. Brazil's old-growth Atlantic Forest has been nearly depleted; approximately 95 percent of the remaining forest cover consists of a mosaic of secondary formations at early, intermediate, and advanced stages of regeneration (e.g., Albuquerque 1995). With this in mind, some researchers have made concerted efforts to improve analyses by developing techniques for measuring changes in these secondary forest classes (Fundação SOS Mata Atlântica and INPE 2002; Hirota 2003, 2005). Therefore, the intentional inclusions of intermediate stages of regenerated natural forests, which along with old-growth and advanced secondary forests are now legally protected by Federal Decree No. 750/93, explain the Fundação SOS Mata Atlântica and INPE (2002) finding of total remaining forest cover exceeding 216,000 km² in 2000. A related issue worthy of further investigation is the extent to which some planted forests of exotic tree species such as pine and eucalyptus may have been included in this estimate as a result of their similarities in spectral signatures to some types of natural forest and/or due to their existence in areas smaller than the minimum classification unit of 10 ha.

3.7 Native Ecosystems of Santa Catarina State

The entire territory of Santa Catarina State is situated within the Atlantic Forest.[45] During pre-colonial times, forests in Santa Catarina are thought to have extended over about 77,000 to 80,000 km², covering between 80 and 84 percent of the state's present territory (e.g., Magnanini 1961). According to Fundação SOS Mata Atlântica, INPE, and ISA (1998), Santa Catarina's remaining forest cover in 1995 was 16,662 km², representing less than 22 percent of its pre-colonial extent. Later applying a broader definition of forest cover including intermediate stages of succession, the assessment for the period 1995–2000 by Fundação SOS Mata Atlântica and INPE (2002) reported that Santa Catarina contained about 30,000 km² of Atlantic Forest in 2000 corresponding to nearly 40 percent of the area previously forested.

As part of a strategy to foster effective approaches for the protection and restoration of the Atlantic Forest, it would be helpful to encourage efforts that improve the depth and quality of our understanding of the probable composition of the Atlantic Forest over the past several thousands of years in each of its specific subregions. Although information about southern Brazil's paleo-ecological history is limited, a small group of researchers has made important strides using pollen records to reconstruct Late Quaternary environmental change by looking at fluctuations in climate and the impacts of these fluctuations on the extent and distribution of plant communities in Santa Catarina's lowland and highland areas (Ledru *et al.* 1996; Behling 1998; Ledru, Salgado-Labouriau, and Lorscheitter 1998; Behling and Negrelle 2001; Pillar 2003). These studies provide insights into the ecological links among past and present plant communities which should

[45] Three Brazilian states (Santa Catarina, Rio de Janeiro, and Espírito Santo) are completely contained within the Atlantic Forest, while about 98 percent of the state of Paraná falls within the ecoregion (Fundação SOS Mata Atlântica and INPE 2002).

be useful to a wide array of social actors concerned with protecting biological diversity in an increasingly human-dominated landscape. Likewise, given that Santa Catarina's environment was modified by human occupation for thousands of years prior to European colonization, present-day social actors might benefit from learning more about the environmental impacts of these early societies.

While assessments of past and present levels of biological diversity in Santa Catarina are underway, there is still a need to continue compiling, organizing, and disseminating existing information as well as a need for additional data collection. For instance, in the mid-1990s, Cimardi (1996) reported that Santa Catarina State contained 169 registered mammalian species. A more recent study by Cherem *et al.* (2004) reported confirmed occurrence of 152 mammalian species and the possible occurrence of an additional 59, further stating that since 1995 several new mammalian species have been registered in the state.

Pioneering botanical studies of Santa Catarina were carried out from the mid-1950s to the mid-1980s by botanists Raulino Reitz, Roberto M. Klein, Ademir Reis, and Henrique P. Veloso collaborating in association with the Barbosa Rodrigues Herbarium in the state's northeastern city of Itajaí (Veloso and Klein 1957; Klein 1960, 1969, 1972, 1975, 1978, 1980, 1981, 1984; Reitz 1961; Reitz and Klein 1964; Reitz, Klein, and Reis 1978, 1979; Caruso 1990). These investigations contributed to a better understanding of the state's diverse ecosystems. Currently, IBGE (2004a, b) classifies the land area of Santa Catarina State into four major ecosystem types: dense broadleaf forest in association with coastal mangroves and *restinga*; upland mixed broadleaf forest; deciduous seasonal forest; and high-altitude grasslands (*campos*).[46]

Dense broadleaf forest, previously referred to as Atlantic pluvial forest, may have covered as much as one-third of Santa Catarina (Behling 1995).[47] With its southern limit in southern Santa Catarina, dense broadleaf forest is found throughout the state's coastal lowlands as well as on much of the Serra do Mar and Serra Geral slopes (Klein 1978). It is characterized by either the absence of a dry season or the presence of a short dry season lasting less than two months; average annual precipitation ranges from 1,250 to 2,000 mm (the maximum annual precipitation measured in the region is 4,000 mm) and average annual temperatures range between 17°C and 25°C. It is thought that by the end of the last late-glacial period, some tropical rain forest taxa had migrated to the southern lowlands in Santa Catarina and that conditions during the Holocene allowed dense broadleaf forest to expand from lowland to highland areas forming the ecological transition zones observed in several of the state's mountainous areas today, for example at Serra da Boa Vista (Behling 1998; Behling and Negrelle 2001). Multi-layered and with canopy heights reaching about 35 m, dense broadleaf forest is often recognized for its rich epiphytic flora in the families Araceae, Bromeliaceae, Orquidaceae, Piperaceae, Heliconaceae, and Gesneriaceae; common tree species in this forest type include *Sloanea guianensis, Ocotea sp., Alchornea triplinervia, Ficus organensis,* and *Euterpe edulis*

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[46] Previously, Monteiro (1959) classified the original vegetation of the entire state into five types: tropical Atlantic Forest, subtropical Atlantic Forest, *Araucaria* forest, *campos*, and littoral vegetation (Caruso 1990). This was followed by Klein (1978) who proposed six distinct phytogeographic formations, each with subformations: (1) littoral vegetation encompassing mangroves and *restingas*, (2) Atlantic pluvial forest subdivided into alluvial forest, lowland forest, submontane forest, and montane forest, (3) *Araucaria* forest, (4) *campos*, (5) upper montane cloud forest (*floresta nebular*), and (6) subtropical forest.

[47] Ellenberg and Mueller-Dombois (1967) are recognized for coining the term *dense ombrophilous forest* (i.e., *floresta ombrófila densa* meaning dense broadleaf forest) (see Neto 1997; Veado 2004a) which has gained wide acceptance, substituting the term *pluvial tropical forest* previously used by Schimper (1960), Richards (1952), and others.

(Klein 1978, 1980; Mori and Boom 1981; Nimer 1989; Caruso 1990; Behling 1995, 1998; Diegues 1995: 8; Martinelli 2000; Tiepo 2005).

Atlantic mixed broadleaf forest occurs further inland, in cooler highland climates, and contains areas in which the native conifer *Araucaria angustifolia* (common name *pinheiro-do-Paraná*) dominates the forest canopy (reaching heights between 20 and 30 m) and species from the families Lauraceae and Myrtaceae typically populate the lower strata (Noble 1967; Klein 1978; Reitz, Klein, and Reis 1978; Behling 1995, 1998; Neto 1997; Medeiros *et al.* 2004; Medeiros, Savi, and Brito 2005). *A. angustifolia* requires a humid climate with a minimum of 1,400 mm annual rainfall and without significant dry periods (Hueck 1953, 1966; Martin *et al.* 1997; Behling 1998). During the late Holocene, which is considered the wettest period since the last glacial maximum, *Araucaria* forests expanded replacing grasslands. These forests are highly threatened, having been heavily cleared by human action since the nineteenth century and most intensively exploited during the decades between 1930 and 1970 (see Medeiros, Savi, and Brito 2005). Old-growth Atlantic mixed broadleaf forests with *Araucaria* and advanced stages of regrowth are said to cover less than two percent of their original estimated extent of between 200,000 and 250,000 km² which once occurred continuously on the southern Brazilian highlands between 24°S and 30°S at elevations between 1,000 and 1,400 m primarily in the states of Paraná (40 percent), Santa Catarina (31 percent), Rio Grande do Sul (25 percent), as well as in smaller isolated areas between 18°S and 24°S at elevations between 1,400 and 1,800 m a.s.l. in the states of São Paulo (3 percent), Minas Gerais, and Rio de Janeiro (1 percent) (Maack 1950; Hueck 1953; Klein 1960; Mazolli 1993; Behling 1998; Koch and Corrêa 2002; MMA 2002; Medeiros, Savi, and Brito 2005). Nowadays in Santa Catarina, mixed broadleaf forests with *Araucaria* persist in scattered fragments which according to Medeiros, Savi, and Brito (2005) cover about 4,000 km² combined. Since the 1960s, some of these forests, along with neighboring high-elevation grasslands, have been converted to plantations of exotic pine species such as *Pinus taeda* and *Pinus elliotti* (SBS [*Sociedade Brasileira de Silvicultura*] <http://www.sbs.org.br>; Medeiros, Savi, and Brito 2005).

Deciduous seasonal forest, previously referred to as subtropical forest, occurs in the lower montane habitats of the Uruguay River valley in the southwestern part of Santa Catarina at elevations between 500 and 900 m a.s.l.; *Araucaria* pine is sometimes present, but rare in this forest type (Monteiro 1959; Klein 1978, 1981; Lago 2000; IBGE 2004b; Ruschel *et al.* 2005).

High-elevation grasslands, referred to by a variety of names including *campos de altitude* (Safford 1999), *campos do planalto, campos rupestres* and *estepe*, occur in highland areas receiving relatively low annual precipitation (<1,400 mm) and are typically surrounded by mixed broadleaf forests (Behling 1995; Klein 1978). As explained above, paleo-ecological evidence supporting the reconstruction of Late Quaternary vegetation and climate history suggests that the modern Santa Catarina *campos* are remnants of a much larger area of grasslands that existed during the last glacial maximum (~14,000 to 10,000 BP) when the climate was drier and when mixed broadleaf forest species were rare on the highlands of southern Brazil, existing only in scattered patches in areas with sufficient moisture such as in riparian gallery forests. After 4,000 to 3,000 BP during the late-Holocene as the climate became moister, mixed broadleaf forests with *Araucaria* began to replace the *campos*; evidence indicates that the strongest *Araucaria* forest expansion episode took place within the past 1,000 years and that under existing climatic conditions this dynamic continues although it is now altered by human interventions in both habitat types converting lands into cropland and planted forests (Klein 1960, 1975, 1984; Behling 1998, 2002; Pillar 2003; Behling *et al.* 2004).

Cloud forest (*matinha nebular*) occurs at very high altitudes in Santa Catarina (usually above 1,200 m a.s.l.) on Atlantic facing slopes of the Serra do Mar and the Serra Geral in areas characterized by frequent cloud cover, high precipitation, and an absence of frosts; it is found forming ecological transition zones (*ecotones*) at the dense broadleaf forest–mixed broadleaf forest interface as well as at the dense broadleaf forest–*campos* interface (Rambo 1949; Falkenberg and Voltolini 1994; Behling 1998).

3.8 Major Native Ecosystems of Santa Catarina Island

As explained above, the *Mata Atlântica* as a whole is characterized by a high degree of habitat heterogeneity supporting high levels of species diversity. In reference to terrestrial ecosystems, habitat heterogeneity refers to vertical and horizontal vegetation structure as well as landscape structure (e.g., Tews *et al.* 2004).[48] On Santa Catarina Island (SCI), as well as more extensively in the coastal zone of Santa Catarina State, patterns of habitat heterogeneity and high local biological diversity are expressed by the following four ecosystem types and their zones of transition: dense broadleaf forest; Quaternary coastal plain forest; *restinga*; and mangrove. In addition to describing the distinguishing characteristics of each of these ecosystems, this section provides the reader with a basic

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[48] Tews *et al.* (2004) point out that while use of the term habitat heterogeneity has become common since the 1980s and 1990s (e.g., Kerr and Packer 1997), authors have used related terms such as habitat diversity (Simpson 1949; MacArthur and Wilson 1967; Rosenzweig 1995), habitat complexity (August 1983), spatial heterogeneity (Roth 1976; Huston 1994; Lindenmayer, Margules, and Botkin 2000), spatial/structural complexity (Lindenmayer, Margules, and Botkin 2000), and structural diversity (Bersier and Meyer 1994).

understanding of the various kinds of interfaces (i.e., ecological gradients) that exist between them. As argued by Smith *et al.* (2001), comprehensive long-term approaches to biodiversity conservation in hotspot regions should include the protection of ecological gradients to maximize protection of adaptive variation. In other words, although certain habitats within hotspot landscapes may not be the highest in species richness, they may still function in important ways that help maintain and generate biodiversity.

The edaphic variance found within a landscape (along with other key factors such as topographic position, microclimate, disturbance regime, and land-use history) affects ecosystem distribution and ecotonal expression (Clark, Palmer, and Clark 1999). Several soil types are found on SCI, either distributed in patches or along edaphic gradients. The following brief descriptions of five common island soil types are based on more detailed descriptions by Luiz (2004b) who cites Sommer and Rosatelli (1991). Red-yellow and red *podzols* (also known as *spodosols*; on average ~1.5 m deep) supporting SCI's dense broadleaf forests have accumulated substantial amounts of organic material; they are acidic, usually high in aluminum and iron, and mostly sandy resulting from quartz parent material, but also contain clay which has migrated from the A to the B horizon. *Cambisols,* with depths of 0.5 to 1.5 m, contain less organic material than podzols and are at the early stages of horizon differentiation when the B horizon is still poorly formed. Clayey *gleysols* are formed under conditions of prolonged water saturation and are typical of SCI's mangroves as well as other wetland areas. *Quartz neosols*, with depths of 1.0 to 3.0 m, are characteristic of *restingas* and are generally of low-fertility, composed mostly of quartz marine sand; they can be either well drained or, when occurring closer to the water table (i.e., hydromorphic quartz neosols), can accumulate more organic material resulting in somewhat higher fertility. *Lithic neosols,* such as those found in small vegetated patches along SCI's rocky shores, are very shallow soils (depths of 0.14 to 0.40 m) with parent material close to the surface and lacking a B horizon.

3.8.1 Dense Broadleaf and Quaternary Coastal Plain Forests

Most of the naturally occurring forests on SCI are dense broadleaf forests attaining maximum canopy heights of about 30 m (see Figure 3.2). Additionally, Quaternary coastal plain forests occur in some areas with canopy heights attaining 15 m. Together, these two evergreen forest types once represented about 82 percent of the island's total vegetation cover (Caruso 1990).

These forests were drastically reduced during the colonial, imperial, and First Republic periods, particularly after the mid-eighteenth century (see Chapter 4). However, a forest turnaround began to unfold on the island during the 1930s as the local economy and landscape started to shift from extractive and agricultural pursuits towards urban ways of life and an expanding service sector (Caruso 1990; Veado 2004a, b). Chapters 5 and 6 address this early stage of the forest transition process including explanations of agricultural abandonment, land-use conversions, and the key environmental legislation, policies, and institutions that evolved over the twentieth century.

The few remnants of old-growth dense broadleaf forest (i.e., relatively undisturbed forest growth of approximately 150 years or more) on SCI exist at the hilltops of Ribeirão da Ilha, Lagoa do Peri, Maciço da Costeira, Rio Tavares, Costa da Lagoa, Monte Verde, and Ratones, however, these old-growth remnants comprise less than 10 percent of SCI's total area and most have been selectively logged (Caruso 1990;

Naka *et al.* 2002; Veado 2004a). As in much of the Atlantic Forest (Viana, Tabanez, and Batista 1997; Oliveira-Filho *et al.* 2004), the mosaic of regenerating forests—not only at various stages of regrowth, but also reflecting the different land-use histories that have affected soil conditions and species compositions—constitute a high percentage of SCI's remaining native forest cover. Therefore, to be successful, conservation efforts will need to appreciate this landscape heterogeneity. The following sequence summarizes the typical stages of regrowth: first, pioneer herbaceous species colonize a given clearing forming a *campo* (patch of grasses) which lasts for about five years; second, *capoeirinha* containing both herbaceous and shrub species (e.g., *Dodonea viscosa*) develops lasting for about 10 years; third, is the formation of *capoeira* which lasts for 15 to 20 years characterized by shrubs and short trees such as *Inga striata* attaining heights of up to 8 m; the fourth stage is *capoeirão,* lasting for 50 to 80 years, during which taller trees such as the *jacatirão* (*Miconia cinnamomifolia*) reaching heights of 20 m are characteristic, followed by others such as *Cecropia adenopus, Tapirira guianensis,* and *Nectandra rigida*; fifth, is advanced secondary forest (*mata secundária*) which has begun to emerge in several areas of the island such as the hill slopes of Peri Lagoon, Ponta dos Naufragados, Conceição Lagoon, and Morro da Costa da Lagoa (Caruso 1990; Veado 2004a, b).

Quaternary coastal plain forests form ecotones between dense broadleaf forests and littoral vegetation. Generally, they possess lower soil fertility and lower species richness than dense broadleaf forests. Quaternary coastal plain forest formations occur along the base of SCI's hill slopes on predominantly sandy soils containing older Quaternary marine sediment deposits and clay alluviums, and often in poorly drained

Figure 3.2 Dense broadleaf forest on Morro da Costa da Lagoa, Santa Catarina Island (Florianópolis, Santa Catarina, Brazil). *Source:* author, December 2003.

areas. These typically humid soils are formed by both the sediments originating from the *restingas* and the sediments deposited by runoff from the hill slopes. In addition, these soils tend to contain more organic material than the younger marine sediment deposits that characterize *restingas* and therefore retain more moisture. Falkenberg (1999) notes the similarities of this ecotonal forest to early and mid-successional stages of dense broadleaf forest. While the few remnants of Quaternary coastal plain forest on the island benefit from protection under the Brazilian Federal Forest Code as APPs, they are not currently found within the boundaries of the island's existing conservation units. The dominant tree species in the upper stratum of this forest type is *Calophyllum brasiliense* (Caruso 1990; Fisher and Santos 2001; Veado 2004a). Other tree species commonly found in its upper stratum are *Tapirira guianensis*, *Ficus organensis*, *Coussapoa schottii*, and *Tabebuia umbellata*. Common understorey species include *Myrcia dichrophylla* and *M. multiflora* as well as the palms *Geonoma schottiana* and *Bactris lindmaniana*. Ground covering bromeliads *Nidularium innocentii, N. procerum,* and *Canistrum lindeni* are also typical of these forests (Bresolin 1979; Caruso 1990: 70; Veado 2004a).

Figure 3.3 Dense broadleaf forest on the hill slopes surrounding the Peri Lagoon (*Lagoa do Peri*), Santa Catarina Island (Florianópolis, Santa Catarina, Brazil). *Source:* author, October 2003.[49]

[49] The forest cover shown in Figure 3.3 is predominantly advanced secondary forest (i.e., *capoeirão* and *mata secundária*) with a few small remnant patches of selectively harvested old-growth forest located at higher elevations. The lagoon is named after the common name for the type of grass (*peri*) growing on its sandy banks in the foreground.

3.8.2 Coastal Plain Restingas

The term *restinga* has been used in a narrow sense to refer to Brazil's Quaternary sandy coastal plains (Mori, Boom, and Prance 1981; Zamith and Scarano 2006). However, broadly defined, *restinga* is an edaphic (psammophilous) vegetation complex which encompasses the range of coastal sandy-soil ecosystem gradients that occupy Brazil's littoral zone spanning beach and dune structures as well as post-dune coastal plains (Rizzini 1963; Bresolin 1979; Lacerda, Araújo, and Maciel 1982; Cordazzo and Seeliger 1988; Santos *et al.* 1989; Neto 1997; Reinert *et al.* 1997; Falkenberg 1999; Scheel-Ybert 2000; Santos 2001; Ab′Sáber and Holmquist 2003; Marques *et al.* 2004). *Restinga* vegetation is characteristically adapted to multiple environmental stresses. In addition to the capacity to thrive in saline and often water-scarce conditions, the plant species found in *restingas* are typically well adapted to limited soil nutrient availability, high wind exposure, and high soil and air temperatures (Neto 1997; Reinert *et al.* 1997; Veado 2004a; Zamith and Scarano 2006).

Falkenberg (1999) provides an in-depth examination of the *restingas* of Santa Catarina, reporting on ecosystem structure, floristic composition, endemism, endangered species, and secondary succession.[50] Addressing vegetation structure and composition, Falkenberg classifies *restinga* plant communities into three primary formations: herbaceous; scrub; and arboreal. While herbaceous and scrub species dominate *restinga* plant communities, trees may be common at the interfaces with dense broadleaf or Quaternary coastal plain forests, in zones where sufficient moisture and organic material are available (Bresolin 1979; CECCA 1997a). Although *restinga* ecosystems are often

[50] For listings of plant species found in the *restinga* of the Santa Catarina coastal zone see Bresolin (1979) and Falkenberg (1999).

species rich, they usually have lower levels of diversity and endemism than neighboring Quaternary coastal plain and dense broadleaf forests (Scarano 2002; Barbosa *et al.* 2004; Zamith and Scarano 2006). However, a unique quality of the *restinga* ecosystem is the *ecological plasticity* demonstrated by several of its plant species which are thought to have migrated from inland ecosystems of the Atlantic Forest to colonize the geologically younger and more environmentally stressful coastal lowlands. Knowledge of the ecological plasticity of certain species has been useful to ecological restoration efforts. Scarano (2002) reported that when certain clusias and bromeliads migrate from forested hill slopes to lowlands, instead of developing into the epiphytic form found in forests, they become ground-covering plants in *restingas*. Further, in *restingas* they serve as pioneer *nurse plants* facilitating the establishment of other plant species which would otherwise be unable to colonize bare sand (Scarano 2002; Zamith and Scarano 2006).

In addition to its role in supporting native biodiversity, *restinga* vegetation provides the important ecological functions of mitigating wind and marine erosion and protecting against periodic storm surges, thus serving to stabilize the coastline. In the northern sector of SCI, *restingas* are found at Daniela, Jurerê, Canasvieiras, Ingleses, Ponta das Canas, Santinho, Rio Vermelho, and Mole Beach. In the island's southern sector, they occur at Joaquina, Rio Tavares, Campeche, Morro das Pedras, Armação, Lagoinha do Leste, Pântano do Sul, and Naufragados. The island's sand dunes are zoned as APPs. They are systems comprised of fixed, semi-fixed, and mobile dunes, some reaching heights up to 40 m. Vegetated and bare dunes can be found at Armação, Barra da Lagoa, Moçambique, Joaquina/Campeche, Ingleses, Santinho, Lagoa da Conceição, and Pântano do Sul (CECCA 1997a; Hauff 1997; Bigarella *et al.* 2005).

While *restinga* vegetation on SCI is thought to have once covered as much as about 29.6 km² in 1938 (about 7 percent of the island's total vegetation cover), by 1978 human activities had reduced this area to about 23 km² (Caruso 1990; CECCA 1997a). Previously, *restingas* were primarily converted to pastures and croplands. As along many urbanizing segments of the Brazilian coastline (Marques *et al.* 2004; Zamith and Scarano 2006), nowadays, the *restingas* of SCI are the prime areas targeted for real estate and tourism development. My review of the available literature did not furnish an estimate of the current area of native *restinga* vegetation remaining on SCI. However, it appears that urban expansion since the late 1970s has further reduced the area of *restinga* thereby threatening this ecosystem type.

Figure 3.4 Littoral *restinga* vegetation of the Campeche Coastal Plain. *Source*: author, May 2004.

3.8.3 Rocky Shores and Neighboring Islets

Xerophytic vegetation grows on the rocky substrates of SCI and neighboring islets, including several species of cacti, orquids, and bromeliads. Rocky shores also provide stepping-stone habitats for several pioneer species that are able to seed and develop in other areas such as *restingas*. Several of the islets are large enough to support stratified plant communities on soil substrates, and a few such as Campeche Island (see photo in Figure 5.12, Chapter 5) possess forested areas.

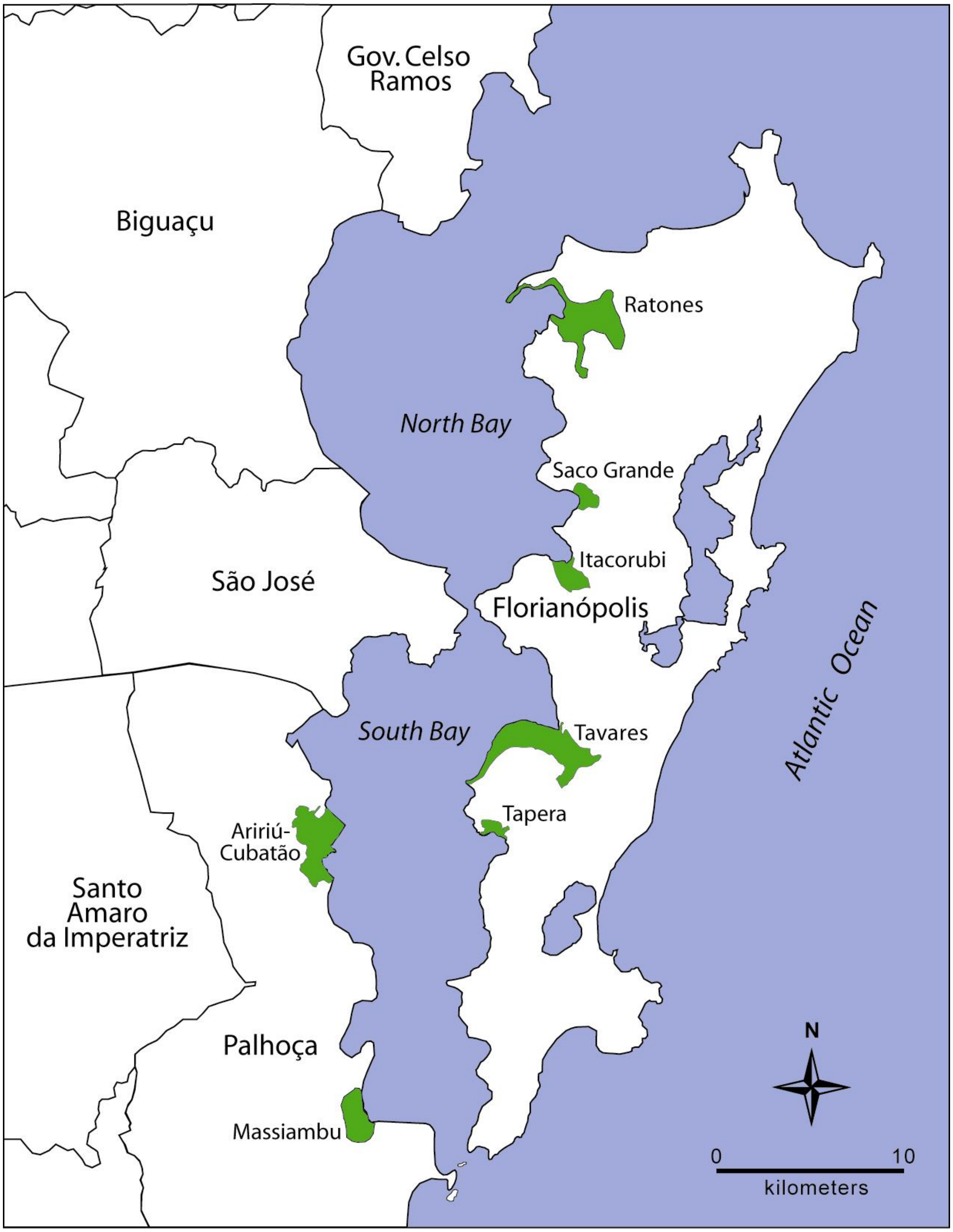
3.8.4 Mangrove Ecosystems

Intertidal mangrove ecosystems occur discontinuously along the Brazilian coastline from the northern state of Amapá at Cape Orange (4°20′ N) to the municipality of Laguna in Santa Catarina at the Araranguá River estuary (28°30′ S) (Caruso 1990; Schaeffer-Novelli *et al.* 1990; Hertz 1991; Schaeffer-Novelli *et al.* 2000; Ab′Sáber and Holmquist 2003; Wilkie and Fortuna 2003; Marques *et al.* 2004). In recent decades, mangrove areas worldwide, particularly those in or near urban, industrial, and tourism centers, have experienced extensive losses due to anthropogenic disturbances (Saenger, Hegerl, and Davie 1983; Saenger 1998; Kathiresan and Bingham 2001; Alongi 2002; Couto, Silveira, and Rocha 2003). Authors of a recent FAO Forest Resources Assessment report estimate that global mangrove area decreased from 198,000 km² in 1980 to 164,000 km² in 1990 to 147,000 km² by 2000; over the same time period, the total mangrove area in South America diminished from 38,000 km² in 1980 to 22,000 km² in 1990 to 20,000 km² in 2000 (Wilkie and Fortuna 2003). Brazil's mangroves (*manguezais*) presently cover about 10,000 km², reduced from an estimated 25,000 km² in the early 1980s (Saenger, Hegerl, and Davie 1983; Kjerfve and Lacerda 1993; Netto and Gallucci 2003; Wilkie and Fortuna 2003). Therefore, constituting nearly 7 percent of the world total and about 50 percent of the South American total, they currently represent an important yet threatened reserve of this ecosystem type.

Mangrove formations in metropolitan Florianópolis exist near the southern limit of this ecosystem's distribution in South America. Five of these mangroves are located on the western coast of SCI: three (Ratones, Saco Grande, and Itacorubi) occupy areas along the North Bay and two (Tavares and Tapera) are found along the South Bay. The Aririú-Cubatão and Massiambu mangroves occupy coastal areas on the continent in the municipality of Palhoça (see Figure 3.5). Developing on the clay and silt substrate of estuarine areas, forming ecotones between terrestrial and marine environments, these mangroves have long played an important role in the local economy and culture. By providing spawning, nursery, and feeding habitat, they support local wetland and aquatic fauna, including commercial species of fish, crustaceans, and molluscs. In addition to sustaining fisheries, they also carry out multiple environmental services such as improving water quality by filtering waste water, providing natural flood control, buffering against storm surges and tidal action, and preventing erosion.

By 1978, SCI had lost just over a quarter of its total mangrove area; by the end of the twentieth century, it had lost over half of its total mangrove area (Caruso 1990; Camargo, Pellerin, and Panitz 2001; Netto and Gallucci 2003). Today, the insular mangroves cover about 16 km² which represents about 45 percent of the estimated 35.56 km² that existed in 1938 based on interpretation of the first aerial photographs taken of

Figure 3.5 Locations and approximate extents of mangroves in metropolitan Florianópolis at the start of the twenty-first century. *Source:* map created by author based on information from sources cited in subsection 3.8.4.



the island (Caruso 1990). In other words, while mangroves covered over 8 percent of SCI’s surface during the early decades of the twentieth century, at the start of the twenty-first century they represent less than 4 percent of the island’s surface.

During the eighteenth and nineteenth centuries, these mangrove areas were impacted by the extraction of a variety of products such as fuelwood, timber, and tannin (used to tan leather and to treat cotton fishing lines and nets); they have provided colonial as well as post-colonial populations with an important dietary source of fish and shellfish (Souza Sobrinho, Bresolin, and Klein 1969; Caruso 1990; Neto 1997; Miller 2003). Since the mid-twentieth century, SCI mangroves and salt marshes have been further impacted by conversions to aquaculture, drainage and landfill projects preceding conversions to cropland and pasture, road construction, urban encroachment, and both legal and illegal waste disposal practices (Saenger, Hegerl, and Davie 1983; Caruso 1990; Froidefond and Soriano-Sierra 1996; CECCA 1997a; Camargo, Pellerin, and Panitz 2001; Netto and Gallucci 2003; Oliveira and Panitz 2003; Veado 2004a).

At the federal level, Brazilian mangrove forests are legally protected as APPs under Article 2 of the Brazilian Federal Forest Code (CFB 1965) (Fiorillo 2003; Horn Filho 2006). The specific legal parameters defining mangroves were most recently outlined by the Brazilian National Council on the Environment (CONAMA) in Resolution 303 on March 20, 2002. Brazil’s mangroves are also protected by Articles 3 and 7 of Federal Decree No. 750/1993 which prohibits the destruction of Atlantic Forest and its associated ecosystems. In addition to protection under federal legislation, the mangroves of Florianópolis have been protected under municipal legislation since 1985

(Municipal Law No. 2193/85) and are accordingly zoned as APPs in the municipal master plan.

Three mangrove tree species are dominant on SCI: *Avicennia schaueriana* (black mangrove or *siriúba*); *Laguncularia racemosa* (white mangrove or *mangue branco*); and *Rhizophora mangle* (red mangrove or *mangue vermelho*) (Klein 1978; Bresolin 1979; Caruso 1990; Souza *et al.* 1994; Froidefond and Soriano-Sierra 1996; Lopes and Santos 1996; Neto 1997; Netto and Gallucci 2003; Veado 2004a). Stands of these three species occur in distinct zones along the tidal gradient with *R. mangle* occurring along the outer estuary, *A. schaueriana* covering the middle zone, and *L. racemosa* growing furthest inland on drier, sandier soils submerged at high tides (Caruso 1990; Miller 2003).[51] Currently, *A. schaueriana* dominates SCI's mangrove forests while *R. mangle* is the rarest and most threatened on the island although several stands can be found in the Tavares River mangrove (Souza Sobrinho *et al.* 1969; Caruso 1990; Souza *et al.* 1994; Neto 1997; Netto and Gallucci 2003; Veado 2004a).[52]

In their outer zones, these mangrove communities also contain salt marsh components such as *Spartina densiflora*, *Spartina alterniflora,* and *Typha domingensis* (Souza Sobrinho, Bresolin, and Klein 1969; Klein 1978; Froidefond and Soriano-Sierra 1996; Lopes and Santos 1996; Neto 1997; Lebigre 1999). At the opposite end of the

[51] The tidal amplitude influencing mangrove ecology on SCI is about 1.3 m (Camargo, Pellerin, and Panitz 2001).

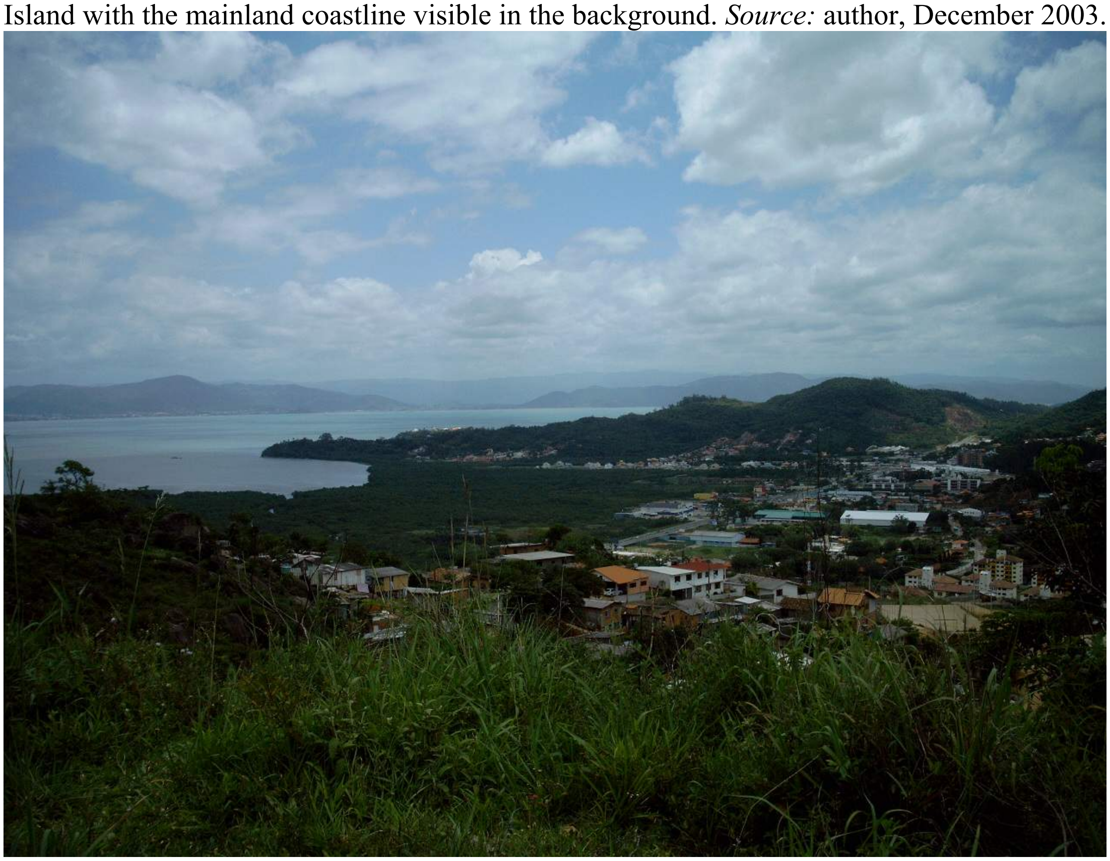
[52] During the colonial period, *R. mangle* was highly valued for the tannin contained in its bark as well as for fuelwood and charcoal production because of its relatively high density; in addition to domestic consumption, mangrove-based fuels supported many colonial industries including whale oil processing, kiln-fired brick and ceramic pottery, shell lime production in *caieiras*, sugar and manioc flour mills, and sugarcane alcohol distilleries (Caruso 1990; Miller 2003). As previously hypothesized by Souza Sobrinho, Bresolin, and Klein (1969), the past exploitation of *R. mangle* by local populations may in part explain its present rare occurrence. Another factor which may contribute to the rarity of *R. mangle* on SCI when compared to *A. schaueriana* and *L. racemosa* is its lower tolerance of high salinity (Scheel-Ybert 2000).

ecological gradient, in drier inland areas transitioning to *restinga*, Quaternary plain forest, and dense broadleaf forest communities, common species include *Hibiscus tiliaceus*, *Juncus acutus*, *Acrostichum aureum, Acrostichum danaeifolium*, *Annona glabra*, *Rapanea parvifolia*, *Fimbristylis diphylla, Scirpus maritimus, Paspalum vaginatum, Sporobolus poiretii, Sporobolus virginicus, Dalbergia ecastaphyllum,* and *Mimosa bimucronata* (Souza Sobrinho, Bresolin, and Klein 1969; Klein 1978; Caruso 1990; Souza *et al.* 1994; Froidefond and Soriano-Sierra 1996; Lopes and Santos 1996; Neto 1997; Camargo, Pellerin, and Panitz 2001; Veado 2004a).

The Ratones mangrove**,** at the Ratones River estuary, is the northernmost mangrove on the island. It is part of the Carijós Ecological Station (*Estação Ecológica Carijós*), a federally protected area established in 1987 (Federal Decree No. 94656/87) (see <http://www.ibama.gov.br/carijos>). Although it is located just south of three highly urbanized neighborhoods in the Canasvieiras District (Daniela, Jurerê, and Canasvieiras) and about 30 km north of the Central City District, it is considered a relatively well-preserved mangrove (Lopes and Santos 1996; Mater *et al.* 2004). Nonetheless, it has been altered by conversion to cropland, pasture, aquaculture, as well as by transportation infrastructure, tourism, and real estate development (Caruso 1990; Froidefond and Soriano-Sierra 1996; Camargo, Pellerin, and Panitz 2001). Portions of its western edge, at Pontal da Daniela, have been illegally used as landfills (Netto and Gallucci 2003). According to Caruso (1990), its original extent of about 17 km² had been reduced to 13.78 km² by 1938. Later, Fidélis Filho (1998) reported its area in 1978 as 7.3 km². While several of the most recent sources report its current area as 6.25 km² (Froidefond and Soriano-Sierra 1996; Netto and Gallucci 2003; Mater *et al.* 2004), a thematic map of the vegetation classes produced by Camargo, Pellerin, and Panitz (2001) using remotely-sensed imagery leads these researchers to estimate its area in the mid-1990s as 8.9 km².

The Saco Grande mangrove (see Figure 3.6) is also part of the Carijós Ecological Station. It now covers about 93 ha, having lost over 30 percent of its 1938 estimated extent of 1.38 km² (CECCA 1997a; *Estação Ecológica Carijós* <http://www.ibama.gov.br/carijos>; PMF <http://www.pmf.sc.gov.br>). This area has been heavily impacted by road construction, illegal landfills, and the development of commercial activities along highway SC-401 as well as by untreated sewage effluent from the neighborhoods Monte Verde and Saco Grande II in the Central City District (Caruso 1990; CECCA 1997a).

Figure 3.6 The Saco Grande mangrove and its vicinity along the North Bay of Santa Catarina Island with the mainland coastline visible in the background. *Source:* author, December 2003.



The Itacorubi mangrove, at the estuary formed by the confluence of the Itacorubi and Sertão Rivers, was reduced over the four decades between 1938 and 1978 from an estimated 2.53 km² to 1.73 km² (Caruso 1990; Panitz 1997; Teixeira 1998; Oliveira and Panitz 2003). It has been managed by UFSC since 1969, and is now called the Itacorubi Mangrove Park (*Parque do Mangue do Itacorubi*) having been recently transformed into a conservation unit designated for recreation, education, and research (Oliveira and Panitz 2002; Rocca 2002: 95). Although often reported as having a current area of 1.5 km² (Martins 2002; Rocca 2002), Oliveira and Panitz (2003)—presenting the results of their aerial photograph interpretation, field surveys, and thematic mapping—conclude that in 2002 its total area was closer to 1.78 km². Interestingly, due to deposition of sediments from the watershed and colonization by pioneer plant species such as *Spartina* cordgrasses, these researchers found that the salt marsh area at the outer estuary (i.e. the mangrove's *progradation front*) expanded into the bay, enlarging the total mangrove area by 1.5 ha over the eight-year period from 1994 to 2002 and offsetting some of the mangrove losses resulting from: landfill and construction in the João Paulo neighborhood; dredging and dumping of sedimentary material associated with artificial canal maintenance; and degradation occurring along roadways. Of the island's five mangroves, Itacorubi is arguably the most impacted by anthropogenic activities (Caruso 1990: 120). It is located in a densely populated area adjacent to the Central City District and is contaminated by untreated domestic sewage discharged into both the Itacorubi and Sertão Rivers from the neighborhoods Santa Mônica, Trindade, Pantanal, Itacorubi, Universidade, and Córrego Grande (CECCA 1997a; Torres *et al.* 2002; Mater *et al.* 2004; Veado 2004b). This mangrove has also been impacted by road construction and a now abandoned aquaculture station constructed by UFSC, and has been the site of a major sanitary landfill accepting domestic, municipal, industrial, and hospital wastes; past disposal practices by UFSC laboratories and the University Hospital polluted it with toxic substances including heavy metals (Saenger, Hegerl, and Davie 1983: 44; Oliveira and Panitz 2003).

The Tavares River mangrove, bordering the Hercílio Luz International Airport, is thought to have covered an area of about 15 km² in 1938. By the mid-1990s, about half of this mangrove area had been lost due to anthropogenic activities leaving about 7.5 km² (Souza *et al.* 1994; CECCA 1997a: 87). Much of the habitat loss resulted from drainage and landfill projects associated with the construction of the airport, the air force base (*Base Aérea*), access roads, and lower income residential areas in the Carianos, Costeira, and Rio Tavares neighborhoods; vegetation clearing and drainage projects converting eastern and southern portions of this mangrove to pasture resulted in additional losses (CECCA 1997a: 83). The Tavares River estuary is the site of a federal conservation unit, the Marine Extractive Reserve of Pirajubaé (*Reserva Extrativista Marinha do Pirajubaé*) established in 1992 (see <http://www.ibama.gov.br/resex/pirajuba/visite.htm>).

Lastly, the Tapera mangrove, with an area of about 50 ha, is currently the smallest mangrove forest on SCI. It has been reduced from its 1938 area of about 2.0 km² as a result of drainage and landfill projects establishing pasture and extending residential neighborhoods (CECCA 1997a). To date, it has not been designated a conservation unit and, therefore, is solely protected under the Brazilian Federal Forest Code and by zoning regulations outlined in the 1985 municipal master plan.

CHAPTER 4

THE HISTORICAL CONTEXT

> When we describe human activities within an ecosystem, we seem always to tell *stories* about them. Like all historians, we configure the events of the past into causal sequences—stories—that order and simplify those events to give them new meanings. We do so because narrative is the chief literary form that tries to find meaning in an overwhelmingly crowded and disordered chronological reality. When we choose a plot to order our environmental histories, we give them a unity that neither nature nor the past possesses so clearly. In so doing, we move well beyond nature into the intensely human realm of value. There, we cannot avoid encountering the postmodernist assault on narrative, which calls into question not just the stories we tell but the deeper purpose that motivated us in the first place: trying to make sense of nature's place in the human past.
>
> William Cronon (1992: 1349)

4.1 Overview

Early on in the sixteenth century, after thousands of years of occupation by aboriginal cultures, the modification of natural habitats in eastern South America began to occur in ways that were distinct from those of previous human disturbance regimes. The earliest presence of European traders, mainly in coastal areas, led to rapid timber extraction and to changes in indigenous fishing, hunting, gathering, and agricultural subsistence practices. The capitalistic colonial economy quickly expanded from an initial phase based on forest-product extraction to include large-scale agricultural production of sugarcane and other cash crops for export which incorporated the use of domesticated animals. Increasingly, European colonists exploited Amerindian and African slave labor in extractive and agricultural profit-driven pursuits and in the domestic realm. From about 1690 to 1760, mineral extraction (primarily gold mining) predominated and cattle-raising activities expanded. Although the enslavement of Amerindians was officially prohibited in Portuguese America in 1755, it continued in practice. Social transformations associated with the spread of Enlightenment philosophies and with the processes of industrialization and urbanization began to build momentum among diverse groups after 1822 when Brazil gained independence from Portugal. During the Imperial Period, coffee production in the southeastern region created a new economic boom. The first railways were constructed and new waves of European immigrants began entering Brazil to meet growing demands for labor. The Brazilian government took legislative measures to end its participation in the transatlantic slave trade in 1850.[53] However, the enslavement of Africans and Afro-Brazilians within the country was not abolished until 1888.[54] After the fall of the Brazilian monarchy in late 1889, socioeconomic and political modernization trends continued during consolidation of the country's First Republic which lasted until 1930.

The purpose of this chapter is to use the narrative form to elaborate on the simplified chronicle of Brazilian history outlined above and to develop a meaningful plot line for the specific story of Santa Catarina's social and landscape transformations. Section 4.2 briefly discusses my methodological rationale towards the construction of an environmental history.[55] Section 4.3 reviews current knowledge of the earliest human settlements in South America as a whole and the settlement history of the continent's southern Atlantic coast in particular, thus providing readers with a sense of the "humanized landscape" (Denevan 1992) in this part of the world prior to 1500. In sections 4.4, 4.5, and 4.6, the narrative continues with the transatlantic stories of

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[53] The Queirós Law (*Lei Eusébio de Queirós*) ending Brazil's transatlantic slave trade was proposed by then Minister of Justice Eusébio de Queirós Coutinho Matoso Câmara and was approved into law in September 1850. According to Fausto (1999: 110), "The entry of slaves into Brazil [from Africa] fell from nearly 54,000 in 1849 to less than 23,000 in 1850, and down to around 3,300 in 1851."
[54] In May 1888, the Golden Law (*Lei Áurea*) formally abolished slavery in Brazil.
[55] See Cronon (1992) for a critical discussion of the distinctions between "chronicle" and "narrative" and for a perceptive analysis of the origins of plots that order environmental histories.

relationships between Amerindian, European, and African peoples and with descriptions of the types of social and landscape transformations that occurred in Brazil during the Colonial Era (1500–1822), the Imperial Period (1822–1889), and the First Republic (1889–1930) respectively, while highlighting the territorial, social, political, and economic formation of Santa Catarina in each period. Toward the aim of organizing the historical background information necessary to adequately compare forest-cover changes in southern Brazil with the experiences of forest transitions documented for other parts of the world, the narrative integrates a review of the available accounts of both deforestation and reforestation in Santa Catarina.

4.2 An Environmental History of Florianópolis: Constructing the Narrative

In order to answer the research questions posed in Chapter 1, it is necessary to produce a historicized account of landscape transformations that characterizes the middle coast of Santa Catarina State. While the historical narrative herein is predominantly based on bibliographic sources, it is also influenced by my direct experience of the study area's physical environment and its social dynamics during the period from 2000 to 2004. Visual reminders of and clues about the past as well as dialogue with present-day inhabitants have facilitated and enriched my understanding of the variety of historical texts that have contributed to this project. By consulting a set of Portuguese- and English-language texts addressing Brazil's historical geography and integrating these perspectives, chronologies, and interpretations with those offered in texts focused on Santa Catarina, I attempt here to provide the reader with a both a comprehensive and in-depth understanding of the specific landscape under investigation in this dissertation and thus effectively communicate its human-ecological complexity over time. My synthesis of this literature underpins and helps validate the development of ideas about the possible futures of metropolitan Florianópolis that appear in this dissertation's final chapter.

In the process of designing the present narrative, I have drawn inspiration and guidance from the work of several scholars including: William Cronon's (1983) *Changes in the land: Indians, colonists, and the ecology of New England* and (1991) *Nature's metropolis: Chicago and the Great West*; Mike Davis' (1990) *City of quartz: excavating the future in Los Angeles*; Warren Dean's (1995) *With broadax and firebrand: the destruction of the Brazilian Atlantic forest*; and Gordon G. Whitney's (1994) *From coastal wilderness to fruited plain: a history of environmental change in temperate North America, 1500 to the present.* Each of these books provides a model of how to analyze human societies within ecological systems. In addition, as indicated in Chapter 2, Conrad Totman's (1982, 1986, 1987, and 1989) writings on early modern Japan have been an important influence.

My ultimate purpose in constructing this narrative is to better participate in critical dialogue about the future of metropolitan Florianópolis by doing so from a historically-informed perspective. By relating the particular history of human-environment interactions and social relations in the study region, I aim to address two distinct audiences. On the one hand, my narrative is intended to aid readers with limited knowledge of metropolitan Florianópolis in visualizing the palimpsest embedded in the present-day landscape. On the other hand, I hope that those readers who are knowledgeable about this history will assist me by providing feedback and pointing out any errors or omissions. Lastly, as with other attempts at historiography, I recognize that my own continued study of the region may lead me to revise or make additions to this narrative at some later date.[56]

4.3 The Human Presence in South America and Current Knowledge of Santa Catarina's Prehistory

Although the antiquity of the earliest human presence in South America and the probable pathways of early human dispersion throughout the continent remain ongoing research questions, radiocarbon dates obtained for a variety of preserved materials at diverse archaeological sites and stratigraphic interpretations at the same localities indicate that humans have inhabited the region *at least* since the late Pleistocene about 12,500 to 11,500 years before the present (BP) (Lanning and Hammel 1961; Schmitz 1987; Guidon 1989; Guidon and Arnaud 1991; Roosevelt *et al.* 1991; Prous 1992; Meltzer 1995; Roosevelt *et al.* 1996; Meltzer *et al.* 1997; Coronato, Salemme, and Rabassa 1999; Dillehay 1999, 2000, 2003; Meltzer and Dillehay 1999; Prous and Fogaça 1999; Lavallée 2000; Cleary 2001; Dixon 2001; Neves *et al.* 2003; Scheinsohn 2003; Watanabe *et al.* 2003; Araujo *et al.* 2005; Barreto 2005; Neves *et al.* 2005; Neves, Hubbe, and Piló 2007). Dillehay (1999), for instance, asserts that in light of reliable dates between 12,500 and 11,000 BP for a number of archaeological sites—including conclusive evidence of a late Pleistocene hunter-gatherer culture at Monte Verde in southern Chile (Meltzer *et al.* 1997)—it is reasonable to presume that human populations reached South America

[56] Russell-Wood has written two articles surveying scholarly contributions to the historiography of colonial Brazil; the first article (Russell-Wood 1985) surveys the work of United States historians, while the second article surveys the work of Brazilian scholars (Russell-Wood 2001).

sometime between 20,000 and 15,000 BP.[57] Others have defended much longer chronologies, claiming that Pleistocene colonizations took place in South America up to 35,000 years ago or earlier. Among the sites reported to support a longer chronology of human occupation is Pedra Furada in São Raimundo Nonato, Piauí State, Brazil where materials excavated from Pleistocene stratigraphic layers at a rockshelter (Toca do Boqueirão) have yielded dates ranging from 14,300 to 48,000 BP (Guidon and Delibrias 1986; Guidon 1989; Guidon and Arnaud 1991; Bahn 1993; Parenti 1993; Parenti, Fontugue, and Guérin 1996; Watanabe *et al.* 2003).[58]

So far, the earliest South American ceramics —dating from around 8,000 to 7,000 BP—have been found in the lower Amazon at the Taperinha riverine shell midden site located near Santarém, Pará State, Brazil providing evidence of an ancient village where pottery was manufactured by a fishing–foraging culture (Roosevelt *et al.* 1991). Roosevelt *et al.* (1991: 1624) conclude that "Although similar to some other early pottery, Taperinha pottery is at least 1000 years earlier than northern South American pottery and 3000 years earlier than Andean and Mesoamerican pottery and could not be derived from them, although the reverse is possible, or independent origins." In a synthesis of the body of archaeological work addressing early ceramics in the Americas, Hoopes (1994) argues that the development of pottery production in the New World probably occurred independently at eight hearths including the following four loci in South America: lowland Brazil between 8,000 and 7,000 BP; northern Colombia from

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[57] For extended discussions about ancient South American archaeological sites and competing theories about the earliest Paleo-American human settlements, see books by Dillehay (2000) and Lavallée (2000). Prous (1992) has written a book dedicated to Brazilian archaeology.

