■ BRIAN J. GODFREY

Urban Renewal, *Favelas*, and Guanabara Bay

ENVIRONMENTAL JUSTICE AND SUSTAINABILITY IN RIO DE JANEIRO

Famous for its dramatic landscapes and cultural contrasts, Rio de Janeiro evokes images of towering mountains, luxuriant tropical vegetation, white beaches and scenic lagoons, and exuberant carnival celebrations with a pulsating samba beat. The city's panorama exhilarates visitors landing by plane, although the time-honored arrival by sea remains even more aweinspiring, as vessels sail past Sugarloaf Mountain to behold the breathtaking tableau of Guanabara Bay. The need to preserve the city's beautiful natural setting led the United Nations to inscribe "Rio de Janeiro, Carioca Landscapes between the Mountain and the Sea" as a world heritage site in 2012. Amid these spectacular surroundings, travelers may note unsightly trash and wastewater in the bay or on nearby beaches. Sightseers also notice the ramshackle shantytowns, known as *favelas,* set on the city's hills or wetlands. While picturesque from a distance, at close range these informal settlements bring to mind poverty, crime, and violence, as popularized by such films as *City of God* and reinforced by the news media. Rio's stunning views, so enthralling at first sight, ultimately display a metropolis divided by wealth and poverty (fig.1).

For all its exceptional scenery, Rio de Janeiro highlights ecological problems of rapid urbanization common in developing countries. For centuries visitors have rhapsodized about the city's great bay, but it has long served as a dumping ground. Literally meaning "breast of the sea" in the native Tupí-Guaraní language, Guanabara Bay shrank from 180 square miles (466 square kilometers) in 1500 to 154 square miles (399 square kilometers) in 2000—a decrease of 15 percent—due to shoreline expansion. Shaped like an oval, the bay narrows to 1.1 miles (1.8 kilometers) at its entrance, then broadens to about 15 miles (24 kilometers) at its widest east-west spot; its north-south distance is approximately 18.6 miles (30 kilometers).[1] This enclosure shelters the port from Atlantic storms, but also inhibits the ocean's natural flushing action in the bay, particularly in the context of mounting landfill, pollution, and sedimentation. As the city's original raison d'être and

COURTESY OF BRIAN J. GODFREY

Figure 1. Rio's classic postcard of Sugarloaf Mountain at the entrance to Guanabara Bay, taken from Corcovado Mountain above the city, obscures the marked socioeconomic disparities evident from below.

continuing economic hub, Guanabara Bay's margins are highly urbanized and contain most of the metropolitan population, industries, oil refineries, two major airports, the seaport and naval base, and the main campus of the Federal University of Rio de Janeiro (fig. 2).

When a Portuguese expedition visited the bay in January 1502, the explorers named it Rio de Janeiro. According to tradition, the mariners mistook Guanabara Bay's entrance for the mouth of a great river, although a rival interpretation suggests that they recognized a drowned river valley, or "ria." Certainly the bay once had been a river in prehistoric times. During the Holocene period, when the sea level was some 425 feet (130 meters) lower than at present, a river system developed in Guanabara Valley, only to be flooded by rising oceans about 12,000 years ago as the last ice age ended. This submerged Guanabara paleoriver forms the central trough where the bay reaches its greatest depths of some 164 feet (50 meters). Otherwise, depths on the irregular bottom of this drowned river valley vary from about 56 feet (17 meters) at the entrance, to less than 10 feet (3 meters) away from the navigation channels. The bay's average depth has been variously estimated between 19 feet (5.7 meters) and 25 feet (7.6 meters), but it is much less in the shallow northwestern parts. Officials have warned that half of the bay is "only about a foot and a half deep and runs the risk of drying up" (fig. 3).[2]