[58] Several additional articles address the controversies surrounding many of these longer-chronology claims of Paleo-Brazilian antiquity; among them are Prous and Fogaça (1999) and Rowe and Steelman (2003).

about 7,000 to 6,500 BP; Pacific Ecuador circa 6,000 to 5,500 BP; and the central coast of Peru from around 2,900 to 2,300 BP.

Investigations since the 1990s, in the southern South American lowlands specifically have uncovered evidence at several sites suggesting higher levels of social complexity than were previously believed to have existed and indicating that some of the people living in this region during the mid-Holocene did, in fact, practice agriculture. To date, the earliest findings of pottery-making *horticulturalists* in Brazil are dated between 4,500 and 3,500 BP. These include evidence of manioc cultivation in the coastal zones of present-day Rio de Janeiro and Espírito Santo by 4,000 BP and of maize cultivation in Minas Gerais by about 3,500 B.P (Schmitz 1987).[59] Recent reports by Marco Aurélio Nadal De Masi announce the identification of maize cultivation around 4,320 BP in Campos Novos, an interior municipality of Santa Catarina State (Karam 2006). Believed to have lasted from about 5,000 to 300 BP, the culture identified at Campos Novos is linked to the Taquara tradition which is considered the antecedent of the contemporary Xokleng and Kaingang indigenous groups.[60]

Current archaeological knowledge about the southern states of Rio Grande do Sul, Santa Catarina, and Paraná as well as neighboring parts of São Paulo and Rio de Janeiro suggests that several human occupations occurred during distinct time periods and in distinct environments since the late Pleistocene (Schmitz 1987). While much more

[59] See also the work of Iriarte *et al.* (2004) in *Nature* reporting data on multidisciplinary investigations of pre-ceramic and ceramic mound contents at the Los Ajos archaeological site in the La Plata Basin of southeastern Uruguay. Radiocarbon dates for the phytoliths and starch grains found at this site indicated agricultural activities in permanent settlements prior to 4,000 BP.

[60] Earlier evidence of plant domestication has been uncovered in South America. For example, Cleary (2001: 74) points out that indigenous human populations are believed to have cultivated maize in the Ecuadorian Amazon since about 6,000 BP; he argues that during the early Holocene (c. 10,000 BP) people may have been cultivating manioc as their chief crop in the Amazonian floodplain as part of a broader subsistence strategy integrating horticulture with fishing and gathering activities. Dillehay (1999) also states that plant domestication in South America may have begun as early as 10,000 to 8,000 BP.

remains to be studied within this territory (Prous and Fogaça 1999), researchers have gathered sufficient data to reconstruct its regional archaeological sequence.[61] It is believed that the earliest human occupations in southern Brazil, referred to as the Ibicuí and Uruguai *phases*, began during the late Pleistocene and lasted into the early Holocene, and that these were followed by two more occupations during the Holocene called the Umbu and Humaitá *traditions*.[62] Schmitz (1987) reported that both the Ibicuí and the Uruguai phases occurred in southern Brazil between 13,000 and 8,500 BP. This dating is reinforced by Prous and Fogaça (1999) who explained that the earliest known archaeological sites in southern Brazil have been classified either as part of Ibicuí phase with radiocarbon dates of ~12,500 BP or as part of the Uruguai phase dated at ~10,000 BP.[63] While Schmitz (1987) described the Umbu and Humaitá traditions emerging around 7,000 BP and likely persisting until circa 2,000 BP, the temporal framework presented more recently by Prous and Fogaça (1999: 30) placed the start of the Umbu and Humaitá traditions a thousand years earlier at around 8,000 BP. As in the case of the older Uruguai phase, the Umbu tradition is characterized by open-landscape hunting with stemmed projectile points; members of the Humaitá tradition, on the other hand, are thought to have evolved mainly as gatherers in broadleaf forests, developing a lithic

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[61] Dillehay (1999: 209–210) offers an in-depth discussion of the regional cultural diversity that existed in South America as early as the late Pleistocene (between 12,500 and 10,000 BP) forming distinct traditions culturally adapted to different environments (e.g., big-game hunting in open grassland environments versus generalized foraging in highly productive wetland environments).

[62] As explained by Schmitz (1987: 55), investigators of New World prehistory have adopted the concepts of *tradition* and *phase* to facilitate data comparison and correlation.

[63] Similarly, in Dillehay (2000: 200–201), the radiocarbon ages given for the Ibicuí phase are 12,770 and 12,690 BP, and the Uruguai phase sites are said to fall “between 11,555 and 8,585 B.P., with most dates falling between 10,180 and 9,000 B.P.”

industry of large bifacial tools such as choppers and scrapers (Prous and Fogaça 1999; Ribeiro 1990; Schmitz 1987).[64]

There are about 3,500 registered archaeological sites in southern Brazil; of these, about 1,400 archaeological sites have been registered for Santa Catarina State alone (Gonçalves and Carlson 2003). Presently, the oldest archaeological site found in Santa Catarina is located along the Paraná River in the state's southwestern corner in the municipality of Itapiranga. Evidence at the Itapiranga site includes hearth remains indicating the presence of fisher-gatherers around 8,640 BP and remains of a lithic industry dated circa 7,260 BP (Rohr 1968; De Masi and Artusi 1985; Schmitz 1987; Prous and Fogaça 1999; Karam 2006). Investigators currently classify the Itapiranga site as belonging to the Humaitá tradition (Karam 2006).

In addition to the two inland Paleoindian traditions in southern Brazil (i.e., the Umbu tradition associated with hunting in open landscapes and the Humaitá tradition associated with gathering in broadleaf forests), a third called the Sambaqui tradition is known to have occupied the region's coastal plains. Extensive research has been conducted on the remnants of the Sambaqui tradition—preceramic shoreline fisher-gatherer-hunter populations that occupied much of the Brazilian coast from at least 7,000 to 2,000 BP, used large bifacial tools, and developed cultures adapted for the intensive use of coastal resources (Emperaire and Laming 1956; Hurt 1964, 1966, 1974; PRONAPA 1970; Fairbridge 1976; Uchôa 1982; Martin, Suguío, and Flexor 1986; Schmitz 1987; De Blasis *et al.* 1998a; De Blasis *et al.* 1998b; Gaspar 1998, 2000;

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[64] In the more recent publication by Prous and Fogaça (1999: 29), the Uruguai people are listed along with the Batinga and Capivara peoples as possible ancestors of the Umbu.

Dillehay 2000: 187; Scheel-Ybert 2001; Barreto 2005).[65] Occupying highly productive environments near the ocean (i.e., rocky intertidal zones, bays, estuaries, mangroves, and lagoons) which were abundant in molluscs, crustaceans, and fish, these societies depended heavily on shellfish consumption and used the discarded shells of mussels, oysters, and cockles to construct mounds (*sambaquis*) of varying sizes (Hurt 1964, 1966, 1974; Fairbridge 1976; Schmitz 1987; Dean 1995: 24; Scheel-Ybert 2001; Gonçalves and Carlson 2003; Bastos and Teixeira 2004). These anthropogenic shell middens have been found to reach heights of up to 30 m and lengths of up to 500 m. Formed mainly by the layered accumulation of mollusc shells, animal bones (fish, bird, mammal), and sediments, sambaqui excavations have also uncovered plant food remains including palm fruits, seeds, and tuber fragments (Scheel-Ybert 2001) and a variety of lithic artifacts such as *zooliths* (i.e., stone sculptures in the forms of animals) and stone tools used for scraping, chopping, pounding, grinding, and polishing (Tiburtius and Bigarella 1960; Hurt 1964; Chapman 1973; Prous 1977; Gaspar 1998, 2000; Gonçalves and Carlson 2003; Barreto 2005). Some of the larger mounds also contain the remains of habitational structures, hearths, and human burials (Hurt 1964; Chapman 1973; Gaspar 1998; Scheel-Ybert 2001).[66]

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[65] Given that early shell-midden sites on the Pacific coast of South America in Chile and Peru have been radiocarbon dated to between 10,800 and 9,700 BP, Dillehay (1999: 212 and 2000: 187) speculated that coastal shell middens on the Atlantic constructed prior to or during the terminal Pleistocene and early Holocene were probably submerged by sea-level rise. Similarly, Prous and Fogaça (1999: 21, 25) defended the idea that humans probably inhabited the Atlantic coast of South America between 17,000 and 7,000 BP in areas that are now submerged, and Fairbridge (1976: 354) estimated that “Some sites might be 40 to 50 km seaward.”

[66] See Gaspar (1998 and 2000) for more information on the sambaquis of the Brazilian coast. Their distribution includes Brazil’s northeast, but they are concentrated along the southeastern and southern coasts from Espírito Santo to Rio Grande do Sul. According to Gonçalves and Carlson (2003), zooliths dating between 5,000 and 2,000 BP have been found in sambaquis from São Paulo (Brazil) to Uruguay.

Researchers estimate that the groups responsible for constructing these sambaquis lived in population clusters ranging from 50 to 600 individuals (Schmitz 1987: 107). Estimated periods of continuous occupation have ranged from several centuries to over 3,000 years (Fairbridge 1976; Scheel-Ybert 2000, 2001; Barreto 2005). There is also evidence of reoccupations of some sambaqui sites after long periods of abandonment associated with sea-level fluctuations. The archaeological record shows that by about 1,000 BP the sambaqui culture had become uncommon and that eventually the culture faded out completely, perhaps due to the arrival and influence of other Amerindian groups or as a result of the depletion of shellfish resources (Barreto 2005).

Centuries later, many sambaquis throughout Brazil were destroyed before archaeologists had the chance to study their contents. The shell mounds were heavily mined as sources of calcium carbonate used in the production of both lime mortar and agricultural lime fertilizer (Gonçalves and Carlson 2003).[67]

4.3.1 Human-Ecological Footprints of Amerindian Traditions on Santa Catarina Island

Having summarized the archaeological context for southern Brazil and Santa Catarina State, subsections 4.3.1 through 4.3.4 describe the prehistory of Santa Catarina Island specifically. The existing archaeological record strongly suggests that prior to the arrival of Europeans in the early sixteenth century at least three distinct Amerindian traditions occupied the area that would later become known as Santa Catarina Island (Gonçalves and Carlson 2003). While the first two cultures appear to have been entirely or

[67] According to Igor Chmyz, in 1951 legislation was enacted in Paraná suspending the commercial exploitation of sambaquis and reserving them for scientific research (see Delle 2003). Similar legislative measures were taken in other Brazilian coastal states as awareness grew about the archaeological importance of these sites.

predominantly fisher-gatherer-hunter populations, investigations have revealed that the third group (considered part of the ceramic Tupiguarani tradition) practiced horticulture, having domesticated dietary staples such as manioc, maize, squash, and beans.[68]

The human-environment interactions characteristic of each of these three eras would have contributed to unique landscape dynamics producing different land-use mosaics in the area; human impacts on local aquatic resources also would have been distinct. In other words, each era had its own human-ecological footprint. Conceivably, between occupations by each of the major traditions, there may have been periods of either total abandonment or very low population densities that were sustained long enough for local ecosystems such as forests, *restingas*, mangroves, and lagoons to recover from anthropogenic disturbances. Further, one might also consider the possibility that the pre-colonial horticulturalists of Santa Catarina Island may have actually enriched soils in some fields to improve production and that when abandoned these enriched soil sites would have supported a vegetation community different from that which existed prior to farming.[69] Based on colonial-period documents (such as travel accounts written by European visitors) and on the interpretation of these records by contemporary scholars, the anthropogenic manipulations of island ecosystems by the indigenous people that Europeans encountered during the early colonial period probably maintained dense forest cover on much of the island (Caruso 1990; Haro 1996).

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[68] Conventionally, the hyphenated term Tupi-Guarani is used to refer to peoples (past or present) speaking the related Tupi and Guarani languages, however, the umbrella term 'Tupiguarani tradition' (coined by archaeologists in the late 1960s) has been assigned to multiple indigenous archaeological sites in South America dating from about 1,500 BP which contain decorated ceramics and appear to have been inhabited by 'proto-Tupi' and 'proto-Guarani' peoples who may or may not have been speakers of Tupi-Guarani but are thought to be (at least to some degree) the ancestors of modern Tupi-Guarani speaking peoples (PRONAPA 1970; Prous 2005).

[69] This type of soil modification by human action has been documented for both prehistoric and contemporary *terra preta* sites in Amazonia (Cleary 1991: 76-77).

4.3.2 The Sambaqui Tradition

As explained above, investigators associate the initial human occupation of Brazil's southern coast with the preceramic Sambaqui tradition, a fisher-gatherer-hunter culture which existed in the coastal Brazilian lowlands for millennia. Radiocarbon dates for samples collected at multiple archaeological sites on Santa Catarina Island, on surrounding islets, and at sites in neighboring mainland areas indicate that these early colonizers occupied the area's paleo-shoreline by 5,000 BP if not earlier (Duarte 1971; Gonçalves and Carlson 2003; Zeferino 2004).[70] Excavations have uncovered a variety of lithic and animal-bone artifacts produced during this era. So far, an archaeological site at Rio Vermelho in the island's northeast sector has yielded the oldest date of 5,020 BP (De Masi 1999). Artifacts found at Pântano do Sul in the southern portion of the island have been dated to about 4,500 BP (Rohr 1977; Zeferino, Santos, and Câmara 1998). Studies of the shellmound at Ponta das Almas, located in the Lagoa da Conceição District, have derived dates between 4,300 and 2,000 BP. (Piazza 1966a; Meggers 1968; Fairbridge 1976). Interestingly, the sambaqui at Ponta das Almas appears to have been occupied first for a period that began prior to 4,000 BP and then reoccupied during the period between 2,600 and 2,000 BP after interruptions associated with sea-level oscillations (Meggers 1968; Fairbridge 1976). Certain sambaquis on Santa Catarina Island may have been occupied continuously for up to 1,000 years (Gonçalves and Carlson 2003).

[70] In addition to the 70 registered sambaquis on Santa Catarina Island (Bastos and Teixeira 2004), at least 55 sambaquis occur along the Santa Catarina mainland coast south of Florianópolis and another 80 sambaquis occur along the state's coast, north of Florianópolis (Meggers 1965).

4.3.3 The Itararé Tradition

The ceramic Itararé tradition is the second Paleoindian culture known to have inhabited Santa Catarina Island. Based on analyses of their pottery remains, it appears that they are closely related to the Taquara tradition (lasting from 5,000 to 300 BP) having originated from highland Taquara settlements (Gonçalves and Carlson 2003). Archaeologists have dated the inception of the Itararé era in the coastal zone of Santa Catarina at about 1,200 to 1,000 BP (Fairbridge 1976: 358; Karam 2006) and potentially as early as 2,000 BP (Gonçalves and Carlson 2003). The Itararé tradition is considered distinct from the Tupiguarani tradition (PRONAPA 1970). Ceramic similarities suggest that Itararé and Taquara populations are probably the ancestors of the Kaingang and Xokleng indigenous groups of the Jê linguistic branch currently inhabiting Santa Catarina State and other parts of southern Brazil (Santos 1970, 1973, 1977, 1987, 1997; Demarquet 1983; Urban 1985; Hemming 1987; Silva 1988; Silva *et al.* 1988; Oliveira 1997; Diehl 2001; Wiik 2001, 2004; Gonçalves and Carlson 2003; Karam 2006).

The first organized excavation on Santa Catarina Island took place in 1958 at *Base Aérea* (an air base along the South Bay near the Hercílio Luz International Airport) and found over a hundred Itararé human burials. A few years later in 1962, as a result of an excavation just south of Base Aérea at another bayside location called Tapera, over 150 human burials were discovered; radiocarbons dates for the Tapera skeletons ranged from about 1,000 to 500 BP (Chapman 1973; Rohr 1966b). Excavations at the Base Aérea and Tapera sites also uncovered a variety of Itararé artifacts and cultural debris. Rudimentary ceramic vessels provide the earliest evidence of this culture on Santa

Catarina Island and at other coastal sites in the region. Itararé pottery was used for food preparation, consumption, and storage. Ceramics found at Base Aérea were dated 800 BP, and ceramics discovered at Tapera Beach (measuring 20 cm in diameter and 30 cm in height) were dated 1,140 BP (Silva 1988; Silva *et al.* 1988; Gonçalves and Carlson 2003). Excavation of the Rio Lessa sambaqui in 1969 revealed evidence of Itararé occupation dated 800 BP (Beck 1972). Itararé sites on the island have also been found in the north at Rio do Meio in Jurerê Internacional and in the south at Alto Ribeirão (Gonçalves and Carlson 2003).

In addition to pottery remnants, the artifact assemblage of the Itararé includes adornments such as necklaces made from shells or fish bones, several types of stone implements used in food processing and woodworking as well as a variety of tools made from animal bones. While thought to have been largely a fisher-gatherer-hunter population, some have theorized that the coastal Itararé (like the earlier Taquara groups identified at the interior sites of Campos Novos) also practiced horticulture and that—if their arrival did indeed overlap with the Sambaqui occupation as suggested by some of the data—the introduction of horticultural practices may have been a key factor in the decline of the shellmound-building culture (CECCA 1997a: 33; Gonçalves and Carlson 2003; Barreto 2005).

4.3.4 The Tupiguarani Tradition

Archaeologists associate the third and most recent Amerindian society known to have occupied Santa Catarina Island with the Tupiguarani tradition (Chapman 1973; Prous 2005). The Tupiguarani tradition is thought to have originated from Amazonian populations that migrated through central and southern Brazil, probably along major waterways such as the Paraná and Uruguai Rivers, during the first millennium of the Common Era and eventually settled sites along the coast in the centuries prior to European arrival (Diegues 1995; Zeferino, Santos, and Câmara 1998; De Masi 1999; Reis 2002: 45; Gonçalves and Carlson 2003; Karam 2006). The Guarani of southern Brazil are a subgroup of this tradition. Walter F. Piazza led the first excavation of a Guarani archaeological site on Santa Catarina Island in 1964 at Lagoinha do Rio Tavares which uncovered painted pottery (Gonçalves and Carlson 2003). While a consensus about the time of the earliest Guarani colonization of the island has not yet been reached, investigators have published some dates derived from local Guarani materials. For instance, based on data collected at Rio Vermelho, De Masi (1999) detects Guarani presence around 910 BP.

The early Portuguese and Spanish colonists who encountered Guarani Amerindians in the sixteenth century called them *Carijós* (e.g., Brito 1829; Boiteux 1917; Nowell 1946; Rohr 1959).[71] The Guarani name for the island was *Meiembipe* which has been translated by Evaldo Pauli (1983) as "mountains along the canal" referring to the view of the island from the continent; the strait between the continent and the island was called *Jureremirim* (also spelled Jururê-mirin or Yuru minrin) translated as "small mouth" (Nowell 1946; Rohr 1959; Pauli 1983).

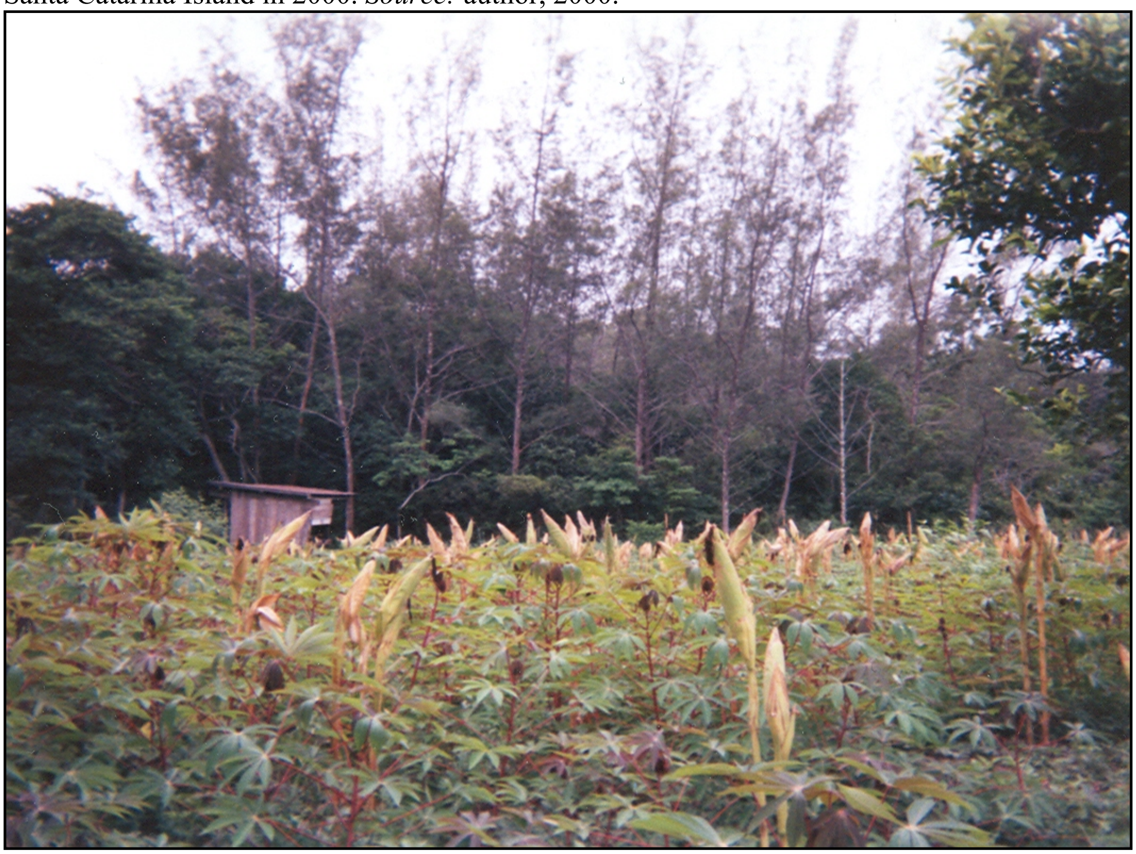
[71] The name *Carijó* has been used to designate a subset of the many linguistically-related Tupi-Guarani groups. In 1500, most of the indigenous populations living along the coast from present-day Maranhão to São Paulo spoke Tupi while most of those occupying the coast from present-day Paraná to Argentina spoke Guarani (Prous 2005). Carijó populations inhabited coastal areas within the region that later became southeastern and southern Brazil. Other coastal Tupi-Guarani groups include the Potiguara along what are today the Ceará and Paraíba coasts, the Caeté in the coastal area from Itamaracá in Pernambuco to the mouth of the San Francisco River at the border between Alagoas and Sergipe, the Tupiniquim along what became the São Paulo coast, and the Tamoio in the area that is now Rio de Janeiro (Abreu 2004; Araujo 2005; Diegues 1995).

While some Carijó sites occur in areas formerly occupied by the Itararé, it is not yet clear whether or not the two groups interacted (Silva 1988; Silva *et al.* 1988; CECCA 1997a). Unlike most Itararé pottery, the Carijó pottery found on the island is typically decorated with white, red, or black paint; another difference between the two cultures is that in addition to food-related pottery use, the Carijó made ceramic burial urns (Gonçalves and Carlson 2003). Other Carijó artifacts including blades, arrowheads, and adornments made from wood, bones, teeth, shells, stones, and vegetable fiber have also been uncovered on Santa Catarina Island (Chapman 1973; Gonçalves and Carlson 2003).

Artifacts provide insights into the activities of Carijó society and their use of different ecosystems and elevational zones for sustenance. Based on both archaeological evidence and accounts by early European travelers (namely the expeditions led by Sebastiano Caboto in 1526 and by Álvaro Nuñez Cabeza de Vaca in 1541, both discussed below) the Carijó lifeway integrated fishing, hunting, and gathering with the cultivation of manioc, gourds, squash, maize, beans, cotton, chili peppers, peanuts, and tobacco on the island's holocenic sandy coastal plains (Piazza 1970; Saint-Hilaire 1978[1851]; Caruso 1990: 79-80; Gonçalves and Carlson 2003). Researchers believe that many of their cultivars in southern Brazil were derived from plants transported by their Amazonian ancestors. Given that manioc cultivation was central to this culture, the sandy plains (i.e., the *restinga* areas) were preferred sites for establishing villages.

Regardless of whether or not Itararé and Carijó people had direct contact, based on findings of site reoccupations, it appears that Itararé land-use patterns influenced Carijó settlement to some extent. Generations later, it is unquestionable that Carijó culture influenced the settlement and subsistence patterns of colonial populations arriving from Europe. Furthermore, at the start of the twenty-first century when my fieldwork for this dissertation project began, some of the contemporary agricultural practices that originated from Amerindian culture were apparent on the Campeche Coastal Plain (see Figure 4.1). Many of the present-day roads and trails in the municipality of Florianópolis can be traced back to the network of footpaths used by indigenous societies for gathering and hunting and to access cultivated plots (see Zeferino, Santos, and Câmara 1998; Zeferino 2001, 2004).

Figure 4.1 The intercropping of manioc and maize in a plot on the Campeche Coastal Plain of Santa Catarina Island in 2000. *Source:* author, 2000.



4.3.5 A Brief History of Archaeological Research in Santa Catarina State

Although a few archeologists, geologists, and paleontologists began studying sambaquis and ancient rock art in the states of São Paulo, Paraná, Santa Catarina, and Rio Grande do

Sul from the 1910s to the 1940s (Abreu 1928, 1932, 1944a, b; Meggers 1985; Gonçalves and Carlson 2003; Comerlato 2005; Neves *et al.* 2005), it was not until the 1950s and 1960s that coordinated long-term scientific research and professional training programs were established to examine archaeological sites throughout Brazil and to analyze findings towards the construction of frameworks, typologies, and chronologies (Hurt 1964; Meggers 1965, 1969, 1985; PRONAPA 1970; Chapman 1973; Schmitz 1987; Delle 2003).[72] By the late 1960s archaeological methodologies developed by the first generation of professionally-trained investigators were widely adopted throughout Brazil. From 1965 to 1970 the Smithsonian Institution of the United States and Brazil's *Conselho Nacional de Pesquisas* (CNPq; Brazilian National Research Council) conducted the *Programa Nacional de Pesquisas Arqueológicas* (PRONAPA; Brazilian National Program for Archaeological Research) involving a coordinated plan for 11 Brazilian primary investigators to carry out research at 1,500 sites within Brazil's coastal region extending from the mouth of the Amazon River to southern Brazil's border with Uruguay including the states of Pará, Rio Grande do Norte, Bahia, São Paulo, Minas Gerais, Rio de Janeiro, Paraná, Santa Catarina, and Rio Grande do Sul. A separate initiative led by Pedro Ignacio Schmitz based in Rio Grande do Sul convened archeologists from Santa Catarina, Paraná, Rio Grande do Sul, Uruguay, and Argentina (Schmitz 1967; PRONAPA 1970; Meggers 1985).

The earliest phase of archaeological research on Santa Catarina Island began in the late 1950s with investigations led by Jesuit priest João Alfredo Rohr, S.J. Beginning his early scientific career with studies in biology and later specializing in botany, Rohr

[72] Brazil's Federal Law No. 3924/61 protecting Brazilian archaeological sites was passed in 1961; in addition, Articles 23, 215, and 216 of the Brazilian Federal Constitution of 1988 protect the country's archaeological patrimony (Delle 2003; Bastos and Teixeira 2004).

eventually dedicated himself to archaeological research. Having authored more than 90 scientific papers and having registered 430 archaeological sites in the state, Rohr is considered Santa Catarina's pioneer in archaeology both for the extensive body of research he produced and for his life-long commitment as an advocate for the protection of archaeological sites (Gonçalves and Carlson 2003).[73] Many of his findings were published in an anthropology series published by the Instituto Anchietano de Pesquisas in São Leopoldo (Rio Grande do Sul State) called *Pesquisas* (Rohr 1966a, 1966b, 1968, 1969; Meggers 1969, 1985; Rohr and Andreatta 1969). Rohr conducted surveys of sambaqui sites and followed a number of these surveys with excavations. He undertook his first excavation in 1958 at Base Aérea (Caiacanga Mirim site), quickly followed by another in 1959 at Praia Grande (also known as Moçambique Beach). In 1962, he began the excavation at Tapera Beach which over the course of about four years resulted in the discovery of 172 human burials (93 adults and 79 children) (Gonçalves and Carlson 2003). Excavating the Pântano do Sul sambaqui in 1975, Rohr found artifacts associated with food preparation, skeletons dated about 4,500 BP, and evidence of footpaths from the island coast to its mountain ridges (Zeferino, Santos, and Câmara 1998: 108). Rohr was also involved in the study of Armação do Sul (Rohr and Andreatta 1969) and the Rio Tavares IV sambaqui (Gonçalves and Carlson 2003).[74]

Walter F. Piazza of the Anthropology Department at the Universidade Federal de Santa Catarina (UFSC) led several archaeological investigations in both the highlands and coastal lowlands of Santa Catarina State and systematically documented research

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[73] For a time, Padre João Alfredo Rohr served as director of a Jesuit high school (*Colégio Catarinense*) in Florianópolis (Meggers 1985; Gonçalves and Carlson 2003).

[74] The work of Igor Chymz, a contemporary of Rohr, is also noteworthy. Chymz (1976) published on the coastal ceramic cultures of Paraná and Santa Catarina.

findings at these various rock-shelter, petroglyph, and ceramic sites (Meggers 1965; Piazza 1966a, b). On Santa Catarina Island, Piazza coordinated the 1962 excavation of the sambaqui at Ponta das Almas in the Lagoa da Conceição District (Gonçalves and Carlson 2003) and continued to serve as an advisor during subsequent excavations at this site (Meggers 1968). In 1964, Piazza began to excavate the Guarani ceramic site at Lagoinha do Rio Tavares in Campeche District (Gonçalves and Carlson 2003).

In 1969, as part of a larger body of archaeological research investigating a number of coastal sites in Santa Catarina from the São Francisco region along the state's northern coast to the Laguna region along the state's southern coast (Meggers 1969; Beck, Duarte, and Araújo 1970; Beck 1972), Anamaria Beck coordinated an excavation on Santa Catarina Island at the Rio Lessa sambaqui uncovering remnants of Itararé pottery. Around the same time, Gerusa M. Duarte conducted a survey of sambaqui sites throughout the island and gathered an extensive collection of artifacts (Duarte 1971). Beck, Duarte, and Edison Araujo had previously assisted in the excavation of the Ponta das Almas sambaqui (Meggers 1968). During the 1980s Teresa D. Fossari coordinated a project called "The Prehistoric Settlement of Santa Catarina Island" which catalogued more than 120 sites in the area (Fossari 1994). In the early 1990s, Maria Madalena Velho do Amaral (1995) developed a research framework for the lithic workshop sites as part of her master's project. As recently as 1997, De Masi excavated a site in Rio Vermelho finding evidence of human occupation from 5,020 to 910 BP (De Masi 1999; Gonçalves and Carlson 2003: 17).

According to Bastos and Teixeira (2004), there are 142 registered archaeological sites located within the municipality of Florianópolis. Records for these archaeological sites are registered under the *Cadastro Nacional de Sítios Arquelógicos* (CNSA; Brazilian National Register of Archaeological Sites) maintained by the *Instituto do Patrimônio Histórico e Artístico Nacional* (IPHAN; Brazilian National Institute of Historic and Artistic Heritage) which is the federal agency responsible for documenting and protecting archaeological heritage sites (Bastos and Teixeira 2004; Comerlato 2005).

In recent decades, collections and archives have been established at two local museums. The *Museu do Homem do Sambaqui "Padre João Alfredo Rohr, S.J."* at the *Colégio Catarinense* (founded by Rohr in 1964) now contains over 5,000 prehistoric artifacts obtained from Itapiranga in western Santa Catarina, from Laranjeiras Beach (located on the mainland coast north of Florianópolis), and from Santa Catarina Island. The island artifacts in this collection are primarily from the sites at Base Aérea, Armação do Sul, Pântano do Sul, and Tapera Beach including human skeletons dated between 1,552 and 1,055 BP. The second local museum, the *Museu Universitário Oswaldo Rodrigues Cabral* at UFSC (initially established in 1965 as the *Instituto de Antropologia*), contains both prehistoric and colonial period artifacts (Gonçalves and Carlson 2003).

Lastly, it is important to describe the *in situ* lithic workshop and petroglyphs sites. Lithic workshop sites have been found at about 25 beach and islet locations in the area including Barra da Lagoa, Santinho, Galheta, Matadeiro, Armação, Pântano do Sul, Naufragados, Ponta das Canas, Ingleses, Joaquina, Campeche Island, and Anhatomirim Island (Amaral 1995; Gonçalves and Carlson 2003). Hundreds of prehistoric petroglyphs occur on Santa Catarina Island at Santinho, Galheta, Pântano do Sul, Armação, Ingleses, Barra da Lagoa, Mole, Ponta das Canas, Joaquina, Solidão, and on the islets of

Campeche, Arvoredo, Aranhas, and Coral (Rohr 1969; Gonçalves and Carlson 2003; Soares 2003; Comerlato 2005). Despite the advancement of a few theories, researchers are still uncertain about which Amerindian group or groups were responsible for either the stone workshops or the artistic rock carvings (Gonçalves and Carlson 2003). In recent years many of these sites, particularly those at Santinho Beach, Ingleses Beach, and on Campeche Island, have become popular tourist attractions (see Figure 4.2).

Figure 4.2 A prehistoric petroglyph site located along a trail near the southern end of Santinho Beach, Santa Catarina Island. *Source:* author, October 2003.

4.4 Colonial Settlement and Deforestation of Santa Catarina Island (1500–1822)

4.4.1 Background Information on the Diverse Origins of Brazilian Society

In addition to chronicling the history of Santa Catarina Island and its vicinity from the early 1500s to the early 1800s, section 4.4 presents pertinent information about the diverse origins of Brazilian society overall. By framing *catarinense* (meaning "of Santa Catarina") history within the broader historical contexts of Portuguese and Spanish America and later Brazil, my primary purpose here is to demonstrate how contemporary patterns of both land use and social inequality in Brazil are linked to the country's colonial and imperial past. Over the course of more than three centuries, various ideologies, institutions, policies, and practices related to monarchical governments, the Catholic church, agricultural production, and international commerce such as methods of frontier expansion and resource extraction, systems of land distribution, and slavery—whether legally sanctioned, in violation of law, or neither—formed a regime that privileged white, male, and, predominantly, Christian Europeans at the expense of diverse peoples of Amerindian and African origins (Bethell 1969; Schwartz 1970, 1977, 1978, 1982, 1985, 1992, 2000; Beeman 1971; Worcester 1973; Russell-Wood 1977, 2000, 2005; Hemming 1978, 1987; Galloway 1979; Chasteen 1991; Monteiro 1994; Dean 1995; Mattoso 1996; Fausto 1999; Abreu 2004; Wadsworth 2004; Metcalf 2005a). Sociospatial patterns of inequality, rooted in the colonial establishment of a hierarchical social order, are evident today at regional, metropolitan, and neighborhood scales.

Although there is some evidence and much speculation of several pioneering voyages to the South American continent by European mariners during the late fifteenth century, official European-sponsored exploration of the South Atlantic coastline in the region that became eastern Brazil is conventionally marked by the visit in 1500 of an unprecedentedly large and well-equipped fleet at the command of Pedro Álvares Cabral in service of the Portuguese crown (Nowell 1936; Dias 1992; Fausto 1999).[75] Following Vasco da Gama's successful return to Lisbon in 1499 after reaching the west coast of present-day India by sailing around the southern tip of Africa, Portugal's King Manuel I sponsored Cabral's expedition with the primary ambition of continuing exploration and expansion of the Portuguese empire's burgeoning trade route to Asia. Before sailing around the Cape of Good Hope towards destinations on the Malabar Coast, this expedition crossed the Atlantic Ocean reaching northeastern South America at present-day Bahia (~17°S) where Cabral claimed possession of the land for Portugal naming it *Terra de Vera Cruz* (Land of the True Cross) (Nowell 1936; Beeman 1971; Delson and Dickenson 1984; Dean 1995: 42; Eakin 1997; Skidmore 1999; Anderson 2000).[76] As Nowell (1936) and Marchant (1941a) pointed out, at this time Portugal's rulers valued lands in the South Atlantic mainly as way stations for ships traveling to Asia. Thus Portuguese America was initially planned as an extension of the Atlantic outposts already established on the Madeiras, Azores, and Cape Verde Islands. Cabral sent one of his ships back to Portugal to report on this "discovery" of land to the west and on the group's experiences with the native population encountered there.[77]

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[75] Cabral's expedition, which began with 13 vessels carrying between 1,200 and 1,500 men, sailed from Portugal in early March 1500 and reached the South America coast in April 1500 (Nowell 1936; Maior 1972; Dias 1992; Fausto 1999). Duarte Pacheco Pereira may have clandestinely explored the South American coastline for Portugal in 1498 and joined Cabral's fleet two years later to contribute his experience to the follow-up mission (Nowell 1936; Maior 1972: 23). An expedition led by Spanish navigator Vicente Yáñez Pinzón is also credited with reaching the South American coast in late January 1500 before Cabral (Maior 1972: 21-22).

[76] Although some continue to entertain the notion that Cabral's landing on the South American coast may have been accidental (e.g., Beeman 1971; McNeill 1986: 123; Fausto 1999: 6), it seems likely that this leg of the expedition's itinerary was indeed intentional. Nowell (1936: 311) traced the history of this debate back to 1849 when Brazil's Emperor Dom Pedro II proposed the research question, "Was the discovery of Brazil by Pedro Álvares Cabral due to a mere accident or had he any information to guide him?" to members of the *Instituto Histórico e Geográfico Brasileiro* (Brazilian Historical and Geographic Institute).

[77] A first-hand account of this encounter, dated 1 May 1500, was written by Pero Vaz de Caminha, captain of one of the fleet's vessels (Nowell 1936; Cortesão 1943; Caminha 1965[1500]; Beeman 1971; Maior 1972). Cabral's expedition departed from South America in early May 1500 and went on to establish a

Around the year 1500, Portugal's total population numbered somewhere between 1 and 1.5 million inhabitants (Passos 1969: 137; Worcester 1973: 1), while estimates of the indigenous population living in the territory that became Brazil range between 2 and 5 million inhabitants (Hemming 1978, 1987; Eakin 1997: 13; Fausto 1999: 7–9; ISA 2006).[78] As the process of European imperial overseas expansion began to take hold in the New World and knowledge of its resources spread, Portuguese America emerged in the early decades of the 1500s as an export-oriented economy largely based on the logging of brazilwood (*ibirapitanga* in Tupí; *pau-brasil* in Portuguese; scientific name *Caesalpinia echinata*) from the secondary forests of eastern South America, along the coastline from present-day Rio Grande do Norte (~5°S) to Rio de Janeiro (~23°S), giving rise to the colony's name Brazil (Beeman 1971: 614; Maior 1972; Worcester 1973; McNeill 1986; Dean 1995: 45; Conley 2000: 756; Baer 2001).[79] Prior to the commercial extraction of brazilwood in South America, Asian dyewood trees of the same genus (*Caesalpinia sappan*) had already become highly valued in European markets as a source of brazilin which was used as a red dye (Maior 1972; Dean 1995: 45). Despite the Portuguese crown's declaration of a monopoly on the South American brazilwood trade in 1534 (Dean 1995: 50), contraband activity persisted.

As was the case in Portuguese colonies in Africa and Asia during this time period, the earliest South American coastal sites occupied by the Portuguese were conquered and fortified to create a network of enclaves and trading posts, called *feitorias,* supporting

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trading post at Calicut on the Malabar Coast, losing four vessels in a storm while rounding the Cape of Good Hope (Maior 1972). The surviving ships and seamen eventually returned to Portugal in June 1501.

[78] Denevan (1992: 370) estimated an indigenous population of 8.6 million for all of lowland South America at the end of the fifteenth century.

[79] *Caesalpinia echinata* attains heights of eight to 12 m and an average diameter of 80 cm; another species of brazilwood (*Caesalpinia crista* or *pau-de-pernambuco*) was extracted from a region that became part of Pernambuco State (Maior 1972).

bartering activities with indigenous populations (Beeman 1971; Eakin 1997; Fausto 1999; Skidmore 1999). These fortified enclaves were built by the Portuguese as a form of protection from the threat of hostility from Amerindian groups and European competitors. In addition to bartering for brazilwood, food, and labor, the Portuguese traded with Amerindians for captives held among rival indigenous groups. These "ransomed" prisoners were referred to by the Portuguese as *resgatados* (Schwartz 1978; Dean 1995; Metcalf 2005a: 376). Typically, the enslaved *resgatados* were forced to provide labor for colonial ventures in South America. In some instances, they were transported to Europe.[80]

Bartering relationships between indigenous peoples of eastern South America and newly-arrived Portuguese sailors—sometimes associated with intermarriages of the more highly-regarded sailors with the daughters of indigenous leaders—were sustained until the 1530s at which point interactions became increasingly confrontational and violent (Nowell 1936; Marchant 1942b; Beeman 1971; Worcester 1973; Hemming 1978; Schwartz 1978; Dean 1995; Abreu 2004).[81] As the conquerors and colonists expanded their land occupations for the purposes of resource extraction and later for agricultural development and permanent settlement, indigenous population losses reached genocidal proportions (Dean 1995: 60–62). The colonists' dual practice of exchanging merchandise for human captives with indigenous allies and of direct enslavement of conquered indigenous enemies accelerated over the course of the sixteenth century. Indigenous

[80] Before the use of this tactic in South America, the Portuguese had been practicing *resgate* in West Africa to supply slaves to mainland Portugal and the Portuguese Atlantic island colonies. Initiating the long period of transatlantic traffic in human cargo from Africa to eastern South America, African slaves were transported either directly from the Guinea coast or from the island of São Tomé to the Portuguese American settlement of São Vicente as early as 1531 by Martim Afonso de Sousa (Piazza 1975: 11–12).
[81] European metal tools such as steel axes and knives and iron fishhooks were among the items most highly valued by Amerindian traders who were often willing to exchange brazilwood, captive humans, a variety of live animals, and pelts for exotic ironware (Dean 1995: 47–49).

mortality rates were particularly severe in coastal areas due to the combined impacts of warfare, displacement, dispossession, enslavement, and the introduction of various Old World epidemic diseases (Hemming 1978, 1987; Denevan 1992; Dean 1995; Eakin 1997; Fausto 1999; Bonnici 2002; Veiga 2004; Metcalf 2005a, b; Russell-Wood 2005).[82]

The Treaty of Tordesillas, negotiated between the Spanish and Portuguese crowns in mid-1494, declared that a meridian drawn 370 leagues west of the Cape Verde Islands would formally demarcate lands to the west of the line as Spanish possessions and those to the east as Portuguese territory (Nowell 1936; Anderson 2000; Turnbull 2005).[83] In practice, however, the formal claims of the treaty were not always upheld by the Iberian powers nor were they respected by non-Iberian European states with substantial naval capacity such as France, Holland, and England (Dean 1995; Skidmore 1999). From the time of the Treaty's negotiation to the early decades of the nineteenth century as the South American colonies began to gain their independence, the Spanish and Portuguese spent more than three centuries struggling over control of lands in the New World. Portugal acted strategically not only to defend its claims under the treaty, but also to extend its New World dominions west of the treaty's defined limit. For a period of six decades, between 1580 and 1640, the Spanish and Portuguese crowns were united, under the successive reigns of King Philip II (*Filipe I*), King Philip III (*Filipe II*), and King Philip IV (*Filipe* III) of Spain (*of Portugal*), to form an Iberian Union (Fausto 1999: 40-

[82] In addition to the Portuguese, other European traders, soldiers, and colonists interacting with South Atlantic Amerindian populations during the early decades of the sixteenth century included the Spanish, French, Dutch, English, Irish, and German (Russell-Wood 2005; Martel 2006).

[83] Papal bulls had been issued by Pope Alexander VI in the previous year (1493) with the intention of dividing the New World territories between the Spanish and Portuguese crowns; however, they were rejected by the Portuguese.

44).[84] This period has also been referred to as the Philippine dynasty, the "Spanish Captivity" (Boxer 1949; Worcester 1973), and the "Babylonian Captivity" (Nowell 1952: 135–149). Once Portugal began to restore its independence in 1640 under the House of Bragança, conflicts resumed between the Portuguese and the Spanish surrounding competition for frontier areas in South America. This dynamic continued throughout the Colonial Era.

In addition to its rivalry with Spain, Portugal faced significant threats from other European nation-states that disregarded what must have seemed to them outrageously greedy and overreaching claims of ownership made by the Iberian powers under the Tordesillas pact. Early exploratory expeditions, trading activities, and colonization efforts organized by the French posed a serious threat to Portugal's interests during the sixteenth and early seventeenth century (Marchant 1942a; Nowell 1949; Beeman 1971; Maior 1972: 44−45; Costa and Menezes 2002). For most of the seventeenth century, the Dutch were Portugal's major commercial and military rival in the New World (Boxer 1949; Nowell 1952). As early as January 1504, the ship *L'Espoir* at the command of Binot Paulmier de Gonneville, having left Honfleur, Normandy in June 1503 with the Orient as its destination, reached the northern coast of present-day Santa Catarina—approximately 2,000 km southwest of Cabral's landing site four years earlier—in the area known today as São Francisco do Sul (Gonneville 1869; Perrone-Moisés 1996; Skidmore 1999; Araujo 2005: 16). From 1504 until about 1630, French mariners established bartering

[84] The lack of a royal heir to Portugal's throne led to Spain's formal takeover of Portugal until a successor to the Portuguese throne, João II, was proclaimed king in 1640 (Skidmore 1999). According to Skidmore (1999), the most notable legacy of formal Spanish rule during the 1580−1640 period was the regularization of administrative and judicial procedures by Spanish authorities which led to strong resemblances between the governments of Spanish America and Brazil; this included the development of new civil and penal codes in the early seventeenth century.

relationship with Amerindians at various coastal sites. From 1555 to 1560, under the command of Nicolas Durand de Villegagnon, French forces occupied an island in Guanabara Bay at present-day Rio de Janeiro constructing Fort Coligny (Léry 1990 [1578]); writers of the time period such as André Thevet referred to the site as *France antarctique* (Antarctic France) (Anchieta 1933: 310−312; Nowell 1949; Worcester 1973; Forsyth 1985; Conley 2000; Schwartz 2000; Araujo 2005: 16; Martel 2006). The Dutch, with the support of the Dutch West India Company, occupied and maintained control over the sugar trade operating out of Recife, Pernambuco from 1624 to 1654 (Boxer 1949; Worcester 1973: 253; Fausto 1999; Skidmore 1999). By some estimates, Dutch forces succeeded in capturing more than 500 Portuguese and Spanish vessels between 1623 and 1638 (Boxer 1949; Anderson 2000).

Due to uncertainties surrounding the economic potential of ventures in the New World, during the early sixteenth century the Portuguese crown adopted a decentralized, privately-sponsored approach to colonization in eastern South America in order to minimize costs (Marchant 1942a; Beeman 1971: 622; Baer 2001: 11−12). At this time, Portugal's rulers prioritized enterprises aimed at exploiting overseas trade along the west and east African coasts, along the west coast of present-day India, and in the Persian Gulf. By the second decade of the sixteenth century, Portuguese mariners were reaching further destinations in the East such as the Moluccas, Timor, Ceylon, and Macau. Therefore, as a means of avoiding the expense of state-sponsored colonization and centralized administration in its nascent South American colony, between 1534 and 1536, adding to one previously granted concession, the Portuguese crown under King João III demarcated an additional 14 hereditary captaincies (*capitanias hereditárias*) and by royal charter (*cartas de doação*) distributed the rights to develop these extensive tracts among a dozen individuals named *donatários* (Marchant 1942a; Beeman 1971; Johnson 1972; Maior 1972: 52–61; Worcester 1973; Dean 1995; Fausto 1999; Skidmore 1999; Anderson 2000; Baer 2001).[85] Thus the burden and cost of colonization, economic development, and administration was placed on the shoulders of these *donatários*—private investors who incurred the cost of pioneering settlement in their captaincies in exchange for extensive powers and privileges. Among their economic, political, judiciary, and administrative powers as granted by royal charters called *forais* were the rights to: enslave and sell Amerindians; administer civil and criminal courts; found *vilas* (towns) and nominate their administrators; concede *sesmarias* (i.e., titled lots with specified property boundaries ranging in area from about 60 to 130 km² each) for agricultural use by settlers; and collect a variety of taxes (Marchant 1942a, 1942b; Lima 1954; Piazza 1970; Beeman 1971; Maior 1972: 53; Chasteen 1991; Skidmore 1999: 10–14; Baer 2001; Abreu 2004).[86] Ultimately, only two of the original 15 captaincies—Pernambuco and São Vicente—prospered (Marchant 1942a; Bethell 1984; Fausto 1999; Skidmore 1999). Six additional captaincies were created in the 1620s in Maranhão which reported directly to Lisbon rather than to Salvador. Over the course of the eighteenth century, for reasons addressed below, many of the original captaincies were reorganized and new captaincies were created such as São Paulo and Minas de Ouro (1709), Minas

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[85] Prior to applying the captaincy system in Brazil, Portugal had used a similar approach in the fifteenth century to occupy the Atlantic islands (i.e., the Azores, Madeira, Cape Verde, and São Tomé); concessions were granted to prominent individuals giving them the right to colonize the islands at their own expense (Marchant 1942a; Johnson 1972; Maior 1972: 52; Worcester 1973).

[86] *Donatários* have been described generally as gentry or petty noblemen of Portugal's "*pequena nobreza* and the middle class" (Marchant 1942a: 505). As Fausto (1999: 11–12) noted, "There was no one from the high nobility on the list of original donataries because at that time dealings in India, in Portugal, and on the Atlantic islands were more attractive." Beeman (1971: 623) explains that "The *donatarios* themselves came from different classes and the settlers living on the *donatario* grants had ample opportunity to move up and down the social scale as their economic progress dictated."

Gerais (1721), Santa Catarina (1738), Goiás (1748), and Mato Grosso (1748) (Skidmore 1999; Russell-Wood 2005).

Nearly half a century after Cabral's visit and about 15 years after institution of the captaincy system, the Portuguese government took measures to establish formal authority in and develop greater control of its New World dominions. To a large extent the Portuguese were responding to continued incursions by the French as sugar produced in the northeast became an increasingly profitable export, particularly in the captaincy of Pernambuco which had been granted to Duarte Coelho Pereira (Beeman 1971). In addition to expulsion of the French, they were concerned to curb territorial encroachments by the Spanish and others. In 1549 a representative of the Portuguese royal government, Tomé de Sousa, was appointed to the post of governor-general and sent to Portuguese America; he was accompanied by the high-ranking Jesuit priest Manuel da Nóbrega and about 1,000 colonists to found the colony's capital at Salvador, Bahia (Anchieta 1933; Beeman 1971; Worcester 1973; Skidmore 1999; Anderson 2000; Russell-Wood 2000; Abreu 2004; Wadsworth 2004; Metcalf 2005a).[87] By this time, news of riches derived from the Andean Potosí mines was widespread, and interest in finding additional sites containing precious metals was growing (Dean 1995; Guerra 2004).