Such dire projections contrast with an unspoiled state upon European arrival five centuries ago, when the bay and nearby lagoons and mangrove forests teemed with fish and wildlife, including dolphins, whales, birds, and shellfish. Tupí-Guaraní groups, locally called Tupinambás or Tamoios, clustered in agricultural villages around Guanabara Bay. The Portuguese founded São

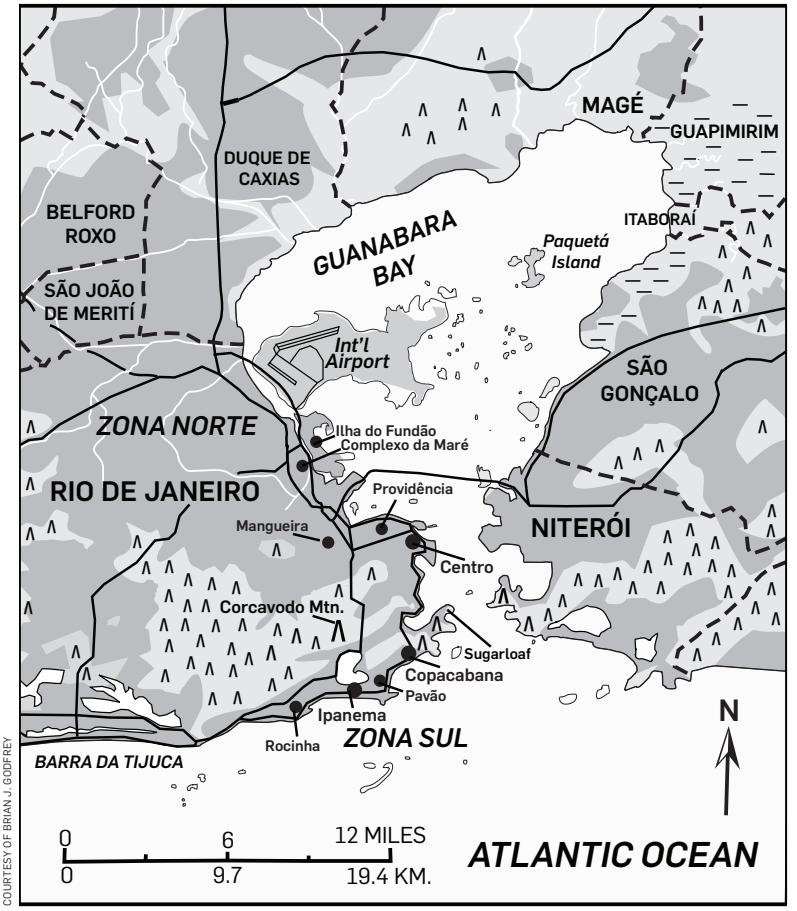


Figure 2. Metropolitan Rio de Janeiro.

Sebastião do Rio de Janeiro in 1565, which began a long process of urbanization—along with deforestation, wildlife extinction, wastewater contamination, and tropical disease. By 1850, when Herman Melville visited and praised "the Bay of all Rivers—the Bay of all Delights—the Bay of all Beauties," overexploitation of the whale population, which once found an ideal breeding ground here, had already ended a local industry in whale meat and oil that had flourished for two centuries.[3] Environmental degradation mounted as Rio grew into a megacity: hillside erosion, sedimentation, and landfill steadily encroached on the bay's shorelines, while pollution by industry, shipping, oil spills, and untreated sewage rendered its once-pristine beaches unsafe for swimming. Rio's mountains, historic hills, and national forests were declared national landmarks in 1973, but Guanabara Bay remained without such protection.[4] State agencies now monitor the bay, and nongovernmental organizations (NGOs) advocate its restoration, but political obstacles, economic realities, and the task's daunting scale stifle progress. During the 1992 United Nations Conference on Environment and Development, Rio's "Earth Summit," signatories of an Alternative Treaty famously proposed "that Guanabara Bay and its surrounding environments be declared a World Heritage Site."[5]

COURTESY OF BRIAN J. GODFREY

Figure 3. Downtown Rio de Janeiro with the Rio-Niterói Bridge (8.25 miles or 13.2 kilometers long) in the background; despite modern shoreline consolidation, sixty-five islands still dot Guanabara Bay.