Between 1549 and 1604, twenty-eight Jesuit missions arrived in Portuguese America (Anderson 2000: 94). Initially the brothers of the Society of Jesus established mission villages (*aldeias*) in Bahia. Later they expanded the *aldeia* system in other

[87] Quoting Beeman (1971: 628–629), "in 1549, the donatários were allowed to keep as much land as they had actually brought under cultivation, but much of their political power was taken over by a royal governor, a chief justice, and a treasury official….The single most important decision made by the Portuguese royal government was to continue to attempt to exploit the land and the people of the New World to the fullest extent possible. Only the emphasis had changed; the exploitation was no longer to be purely extractive, but, rather, was to be aimed at utilizing Indian and imported labor in the intensive cultivation of export crops."

captaincies. Supported by crown policy, the Jesuit *aldeias* were part of a system set up to displace, catechize, and acculturate Amerindians for the purpose of organizing indigenous labor pools that would contribute to the economic development of the colony (Schwartz 1978). *Aldeias* also served colonial interests by extending the frontier (Dean 1995: 71).[88]

In addition to the highly influential Jesuit presence in colonial Brazil for about two centuries from the mid-sixteenth to the mid-eighteenth centuries, several other religious orders, such as the Carmelites, Franciscans, Dominicans, and Benedictines, were active (Habig 1946). Russell-Wood (2000: 817–818) in a paper addressing clerical participation in the remittances of gold from Brazil to Portugal from 1706 to 1750, describes the economic role of these religious orders as follows:

> The Society of Jesus most notably, and all religious orders to a greater or lesser extent, were inexorably drawn into the colonial economy. This was attributable to their entrepreneurial acumen in some instances; in others, it was the result of being the beneficiaries of legacies, such as land, urban properties, slaves, cattle, mines, plantations, and cash, whose administration religious houses accepted in anticipation of the revenues which they would generate for the order. Religious orders in Portugal viewed Brazil not only as a fertile land for evangelization but also as a resource to be tapped in their efforts to rescue themselves from financial straits.

Thus these various religious orders played a crucial role in facilitating Portuguese occupation of South American lands.

On the other hand, conflicts between Jesuits and other colonists mounted because many settlers were unwilling to pay for *aldeia*-based indigenous labor, preferring instead to acquire Amerindians as slaves. With promulgation of a new law in 1570, the Portuguese crown under King Sebastião attempted to limit the capture and enslavement

[88] It is relevant to note that Jesuits administered sugarcane plantations and sugar mills exploiting Amerindian and African labor, for example on the Engenho Santana in Ilhéus and the Engenho Sergipe do Conde in the Bahian Recôncavo (Schwartz 1977: 71). According to Morton (1978: 42–43), the Jesuits "came to own no less than 145 kilometers of coastline in Ilhéus alone" and participated in the timber and firewood trade.

of Amerindians to declarations of "just war" against indigenous groups deemed to be enemies of Portugal (Beeman 1971). According to this new policy, declarations of just war had to be sanctioned either by the king or the colony's governor-general. In some cases, settlers successfully circumvented the 1570 law by obtaining government permission even when their proposed targets were non-threatening indigenous populations. For instance, in 1585, when settlers in São Vicente, Santos, and São Paulo sought the approval of the colonial authorities to organize an expedition against the Carijós under the guise of just war, their petition highlighted the scarcity of slave labor rather than any direct threat posed by this group to the Portuguese (Monteiro 1994, 2000; Abreu 2004). Because the law of 1570 turned out to be largely ineffective in curbing Amerindian slave-hunting expeditions, the Jesuits continued to lobby the royal government and the Papacy for greater control over the transfers of indigenous populations. Several new royal orders addressing the enslavement of Amerindians were issued by the Spanish crown in 1587, 1595, 1596, 1605, 1609, 1611, and 1639 during the Iberian Union and, later, by the Portuguese crown in 1648, 1655, and 1686 (Beeman 1971; Abreu 2004). Over and over settlers protested restrictions on the enslavement of Amerindians and managed to manipulate the system to suit their interests, in defiance of the Jesuit agenda and with tragic consequences for indigenous people (Skidmore 1999; Abreu 2004: 371; Metcalf 2005a). By the time Portugal restored its independence in late 1640 under King João II of the House of Bragança, Jesuit *aldeias* were under frequent attack by settlers.

Commercial agricultural production for export exploiting slave labor expanded from the mid-sixteenth to the mid-seventeenth century in the northeastern coastal zone with the establishment of lucrative sugarcane plantations and sugar mills on lands surrounding Salvador in Bahia and Recife/Olinda in Pernambuco.[89] Following the arrival of the first governor-general and the first Jesuits in 1549, wealthy sugarcane planters operating in the northeast accelerated the brutal exploitation of African slave labor at a point in time when Amerindian coerced labor was deemed insufficient to meet the demands of European investors in the expanding colonial enterprises (Beeman 1971; Mattoso 1996; Eakin 1997; Abreu 2004; Metcalf 2005a). By the 1580s, Portuguese planters in South America were importing more than 2,000 Africans annually to work as slaves (Skidmore 1999: 17). During the 1620s, the rate of importation increased to 15,000 annually, and about 40,000 Africans were enslaved in Portuguese America, providing field labor and the labor needed to run about 230 sugar mills producing 22.4 million pounds of sugar annually (Beeman 1971: 631).[90] By 1850 when slave traffic between Africa and Brazil was officially prohibited, over 3.65 million Africans from many different regions—including Senegambia, Angola, the Congo, the Mina Coast, the Bight of Benin, and Mozambique—had been transported to Brazil by slave traders (Bethell 1969; Fausto 1999: 18; Skidmore 1999: 17).[91]

As Metcalf (2005a) has documented, despite this increase of African slaves in the coastal plantations and settlements of Bahia and Pernambuco, Amerindian slavery

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[89] Previously, in the fifteenth and early sixteenth centuries, sugarcane had been planted by the Portuguese in southern Portugal and the Atlantic island colonies for export to markets in northern Europe (Baer 2001: 11; Beeman 1971: 631; Dean 1995; Eakin 1997: 17; Fausto 1999; Marchant 1942a; Worcester 1973). The first sugar mill to be built and operated in Portuguese America was established in Pernambuco in 1516; from the mid-sixteenth century to the start of the seventeenth century, the number of operating sugar mills in Brazil increased from only five to 120 (Worcester 1973: 24).

[90] Luiz Felipe de Alencastro estimated that between 1550 and 1575 about ten-thousand Africans were imported to Brazil as slaves and another forty-thousand were enslaved from 1576 to 1600 (Metcalf 2005a).

[91] The enslavement of Africans by the Portuguese dates back to the 1440s during the lifetime of Prince Henrique “the Navigator.” As Portuguese sailors established trading posts along the west coast of Africa during the fifteenth century, in addition to trading for precious materials such as gold and ivory, they exchanged goods for captive people who were then sold into slavery in Europe and the Atlantic islands (Beeman 1971; Worcester 1973; Mattoso 1996; Anderson 2000).

continued to increase after 1570 as *mameluco* (of mixed European and Amerindian parentage) slave traders led or assisted expeditions into the interior (*sertão*) both to capture slaves and to search for precious metals. Metcalf is supported by Dean's (1995: 57) assertion that while the operators of sugarcane plantations and sugar mills surrounding Salvador and Recife controlled enough wealth to compete with Portugal's Atlantic island colonies for African slaves, investors in enterprises in the "less well capitalized and less efficient Southeast" continued to rely heavily on Amerindian slave labor. Another factor driving greater demand for Amerindian slaves in São Paulo's agricultural economy was the shortage of African slaves entering Portuguese America from about 1625 to 1650 during Dutch invasions in West Africa, Bahia, and Pernambuco (Fausto 1999: 49). Before addressing the significance of the various types of operations (i.e., *descimentos*, *entradas,* and *bandeiras*) that emerged during the latter half of the sixteenth century and their role in the formation of colonial Brazil, a brief account of this dissertation's study area during the sixteenth century is necessary.

4.4.2 Santa Catarina Island during the Early-Colonial Period

In 1530, four years before instituting the captaincy system in Portuguese America, King João III appointed Martim Afonso de Sousa commander of an expedition to South America composed of five ships and 400 sailors (Marchant 1942a: 508; Maior 1972; Fausto 1999). First visiting the northeast coast at Bahia, Martim Afonso's fleet sailed southward reaching points at Guanabara Bay, Cananéia, Santa Catarina Island, and the Río de la Plata estuary. After this extensive reconnaissance trip, in 1532 Martim Afonso founded the settlement of São Vicente at a coastal site between Guanabara Bay and

Cananéia which was known as *Temiuru* among Amerindians and had been renamed *Porto dos Escravos* (Port of Slaves) by the earliest Portuguese sailors (Nowell 1946; Maior 1972: 47; Worcester 1973: 253; Dean 1995: 51−56; Fausto 1999; Costa and Menezes 2002). One of Martim Afonso's initial projects in São Vicente was the construction of a sugar mill in 1533 (Worcester 1973).[92] When the Portuguese crown distributed hereditary captaincies from 1534 to 1536, two of the concessions were issued to Martim Afonso. One of these two tracts was centered on the settlement of São Vicente extending along the coastline from Cananéia to Bertioga (within present-day São Paulo State) and the other extended from Parati to Cabo Frio (within present-day Rio de Janeiro State). Although divided into two lots separated by the captaincy of Santo Amaro, together these territories formed the captaincy of São Vicente.

Portuguese America's southernmost captaincy of Santana (or Terra de Sant'Ana) was situated along a narrow strip of coastal land precariously close to the Tordesillas Line (Rodríguez 1958: 185; Maior 1972: 56; Bethell 1984: 263; Caruso 1990: 83; Dean 1995: 43, 67). Latitudinally, it extended from about 25°S at Cananéia to about 28°S at Laguna encompassing the entire stretch of the present-day Paraná State coast and most of the coastal zone of present-day Santa Catarina State. On January 21, 1535, King João III issued the captaincy of Santana to Pero Lopes de Sousa who was the brother of Martim Afonso de Sousa (Piazza 1970; Maior 1972; Várzea 1985 [1900]). Pero Lopes also received the northeastern concession of Itamaracá and the southern captaincy of Santo Amaro. Santo Amaro as previously mentioned was situated between the two São Vicente lots, stretching from the sites of Bertioga to Parati. In other words, the rights to develop

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[92] Within 12 years, Martim Afonso had six sugar mills in the captaincy of São Vicente and over 3,000 slaves cultivating the sugarcane and operating the mills (Marchant 1942a: 508).

five of the 15 tracts delineated by the original captaincy plans were bestowed upon these two brothers—the four southernmost captaincies alternated between them and in addition Pero Lopes was named *donatário* of a northeastern captaincy. Pero Lopes disappeared in the waters near Madagascar in 1539 while returning from a voyage to the East Indies. Responsibility for the development of his captaincies was bequeathed to his surviving relatives and lieutenants. His brother Martim Afonso, who lived until 1571, continued to develop São Vicente and advance Portuguese interests in the region with the assistance of several lieutenants. As was the case for all of the original captaincies, Santana fell under Spanish domination from 1580 to 1640 during the period of the Iberian Union.

Prior to the 1530s, several sites along the southern South American coast were visited by expeditions sponsored by a number of European powers. In fact, the concessions under the captaincy system were intended by the Portuguese royal government to accelerate the process of staking tangible claims in these territories and thus deter competitors. When in 1504 the French commander Gonneville and his crew on the *L'Espoir* anchored along the coast at a site which eventually became São Francisco do Sul in northern Santa Catarina, they remained there for about six months and returned to France with at least one Carijó male youth who served as Gonneville's tutor and later married his daughter in 1521 (Gonneville 1869; Perrone-Moisés 1996).

Santa Catarina Island and its immediate surroundings, then called *Meiembipe* and *Jureremirim* by the local Guarani population, as well as continental sites nearby were reached by numerous European-based maritime expeditions during the first decades of the sixteenth century. As a result, a considerable number of shipwreck survivors and deserters remained in the area contributing to a new era in the region's social transformation process.[93] Although the possibility of a brief passage in 1514 by Portuguese navigators Nuno Manuel and Cristóvão de Haro is mentioned in some texts, the earliest contact between the Guarani of Meiembipe and members of European-sponsored expeditions is most often attributed to an expedition of three vessels led by commander Juan Díaz de Solís which departed from Spain in 1515 and is thought to have left several crew members in the Meiembipe area in 1516 (Brito 1829; Nowell 1946; Piazza 1970; Cabral 1971; Várzea 1985 [1900]; Zeferino 2004).[94] Solís was either killed in a confrontation with Amerindians while exploring areas further south, in what later became known as the Río de la Plata estuary but was for a short time named the Río de Solís, or he was killed by members of his own crew in a mutiny. After his death, as the surviving sailors began their return trip to Spain, "one vessel was wrecked off the Brazilian island of Yuru minrin (Santa Catharina)" (Nowell 1946: 454). Somewhere between 11 and 18 survivors of this wreck remained in Meiembipe and Jureremirim; four of them have been identified as Aleixo Garcia (white Portuguese), Henrique Montes (white Portuguese), Francisco Pacheco (black African or mulatto Afro-Portuguese), and Melchoir Ramírez (Spanish) (Nordenskiöld 1917; Nowell 1946; Piazza 1970; Cabral 1971; Bueno 1998).

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[93] In the book *Náufragos, traficantes e degredados: as primeiras expedições ao Brasil, 1500–1531,* Eduardo Bueno (1998) describes the earliest European expeditions reaching the eastern coast of South America, recounting the stories of several men who remained in the New World either 'jumping ship' by their own volition or by circumstance as castaways, exiled convicts, or otherwise banished individuals (*degredados*). In addition to carrying out their banishment, *degredados* were placed on Portuguese expeditions to the New World with the intention of using them to carry out reconnaissance missions and to eventually serve as informers, translators, and facilitators of barter trade (Dean 1995: 44).

[94] Records show that crews leaving Europe during these times included not only European individuals, but also individuals of African origin and of mixed race, therefore, to reflect this knowledge herein I intentionally use the phrase "members of European-sponsored expeditions" rather than the term "Europeans." By the late fifteenth century, Portugal was steadily importing slaves from Africa (700 to 800 annually) and an estimated tenth of Lisbon's population (10,000 of about 100,000) were black Africans (Anderson 2000: 55).

After a few years living among the coastal Guarani, Garcia traveled westward along the Peabirú trail, leading a small party of a half dozen or so of the shipwrecked men including Pacheco, in search of the riches of the Inca empire (Nordenskiöld 1917; Nowell 1946; Piazza 1970; Maior 1972: 46; Anderson 2000: 89–90). It is believed that the others in the shipwrecked party, including Montes and Ramírez, remained on the coast. After enlisting about 2,000 Chiriguano Guarani warriors in the area that became Asunción, Paraguay, Garcia's war party continued across the Gran Chaco toward the outskirts of the Inca empire reaching as far as present-day Bolivia sometime between 1522 and 1524 during the reign of Emperor Huayna Cápac (Nowell 1946).[95] Therefore, Garcia's arrival in Inca territory appears to have taken place before Spanish conquistador Francisco Pizarro's expedition first reached the Inca empire from the north in 1526 (Nordenskiöld 1917; Anderson 2000: 89–90). After raiding some of the peripheral villages under Inca rule, Garcia's war party retreated to the Guarani settlement with plundered silver, copper, and cloth, and Garcia sent two members of his party with a sample of their spoils back to the coast to report his findings (Guzman 1836 [1612]; Nordenskiöld 1917). In 1525, Garcia was killed by Amerindians under uncertain circumstances (Nowell 1946: 460). Some documents indicate that he was survived by a young son named Aleixo Garcia Filho who he had fathered with a Guarani woman and who was probably born in the Meiembipe area sometime between 1516 and 1523. Historian Rosana Bond, author of *A saga de Aleixo Garcia: o descobridor do império inca* (2004 [1998]), recently reported the existence of a sixteenth-century will believed to have been written by Aleixo Garcia Filho in which he leaves his possessions, consisting of cloth and a few Amerindian

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[95] The Inca empire, which emerged in Cuzco in the twelfth century, had by this time expanded considerably to the south encompassing parts of present-day Bolivia, Peru, Chile, and Argentina.

slaves, to his children Domingo, Gracia, and Maria.[96] This recent finding supports an early seventeenth century report by Ruy Díaz de Guzmán (1612) in *Anales del descubrimiento, población y conquista del Río de la Plata*, that Aleixo Garcia had a son with a Guarani woman of Meiembipe.[97]

Without providing a complete list of the many expeditions that reached the Santa Catarina coast during the first half of the sixteenth century, a few more notable cases follow. In 1525, nearly a decade after the arrival of the seamen from the Solís crew, the Spanish ship *São Gabriel* commanded by Rodrigo de Acuña is believed to have left as many as 17 deserters in the then Guarani-inhabited coastal area just south of Meiembipe which would later become the town of Garopaba (Nowell 1946; Cabral 1971). Some of the earliest European maps and other documents name the Jureremirim and Meiembipe area *Porto dos Patos* (or *Puerto de los Patos*) and *Ilha dos Patos* (Brito 1829) respectively, perhaps named by Nuno Manuel and Cristóvão de Haro in 1514 (Nowell 1946; Saint-Hilaire 1978 [1851]; Várzea 1985 [1900]). The literature at my disposal is unclear regarding the origin of the name Santa Catarina Island which would later lend its name to the entire colonial subcaptaincy (1738–1822), imperial province (1822–1889), and eventually to the Republic's southern state of Santa Catarina (1889–present). Várzea (1985 [1900]: 7) footnotes a version of the story which credits either Gonçalo Coelho or Cristóvão Jacques with naming the island in 1501 or 1502 during exploratory travel along the South American coast. Other authors credit sixteenth-century Italian navigator and

[96] Rosana Bond credits historian Roberto Quevedo with locating the document in the National Archives of Paraguay in Asunción (*Archivo Nacional de Asunción*); Quevedo is president of the Paraguayan Academy of History (*Academia Paraguaya de la Historia*).

[97] Both Guzmán and Garcia Filho lived in Ciudad Real del Guayrá (presently the municipality of Guaíra located along the western border of Brazil's Paraná State) in the late sixteenth century where Guzmán claims to have met Garcia Filho (Buss 2006). Nowell (1946) questioned the validity of Guzmán's claims regarding Garcia Filho's existence.

explorer Sebastiano Caboto with naming Santa Catarina Island in 1526 or 1527 after he stopped at the island to restock provisions on his way to the Río de la Plata estuary. By some accounts, Caboto's expedition of three ships and 150 men remained in the area for four months, constructing a ship using timber extracted from the island's forests and naming this ship the *Santa Catarina* which is thought to be the first European-style sailing vessel constructed on the island (Saint-Hilaire 1978 [1851]; Caruso 1990: 79). Piazza (1970), however, raises some doubts about these claims and instead credits cartographer and explorer Diego Ribeiro with labeling the island and neighboring continent *Santa Catarina* on his well-known map the *Padrón Real* dated 1529.

Sebastiano Caboto, who embarked on his journey from southern Spain in 1526 initially with the objective of exploring passage to the Pacific Ocean and charting a new route to the Moluccas, is believed to have encountered survivors of both the Solís and Acuña expeditions and learned from these men of the inland riches found by Aleixo Garcia's party. With this new information, Caboto decided to change plans, sail to the Río de Solís which he renamed the Río de la Plata, and explore the Paraná and Paraguay Rivers. He finally returned to southern Spain in 1530 reporting to King Charles V who then used this information to organize an expedition to the Río de la Plata under the command of Pedro de Mendoza.[98]

Interestingly, a large Spanish expedition led by Álvar Nuñes Cabeza de Vaca, who was appointed governor (*adelantado*) of the Río de la Plata region by the Spanish crown in 1540, spent a considerable length of time on the Santa Catarina coast (Nowell

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[98] Sebastiano Caboto was the son of Giovanni Caboto. In the late fifteenth century, Giovanni Caboto led expeditions to the North Atlantic (reaching Newfoundland) in the service of England. Their names appear in English-language texts as Sebastian and John Cabot and in Portuguese-language texts as Sebastião and João Caboto.

1946; Várzea 1985 [1900]; Costa and Menezes 2002). Cabeza de Vaca's expedition of 400 men and 46 horses was on its way to Asunción over land via the Peabirú trail.[99] It appears that in 1541 at least part of this group spent several months on Santa Catarina Island to repair a ship prior to heading toward Asunción. During their stay on the island, the men encountered Carijó inhabitants cultivating manioc, maize, and cotton, and simultaneously observed extensive forest cover (Caruso 1990: 79–80).

German gunner Hans Staden of Hesse, who traveled on a vessel commanded by Diego de Sanabria, spent about two years in the area after being shipwrecked along with about 100 others in the late 1540s. Staden developed relationships with the local Carijós and reported encountering several of the previous deserters and their offspring with Guarani women on the mainland (Staden 1928, 1929 [1557]; Forsyth 1985; Whitehead 2000; Martel 2006).[100]

As already outlined and as will be addressed in greater depth below, indigenous populations throughout eastern South America were decimated as a consequence of violent confrontations, displacement, enslavement, and the spread of Old World diseases. There is no doubt that the century-long period from the mid-sixteenth century to the mid-seventeenth century was brutal for the Guarani of southern Brazil, driving many of the survivors in coastal areas to seek refuge in the mainland interior. Slave-trade records

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[99] The Spanish settlement of Nuestra Señora Santa Maria de la Asunción was founded by Juan Salazar de Espinosa and Gonzalo de Mendoza in 1537; it developed into a major port along the silver route from mines in the Andean region to trading posts in the New World, and to the ports of Europe. Cabeza de Vaca chronicled his experiences in *Comentarios* which was first published in 1555 (Nowell 1946).

[100] Hans Staden, who spent most of 1553 working for the Portuguese at São Vicente, is better known for his narrative of captivity among the Tupinambá in the region of present-day Rio de Janeiro after being forced to serve as a gunner for the Portuguese. Captured in early 1554, he lived among the Tupinambá for nearly ten months, then managed to return to Europe on a French vessel in late 1554 arriving in Honfleur in Normandy in February 1555. Staden's original manuscript was published in 1557. Translated from German by Malcolm Letts, two English-language editions were published under the title *Hans Staden: the true history of his captivity* (Forsyth 1985; Martel 2006; Staden 1928, 1929).

indicate an estimated 12,000 enslaved Carijós were transported from the seaport of Laguna prior to 1635 (Cabral 1971: 18).[101] Consistent with these circumstances, Santa Catarina Island is believed to have been largely depopulated from about 1550 to 1650 (Saint-Hilaire 1978 [1851]: 120; Zeferino, Santos, and Câmara 1998). Jesuit missionaries traveling in the area in the early seventeenth century reported that the island was deserted (CECCA 1997a; Kuhnen 2002). As Dean (1995: 65) reports occurring in other parts of Brazil, this depopulation period may have allowed the island's forests and other ecosystems to recover from previous human disturbance regimes.[102] Regarding forest policy by the mid-seventeenth century, it is interesting to note that in 1652 the royal government promulgated a law reserving certain highly-valued timber species (i.e., the *madeiras de lei*) exclusively for the Portuguese crown (Miller 2000).

4.4.3 Bandeirismo and the Founding of Nossa Senhora do Desterro

In recent years, the umbrella term *bandeirismo* has been applied in reference to a set of socioeconomic practices that emerged in Portuguese America during the sixteenth century and over time evolved into a variety of forms. The history of bandeirismo is essential to understanding the territorial formation of Brazil and the subjugation of many of the indigenous peoples who managed to survive the initial waves of violence, epidemic diseases, and enslavement that devastated their populations during the first century of

[101] During this time, Laguna was one of the region's primary ports in the slave trade along with the ports of São Vicente and Santos to the north (Cabral 1971a).

[102] Demographic data for colonial Brazil at the start of the seventeenth century is uncertain. Baer (2001: 22), citing Prado (1970), indicates that Brazil's colonial population in 1600 may have been as high as 100,000 individuals. Dean (1995: 64) suggests a more conservative total of about 65,000 persons of which fewer than 10,000 were European and mestizo. Worcester (1973: 33) estimates a total of about 57,000 persons of which 25,000 were white European, 18,000 were Amerindian, and 14,000 were black African.

Portuguese occupation.[103] As coastal indigenous populations declined precipitously, *descimentos* (transfers)—encompassing both violent and non-violent practices by which Amerindians were relocated from inland areas to supply labor to colonial settlements—became increasingly common during the last quarter of the sixteenth century (Dean 1995; Abreu 2004; Metcalf 2005a; Russell-Wood 2005).[104] The conquest of land and indigenous peoples in Brazil continued over the next two centuries with the organization of profit-driven armed expeditions, in groups formed by tens, hundreds, and sometimes thousands of people, called *entradas* and *bandeiras* (Moog 1964; Taunay 1975). During this next phase, in addition to supplying colonists with slaves, expeditions were also geared toward increasing the number of coastal settlements and advancing colonial exploration and occupation of the interior (Fausto 1999: 47–54; Metcalf 2005a, b; Russell-Wood 2005).[105]

Beyond killing, capturing, and dispossessing Amerindians, *entradas* and *bandeiras* were organized to prospect for precious metals and gemstones. Prospecting expanded after 1670 with the encouragement of the Portuguese crown under Dom Pedro II (Rodríguez 1958). Before long, from the 1690s to the 1720s, gold was discovered in highland areas of present-day Minas Gerais, Mato Grosso, Goiás, and south-central Bahia initiating a gold rush. Lasting until about the 1760s, this gold rush shifted the colony's

[103] The etymology of the term *bandeirismo* is addressed in Russell-Wood (2005). Costa and Menezes (2002) used the similar term *bandeirantismo* in reference to the activities of expeditions from the Vila of São Paulo de Piratininga during the sixteenth and seventeenth centuries.
[104] Schwartz (1978) and Dean (1995: 57) referred to Portuguese raids on Amerindian settlements in the sixteenth century as *saltos* rather than *descimentos.*
[105] In the book *O Ciclo da Caça do Indio,* Basilio de Magalhães (1978) suggested that this cycle of capturing Amerindians began in the 1560s, reaching its zenith from 1628 to 1680, and ending by 1695. Presenting other views, Abreu (2004) argued that transfers of indigenous populations for resettlement in labor camps lasted into the eighteenth century, while Russell-Wood (2005: 354) stated that as a "colony-wide phenomenon" *bandeirismo* "persisted in its various manifestations from the sixteenth century through to independence" in 1822. Furthermore, Hemming (1987) documented multiple nineteenth-century campaigns organized during the Imperial Period (i.e., post-1822) by government officials, colonists, and *bugreiros* (Indian hunters) aimed at killing and enslaving Amerindians in southern Brazil.

existing population toward these hinterland areas, attracted a new wave of over half a million young immigrants from Portugal and the Atlantic islands, and transformed the colonial economy profoundly as Brazil became the world's largest gold producer (Anson 1748; Cardozo 1940; Nowell 1952: 162; Boxer 1969; Love 1977; Dean 1995; Fausto 1999: 49–50; Skidmore 1999; Russell-Wood 2000; Baer 2001; Guerra 2004; Langfur 2005).[106] Brazil's gold mining era, which peaked between 1730 and 1750, enabled the Portuguese empire to stave off financial crisis and to invest in imperial navy and merchant fleets as well as in Portugal's scientific, cultural, and educational institutions in Europe (Nowell 1952: 163).[107]

The sugar economy of northeastern Brazil, which had prospered during the late sixteenth century and most of the seventeenth century, faced low sugar prices on the international market and thus serious declines in profits by the 1730s and 1740s, in part due to increased Caribbean sugar production in the Dutch, French, and British colonies (Galloway 1979; Pang 1979; Skidmore 1999; Baer 2001: 13–14).[108] To a considerable extent Brazil's gold cycle made up for the weaknesses of the sugar sector and enriched the Portuguese royal court, clerical elites, and some colonists, but a large proportion of the wealth derived from mining flowed to England to service Portugal's debts, to counter Portugal's trade deficits, and as contraband (Cardozo 1940; Love 1977; Eakin 1997: 23; Fausto 1999: 49–50; Skidmore 1999).

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[106] By the 1730s prospectors had also discovered diamonds in Brazil (Fausto 1999: 49).
[107] Gold mining began to decline after the middle of the eighteenth century and, by the early nineteenth century it no longer held a significant position in Brazil's economy.
[108] Sugar accounted for 90 percent or more of Brazil's export earnings during the first half of the seventeenth century, but by 1700 export earnings from sugar represented only about 15 percent of Brazil's export revenues; between 1650 and 1750, sugar exports as a percent of Brazil's total exports declined from 95 to 47 percent (Skidmore 1999).

Perhaps under different geopolitical and social circumstances, the tremendous wealth generated by the mining boom could have been invested domestically, providing the financial impetus to begin a revolutionary socioeconomic transition in Brazil. In other words, perhaps Brazil's eventual transition from a predominantly rural society dependent upon export-oriented extraction and plantation agricultural exploiting slave and servile labor, toward economic and political modernization could have taken place earlier had its extraordinary mineral wealth supported: technological innovations in agricultural production, mineral extraction, and transportation; greater agricultural diversification not only for export but also for domestic markets; social reforms such as the abolition of slavery and the redistribution of land ownership; and greater levels of industrialization and urbanization.

Instead, the reality was that most of Brazil's mineral wealth flowed out of the subordinated colony and overseas to Western Europe where it rescued Portugal from financial ruin and helped to finance England's industrial revolution (Eakin 1997; Pedreira 2000). Although the suggestions made by Luso-Brazilian reformers in the late-eighteenth century to revive Brazil's economy ranged across the political spectrum from conservative to liberal ideologies, Portuguese authorities chose to avoid controversial social issues and supported only those reforms that promised to increase agricultural production and encourage diversification in ways that would reinforce Brazil's economic dependence on Portugal, protect powerful slave-holding, landed interests in Brazil (i.e., the Brazilian slavocracy or *escravocracia*), and increase profits for elites on both sides of the Atlantic (Galloway 1979). Laws passed in 1785 banned manufacturing in Brazil in order to protect Portugal's export of manufactured goods to the colony (Pedreira 2000).

Economic modernization by means of capitalization and technological advance and social reforms toward freedom and egalitarianism were thus delayed in Brazil in order to benefit metropolitan powers in Europe and landholding oligarchies in Brazil (Pang 1979). Consequently, these conditions led to the patterns of dependency on foreign technology and foreign capital that shaped Brazil's economic development pathways in the nineteenth and twentieth centuries.[109]

Despite these impediments, the new-found sources of mineral wealth did facilitate economic, social, and cultural development of several urbanizing nuclei in the captaincies of Minas Gerais, São Paulo, and Rio de Janeiro during the eighteenth century. In addition to the centers of mining districts in Minas Gerais, among the most prominent urban areas to benefit were the port cities of Rio de Janeiro, São Vicente, and Santos, and the highland city of São Paulo de Piratininga which expanded to become the present-day megacity of São Paulo (Russell-Wood 2000).[110] The eighteenth century was also a period when the political-economic alliances which had been developing among the colony's wealthiest and most powerful families were becoming entrenched into regional oligarchies with the ability to influence the agents and institutions of the state to their advantage (Skidmore 1999; Needell 2001a). Landowners of large rural properties and

[109] For example, initially railway construction in São Paulo Province depended on British capital, technology, and expertise. The São Paulo railway network, linking interior highland areas to port cities, developed in response to and in concert with the westward expansion of coffee plantations. Mattoon (1977) argues that development of the São Paulo railway by "external" entrepreneurial elites based in Rio de Janeiro and Britain in the 1850s and 1860s served as a catalyst for São Paulo's provincial oligarchy to organize, build, and control their own railway companies and thus establish the business structures and political strength that not only supported tremendous agro-industrial growth in São Paulo Province, but also made it possible for the city of São Paulo to become the country's financial and commercial center in the twentieth century.

[110] São Paulo de Piratininga, which had fewer than 2,000 inhabitants in 1600 (Fausto 1999: 34), was elevated from town (*vila*) to city status in 1711.

wealthy merchants were at odds on some issues and in agreement on others (Fausto 1999: 29).

The commercial and hence the administrative structure of colonial Brazil underwent significant changes during the eighteenth century. In 1709, colonists succeeded in their petition to King João V to create the captaincy of São Paulo and Minas de Ouro separating it from the captaincy of Rio de Janeiro, and just over a decade later, in 1720, the crown permitted further partitioning to separate the captaincy of Minas Gerais from the captaincy of São Paulo. In the early decades of the gold rush, populations in the mining regions suffered from food scarcity, but in time as demographic growth continued into the late-colonial period, not only did the regional economy of Minas Gerais diversify (Libby 1997; Klein and Luna 2000: 919; Needell 2001a: 134), but economic linkages were also established with cattle and crop producers in the peripheral captaincies to the north and south who were eager to access the expanding southeastern and central markets (Cardoso and Ianni 1960; Fausto 1999: 49–54; Baer 2001: 15).

Responding to the colony's new set of economic and demographic dynamics, the Portuguese government decided to transfer Brazil's administrative capital city southward from Salvador to Rio de Janeiro in 1763 in the interest of improving the crown's supervision of local colonial authorities, establishing greater control over tax collection, enforcing trade policies, and minimizing the degree of contraband exchange (Love 1977; Fausto 1999: 50–52; Baer 2001: 15).[111] It was not until the nineteenth century that economic modernization processes were encouraged in Brazil after the transfer of the seat of the Portuguese empire from Lisbon to Rio de Janeiro in 1808, followed by Brazil's independence in 1822, and the start of Brazil's coffee cycle in the 1830s which created a

[111] At the time, both the cities of Salvador and Rio had populations of ~40,000 people (Fausto 1999: 50).

new agrarian and mercantile elite (Taunay 1939; Graham 1968; Bernstein 1973; Mattoon 1977; Pang 1979; Barman 1988, 1999; Font 1990; Fausto 1999; Skidmore 1999).

According to Souto Maior (1972: 91), with some exceptions, *entradas* were official government-sponsored undertakings, while *bandeiras* were privately-financed commercial enterprises. Souto Maior further explained that, as campaigns directly linked to the Portuguese government, *entradas* were bound by the limits established in the Tordesillas Treaty, whereas *bandeiras* often ventured much further into the interior, reaching westward past the line of demarcation. As a result, participants in the *bandeiras*, known as *bandeirantes*, were pioneers in the territorial expansion of Brazil into the hinterlands well beyond the limits of the Tordesillas Line, and in this way they indirectly served the interests of the Portuguese crown.[112]

Authors of more recent publications, however, appear to blur any such distinction between *entradas* and *bandeiras*. Metcalf (2005a), for example, treated the sixteenth- and seventeenth-century practice of *entradas*, mounted from Bahia and Pernambuco, as practically synonymous with *descimentos* and with the widespread eighteenth-century *bandeiras*. Russell-Wood (2005) categorized the multiple strategies and manifestations of conquest, slave hunting, searching for other commercially-valued commodities, and settlement expansion across Brazil into the broad rubric of *bandeirismo*. Fausto (1999: 48), discussing the *bandeiras* mounted from São Paulo during the seventeenth century, wrote that “the search for precious metals, the capturing of Indians during specific periods, and territorial expansion were compatible with Lisbon’s objectives” and, furthermore, that some of the *bandeiras* were indeed directly linked to the Portuguese

[112] In the second half of the eighteenth century, the Tordesillas Line was officially rendered obsolete by agreements signed in 1750 (Treaty of Madrid), 1761 (annulment of the Treaty of Madrid), and 1777 (Treaty of San Ildefonso) (Fausto 1999).

administration. Similarly, in his study of frontier violence between natives and settlers as a means of cultural exchange in the Eastern Sertão region of Minas Gerais, Langfur (2005) referred to the *bandeiras* organized between 1760 and 1808 as both military and paramilitary expeditions. Moreover, as Costa and Menezes (2002: 229) pointed out, from 1580 to 1640 during the period of Spanish domination, the Tordesillas Line held little relevance to Iberian colonists in the frontier region of Guairá where the commercial interests of the Spanish colonists with economic ties to Asunción and those of the Portuguese colonists linked to the Vila of São Paulo de Piratininga converged on the Amerindian slave trade.

Although *bandeiras* typically shared in common the goal of short-term revenue generation, they took diverse forms and tended to be flexible, allowing entrepreneurial leaders considerable leeway for adjustments and improvisation in order to maximize profits (Russell-Wood 2005). The social conditions and identities of participants in any given *bandeira* were often diverse, including persons not only of different racial origins, but also of both genders thus representing a range of positions on the colonial social hierarchy including some who had enjoyed freedom since birth and as *bandeirantes* were voluntarily seeking personal wealth and status, others who had been manumitted after enduring a period of enslavement and sought to improve their fortunes and social status, and many who were enslaved or otherwise coerced to serve the free fortune-seekers. As previously mentioned, *bandeira* leaders as well as lower-ranking *bandeirantes*, were often free-born *mamelucos* of mixed race who possessed the cultural knowledge and linguistic ability to serve as mediators and translators between colonists and indigenous peoples and the environmental knowledge to guide the *bandeiras* along river networks and indigenous trails (Metcalf 2005a, 2005b).[113]

When *bandeiras* became violent, Amerindian communities responded to outside aggression with various forms of resistance and retaliation (Fausto 1999; Langfur 2005). As rivalries between the beneficiaries of the Amerindian slave trade and the Jesuit missionaries intensified, *bandeirantes* raided mission *aldeias* as another means of capturing slaves, causing thousands of mission Amerindians to abandon the vulnerable *aldeias* in search of safer environments (Cortesão 1951; Costa and Menezes 2002; Abreu 2004; Metcalf 2005a; Russell-Wood 2005).[114]

Bandeirismo is a critical component of *catarinense* history given that its proliferation and extension into new territories represents the first major stage of colonial territorial expansion in southern Brazil. *Bandeiras* were responsible for expelling, killing, and enslaving the Carijós that remained in Santa Catarina's coastal areas during the seventeenth century, and they led to the establishment of the three earliest colonial settlements along the Santa Catarina coastline (Campos 1991). *Bandeirantes paulistas* (meaning *bandeirantes* from São Paulo) were predominantly based out of two towns located in present-day São Paulo State—the highland Vila of São Paulo de Piratininga founded in 1554 and the coastal Vila of São Vicente founded in 1532 (Nowell 1952: 161;

[113] The coastal zone of present-day Santa Catarina was linked to present-day Paraguay, Bolivia, and Peru by the Peabirú trail (Nowell 1946; Bond 1998, 2004; Bueno 1998). The Peabirú trail was also accessible from other points on the southern coast such as São Vicente and Cananéia (Nowell 1946). The word Peabirú is derived from the Guaraní words *pe* (trail) and *abiru* (flattened vegetation).

[114] Antônio Raposo Tavares is well known for leading slave-hunting *bandeiras* in southern Brazil during the 1620s and 1630s (Cortesão 1958; Maior 1972: 96; Costa and Menezes 2002). Born in Portugal at the end of the sixteenth century, in 1618 as a young man Raposo Tavares arrived in Brazil with his father Fernão Vieira Tavares who became governor of São Vicente. Raposo Tavares settled in the Vila of São Paulo de Piratininga and participated in multiple expeditions before his death in 1658. One of these expeditions was a relatively large *bandeira paulista* which Raposo Tavares organized in 1629 with Manuel Preto to attack the Jesuit missions in the Guaíra region (interior of the present-day state of Paraná); it consisted of 69 white *paulistas*, 900 *mamelucos*, and 2,000 Amerindians (Maior 1972: 96; Fausto 1999: 48).

Taunay 1975 [1951]; Monteiro 1994). During the period from 1640 to 1680, at the height of *bandeirismo*, members of the São Vicente population, referred to as *vicentistas*, traveled south to establish: Nossa Senhora da Graça do Rio São Francisco (present-day São Francisco do Sul); Nossa Senhora do Desterro (present-day Florianópolis); and Lagoa de Santo Antônio Alaguna or Lagoa de Santo Antônio dos Anjos da Laguna (present-day Laguna) (Cardoso and Ianni 1960; Piazza 1970, 1975; Cabral 1971: 19–23; Prado 1988; Caruso 1990; Campos 1991; Pereira 2003).[115] Given that the primary economic objective of these three southern *vicentista* settlements was to form a base from which expeditions could venture inland to capture slaves and prospect for mineral wealth, they were initially organized as relatively isolated subsistence economies (Cabral 1971). In time, agrarian enterprises gradually developed, particularly since prospecting for precious metals and gemstones in the region proved fruitless. In the case of Laguna, linkages were established with the cattle ranching economy that was beginning to flourish in the grasslands to the south (Cardoso and Ianni 1960; Piazza 1970).

In December of 1640, Portuguese nationalists succeeded in overthrowing Spanish rule and elevated the Duke of Bragança to the position of king thus initiating Portugal's Bragança dynasty with the coronation of Dom João IV. The new Portuguese crown faced the difficult task of restoring the independence of the Portuguese empire after more than half a century of Spanish domination. In terms of financial resources, Portugal's reassertion of colonial control in South America was severely limited by the need to fund Portuguese defenses on the Iberian Peninsula during the War of Restoration which lasted for about 28 years from 1640 to 1668. This prolonged struggle with Spain, conflicts with

[115] São Francisco do Sul was founded in 1658 by *vicentista* Manoel Lourenço de Andrade, and Laguna was founded in 1676 by *vicentista* Domingos de Brito Peixoto (Brito 1829; Piazza 1970, 1975; Cabral 1971: 23; Pereira 2003).

the Dutch in Brazil and Angola, and efforts to gain the protection of England resulted in substantial debt burden for Portugal (Nowell 1952).[116] Therefore, privately-financed, *vicentista* settlement and agricultural development of the Santa Catarina coast and of disputed borderlands further south in the Río de la Plata region (present-day Rio Grande do Sul State and Uruguay) served a crucial political-economic role by claiming southern South American lands through so-called "effective occupation" without putting additional strain on Portugal's overstretched military forces and impaired financial status.

Once independence was secured, the Portuguese government underwent major reform during the 1670s—a period known as the *Nova Reformação*—resulting in the drafting of a new code (*Regimento Novo*) for Brazil which was completed in 1677 by the Overseas Council (*Conselho Ultramarino*) (Rodríguez 1958).[117] For Portuguese America overall, colonial policies under the *Regimento Novo* were intended to improve administrative control and efficiency, occupy more territory, search for mineral wealth, and stimulate economic diversification. Within these broad colonial objectives, the plan outlined for the lands of southern Brazil during the last quarter of the seventeenth century was to expand its settlement, to explore its mineral and agricultural potential, and to gain greater control over the Río de la Plata region (Rodríguez 1958). As part of this regional plan, the Portuguese government established the Colônia do Sacramento in 1680 on the Río de la Plata opposite the Spanish port of Buenos Aires to serve as a military outpost and commercial entrepôt along the silver trade route out of the Andean mines (Rodríguez 1958: 187; Caruso 1990: 82; Fausto 1999: 47, 72–73).

[116] In the early 1660s to seal the alliance between the Portugal and England, the Portuguese crown paid an enormous dowry to England's Charles II for marrying Portugal's Catarina of Bragança (Nowell 1952: 156).
[117] The *Conselho Ultramarino* was created in 1642 replacing the *Conselho da India* (India Council) which had existed since 1604 under Spanish rule (Kiemen 1958; Worcester 1973: 26–27; Hudson 1998).

The first major colonial occupation of Santa Catarina Island took hold in the 1670s when *vicentista* Francisco Dias Velho founded the agrarian settlement of Nossa Senhora do Desterro, henceforth Desterro, with his wife Maria Pires Fernandes, their children including a son José Pires Monteiro, a white *agregado* named José Tinoco, Tinoco's wife and children, two Jesuit priests, and about 500 Amerindian slaves (Brito 1829; Cabral 1971, 1979; Piazza 1975; Pereira 1978; Caruso 1990; Kuhnen 2002). The name Desterro was to last until 1894. By some accounts, Dias Velho had visited the site previously, probably in 1651, while accompanying his father on a reconnaissance expedition.[118] During the 1670s, José Pires Monteiro oversaw farming and construction projects while his father Dias Velho traveled back and forth between Desterro and the Vila of Santos to formalize his claim to the territory by requesting legal rights through the Portuguese colonial administration to a *sesmaria* centered on Desterro and stretching south to the Araçatuba River.[119] In his petition, he strengthened his case by reporting the multiple "improvements" that had been made under his leadership including the construction of several houses and a chapel as well as the cultivation of a variety of crops and cattle rearing. The first chapel in Desterro, constructed between 1675 and 1678, was located at the site where the Metropolitan Cathedral of Florianópolis presently stands. At this time, a large proportion of the colonizing population resided in the area now known as Praça XV de Novembro, the main plaza in the Central City District of Florianópolis,

[118] The exact year of the founding of Desterro by Francisco Dias Velho is unclear. Caruso (1990: 81-82) reports it as 1673 or 1675. Várzea (1985 [1900]) reports a much earlier arrival in 1651 of Francisco Dias Velho "Monteiro" and his followers, but it appears that this may be due to confusion with the date of Dias Velho's first visit accompanying his father rather than his return to the site more than two decades later with the intention of establishing a permanent settlement.
[119] The Vila of Santos was founded in the mid-1540s by Brás Cubas, a Portuguese nobleman who had arrived in the early 1530s with the Martim Afonso de Sousa expedition (Maior 1972: 55).

while some of the other inhabitants occupied small villages at other neighboring sites.[120] Trade relations, which already existed between some of the Carijós in the vicinity of Santa Catarina Island and the colonists at the relatively distant port of Santos to the north, developed locally between the colonists of Desterro and the Carijós who inhabited the continental area directly across from Desterro (Várzea 1985 [1900]).

In the late 1680s, Dias Velho was killed by pirates who may have been Dutch, Belgian, English, or some combination thereof (Caruso 1990: 82).[121] After his assassination, his surviving family returned to São Vicente and, although Tinoco and some others remained in Desterro, most of the settlers dispersed. Some relocated to Laguna or São Paulo, and it is likely that many of the slaves were able to escape as a result of the crisis (Várzea 1985 [1900]).[122]

Just over a decade after the death of Dias Velho, colonial occupation of Desterro appears to have been tentatively renewed around 1700 with the arrival of settlers relocating from São Francisco do Sul under the leadership of Manuel Manso de Avelar. Official administration of Santa Catarina Island and neighboring *sesmarias* on the mainland was transferred from the captaincy of Rio de Janeiro to the captaincy of São Paulo in 1711 (Várzea 1985 [1900]: 10). Judging from the descriptions in available texts,

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[120] In 1666, before the arrival of the group led by Dias Velho, a number of settlers from São Vicente, Paranaguá, and Gurauratuba, including Antônio Afonso, arrived on Santa Catarina Island establishing small villages; later, in 1698 another group of settlers, composed of Antônio Bicudo Camacho and twenty couples, relocating from São Francisco expanded several of these villages including Desterro, Santo Antônio, Lagoa da Conceição, and Ratones (Várzea 1985 [1900]: 83).

[121] Várzea (1985 [1900]: 8) tells a version of this story in which a Dutch crew under the command of Robert Lewis anchored on the northern shore at Canasvieiras to repair their ship and in the process unloaded a cargo of silver obtained in Peru. Unaware of the presence of the Desterro settlers, the crew was ambushed by some of Dias Velho's men and although many of the sailors managed to escape, they were forced to leave the Peruvian silver behind. The loot was the then stored in the Desterro chapel until a year later when Lewis and/or others associated with Lewis returned to recover their loss and to take revenge on Dias Velho.

[122] While some eighteenth-century constructions on Santa Catarina Island and in its vicinity have survived, few traces remain of the earliest colonial structures built during the sixteenth or seventeenth century (Veiga 2001: 87).

the human-induced landscape transformations occurring on Santa Catarina Island between about 1690 and 1720 appear to be relatively minor in scale. However, it is important to note that the introduction of cattle to the island appears to have continued during this period.

Demographic data for Santa Catarina during the early eighteenth century is limited to that which is contained in a handful of accounts recorded by visitors, which typically failed to enumerate the number of children and non-white inhabitants. Nevertheless, these reports suggest that human population densities in the region were very low. French navigator Amédée François Frézier visited Santa Catarina Island in 1712 as commander of the ships *Saint Joseph* and *Marie* and reported the presence of 147 white residents plus an unspecified number of Amerindians, Africans, and Afro-Brazilians living in an estimated 12 to 15 small villages primarily located along the bayside (Frézier 1717). In addition to comments about the human population he encountered, Frézier recorded his observation of extensive forest cover on the island, as well as on the neighboring continent, which was broken only by the dozen or so scattered settlements (Frézier 1717; Caruso 1990: 85; Campos 1991: 23). When Manual Gonçalves de Aguiar visited the Santa Catarina coast from 1711 to 1714 he reported the presence of 22 married couples (*casais*) in the settlement of Desterro and another 30 *casais* in the settlement of Laguna which Piazza (1975: 17) estimated to total about 260 inhabitants based on an average of five individuals per married couple (i.e., household). A few years later in 1719, George Shelvocke, captain of an expedition on the ship *Speedwell* also characterized land cover on the island as an extensive and dense forest with limited clearings for crops. Beyond merely commenting on the abundance of timber on the island, Shelvocke highlighted the lack of proper equipment for timber extraction among local inhabitants (Shelvocke 1726; Caruso 1990: 85). Shelvocke also observed trading between the local population and ships and early signs of a monetized economy (Shelvocke 1726; Cardoso and Ianni 1960).

Based on what is known about this period, most of the non-white inhabitants were most likely enslaved by the white settlers, and the non-white population probably outnumbered the white population.[123] While seminal books by Cardoso and Ianni (1960) and Piazza (1975) provide helpful reviews and analyses of the demographic and socioeconomic information available for southern Brazil during the Colonial Era, more research is needed into questions addressing the social composition and social relations of Santa Catarina Island and its neighboring mainland coast, particularly during the first half of the eighteenth century.

4.4.4 Increased Human Pressure on Natural Resources: Military Fortification, the Whaling Cycle, and Azorean Settlement

It is clear that by the late-Colonial Era (1740–1822) the coastal zone of Santa Catarina no longer possessed a "pre-industrial" forest. The combined human impacts associated with: Portuguese military fortification and increased administrative control; the development of the whaling industry; and agricultural expansion by Azorean colonists initiated a period characterized by the extensive disturbance of native ecosystems including rapid deforestation.

[123] According to Dean (1995: 90), by the late 1600s "Humans within the Portuguese-controlled sector of the Atlantic Forest may have numbered 300,000, of whom perhaps a third were of Portuguese origin. Perhaps 20,000 lived in towns. Rural density continued to be quite low, perhaps 5 per square kilometer on the coast and 2 per square kilometer in the Paulista highlands, a total area occupied by neo-Europeans and their subordinates of about 65,000 square kilometers."

Figure 4.3 Colonial-era structure on Santa Catarina Island, located near the South Bay. *Source:* author, December 2003.

Intertwined military, commercial, and ecclesiastical institutions governed eighteenth-century Brazilian society. Among various functions, they shaped the laws dictating property rights and administrative divisions by establishing towns (*vilas*) and parishes (*freguesias*) (Deffontaines 1938; Fausto 1999: 23). The burgeoning settlement of Desterro was no exception in this regard. By the 1720s and 1730s Portugal had long regained its independence as a European colonial power and was still reaping economic benefits from Brazil's gold cycle. Under these more favorable circumstances, rulers had the resources to reorganize and strengthen administrative control of the colony. This included paying more attention to the *sesmarias* claimed by *bandeirantes* in southern Brazil. In fact, Portugal's rulers were particularly inclined to increase the Portuguese military and commercial presence in the colony's southern region at this time in order to promote Portuguese trade in the Río de la Plata and to discourage territorial encroachment by the Spanish. In this context, Santa Catarina Island was strategically located to serve as a military and commercial base of operations (Brito 1829; Cardoso and Ianni 1960). Therefore, the crown planned continued settlement of the island as well as its neighboring mainland coast both to help defend and extend Portuguese territory and to provide a controlled region of economic, political, and cultural intersection with the Spanish colonial realm.

On March 23, 1726, government authorities made Desterro administratively independent from Laguna by formally proclaiming it a town (*Vila do Desterro*) (Brito 1829; Cabral 1970: 53).[124] This date is presently celebrated as the anniversary of the city of Florianópolis. Elevation to *vila* status was followed by Desterro's ecclesiastical recognition as a parish in 1732 (Várzea 1985 [1900]: 12). In 1738, the larger territory of Santa Catarina began to gain greater administrative autonomy when it was dismembered from the captaincy of São Paulo, a process which became final in 1739 and included the stationing of military and civilian administrative personnel in the area. At this time, although Santa Catarina had been separated from São Paulo, it became directly subordinated to the authority of the captaincy-general of Rio de Janeiro (Cardoso and Ianni 1960; Alden 1963). Thus in 1739 the Vila of Desterro was recognized as the administrative center of the newly-created subordinate captaincy (or subcaptaincy) of Santa Catarina (Piazza 1970; Saint-Hilaire (1978 [1851]; Pauli 1983; Várzea 1985 [1900]: 10; Caruso 1990: 82, 84; Pereira 2003).

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[124] Laguna had been designated a *vila* in 1714, more than a decade before Desterro's elevation.

The many socioeconomic transformations which unfolded in Santa Catarina during the eighteenth century should be framed within the broader colonial context of this period. Competition between Portugal and Spain for control of frontier areas in South America had intensified. To an extent the Treaty of Madrid (1750) helped to settle territorial disputes between the two Iberian powers under the principle of ownership by possession (*uti possidetis*). However, conflicts broke out from time to time calling for successive negotiations. In the specific case of Santa Catarina, Luso-Spanish rivalry culminated in the Spanish invasion and temporary takeover of Desterro and Santa Catarina Island in 1777 led by Don Pedro de Cevallos (Alden 1963: 187; Várzea 1985 [1900]; Caruso 1990: 93; Campos 1991: 29; Flores 2004).[125]

As Brazilian gold and diamond production declined after the mid-1700s, Portugal's rulers were eager to revive formerly profitable agrarian enterprises in Brazil, such as sugar production, and to identify new sources of revenue for the royal treasury (Alden 1959; Galloway 1979; Pang 1979; Carvalho 1982; Skidmore 1999). These financial pressures in the commercial sector were exacerbated by the burden of rebuilding Lisbon after the disastrous impacts of an earthquake in 1755 and by Portugal's increased military spending in conflicts with Spain (Maxwell 1968: 623; Fausto 1999: 56-59; Skidmore 1999: 30; Pedreira 2000).[126] Mercantilistic economic policies adopted under the ministerial leadership of Sebastião José de Carvalho e Melo, the Marquis of Pombal (hereinafter referred to as Pombal), from 1750 to 1777 were intended to avoid economic

[125] The Spanish invasion of Desterro (February 22–28, 1777) (Alden 1963: 187), coincided with the death of King José I on 24 February 1777 and, thus, with the dismissal of the king's chief minister, the Marquis of Pombal. Several months later in October of 1777, the Spanish and Portuguese agreed to the Treaty of San Ildefonso which aimed to settle the territorial disputes in the Río de la Plata and Amazon regions; under this agreement, the *Banda Oriental* (present-day Uruguay) was recognized as part of the Spanish empire while possession of the Amazon Basin was ceded to the Portuguese empire (Hemming 1987; Hudson 1998; Fausto 1999: 75; Skidmore 1999). Desterro was returned to Portuguese control in July 1778.
[126] The Spanish-Portuguese War took place from 1761 to 1777.

crisis and secure prosperity for Portugal by stimulating Brazil to increase primary production of export commodities and simultaneously encouraging industrialization in Portugal in order to sell manufactured goods, such as textiles and ceramics, to Brazilians as well as to Europeans (Christelow 1947; Alden 1959; Maxwell 1968; Maior 1972; Galloway 1979; Campos 1991: 21; Fausto 1999; Skidmore 1999; Pedreira 2000).[127] As a result of Pombaline policy, an "agricultural renaissance" (Alden 1959; Pang 1979) was promoted in Brazil during the second half of the eighteenth century leading to the expansion of sugar production to new areas and the emergence of several new industries such as wheat, rice, cotton, indigo, cacao, cinnamon, clove, and coffee production (Alden 1959, 1965; Galloway 1979; Fausto 1999; Pedreira 2000). Other key measures taken during the Pombaline period were aimed at ending England's commercial treaty privileges in the Lisbon-Brazil trade (e.g., preferential tariffs) thus reducing Portugal's dependence on English trade, and at enforcing the right of search thereby reducing contraband activity (Christelow 1947; Maxwell 1968). Portugal's trade deficit was reduced by about 70 percent between 1751 and 1775, and a favorable trade balance was maintained even after Pombal's dismissal in 1777 (Alden 1959; Skidmore 1999).

While the cultivation of export-oriented cash crops came to dominate planters' fields in certain areas of Brazil, such as in the captaincy of Rio de Janeiro where rice and indigo had gained popularity by 1780, the cultivation of food crops for local populations was often neglected (Alden 1959, 1965). Unlike the major slave-holding plantation zones in Brazil's northeast and southeast during this period which typically specialized in export crops, the small-scale family farms that were established on Santa Catarina Island

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[127] Fausto (1999: 56–58) explained that the Pombaline period marks the beginning of political reform in Portugal from absolutism to "enlightened absolutism" by which the Church was increasingly subordinated to the State.

after about 1750 cultivated a relatively diverse array of crops to feed the growing local population which included the Portuguese troops stationed in the area. In addition, surplus rural production was exported to other coastal markets, such as the port cities of Rio de Janeiro, Salvador, Buenos Aires, and Montevideo, generating the revenue needed to acquire industrialized products from Portugal and England.[128] Manioc flour (*farinha de mandioca*) emerged as the main dietary staple exported from Santa Catarina Island (Cardoso and Ianni 1960; Hübener 1981; Campos 1991: 33–37; Lago 1996; Cruz 1998: 19; Pereira 2003).

Unsurprisingly, a number of major political and social changes took place in Brazil during the Pombaline period and the decades that followed. These changes helped to establish the conditions for Brazil's movement toward independence from Portugal in the early nineteenth century. Describing the profound shifts from an old colonial system to "a new model of colonization" in the eighteenth-century Luso-Brazilian empire, Arruda (2000: 876) wrote:

> The metropole advances creating its factories; the colony diversifies its agricultural production, markets become internally and externally integrated. The incomes generated by export are smaller in both Brazil and in Portugal if compared to the height of gold production, but the wealth created is more intensely distributed thus created higher per capita indices. There was economic growth in Brazil and in Portugal. The conjuncture was one of prosperity not depression. Moments like these as is well known have a great potential for transformation.

The Portuguese empire faced several internal conflicts of interest as the government led by Pombal struggled to centralize authority and complete the nationalization process by transferring administration of the captaincies from private to public control (Maxwell

[128] In the 1770s, the governor of Santa Catarina expressed concern over the shortage of currency circulating in the local economy largely due to the Portuguese government's long delays in paying salaries to the troops in the area which either forced farmers and merchants to sell provisions to the soldiers at very low prices or forced them to accept unpaid government contracts (Alden 1959).

1968; Fausto 1999: 13). Resentment against the reassertion and expansion of Portuguese authority spread in population centers throughout the South American colony. Portuguese officials tried to suppress any manifestations of insurgency. In addition to limiting speech and outlawing the printing press, the Portuguese government with the backing of the Church adopted the policy of replacing Tupi-Guarani, which had by the seventeenth century become the country's *lingua franca*, with Portuguese (Dean 1995: 71; Skidmore 1999; Wadsworth 2004).[129]

Equally, if not more, threatening to Portuguese authority than expressions of indigenous cultures were Jesuit wealth and power. In conflict over territorial control of the Jesuit missions at Sete Povos das Missões on the Upper Uruguay River, from 1754 to 1756, Portuguese and Spanish armed forces attacked and eventually defeated the Guarani resistance. During this conflict, in June 1755, the Portuguese crown issued two laws to curb the power of the various religious orders that were running missions in Brazil, particularly the power of the Jesuits; these laws were the Law of Liberty for Indians and another law reducing missionary control of Amerindian affairs to evangelizing (Hemming 1987: 1–2; Fausto 1999: 57–58). Soon after, in 1759 Pombal demanded the expulsion of the Jesuits from Brazil, a process which would last nearly a decade.[130] Expropriation of Jesuit wealth was part of Pombaline policy to assert the primacy of State interests over the interests of religious institutions. Jesuit properties, both rural and urban, were confiscated by the Portuguese government and auctioned off to Brazilian

[129] In line with colonial policies to suppress movements for independence, use of the printing press did not become legal in Brazil until 1808 (Skidmore 1999; Wadsworth 2004). For the same reason, the creation of institutions for higher education (such as medical schools, military academies, and law schools) was prohibited in Brazil by the Portuguese government until the early nineteenth century after the arrival of the Portuguese court in 1808 (Carvalho 1982).

[130] The Jesuits were expelled from the Spanish empire in 1767 (Hemming 1987).

landowners and merchants at prices well below their market value (Alden 1959; Hemming 1987; Fausto 1999: 57–58; Anderson 2000; Cleary 2001: 88; Abreu 2004; Russell-Wood 2005: 359).

By the late eighteenth century, as the French Revolution (1789–1799) unfolded in Europe and as the Haitian Revolution dismantled French colonial rule of Saint Domingue (1791–1804), discontent among Brazilian colonists about the centralization of Portuguese colonial power was on the rise, as was resistance to slavery (Schwartz 1977). Motivations for rebellion differed among Brazil's social strata. On the one hand, as Skidmore (1999: 27) wrote, "Brazil had become richer and more important than the mother country" and "this realization caused the Brazilian elite to begin to question their subordination to Lisbon." On the other hand, the laboring classes, both free and enslaved, saw opportunities to improve their conditions. However, the conspiracies and rebellions that stirred in the captaincies of Minas Gerais and Bahia were swiftly quelled by Portuguese authorities. Nevertheless, these early rebellions came to serve as important symbolic manifestations of the desire for independence,[131] and, in the words of Pang (1979: 670), "Unrest and revolts in both urban and rural areas forced colonial and metropolitan elites to rethink their priorities and, in the wake of this reassessment, the 'Generation of the 1790s' initiated a protomodernization movement in the colony and metropolis."

Situated between the colonial ports of Santos and Rio de Janeiro to the north and Laguna and Buenos Aires to the south, during the eighteenth century Santa Catarina

[131] One of the major conspiracies against the Portuguese government during this period—known as the *Inconfidência Mineira* (1788–1789)—occurred in Ouro Preto, Minas Gerais. This movement aimed to rid Brazil of domination by Portugal and to create an independent nation. The *Inconfidência Mineira* has since been celebrated as a precursor to Brazilian independence, and one of its leaders, Joaquim José da Silva Xavier (known as *Tiradentes*), who on April 21, 1792 was executed for crimes of treason, is celebrated as one of Brazil's greatest martyrs in the cause for independence (Marchant 1941b).

Island continued to serve as a way station for vessels sailing to and from a variety of destinations such as sites along the Río de la Plata and its tributaries or locations in the Pacific accessible by passage through the Strait of Magellan or around Cape Horn. The large bay provided ships with safe harbor and both the island and the mainland offered plentiful natural resources to sailors such as fresh water, foodstuffs, and fuelwood to renew provisions as well as timber for ship repairs (Anson 1748; Campos 1991). For some time Desterro held the reputation of offering more hospitable reception than the larger ports of the day by providing cheaper, or sometimes free supplies, and by requiring less bureaucracy (Anson 1748; Caruso 1990: 78). However, by the 1740s, under the newly-arrived Portuguese military administration, this scenario seems to have changed, at least for those ships viewed with suspicion by local colonial authorities. Such was the case for the British squadron of about 1,000 men on seven vessels commanded by Admiral George Anson which arrived on 18 December 1740 and remained until 18 January 1741 before continuing around Cape Horn to the coast of Chile. The following excerpt about the observations made of Santa Catarina Island during that month was compiled from Anson's records (1748: 44–45):

> The soil of the Island is truly luxuriant, producing fruits of most kinds spontaneously; and the ground is covered over with one continued forest of trees of a perpetual verdure, which, from the exuberance of the soil, are so entangled with briars, thorns, and underwood, as to form a thicket absolutely impenetrable, except by some narrow pathways, which the inhabitants have made for their own convenience. These with a few spots cleared for plantations along the shore facing the continent, are the only uncovered parts of the Island. The woods are extremely fragrant, from the many aromatick trees and shrubs with which they abound; and the fruits and vegetables of all climates thrive here, almost without culture, and are to be procured in great plenty; so that here is no want of pine-apples, peaches, grapes, oranges, lemons, citrons, melons, apricots, nor plantains. There are besides great abundance of two other productions of no small consideration for a sea-store, I mean onions and potatoes. The flesh provisions are, however, much inferior to the vegetables: there are, indeed, small wild cattle to be purchased, somewhat like buffaloes; but these are very indifferent food, their flesh being of a loose contexture, and generally of a disagreeable flavour, which is probably owing to the wild calabash on which they feed. There are likewise great plenty of pheasants; but they are not to be

> compared in taste to those we have in England. The other provisions of the place are monkeys, parrots, and, above all, fish of various sorts; these abound in the harbour, are all exceeding good, and are easily catched; for there are a great number of small sandy bays very convenient for haling the seyne.

The above description reveals that in early 1741 a large proportion of Santa Catarina Island's forest cover was probably intact. The presence of "absolutely impenetrable" vegetation along the trails seems to indicate substantial secondary growth in areas which may have been left fallow after use for extractive and agricultural purposes. Similar to previous descriptions by Frézier and Shelvocke, Anson's account explains that the island's abundant forests are interrupted by only "a few spots cleared for plantations along the shore facing the continent." Lastly, this excerpt suggests that although cattle-grazing was fairly common on the island at this time, a larger proportion of the local population's dietary needs were met by local marine and estuarine environments.

Only a year or two before Anson's arrival, in 1739 the Portuguese authorities appointed Brigadier General José da Silva Paes to serve as the first governor of the subcaptaincy of Santa Catarina (Brito 1829).[132] Arriving in Desterro from Rio de Janeiro accompanied by troops and servants, Silva Paes becomes the most powerful figure in eighteenth-century Santa Catarina (Piazza 1970; Pereira 1978; Várzea 1985 [1900]; Caruso 1990: 82, 84).[133] Trained as a military engineer, this governor oversaw the construction of multiple fortifications on and around Santa Catarina Island, transforming the bay into one of the most fortified areas in Brazil at that time (Cabral 1972; Campos

[132] Military personnel had been stationed in the Desterro region before 1739.
[133] It is worth noting that just prior to being appointed governor of Santa Catarina, Silva Paes was instrumental in separating both Santa Catarina and Rio Grande de São Pedro (present-day state of Rio Grande do Sul) from the captaincy of São Paulo in 1738 (Cardoso and Ianni 1960). Santa Catarina, Rio Grande de São Pedro, and the Colônia do Sacramento on the Río de la Plata all became subordinate to the captaincy-general of Rio de Janeiro around this time (Alden 1961: 186).

1991: 30; Zeferino 2004).[134] Several of these fortifications remain to this day as nationally-recognized historic cultural heritage sites and have, to varying degrees, undergone restoration: Fortaleza de Santa Cruz on Anhatomirim Island, originally constructed in 1739, has been adapted to serve as a popular tourism stop for local sailboat excursions; Fortaleza de São José da Ponta Grossa on Santa Catarina Island constructed in 1740; Fortaleza de Santo Antônio on Ratones Grande Island constructed in 1740; and Fortaleza de Nossa Senhora da Conceição on Araçatuba Island (also called Fortaleza da Barra do Sul) constructed in 1742 (Cabral 1972; Campos 1991: 30).[135] Silva Paes also oversaw construction of the *Igreja Matriz* (Mother Church) from 1749 to 1753 on the site where the Metropolitan Cathedral of Florianópolis stands today; this is the same location of the seventeenth-century chapel built by the Dias Velho settlers (Várzea 1985 [1900]; Vaz 1991).

In addition to heavy investment in military fortification, colonial authorities sought to control the southern coast by means of a colonization scheme to populate it with Portuguese subjects who would serve not only to occupy the territory but also to sustain the agricultural production necessary to feed the military and civilian personnel they had stationed there (Cardoso and Ianni 1960; Campos 1991: 24–28; Pereira 2003).[136] At this point in the environmental-history narrative, it becomes clear that after the period of modestly-sized colonial settlements established by seventeenth-century *bandeirantes*

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[134] Until the formation in 1874 of the *Escola Politécnica* (Polytechnic School) followed by other civilian schools, the only institutions offering engineering education in Brazil were linked to the military (Mattoon 1977: 289).

[135] A total of ten fortifications were constructed in the area between 1739 and 1793, four of which no longer exist, while the remaining six have been converted to various new uses; the Fortaleza de São Francisco Xavier constructed in 1761 was demolished in 1841, the Fortaleza de São Luiz da Praia de Fora constructed in 1771 was demolished in 1839, the Fortaleza de São João constructed in 1793 was demolished in 1880 (Zeferino 2004: 74).

[136] Eighteenth-century Portuguese troops in Brazil were composed of white, black, and mulatto soldiers (Cardoso and Ianni 1960).

vicentistas, the mid-eighteenth century marks a new era in the colonization of Santa Catarina's coastal zone, and, thus, the onset of extensive land clearance for timber and fuelwood extraction and for the expansion of cropland and pasture. Furthermore, classified according to the typology of urbanization proposed in 1938 by Pierre Deffontaines, French geographer and specialist in Brazilian studies, the city of Florianópolis represents one of Brazil's major urban "agglomerations of military origin" (Deffontaines 1938: 381).

The idea of occupying the coast of southern Brazil with couples from those parts of the Azores which were facing population pressures was first proposed to the Portuguese crown in 1720 by Vigário Frei Agostinho da Trindade, and King João V may have tried to implement this plan in 1722 by recruiting couples from Pico Island (Piazza 1970).[137] Governor Silva Paes, finding only about 4,000 residents in Desterro and its surrounding area upon his arrival, encouraged the royal government to renew colonization efforts. In August of 1747, the Portuguese crown responded by opening migration applications to couples of childbearing age from its Atlantic island colonies. From 1748 to 1756, at least 5,000 and perhaps as many as 6,000 of the colonists who applied traveled to the Santa Catarina coast in five waves and received small royal land grants upon their arrival; the vast majority arrived from the Azores while about 60

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[137] The archipelago of the Azores consists of nine islands in the North Atlantic ranging in area from 17 km² (Corvo) to 757 km² (São Miguel) and covering a total area of about 2,300 km² (Lacerda 2003: 40). Portuguese exploration of the Azores began in 1427 (Anderson 2000). By 1439, Portugal began to colonize the islands with settlers from Portugal; later, during the second half of the fifteenth century and into the sixteenth century, additional settlers arrived from Flanders, North Africa, and Spain (Veiga 2001; Santos *et al.* 2003; Montiel *et al.* 2005; Pacheco *et al.* 2005). Historical records show that the population of the Azores experienced hunger beginning in 1680 due to the combined effect of population increase and inadequate farming techniques. The Portuguese government began to offer Azoreans incentives to settle in Brazil promising to cover the cost of transportation to the colony and to grant each settler household with a small parcel of land, a cow, some farm equipment, and seed. The Azores became an Autonomous Region of Portugal in 1976.

individuals originated from the Madeiras (Boiteux 1912; Cabral 1970; Piazza 1970, 1988; Pereira 1978; Várzea 1985 [1900]; Caruso 1990; Campos 1991; Lins 1994; Lago 2000: 31; Veiga 2001; Lacerda 2003).[138]

During the latter half of the eighteenth century and throughout the nineteenth century, the smallholders of Santa Catarina Island developed highly self-sufficient rural communities maintaining much of the Azorean culture and language and cultivating a variety of crops not only for their own domestic consumption and for exchange with members of neighboring communities, but also to feed the Portuguese troops in fulfillment of their obligations to the crown (Pereira 2003). For instance, the community of Ribeirão da Ilha produced manioc, sugarcane, maize, beans, coffee, and melon (Várzea 1985 [1900]; Caruso 1990). When local circumstances allowed for surplus production, manioc and sugarcane developed into the island's two preferred cash crops; their profitability fluctuated according to levels of external market demand in population centers such as Rio de Janeiro (Cardoso and Ianni 1960). Based on knowledge of recent land-use patterns on Santa Catarina Island and elsewhere in coastal areas of Brazil, manioc was primarily cultivated in the sandy soils of the coastal plains in areas naturally covered by *restinga* vegetation, while sugarcane was mostly grown in areas of higher elevation and soil fertility where forests were cleared to establish fields in soils containing more organic material (i.e., podzols).

Sugarcane production was already familiar to Azorean farmers, but they acquired the knowledge and skills to cultivate and process manioc from Brazilians.[139] As

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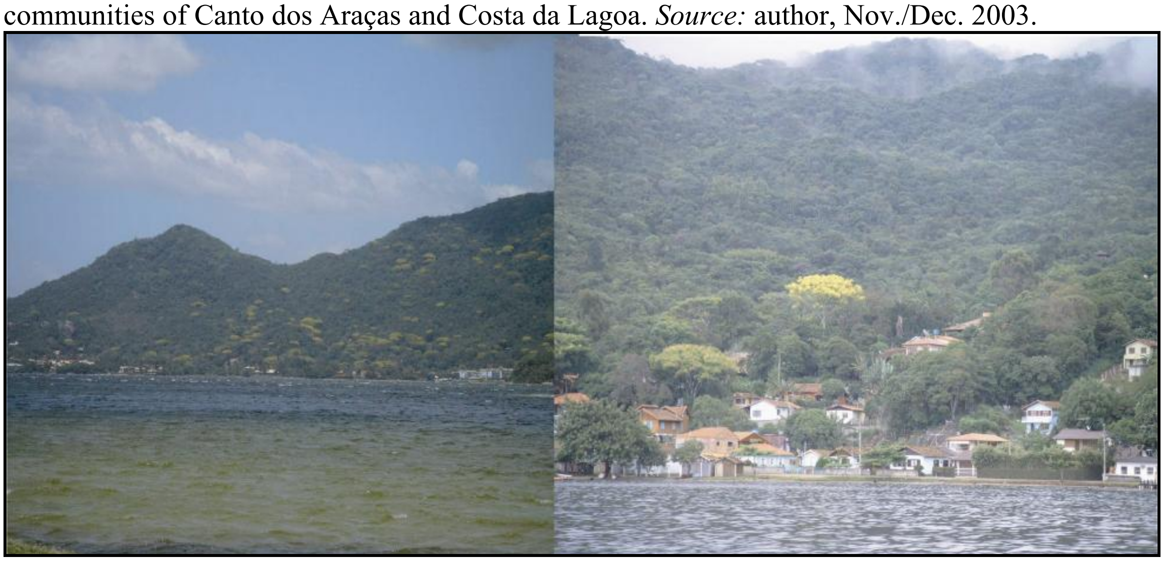
[138] According to Várzea (1985 [1900]: 19–20) the Azorean colonists who settled on Santa Catarina Island in the mid-eighteenth century originated primarily from the islands of Terceira, São Jorge, São Miguel, and Pico.

[139] Sugarcane had been introduced to the Azores in the 1400s (Eakin 1997: 17).

previously mentioned and illustrated in Figure 4.1, the colonists and their descendants adopted multiple Amerindian subsistence practices including the intercropping of manioc and maize. Furthermore, although many of the Azoreans arrived with considerable maritime and fishing experience, the Brazilians they encountered informed them of where and what to fish in Santa Catarina and instructed them on local techniques and technologies for harvesting marine and estuarine resources. An interesting example of this type of cultural exchange was the adoption by Azorean colonists of a Guarani-style canoe built out of a single trunk of *guapuruvu* (*Schizolobium parahyba*), a fast-growing tree characteristic of secondary Atlantic forests (see Figure 4.4).[140]

Figure 4.4 Flowering *guapuruvu* trees in the secondary forests surrounding Conceição Lagoon, Santa Catarina Island. The photo on the left shows the hillslope adjacent to the southern portion of the lagoon, while the image on the right show a part of the lagoon's northern shore near the communities of Canto dos Araças and Costa da Lagoa. *Source:* author, Nov./Dec. 2003.



Once harvested, manioc root can be cooked and eaten with minimal preparation, but in order to package and store it for long periods of time it must be processed into

[140] *Guapuruvu*, also known as *garapuvú*, reaches heights of up to 30 m and has a lifespan of four to five decades. In addition to the common occurrence of *guapuruvu* in the process of forest succession which in itself was a potential indicator of human agency in the landscape, local lore tells us that in Guaraní tradition a tree of this species was planted at the birth of a son so that the tree would be large enough to harvest and make a canoe for the child once he became a young man (Queiroz, personal communication, 2003).

flour. Island inhabitants dedicated much of their labor to the production of manioc flour which was the primary agricultural export transported from the port of Desterro throughout the nineteenth century. Manioc was cultivated extensively in the island districts of São João do Rio Vermelho and Campeche (Caruso 1990: 119). Building sugarcane mills and distilleries, the colonists produced two more important products for local consumption and for export—molasses (*melado*) and the alcoholic beverage *aguardente* also known as *cachaça* or *pinga*. Approximately 300 mills (*engenhos*) were constructed to process either manioc or sugarcane. Many of these were concentrated in Ribeirão da Ilha and Costa da Lagoa (Lago 2000). Therefore, in addition to the conversion of island forests into fields and pastures, charcoal production to fuel hundreds of mills also contributed to an increased rate of deforestation. Various other local industries are known to have demanded large amounts of fuelwood. Whale-oil rendering from blubber required fuelwood to heat large iron kettles (*caldeiras de ferro*) (Comerlato 2007). Factories producing pottery, tiles, and bricks (*olarias*) fired these items in wood-burning kilns. Lime kilns (*caieiras*) processed the calcium carbonate mined from local *sambaquis* to produce construction mortar (*argamassa*), whitewash, and soil fertilizer. Leather-tanning operations (*curtumes*) also used fuelwood. Shelter construction and boat-building projects as well as the production of wooden furniture and wooden utensils demanded timber extraction, and some timber was exported to the port of Montevideo. In the years 1754, 1773, and 1784, the Portuguese crown restricted the extraction by colonists of certain highly-valued tree species (*madeiras de lei*)—for example *Aspidosperma pyricolum* (a Brazilian hardwood known as a type of *peroba*)—reserving them for naval shipbuilding and repairs (Caruso 1990: 91–98).

In the same year that Brazil's capital was transferred from Salvador to Rio de Janeiro (1763), a French naturalist named Antoine Joseph Pernetty recorded his observations of Santa Catarina Island and published his journal notes in Paris a few years later in what is perhaps the first published scientific report about the island's geography and natural history containing descriptions of specific plant and animal species (Caruso 1990: 43). Pernetty had joined a two-ship expedition, composed of the *Aigle* and the *Sphinx*, organized and commanded by French navigator Louis Antoine de Bougainville to reach the South Atlantic archipelago named the *Malouines* by Bougainville in 1764, currently known as the Falkland Islands or Islas Malvinas. Having consulted with Anson among others while planning the trip, Bougainville's objective was to start a settlement on the *Malouines* as a strategic base of operations to facilitate France's access to Río de la Plata region and passages to the Pacific Ocean. Pernetty traveled on the larger of the two ships, the *Aigle*, which anchored in the bay near Desterro on November 29, 1763 and remained in the area for two weeks, departing on December 14 to continue the journey south. Pernetty's writings suggest that, by late 1763, forest cover was still abundant on Santa Catarina Island and only about 150 houses had been constructed; in addition to his comments on the island's flora and fauna, he also remarked that it appeared to have the potential to develop into an excellent a settlement (Caruso 1990: 43; Pernetty 1996 [1770]: 75–108).

Four decades later, the landscape displayed more obvious signs of anthropogenic modification. While leading the first Russian circumnavigation of the world, Adam Johann von Krusenstern served as captain of the *Nadeshda.* He was accompanied by Urey Lisiansky, captain of a second vessel called the *Neva*. This two-ship expedition visited Santa Catarina Island from December 1803 to February 1804 with German naturalists George von Langsdorff and Telesius on board. The reports published by these observers describe extensive deforestation, the presence of several hundred houses in Desterro, and the presence of colonists in mainland areas. The naturalists collected information on about 80 tree species and reported the local extinction of jaguars. Interestingly, while acknowledging a significant population increase in Desterro based upon comparisons of his direct observations with observations made in previous reports, Krusenstern noted that although no one in the settlement appeared to be particularly wealthy, the quality of life of the inhabitants appeared to be relatively good and that, despite limited export activity, the shops in Desterro sold a variety of merchandise imported from Europe (Saint-Hilaire 1978 [1851]:125; Caruso 1990; Krusenstern 1996 [1811]: 129–145; Lisiansky 1996 [1814]: 147–156).

While ostentatious displays of wealth—which were probably somewhat commonplace in the centers of much larger Brazilian port cities such as Salvador and Rio de Janeiro—may not have been evident in the streets of Desterro at the time of this Russian expedition's visit, it is nonetheless clear that several new forms of social differentiation were introduced to Santa Catarina Island during the second half of the eighteenth century and that by 1800 social stratification of the island's colonial population was indeed more pronounced that ever before. Besides the various economic activities already mentioned textile production, both for local markets and for export to Rio de Janeiro and Rio Grande do São Pedro, with locally-grown cotton and flax developed into an important cottage industry for women (Várzea 1985 [1900]).[141] The

[141] To this day, Santa Catarina Island is well-known for a traditional Azorean style of lace called *renda de bilró* produced by female lacemakers (*rendeiras*).

development of this nascent textile industry was likely disrupted to some extent between 1777 and 1808 when, as a protectionist measure, Portuguese crown policy prohibited textile factories in Brazil to continue operation with the exception of the production of a type of crude cotton cloth worn by slaves (Fausto 1999: 59). Although smallholder agriculture by fishing-farming Azorean families became the dominate form of rural property holding, there were a few medium-sized rural estates organizing labor forces that combined enslaved and wage workers. Furthermore, thousands of African and Afro-Brazilian slaves were brought to the island from the mid-eighteenth to the mid-nineteenth century primarily to carry out the least desirable tasks in the whaling industry and to provide domestic labor in Desterro (Cardoso and Ianni 1960).[142]

As the island's market economy developed, the town of Desterro expanded and became better linked to a network of parishes and smaller villages scattered throughout the island and the nearby mainland coast. This constellation of fishing-farming communities with Desterro as its major economic pole increasingly traded goods and services along boat routes and an extensive trail network. Zeferino, Santos, and Câmara (1998) described three distinct types of trails that facilitated movement around the island: trails linking the urbanized center of Desterro on the bay to communities located in the island interior; trails linking interior communities to one another; and trails providing quick and easy access from the interior communities to sites on the island's coast. In other words, in addition to circulating goods throughout the island, this colonial trail network also served to integrate the island economy with maritime trade routes transporting

[142] Cardoso and Ianni (1960) provide demographic data on the total and slave populations of the island parishes of Desterro, Santo Antônio, Ribeirão, Lagoa da Conceição, Rio Vermelho, Canasvieiras, and Trindade for the years 1810, 1855, 1856, 1866, and 1872. For instance, in 1810, there were 1,689 slaves living in the capital Desterro which represented about 32 percent of Desterro's total population of 5,250.

manioc flour and other exports to larger markets and bringing some manufactured goods from Europe to Santa Catarina. This economic integration led to the rapid growth of a commercial center in Desterro and the emergence of a merchant-capitalist class during the late eighteenth century. Over the course of the nineteenth century, as the total population grew and processes of social differentiation intensified on Santa Catarina Island, disparities of wealth and social status increased (Cardoso and Ianni 1960; Campos 1991). For mulattos and blacks, in particular, opportunities for socioeconomic mobility remained extremely limited (Cardoso and Ianni 1960).

The whaling industry in Portuguese America emerged in the mid-1740s as the royal government sought opportunities in Brazil to create new revenue-generating activities.[143] Initially, exclusive rights to whaling off the coasts of Santa Catarina, São Paulo, and Rio de Janeiro were granted to Tomé Gomes Moreira and seven partners in Lisbon stipulating a six-year term from January 1743 to December 1748 under terms defined by the *Conselho Ultramarino* (Comerlato 2007). Construction of the first whaling post (*armação*) established on the Santa Catarina coast began in 1743 and was completed by 1746 (Saint-Hilaire 1978 [1851]). Situated on the mainland at the entrance to the North Bay near the fortification of Santa Cruz on Anhatomirim Island, in an area that today falls within the município of Governador Celso Ramos, it was named Armação da Piedade (Cardoso and Ianni 1960; Comerlato 1998, 2007).

In its heyday from 1765 to 1789 Brazil's whaling industry was controlled by the Quintela family which had been awarded the exclusive contract to operate the royal whaling company (*Companhia da Pesca da Baleia*) (Brito 1829; Ellis 1969; Comerlato

[143] The peak whaling season along the Brazilian coast occurred during the winter months from June to August.

2007). Portugal's royal whaling company was established around the same time that Pombal set up two major monopolistic trading companies in the colony's northern and northeastern regions (i.e., the *Companhia do Grão Pará e Maranhão* created in 1755 and the *Companhia de Pernambuco e Paraíba* created in 1759) (Christelow 1947; Alden 1959; Maxwell 1968; Maior 1972; Galloway 1979; Hemming 1987; Fausto 1999: 23, 56; Skidmore 1999: 30; Pedreira 2000). It was during the Quintela contract that a major whaling post was constructed on Santa Catarina Island. The Armação de Santa Anna da Lagoinha or Armação da Lagoinha, referred to now as either Armação do Pântano do Sul or Praia da Armação (Armação Beach), and its chapel were completed in 1772 in the southeastern sector of the island (Cardoso and Ianni 1960; Comerlato 1998, 2007). Next to Armação Beach is Matadeiro Beach where, as its name suggests, captured whales were killed and slaughtered. This whaling-post complex included the Fazenda de Santa Anna da Lagoinha, an estate encompassing the freshwater Peri Lagoon and its surrounding hills (Piazza 1983; Comerlato 2007).[144]

In subsequent years three more whaling posts were constructed in Santa Catarina at mainland sites. In 1778 the Armação de São João Batista de Itapocoroy was founded north of Desterro and Piedade, in present-day Balneário da Penha, by Azorean and continental-Portuguese colonists who had fled Santa Catarina Island in response to the Spanish invasion of 1777. More than a decade later, to the south of Santa Catarina Island, the Armação de São Joaquim de Garopaba was founded in 1795 and the Armação de

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[144] During the nineteenth century, a coffee plantation was established on the Fazenda de Santa Anna da Lagoinha, and by the second half of the twentieth century much of the estate was protected for forest conservation and watershed management, first under federal legislation passed in 1952 and later as the Peri Lagoon Municipal Park (*Parque Municipal da Lagoa do Peri*) which was designated in 1981 and remains in effect today. For more information about its history as a protected area, see Chapter 5.

Imbituba was founded in 1796 (Cardoso and Ianni 1960; Piazza 1983; Campos 1991; Comerlato 1998, 2007). From 1748 to 1796, at least 2,775 whales were captured and slaughtered in Santa Catarina (Cardoso and Ianni 1960). Powered by hundreds of free and forced laborers, whaling represents the first major economic cycle of the Santa Catarina coastal region. The division of labor within the whaling industry, which included administrators, rowers, harpooners, butchers, and processors, introduced a hierarchy that provided some opportunities for socioeconomic mobility among the population of free workers (Campos 1991: 26–27). Generally, free men captured the whales while the processing activities were carried out primarily by slaves (Cardoso and Ianni 1960).

Around the turn of the century, the Portuguese government eliminated its monopoly on whaling, opening the industry to any willing investors (Comerlato 2007). However, by this time, the industry was showing signs of decline (Alden 1964). Its decline continued during the first three decades of the nineteenth century, and it finally collapsed around 1859 when petroleum-based substitutes for whale oil entered the global market and grew to dominate the production of illuminants and lubricants (Cardoso and Ianni 1960).

With a much stronger presence of military, civil, and ecclesiastical institutions keeping records and producing written documents, the demographic profile of Santa Catarina becomes clearer after the mid-eighteenth century. According to Alden (1963: 187), “the earliest known [demographic] census” for the subcaptaincy of Santa Catarina was carried out in 1753 reporting “the total population of the island and of the adjacent mainland as 6,336 communicants, or approximately 7,180 inhabitants.” Zeferino (2004: 75), however, reports the 1753 population size of Santa Catarina Island alone as 7,983 persons. For comparison, in 1750 the city of Salvador probably had about 40,000 inhabitants, half of whom were slaves (Fausto 1999: 34). Alden (1963: 187, 191) estimated that by the mid-1770s the total civilian population for insular and mainland Santa Catarina combined was only 10,000 inhabitants, and it appears that from 1772 to 1782, with only about 0.6 percent of the total population of Portuguese America (between 1.5 and 1.6 million inhabitants), [145] Santa Catarina possessed one of the two smallest colonial populations at the captaincy or subcaptaincy level in the entire Brazilian territory.[146] At the time, the captaincy-general Minas Gerais headed the list with 319,769 inhabitants, followed by Bahia (288,848), Pernambuco (239,713), Rio de Janeiro (215,678), and São Paulo (116,975) to list the top five; even Santa Catarina's neighboring subcaptaincy to the south Rio Grande de São Pedro with about 20,000 inhabitants had a substantially larger colonial population at this time (Alden 1963: 191). For the year 1810, fairly reliable demographic data for Santa Catarina at three spatial scales are available: over about 30 years (1780–1810) the total population of the entire subcaptaincy had more than tripled to about 30,300 inhabitants of which about 7,200 (~24 percent) were slaves; Santa Catarina Island alone had 12,471 residents (i.e., more than 40 percent of the subcaptaincy's population) of which 8,842 were white and 3,629 (~29 percent) were

[145] As Alden (1963: 180) explained, governors and other colonial officials faced numerous difficulties in carrying out population enumerations including "the dispersion of a relatively small population over a large area, the hardships of travel in remote districts, and the lack of special compensation for those charged with preparing the reports." Furthermore, the Portuguese "encounter[ed] passive resistance among colonials who regarded head counts as portents of future financial exactions and increased conscriptions of their sons for the unpopular militia" (Alden 1963: 181). Given these conditions, perhaps the total population of 1.9 million inhabitants in all of Portuguese America in 1776 as listed in Prado (1988: 358) is more accurate. For the year 1798, Alden (1963: 193, 195) estimates the total population of Portuguese America to be in the range of about 2.2 to 2.4 million inhabitants.

[146] Part of the evidence used by Alden to reach this estimate comes from reports produced in 1777 by the invading Spanish who in turn based their figures on information obtained from parish registers which indicated the civilian population of Santa Catarina Island to be about six thousand, in addition to the nearly 3,000 Portuguese and Brazilian soldiers (Alden 1963: 187). Based on reports by Pérouse, in 1783 the central parish of Desterro alone had 3,000 inhabitants occupying about 400 houses (Campos 1991: 23).

black (316 were free blacks); and the capital city of Desterro had 5,250 residents of which 1,689 (~32 percent) were slaves (Brito 1829; Cardoso and Ianni 1960; Piazza 1975: 18–19).[147]

According to Várzea (1985 [1900]), when the Spanish occupation of Santa Catarina Island ended in July 1778, the post-Pombaline Portuguese government appointed Colonel Francisco da Veiga Cabral de Câmara governor of Santa Catarina.[148] However, he was soon substituted by Governor Francisco Barros de Morais Araújo Teixeira Homem in 1779 under whose administration Santa Catarina Island underwent a brief but concentrated period of agricultural and commercial development including the opening of several stores and warehouses in Desterro and the construction of several sugar mills (Várzea 1985 [1900]). This growth spurt was followed by a much longer period of "economic stagnation" on Santa Catarina Island lasting from 1785 to 1808 with little change until after Brazil gained independence in 1822 (Pereira 1978).[149] Caruso (1990: 85–86) and Saint-Hilaire (1978 [1851]: 125) pointed out that, for the period 1785–1803, the increase in Santa Catarina Island's population was accompanied by a significant loss of forest cover. Consideration of the characterizations made by these authors for overlapping time periods raises a couple of questions: how may have this period of "economic stagnation" been related to population growth and deforestation trends; and to what extent is this population growth and deforestation attributable to the immediately preceding period of intensified development in the wake of the area's return to Portuguese control. Perhaps these two decades of economic stagnation and declines in

[147] According to Zeferino (2004: 75) the total population of Santa Catarina Island in 1813 was 11,154 inhabitants.
[148] Pombal was dismissed from the post of chief minister in 1777 and died in 1782 (Maior 1972: 143).
[149] Pereira (1978: 50) writes that in 1796, Desterro was reported to have about 860 houses and about 4,000 inhabitants.

certain exports led to the expansion of subsistence agriculture and of industries primarily geared toward local exchange including a significant degree of non-monetized barter trade.

In addition to the parish of Desterro, six settlements on Santa Catarina Island were formally recognized as parishes between the mid-eighteenth and mid-nineteenth centuries (Saint-Hilaire 1978 [1851]: 129; Lins 1994). Nossa Senhora da Lagoa da Conceição (1750; see Figures 4.5 and 4.6), Nossa Senhora das Necessidades e Santo Antônio de Lisboa (1755), Nossa Senhora Da Lapa do Ribeirão (1809), and Santíssima Trindade detrás do Morro (1835) originated from Desterro. São João do Rio Vermelho (1834) originated from Nossa Senhora da Conceição da Lagoa. São Francisco de Paula de Canasvieiras (1835) originated from Nossa Senhora das Necessidades e Santo Antônio. Several parishes were also established on the mainland during this period including: São Miguel (present-day Biguaçú) (1832); São José da Terra Firme (1832); Enseada do Brito (present-day district within Palhoça); and Vila Nova (present-day Imbituba). It is also important to point out that by the second half of the eighteenth century colonial settlers were occupying more of the mainland interior. In 1770, the interior settlement at Lages (*Vila das Lages*) became emancipated from the captaincy-general of São Paulo and annexed to the subcaptaincy of Santa Catarina, and by 1788 the first effort had been made to construct a roadway facilitating movement between Lages and the coast (Brito 1829).

Figure 4.5 Conceição Lagoon in the foreground and regenerated Atlantic Forest on hillslopes above an urbanized area where the neighborhoods of Lagoa da Conceição and Canto dos Araças meet. *Source:* author, November 2003.

Figure 4.6 The chapel on Morro do Assopra in the Lagoa da Conceição District, built in 1750, is among the earliest constructions on Santa Catarina Island. *Source:* author, December 2003.

4.5 Brazil's Independence and Imperial Government (1822–1889)

By 1800, the total colonial population of Brazil was in the range of 2 to 3 million inhabitants, about one-third of which were slaves (Alden 1963; Bethell 1969; Prado 1988: 358). Events in Europe hastened the collapse of the already declining Portuguese-Brazilian empire in the early nineteenth century. Responding to Portugal's refusal to support Napoleon Bonaparte's Continental System and the Napoleonic campaign against the British, French troops invaded Portugal in 1807. The Portuguese court, still ruled by the House of Bragança, retreated to Rio de Janeiro, Brazil in 1808 with the backing of the British (Carvalho 1982; Pedreira 2000; Baer 2001). This move contributed to the founding of various financial, commercial, political, educational, cultural, and scientific institutions in Brazil.[150] Opportunities in Brazil were increasingly promoted in Europe to merchants, travelers, scientists, and artists (Araujo 2005).

After Napoleon's defeat, the King João III returned to Portugal in 1821, leaving his son, Dom Pedro I, as regent of Brazil. After the series of political, structural and institutional changes that had taken place in the empire since 1808, those in power in Brazil were unwilling to revert to subservient colonial status and hence a movement for independence developed (Carvalho 1982; Baer 2001). Brazil gained its independence from Portugal in 1822 (e.g., Barman 1988). At this point, the population of Brazil was approaching 4 million inhabitants of which over one-quarter—that is about 1.1 million—were slaves (Prado 1988). On 20 March 1823, Desterro was elevated from a town to a city by royal decree and designated the capital city of Santa Catarina Province (Várzea 1985 [1900]). Brazil's new imperial regime was consolidated under Dom Pedro I with the

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[150] For instance, the first *Banco do Brasil* (Bank of Brazil) was founded in 1808 (Baer 2001: 16). The *Instituto Histórico e Geográfico Brasileiro* (Brazilian Historical and Geographic Institute) was founded in 1838.

Brazilian Constitution of 1824. After Emperor Dom Pedro I abdicated the throne to his five-year-old son Dom Pedro II, Brazil was governed by a body of regents from 1831 to 1840. From 1840 to the end of the constitutional monarchy in 1889, Emperor Dom Pedro II ruled.

After Brazil gained independence from Portugal, Brazil's imperial government continued to protect its intertwined military and commercial interests in the southern region including the Eastern Bank (*Banda Oriental*) of the Río de La Plata estuary and Uruguay River which Brazil tried, unsuccessfully, to establish as Cisplatina Province. At the end of the Cisplatine War (1825–1828) between the Brazilian empire and the Argentine Confederation of the United Provinces of the Río de la Plata, this territorial dispute was settled with mediation by the United Kingdom in August 1828 when Argentina and Brazil signed the Treaty of Montevideo recognizing Uruguay as an independent state (Skidmore 1999).

Engineers at this time were basing the modernization and planning of Brazilian cities on European models. In 1828, the Brazilian legislature passed a Law of Municipal Ordinances which, while granting greater autonomy to the municipalities on issues related to maintenance and development, failed to give municipal authorities any significant powers of enforcement related to land-use restrictions (Delson and Dickenson 1984).

Coffee was first introduced to northern Portuguese America in the 1720s, spreading to the southeastern region by the 1770s (James 1932; Hudson 1998; Lauderdale Graham 2002; Topik 2004). Agricultural experimentation with coffee cultivation during the eighteenth century combined with favorable prices for the commodity on the world market in the early nineteenth century led to the start of Brazil's coffee cycle in the 1830s. Initially, coffee cultivation developed in the mountains of Rio de Janeiro Province using slave labor.[151] The crop quickly spread to other parts of the southeast, and by the 1850s and 1860s Brazil's coffee frontier had begun to expand westward in the provinces of São Paulo and Minas Gerais transforming southeastern Brazil into the world's leading coffee-production region (James 1932, 1933; Bernstein 1973; Hemming 1987; Denevan 1992: 378; Laakkonen 1996; Fausto 1999; Skidmore 1999; Topik 2004).

During the second half of the nineteenth century, as coffee plantations expanded into the southeast's interior highlands, several major transformations occurred. First, labor shortages associated with the official end of Brazil's participation in the transatlantic slave trade in 1850 (Bethell 1970; Needell 2001b) and subsequent steps toward the abolition of slavery in 1888 were addressed by encouraging European immigration. Second, the lack of adequate transportation infrastructure led British investors and Brazilian entrepreneurs to build railroads connecting coffee-producing highland areas to the southeastern port cities of Santos and Rio de Janeiro (James 1932; Mattoon 1977; Graham 1981; Summerhill 2003). Third, British investors supplied financial capital. Foreign trade reached new heights with the establishment of railroad networks integrated with maritime trade and the construction of communications infrastructure using telegraph lines. Thus Brazil's coffee economy played an important role in the onset of multiple economic modernization processes.

[151] During the first half of the nineteenth century, largely to meet the demands of southeastern coffee planters, Africans were illegally imported into Brazil (primarily entering at the port of Rio de Janeiro) to work as slaves at annual rates of 15,000 to 20,000; in 1848 the importation rate reached a high of 60,000 slaves (Bethell 1969: 118, 146–147).

Although southern Brazil was outside the country's central region of coffee production at the time, coffee cultivation became widespread on Santa Catarina Island during the last quarter of the nineteenth century, contributing to continued forest loss and preventing forest regrowth (Várzea 1985 [1900]: 221; Lins 1994). Given the combination of a large number of small-scale family farms dedicated to diversified production and a very limited number of larger plantation estates on Santa Catarina Island, it is reasonable to assume that coffee production was carried out for domestic consumption, for sale in local markets, and for export. The magnitude of each of these activities among the rural producers of coastal Santa Catarina remains a question for future research.

4.6 The First Republic (1889–1930): Desterro Becomes Florianópolis

Beginning in the 1880s, cattle production and distribution, particularly in Brazil's southern and southeastern regions, were transformed by the spread of refrigeration which widely replaced salting as a method of preserving beef and other animal products (Bell 1999). Agricultural activities continued to expand to meet the demands of growing populations in coastal cities. In Santa Catarina, smallholders maintained economic activities in the coastal zone while new waves of European colonists, largely Italian and German, began to expand the agricultural frontier westward, gaining landholdings and establishing new manufacturing industries. Although the 1888 *Lei Áurea* abolished slavery in Brazil, the recently freed population and other non-whites faced tremendous barriers to socioeconomic, political, and educational advancement in a racist and highly stratified society.

The Brazilian monarchy fell soon after abolition. Brazil's First Republic was proclaimed on 15 November 1889 when the *Revolução Federalista* (Federalist Revolution) backed by the coffee oligarchy and led by Marshall Manoel Deodoro da Fonseca deposed Dom Pedro II (Bernstein 1973; Carvalho 1982; Hemming 1987; Bethell 1989). Deodoro da Fonseca became the first president of the Republic of the United States of Brazil with Marshall Floriano Vieira Peixoto as vice-president. In 1894, when the official population of Santa Catarina had surpassed 280,000 inhabitants, Desterro was declared the state's capital city and renamed Florianópolis in honor of Floriano Peixoto who was the second president of the First Republic from 1891 to 1894.

In efforts to promote economic growth through infrastructure projects, educational institutions were established in Santa Catarina's largest cities and roads and railways were expanded throughout the southern region. In 1900 the Brazilian census counted 32,229 inhabitants in the city of Florianópolis which represented about 10 percent of Santa Catarina State's total population. According to Várzea (1985 [1900]), the parish of Nossa Senhora da Lagoa da Conceição alone had about 3,450 residents. By 1919, Florianópolis had 41,338 inhabitants of which 55.33 percent resided in urban areas (Sugai 2002).[152] The urban-industrial development of Florianópolis and other small cities along the Santa Catarina coast paled in comparison to that of the cities of Rio de Janeiro and São Paulo; however, during the earliest decades of the twentieth century there were some signs of modernization in Florianópolis and a few modest attempts to overcome economic stagnation in a rapidly changing world. The city's earliest sanitation and

[152] In 1900, the official total population of Brazil was 17,438,434 enumerated inhabitants, with Santa Catarina State accounting for 320,289 individuals; by 1920 Brazil's total population had grown to 30,635,605 enumerated inhabitants with Santa Catarina State accounting for 668,743 people (Furtado 1965; Prado 1988).

electric energy systems were engineered during this period. In 1922, the Metropolitan Cathedral of Florianópolis was restored and a number of modernization projects were targeted in the area surrounding the main downtown plaza *Praça XV de Novembro*. Construction of the first bridge connecting Santa Catarina Island to the mainland began in 1920; this steel suspension bridge, *Ponte Hercílio Luz,* was inaugurated in 1926. At a time when roadways were becoming increasingly important to trade and commerce, the bridge was intended to usher in a new era of economic integration with the states of Paraná, São Paulo, and Rio Grande do Sul (Pereira 1978).

CHAPTER 5

INDUSTRIALIZATION, URBANIZATION, AND CHANGES IN GOVERNANCE

> Florianópolis is a community whose economic base has remained almost unaltered from the last century to the present day. Only recently (after the second World War) has this situation begun to change. The local history informs us that this community has been affected only by superficial and slow alterations, which permit us to characterize it, even today, as a community dominated by an economy that is poor and not well differentiated.
>
> Fernando Henrique Cardoso and Octávio Ianni (1960)[153]

5.1 Overview

In sharp contrast to the above observations by Cardoso and Ianni made nearly a half century ago, in the 3 July 2006 issue of *Newsweek International,* Florianópolis appeared

[153] I have translated this quote from the original Portuguese text written by Fernando H. Cardoso and Octávio Ianni (1960: xxvii), "Florianópolis é uma comunidade cuja base econômica manteve-se quase inalterável desde o século passado até nossos dias. Só recentemente (depois da segunda grande guerra) essa situação começou a modificar-se. A história local nos informa que ela tem sido afetada apenas por alterações superficiais e lentas, as quais nos permitem caracterizá-la, ainda hoje, como uma comunidade dominada por uma economia pobre e não muito diferenciada." Sociologists Fernando Henrique Cardoso (b. 1931) and Octávio Ianni (1926–2004) were both graduate students of Florestan Fernandes (1920–1995) at the University of São Paulo (USP) during the 1950s and early 1960s. Both were political exiles during the early years of Brazil's military dictatorship (1964–1985). In 1969, Cardoso and Ianni were co-founders of the research group *Centro Brasileiro de Análise e Planejamento* (CEBRAP) or Brazilian Center for Analysis and Planning. Cardoso lived abroad working as a researcher, writer, and professor in Chile, Argentina, Mexico, France, the United States, and England. He co-authored the book *Dependency and Development in Latin America* (Cardoso and Faletto 1979). Cardoso transitioned into a political career during the 1970s and served as senator of São Paulo State during the 1980s as a founding member of the *Partido do Movimento Democrático Brasileiro* (PMDB). President Itamar Franco initially appointed Cardoso as Minister of Foreign Relations (1992–93) then as Minister of Finance (May 1993 to April 1994). As Minister of Finance, Cardoso introduced the Real Plan (*Plano Real*) to combat hyperinflation. Cardoso was elected President of the Federative Republic of Brazil in 1994 and reelected in 1998, thus serving eight consecutive years as president of Brazil from 1 January 1995 to 1 January 2003. Cardoso instituted reforms that have been either strongly criticized or strongly praised for their neoliberal leanings. Under his administration, Brazil adopted structural adjustment policies favoring international economic integration, privatization of state firms in the telecommunications, energy, transportation, and mining sectors, and reduced state intervention. Cardoso was succeeded in 2003 by President Luis Inácio Lula da Silva of the Workers' Party (*Partido do Trabalhador*) who is currently in office after re-election in October 2006. Since leaving office, Cardoso has established the Instituto Fernando Henrique Cardoso (iFHC), a not-for-profit, nonpartisan organization (see http://www.ifhc.org.br). For additional information about Cardoso, see Cardoso (2006) and the collection of articles organized by Hammond and Martins Filho (2007) in an issue of *Latin American Perspectives*. For more information about Ianni see (Grossi Porto 2005).

among the world's "Ten Most Dynamic Cities."[154] In a brief piece entitled "Bigger yet better: on 'Magic Island,' a virtuous cycle began with a ban on heavy industry," Brazil correspondent Mac Margolis wrote (Margolis 2006):

> …From Jakarta to Rio de Janeiro, more people have typically meant more ghettoes, more crime, and less economic life. That's one reasons [sic] urbanites in big cities are moving to places like Florianópolis, an island city 700 kilometers south of São Paulo, where bigger doesn't always mean worse.
>
> Between 1970 and 2004, Florianópolis's population tripled. So did the number of shantytowns. But the local economy grew fivefold, and incomes grew in step. Opportunity seekers, urban and rural, white collar and blue, poured in….And while many Brazilian cities are struggling to graduate from smokestacks to services, Florianópolis is succeeding….
>
> By the late 1990s, private companies were flocking to the island, or emerging from a technology "incubator" at the federal university. (Among the innovations it hatched: the computerized voting machines that have made Brazilian elections fraud-free and efficient.) Local officials now say their aim is to be the Silicon Valley of Brazil, with beaches. Don't count them out.

What happened over the past several decades that contributed to such dramatic change in Florianópolis and, no less importantly, to changes in the ways in which the city is perceived and imagined by a diverse array of social actors? This chapter offers some answers to this question.

Section 5.2 begins the chapter by providing a brief explanation of the series of political and economic changes that transformed the role of the Brazilian state after 1930 and that eventually opened up democratic political spaces for a multitude of civil society organizations. Subsequent sections present a multiscale analysis of socioeconomic and landscape dynamics in the Florianópolis Metropolitan Region (FMR). As explained in

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[154] According to *Newsweek International* contributors Rana Foroohar, Akiko Kashiwagi, Stefan Theil, William Underhill, Tracy McNicoll, Quindlen Krovatin, Owen Matthews, Jason Overdorf, B. J. Lee, and Mac Margolis respectively, the list of "The Ten Most Dynamic Cities" in the world included: (1) Las Vegas (United States), (2) Fukuoka (Japan), (3) Munich (Germany), (4) London (England), (5) Toulouse (France), (6) Nanchang (China), (7) Moscow (Russia), (8) Ghaziabad (India), (9) Goyang (Korea), and (10) Florianópolis (Brazil). The full article titled, "The ten most dynamic cities," is available online at: http://www.newsweek.com/id/46125/output/print.

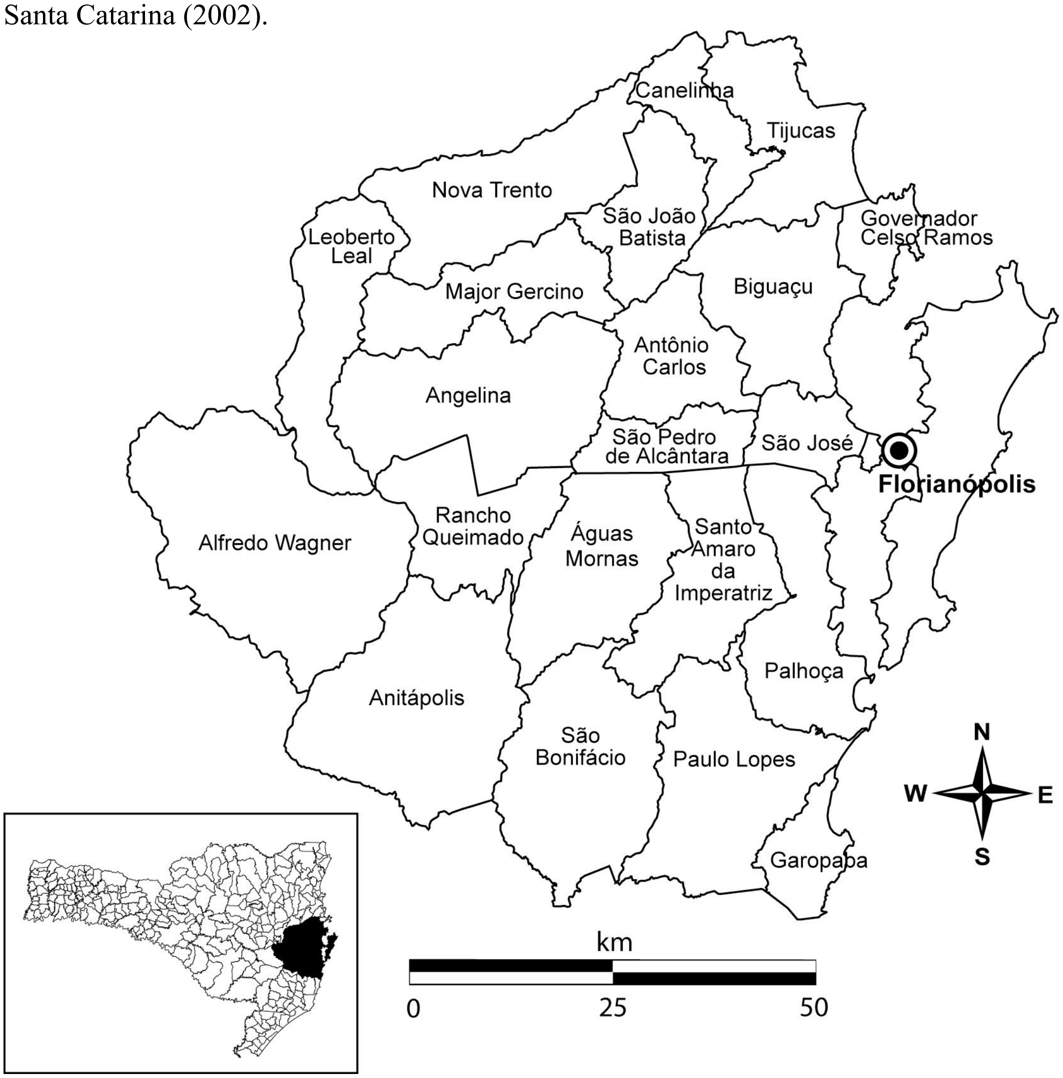
Chapter 1, the terms metropolitan region, city-region, and urban region are largely interchangeable in this dissertation. However, to structure data collection, organization, and spatial analyses with sufficient consistency and clarity, I have operationalized the city-region concept by defining the FMR (27º14'S to 28°01'S and 48°20'W to 49º20'W) more specifically as the contiguous set of 22 municipalities (~7,100 km²) shown in Figure 5.1. Centered on Santa Catarina's capital city of Florianópolis, the FMR encompasses urban, industrial, suburban, peri-urban, rural, and conservation areas ranging from sea-level to over 800 m a.s.l. (see Figure 5.2). Demographic and agricultural censuses conducted by the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística*–IBGE) from 1940 to 2000 provide state and municipal-level data on human population and vegetation cover changes examined in Sections 5.3, 5.4, and 5.5.[155]

Next, Section 5.6 outlines a number of recent legislative and institutional reforms at the federal level which are relevant to the themes of the dissertation and their implications for state and municipal legislative and policy arenas. It then considers how these laws and policies have been implemented by taking a close look at the protected area network that has emerged in the Florianópolis city-region within the existing legal-political framework. Exploring some of the interconnected issues alluded to by Margolis (2006), such as rapid urban expansion, social inequality, quality of life, migration, social capacity, strategic urban planning, economic competitiveness, information technology leadership, and democratic governance, Section 5.7 closes the chapter by reflecting on

[155] Demographic censuses have been conducted by IBGE in Brazil since 1872 and agricultural cultural censuses since 1920.

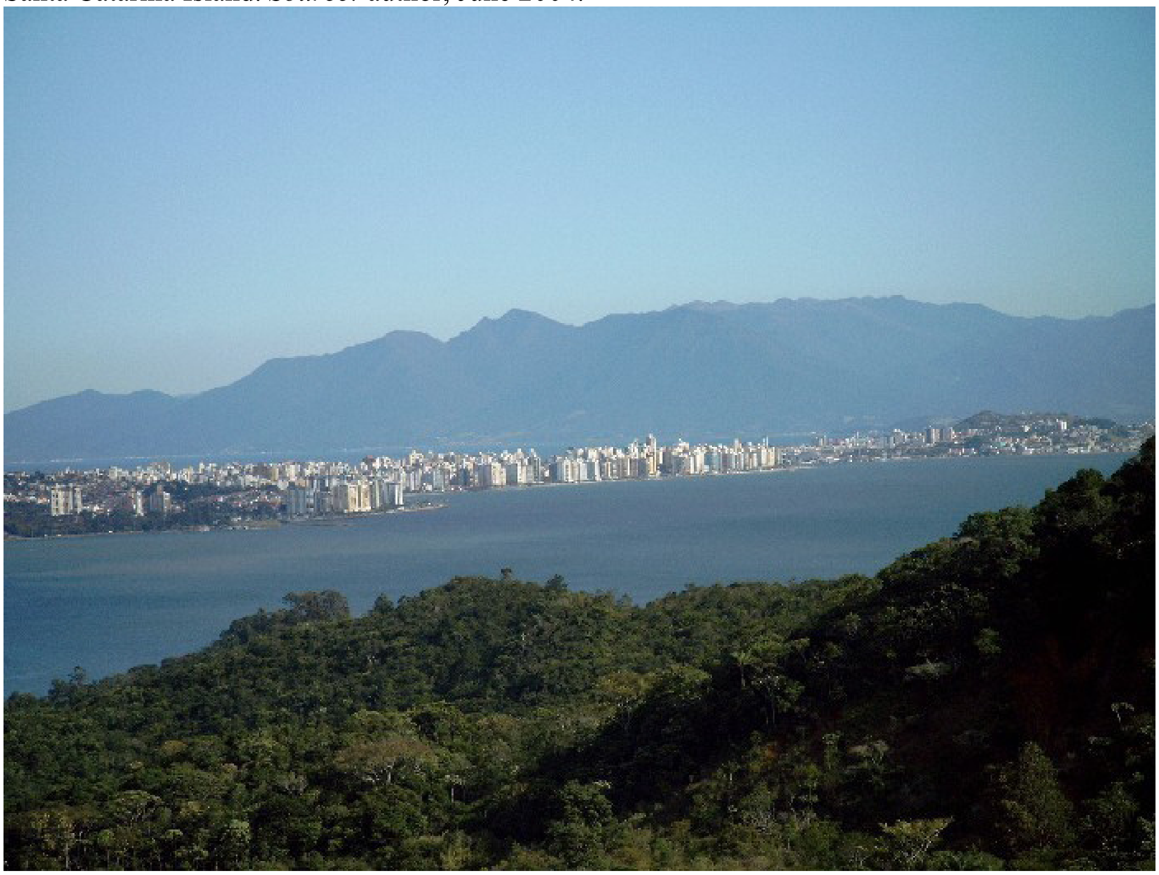
the notion of limits to sustainability and challenging regional and even global perceptions of Florianópolis as one of the world's modern "green" cities.

Figure 5.1 The Florianópolis Metropolitan Region (FMR) in Santa Catarina State.[156] *Source:* Santa Catarina (2002).



[156] The municipal-boundary base map for Santa Catarina used to create this figure is available as a vector file in CorelDRAW format at the state's government website (see Santa Catarina 2002).

Figure 5.2 Central city of metropolitan Florianópolis and its vicinity, viewed from the Desterro Environmental Conservation Unit (*Unidade de Conservação Ambiental do Desterro*—UCAD), Santa Catarina Island. *Source:* author, June 2004.



5.2 The Changing Role of the Brazilian State

Having lasted for four decades, Brazil's First Republic ended with the Revolution of 1930. In opposition to the political hegemony of São Paulo's agrarian oligarchies and associated *paulista* elites, the Liberal Alliance (*Aliança Liberal*) installed Getúlio Vargas, a *gaúcho* (i.e., a person from the state of Rio Grande do Sul), as president of Brazil's provisional government from 1930 to 1934. The political and economic power base of the Liberal Alliance was largely formed by individuals and groups from the states of Minas Gerais and Rio Grande do Sul. By an indirect election held immediately after promulgation of the 1934 Constitution, Vargas remained as Brazil's head of state from 1934 to 1937 (Fausto 1999).[157]

In 1937, Vargas changed the constitution again and established a corporatist state called the *Estado Novo* (New State) which "reflected an alliance between the civilian and military bureaucracy and the industrial bourgeoisie" mobilized by the shared goal of "promot[ing] Brazil's industrialization without causing large social upheavals" (Fausto 1999: 217). The *Estado Novo* dictatorship lasted until 1945 when, after the end of World War II, democratic elections were held in Brazil. Gaspar Dutra was elected president by popular vote. Dutra had been Brazil's Minister of War from 1937 to 1945 and had the support of Vargas. At the end of President Dutra's term in 1950, Vargas was elected president democratically by direct vote and assumed office in January 1951. Under pressure from domestic and foreign interests to surrender power, President Vargas committed suicide on 24 August 1954.

After a brief provisional government headed by Nereu Ramos, in 1955 Juscelino Kubitschek was democratically elected president by direct vote. In office from 1956 to 1961, Kubitschek continued the national industrialization project, but in contrast to Vargas, he welcomed foreign capital in the form of loans from the International Monetary Fund (IMF) and embarked on the construction of Brasília in the country's central highland to serve as the new, modern capital city.[158]

Mounting outrage at the excessive profits of foreign companies and the negative impact this dynamic was having on the Brazilian economy was voiced by Vice-President João Goulart and others, leading President Kubitschek to declare a break from IMF in

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[157] The Brazilian Constitution of 1934 was the country's third, following the 1824 Constitution of the Imperial government and the 1891 Republican Constitution which instituted federalism.
[158] Brasília was inaugurated in April 1960.

1959. In 1961, after President Jânio Quadros resigned, João Goulart (who had been elected vice-president) assumed the presidency from 1961 to 1964. In spite of the efforts of the Goulart Administration to stimulate economic growth and implement social reforms—e.g., Celso Furtado's proposed economic plan to combat inflation and promote development (see Fausto 1999: 273)—Brazil eventually negotiated loans with the IMF as well as bilaterally with the United States. Both creditors demanded reduced national spending, foreshadowing the rise during the 1980s of the neoliberal global economic agenda imposed through the structural adjustment policies of the IMF and the Washington Consensus.

In 1964, a military authoritarian regime took control of the Brazilian government in a *coup d'état* and remained in power until 1985, however, by the mid-1970s and early 1980s, the military dictatorship was losing its hold as a result of "the growing social mobilization through trade unions, civic organizations, social movements, residents' associations, groups linked to the progressive branch of the Catholic Church, and other collective channels; the reorganization of traditional political parties and the creation of new ones expressing renewed political claims for political–institutional change, particularly through democratic elections and the strengthening of local government; and also, to a lesser extent, the rearrangements within land and property capital" (Fernandes 2007: 179). In 1985, towards the restoration of a system of representative democracy, Brazilians began the process of preparing a new federal constitution. Promulgation of Brazil's 1988 Constitution established a legal-political foundation for civil rights and urban reform (Fernandes 2007; Ferreira and Tavolaro 2008).

From the 1930 Revolution to the mid-1950s, Brazil's nationalistic, developmentist, and protectionist political-economic agenda succeeded in: centralizing power; restricting foreign capital; furthering various social welfare programs including the expansion of public education; creating state-controlled labor unions; diversifying the economy; institutionalizing urban planning; and securing state ownership of a number of major enterprises including public utilities, natural resource extraction, transportation and communications infrastructures, and financial institutions (Furtado 1965; Font 1992; Baer and Coes 2001; Amann and Baer 2005; Guimarães 2005). In 1951, President Vargas proposed the creation of a Brazilian state-owned oil company to the Brazilian National Congress and in 1953 Petrobrás (*Petróleo Brasileiro Sociedade Anônima*) was founded (see Smith 1972).[159] In 1954, Vargas proposed a project to create Eletrobrás (*Centrais Elétricas Brasileiras*), a state-owned power utility. Strong state intervention in the development and management of Brazil's energy sector, heavy industries, and transportation and communications infrastructures continued through the 1970s. On the path of debt-led development, during the military dictatorship Brazil borrowed heavily from multilateral lending institutions and thus became increasingly dependent on foreign capital to maintain high levels of economic growth.

The debt crisis and balance-of-payments problems of the 1980s interrupted Brazil's economic growth through the early 1990s, however, from 1980 to 1995 commercial and service sector employment in urban labor markets continued to attract rural-urban migrants. The Brazilian government adopted neoliberal approaches to economic reform, such as the privatization of Brazil's state-owned enterprises, in the late

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[159] As explained by Smith (1972: 185), beginning in 1947 an alliance of groups interested in securing national ownership of Brazil's oil industry and seeking popular support for their cause used the slogan "*O petróleo é nosso*" meaning "The oil is ours."

1980s and 1990s leaving the state to function primarily as regulator and financier (Perz 2000; Fernandes and Negreiros 2001; Amann and Baer 2005). Income distribution worsened in Brazil between 1950 and 1980 during a period of accelerated economic growth, and socioeconomic disparities were aggravated by the adoption of neoliberal policy measures (Baer and Coes 2001, 2002; Skidmore 2004; Amann and Baer 2005).

As suggested by the observations of Cardoso and Ianni (1960), between 1930 and 1960, Brazil's federal government demonstrated limited interest in fostering the economic development of Florianópolis and its surrounding region through public investment. Indeed, prior to 1960, the entire state of Santa Catarina was somewhat marginalized by federal economic policies that favored urban-industrial growth in Rio de Janeiro and São Paulo and later prioritized the construction of Brasília. The commercial importance of Florianópolis had been diminishing since the late nineteenth century as colonists pushed Santa Catarina's agricultural development frontier westward (Katzman 1975), and the city's port activity declined over the first half of the twentieth century. Measures were needed to overcome the city's extended period of economic stagnation and isolation, to foster economic diversification and integration, and to protect the city's status as Santa Catarina's administrative capital.[160] An early response to stimulate the city's economic recovery was the construction of the Hercílio Luz Bridge, a suspension bridge inaugurated in 1926, which connected Santa Catarina Island to the mainland. However, significant roadway improvements in Santa Catarina and upgrades in the urban infrastructure and services of Florianópolis would not be made until the 1960s and 1970s. Around this time, the federal government also encouraged expansion of the ceramic and

[160] In the 1920s, some were advocating the transfer of Santa Catarina's capital from Florianópolis to another city, perhaps in the state's interior (Lago 2000: 20).

textile industries in Blumenau, Brusque, and Criciúma, cities in eastern Santa Catarina, located along the route of the newly constructed highways (Meyer-Stamer 1999; Lago 2000).

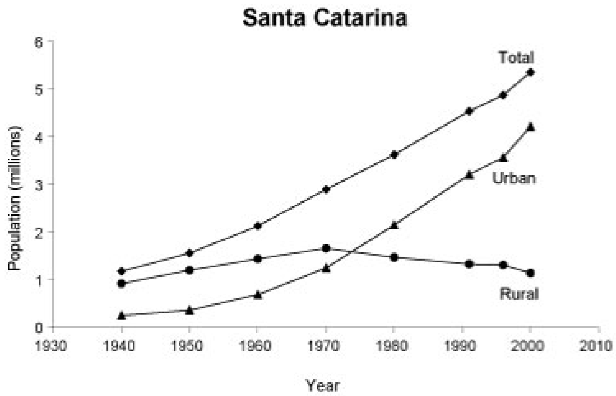
5.3 Demographic Change in Santa Catarina and the Florianópolis Metropolitan Region

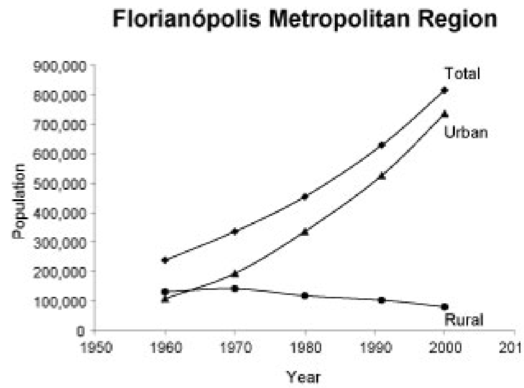
According to recent estimates by IBGE, the total human population of Santa Catarina State is roughly 5.9 million and nearly one million people reside in the FMR (IBGE 2007a). Demographic census results tell us that Santa Catarina's population rose from nearly 1.2 million people in 1940 to over 5.3 million in 2000 (Figure 5.3). From 1940 to 1970, its rural population gradually increased from approximately 925,000 to a peak of about 1.7 million, then declined to around 1.1 million in 2000. Its urban population grew from about 254,000 to roughly 1.2 million people between 1940 and 1970. As the rural population began to fall after 1970, the number of urban dwellers continued to grow, surpassing the rural population between 1970 and 1980. By 2000, Santa Catarina had over 4.2 million urban inhabitants representing nearly 80 percent of its total population.

Over four decades, the FMR population increased from about 239,000 in 1960 to about 816,000 people in 2000 (Figure 5.3). The FMR's rural population peaked around 1970 at about 142,000 people. The number of urban dwellers surpassed the number of rural dwellers well before 1970. By 2000, the FMR urban population which was about 107,000 in 1960 had increased to about 736,000 while its rural population had declined to about 80,000. Populations declined in six FMR municipalities between 1991 and 2000. All six (Alfredo Wagner, Major Gercino, Leoberto Leal, Angelina, Anitápolis, São

Bonifácio) are inland at altitudes greater than 400 m a.s.l. and are among the FMR municipalities with the lowest population densities.

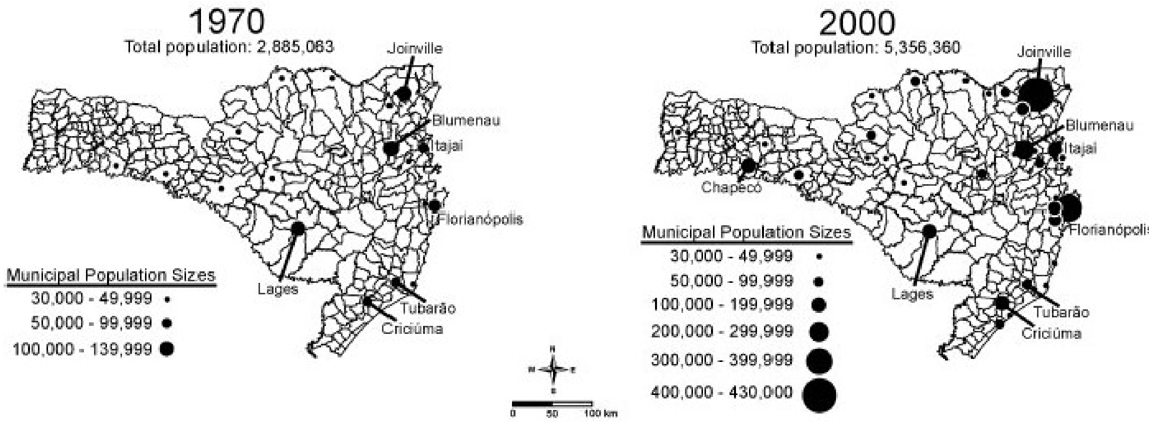
Figure 5.3 Demographic trends in Santa Catarina and the FMR. *Sources:* IBGE 1964, 1974b, 1983b, 1996, 1997, 2001, 2007a, b.





In 2000, Santa Catarina's average population density was 56 people/km² compared to 30 people/km² in 1970. Much of Santa Catarina's population growth from 1970 to 2000 was concentrated in the more urbanized eastern municipalities (Figure 5.4). Average population density for the FMR was 47 people per km² in 1970 with Florianópolis at 307 people per km² while the lowest municipal population densities were in Anitápolis and São Bonifácio, both with eight people per km². By 2000, population densities in Anitápolis and São Bonifácio had dropped to six and seven people/km² respectively while Florianópolis had increased to 780 people per km² and São José reached 1,522 people per km².

Figure 5.4 Distribution of municipalities in Santa Catarina with over 30,000 inhabitants in 1970 and 2000. *Sources:* IBGE 1974b, 2001.



Florianópolis, São José, Palhoça, and Biguaçu, which comprise the Florianópolis conurbation, currently receive more urban than rural migrants. However, over the past half century there has been a significant influx of rural migrants attributed to low income, instability, and difficulty of agricultural work, lack of property ownership, and inadequate health care in rural areas (Casagrande 2006). The rural-urban migration rate increased from 1950 to 1985 peaking during 1985–90, then from the 1990s onward it declined (Casagrande 2006). After Santa Catarina’s internal migrant flow, the next most common origins of migrants to the Florianópolis conurbation are the states of Rio Grande do Sul, Paraná, São Paulo, and Rio de Janeiro. In 2000, about 85.3 percent of the 816,419 FMR residents had been born in Santa Catarina while 5.8 percent had been born in Rio Grande do Sul, 3.5 percent in Paraná, 2.0 percent in São Paulo, 1.0 percent in Rio de Janeiro, and 0.5 percent outside Brazil (IBGE 2001). Of the 40,891 in-migrants over age five who originated from outside Santa Catarina between 1995 and 2000, 34.8 percent were from Rio Grande do Sul, 21.1 percent from Paraná, 17.5 percent from São Paulo, 5.3 percent from outside Brazil, and 5.1 percent from Rio de Janeiro (IBGE 2001).

5.4 Rural Land-Use Change in Santa Catarina and the Florianópolis Metropolitan Region

Land-use tables in the Brazilian agricultural censuses for the years 1970, 1975, 1980, 1985, and 1995/96 report extents of cropland, fallows, pasture, natural forests, and planted forests for each of the country's municipalities. Unlike satellite imagery, which offers the advantage of complete areal coverage, the agricultural censuses are limited to the characteristics of rural private properties. However, changes over time in the ratio of rural private land to overall land area are important to consider in this study in view of the consulted literature documenting rural depopulation, urbanization, and agricultural intensification in the region.

Due to a difference in the seasonal timing of data collection, the potential lack of comparability between 1995/96 agricultural census data and data from the earlier agricultural censuses (see IBGE 1998, Helfand and Brunstein 2000) should be kept in mind, particularly for nonforest categories.[161] However, this may be less of a concern for studies of southern Brazil where the percentage of hired labor in the agricultural sector is much lower than in the country's center-west or south-east (Helfand and Brunstein 2000; Baptista and Rudel 2006).

Wendy Jepson (2005) has recently questioned the reliability of agricultural census data for the *Cerrado* ecoregion, Brazil's tropical savanna. Jepson's case study is located in a frontier region of eastern Mato Grosso where accessibility to remote areas may have interfered with data collection by agricultural census takers. In contrast, given the longer

[161] Prior to the 1995/96 agricultural census, IBGE personnel carried out data collection during the growing season. Data collection for the 1995/96 agricultural census took place after the growing season.

settlement and development history of eastern Santa Catarina, rural properties in the FMR have been more easily accessible to census enumerators.

Modernization and capitalization of Brazilian agriculture from the 1960s onward involved increased mechanization, use of chemical fertilizers and pesticides, a shift to industrial feed in livestock production, changes in labor relations, technological advances in storage, processing, and transportation capacities, and new institutional arrangements providing farmers with subsidized credit (Graziano da Silva and Kohl 1984). In the early 1960s, maize led the list of major crops in Santa Catarina State covering approximately 3,420 km², followed by wheat (~1,000 km²), manioc (~950 km²), and black beans (~870 km²); in the littoral zone, manioc, rice, and sugarcane were dominant (Noble 1967). By the mid-1990s, tobacco had expanded from only ~220 km² in 1962 to 5,965 km², claiming 19 percent of the state's cropland; maize (18 percent), beans (7 percent), and rice (5 percent) remained major crop covers while soybean production expanded to about 8 percent of total cropland area (IBGE 1998).

Agricultural census data for 1970 to 1995/96 reveal that rural private property in Santa Catarina fluctuated between 69.2 and 78.3 percent of the state's total area (Figure 5.5a). Cropland expanded from 1970 to 1985 peaking at 18,688 km² then decreased to 15,704 km² by 1995/96 as yields (kg/ha) for many of the state's major crops improved (IBGE 1998). Pasture area reached a high of 24,909 km² in 1980 and declined to a low of 23,389 km² by 1995/96. Fallows declined from 11,100 km² in 1970 to only 2,939 km² in 1995/96. These three land covers contracted at about the same rate between 1985 and the mid-1990s, as the total number of agricultural establishments declined from 234,973 to 203,347. Cattle production was the most extensive rural activity in Santa Catarina State in the mid-1990s (16,378 km²) when there were nearly 3.1 million heads of cattle, compared to 2.6 million heads of cattle reported in 1980.

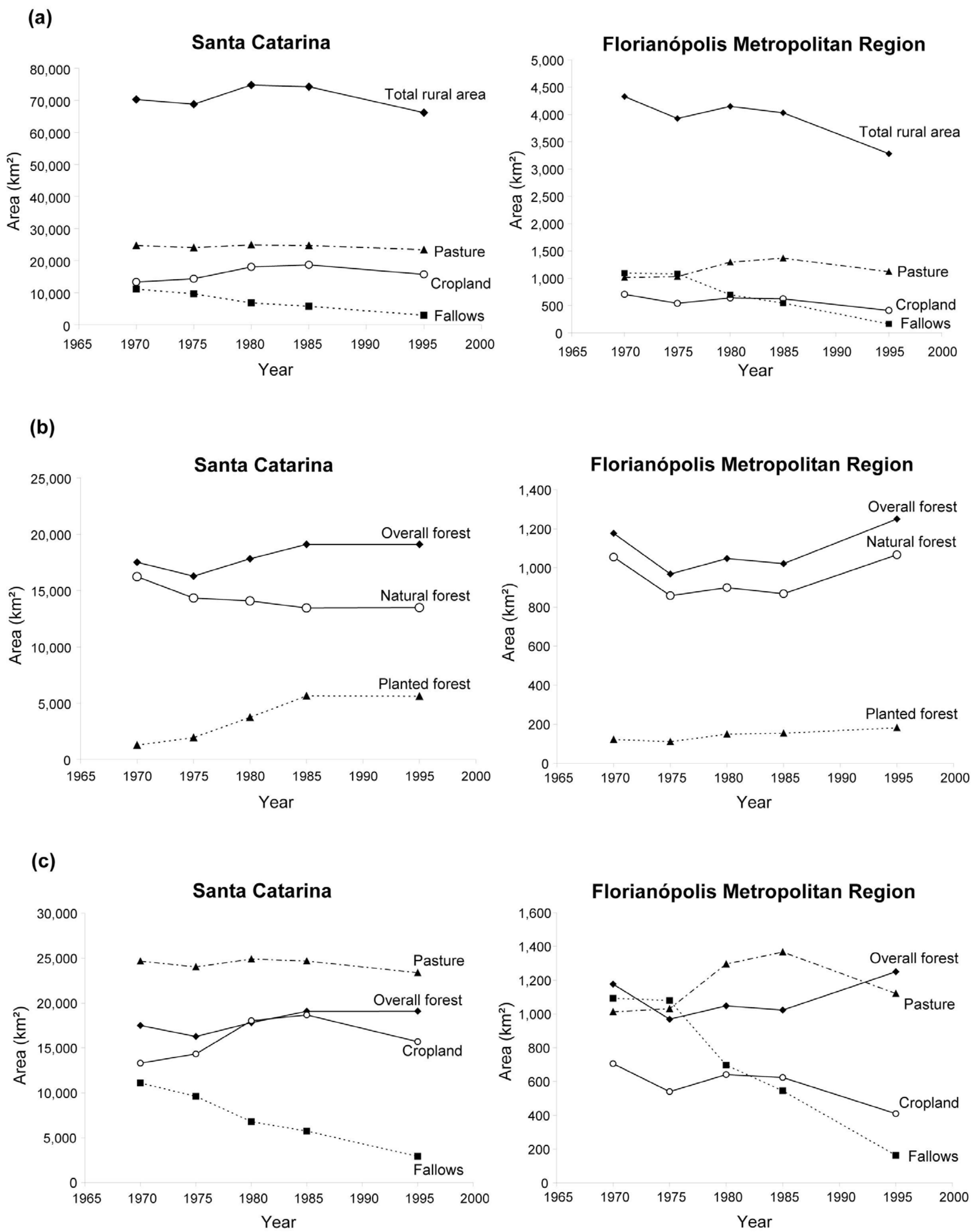
In the FMR, overall rural private land declined after 1980. Cropland, fallows, and pasture all contracted from 1985 to 1995/96 (Figure 5.5a). FMR cropland declined to 410 km² and fallows decreased dramatically to only 163 km² by the mid-1990s. Maize, harvested from about 125 km² (~30 percent), along with tobacco (~9 percent), manioc (~8 percent), beans (~8 percent), and rice (~4 percent) together accounted for nearly 60 percent of FMR 1995/96 cropland. Other FMR crops in 1995/96 included tomatoes, onions, bananas, oranges, peaches, and grapes.[162] Pasture expanded rapidly in the FMR from 1975 to 1980, and then its increase slowed from 1980 to 1985. Reaching 1,367 km² in 1985, during the following decade, pasture declined by about 246 km² to a level well below that of 1980.

Pasture expansion in the FMR from 1975 to 1985 followed by decline raises some interesting questions for future study. To what extent was it related to real estate speculation (Lago 1992; Oliveira 1999; Campos 2002) whereby lands were converted to pasture while landowners awaited increases in land prices before either selling properties to developers or themselves developing properties into residential, commercial, or industrial subdivisions? Was this period (1975-85) of pasture expansion indicative of a societal shift toward urban labor markets, reducing the availability of farm laborers and thus making activities with relatively low labor requirements such as cattle rearing more attractive to landowners? Did temporary pasture expansion reflect an increase in local

[162] According to Araújo (2005), hundreds of family farms in the FMR produce about half of Santa Catarina's horticultural specialties.

demand for bovine products as a result of urban growth which was later met by industrial cattle breeding?

Figure 5.5 Land-use change on rural private property in Santa Catarina and the Florianópolis metropolitan region from 1970 to 1995/1996. Change in (a) total rural area, pasture, cropland, and fallow; (b) forest types; and (c) forest, pasture, cropland, and fallow. Source: IBGE (1974*a,* 1979, 1983a*,* 1990a, 1998).



5.5 Forest-Cover Change in Santa Catarina and the Florianópolis Metropolitan Region

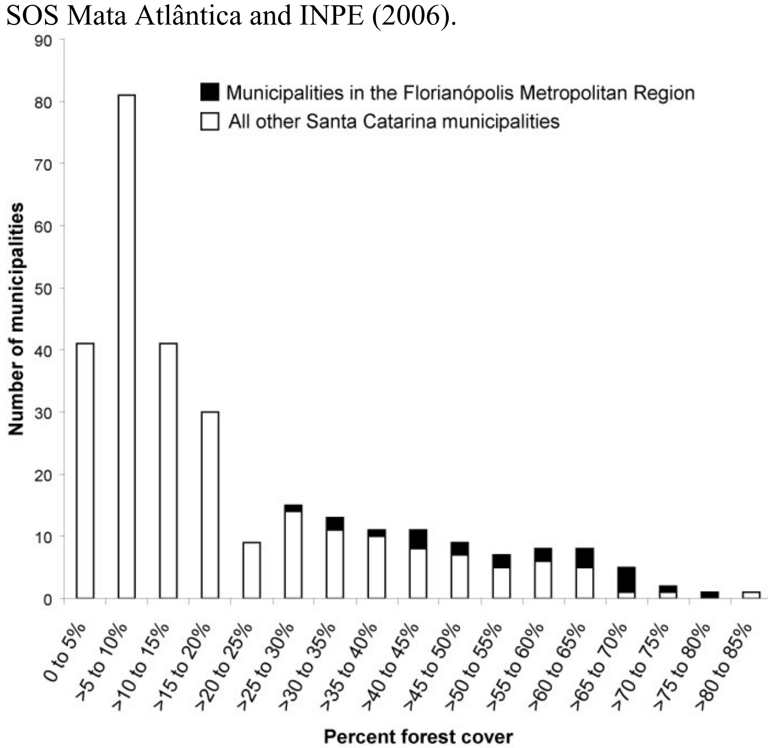
Since the 1990s, the Brazilian NGO *Fundação SOS Mata Atlântica*[163] and Brazil's National Institute for Space Research (INPE), have collaborated to monitor vegetation-cover changes in the Atlantic Forest ecoregion using satellite remote sensing data (Fundação SOS Mata Atlântica, INPE, ISA 1998, Fundação SOS Mata Atlântica and INPE 1993, 2002, 2006). They have released atlases summarizing their findings. According to their most recent analysis, in 2005 eight of the Brazilian states within the Atlantic Forest (i.e., *Mata Atlântica*) contained 97,906 km² of remnants including: 92,402 km² of old-growth and advanced successional forests; 4,634 km² of *restinga* vegetation which includes herbaceous, scrub, and arboreal formations covering beaches, dunes, and sandy coastal plains; and 870 km² of mangroves (Fundação SOS Mata Atlântica and INPE 2006). They also reported that between 2000 and 2005 forest cover alone decreased by about 951 km² with 454 km² (48 percent) of this loss having occurred in Santa Catarina State. Their findings suggest an overall drop in the rate of forest loss due to reduced rates in Rio de Janeiro, São Paulo, Espírito Santo, and Rio Grande do Sul, states that have already experienced severe deforestation, even as Santa Catarina and Goiás, states with larger proportions of remaining forest cover, suffered relatively rapid rates of forest loss.[164] At present, the Fundação SOS Mata Atlântica and INPE (2006) atlas for the period 2000–05 does not provide forest-cover change data disaggregated by municipality, nor does it list the 2000 municipal-level land-cover estimates used to calculate the net deforestation of 951 km². Should this information become available, knowledge of the

[163] The SOS Mata Atlântica Foundation (*Fundação SOS Mata Atlântica*) was founded in 1986.
[164] Along with Rio de Janeiro and Espírito Santo, Santa Catarina is one of three Brazilian states currently defined as being situated entirely within the *Mata Atlântica* domain (IBGE 2004a).

direction of forest-cover change for each municipality will help reveal the spatial pattern of net forest losses and gains in Santa Catarina and other states.

In Santa Catarina, despite a reported forest loss of 454 km², it appears that old-growth and advanced successional forests covered about 21,887 km² corresponding to 23 percent of the state's total area (Fundação SOS Mata Atlântica and INPE 2006). Furthermore, although Fundação SOS Mata Atlântica and INPE analysts determined that 122 municipalities had <10 percent forest cover, they also found that 32 municipalities had >50 percent forest cover (see Figure 5.6), and many of eastern Santa Catarina's long-settled, highly-urbanized, industrialized, and most densely populated municipalities appeared to contain relatively high proportions of forest cover. Garopaba, on the coast, ranked lowest in the Florianópolis city-region with 27 percent forest cover, and the inland municipality of Nova Trento ranked highest with nearly 76 percent.

Figure 5.6 Percent forest cover in Santa Catarina's 293 municipalities, 2005. *Source:* Fundação SOS Mata Atlântica and INPE (2006).



Analysis of Brazilian agricultural census data on land-use changes between 1970 and the mid-1990s and complementary literature provides some insights into Santa Catarina's land-use history and landscape dynamics preceding the Fundação SOS Mata Atlântica and INPE (2006) remote sensing assessment of forest cover in 2005. At the statewide spatial scale, the overall net gain in private forest area after 1975 resulted from planted forest expansion with non-native species even as natural forests continued to contract (Figure 5.5b and Table 5.1). Initially most of these planted forests emerged on lowlands, then after 1980 they began to concentrate at higher-altitudes (see Baptista and Rudel 2006).[165]

Table 5.1 Extents of rural private property and privately-owned forests in Santa Catarina State, Brazil, 1970 to 1995/1996. *Source:* IBGE (1974a, 1979, 1983a, 1990a, 1998).

Agricultural census year	**Extent of rural private property in Santa Catarina**		**Santa Catarina forest areas**		
	ha	*% of state's total area*	*All forests (ha)*	*Natural forests (ha)*	*Planted forests (ha)*
1970	7 025 326	73.58	1 682 891	1 556 735	126 156
1975	6 877 280	72.03	1 560 129	1 367 864	192 265
1980	7 473 778	78.27	1 668 603	1 310 240	358 363
1985	7 419 543	77.71	1 690 605	1 260 992	429 613
1995/1996	6 612 846	69.26	1 765 044	1 239 736	525 308

Federal fiscal incentives promoting afforestation and reforestation from the mid-1960s to 1988 (Bacha 2003*a*, *b*) explains most of the gains in planted forests in Santa Catarina State during the 1970s and 1980s (Figure 5.5*b*). At the spatial scale of the metropolitan region, it appears that a forest transition began in the FMR at roughly the same time, but with some fluctuation (Figure 5.5b). From 1980 to 1985, the net increase

[165] The exotics, *Pinus taeda* and *Pinus elliotti*, which grow well in the cooler conditions found at higher altitudes, made up more than 85 percent of the planted forests in Santa Catarina in 2000 (SBS 2001). Eucalyptus (*Eucalyptus* spp.), which grows well at lower altitudes with warm climates, had only a minor presence in Santa Catarina (SBS 2001; BRDE 2003).

in planted forest (563 ha) did not offset the net loss of natural forest (3,111 ha) sufficiently to result in an overall net forest gain, but in contrast from 1985 to 1995/96 natural forest expansion (19,911 ha) far exceeded planted forest expansion (2,825 ha), accounting for almost 88 percent of total net forest increase of 22,736 ha (Table 5.2).

Twelve FMR municipalities experienced forest expansion on rural private properties from 1985 to 1995/1996 (see Figure 5.7). Private forest gains were mostly in the more rural, inland, higher-altitude municipalities, while private forest losses were mostly in the coastal zone. Natural forest resurgence on private properties occurred primarily in Alfredo Wagner (+6,952 ha), Angelina (+6,717 ha), São Bonifácio (+6,171 ha), and Leoberto Leal (+4,362 ha). The largest losses of natural forest cover on private lands from 1985-95 occurred in Paulo Lopes (-8,637 ha), Tijucas (-3,140 ha), Palhoça (-1,856 ha), and Biguaçu (-1,147 ha). During the same period, substantial planted forest harvesting occurred in Palhoça (-2,070 ha), Florianópolis (-546 ha), and Tijucas (-374 ha), and major planted forest gains occurred in Leoberto Leal (+1,963 ha), Nova Trento (+1,109 ha), Anitápolis (+1,152 ha), Major Gercino (+952 ha), and São Bonifácio (+758 ha) (Table 5.3). By the mid-1990s, the FMR contained 124,989 ha of privately-owned forest of which 85.4 percent were natural and 14.6 percent were planted (Table 5.2). Natural forests covered 32.5 percent of the region's total private rural area while planted forests covered 5.6 percent. Despite an overall reduction in the extent of rural private properties after 1980, private natural forests covered more of the FMR in the mid-1990s than in 1970 (Table 5.2). Although pasture area remained greater than private forest area in Santa Catarina State over the entire period analyzed, in contrast the FMR contained substantially more private forest than pasture by the mid-1990s due to declining pasture area and forest regrowth after 1985 (Figure 5.5c).

Figure 5.7 Private forest-cover gains and losses in the FMR from 1985 to 1995/96. *Sources:* IBGE (1990, 1998).

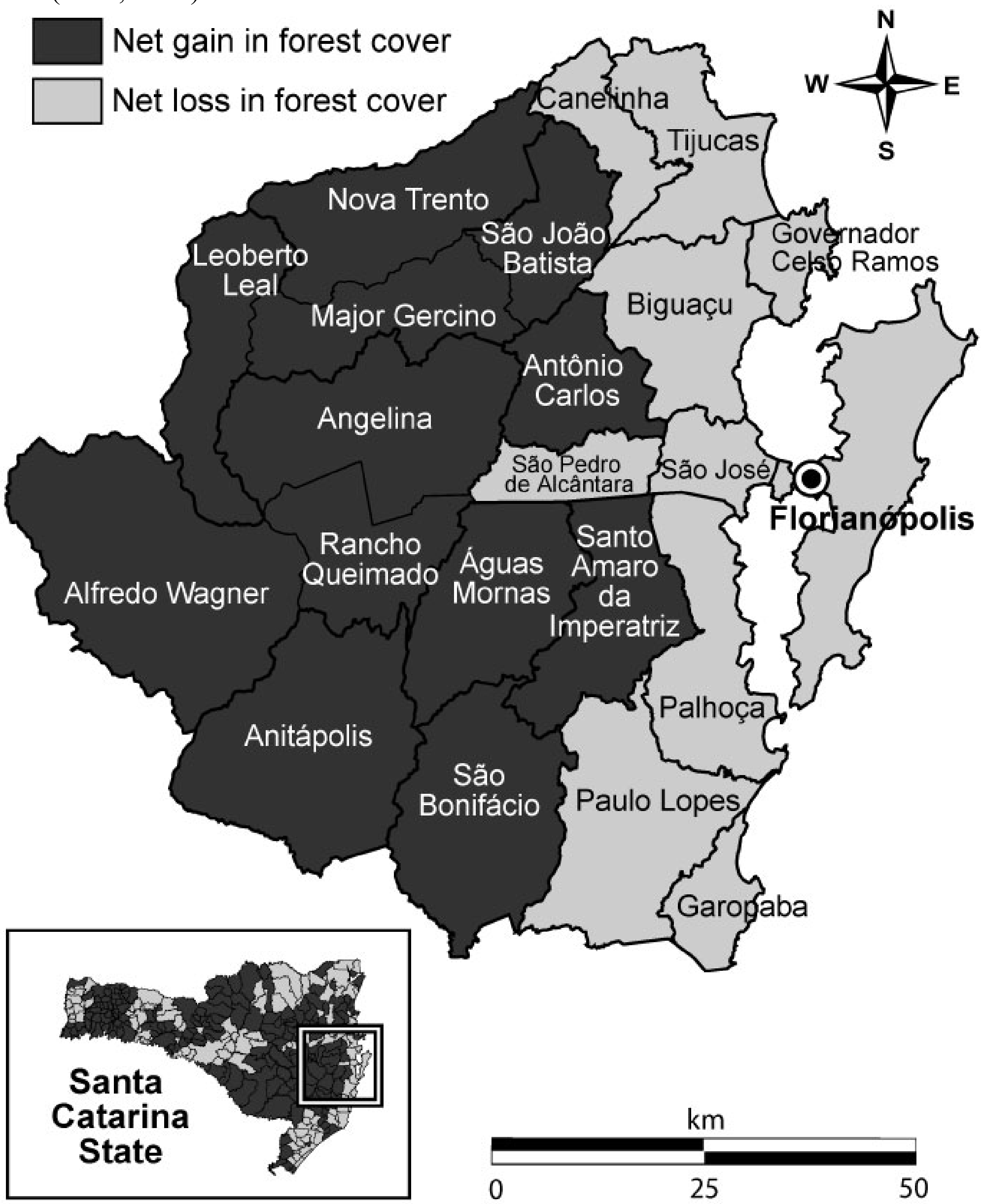


Table 5.2 Extents of rural private property and privately-owned forests in the Florianópolis Metropolitan Region (FMR), 1970 to 1995/1996. *Source:* IBGE (1974a, 1979, 1983a, 1990a, 1998).

Agricultural census year	**Extent of rural private property in the FMR**		**FMR forest areas**		
	ha	*% of FMR total area*	*All forests (ha)*	*Natural forests (ha)*	*Planted forests (ha)*
1970	432,680	61	117,726	105,520	12,206
1975	392,658	55	96,928	85,793	11,135
1980	414,756	58	104,801	89,947	14,854
1985	403,008	57	102,253	86,836	15,417
1995/1996	328,173	46	124,989	106,747	18,242

Table 5.3 Planted forest areas on FMR rural private properties, 1970 to 1995/1996. *Sources:* Santa Catarina (2000) † and IBGE (1974*a,* 1979, 1983a*,* 1990a, 1998).

Municipality	**Altitude at municipal seat (m)†**	**Planted forest area (ha)**				
		1970	*1975*	*1980*	*1985*	*1995/96*
Águas Mornas	70	4	21	71	302	263
Alfredo Wagner	480	1,856	5,729	5,487	3,227	3,130
Angelina	450	239	72	209	260	854
Anitápolis	430	5	63	1,001	1,869	3,021
Antônio Carlos	30	64	258	290	323	273
Biguaçu	2	24	49	57	823	743
Canelinha	17	16	22	261	732	296
Florianópolis	25	768	774	1,526	576	30
Garopaba	18	35	29	124	127	29
Governador Celso Ramos	40	2	6	7	64	14
Leoberto Leal	550	7	0	53	155	2,118
Major Gercino	80	0	46	14	60	1,012
Nova Trento	30	22	0	143	98	1,207
Palhoça	3	8,526	2,978	2,123	2,977	907
Paulo Lopes	2	9	4	135	106	71
Rancho Queimado	810	160	730	950	1,746	2,022
Santo Amaro da Imperatriz	18	140	81	247	399	265
São Bonifácio	410	94	92	724	596	1,354
São João Batista	30	6	10	757	302	334
São José & São Pedro de Alcântara	8	123	156	146	140	138
Tijucas	300	106	15	529	535	161
TOTAL	--	12,206	11,135	14,854	15,417	18,242

5.6 Relevant Legislation, Policies, and Practices

5.6.1 The Brazilian Federal Forest Code and Federal Environmental Agencies

Intended to secure state control of Brazil's land and natural resources and to restrict use by private interests, the first Brazilian Forest Code (*Código Florestal Brasileiro*) was promulgated on 23 January 1934 (Federal Decree No. 23793/34) and the Water and Mines Code (*Código de Águas e Minas*) was promulgated on 10 July 1934 (Federal Decree No. 24643/34). The 1934 Forest Code asserted that forests were of the "common interest" to all Brazilians and defined four forest types: (1) "productive" meaning open to commercial logging by permit; (2) "protective" meaning native forests protecting watersheds, soils, dunes, public health, natural scenery, and rare species; (3) "model" forests meaning replanted forests; and (4) "remnant" forests meaning native forests in national, state, and municipal parks. Protective and remnant native forests were to be set aside for "permanent protection." As a result of the introduction of this national framework for managing forest resources, between 1934 and 1961, sixteen national parks were established (Drummond and Barros-Platiau 2006: 87-88).

After seventeen years of discussion in the Brazilian National Congress, on 15 September 1965, a new Brazilian Forest Code (*Novo Código Florestal*; Federal Law No. 4771/65) was approved, revising the legal foundation for the protection of Brazil's forests and instituting the protection of other associated native plant communities. This new code requires the preservation as a legal forest reserve of at least 20 percent of native vegetation on each property larger than 50 ha in the eastern, central-west, and southern Brazil; as an alternative means of compiance, landowners in these regions are permitted to purchase offsets equivalent to 20 percent of each property if the offset is within the same microregion or equivalent to 30 percent of each property if the offset is located in another microregion. In Amazônia, the 1965 law initially required landowners to preserve at least 50 percent of native vegetation; since 1996, they have been required to preserve at least 80 percent. The Brazilian Forest Code of 1965 also established the concept of the Permanent Protection Area or *Área de Preservação Permanente* (APP) in law and policy. As explained by Drummond and Barros-Platiau (2006: 90):

> Article 2 of the New Forest Code pinpointed the location of all native vegetation to be "permanently protected," inside and outside private properties: on riverbanks, around lakes, reservoirs and watersheds, on hilltops and steep slopes, and on any lands above 1,800 meters. This was an expansion and an improvement of the legal definition of the 1934 "protective" forests. On the basis of this provision, individual landowners are still expected to preserve or restore the native vegetation of these "permanent protection areas," although enforcement is weak, and several legal additions and administrative ordinances have created loopholes.

Brazil's 1988 Constitution reinforces Article 2 of the 1965 Forest Code and recognizes Brazil's biomes as part of the national patrimony.

On 31 August 1981, Brazil's National Environmental Policy Act (*Lei da Política Nacional do Meio Ambiente*; Federal Law No. 6938/81) created the National Environment System (*Sistema Nacional do Meio Ambiente* – SISNAMA). Brazil's National Environment Council (*Conselho Nacional do Meio Ambiente* – CONAMA), the central consultative and deliberative agency of SISNAMA, has issued multiple resolutions regulating environmental licensing, environmental impact assessment, penalties for environmental violations, and protected area creation (Benjamin, Marques, and Tinker 2005; Silva 2005: 608; Drummond and Barros-Platiau 2006: 93). In 1993, to guide Brazil's federal, state, and municipal governments, Federal Decree No. 750/93 defined the boundaries of the Atlantic Forest Domain (*Domínio da Mata Atlântica*) and established criteria for protecting mature forests, advanced secondary forests, and associated ecosystems. After deliberations in the Brazilian National Congress since 1992, the most recent federal law regulating the protection and use of the Atlantic Forest biome, the Atlantic Forest Law (*Lei da Mata Atlântica*; Federal Law No. 11428/06), was approved in December 2006.

Federal government agencies within Brazil's Ministry of the Environment (*Ministério do Meio Ambiente* – MMA) are charged with the tasks of planning, implementing, and evaluating environmental management and biodiversity conservation programs. Within the international framework of the Convention on Biological Diversity (CBD) and with funding from the Global Environment Facility (GEF), the MMA has coordinated the Project for the Conservation and Sustainable Use of Brazilian Biological Diversity (*Projeto de Conservação e Utilização Sustentável da Diversidade Biológica Brasileira* – PROBIO) (Silva 2005). In collaboration with various NGOs, academic research centers, and other types of research institutions, the MMA has conducted several regional workshops and has mapped Brazil's biodiversity priority areas to support ongoing protected area planning and creation (MMA 2003). The Brazilian Institute for the Environment and Renewable Natural Resources (*Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis* – IBAMA) is the federal agency that creates and manages federal protected areas.[166]

5.6.2 Brazil's National System of Conservation Units

Published in September of 1963, H. Daniel Stillwell's article "National Parks of Brazil: A Study in Recreational Geography," is the first in the *Annals of the Association of American Geographers* to discuss the emergence of protected areas in Brazil.

[166] IBAMA was established in 1989.

Interestingly, Santa Catarina and Florianópolis are completely absent from Stillwell's map labeled "Location of Brazilian Parks" (Stillwell 1963: 392) on which only four national parks appear: (1) Paulo Afonso; (2) Itatiaia; (3) Serra dos Órgãos; and (4) Iguassú (or Iguaçu).[167] He displayed Curitiba and Porto Alegre as the only two "major cities" in Brazil's southern region.

Brazil's first National Park was the Itatiaia National Park (*Parque Nacional de Itatiaia*) in Rio de Janeiro created in 1937 (Stillwell 1963; Pádua 1997). The first National Park in Santa Catarina State, the São Joaquim National Park (*Parque Nacional de São Joaquim* – PNSJ), was established nearly a quarter of a century later on 6 July 1961 (Federal Decree No. 50922/61) (Pádua 1997). Stillwell's inset map showing "Proposed National Parks" indicates the location of the PNSJ which was actually established more than two years before publication of Stillwell's paper. The PNSJ (493 km^2) is situated in southeastern Santa Catarina in the municipalities of Urubici, Orleans, Bom Jardim da Serra, and Grão-Pará (Parques Nacionais 1999; Schenini, Matos, and Rensi 2004). At an elevation of 1,822 m a.s.l., Morro da Igreja is the highest point in Santa Catarina State.

Initially, siting decisions for protected areas in Brazil were made on the basis of outstanding scenic beauty, public appeal, faunal richness, or for political reasons, but around the late-1970s, Brazilian protected-area planning increasingly considered scientific research findings and conservation criteria (Pádua 1997). It was in the period

[167] According to Pádua (1997: 216): the first proposal to establish National Parks in Brazil was made by the engineer and politician André Rebouças in 1876; in 1891, a Forest Reserve in Acre was announced (Federal Decree No. 8843), but never implemented; in 1886, the first protected area created in Brazil was a state park in São Paulo called the *Parque Estadual da Cidade*; Iguaçu National Park in western Paraná and Serra dos Órgãos National Park in Rio de Janeiro were both created in 1939; and Paulo Affonso National Park was created in 1948 in Bahia, but no longer exists.

from the late-1970s to the early-1980s that conservation advocates began to develop a long-term plan to create a system of conservation units in Brazil. Many conservation units were created during these years, including the country's first marine park created in 1983, the Abrolhos Marine National Park (*Parque Nacional Marinho de Abrolhos*) located just off the coast of the northeastern state of Bahia. Santa Catarina gained its first marine park in 1990, the Arvoredo Marine Biological Reserve (*Reserva Biológica Marinha do Arvoredo*).

Various federal, state, and municipal-level efforts to create and manage protected areas have evolved into Brazil's current National System of Conservation Units (*Sistema Nacional de Unidades de Conservação* – SNUC), an organizational and administrative system with the objectives of facilitating coordination among units and providing government authorities and other types of natural resource managers with standardized criteria. SNUC is regulated by Federal Law No. 9985/00 which was approved by the Brazilian National Congress on 18 July 18 2000 (IBAMA 2000; Silva 2005). Brazil's MMA coordinates the implementation of SNUC while CONAMA monitors implementation (Silva 2005). The SNUC system encompasses both privately and publicly-owned lands. As in other countries, the Brazil's protected area management policies range from exclusionary measures severely restricting human presence to inclusionary protected areas that integrate sustainable human activities into park management plans. The environmental management categories proposed in 1992 by the IUCN [168] have influenced the SNUC categories (Hauff 1997; Lairana 2003).

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[168] IUCN was founded in 1948 as the International Union for the Protection of Nature (IUPN). In 1956, the organization changed its name to the International Union for the Conservation of Nature and Natural Resources which remains the organization's full legal name. From 1990 to March 2008, the organization

Brazil's federal conservation units fall under 12 environmental management categories within the SNUC framework (Lairana 2003; Rylands and Brandon 2005; Silva 2005; Drummond and Barros-Platiau 2006; IBAMA <http://www.ibama.gov.br>). Five subcategories, designated for indirect use, fall under the rubric "Strictly (or Fully) Protected Unit" (*Unidade de Proteção Integral*). Seven subcategories, managed for direct use, are labeled "Sustainable Use Units" (*Unidades de Uso Sustentável*) (see Table 5.4). About 17 percent of the 700+ Brazilian conservation units are classified under a Strictly Protected subcategory while the other 83 percent are classified as Sustainable Use Units (IBAMA <http://www.ibama.gov.br>).

At the state level, there are seven types of SNUC conservation units with objectives similar to those of their federal counterparts. In the Strictly Protected category they are: (1) State Ecological Station (*Estação Ecológica Estadual*); (2) State Biological Reserve (*Reserva Biológica Estadual*); and (3) State Park (*Parque Estadual*). In the Sustainable Use category they are: (4) State Area of Environmental Protection (*Área de Proteção Ambiental Estadual*); (5) State Area of Relevant Ecological Interest (*Área de Relevante Interesse Ecológico Estadual*); (6) State Forest (*Floresta Estadual*); and (7) State Ecological Park (*Parque Ecológico Estadual*).

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was known as the World Conservation Union. Today, the organization refers to itself as the International Union for the Conservation of Nature. See IUCN website accessible at <http://cms.iucn.org>.

Table 5.4 Twelve federal categories within Brazil's national system of conservation units. *Sources*: Rylands and Brandon (2005), Silva (2005), Drummond and Barros-Platiau (2006: 98).

Strictly Protected Units (indirect use)		**Sustainable Use Units** (direct use)	
English	*Portuguese*	*English*	*Portuguese*
Ecological Station	Estação Ecológica (ESEC)	Area of Environmental Protection	Área de Proteção Ambiental (APA)
Biological Reserve	Reserva Biológica (RB)	Area of Relevant Ecological Interest	Área de Relevante Interesse Ecológico (ARIE)
National Park	Parque Nacional (PARNA)	National Forest	Floresta Nacional (FN)
Natural Monument	Monumento Natural (MN)	Extractive Reserve	Reserva Extrativista (RESEX)
Wildlife Refuge	Refúgio de Vida Silvestre (RVS)	Faunal Reserve	Reserva de Fauna (RF)
		Sustainable Development Reserve	Reserva de Desenvolvimento Sustentável (RDS)
		Private Natural Heritage Reserve	Reserva Particular do Patrimônio Natural (RPPN)

Note: To my knowledge, at present there are no Brazilian conservation units classified as a Natural Monument or a Faunal Reserve.

5.6.3 Urban Reform: Brazil's City Statute

Of course, there is much more to Brazilian federal land use policy than the legal-institutional federal framework regulating environmentally protected areas. Over the past two decades, social mobilizations advocating policies aimed at promoting social inclusion and participatory urban planning have begun to formulate a long-overdue national urban policy and to reform the federal legal-institutional order regulating property rights, land tenure, and urban development. Over the twentieth century, rapid urbanization in Brazil unfolded with minimal government intervention at the federal, state, and municipal levels, contributing to a number of serious socioeconomic and environmental problems. In the words of Fernandes (2007: 178), "rapid urbanization in Brazil has generated a national urban crisis characterized by a combination of sociospatial segregation, negative environmental impact, violence and growing informal development." As Macedo (2008: 261) explains:

> The expansion and spatial structure of Brazilian cities from the 1960s to the 1980s, a period of intense urban growth, was largely defined by speculation. Land parcels within urbanized areas remained unoccupied, capturing value from improvements in urban infrastructure, while the periphery of urban centers was occupied in an unorganized manner, resulting in higher public investment in costly infrastructure.

In an effort to shape sections of what would become the 1988 Federal Constitution, Brazil's Urban Reform Movement, formed by a coalition of over 100,000 social organizations and individuals, suggested six general principles: (1) the autonomy of municipal governments; (2) the democratic management of cities; (3) the social right to housing; (4) the right to the regularization of consolidated informal settlements; (5) the social function of urban property; and (6) the need to combat land and property speculation in urban areas (Fernandes 2007). Many of the movement's proposals were indeed incorporated into constitutional chapters on urban policy and environmental preservation, however, the notion of the social right to housing and the social function of urban property were highly contested at this point.

In the early 1990s, the Urban Reform Movement remobilized and broadened its base to form the National Forum of Urban Reform (*Fórum Nacional de Reforma Urbana* – FNRU).[169] The FNRU organized to encourage the establishment of an institutional structure within the Brazilian federal government that would be responsible for promoting national urban policy and to influence regulation of the constitutional chapter on urban policy through federal legislation (Fernandes 2007). On 14 February 2000, the social right to housing was approved by Constitutional Amendment No. 26.[170] The National Fund for Social Housing was established in 2005.

After more than a decade of negotiations in the National Congress, the City Statute (*Estatuto da Cidade*; Brazilian Federal Law No. 10257/01) was approved on 10 July 2001.[171] Declaring that all people have "the right to the city," the 2001 City Statute regulates and expands on the constitutional chapter on urban policy, institutes new tools to regularize informal settlements in urban areas, and mandates municipalities to democratize local decision-making processes for urban planning, legislation, and management, including the processes that determine the formulation and approval of municipal master plans (Fernandes 2007; Macedo 2008).

Brazil's Ministry of Cities (*Ministério das Cidades*) was created in 2003 by President Luis Inácio Lula da Silva.[172] Presided over by an Executive Secretariat, the four

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[169] The FNRU website is accessible at <http://www.forumreformaurbana.org.br>.
[170] Constitutional Amendment No. 26 alters Article 6 of the 1988 Constitution which declares that education, health, employment, housing, leisure, security, social welfare, protection of mothers and infants, and assistance to the destitute are social rights.
[171] Federal Law No. 10257/01 became known as the City Statute because it was based on a 1990 Senate Bill (No. 5788/90) which was known informally by that nickname (Macedo 2008).
[172] The Ministry of Cities website is accessible at <http://www.cidades.gov.br>.

national secretariats of the Ministry of Cities are: (1) housing, (2) environmental sanitation, (3) transportation and mobility, and (4) urban programs. Among its national initiatives, the Urban Program Secretariat is implementing a Program to Support Urban Land Regularization and the Integration of Precarious Urban Settlements (*Programa Urbanização, Regularização e Integração de Assentamentos Precários*) and a Program to Strengthen Municipal Urban Management (*Programa de Fortalecimento da Gestão Municipal Urbana*). This latter program supports the national campaign for participatory municipal master plans.

At the request of President Lula, in October 2003 the first National Conference of the Cities was held in Brasília convening about 2,500 delegates, representing all of Brazil's states, for a dialogue about the national urban policy and the role of the Ministry of Cities. This conference led to the creation of the National Council of Cities (*Conselho das Cidades* or ConCidades) was formed in 2004. The second and third National Conferences of the Cities were again held in Brasília, in December 2005 and November 2007 respectively. The third National Conference of the Cities adopted the slogan "urban development with popular participation and social justice" and the theme "advancing the democratic management of cities."

5.6.4 Protected Areas in the Florianópolis City-Region

Founded in 1975 (State Decree 5089/75) as the *Fundação de Amparo à Tecnologia e ao Meio Ambiente*, FATMA is Santa Catarina's environmental research, regulatory, licensing, and management agency within the state government's Secretary for Urban Development and the Environment (*Secretaria de Estado do Desenvolvimento Urbano e*

Meio Ambiente – SDM).[173] In December 1998, with the approval of the agency's new statute (State Decree 3572/98), its name was changed to *Fundação do Meio Ambiente,* however, the original acronym has been maintained. FATMA's central administrative facility is located in the *Centro* of Florianópolis (see Figure 5.8) and its regional coordinating facilities and staff are distributed throughout the state in the municipalities of Blumenau, Caçador, Canoinhas, Chapecó, Criciúma, Itajaí, Joaçaba, Lages, Mafra, Rio do Sul, São Miguel, and Tubarão.

Figure 5.8 The central administrative facility of the Santa Catarina State environmental agency (*Fundação do Meio Ambiente* – FATMA) in Florianópolis. *Source:* author, December 2003.

FLORAM (*Fundação Municipal do Meio Ambiente de Florianópolis*) is the municipal-level public environmental agency.[174] It was established in 1995 by Municipal Law No. 4645/95 and is charged with creating, inspecting, and managing municipal protected areas and recreational open spaces. Both FATMA and FLORAM have been

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[173] The FATMA website is accessible at <http://www.fatma.sc.gov.br>.
[174] The FLORAM website is accessible at <http://www.pmf.sc.gov.br/floram>.

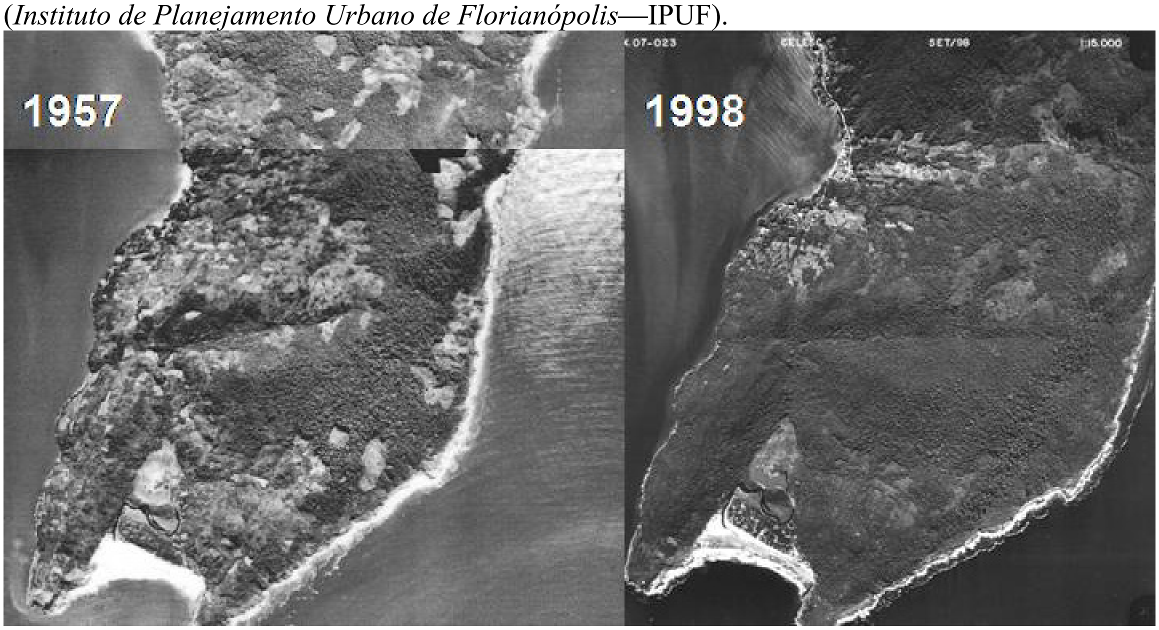
criticized by environmentalists for their negligence and partial enforcement of national environmental policy. For example, Santos (2001) pointed out that the municipal zoning plan for Santa Catarina Island's waterfront communities (*Plano Diretor dos Balneários*; Municipal Law No. 2193/85; IPUF 1985) failed to comply with the 1965 Forest Code because in Permanent Preservation Areas, where federal law prohibits construction or modification of vegetation, the municipality permitted public recreational and tourist facilities. In other words, areas considered APPs according to federal legislation were zoned as AVLs (*Área Verde de Lazer*; Green Area for Leisure and Recreation) by the municipal government.

Presently, Santa Catarina State contains a total of about 109 conservation units recognized by the national SNUC system (IBAMA <http://www.ibama.gov.br>). Sixteen are publicly-owned federal units (~3,200 km^2). Twenty-five are privately-owned Private Natural Heritage Reserves (*Reservas Particulares do Patrimônio Nacional* – RPPNs) (~120 km^2) recognized by Brazilian government authorities at either the federal or state level (Marenzi 2005; Mittermeier *et al.* 2005; Silva 2005; CNRPPN <http://www.rppn brasil.org.br>; APRPPNSC <http://www.rppncatarinense.org.br>). Eight are publicly-owned state units (~1,100 km^2). Sixty are publicly-owned municipal units (~1,400 km^2). The most recently established public federal conservation units in Santa Catarina are the *Parque Nacional das Araucárias* (12,841 ha) located in the municipalities of Ponte Serrada and Passos Maia and the *Estação Ecológica da Mata Preta* (6,563 ha) located in the municipality of Abelardo Luz. Both were created by Federal Decree on 20 October 2005.

The federal RPPN program, established on 30 January 1990 (Federal Decree 98914/90), is administered by IBAMA. It was modified on 5 June 1996 by Federal Decree 1922/96. The potential of RPPNs for managing ecosystem services and biodiversity conservation is growing. By 2004, over 650 RPPNs existed in Brazil protecting ~6,000 km² (Castro and Borges 2004), of which 443 were within the Atlantic Forest ecoregion protecting 990 km² (Costa *et al.* 2004, Mesquita 2004, Tabarelli *et al.* 2005). Of the Atlantic Forest RPPNs, about 25 are located in Santa Catarina protecting approximately 120 km². There are now about ten RPPNs in the FMR totaling roughly 45 km² (Marenzi 2005; APRPPNSC <http://www.rppncatarinense.org.br>; IBAMA <http://www.ibama.gov.br>). The ten RPPNs in the FMR listed in order from largest to smallest are: (1) Caraguatá and (2) Caraguatá II (~4,000 ha) in the municipalities of Antônio Carlos, São João Batista, Biguaçu, Major Gercino e Angelina; (3) Passarim (226 ha) in Paulo Lopes; (4) Prima Luna (100 ha) in Nova Trento; (5) Morro das Aranhas (~44 ha) in Florianópolis; (6) Guaxinim (26 ha) in São José; (7) Rio das Lontras (~18 ha) in São Pedro de Alcântara and Águas Mornas; (8) Hospital da Caridade (17 ha) in Florianópolis; (9) Reserva Natural Menino Deus (16 ha) in Florianópolis; and (10) Reserva Rio das Furnas (10 ha) in Alfredo Wagner.

Occupying nearly one percent of Santa Catarina State's total area, the Serra do Tabuleiro State Park (*Parque Estadual da Serra do Tabuleiro* – PEST) is currently the state's largest terrestrial protected area (Oliveira 2005). Established by State Decree in 1975, PEST protects about 874 km² including portions of Palhoça, Paulo Lopes, Santo Amaro da Imperatriz, São Bonifácio, Águas Mornas, Garopaba, and Florianópolis. Figure 5.9 displays aerial photographs taken in 1957 and 1998 of the 347 ha portion of the park located in Florianópolis and its adjacent communities.[175] Comparison of these images shows substantial forest regeneration after four decades of agricultural abandonment and environmental protection. Some traditional farming-fishing families were expelled by government environmental authorities; others were permitted to stay under a new set of land-use restrictions. The beach, *Praia dos Naufragados,* has evolved into a tourism and recreation site, accessible either by hiking along a trail through secondary forest or by boat.

Figure 5.9 Forest recovery after agricultural abandonment and protected-area creation at the southern extreme of Santa Catarina Island. *Source*: Urban Planning Institute of Florianópolis (*Instituto de Planejamento Urbano de Florianópolis*—IPUF).



The government of Florianópolis established the municipality's first Municipal Park in 1981 after a planning phase that began in the late 1970s when there were approximately 214 people in the area belonging to 54 families of which 174 individuals were identified as permanent residents and 40 individuals as temporary residents (see

[175] I acquired the aerial photographs displayed in Figure 5.8 from the library of the Florianópolis Urban Planning Institute (*Instituto de Planejamento Urbano de Florianópolis*—IPUF).

Santos *et al.* 1989). The political and legislative process that led to the creation of this protected area, Peri Lagoon Municipal Park (*Parque Municipal da Lagoa do Peri* – PMLP), began in 1952 with a Presidential Decree signed by Getúlio Vargas to permanently protect the area's "remnant" forests under the 1934 Forest Code definition (Silva 2000; Nunes Penteado 2002). Located in the southern insular region of Florianópolis, the PMLP encompasses a watershed of about 20 km² which includes Santa Catarina Island's largest freshwater body, the Peri Lagoon (surface area of about 5 km²). Thus the PMLP represents a sizable and extremely valuable proportion of the municipality's ecological services.

In addition to the conservation units formally recognized as belonging to one of the twelve environmental management categories defined by SNUC, there are many other protected areas in the APP category described above which was defined by 1965 Forest Code and has been regulated by subsequent legislation. Examples of APPs are riparian and hilltop vegetation, vegetation surrounding headwaters, lakes, and lagoons, hillsides with slopes equal to or greater than 45°, vegetation formations above altitudes of 1,800 m a.s.l., restinga and dune vegetation, and mangroves (Santos 2001; Rocca 2002). APPs and other protected areas may be regulated by municipal zoning legislation such as a municipal ordinance (*tombamento*) or within an approved municipal Master Plan. Master Plans typically set forth environmental management and restricted use categories specific to the municipality. In the case of Florianópolis, versions of the Master Plan have proposed various land-use zoning categories including: (1) Preservation Area with Limited Use (*Área de Preservação com Uso Limitado* – APL); (2) Area for Rural Exploitation (*Área de Exploração Rural* – AER); (3) Area of Hydrological Elements

Figure 5.10 Peri Lagoon Municipal Park (*Parque Municipal da Lagoa do Peri*) on Santa Catarina Island. *Source*: author, October 2003.

(*Área dos Elementos Hídricos* – AEH); and Green Area for Leisure and Recreation (*Área Verde de Lazer* – AVL).

Protected area planning and creation in Florianópolis began in the 1950s and accelerated during the 1980s and 1990s. When all of the existing forms of legal protection or legally restricted use are combined, legally protected areas cover about 40 percent of the Florianópolis land area (Villela and Baptista 2001; Godoy 2003; Kraselis

2004; Horn Filho 2006).[176] Table 5.5 lists 25 of the legally protected areas in Florianópolis (see also Figures 5.10 and 5.11). Currently, most of them (about 17) are under the administration of FLORAM. A few are under the jurisdiction of either IBAMA or FATMA. Two have been managed by the federal university UFSC.

Figure 5.11 Examples of protected areas on Santa Catarina Island: (a) Galheta Municipal Park (*Parque Municipal da Galheta*); (b) Desterro Environmental Conservation Unit (*Unidade de Conservação Ambiental do Desterro*); (c) Rio Vermelho State Forest (*Parque Florestal do Rio Vermelho*); (d) Lagoa Pequena Municipal APP; and (e) Lagoinha da Chica Municipal APP. *Source*: author, 2003 and 2004.

[176] Naka *et al.* (2002: 130) and Horn Filho (2006: 74) provide maps displaying the locations and boundaries of Santa Catarina Island's protected areas.

Table 5.5 Protected areas in Florianópolis. *Sources:* Dias (1996), CECCA (1997b), Hauff (1997), Rosa Filho (1999), Schneider (1999), Nascimento et al. (2000), Nunes Penteado (2002), Rocca (2002), Queiroz et al. (2002), SC, PMF, and CMV (2006), Debetir (2006), FLORAM (2008).

Name of Protected Area	Protected Area Categories	Date(s) Established and Modified	Legislation	Current Administrative Agency	Area (ha)	Ecosystem Type(s)
Estação Ecológica dos Carijós (EEC)	Federal (Indirect Use)	20 July 1987	Federal Decree 94656/87	IBAMA (since 1989)	718†	mangrove and restinga
Reserva Extrativista Marinha do Pirajubaé (REMP)	Federal (Direct Use)	20 May 1992	Federal Decree 533/92	IBAMA	1,444	mangrove and shoal
RPPN Menino Deus	Federal	6 Oct. 1999	*Portaria*‡‡ 85/99	IBAMA	17	dense broadleaf forest
RPPN Morro das Aranhas	Federal	11 May 1999	*Portaria* 43/99	IBAMA	44.16	dense broadleaf forest, restinga, dunes, beach, rocky intertidal zone
Parque Estadual da Serra do Tabuleiro (PEST)	State (Indirect Use)	1 Nov. 1975 17 March 1977	State Decrees 1260/75 and 2335/77	FATMA	346.5 (insular portion) §	dense broadleaf forests, restinga
Parque Florestal do Rio Vermelho (initially established as a forest experimental station named Estação Florestal do Rio Vermelho)	State	21 Sept. 1962 19 Aug. 1974 14 Sept. 1994 24 May 2007	State Decrees 2006/62, 994/74, 4815/94, and 308/07	CIDASC/ FATMA‡	1,297 (CECCA 1997b); 1,465 (Queiroz et al. 2002)	converted from restinga to an exotic pine plantation; contains a small area of dense broadleaf forest
Parque Municipal da Lagoa do Peri (PMLP)	Municipal, APP	25 Jan.1952 4 June 1976 3 Dec. 1981 1982	Presidential Decree 30443/52, Municipal Decrees 1408/76 and 091/82, Municipal Law 1828/81	FLORAM	2,030††	dense broadleaf forest, restinga, fresh water lagoon
Parque Municipal da Galheta (PMG)	Municipal, APP	21 Sept. 1990	Municipal Laws 3455/90, 197/97, and 6237/03; Municipal Decree 698/94	FLORAM	149.3	restinga, dunes, beach, rocky intertidal zone
Parque Municipal das Dunas da Lagoa da Conceição (PMDLC)	Municipal, APP, APA	16 Sept. 1988	Municipal Law 231/88	FLORAM	563	dunes, restinga
Parque Municipal Maciço da Costeira (PMMC)	Municipal, APP	3 Feb. 1995	Municipal Laws 4605/95 and 4728/95, Municipal Decree 154/95	FLORAM	1,456.53	dense broadleaf forest

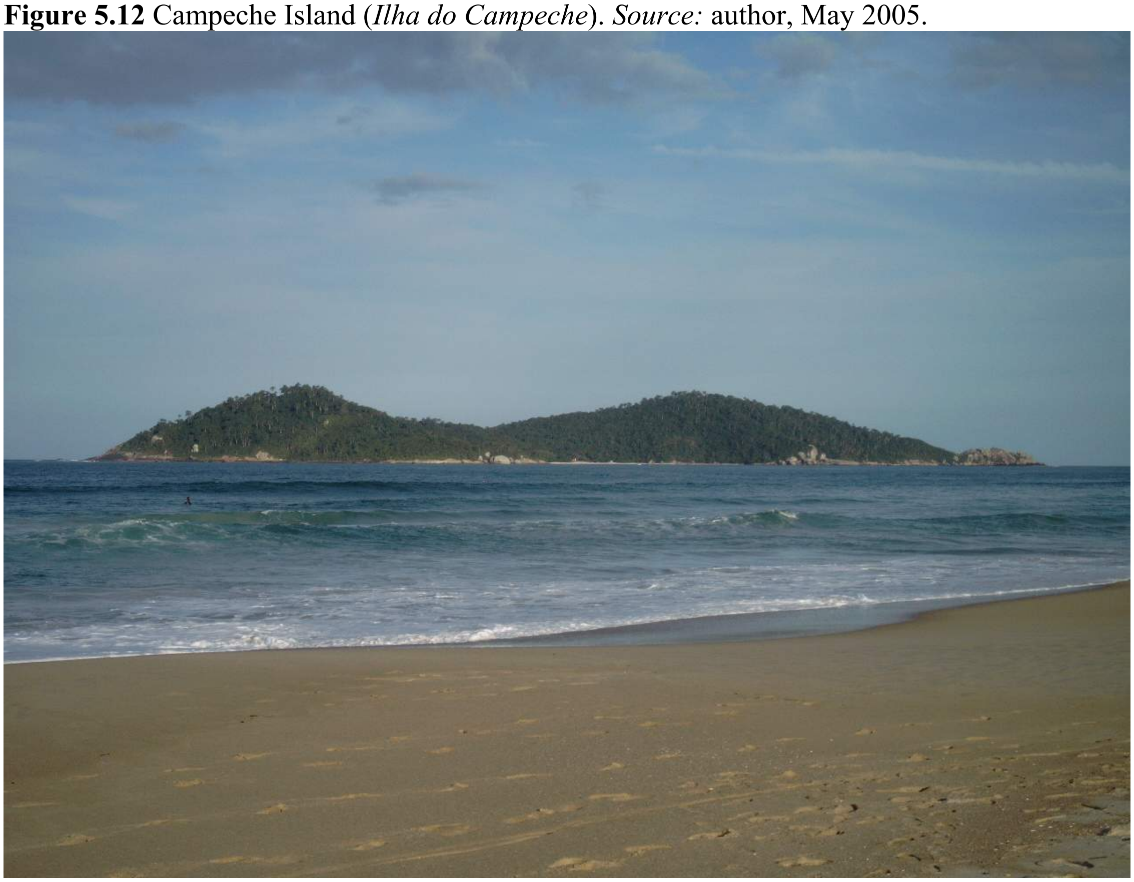
Table 5.5 (continued)

Parque Municipal da Lagoinha do Leste (PMLL)	Municipal, APP	1987 7 Jan. 1992	Municipal Decree 153/87, Municipal Laws 3701/92 and 5500/99	FLORAM	804.1	dense broadleaf forest, restinga, estuary, dunes, rocky intertidal zone
Manguezal da Tapera	APP	1985	Municipal Law 2193/85	FLORAM	52.2	mangrove
Dunas da Armação	APP	31 May 1985	Municipal Decree 112/85	FLORAM	5.9	dunes, restinga
Dunas do Campeche	APP	31 May 1985	Municipal Decree 112/85	FLORAM	121	dunes, restinga
Dunas dos Ingleses	APP, APA	31 May 1985	Municipal Decree 112/85	FLORAM	953.5	dunes, restinga
Dunas do Pântano do Sul	APP	31 May 1985	Municipal Decree 112/85	FLORAM	24.2	dunes
Dunas do Santinho	APP	31 May 1985	Municipal Decree 112/85	FLORAM	91.5	dunes
Dunas da Barra da Lagoa	APP	1992	Municipal Law 3711/92	FLORAM	6.6	dunes
Restinga de Ponta das Canas	APP	13 Sept. 1985	Municipal Decree 216/85	FLORAM	21.5	restinga and mangrove
Ponta do Sambaqui	APP, APA	13 Sept. 1985	Municipal Decree 216/85	FLORAM	1.3	restinga
Região da Costa da Lagoa da Conceição	APP, APA	6 Nov. 1986	Municipal Decree 247/86	FLORAM	976.8	dense broadleaf forest
Lagoa Pequena	APP	5 June 1988	Municipal Decree 135/88	FLORAM	27.5	estuary and restinga
Lagoinha da Chica	APP	5 June 1988	Municipal Decree 135/88	FLORAM	4.6	estuary and restinga
Parque Manguezal do Itacorubi	APP	10 April 1969 8 July 2002	Federal Decree 64340/69 Municipal Decree 1529/02	FLORAM (formerly UFSC)	150	mangrove
Unidade de Conservação Ambiental Desterro (previously named Parque Desterro da UFSC)	APP (Research and Education)	1996	Federal Law 4771/65, *Portaria* 0521/GR/96	UFSC	491.5	dense broadleaf forest

† The Estação Ecológica dos Carijós includes the Rio Ratones mangrove (625 ha) and the Saco Grande mangrove (93 ha).
‡ Although in practice the Parque Florestal do Rio Vermelho has been under the administration of the state entity CIDASC (*Companhia Integrada de Desenvolvimento Agrícola de Santa Catarina*), by law its management should be overseen by FATMA.
§ The entire PEST extends over 87,405 ha of which about 346.5 ha are in Florianópolis at the southern end of Santa Catarina Island and about 87,058.5 ha are on the continent in the municipalities of Palhoça, Paulo Lopes, Santo Amaro da Imperatriz, São Bonifácio, Águas Mornas, and Garopaba. The mainland portion contains upland mixed broadleaf forest and high altitude grasslands in addition to dense broadleaf forest and restinga.
†† The total area of the PMLP (2,030 ha) includes the lagoon’s 515 ha surface.
‡‡ *Portarias* are administrative edicts that regulate the activities of ministries. They serve to promulgate regulations that complement or clarify some aspect of a Federal Law or Federal Decree.

Municipal Laws 2193/85 and 1851/82, both associated with the municipal Master Plan protect an additional 608.4 ha (FLORAM <http://www.pmf.sc.gov.br/floram>). Table 5.5 does not include several additional protected areas established on the islets surrounding Santa Catarina Island, such as Campeche Island (*Ilha do Campeche*) (Figure 5.12). Many of the protected areas on Santa Catarina Island and its surrounding islets, in addition to their ecological features, contain archaeological sites such as prehistoric lithic workshops and petroglyphs which are protected by federal legislation (see Chapter 4); Campeche Island is one example.

Figure 5.12 Campeche Island (*Ilha do Campeche*). *Source:* author, May 2005.



5.7 Limits to Sustainability

Within the first two decades of the twentieth century, the population of Florianópolis gained its first urban water supply system, sewage infrastructure, electricity generation and distribution services, and solid waste incinerator (Pereira 1978; Cruz 1998; Sugai 2002; Bastos 2004; CASAN <http://www.casan.com.br>).[177] Drawing from water sources at Morro da Lagoa da Conceição and Itacorubi, known today as Manancial Cachoeira do Assopra and Manancial do Quilombo, the first aqueduct system was inaugurated in 1910. The city's first reservoir was inaugurated that same year at Morro do Antão (today known as Morro da Caixa). Prior to this (1829-1909), the population had generally accessed water from springs. A third aqueduct was constructed at Rio Tavares in the early 1920s. Later, in 1946 the Cubatão River Basin (*Bacia do Rio Cubatão*), located on the mainland in the area that would later become the municipality of Águas Mornas, was linked to the coastal urban water supply system.[178] According to Pereira (1978: 55) a hydroelectric energy system was constructed in 1910. After 1919, electricity, water, and sewage services were converted from privately-run enterprises to public services with the creation of the Santa Catarina state-run water and sanitation agency *Inspetoria de Águas e Esgotos* (Sugai 2002). Facilities were eventually upgraded during the 1950s in response to water and electricity shortages experienced from the late 1920s, (Pereira 1978).

The city's first public transportation system, consisting of animal drawn streetcars, was provided around 1880. By 1926, the suspension bridge, *Ponte Hercílio Luz,* facilitated the flow of people and goods across the bay between Santa Catarina Island and the mainland, and as automobile travel expanded, roads were paved in the 1940s in the Estreito neighborhood on the continental side of the bridge (Sugai 2002).

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[177] The first street lighting system on Santa Catarina Island, inaugurated in the late 1830s, was fueled by whale oil (CECCA 1997a).

[178] For more information on the history of the water supply system in metropolitan Florianópolis, visit the CASAN (Companhia Catarinense de Águas e Saneamento) website at http://www.casan.com.br.

Whereas the port entry of over 600 ships was registered in Florianópolis in 1940, this number had dropped to a mere 15 ships by 1970 (CECCA 1997a). This sharp decline in port activity after 1940 signaled the urgency for the city to begin to reinvent itself economically and to continue investing in road infrastructure. This process of reinvention was clearly underway in the 1960s and 1970s as universities, public sector agencies, and industries were established in and around the Central City District (Peluso 1979, 1981, 1991; Meyer-Stamer 1998, 1999; Raud 1999). The tertiary sector has expanded further with the rapid development of the information technology and tourism industries (e.g., Machado 1998, 2000; Ouriques 1998). By the 1980s, the seasonal peaks in population due to the influx of tourists during summer holidays were straining the capacity of roadways and sanitation infrastructure and services, problems which were still apparent at the start of the twenty-first century (e.g., Oliveira and Herrmann 2001).

The governments of rapidly growing cities in Brazil typically struggle to provide their inhabitants with adequate access to housing, basic sanitation, education, health services, and employment opportunities. However, in recent years, Florianópolis has consistently been identified among the Brazilian cities with the best human living conditions. This reputation for offering a high quality of life explains, to a large extent, the recent migrant flows to the city.

As a means of comparing municipal levels of human well-being, Brazilian government agencies have adopted the United Nations Development Program’s (UNDP) Human Development Index (HDI), a composite measure of education, income, and life expectancy at birth (PNUD Brasil 2003). The HDI value for Santa Catarina increased from 0.748 in 1991 to 0.822 in 2000 (PNUD Brasil 2003). In 2000, Florianópolis ranked highest in the state with an HDI value of 0.875, and it placed fourth in the national ranking. Leoberto Leal had the lowest HDI value (0.748) in the FMR and was ranked 258th in Santa Catarina and below 1,920th in the nation. While HDI values can provide a general assessment of regional inequalities, their use alone fails to elucidate the finer-grained spatial dimensions and underlying forces shaping social exclusion and poverty within Brazilian metropolitan regions, municipalities, municipal districts, and even neighborhoods. Therefore, quantitative and qualitative research at the local scale is critical to the development of in-depth knowledge of social differentiations and disparities in residential, employment, health care, educational, and leisure opportunities.

Analyzing demographic census data for 1991 at the census tract level, Lacerda, Calvo, and Freitas (2002) explored intra-urban differentials in living conditions within the municipality of Florianópolis to support health services planning and found "A heterogeneous distribution of households within sectors [i.e., census tracts]…whereby Florianópolis was characterized as not presenting large agglomerations of poverty; however, this should not be interpreted as the absence of a poor population in the municipality." Based on the four socioeconomic groups defined by these authors, in 1991 Florianópolis had a total of 10,938 inhabitants in the category with the lowest incomes and lowest levels of education which represented 4.3 percent of the municipality's total population of 254,814. Of these 10,938 people in the poorest and most disadvantaged group, 3,875 were found in the municipality's eastern insular region, 3,519 in the mainland region, 2,268 in the southern insular region, 1,276 in the northern insular region, and none were identified in the center city. Important questions to explore in a future study are: How did the spatial distribution of poverty and disadvantage in

Florianópolis change from 1991 to 2000 (the date of the next national demographic census), and why?

An article appearing in the Brazilian magazine *Veja* on 28 January 2004 may provide some insight into the social dynamics that one would wish to consider in such a study. The article, written by Maurício Lima, was entitled "O outro lado do paraíso," (The other side of paradise) and subtitled "Florianópolis controla a migração para evitar o aumento da violência e das favelas na cidade" (Florianópolis controls migration to avoid an increase in violence and slum expansion in the city). In this article, not only did Lima highlight Brazil's crisis of urban poverty, informality, and violence, he also exposed the existence of an agency created by the Florianópolis municipal government to intercept poor migrants at the city's central bus terminal by interviewing new arrivals to identify those lacking a clear destination, informing these individuals of the difficulties they should expect to encounter in the city, and, in certain cases, offering to cover the cost of their return bus fare to their city of origin. According to Lima, during the first month of this program's operation, over half of the people who were made this offer to turn around and leave Florianópolis accepted. Lima went on to report that in the mid-1980s Florianópolis had only five *favelas*, while in 2004 there were more than 50 *favelas* scattered throughout Santa Catarina Island.[179]

What social justice, economic, and ecological criteria should be used to evaluate metropolitan sustainability and alternative development pathways?[180] If the socioeconomic problems and environmental externalities of a country's megalopolises and most polluted industrial zones are somehow prevented from spreading or leaking into

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[179] For a discussion of *favelas* in metropolitan Florianópolis in the 1980s, see Marcon *et al.* (1987).
[180] Fehr *et al.* (2004) have begun to articulate and experiment with community-based management models and methods to assess the urban sustainability of Brazilian municipalities.

smaller, more attractive cities or are permitted to enter in a controlled, selective manner, can these smaller cities still be considered sustainable, or do these economically dynamic migration poles, offering multiple environmental and urban services/amenities, largely function as exclusive spaces accessible mostly to a wealthy minority? In the context of national and global economic inequalities, how can democratic and participatory governance influence environmental and urban planning at the local-level in ways that effectively promote social inclusion and human well-being, reduce informality, and help to overcome the limits to sustainability? The next chapter (Chapter 6) describes the recent history of interactions among local communities, private interests, and the institutions and representatives of local government in Florianópolis.

CHAPTER 6

IS FLORIANÓPOLIS A "LIVABLE CITY"? [181]

> Urban elites and impoverished slum dwellers share a common interest in livability, but the poor's dreams of urban homes and elite imaginaries of the global city hardly overlap.
>
> Peter Evans (2002)[182]

6.1 Overview

The terms First World/Third World, North/South, and developed/developing persist in the academic and popular media, reinforcing dichotomous conceptualizations of global society and space.[183] Meanwhile, within "developing countries" wealthy individuals and communities self-segregate to enjoy First World lifestyles. They increasingly rely on gated communities and other security systems to maintain their quality of life, particularly in large metropolitan regions. Within "developed countries" where gated residential communities and other types of exclusive spaces are prevalent, poor individuals and communities struggle in difficult Third World conditions and seek opportunities to access First World advantages and amenities. Ideas about the "livable city" or the "sustainable city" are widely debated in these contexts. Consideration of the complex socioeconomic (dis)order in contemporary urban regions worldwide, its relationship to global political economy, and the interplay between structure and agency is central to this dissertation project.

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[181] The concept of the "livable city" has been widely adopted. It was recently chosen as the theme for a book edited by Peter Evans (2002) entitled *Livable Cities? Urban Struggles for Livelihood and Sustainability.*

[182] Peter Evans, "Introduction: Looking for Agents of Urban Livability in a Globalized Political Economy," in P. Evans (ed.), *Livable Cities? Urban Struggles for Livelihood and Sustainability*, 2002, p. 2.

[183] In *Encountering Development: The Making and Unmaking of the Third World*, Arturo Escobar (1995) offers an excellent critique of the terms First, Second, and Third World.

Over the past decade or so, Florianópolis has emerged as one among few Brazilian cities that many Brazilians perceive as "*uma cidade de Primeiro Mundo*" (i.e., "a First World city"). Clearly, many public and private actors have strategically promoted this reputation and reproduced this image. However, to what extent have these perceptions and marketing images reflected reality? When and how did Florianópolis "develop" into a "First World city"? In the coming decades, if the city continues to expand and its population continues to increase, will it hold onto its current status as a "livable city"? Will it succeed in devising locally-appropriate, long-term development solutions thus avoiding many of the socioeconomic and environmental problems of Latin America's largest urban regions? Does it have the adaptive capacity to grow into a socially just and ecologically sustainable city, or is it likely to reproduce metropolitan patterns of socioeconomic polarization and environmental degradation found elsewhere?

As part of a nested, multiscale approach to the study of human-environment dynamics in metropolitan Florianópolis, this chapter examines in some detail the communities and neighborhoods of a heterogeneous and rapidly urbanizing area located in the southern sector of Santa Catarina Island (SCI). This detailed, local-scale investigation is organized around three aims. First, I show how local land-use trajectories are related to planned development, meaning not only government research, planning, policymaking, and management activities, but also the actions of civil society organizations (CSOs)[184] to formulate counter proposals democratically, to present their alternative plans to city officials, and to bring about fundamental institutional changes. In Brazil, CSOs and the coalitions they form have begun to invoke the *Estatuto da Cidade*

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[184] CSOs include nongovernmental organizations, community-based organizations, and social movement organizations.

or the City Statute (i.e., Brazilian Federal Law No. 10257, enacted in 2001; see Fernandes 2007; Macedo 2008) as a legal-political tool to bolster their demands for true participatory governance. Second, in the contexts of globalization, I identify and discuss some of the more spontaneous socioeconomic processes contributing to contemporary social and landscape transformations, namely shifts in local livelihood activities, recent migration flows, and sprawling urban development. Third, this chapter serves as a local-scale narrative of intertwined social justice and environmental issues as they relate to the emerging early twenty-first century landscape in a rapidly urbanizing subregion of metropolitan Florianópolis. This recent local history is complex and, at times, contradictory. It is made up of stories of both adaptation and displacement of traditional households, of the influx of amenity-seeking and entrepreneurial migrants and their aesthetic preferences, of tensions and conflicts as well as hybridities resulting from contact between recent migrants and preexisting social groups, of environmental degradation, and of ecological stewardship. I illustrate this account with photographs taken during field visits from early-2000 to mid-2004 and with aerial photographs obtained from government planning agencies which aid in documenting land-use transitions from 1957 to 2001.

6.2 Background on *Sul da Ilha* and the Campeche Coastal Plain

Santa Catarina Island's geographic form and its physical features have long influenced place names and human settlement patterns. Its central hill range is divided into northern and southern sectors by the Island's largest sedimentary plain known as the *Planície do Campeche* or *Planície Entremares*, hereinafter referred to as the Campeche Coastal Plain.

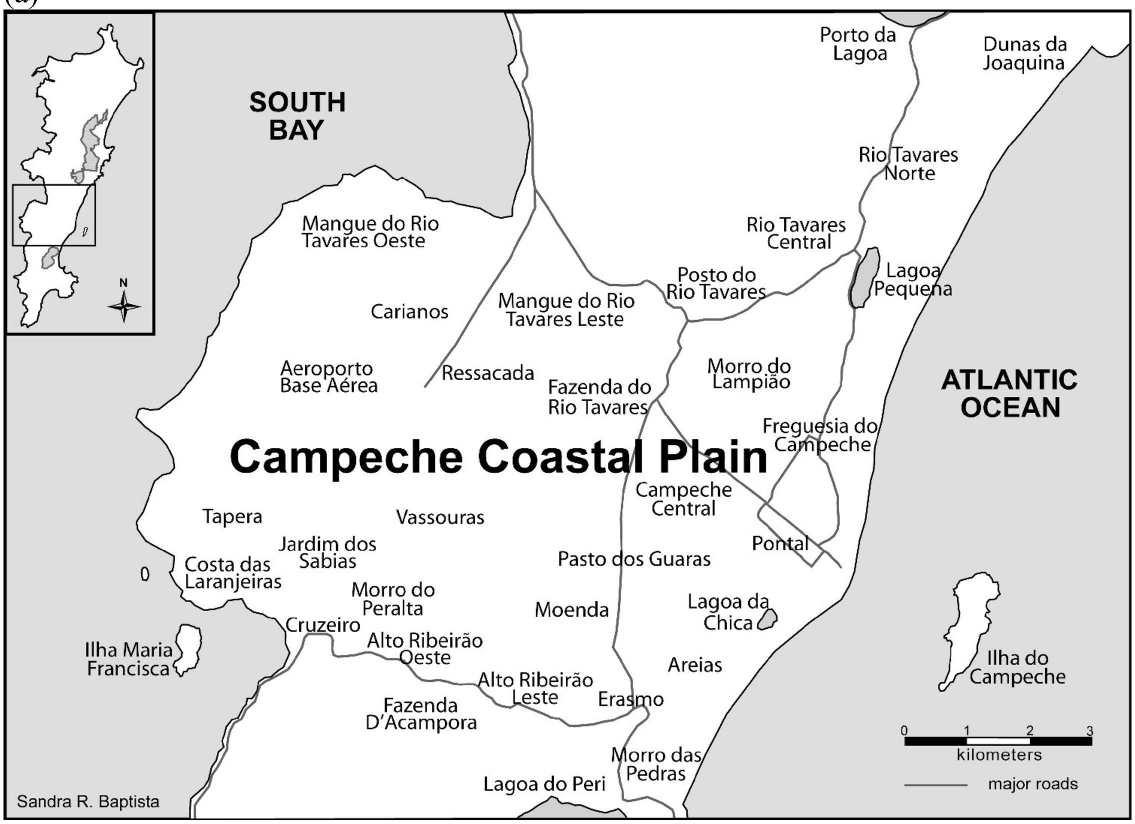
This low-lying sandy plain and the hilly area to its south are together called *Sul da Ilha.* As traditional smallholder agriculture and extraction have largely faded from the socioeconomic fabric of *Sul da Ilha*, a diverse array of local and outside actors have pursued opportunities for land speculation and real estate development through a variety of ventures. The Campeche Coastal Plain, covering approximately 55 km², represents about 13% of SCI's territory. It stretches north to south from the communities of Porto da Lagoa to Morro das Pedras and east to west from the communities of Campeche and Rio Tavares along the Atlantic Coast to Tapera and the International Airport Hercílio Luz on the South Bay (see Figures 6.1 and 6.2). It includes all of Campeche District, southern portions of the Central City and Lagoa da Conceição Districts, and the northern portion of Ribeirão da Ilha District.

Campeche District (35.32 km²) is one of twelve districts that constitute the municipality of Florianópolis (see Table 6.1). Established in late 1995, it originated from the older districts of Lagoa da Conceição and Ribeirão da Ilha which were established in 1750 and 1809 respectively. In 2000, there were about 18,570 people living in Campeche District, representing 5.4% of the total municipal population of 342,315 inhabitants. Thus, after the Central City District (*Distrito Sede*) with 228,869 people and Ribeirão da Ilha District with 20,392 people, Campeche was the municipality's third most populous district at the end of the twentieth century.

From the late-1950s through the 1980s, urbanization occurred vertically in the *Centro* of Florianópolis as well as horizontally into the adjacent Central City District neighborhoods of Agronômica, Saco dos Limões, Trindade, Santa Mônica, Córrego Grande, and Itacorubi. During this period, Lagoa da Conceição District—one of SCI's oldest communities located over the hill range from Itacorubi, Córrego Grande, and Santa Mônica—also became increasingly urbanized. Since the 1980s, urban growth in these central areas has intensified (Teixeira and Silva 1999).

Figure 6.1 The Campeche Coastal Plain on Santa Catarina Island. Map (a) shows the locations of neighborhoods and features mentioned in the text. A compilation of aerial photographs dated November 2001 (b) illustrates land uses and land covers in the area.

(a)



Source: author.

Figure 6.1 (continued).

(b)

Source: IPUF library.

Figure 6.2 Lots for sale (a) and housing under construction (b) in Campeche District.

(a)

Source: author, April 2004

(b)

Source: author, April 2004.

Planning of the federal university (*Universidade Federal de Santa Catarina*—UFSC) began in 1956. UFSC was formally established in Trindade in 1960. With the arrival of the public electric utility company (*Centrais Elétricas do Sul do Brasil SA* or *Eletrosul*), the Florianópolis population was provided with new energy infrastructure during the 1960s and 1970s. This infrastructure upgrade led to increasing levels of electric energy consumption as modernizing households began to acquire domestic electrical appliances such as refrigerators. The market for televisions emerged in the 1970s (Lohn 2007: 304). Improved electric energy services also enabled the development of industrial and commercial firms. As suggested by the demographic census data analyzed in Chapter 5 and as supported by several authors (e.g., Pereira 1978; Amora 1996), the transition of Florianópolis from a mostly rural to a mostly urban society was clearly underway by the early-1960s.

Along with the extensive road building projects of the 1970s and 1980s, came further expansion of urban space throughout SCI along greatly improved access roads. This urbanization process included leapfrogging towards several peripheral settlement areas that up until that point had existed as relatively isolated traditional fishing-farming communities that had long relied upon waterways, footpaths, and wider trails accommodating animal-drawn carts. Initially, the advent of automobile-oriented transportation infrastructure, with state highways approaching SCI's extremities, had the greatest impact on the economy and landscape of SCI's northern coast where during the 1980s the communities of Canasvieiras and Ingleses were transformed into major beachfront tourist destinations (Amora 1996; Oliveira 1999; Reis 2002). During this period, tourism development and secondary homes began to appear in several other neighborhoods throughout SCI. Population densification in some communities located along SCI's bayside were in part due to local demographic shifts whereby residents decided to move closer to employment opportunities in the *Centro*. Population growth in a number of oceanside neighborhoods were signs of the early stages of urban-urban migration originating from cities both inside and outside Santa Catarina State.

Continuous and discontinuous urban development on SCI proceeded into the 1990s as several eastern and southern settlements began to experience rapid urban growth due in part to tourism development, but increasingly resulting from residential real estate development. These included São João do Rio Vermelho District located in the northeastern sector and Barra da Lagoa District located east of Lagoa da Conceição along the canal that connects the lagoon to the ocean. Barra da Lagoa is among SCI's largest traditional communities (Lins 1994). As the land and housing markets in Lagoa da Conceição and Barra da Lagoa became more saturated and the southern portion of SCI became more easily accessible by road, the attention of developers—increasingly eager to cater to middle- and upper-class urban migrants—shifted to *Sul da Ilha* in the 1990s.

Many modest investors have purchased individual lots, with or without built structures. These lots typically range from 300 m² to 500 m². Developers with enough capital to purchase much larger tracts of land have created residential and commercial subdivisions. Several developers increased the market value of their properties by further investing in infrastructure, for example, by extending water, telephone, and electricity services, by paving roads, by providing visitor parking, and sometimes by enclosing residential subdivisions (*loteamentos fechados*) to offer greater exclusivity. Oftentimes, investors constructed residential or commercial structures to sell or lease (e.g., *Notícias* *do Campeche e Sul da Ilha* 2001: 7). Several regional real estate agencies, eager to capitalize on the urban-urban migration trend, set up branch offices in *Sul da Ilha* (see Figure 6.3a). Deploying idealized representations of their properties and clients in billboard and print advertisements, real estate agencies emphasize the livability factor in their marketing strategies (Figure 6.3b).

The transformations occurring in the Campeche Coastal Plain have serious repercussions for the peri-urban communities further south in the districts of Ribeirão da Ilha and Pântano do Sul where land prices are presently more affordable than in communities closer to the Central City District where property values have increased dramatically since the early 1990s. Growing interest in urban development in Ribeirão da Ilha and Pântano do Sul is now compounded by the recent construction of a major roadway, *Via Expressa Sul*, which was built to relieve traffic congestion, particularly during peak hours in the Costeira do Pirajubaé area just south of the *Centro* (*Notícias do Campeche e Sul da Ilha* 2001: 5; Santos 2004). Another major roadway has been proposed for construction along the Island's eastern coastline from Joaquina Beach to Morro das Pedras (Luiz and Silva 1996), however, the future of this proposal remains uncertain. Organized opposition to this proposed oceanside roadway and related pro-growth proposals is described below in section 6.6.

Table 6.1 The twelve districts of Florianópolis. *Sources:* IBGE (2000), Bevilacqua (2004), and PMF (2008).

District Name	Year Established	Area (km^2)	Pop. (2000)	Pop. Density (inhab./km^2)
1. Distrito Sede (Central City)	1997	74.54	228,869	3,070.42
2. Lagoa da Conceição	1750	55.28	9,849	178.17
3. Ribeirão da Ilha	1809	51.54	20,392	395.65
4. Pântano do Sul	1966	47.68	5,824	122.15
5. Campeche	1995	35.32	18,570	525.76
6. Ratones	1934	33.12	2,871	86.68
7. São João do Rio Vermelho	1831	31.68	6,791	214.36
8. Cachoeira do Bom Jesus	1916	30.37	12,808	421.73
9. Canasvieiras	1835	29.30	10,129	345.70
10. Santo Antônio de Lisboa	1751	22.45	5,367	239.06
11. Ingleses do Rio Vermelho	1831	20.47	16,514	806.74
12. Barra da Lagoa	1995	4.75	4,331	911.79
TOTAL		436.50	342,315	784.23

Figure 6.3 (a) *SP Imóveis*, one of several real estate agencies operating on Santa Catarina Island. The letters "SP" signify São Paulo, the Brazilian state from which many recent migrants to the Island have originated. **(b)** Marketing properties for sale in a residential subdivision, this real estate billboard in Morro das Pedras entices potential buyers with the phrase: *"Você de férias todos os dias"* ("You on vacation everyday").

(a)

Source: author, April 2004.

(b)

Source: author, June 2004.

6.3 Communities and Neighborhoods in Flux

The present-day residents of Florianópolis are commonly referred to as either *nativos* or *de fora,* i.e., either native-born or outsiders. While the former group is far from homogeneous, the latter group conflates migrants from other regions of Santa Catarina, other Brazilian states, and other countries. The terms *manezinho* and *manezinha* are synonymous with native-born,[185] and among native residents they are frequently used as terms of endearment and expressions of cultural pride. Among many non-native residents, particularly those originating from large urban centers, however, the terms are often used in a derogatory sense to mean backward, ignorant, or provincial. Ironically, this degrading attitude towards native-born residents exists despite the fact that many urban migrants have been drawn to Florianópolis seeking relief from the anxieties of frenetic city life and a change in lifestyle that emulates the tranquility and proximity to nature considered characteristic of the local traditional culture (cf. Kuhnen 2002).

Without minimizing the significance of factors such as socioeconomic class, race, and public policies, the native/non-native social rift has undoubtedly influenced patterns of sociospatial segregation throughout SCI (cf. Lago 1996; Fantin 2000; Sugai 2002). Residential clusters in suburban and peri-urban communities often reflect the dominant presence of either native or non-native households. In the midst of massive social and territorial restructuring in the municipality and beyond, many native-born residents have managed to remain rooted in their historical, traditional neighborhoods (Figure 6.4).

[185] Those born on SCI are more specifically referred to as *nativo da Ilha* or *manezinho/a da Ilha.*

Figure 6.4 In the Rio Tavares neighborhood, an older residential cluster mostly inhabited by "native" households. It is adjacent to an area of pasture (foreground) and secondary forests on the hillslopes (background). *Source:* author, April, 2004.

Contrastingly, in other localities, household clusters of mostly outside origin have occupied newly-developed properties on formerly agricultural lands, i.e., parcels previously managed as pastures, croplands, and fallows. In this new type of residential landscape, the scattered, small, usually wooden, traditional houses have been engulfed by new waves of development and abandoned by native households at varying stages of the urban development process depending upon specific circumstances (Figure 6.5a, b)

Figure 6.5 (a) Traditional residence (right) next door to a recently built, larger house (left). **(b)** An abandoned, traditional house engulfed by vegetation (foreground) juxtaposed by an upper-income, residential subdivision (background).

(a)

Source: author, 2000.

(b)

Source: author, April 2004

In her master's thesis, geographer Ana Maria Amora (1996) analyzed the links between the urbanization process and transformations in the social life of Campeche's native-born population. Amora (1996: 60) explained that:

> …it is the city that reaches Campeche via infrastructure, urban environmental impacts, rising land values, and the arrival of a population of urban origins; and Campeche reaches the city by way of the consequent changes taking place in social life, in the quotidian of its native-born population, and in the social identity of its constituents. These constituents take on, in their development as individuals, as subjects of their interaction with this mutating way of life, new values and habits that will modify their relationship with the physical space in which they are enmeshed, constructing the urban, in its multiple dimensions, within Campeche.[186]

Drawing on Marxist theory, Amora (1996: 71–77) also noted that the physical changes in the Campeche landscape reflect the integration of SCI communities into the dominant capitalist economic order, and that there has been a profound change in social values in relation to the land whereby use value has shifted to exchange value. By the mid-1990s, the land had almost entirely ceased to provide residents with a means of primary production for subsistence and trade. Since the 1970s, use value of agricultural land has diminished, real estate exchange value has increased, and integration into the real estate market has involved non-local buyers both domestic and international. Production value of the land has shifted to landscape consumption value. In sum, Campeche's complex social and territorial dynamics result from the persistence of "old" residents and the arrival of "new" residents from diverse regions (Figure 6.6). The multiple encounters among these social groups are embedded in the global capitalist system.

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[186] I have translated this quote from the original Portuguese text written by Amora (1996: 60), "…é a cidade que chega ao Campeche via infra-estruturas, impactos da urbanização sobre o meio ambiente, valorização do solo urbano, e chegada de uma população de origem urbana; e o Campeche chega à cidade através das conseqüentes mudanças ocorrida na vida social, no cotidiano da sua população nativa, e na identidade social de seus components. Estes assumem, na sua elaboração enquanto indivíduos, como sujeitos na sua interação com este modo de vida em mutação, novos valores e hábitos que irão modificar a sua relação com o espaço físico onde estão inseridos, construindo o urbano, nas suas múltiplas dimensões, dentro do Campeche."

Figure 6.6 The eastern portion of the Campeche Coastal Plain as viewed from the hillside of Morro do Lampião. *Source:* author, July 2004.

Given the heterogeneity of the population currently living in the Campeche Coastal Plain, one might expect to find contradictory narratives about the region's history and development trajectory over the past three decades as well as competing visions for its future. The results of this research project indicate that from the perspective not only of many native-born residents but also of non-native long-term residents,[187] recent social and landscape transformations on SCI represent a devastating loss of livability and a rapid decline along a destructive path similar to paths taken elsewhere in Florianópolis and elsewhere in Brazil. Some native-born residents openly expressed a sense of resentment toward affluent new residents who are perceived as arrogant and disrespectful of the local culture and environment. Yet, feelings of loss, resentment, and nostalgia among native-born residents were often mixed with keen interest in acquiring many of the advantages of modern life and in pursuing new occupational paths, moving them

[187] Here I define long-term residents as those who have lived on SCI since the 1970s or longer.

further away from the “traditional” livelihood activities of their parents and grandparents and toward more promising possibilities. For instance, I found native and non-native entrepreneurs developing new economic opportunities in the tourism and leisure sector by combining elements of the traditional and the modern. More often than not, these ventures involved some level of native/non-native collaboration. In addition, new and old residents entered into formal and informal labor agreements in activities such as childcare, housekeeping, construction, and landscaping.

From the viewpoint of many of the more recent urban in-migrants, i.e., those arriving since the 1980s, Campeche’s transformation represented a new beginning and an opportunity to escape regions where they were experiencing stressful economic, social, and environmental conditions in exchange for a much more affordable and livable city. Some of these new residents sought to explore possibilities for sustainable development with like-minded residents and to learn from and avoid mistakes made elsewhere. For migrants seeking an alternative to megalopolitan life in cities like São Paulo or Rio de Janeiro, there was a clear economic advantage to establishing residency on SCI where the cost of living was much lower and opportunities for people of all ages to enjoy a variety of free outdoor leisure activities abounded. Furthermore, cooperative leisure activities such as fishing and shellfish gathering simultaneously supplemented household diets. Catches and harvests were regularly shared at meals with family and friends during weekend gatherings.

High livability ratings, however, did not necessarily translate into permanent residence for urban in-migrants. Whether seasonal or short-term, migrations were often temporary. Many new residents maintained out-of-state license plates on their vehicles and maintained voter registration in their municipalities of origin. One of the main drawbacks for new residents accustomed to more cosmopolitan lifestyles was boredom. Others became disillusioned for economic reasons such as failing to secure adequate employment.

Amora (1996) concluded that Campeche's new residents, for the most part, had not yet developed community ties strong enough for them to identify with collective interests. However, my observations made nearly a decade after Amora's study suggest that by the early years of the twenty-first century at least some recent arrivals were indeed identifying with locally-based, collective interests and participating in social mobilizations. That is to say that although the social networks of recent arrivals commonly developed along previous places of residence and decidedly non-local identities—maintaining strong extra-local social, economic, and cultural connections—there were other kinds of affinities motivating some non-native individuals to become active members of local community movements and citizen mobilizations addressing social justice and environmental concerns. These other affinities included: social ties to native-born families through marriage; having native-born children; the migration of one's extended family to Florianópolis; a high degree of investment locally whether in one's property, career, business, or some combination of these; and commitment to democratic values, social justice, and environmental stewardship.

6.4 Government Planning for Urban Expansion and Economic Development

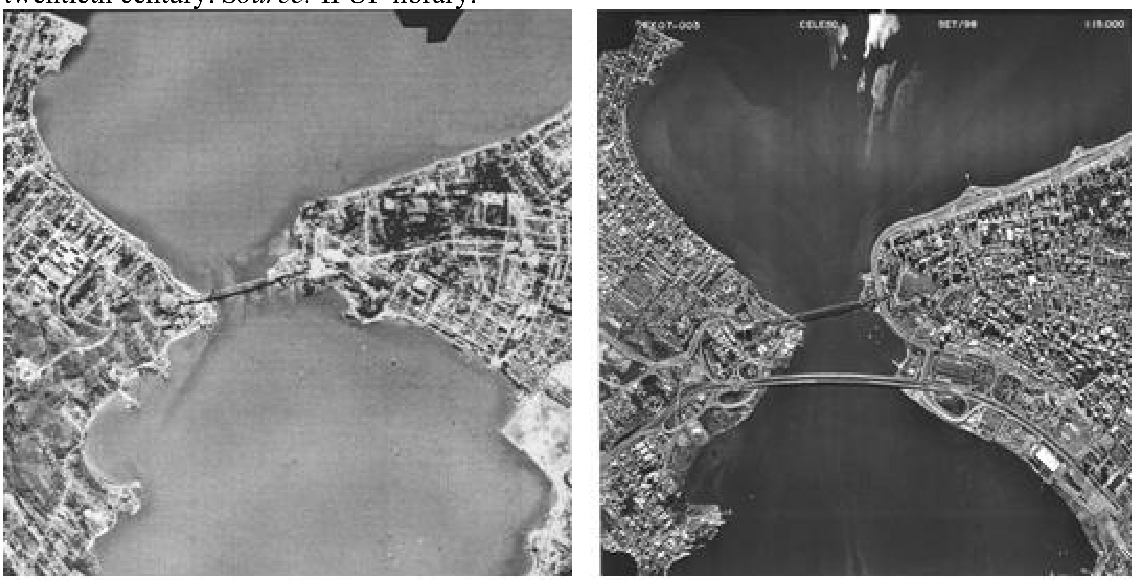
After 1950, major infrastructure development projects supported by Brazil's federal government in alliance with Santa Catarina's elites enabled the expansion of public services, the tertiary sector, and real estate development in the Florianópolis region thus spurring the institutionalization of modern public planning for urban development (cf. Lago 2000 and Lohn 2007). Influenced by the policies of the 1948 United Nations Economic Commission for Latin America, the first Master Plan (*Plano Diretor*) for the city of Florianópolis was developed from 1952 to 1954 and approved in 1955 (PMF 1955; Reis 2002). Around the same time, a new Municipal Code was adopted (Lohn 2007: 310). At the state level, the ten-year *Plano de Obras e Equipamentos* (POE; i.e., Plan for Public Works and Equipment) was conceived in 1954 and legislated in 1955 to initiate major public works projects, including the development of the electric energy sector (Caballero 2002: 80).[188]

During the late 1960s and the early 1970s, the *Plano de Desenvolvimento da Área Metropolitana de Florianópolis* (Development Plan for the Florianópolis Metropolitan Area) prioritized the construction of a high-speed road network (*vias expressas*) serving the dual purpose of economically integrating SCI with the mainland and promoting urban expansion and tourism development on the Island (Amora 1996: 50–51; Reis 2002: 171–174). This plan led to the completion of a bayside landfill project (*Aterro da Baía Sul*) which added 6 km² to SCI, providing space for the construction of two new bridges connecting the Central City District to the mainland—*Ponte Colombo Salles* inaugurated in 1975 and *Ponte Pedro Ivo Campos* inaugurated in 1991 (see Figure 6.7). The original

[188] The ten-year POE began under the administration of Governor Irineu Bornhausen (1951–1956) who was succeeded by Governors Jorge Lacerda (1956–1958), Heriberto Hülse (1958–1961), and Celso Ramos (1961–1966).

bridge *Ponte Hercílio Luz* was closed to traffic in 1982.[189] Today, the *Aterro da Baía Sul* is also the site of the city's central bus terminal.

Figure 6.7 Transformation of the Florianópolis Central City District over the second half of the twentieth century. *Source:* IPUF library.



During the 1970s, several new federal and state government agencies were established in the Central City District. Many of them were sited in the Itacorubi neighborhood. The jobs created by the presence of these new agencies stimulated new residential and commercial development. The *Instituto de Planejamento Urbano de Florianópolis* (IPUF), the municipal urban planning agency of Florianópolis, was established in 1977 (Adams 2004; IPUF <http://www.ipuf.sc.gov.br). In 1981, the *Plano de Desenvolvimento Turístico do Aglomerado Urbano de Florianópolis* (Tourism Development Plan for the Florianópolis Urban Agglomeration) was proposed as part of a larger federal program targeting medium-sized cities for economic development (Amora

[189] The suspension bridge *Ponte Hercílio Luz*, inaugurated in 1926, was designed by David B. Steinman and Holton D. Robinson (partners of Robinson & Steinman). Steinman, a PhD graduate of Columbia University, also designed the Henry Hudson Bridge.

1996). In addition to continuing the work of developing the Master Plan for Florianópolis, IPUF has participated in the preparation of additional Master Plans for neighboring municipalities towards the development of an integrated metropolitan region (Sugai 2002).

Since the 1980s, in response to observed land-use trends, a series of reevaluations by the municipal legislature, and federal legislative changes, IPUF has revised the Master Plan for the Central City District and has prepared plans for other submunicipal units creating new zoning categories in the process (Teixeira and Silva 1999).[190] IPUF submitted the first version of the *Plano de Desenvolvimento do Campeche* (PDC; Campeche Development Plan) to the City Council in 1992 (IPUF 1992; Amora 1996; Reynaud 2001; MCQV <http://www.campeche.org.br>).[191]

6.5 From an Agricultural Mosaic to Subdivisions: The Transition to Lots and Condominiums

The rural-to-urban land transitions that have taken place in the Campeche Coastal Plain over the past three decades have occurred in similar ways in other regions of the Brazilian coastal zone. However, to understand the site-specific processes of land partitioning in Campeche and other parts of *Sul da Ilha*, it is important to place them in the historical context of land partitioning in Florianópolis. After over a half-century of land partitioning from 1940 to 1996, only about 20 percent of the properties in Florianópolis had been occupied with formal approval of municipal authorities (*parcelamento legal*) and public registry while about 80 percent of the municipality's

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[190] IPUF has prepared submunicipal Master Plans for neighborhoods (Reis 2002: 174), districts, beaches (e.g., IPUF 1985), and municipal protected areas (e.g., IPUF 1978).

[191] The PDC is also referred to as the *Plano de Desenvolvimento Entremares para a Planície do Campeche.*

urban occupation had resulted from unplanned, unapproved partitioning (*parcelamento clandestino*) (Oliveira 1999: 12). To clarify this issue of such widespread informal urban development, it is important to point out that in Florianópolis unlawful occupations and other land or housing irregularities are found in low-, middle-, and high-income housing areas (e.g., Luiz and Silva 1996). Speculative land investments and subsequent development and occupation—undertaken through both lawful and unlawful means—have caused the displacement of poor households from well-located land (e.g., prime beach-front areas; see Figure 6.8). This displacement has contributed to growth of poor, informal settlements in precarious areas lacking infrastructure and services. Many of the municipality's poorest neighborhoods are located in areas zoned for environmental protection such as mangrove and steep hillslopes.

Figure 6.8 (a) Early stage of residential subdivision development on formerly agricultural parcel in Campeche alongside the paved Avenida do Campeche. (b) Entrance to a gated condominium in Rio Tavares.

(a)

Source: author, May 2004.

Figure 6.8 (continued)
(b)

Source: author, April 2004

Property titles fall into one of two categories: possession (*escritura de posse*) or ownership (*escritura pública*). Purchase of a property with a title of possession (i.e., right to occupy without ownership), while very common, can be risky for the investor for a number of reasons. The land may be zoned for a non-residential purpose such as permanent environmental protection which is the case for dunes and hillslopes (see Figure 6.9; Santos 2001). Or, the government may decide to evict occupants to construct a road or other major project. On the other hand, properties with titles of possession often cost less than those with titles of ownership. Moreover, many of these properties are eligible to be regularized and later converted to formally registered ownership. The municipal government currently has policies and programs in place to help prevent the spread of informality and to encourage land and housing regularization (see Figure 6.10).

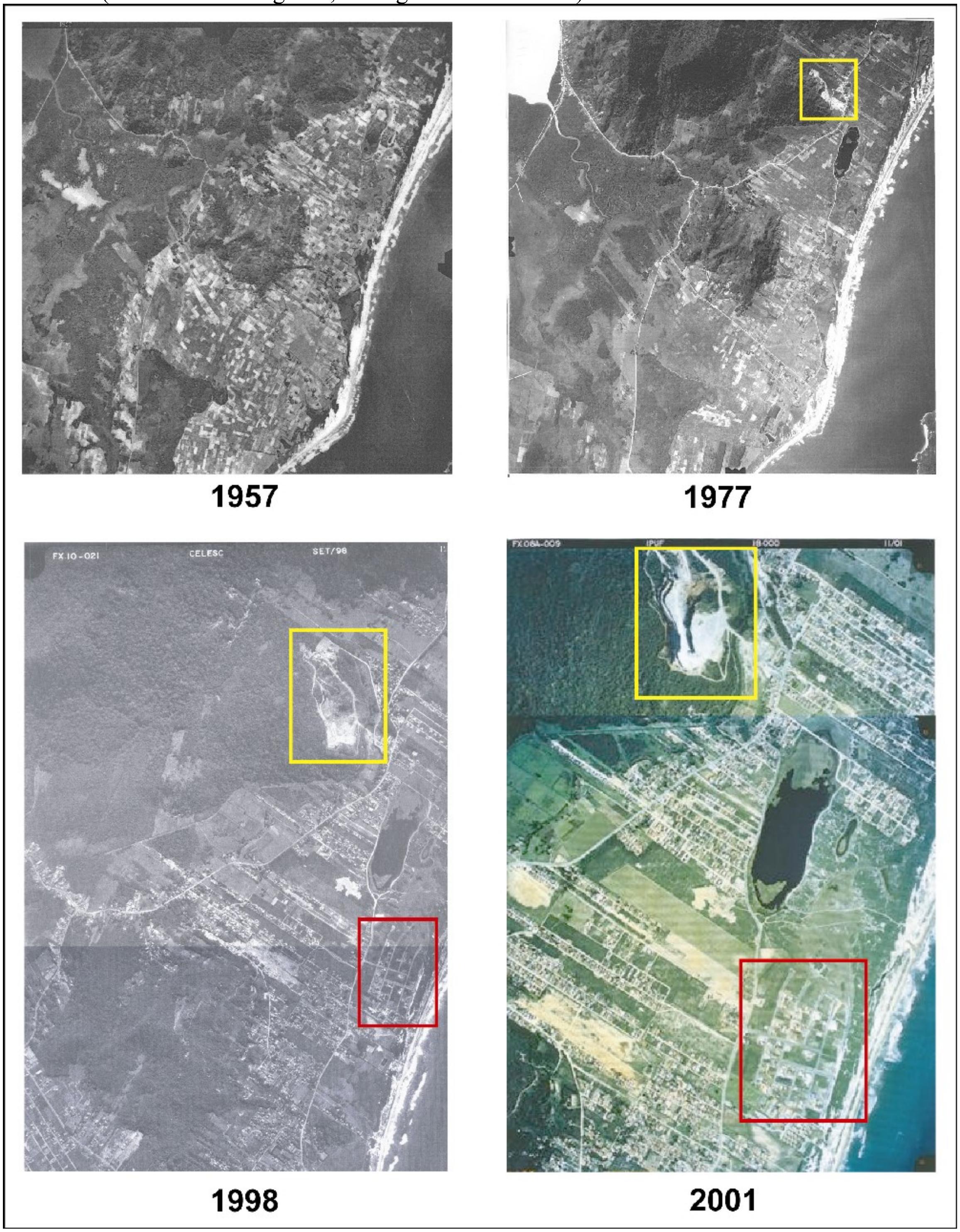
Figure 6.9 Protected dunes (foreground), residential and commercial urbanization in the coastal plain, and the slopes of the Morro do Lampião (background) in Campeche. *Source:* author, April 2004.

Figure 6.10 Billboard in the Lagoa da Conceição District placed by the municipal government of Florianópolis: “Avoid future problems. Before purchasing a property, research its viability. Consult SUSP.” SUSP (Secretaria Municipal de Urbanismo e Serviços Públicos) is the Florianópolis Municipal Office of Urbanism and Public Services. *Source*: author, March 2004.

In addition to concerns about property titles, occupants in possession or ownership must also verify that built structures comply with municipal zoning regulations, other municipal codes, and federal legislation. The municipal government issues a certificate (*habite-se*) to formally recognize that a house or other structure is in compliance with legislation. Affluent buyers tend to either purchase regularized properties with newly-built or renovated houses from developers or they may purchase vacant land and contract architectural and construction firms to build a customized, regularized home. Those with fewer financial resources may themselves do much of the work of designing and building a new house or improving an existing structure. They may have limited experience with zoning laws and building codes. Another relatively low-cost option is to contract one of several companies specializing in the construction of wooden, pre-fabricated houses.

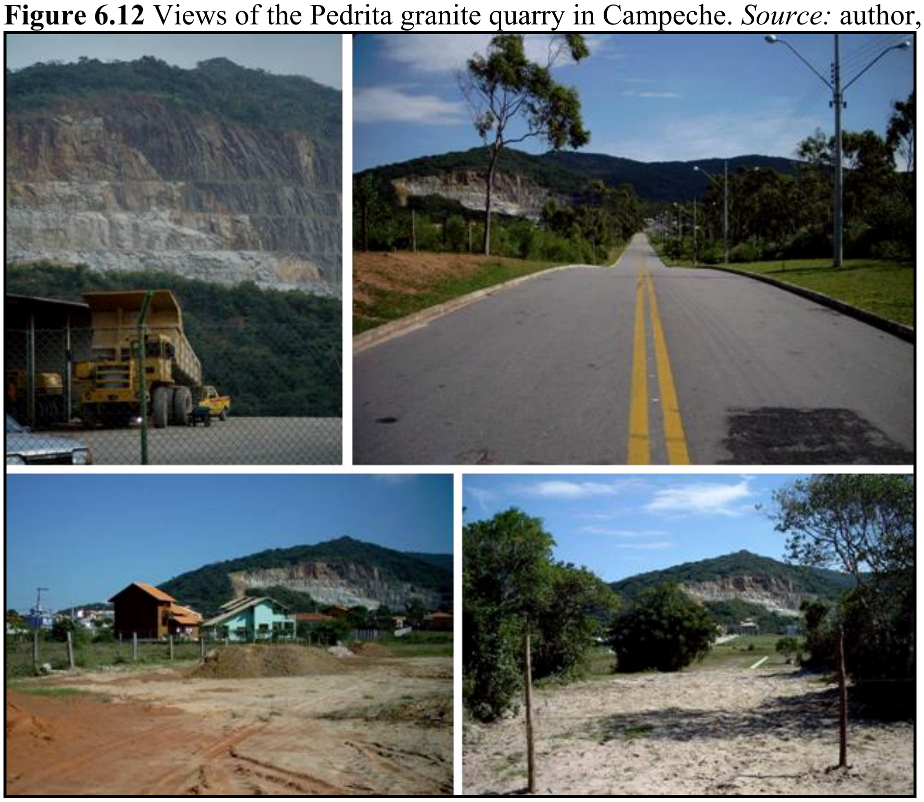
As shown in Figure 6.11, in 1957 the Campeche Coastal Plain appears as a mosaic of agricultural parcels. In the 1977 image, it is possible to detect roadway expansion, a reduction in agricultural activity, and some urbanization. By 1998, many of the older, main roadways had been paved and new, secondary roads opened. Urbanization was prominent at the end of the twentieth century, including the appearance of residential subdivisions (*loteamentos*). Three years later, by 2001, urbanization had increased and several additional roads had been paved. The beach-front residential cluster framed in red in the bottom right-hand corner of the 1998 and 2001 aerial photographs is *Novo Campeche* (New Campeche), an upper-income subdivision (Figure 6.11)

Figure 6.11 Land-use change in the Campeche Coastal Plain from 1957 to 2001. *Sources:* IPUF library and Santa Catarina Secretaria de Estado do Desenvolvimento Econômico e Integração ao Mercosul (Diretoria de Geografia, Cartografia e Estatística).



A quarry on the hillside of Morro do Campeche in the Campeche District is operated by the firm Pedrita (Figure 6.12).192 The Pedrita quarry is considered an eyesore among many local residents who are also disturbed by the noise pollution caused by frequent mining explosions. Several residents in the neighborhood have complained that these mining explosions are causing structural damage to their homes. When Pedrita was first established in 1973, its activities were limited to granite extraction, processing, and commercialization. During the 1980s, it diversified into road construction and road paving. By the 1990s, Pedrita had expanded into real estate development. The Novo Campeche subdivision represents one of its recent projects (see Figures 6.13 and 6.14). Pedrita is framed in yellow in the 1977, 1998, and 2001 aerial photographs (Figure 6.11).

Figure 6.12 Views of the Pedrita granite quarry in Campeche. *Source:* author, 2004.



[192] The full name of the firm is Empresa Pedrita – Planejamento e Construção Ltda., URL <http://www.pedrita.com.br>.

Figure 6.13 (a) View of *Novo Campeche,* an ocean-side, residential subdivision, and the surrounding residential area from the hill Morro do Lampião; (b) Billboard at the entrance to the subdivision reads, "*LOTEAMENTO NOVO CAMPECHE: Terrenos a partir de 450* m^2*, na área mais valorizada do sul da Ilha* ("NEW CAMPECHE SUBDIVISION: Lots from 450 m^2, in the most valued area of sul da Ilha").

(a)

Source: author, July 2004.

(b)

Source: author, April 2004.

Figure 6.14 Sign posted by the residential association *Associação de Moradores do Novo Campeche* (AMONC). The top two banners advise potential real estate buyers to avoid problems prior to purchase by researching properties of interest for possible violations of environmental legislation and embargos imposed by the federal environmental agency IBAMA. The bottom banner invites passersby to visit the *Movimento Campeche Qualidade de Vida* (Campeche Quality of Life Movement) website. *Source:* author, April 2004.

6.6 Local Struggle for Participatory Governance and Brazil's City Statute

In 1989, the year following promulgation of Brazil's 1988 Federal Constitution, an organization of concerned surfers wrote a public letter of complaint and submitted their letter to municipal authorities. At the time, IPUF was preparing the first PDC. This surfers' letter, referred to as the *Carta do Campeche*, urged compliance with environmental legislation designed to protect ecosystems and called for the preservation of historic paths and sites, improvement of public transportation and public health services, expansion of public schools, expansion of telecommunications infrastructure, the provision of a local post office, and provision of water and sewage infrastructure (Amora 1996; MCQV <http://www.campeche.org.br>).

By the time IPUF released the first version of the PDC in 1992, community pressure among Campeche residents had mounted. Community groups were beginning to mobilize to hold public agencies accountable to the 1988 Federal Constitution and existing laws and to demand that citizen voices and the long-term well-being of ordinary people be taken seriously in the planning process. Many community groups and individuals agreed that the PDC proposal to expand and extend roadways, to allow the construction of taller buildings, and to encourage tremendous population growth would have damaging social and environmental consequences for *Sul da Ilha.*[193] However, the second version of the PDC produced by IPUF and presented to the City Council in 1995 contained few changes. The municipal government's plan continued to favor ideas backed by local elites, and the major points of contention between IPUF and the communities of Campeche remained. The PDC planned roadway expansion and an increase in the resident population of the Campeche Coastal Plain to 450,000 inhabitants, without adequate provision of basic sanitation infrastructure and public services.[194]

The community-based movement responded in early 1996 by organizing a petition, submitted to Mayor Sérgio Grando, requesting that the City Council suspend its consideration of the PDC to allow for a period of further public feedback. With the

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193 For instance, many were concerned that a road system designed to accommodate heavier and faster automobile traffic was likely to introduce physical barriers between neighborhoods that would erode the region's social fabric and lead to undesirable patterns of segregation.

194 According to Reis (2002: 182), the PDC planned for a population increase to 450,000 people over a period of about 30 years.

election of Mayor Angela Amin who took office in early 1997, the community-based movement organized a follow-up petition and submitted it to Mayor Amin in March 1997. [195] Subsequent actions by the City Administration and IPUF were, at best, dismissive of the community-based initiative to open channels for dialogue. IPUF divided the PDC into multiple Spatial Units for Planning (*Unidades Espaciais de Planejamento*—UEPs) and gave communities a deadline of one month to comment. Communities were permitted to review and comment on their particular UEP only. Critics rightly protested that this process denied communities the opportunity for integrated evaluation of the PDC, limiting them to fragmented discussions with IPUF. The communities of Morro das Pedras and Jardim Castanheiras participated in the questionable process by commenting on their respective UEPs. Representatives of the communities of Campeche, Areias do Campeche, Rio Tavares, Fazenda do Rio Tavares, and Porto da Lagoa, however, refused to comment objecting on the grounds that the partitioning of the PDC had the effect of disempowering communities. Furthermore, the UEP planning strategy was judged by some opponents as legitimizing a divisive political process that was likely to foster sociospatial segregation by isolating the poorest communities with least political power from the politically stronger middle- and upper-class communities.[196]

Frustrated by the municipal government's continued refusal to address community concerns in good faith, leaders of the consolidating community-based movement decided to take the bold step of formulating an alternative proposal for the

[195] Angela Amin was elected Mayor of Florianópolis for two consecutive terms from 1997 to 2004. In 2006, she was elected to the federal Chamber of Deputies in the Brazilian Congress (see URL http://www.angelaamin.com.br). Dário Berger is the current Mayor of Florianópolis having taken office on January 1, 2005. Previously, Berger served as President of the Florianópolis City Council in 1994, and he served two consecutive terms as Mayor of São José from 1997 to 2004.
[196] In his doctoral dissertation, Almir Francisco Reis (2002: 188) criticizes IPUF for producing urbanization plans for specific localities such as the PDC during the 1990s and, as a result of this fragmented approach, failing to propose an integrated plan for the entire municipality.

development of the Campeche Coastal Plain. The first step in the process to create a community proposal was the organization of the First Community Planning Seminar in Campeche (*I Seminário Comunitário de Planejamento do Campeche*) held October 23–25, 1997 (Teixeira and Silva 1999). This three-day Seminar set out to accomplish what the official process had impeded—i.e., an open discussion and critique of the PDC as well as analysis of the Campeche Coastal Plain's status and possible future. The Seminar drew about 250 participants including community residents, City Council members, representatives of environmental NGOs, and a variety of professionals.[197] The event established four working groups (*comissões temáticas*) to assess aspects of the IPUF proposal and propose alternative guidelines. The themes of these four working groups were: natural resources and urban zoning, the roadway system, basic sanitation, and public space. Integrating the results of the Seminar with existing municipal, state, and federal legislation as well as with ideas in the municipality's existing Local Agenda 21 (i.e., to promote economic development, social equity, environmental protection, historical and cultural preservation, and quality of life), the Seminar organizers issued a report called the *Dossiê Campeche*. This document also asserted the principle of public participation in the municipal planning process and objected to the projection of 450,000 inhabitants. The *Dossiê Campeche* was distributed to relevant municipal, state, and federal agencies. However, the community-based attempt to negotiate with the municipal government and initiate a participatory urban planning process was not well received. Eight months later in 1998, the municipal government responded by dismissing the *Dossiê Campeche* and questioning its scientific and technical validity. In 1999, IPUF

[197] Geographers, biologists, ecologists, civil engineers, sanitation engineers, sociologists, architects, lawyers, educators, and journalists were among the Seminar participants.

submitted the PDC to the City Council. It was subdivided into 14 legislative projects (*Projetos de Lei*).

Again, the leaders and supporting participants of the community-based movement were not deterred by the rejection of their efforts. They continued to assemble and to urge the City Council to put the legislative projects on hold until a legitimate participatory process was implemented. Forming an alliance of entities working to promote sustainable development in the Campeche Coastal Plain and with the continued involvement of university professors and other professionals, the *Movimento Campeche Qualidade de Vida* (MCQV) was established in 1998 (MCQV <http://www.campeche.org.br>). In 1999, the City Council's Justice Committee mediated meetings between representatives of IPUF and MCQV (Bittencourt 2005). Community negotiators submitted another document to the City Council outlining the multiple violations of environmental legislation in the PDC and putting forth MCQV positions. MCQV clearly criticized the notion that a purely scientific and technical approach to planning in favor of process that includes community participation. After several months, these meetings had failed to bring about consensus. There continued to be fundamental disagreement over the carrying capacity of the Campeche Coastal Plain. MCQV reached the conclusion that it was time to prepare an alternative plan that would seek to promote and maintain local ecological integrity and social well-being.

The alternative proposal spearheaded by MCQV was called the Community Plan for the Campeche Plain: A Proposal for Sustainable Development (*Plano Comunitário da Planície do Campeche: Proposta para um Desenvolvimento Sustentável*). In the spirit of encouraging broad-based resident participation and valuing local knowledge, the

Community Plan was developed over several months during itinerant weekly planning meetings held in public venues throughout Campeche on Saturdays. Professionals committed to the movement contributed further with field work in their areas of expertise. Participants deliberated on how the territory should be zoned for urban use, ecological protection, historical and cultural preservation, and recreation. The Community Plan was submitted to the City Council in March 2000 (Bittencourt 2005).

Community groups continued to convene for the purpose of monitoring and denouncing environmental crimes, degradation of cultural-historical sites, and inadequate enforcement of existing legislation intended to protect natural and cultural features (*Notícias do Campeche e Sul da Ilha* 2001: 1–3). They also discussed ideas for legislative proposals at the municipal level. As a result of these gatherings, in October 2003 the alliance of community groups produced a document entitled *Compromisso do Campeche* outlining what they viewed as the minimum level of commitment necessary to contain the accelerated process of sociocultural and environmental degradation in the region (MCQV <http://www.campeche.org.br>). In sum, the list of 12 commitments were: (1) support for a legislative proposal to limit construction to two floors, (2) compliance with federal environmental legislation (CONAMA Resolution 303/02) defining Areas of Permanent Preservation, (3) review of previously granted variances on building codes and the discontinuation of issuing building permits for construction or other activities in violation of existing legislation, (4) support for effective monitoring and regulation by competent authorities with the assistance of citizen volunteers, support for the protection of local wetlands (5) Lagoa Pequena and (6) Lagoa da Chica, (7) support for a municipal law zoning the historic Campeche Airfield as an *Área de Interesse Social* (Area of Social

Interest) designated to serve as a public space for cultural and recreational activities rather than for privatization, (8) support for the protection and restoration of *restinga* vegetation, (9) construction of pedestrian sidewalks and bicycle paths in accordance with existing legislation, (10) democratic development of a "third" alternative plan to get beyond the stalemate between IPUF and the community, (11) prioritization of the provision of adequate sanitation infrastructure and services, and (12) support for the proposal to form a committee (*Comitê de Acompanhamento e Relatoria Ambiental da Planície do Campeche*) bringing together government agencies and community groups to report on, guide, and integrate efforts. The *Compromisso do Campeche* was signed by supporters and submitted to government authorities.

The community movement succeeded in obtaining a preliminary injunction (*mandato de segurança*) preventing the City Council from voting on the municipal Master Plan on the legal grounds that the City Council was in violation of the federal City Statute (see Fernandes 2007; Macedo 2008) by impeding the effective participation of citizens and community associations in the preparation of the municipal Master Plan (Bittencourt 2005). Although the preliminary injunction was later revoked, continued attention to the issue revealed that parts of the municipal Master Plan had been approved by the City Council during the period when the injunction was in effect. It became clear that the unconstitutionality of the City Council's conduct could be the basis for a class-action civil lawsuit. Under these circumstances, in 2005 Mayor Dário Berger requested the complete removal of the 1999 IPUF municipal Master Plan from the City Council docket and proposed (Municipal Decree 3357/05) the creation of a Planning Commission composed of members of the City Administration and community representatives (Bittencourt 2005).

In April 2005, a newly-established nonprofit organization Radio Campeche Community Association (*Associação Comunitária Rádio Campeche*) began organizing a number of educational and informative community services and activities by means of an FM radio program and website (Rádio Campeche <http://radiocampeche.org.br>). To reunify and strengthen civic mobilization for the next stage of their struggle for democratic participation in city planning, in an assembly held in June 2006, the Campeche community-based movement approved the creation of the Campeche Plain Popular Council (*Conselho Popular da Planície do Campeche*) scheduling weekly meetings on Monday evenings at a local public school (*Fala Campeche* 2006: 3). In August 2007, the municipal government of Florianópolis initiated the process to prepare the *Plano Diretor Participativo* (PDP; Participatory Master Plan) a new plan for Florianópolis in compliance with the City Statute (IPUF <http://www.ipuf.sc.gov. br>).

CHAPTER 7

SOCIOECOLOGICAL COMPLEXITY, JUST SUSTAINABILITY, AND ENVIRONMENTAL IMAGINARIES

> On the institutional level, regulation both extends and restricts freedom; only the balance of the freedoms lost and won is significant. This is true of juridical and actual freedoms alike. The comfortable classes enjoy the freedom provided by leisure in security; they are naturally less anxious to extend freedom in society than those who for lack of income must rest content with a minimum of it. This becomes apparent as soon as compulsion is suggested in order to more justly spread out income, leisure and security. Though restriction applies to all, the privileged tend to resent it, as if it were directed solely against themselves.
>
> Karl Polanyi (2001: 262–263; 1st ed., 1944)

> We cannot predict the outcome of every human action, but we can use our knowledge of environmental change in the past to create a better future–a future that respects the land and its ecological constraints.
>
> Gordon G. Whitney (1994: 337)

> For us the response to unreason has to be a different kind of reasoning, to guide a different social order of practice on nature, with a knowledge of natural processes, and the effects of human activity on them, consciously integrated into the very relations that make up society.
>
> Michael Watts and Richard Peet (1996: 261)

> And what if growing environmental and social turbulence, instead of galvanizing heroic innovation and international cooperation, simply drive elite publics into even more frenzied attempts to wall themselves off from the rest of humanity? Global mitigation, in this unexplored but not improbable scenario, would be tacitly abandoned (as, to some extent, it already has been) in favor of accelerated investment in selective adaptation for Earth's first-class passengers. We're talking here of the prospect of creating green and gated oases of permanent affluence on an otherwise stricken planet.
>
> Mike Davis (2008)

7.1 Self-Reflection on Research: A Personal Trajectory

Individuals and social groups have long been engaged in diverse and conflicting political, economic, and cultural projects to produce knowledge, elaborate ideologies, construct empires, build institutions, formulate policies, establish regulations, control resources, devise management strategies, and implement plans. As leaders and other participants in such efforts, social actors draw on the lessons of past experiences, explore human consciousness, utilize increasingly sophisticated and rapid means of communication, and adjust their strategies and activities in response to internal and external forces of change (i.e., feedbacks). Based on these assumptions, there should be sufficient innovative *potential* through awareness, flexibility, and ingenuity for the balance of human activity to reorient socioeconomic systems along more environmentally-sustainable and socially-just trajectories. Such trajectories might be called pathways of 'just sustainability.' In this last chapter, I present some ideas about potential pathways to just sustainability in the Florianópolis city-region.

This dissertation has explored human-environment interactions in the Florianópolis city-region from a just sustainability perspective. It has focused attention on metropolitan land-use patterns, forest-transition dynamics, sociospatial inequalities, legal-institutional reforms, and democratic practice during the period from the late twentieth century to the present. As a case study, it provides a small piece of the much larger puzzle of global socioeconomic transformations and environmental change. As the capstone of my experience as a graduate student, it represents a juncture along my life course, a pathway that has been the outcome of history, environment, relationships, agency, and contingency. Therefore, before revisiting the research questions set forth in the introduction of this dissertation (Chapter 1) and offering my conclusions, in this section I offer a summarized account of how my personal trajectory intersects with the central issues of this dissertation.

As the daughter of Brazilians who migrated from the urban-industrial northeastern zone of the municipality of Rio de Janeiro (*Zona Norte*) to the city of Newark, New Jersey (United States) in the late 1950s and who to this day maintain strong ties to their country of origin, I spent my childhood in and around these two cities—one in the 'North' and the 'Other' in the 'South.' I was born in Newark in 1971, after the city's post-World War II period of 'depopulation,' i.e., 'white flight' to suburbia and economic disinvestment. The first few years of my life came only a few years after the uprising that occurred in Newark in July of 1967 and in the midst of the Vietnam War. At the time of my birth, Brazil had been under military rule for nearly seven years; restoration of democratic governance in Brazil would take another 14 years. In the heterogeneous *subúrbio* of Rio's *Zona Norte*, containing mostly lower middle-class neighborhoods and *favelas* mixed with industrial and commercial areas, I stayed in the home of my paternal grandparents in Penha during many of my school vacations and frequently visited family and friends in several other *carioca* communities (e.g., Irajá, Pavuna, Bonsucesso, and Ramos).[198] Thus, at an early age, my observations and experiences provided me with a critical sense of First World/Third World discourse, multilevel centers and peripheries, racial discrimination, social stratification, and metropolitan sociospatial inequalities from a transnational comparative perspective, although of course this social science terminology was unfamiliar to me at the time. I was, however, acutely aware of the mismatch between dominant discourses and what I perceived as reality, and I began to

[198] Originating from the indigenous Tupi-Guarani language, the term *carioca* refers to people and things of or from the city of Rio de Janeiro. See O'Hare and Barke (2002) for more information on sociospatial inequality in the *município* of Rio de Janeiro including maps displaying the spatial distribution of Rio's *favelas* from 1910 to the late 1990s and the locations of municipal administrative districts and planning zones. See also the recent article by João H. Costa Vargas (2006) in *Latin American Perspectives* entitled, "When a favela dared to become a gated community: the politics of race and urban space in Rio de Janeiro."

develop skepticism toward statements made by people in positions of privilege who uncritically and irresponsibly attributed social and/or environmental problems to 'poverty' or, even worse, to 'poor people.'

Similarly, my earliest experiences enjoying and exploring 'natural' ecosystems occurred in the densely populated states of New Jersey and Rio de Janeiro, either along the coast (e.g., Ocean Grove, Bradley Beach, and Belmar on the Jersey Shore and along the stretch of coastline from the city of Rio to Mangaratiba) or in what are called 'urban forests.' These urban forests are recreational parks containing picnic areas, hiking trails, and advanced secondary forest. In northern New Jersey during the 1970s and early 1980s, my parents often took our family of six on outings to South Mountain Reservation in the Watchung Mountains, a protected area, of about 8 km^2, first established in 1895. In Rio de Janeiro, on occasion we visited Tijuca National Park (*Parque Nacional da Tijuca*) which covers 32 km^2 and encompasses the Tijuca Forest (*Floresta da Tijuca*) (see Menezes 1999; Freitas, Neves, and Chernicharo 2006). Protection and restoration of Tijuca Forest was initiated in the early 1860s; about a century later Tijuca National Park was created in 1961 (Parques Nacionais 1999). It was in the early 1980s that I visited Florianópolis, Santa Catarina for the first time, staying in the home of family friends who my parents had met through a chance encounter in a New York City restaurant. Although my first visit to '*Floripa*, a *Ilha da Magia*' lasted only a few days, my impressions of its environment and culture at that time have remained with me.

Without a doubt, these childhood experiences helped shape my social and environmental values, eventually influencing my decision to focus on environmental studies and Portuguese and Brazilian studies as an undergraduate at Brown University

(1989–1993) in Providence, Rhode Island, and to spend a semester studying geography and anthropology at the Pontifical Catholic University in Rio de Janeiro (PUC–RJ) in 1991. At PUC–RJ in the Gávea neighborhood of the municipality, I had the very good fortune of studying the spatial formation of Latin America with Professor Regina Célia de Mattos and biogeography under the guidance of Padre Josafá Carlos de Siqueira who took our class on several field trips to the Botanical Garden of Rio de Janeiro (*Jardim Botânico do Rio de Janeiro*) as well as to a variety of Atlantic Forest ecosystems in Rio de Janeiro State including the *restinga* of Massambaba in the municipality of Arraial do Cabo. Through this experiential approach to teaching, Padre Josafá wisely integrated a healthy dose of interdisciplinarity and practicality into the coursework to supplement and reinforce our classroom learning. One particular conversation during a field trip stands out in my memory; he patiently and thoroughly answered my questions about Brazilian cities. At PUC–RJ, I was also very fortunate to have studied cultural anthropology with the late Professor Lélia Gonzalez, co-author with Carlos Hasenbalg of *Lugar do Negro* (1982) and a founding member of the Unified Black Movement against Racial Discrimination (*Movimento Negro Unificado Contra Discriminação Racial*) (see Gonzalez 1985). Beyond academic settings, during the six months in 1991 that I spent living in Rio and traveling in the states of Minas Gerais and Bahia, I met many people who were volunteering their time to work in the third sector toward a variety of public-interest projects or working in the public sector to address important social and environmental issues. Dr. Edialeda Salgado do Nascimento was one of these highly committed, courageous, and energetic people.[199]

[199] I first met Dr. Edialeda Salgado do Nascimento at Brown University in the fall of 1990 when she was a guest speaker in the course 'Afro-Brazilians and the Brazilian Polity' taught by Professor Anani

After a brief internship in 1991 with the Brazilian Federal Working Group in preparation for the first United Nations Conference on Environment and Development, I returned to Rio in June of 1992 to participate in the Global Forum, the Earth Summit's parallel nongovernmental conference. Finishing college from 1992 to 1993, I continued to engage with ideas about sustainable development, environmental justice, and globalization. In preparation of my undergraduate thesis, I investigated environmental education policy and practice in urban New Jersey examining the themes of metropolitan social inequality and sustainability (Baptista 1993).[200] Later, in the mid-1990s, I worked in the third sector at the Union of Concerned Scientists (UCS), a nonprofit environmental organization, where I was part of a small team implementing the Sound Science Initiative, a program mobilizing a large network of scientists to communicate, to policymakers and the general public, the results of scientific research on global climate change and biodiversity loss and their implications for environmental policies. During this period (1995–1997), I learned more about global environmental change research and began to read the political ecology literature starting with the collection of work published in *Liberation Ecologies* (Peet and Watts 1996) which had been recommended to me by peace activist, author, and physicist Dr. Zia Mian. It was at this point that I decided to pursue graduate studies that would allow me to gain expertise on the Earth's forest resources in an interdisciplinary setting. The Graduate Program in Geography at Rutgers University afforded me the opportunity to develop skills in applied research with theoretical grounding in human-environment subfields.

Dzidzienyo. I am deeply grateful to Doutora Edialeda for her gracious welcome in Rio and her generosity of time, intellect, and spirit as both a mentor and a friend.

[200] My undergraduate thesis advisor was Professor Ross Cheit; Professors Phil Brown and Karen Wyche served as readers.

In the course of carrying out this doctoral dissertation project (2000–present), I have spent most of my time circulating within or between the metropolitan regions of Florianópolis, New York, and Washington, DC. I have also made trips to several other sites in the Americas. During this period, I have gained a much deeper awareness of the contrasting yet interconnected multiscalar, multitemporal dimensions of social and ecological dynamics (e.g., landscape mosaics, edges, gradients, nodes, clusters, networks, connectivity; hierarchies, thresholds, and cascading effects; modes of production and articulations; events; historical processes; international trade relations; multilevel policies and institutions; human behaviors; international flows of capital and people). I have also become better informed of divergent perceptions of 'empirical' realities and the theories and discourses presented to explain them. I have had multiple opportunities to learn about the work of social actors dedicated to creating solutions to environmental problems that synergistically contribute to ongoing struggles to uphold basic human rights equitably by advocating the goal of securing high levels of environmental quality not only for "Earth's first-class passengers" (Davis 2008) but for all. In short, far beyond my initial expectations, my journey along this long, unpredictable, bumpy, and sometimes bewildering road of interdisciplinary professional training in geography, human ecology, and land-change science has heightened my senses of observation, extended my network of relationships, and expanded my comprehension of the world's socioecological complexity and its possibilities.

I come away from the experiences of being a graduate student and an undergraduate instructor with the hope that consciousness of socioecological complexity and of the relevance of this complexity for the practice of just sustainability will become more accessible to growing numbers of people. In particular, I hope that these ideas will become increasingly available to future generations and to the many members of today's younger generations who have been unhinged by despair at some point in their lives or, at the very least, beset by uncertainty regarding the future of their society and planet. These are the people who sense the greatest urgency to resolve or simply to survive gargantuan political, socioeconomic, and environmental ills. One of the many experiences that helped to crystallize this viewpoint for me took place in the fall of 2001. As an instructor in the Department of Human Ecology at Rutgers, I was teaching a section of the course 'Environment and Development' in New Brunswick, New Jersey. In a group of about 15 students, two (a young woman and a young man) who held jobs in New York City's World Financial Center returned to class still in a state of shock having witnessed on site the devastation of September 11th. In ways spoken and unspoken, their direct experience of the event at 'ground zero' and the longer-lasting ripple effects of the event certainly transformed the nature of the course by influencing our classroom interactions, our interpretations of the assigned texts, and the paper topics selected by students. That moment in history desperately called for "a different kind of reasoning" in "response to unreason" (Watts and Peet 1996). In the classroom and in this dissertation, I have tried to explore new ways of reasoning.

Next, in sections 7.2 through 7.5, I return to the research questions posed at the outset of this dissertation: As population increase, economic expansion, and urbanization have occurred in metropolitan Florianópolis, what has happened to the city-region's landscape and ecosystems? Has a forest transition taken place in eastern Santa Catarina? As population increase, economic expansion, urbanization, and landscape transformations have taken place, what has happened to the socioeconomic status of people in the region? How have demographic, economic, and environmental changes impacted the living conditions of different segments of society, from the poorest to the wealthiest in the region? How have policies and institutions at multilateral, federal, state, and municipal levels influenced land-use patterns, environmental quality, and social equity/justice concerns? Section 7.6 imagines possible environment-development scenarios for the Florianópolis city-region over the twenty-first century. I end this final chapter by discussing the policy implications of the dissertation's main research findings (Section 7.7), identifying issues left unresolved, and suggesting a few directions for further research (Section 7.8).

7.2 A Condensed Environmental History of Florianópolis

There is a rich and growing body of work written in Portuguese that details the history and contemporary circumstances of the Florianópolis city-region. Much of this research has been carried out since the 1960s, following the establishment and expansion of universities and other research institutions in Santa Catarina State. Although I have endeavored to consult as many of these sources as possible, it is likely that I have missed some important contributions. In subsequent work, I plan to fill in any remaining gaps and to continue reviewing new additions to the literature. Nevertheless, as far as I know, this dissertation is the first text in the English-language social science literature that discusses the nature-society relationship in Florianópolis in depth and at length. Hence, in the process of working on this dissertation, I have initiated a project to write an urban environmental history of Florianópolis. I have traced the origins of this intriguing city on the southern Atlantic coast of South America from the region's earliest known human settlements which left behind numerous coastal *sambaquis* to the present-day emergent 'green metropolis' of nearly one million people. To summarize this portion of the dissertation, a highly condensed version of the social and landscape change narrative presented in Chapters 4, 5, and 6 follows.

To date the oldest archaeological site found in Santa Catarina is located along the Paraná River in Itapiranga, the state's southwestern-most municipality. Evidence at the Itapiranga site suggests human presence circa 8,000 years BP. The south Atlantic coastal lowlands were settled by preceramic fisher-gatherer-hunter populations at least 5,000 years BP. These early groups were followed by ceramic and horticultural societies cultivating dietary staples such as manioc, maize, squash, and beans. Anthropogenic disturbance regimes began to shift over the sixteenth century as indigenous populations increasingly came into contact with members of various European-based expeditions. Violent confrontations, displacement, enslavement, and the spread of Old World diseases decimated Amerindian populations in many coastal areas by the early to mid-seventeenth century. During the latter half of the seventeenth century, slave-owning colonists from the Vila of São Vincente helped to expand the Portuguese territory by establishing small settlements along the Santa Catarina coast at sites which eventually became the present-day cities of São Francisco do Sul, Florianópolis (then known as Nossa Senhora do Desterro or simply Desterro), and Laguna. These early colonial settlements, relying on extractive activities and subsistence agriculture, were intended to serve primarily as trading posts and bases supporting slave-hunting and mineral-prospecting operations.

By the late-Colonial Era (1740–1822), Desterro and its neighboring colonial communities had grown substantially increasing demands for timber, fuelwood, and food. Accelerated ecosystem disturbance occurred as a result of rapid deforestation associated with: Portuguese military fortification and the arrival of military-administrative personnel; agricultural expansion of cropland, pasture, and fallows by Azorean colonists invited by the Portuguese government to occupy the territory and to produce agricultural goods for the military-administrative households; and a booming whaling industry. During this era, many Africans and Afro-Brazilians were exploited as slave laborers in domestic settings, agricultural activities, in the whaling industry, and in a variety of cottage-industries including the production of sugar and manioc flour. An emerging merchant class exported the surplus of some products, particularly manioc flour, from Desterro to large population centers on the continent's Atlantic coast.

During the post-colonial Imperial Period (1822–1889) and First Republic (1889–1930), smallholders maintained economic activities in the coastal zone while new waves of European colonists, largely Italian and German, began to expand the agricultural frontier westward, gaining landholdings and establishing new manufacturing industries (e.g., Waibel 1950). In 1894, when the official population of Santa Catarina had surpassed 280,000 inhabitants, Desterro was declared the state's capital city and renamed Florianópolis in honor of Marshall Floriano Vieira Peixoto who was the second president of the First Republic of Brazil from 1891 to 1894. Educational institutions were established in the state's largest cities, and roads and railways were expanded throughout the region. Early on in the twentieth century, Florianópolis gained its first transportation, electric energy, water supply, and sanitation systems, and in 1926 the city entered a new era of regional economic integration with the inauguration of the first bridge, Ponte Hercílio Luz, linking Santa Catarina Island to the mainland transportation network. The agrarian economy of Santa Catarina Island was already in decline before the middle of the twentieth century. After 1950, as the urban population grew and concentrated, government planning agencies emerged and formulated master plans using a top-down approach. By the late twentieth century, many formerly agricultural areas of the island had reverted to intermediate and advanced stages of forest cover. Geographer Mariléa Caruso (1990) began to document this process in the late 1970s and early 1980s.

By the 1980s, continued economic restructuring towards an increasingly urban-industrial society, evolving environmental policies, and rising public concern over ecological issues helped to stabilize much of the forest cover that had already begun regenerating after widespread agricultural abandonment in many of the longer-settled coastal areas of the Florianópolis city-region. Many of the current Brazilian leaders, institutions, laws, policies, and programs serving to protect the environment and promote human welfare, social justice, and social equity emerged from social mobilizations and collective actions that were initiated in the 1970s and gained strength during the redemocratization period following the end of military rule in 1985. These social mobilizations and collective actions were instrumental in the process of drafting Brazil's 1988 Federal Constitution. From the national to local levels of organization, social mobilizations and collective actions continue to actively shape legal and institutional reforms with tangible consequences for civil rights, livelihoods, land use, and environmental quality. Urban planning policy underwent profound reform in Brazil after 1985, leading to the enactment of the City Statute (Brazilian Federal Law No. 10257/01) in 2001 regulating and extending Articles 182 and 183 in Brazil's 1988 Federal Constitution by recognizing the "right to the city" and elaborating on the principle of the "social function of property and of the city" (Fernandes 2007). Now that this legislative-institutional framework is in place, stakeholders are convening in cities across Brazil to develop participatory municipal master plans (*Planos Diretores Participativos*). Florianópolis is one of these cities.

7.3 Forest Transition and the Concept of Land Quality

As an empirical exploration of forest transition theory (FTT), the results of this study suggest that the Florianópolis city-region has indeed experienced a forest turnaround from a period of net deforestation caused by extractive and agricultural activities to a period of net forest recovery. Forest recovery has resulted from two distinct processes. First, since the 1960s, exotic tree monocultures (primarily *Pinus spp.* and *Eucalyptus spp.*) have been planted. Although experimental planted forests initially emerged in the coastal lowlands, many of these exotic tree plantations have since been established in inland municipalities. This first type of 'active' forest recovery has done little to conserve biological diversity, but it has provided forest products and other environmental services such as carbon sequestration, soil conservation, and watershed management. Second, 'passive' or 'spontaneous' forest-recovery dynamics in coastal municipalities have resulted in the regeneration of secondary forests composed of diverse successional communities including the expansion of advanced secondary dense broadleaf forests on hillslopes that in some locations surround biologically-diverse old-growth remnants. In the municipality of Florianópolis and in other coastal municipalities in the metropolitan region (e.g., Garopaba), much of this ‘spontaneous regeneration’ has occurred since the 1970s and 1980s during a period characterized by further decline in agricultural land use, agricultural abandonment, real estate speculation, and the establishment of a variety of conservation units and other types of land-use restrictions which created the present-day network of protected areas and thus a system of ecological corridors. The environmental services and amenities associated with this protected-area network have contributed to the ongoing viability of local tourism development as well as to rising real estate prices in certain well-located neighborhoods. Middle- and upper-income housing construction has accelerated since the 1990s, converting parcels (formerly serving as cropland, pasture, and fallows) to residential or commercial subdivisions in suburban and peri-urban landscapes. In short, as the economic importance of agriculture diminished in and around urbanizing areas, forests regenerated on the hillslopes; land parcels in the coastal plains, which had formerly been valued for agricultural use, gained exchange value and landscape consumption value in the Brazilian real estate market.

As explained in Chapter 2, forest transitions are uncertain and reversible, i.e., analysts should consider nonlinearity, spatial variability, and spatial and temporal contingencies in studies of forest change. Lulls in deforestation activity and periods of active reforestation (or afforestation) may alternate with periods of accelerated forest clearance. I strongly agree with the argument made by Bray and Klepeis (2005: 197) that, “There is cause for concern…when a simplistic, linear narrative dominates understanding of forest change dynamics at the expense of understanding the real complexity and opportunities for conservation that exist.” In the case of the Florianópolis city-region, intraregional variations in soil quality, topography, proximity to the coast, economic activities, urban infrastructure, human settlement of different socioeconomic groups, and degree of enforcement of environmental regulations are among the many factors affecting the presence/absence, extent, composition, pattern, and rate of forest recovery. Continued urban expansion and/or increased internal and external demands for forest products could result in future net forest loss.

Theorization of changing notions of *land quality* in the context of rapid urbanization and metropolitanization deserves more attention from land-change scientists. Land quality varies over space, over time, and depending on the socioeconomic context. That is, spatiotemporal variation in land quality should be conceptualized not only in relation to the physical changes in space and over time that typically influence land-use adjustments for agricultural purposes (e.g., change in soil fertility, access to water sources, access to transportation infrastructure, environmental contamination), but also in relation to shifts in human population sizes and distributions, social values, economic opportunities, business interests, government priorities, and the investment behaviors of land speculators and developers, to name a few possible factors. As the case of coastal Santa Catarina State demonstrates, many formerly rural parcels of 'marginal' agricultural land have quickly become 'prime' real estate in the tourism and housing sectors. Furthermore, in the contexts of environmental management, conservation, and quality-of-life policies in Brazil's rapidly urbanizing coastal zone, Atlantic Forest ecosystems in metropolitan Florianópolis have become highly valued for their ecosystem services. In contrast, landowners in inland subregions of Santa Catarina State continue to exploit their comparative advantages in land quality for agricultural and timber production.

7.4 Uneven Metropolitan Development and the Uneven Valuation of Ecosystems

In recent years, many urban dwellers—rich, middle class, and poor—have been moving to intermediate-sized cities in southern and southeastern Brazil seeking affordable housing, life opportunities, and environmental quality. The interacting human activities associated with growth in these new metropolises have set in motion dynamics that create social and environmental problems as well as a multitude of possibilities for what Michael Watts and Richard Peet (1996: 261) have called "a different kind of reasoning, to guide a different social order of practice on nature." In this study of the Florianópolis city-region, I argue that urban dualization and peripheralization, in the context of globalization, act as processes of social exclusion resulting in differential access to life opportunities and environmental services as well as differential exposure to environmental hazards. The results of this case lend *partial* support to the findings of UN-Habitat (2003) by indicating that the expansion of low-income informal settlements (so-called slums or *favelas*) is in fact to a large extent a consequence of rapid urbanization. However, whereas *The Challenge of Slums* report (UN-Habitat 2003) states that rapid urbanization in the developing world is largely a result of rural-urban migration, this dissertation shows that, in the case of the metropolitan Florianópolis, the bulk of rural-urban migration flows to the coastal conurbation had already occurred by the close of the twentieth century and that *urban-urban migration* has been a major driver of rapid urbanization and urban dualization in recent years (Chapters 5 and 6). That is, metropolitan Florianópolis, in its regional, national, and global contexts, fits Mike Davis'

(2006) analysis of the global trajectory of informal settlement expansion over the past half century.

Considering the linked themes of legislative and policy reform, multilevel governance, and land-use planning, the findings presented in Chapters 5 and 6 suggest that not only the failures, but also the *successes* of democratic governance have been influenced by a variety of social networks, social mobilizations, and collective actions. Therefore, social learning has been taking place and noteworthy advances have indeed been made toward the goal of just sustainability. This finding leads me to question the generalization made by UN-Habitat (2003) that attributes the urbanization of poverty to failures of governance and to inadequate urban planning and urban management policies. Analysts seeking to identify the causal factors and causal factor interactions contributing to increased urban poverty, sociospatial inequality, and environmental injustices in the 'developing world' should be wary of limiting or oversimplifying their investigations by only considering rural exodus, local failures of governance, and incompetent urban planning/management. Political-economic factors such as macroeconomic neoliberal policies imposing structural reforms (e.g., reduction or elimination of social spending and widespread privatization) have transformed livelihoods and landscapes, often with devastating outcomes for vulnerable low-income communities struggling to survive and improve their living conditions. As O'Brien and Leichenko (2003: 95) have pointed out "growing evidence suggests that globalization is not promoting convergence in incomes between rich and poor countries, but, instead, is increasing global income inequality." Moreover, as impoverished urban communities have expanded in Brazil since the 1980s, middle- and upper-income communities have responded to risks (both real and imagined) with self-segregating behaviors and actions intended to minimize their exposure to environmental hazards and urban violence. That is, as elite entrepreneurs and middle-class migrants claim emergent territories and economic opportunities in the so-called new metropolises of Brazil, they tend to reproduce the exclusionary patterns of land use that are now typical of the older metropolises while maintaining articulations to the country's and the world's major centers of informational, financial, and political power.

I conclude that in the communities of Greater Florianópolis that are characterized by high proportions of successful entrepreneurs, highly-educated professionals, and land owners (see Chapter 6), these social actors possess financial resources, social capital, and external connections that enhance their power and effectiveness as agents in political struggles for 'urban livability' and 'sustainability.' Competent civil society organizations (CSOs) dedicated to promoting social and environmental reforms in the public interest together with their allies in government and business have made significant strides. However, at present it appears that the net effect of coalitions for collective action favors individual self-interest and the more powerful interest groups over broader public interests. In other words, the viability of projects to create and maintain a high quality of life on Santa Catarina Island and to protect investments in real estate and business enterprises relies on the capacity of the more advantaged social actors to control and limit access to environmental amenities and to shift negative social and environmental externalities to poorer communities in neighboring municipalities on the mainland. This raises questions about the extent to which social movements dominated by upper- and middle-class quality-of-life and security concerns and the collective actions that they generate will continue to marginalize the livelihood, infrastructure, and service needs of poorer communities and thus contribute to further urban dualization and economic polarization.

Another finding of this study is that while forests have regenerated on hilltops and hillslopes, real estate development has concentrated in the coastal plains. This is true in coastal areas of the city-region's mainland as well as on Santa Catarina Island. This finding is consistent with Mather and Needle's (1998) conception of the forest transition. This pattern has also been observed in Puerto Rico (Parés-Ramos, Gould, and Aide 2008). This dissertation confirms findings reported by other authors that *restinga* and coastal plain dense broadleaf forest formations are the two ecosystems most threatened by current development patterns on Santa Catarina Island (e.g., Santos 2001; Queiroz *et al.* 2002: 409). More work is needed to quantify and monitor these changes. The results of this study lead me to conclude that uneven metropolitan development, uneven valuation of ecosystems, uneven ecosystem protection, and uneven environmental quality are part and parcel of the same set of social relations and social inequalities that become visible on the landscape as the physical outcomes of social contestations over the control and use of resources.

The substantial beneficial outcomes of accelerated urban growth in metropolitan Florianópolis should be acknowledged. 'Floripa' might be classified as a 'globalizing city-region' (e.g., Bunnell, Barter, and Morshidi 2002), and in the global economy it is well-positioned not only as a tourism pole but also as an 'information-age metropolis' (see Audirac 2003). It is part of a larger polycentric urban region along the Santa Catarina coast which includes the cities of Joinville, Blumenau, Criciúma, Itajaí, Tubarão, Brusque, and Balneário Camboriú. Tourism development, real estate development, and population growth have created jobs in the service and construction sectors as well as opportunities for a wide range of entrepreneurs. In addition, public and private sector actors have cultivated information technology industries in the region. The city is home to a highly-educated and technology-savvy population emanating from local universities established in the 1960s and 1970s, from the recent migration flows from other cities (i.e., other cities inside *and* outside Brazil), and from a newer wave of graduates from regional private institutions of higher learning emerging since the 1990s.

7.5 Participatory Democracy in Urban and Regional Planning

Social movements organized to promote environmental quality, social justice, and social equity by participating in the democratic formulation and reform of urban policies and land-use regulations may not be effective enough to remove major obstructions on the pathways to just sustainability. In many Brazilian cities, socioeconomic polarization and social exclusion are deeply rooted in entrenched structures of inequality and asymmetrical power relations. Coalitions of social actors in positions of political and economic power act to protect and further their interests. Therefore, one central question to keep in mind is: Will the poorest and most vulnerable populations already living in, or soon to arrive in, metropolitan Florianópolis be adequately represented in community-driven, consensus-building, democratic policy formulation, land-use planning, and budgeting processes? This remains to be seen. In a recent review of the Brazilian third sector literature and empirical analysis of civil society as part of a “dense policy network” in Santa Catarina, Candler (2000: 55) concluded that “groups of technological elites have links throughout *catarinense* society: with government, business, and other professional groups, as well as with a range of NGOs and social movements" and that "professional groups have been able to participate freely, autonomously, and often in the broader public interest." As shown in Chapter 6, CSOs in Florianópolis have benefited from legitimizing legislative and policy victories at the national level and have successfully mobilized diverse social organizations, social movements, and individuals including neighborhood associations, NGOs, a local radio association, youth groups, a surfers' association, issue-specific social and environmental movements, researchers, university professors, and other professionals. Since the late 1980s, coalitions of these social actors have organized (and reorganized) in the public-interest to demand, from the institutions and officials of local government administrations, meaningful compliance with environmental regulations and the participatory planning approach mandated by Brazil's City Statute.[201]

7.6 Metropolitan Florianópolis in the Coming Decades: Possible Future Scenarios

In what direction might metropolitan Florianópolis be headed over the twenty-first century? What reasons are there to be optimistic, guardedly optimistic, or pessimistic about its future? How might one contribute to a shift toward just sustainability? Among the panoply of social actors participating in the complex dynamics that are transforming metropolitan Florianópolis into a globalizing city-region many if not most are aware of the past experiences of 'cosmopolitan' city-regions like Rio de Janeiro, São Paulo, and Buenos Aires. As a result of social learning and local innovation will these actors be able to: avoid repeating the past failures of large cities; adapt approaches that have been successful elsewhere to their local conditions, needs, and preferences; and create and

[201] A book by Ilse Scherer-Warren (1996) presents detailed research on voluntary organizations in Florianópolis.

experiment with completely new approaches that others around the world might learn from? What kinds of support will they need from the federal government and from supranational organizations?

Reorientation towards just sustainability may be motivated by necessity, moral conviction, pragmatism, compassion for those less fortunate, or the recognition that eventually there are limits to self-segregation. The massive errors as well as the great triumphs of humanity's past experience around the globe might compel leaders and ordinary citizens to be more committed to the related tasks of defending true democratic governance and empowering and protecting the weakest, most vulnerable, and historically most oppressed sectors of society rather than excluding, ignoring, dismissing, marginalizing, or putting their needs and aspirations on hold. There is certainly evidence of this commitment in Latin America's social movements and political trends over the past decade[202] and in the recent swell of grassroots support for Democratic presidential candidate Senator Barack Obama in the United States in the wake of the disastrous Republican Bush Administration (2001–present).

In the greater global scheme of urban development, the Florianópolis city-region could do much worse than to maintain the *status quo.* Over the past few decades, the human activities of *ecologies of actors* (see Evans 2002) have resulted in a number of socially, economically, and ecologically beneficial outcomes. But, it would be unwise and short-sighted to ignore the environmental degradation caused by human agency (e.g., habitat alterations, polluted water bodies, roadway congestion, rising levels of consumption and solid waste production) or the various distributional inequalities of

[202] For example, in Brazil, former metallurgist and labor union leader, President Luis Inácio Lula da Silva of the Workers' Party (*Partido dos Trabalhadores*–PT) was elected in 2002 and reelected in 2006.

benefits and hazards (e.g., inequalities of health, housing, employment, income, education, information, infrastructure, public services, ecological services, security from violence). Perhaps a reasonable forecast of the business-as-usual scenario would be a pathway similar to, but not as extreme as that which has already occurred in the city of Rio de Janeiro, i.e., a beautiful coastal global city that is culturally vibrant and economically dynamic, but that has become extremely unequal and violent. The perception of the strong probability of this type of scenario was on the minds of many of the people I spoke to in Florianópolis. Thus trajectories approaching, reaching or surpassing the levels of inequality, violence, and environmental degradation currently found in Rio de Janeiro might be classified as a range of pessimistic scenarios for Florianópolis. Of course, things could get much worse for the island-city of Florianópolis if Santa Catarina's coastal zone were to suffer a catastrophic weather event with little to no warning or to experience more frequent and more intense extreme weather events, scenarios that cannot be easily dismissed in light of the predicted effects of climate change (e.g., sea-level rise, storm surges, and flooding). The consequences of such events would be particularly devastating for low-income people living on steep slopes or poorly-drained locations.

In an optimistic and idealistic though not impossible scenario, networked social actors at *all* spatial and organizational scales in Brazilian civil society, government, and the private sector would need to unify and cooperate to: maintain the hard-won systems of democratic governance; improve legal-institutional frameworks, policies, programs, and practices; exchange information through publicly accessible networks; and promote increased levels of social inclusivity. To choose multilevel, just-sustainability pathways, these ecologies of actors extending across Brazil and across the world would need to purposefully redirect themselves *away* from the rampant yet terribly flawed logic "of creating green and gated oases of permanent affluence on an otherwise stricken planet" (Davis 2008).[203] Indeed, ecologies of actors form the social basis for "shifting, reshaping and enlarging freedoms" (Polanyi 2001: 263).

7.7 Policy Implications of Research Findings

Social relations and freedoms in society are affected by bodies of knowledge, value systems, discourses, and institutions. They are shaped by political, economic, cultural, and ecological processes. Depending on how political, economic, cultural, and ecological systems are imagined, constituted, and articulated, they can function either to facilitate the self-interested agendas of the wealthy and powerful few or they can open spaces for the many to engage in dialogue and collective action to effectively counter environmental degradation and social injustice. Spanning the public, private, and third sectors, effective policies and programs have been designed and implemented throughout Brazil to reduce poverty and sociospatial inequalities. However, in view of the persistence of worrisome trends in and around many of Brazil's largest cities, much more can and should be done. To continue to address these problems, concerned social actors need to improve strategies and to expand the existing approaches that have already proven their effectiveness at improving life conditions for all without compromising environmental quality.

Recognizing that there are obvious intraregional socioeconomic disparities in metropolitan Florianópolis requiring attention, the reasons to be hopeful about the city-

[203] As Satterthwaite (1997: 216) put it, "One reason why the environmental quality of wealthy cities can improve is the capacity of the consumers and producers they concentrate to transfer some of their environmental costs to other people, other regions or into the future."

region's future should not be overlooked or denied. Shaped by the region's outstanding terrestrial and marine endowments, the environmental imaginaries that have permeated the region's human consciousness in the recent past tilt strongly toward Edenic narratives of an urban-ecological paradise (i.e., a 'green city' and a 'livable city'). Furthermore, these more recent narratives are linked to environmental imaginaries among peoples who occupied or visited this site during earlier periods in human history. The key questions then are: (1) To what extent are current environmental imaginaries merely unrealistic Utopian fantasies fueling the rapid rise of a consumption-oriented society and landscape?; (2) To what extent do/may they serve as sources of human meaning and inspiration for affecting actual social and environmental change with outcomes that might be reasonably characterized as approaching just sustainability? To be sure, the human population of Florianópolis faces serious social and environmental problems now and in the near term, but they may not be as dire as those found in many other Brazilian city-regions (arguably, precisely *because* they are found in *other* city-regions). Still, many lower-income and even some middle-income communities—within a regional population that is now highly concentrated in the Florianópolis conurbation—lack adequate infrastructure (e.g., roadways, safe bicycle routes, pedestrian walkways, well-engineered drainage systems, piped water, sanitation, and sewage lines), public services (e.g., public schools and post offices), and private services (e.g., banks).

Based on the principles of freedom in a complex society (see Polanyi 2001: 257–268), self-determination, social justice, the social function of land, and ecological integrity, below I outline four main insights and policy implications that I consider critical to pathways to just sustainability in the Florianópolis city-region. Many of these may be applicable to other city-regions around the world.

1. *Equitable access and participatory democracy.* Public-, private-, and third-sector leadership and broad-based citizen support for just sustainability might be achieved by strengthening democratic institutions of participatory governance; these institutions are needed to work toward more equitable access to ecosystem services in metropolitan regions, including access to environmental amenities. However, socioeconomic polarization and social exclusion are often deeply rooted in entrenched structures of inequality and asymmetrical power relations. Coalitions of social actors in positions of political and economic power act to protect and further their interests, thus reducing the likelihood that the poorest and most vulnerable populations will be adequately represented in democratic policy formulation, land-use planning, and budgeting processes.

2. *Equitable educational opportunities, mobilizing existing expertise, job creation, and the role of information and communication technologies:* Fifteen years after completing my undergraduate thesis, I am convinced more than ever that equitable educational opportunities are essential to metropolitan sustainability in New Jersey, Santa Catarina, and elsewhere. Public-, private-, and third-sector parties should collaborate to improve and expand educational and training opportunities for poor young people in the Florianópolis city-region; these opportunities should be well articulated with the region's expanding economic sectors (e.g., by providing paid internships and entry-level jobs with

opportunities for advancement). In addition to improving the quality of education and training for disadvantaged populations, it would be important to create more formal jobs in the growing sectors of the regional economy. Government, the business community, and CSOs should further develop environmentally- and socially-conscious strategies for drawing upon the accumulation of social capital in Florianópolis (including the recent influx of highly-educated and skilled migrants), domestic private capital, and foreign investment. Rapidly advancing information and communication technologies (ICT) can play an important role if these technologies become even more widely available and are harnessed in ways that serve as powerful and effective tools for promoting social change and achieving just sustainability by: encouraging people to exercise freedom (e.g., the right to self-determination, political participation in social movements, freedom of expression); increasing individual and collective self-awareness; and collaborating to feed, house, educate, employ, and provide health care to the poor.

3. *Conservation and ecological restoration in city-regions*. As Crane and Kinzig (2005) point out, an "important consequence of increased urbanization is that most of the world's people will have much of their direct contact with nature in an urban rather than rural setting." A city-region approach might facilitate integrated urban planning and ecosystem management in metropolitan Florianópolis and elsewhere. Many protected areas established in the Florianópolis city-region continue to be poorly funded and understaffed. The institutions and processes evolving to produce participatory municipal master plans should develop an effective mechanism for addressing budgetary and staffing issues for specific protected areas. To help 'green the city' (e.g., Tjallingii 2000)

and to increase residents' environmental awareness and understanding of local ecological dynamics, leaders might encourage sustainable landscaping practices in urbanized and urbanizing areas. One possibility is the creation of a public forum for exchanging knowledge about conservation and ecological restoration practices such as how to maximize ecological connectivity with 'actively' planted or 'spontaneously' regenerated native plant assemblages. Programs should be flexible in order to be most effective in different communities. For example, residents in wealthier suburban and peri-urban communities might be persuaded to build fewer ecological barriers (e.g., walls and impermeable surfaces). Poorer communities could be provided with seeds and seedlings at low to no cost to green their home gardens, school yards, and neighborhood parks. Past and current programs and activities in Florianópolis indicate that these sorts of strategies would be viable.

4. *Macroeconomic policies.* Last, but certainly not least, macroeconomic policies have distributional consequences and, therefore, can act as either enormous obstacles to or powerful catalysts of just sustainability. Interregional disparities in income, education, and other human development indicators in Brazil and other large countries have been affected by biased macroeconomic and social policies at the international and national levels that have directed private and public investments toward some regions while largely neglecting others. For instance, in a recent study of the spatial dynamics of labor markets in Brazil, Chomitz *et al.* (2005) found "an accelerator effect, where more-educated regions [of Brazil] experience more rapid wage growth" which "suggests that wages will continue to diverge between the more-educated south and the less-educated

north.” In an examination of the effects of structural reform on regional development in India, Chakravorty (2000) hypothesized that national governments favor advanced industrial regions, existing metropolitan regions, and coastal regions and found that: lagging regions such as Uttar Pradesh and Bihar continue to be disadvantaged by the lack of private investment and second-rate government investment whereas advanced or leading regions have been favored by new private and public investments albeit with transformations in the configurations of leading clusters; metropolitan regions continue to receive more investment than nonmetropolitan regions; and coastal regions are favored by the domestic private sector, foreign investors, and the central government over inland regions.[204] Similar spatial patterns of investment are evident in Santa Catarina where coastal metropolitan regions have been advantaged by recent private and public investments.

7.8 Unresolved Issues and Directions for Further Research

7.8.1 Unresolved Theoretical Considerations

This dissertation opens for discussion, but does not completely address several of the intersecting theoretical perspectives presented in Chapter 2. For example, much more remains to be explored to relate this empirical case study to the literatures on sociospatial inequality, collective action, urban growth management, risk, reflexivity, postindustrial society, and globalization. In addition, further work is needed to develop an understanding of the sustainability of the Florianópolis city-region as a social-ecological

[204] Chakravorty (2000: 389, 391) observed, “It is tempting to look at Maharashtra’s relative decline and declare that advanced regions have fallen out of favor; but in reality, Maharasthtra continues to be in favor, whereas overbuilt, congested, expensive Greater Bombay district is relatively out of favor” and “In Mumbai, Delhi, and Chennai, there is clear evidence that the suburban districts have become more important investment destinations than the core urban districts.”

system through investigation of its resource system, resource units, governance systems, users, interactions, and outcomes (Ostrom 2007, 2008).

7.8.2 Metropolitan Land-Change Science

This study of metropolitan Florianópolis has led me to explore metropolitan land-use transitions through a land-change science framework that might be referred to as 'metropolitan land-change science' (MLCS). Three overarching questions that might guide future MLCS research come to mind. First, to what extent can the social and ecological consequences of metropolitan expansion be projected (by analyzing past and current trends) or predicted (by taking uncertainty and contingency into account) over the short, medium, and long term? Second, under different scenarios, how might such consequences be beneficial or harmful, intended or unintended, reversible or irreversible? Third, how should urban, suburban, and peri-urban forested ecosystems and other greenspaces be planned and managed to contribute to the equitable well-being of present and future metropolitan populations? Toward comparative empirical analyses of metropolitan land-use dynamics, future investigations should compare the Florianópolis city-region to other emergent metropolitan regions in Brazil's Atlantic Forest ecoregion and elsewhere. Integrated analysis of multiple case studies of land change in metropolitan regions represents a promising line of research within the broader effort to develop of an overarching land-change theory (Lambin, Geist, and Rindfuss 2006: 7–8; see Chapter 2). In addition to contributing to the refinement of FTT, MLCS could, for example, serve as a useful research framework for the study of *novel* or *emerging ecosystems* (see Lugo and Helmer 2004; Hobbs *et al.* 2006).[205]

7.8.3 Santa Catarina State and the Florianópolis City-Region

There are many opportunities for the study of metropolitan land-use transitions in southern Brazil. Future work might explore the variability of metropolitan land-use dynamics within Santa Catarina State by comparing its major city-regions. This research agenda might include the construction of a geographic information system (GIS) that integrates remotely-sensed observations from satellite images acquired on dates since 1980 with socioeconomic and biogeophysical data. The preliminary results of the most recent Brazilian agricultural census (*Censo Agropecuário 2006*) were recently released (IBGE 2008). These preliminary data indicate that agricultural expansion and land consolidation occurred in Santa Catarina State in the decade from the mid-1990s to 2006; total areas of cropland, pasture, and forest increased while the number of agricultural establishments declined. The municipal-level data are not yet available. When the complete and final version of the 2006 Brazilian agricultural census becomes publicly available, it will be possible to revisit the land-use change analyses for Santa Catarina State and the Florianópolis metropolitan region presented in Chapter 5 and to explore other land-change questions such as those related to changes in the extents of specific crops (e.g., tobacco, soybean, maize, sugarcane) and in the extents of natural and planted forests in Santa Catarina overall and in specific *municípios*. Future research might also analyze Santa Catarina's plantation forestry and forest products industry in depth. Lastly,

[205] In the words of Hobbs *et al.* (2006: 1), novel ecosystems are "those types of ecosystems containing new combinations of species that arise through human action, environmental change, and the impacts of the deliberate and inadvertent introduction of species from other regions."

in future study of the Florianópolis city-region, it would be valuable to monitor and analyze protected-area planning and management, the tourism and real estate sectors, processes and outcomes of the participatory municipal master plans, sociospatial inequalities, urban dualization, and social mobilizations.

APPENDIX A: Resumo (Abstract in Portuguese)

Recuperação Florestal e Sustentabilidade Justa na Região Metropolitana de Florianópolis

SANDRA REGINA BAPTISTA

Orientador:

Professor Dr. Thomas K. Rudel

Esta dissertação examina interações entre a sociedade e seu meio ambiente na região metropolitana de Florianópolis, no Estado de Santa Catarina, Brasil, observadas pela perspectiva de sustentabilidade justa. Construo uma aprofundada narrativa histórica de transformações sociais e na paisagem, e ofereço uma análise das diversas origens dessa metrópole em expansão. Esta narrativa histórica proporciona um contexto para melhor entendimento de mudanças demográficas, padrões no uso de terra na região metropolitana, dinâmicas de transição florestal, desigualdades socioespaciais, reformas legais e institucionais, e práticas democráticas contemporâneas. Utilizando uma abordagem metodológica que integra múltiplas escalas espaciais, temporais e organizacionais, combinei pesquisa documental, fotos aéreas, entrevistas, observação participativa, e visitas a localidades. Analiso dados socioecológicos em escalas espaciais e organizacionais hierárquicas desde o nível de bairros a esferas nacionais e globais. Os resultados deste trabalho sugerem que a região municipal de Florianópolis passou por uma transição florestal de um período de desmatamento causado por atividades extrativas e agrícolas, para um período de expansão florestal. Esta expansão resultou tanto da

plantação florestal com espécies exóticas quanto da regeneração 'espontânea' de matas secundárias. A partir da década de 1960, monoculturas de árvores exóticas foram plantadas nessa região. Em grande parte, a regeneração florestal ocorreu a partir da década de 1980 durante um período caracterizado pelo decréscimo de áreas agrícolas, pela especulação imobiliária, e pelo estabelecimento de unidades de conservação e outros tipos de restrições ao uso de terra. Os serviços ambientais e as amenidades associadas à rede de áreas protegidas têm contribuido para a viabilidade prolongada do desenvolvimento turístico local, bem como para a valorização imobiliária de certas áreas em bairros bem situados. A construção de casas destinadas às classes média e alta tem-se acelerado a partir da década de 1990, pela conversão de terras localizadas em áreas suburbanas e peri-urbanas em loteamentos residenciais e comerciais. Na Grande Florianópolis, têm surgido favelas que se expandiram por terras 'marginais', 'periféricas', e 'precárias', em muitos casos em locais definidos como áreas legalmente protegidas e em lugares sem saneamento adequado. Esse processo de dualização urbana tem resultado em injustiças socioambientais, reforçando e exacerbando o accesso diferencial às oportunidades de vida e aos serviços ambientais, bem como a exposição desigual aos riscos ambientais. Em conclusão, apresento elementos para uma discussão sobre a qualidade da terra, desenvolvimento desigual, valorização desigual de ecosistemas, democracia participativa, possíveis cenários futuros, e ainda referências para políticas públicas, assuntos pendentes de solução, e sugestões para pesquisas futuras.

APPENDIX B: Semi-Structured Interview Questionnaire

The following open-ended questions formed the core of the semi-structured interviews. These interviews lasted from half an hour to two hours. I asked the questions in Portuguese. English translations are provided below.

1. *Há quanto tempo você mora e/ou trabalha em Florianópolis?*

   How long have you been living and/or working in Florianópolis?

2. *a. Quando aplicável: Por que você decidiu se mudar para Florianópolis?*

   b. Quando aplicável: Por que você decidiu trabalhar em Florianópolis?

   a. When applicable: Why did you decide to move to Florianópolis?

   b. When applicable: Why did you decide to work in Florianópolis?

3. *a. Através de suas observações, quais foram as maiores transformações que ocorreram na paisagem, economia, sociedade, e cultural durante este período?*

   b. Por que essas transformações ocorreram?

   a. During this period, what major transformations in the landscape, economy, society and culture have you observed?

   b. Why did these transformations occur?

4. *Na sua opinião, qual será o maior desafio para o desenvolvimento local nos próximos anos?*

What do you think will be the most important challenge for local development in the coming years?

5. *a. Na sua opinião, existem tipos de lugares em Florianópolis que merecem atenção especial no processo de desenvolvimento local?*

   b. Se sim, você pode dar alguns exemplos específicos?

   c. Quais são as características que tornam estes lugares importantes?

   a. Are there types of places in Florianópolis that you view as requiring special attention in the process of local development?

   b. If so, can you provide a few specific examples?

   c. What are the characteristics that make these places important?

6. *a. Qual é a sua visão para o futuro de Florianópolis?*

   b. Quais são os seus anseios para o futuro de Florianópolis?

   a. What future do you envision for Florianópolis?

   b. What are your hopes for the future of Florianópolis?

7. *a. Como você descreveria a identidade de Florianópolis no contexto mais amplo do Brasil contemporâneo?*

   b. Esta identidade é diferente em relação à identidade de Florianópolis no passado?

   c. Se sim, como?

   d. Você percebe alguma tendência atual na mudança da identidade de Florianópolis?

a. How do would you describe the identity of Florianópolis in the wider context of contemporary Brazil?

b. Is this different from its past identity?

c. If so, how?

d. Do you perceive any current trends that are changing of the identity of Florianópolis?

8. *Turistas são atraído por que tipo de paisagem em Florianópolis?*

   What kinds of landscapes attract tourists to Florianópolis?

9. *Residentes recém-chegados são atraídos por que tipo de paisagem em Florianópolis?*

   What kinds of landscapes attract newly-arrived residents to Florianópolis?

10. *Turistas estão procurando que tipos de experiências em Florianópolis?*

    What kinds of experiences are tourists seeking in Florianópolis?

11. *Residentes recém-chegados estão procurando que tipos de vantagens e amenidades em Florianópolis?*

    What kinds of advantages and amenities are newly-arrived residents seeking in Florianópolis?

12. *Qual infra-estrutura tem sido fornecida em anos recentes para atender ao crescimento populacional, o crescimento urbano, e a expansão do setor de turismo na região de Florianópolis?*
    What infrastructure has been provided in recent years to accommodate population growth, urban growth, and expansion of the tourism sector in the Florianópolis region?

13. *Qual infra-estrutura está faltando para atender ao crescimento populacional, o crescimento urbano, e a expansão do setor de turismo na região de Florianópolis?*
    What infrastructure is lacking to accommodate population growth, urban growth, and expansion of the tourism sector in the Florianópolis region?

14. *Como foram os residentes antigos e as communidades nativas de Florianópolis afetados pela expansão do setor de turismo e pelas populações recém-chegadas?*
    How have the expansion of the tourism sector and recent in-migrations affected long-time residents and native-born communities of Florianópolis?

APPENDIX C: Abbreviations and Acronyms

AEH	Área dos Elementos Hídricos (Area of Hydrological Elements)
AER	Área de Exploração Rural (Area for Rural Exploitation)
AMONC	Associação de Moradores do Novo Campeche (Residents Association of New Campeche)
APL	Área de Preservação com Uso Limitado (Preservation Area with Limited Use)
APP	Área de Preservação Permanente (Permanent Preservation Area)
APRPPNSC	Associação de Proprietários de Reservas Particulares do Patrimônio Natural de Santa Catarina (Owners' Association of Private Natural Heritage Reserves of Santa Catarina)
a.s.l.	above sea level
AVL	Área Verde de Lazer (Green Area for Leisure and Recreation)
BP	years before the present
BRDE	Banco Regional de Desenvolvimento do Extremo Sul (Regional Development Bank of the Extreme South)
CASAN	Companhia Catarinense de Águas e Saneamento (Santa Catarina State Water Agency)
CBD	Convention on Biological Diversity
CECCA	Centro de Estudos Cultural e Cidadania (Center of Studies Culture and Citizenship)
CFB	Código Florestal Brasileiro (Brazilian Federal Forest Code)
CMV	Câmara Municipal de Vereadores (City Council)

CNPq	Conselho Nacional de Pesquisas (Brazilian National Research Council)
CNRPPN	Confederação Nacional de Reservas Particulares do Patrimônio Natural (Brazilian National Confederation of Private Natural Heritage Reserves)
CNSA	Cadastro Nacional de Sítios Arquelógicos (Brazilian National Register of Archaeological Sites)
CONAMA	Conselho Nacional do Meio Ambiente (Brazilian National Council on the Environment)
CSO	Civil Society Organization
EMBRAPA	Empresa Brasileira de Pesquisa Agropecuária (Brazilian Agricultural Research Corporation)
EPAGRI	Empresa de Pesquisa Agropecuária e Extensão Rural de Santa Catarina (Agricultural Research and Rural Extension Enterprise of Santa Catarina)
FAO	Food and Agricultural Organization of the United Nations
FATMA	Fundação de Amparo à Tecnologia e ao Meio Ambiente; Fundação do Meio Ambiente (Santa Catarina State Environmental Agency)
FLORAM	Fundação Municipal do Meio Ambiente de Florianópolis (Florianópolis Municipal Environmental Agency)
FMR	Florianópolis Metropolitan Region
FNRU	Fórum Nacional de Reforma Urbana (Brazilian National Forum for Urban Reform)
FRA	FAO Global Forest Resources Assessment
FTT	Forest Transition Theory
GDP	Gross Domestic Product

GEF	Global Environment Facility
HDI	Human Development Index
IBAMA	Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brazilian Institute for the Environment and Renewable Natural Resources)
IBGE	Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics)
ICT	Information and Communications Technologies
IGBP	International Geosphere-Biosphere Programme
IHDP	International Human Dimensions Programme
IMF	International Monetary Fund
INPE	Instituto Nacional de Pesquisas Espaciais (Brazilian National Institute for Space Research)
IPEA	Instituto de Pesquisa Econômica Aplicada (Brazilian Institute for Applied Economic Research)
IPHAN	Instituto do Patrimônio Histórico e Artístico Nacional (Brazilian National Institute of Historic and Artistic Heritage)
IPUF	Instituto de Planejamento Urbano de Florianópolis (Florianópolis Urban Planning Institute)
ISA	Instituto Socioambiental (Socioenvironmental Institute)
IUCN	International Union for Conservation of Nature and Natural Resources; World Conservation Union
LUCC	Land-Use and Land-Cover Change

MCQV	Movimento Campeche Qualidade de Vida (Campeche Quality of Life Movement)
MMA	Ministério do Meio Ambiente (Brazilian Ministry of the Environment)
NGO	nongovernmental organization
PA	protected area
PDC	Plano de Desenvolvimento do Campeche (Campeche Development Plan)
PDP	Plano Diretor Participativo (Participatory Master Plan)
PEST	Parque Estadual da Serra do Tabuleiro (Serra do Tabuleiro State Park)
PMF	Prefeitura Municipal de Florianópolis (Municipal Government of Florianópolis)
PMLP	Parque Municipal da Lagoa do Peri (Peri Lagoon Municipal Park)
PNUD Brasil	Programa das Nações Unidas para o Desenvolvimento no Brasil (United Nations Program for Development in Brazil)
PMF	Prefeitura Municipal de Florianópolis (Municipal Government of Florianópolis)
PNF	Programa Nacional Florestal (National Forestry Program)
PNSJ	Parque Nacional de São Joaquim (São Joaquim National Park)
POE	Plano de Obras e Equipamentos (Plan for Public Works and Equipment)
PROBIO	Projeto de Conservação e Utilização Sustentável da Diversidade Biológica Brasileira (Project for the Conservation and Sustainable Use of Brazilian Biological Diversity)
PRONAPA	Programa Nacional de Pesquisas Arqueológicas (Brazilian National Program for Archaeological Research)

RBMA	Reserva da Biosfera da Mata Atlântica (Atlantic Forest Biosphere Reserve)
RPPN	Reserva Particular do Patrimônio Nacional (Private Natural Heritage Reserves)
SBS	Sociedade Brasileira de Silvicultura (Brazilian Society of Silviculture)
SC	Santa Catarina State
SCI	Santa Catarina Island
SES	Social-Ecological System
SISNAMA	Sistema Nacional do Meio Ambiente (Brazilian National Environment System)
SNUC	Sistema Nacional de Unidades de Conservação da Natureza (Brazilian National Protected Areas System)
SUSP	Secretaria Municipal de Urbanismo e Serviços Públicos (Florianópolis Municipal Office of Urbanism and Public Services)
UC	Unidade de Conservação (Conservation Unit)
UEP	Unidade Espacial de Planejamento (Spatial Unit for Planning)
UFSC	Universidade Federal de Santa Catarina (Federal University of Santa Catarina)
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-Habitat	United Nations Human Settlements Programme

UNICAMP	Universidade Estadual de Campinas (State University of Campinas)
USP	Universidade de São Paulo (University of São Paulo)

APPENDIX D: Glossary

Açorianos: Azoreans

Agregado: an attached dependent who joins a household, often as a servant

Aguardente: an alcoholic rum-like beverage distilled from a fermented sugarcane product; also known as *cachaça* or *pinga*

Aldeias: mission villages established in Portuguese America in the sixteenth, seventeenth, and eighteenth centuries by the Jesuits that were used to extend the colonial frontier and to catechize and acculturate Amerindians for the purpose of organizing indigenous labor

Alvará: permit, charter, warrant, judicial writ

Araucaria: the native Brazilian pine *Araucaria angustifolia*

Argamassa: construction mortar

Armação: whaling post

Balneário: beach resort.

Bandeiras: colonial-period *bandeiras* along with *entradas* were profit-driven armed expeditions organized to capture and enslave Amerindians, to prospect for mineral wealth, to establish new settlements, and to advance the colonial frontier in Portuguese America

Bandeirismo: the activities and events related to the sixteenth and seventeenth century colonial expeditions to capture and enslave Amerindian, to prospect for minerals, and to expand Brazil's territory

Caatinga: the semi-arid ecoregion in northeastern Brazil

Cachaça: an alcoholic rum-like beverage distilled from a fermented sugarcane product; also known as *aguardente* or *pinga*

Caiçaras: people belonging to traditional fishing communities living in coastal areas of Brazil, usually in São Paulo State

Caieiras: lime kilns used to produce construction mortar, whitewash, and soil fertilizer by processing the calcium carbonate mined from *sambaquis* (prehistoric shellmounds)

Caldeiras de ferro: large iron kettles

Campos: high-altitude grasslands

Capitanias hereditárias: land concessions that were initially granted to gentry by the Portuguese crown in the sixteenth and seventeenth centuries to colonize territory in the New World and later restructured over the course of the eighteenth century

Capoeira: early-intermediate stage of forest regeneration characterized by shrubs and short trees

Capoeirinha: early stage of forest regeneration containing herbaceous and shurb species

Capoeirão: late-intermediate stage of forest regeneration lasting for 50 to 80 years and characterized by taller trees (up to ~20 m)

Carioca: of or from the city of Rio de Janeiro, Rio de Janeiro State, Brazil

Cartas de doação: royal charters issued by the Portuguese crown during the Colonial Era distributing rights to develop land

Catarinense: of or from Santa Catarina State, Brazil

Centro: city center

Cerrado: Brazil's neo-tropical savanna

Condomínio: condominium

Condomínios exclusivos or condomínios fechados: exclusive or closed condominiums; gated communities

Casais: married couples; singular form is *casal*

Conselho Ultramarino: the Overseas Council was the administrative body within the Portuguese government that determined the policies and regulations of Portuguese America during the colonial period

Curtumes: leather-tanning operations

Descimentos: the initial period occurring in the sixteenth century of forced transfers of Amerindian populations from inland areas to supply labor to colonial settlements

Distrito Sede: Central City District

Donatários: the recipients by royal charter of extensive land concessions (*capitanias hereditárias*) granted by the Portuguese crown in the sixteenth century to advance colonization in the New World

Engenhos: mills (e.g., for the production of manioc or sugarcane products)

Entradas: colonial-period *entradas* along with *bandeiras* were profit-driven armed expeditions organized to capture and enslave Amerindians, to prospect for mineral wealth, to establish new settlements, and to advance the colonial frontier in Portuguese America

Escravocracia: slavocracy

Estatuto da Cidade: Brazil's City Statute

Farinha de mandioca: manioc flour

Favelas: low-income informal settlements that occur in urban, suburban, and peri-urban areas of Brazil

Feitorias: colonial fortified enclaves and trading posts established by the Portuguese

Forais: royal charters issued by the Portuguese crown during the Colonial Era granting *donatários* economic, political, judiciary, and administrative powers

Fortaleza: fortification

Fossa: septic tank

Freguesias: parishes

Garapuvú or *Guapuruvu:* a fast-growing tree species (*Schizolobium parahyba*) native to tropical and subtropical areas of Brazil; it commonly occurs in the coastal secondary dense broadleaf forests of Santa Catarina and reaches heights of up to 30 m

Gaúcho: a person from Rio Grande do Sul State, Brazil

Jangadeiros: fishers who use a type of boat called a *jangada*

Leste: east

Loteamento: division of land into lots or parcels

Maciço: hill range

Madeiras de lei: highly-valued timber species reserved by law exclusively for the Portuguese crown

Mameluco: someone of mixed Amerindian and European parentage

Manancial: headwaters

Mandioca: manioc; cassava

Manezinho(a): a native-born resident of Florianópolis

Mangue or *manguezal* (singular) and *manguezais* (plural)*:* mangrove(s)

Mata Atlântica: Atlantic Forest

Mata secundária: advanced secondary forest approaching mature stages

Melado: molasses

Ministério das Cidades: Brazilian Ministry of Cities

Morro: hill

Município: municipality

Olarias: factories producing pottery, tiles, and bricks that are fired in kilns

Pampa: Brazil's southern grasslands

Pantanal: a large wetland ecoregion within the Brazilian states of Mato Grosso and Mato Grosso do Sul as well as small portions in Bolivia and Paraguay

Paulista: of or from São Paulo State, Brazil

Pinga: an alcoholic rum-like beverage distilled from a fermented sugarcane product; also known as *aguardente* or *cachaça*

Planalto: Brazil's interior highlands

Plano Diretor: Master Plan

Plano Diretor Participativo: Participatory Master Plan

Portaria: an administrative edict or a written ruling used by cabinet ministers to regulate the activities of their ministries; these edicts are used to promulgate regulations that complement or clarify a law or decree

Projetos de Lei: legislative projects

Renda de bilró: a traditional Azorean style of lace

Rendeiras: female lacemakers

Resgatados: Africans and Amerindians who were first captured and held in captivity by rival groups then traded and enslaved by Portuguese colonists

Restinga: an edaphic vegetation complex which encompasses the range of coastal sandy-soil ecosystem gradients that occupy Brazil's littoral zone spanning beach and dune structures as well as post-dune sandy coastal plains

Sambaquis: prehistoric shellmounds produced by the preceramic shoreline fisher-gatherer-hunter populations that occupied much of the Brazilian coast from at least 7,000 to 2,000 BP

Serra: mountain range

Sertão: the interior of Portuguese America and, later, Brazil

Sesmarias: titled tracts of land with specified property boundaries conceded to settlers and taxed by *donatários* during Brazil's Colonial Period

Sul da Ilha: the southern portion of Santa Catarina Island

Vicentistas: of or from the Vila of São Vicente

Vila: town

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PUBLICATIONS

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