In that spirit, this chapter examines Rio de Janeiro's urban sustainability with regard to the interactions of urban renewal programs, *favela* communities, and Guanabara Bay. As popularized by the Earth Summit's "Agenda 21" program, sustainability has been widely regarded as equitably meeting "the developmental and environmental needs of present and future generations."[6] Despite the concept's ambiguities and contradictions, sustainability has the virtue of linking environmental quality to human welfare. While mainstream environmentalism has at times been criticized for downplaying issues of social justice, sustainable development attempts to reconcile, at least in principle, the "three Es" of environment, economy, and equity. Thus arise concerns for environmental justice, as defined by the U.S. Environmental Protection Agency (EPA): "The fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations and policies."[7]

As in other cities, the problems of Rio's *favelas* underscore how unsustainable urban growth results from environmental injustice—spatial (dis)placement, inadequate housing, landslides and other environmental hazards, and lack of such urban services as potable water, electricity, and sewage treatment.[8] Indeed, since *favela* residents are overwhelmingly poor and people of color, their communities reflect deprivations of both race and class. Robert Bullard's appraisal of the U.S.

applies equally well to Brazil: "institutional racism and discriminatory land-use policies and practices of government—at all levels—influence the creation and perpetuation of racially separate and unequal residential areas for people of color and whites." Environmental justice, he goes on, would ensure "equal protection of environmental, health, employment, housing, transportation, and civil rights laws."[9] By juxtaposing the degradation of Guanabara Bay and the infrastructural problems of the port, industry, and *favelas* nearby, this chapter analyzes the coevolution of Rio's most pressing sustainability issues in both ecological and socioeconomic terms.

Urban Metabolism, Environmental Justice, and Rio's *Favelas*

As ecological communities, cities can be viewed as organisms that require a variety of inputs to survive and thrive, resulting in outputs of unwanted waste products. Urban centers need materials and resources to sustain inhabitants, to maintain the built environment, and to operate machines, transportation, and other moving parts. As Herbert Girardet reminds us, a city's sustainability can be gauged by the efficiency and renewability of its metabolism—"the flow of resources and products through the urban system for the benefit of urban populations." On one hand, natural ecosystems feature *circular metabolisms* in which local outputs become inputs (and viceversa) in largely self-contained chains of mutual benefit. Unfortunately, modern cities favor *linear metabolisms,* as resources are directed "through the urban system without much concern about their origin or about the destination of wastes, resulting in the discharge of vast amounts of waste products incompatible with natural systems." Hence urban ecologists like Girardet emphasize the importance of closing the open-ended resource loops of modern cities through recycling and reusing materials, rather than dumping unwanted "externalities" in landfills, incinerators, and waterways.[10]

Water is of particular importance. Since citydwellers require potable water for drinking, cooking, and sanitation, metropolises cannot grow without systems to provide fresh water and then to discharge domestic and industrial wastewater. Metabolic infrastructures must collect, treat, and dispose of wastes before they expose residents to pathogens resulting in such diseases as cholera, typhoid, and dysentery, which historically plagued London, New York, and other early industrial metropolises. At present, such waterborne diseases still threaten poor communities in Mexico City, São Paulo, Lagos, and other rapidly growing cities of the developing world, where much of the urban population lacks sewerage. Of course, sewage treatment and safe disposal of sludge is essential for economic growth as well as public health.[11]

In Brazil, sewage systems reached only 50 percent of the urban population in 2004—and even then most of the discharged sewage remained untreated—although 85 percent benefited from public water provision. The half of the urban population with sewerage generally coincides with what has been called the "organized city" of relatively affluent populations, paved streets, high-rise buildings, and urban services. The other half without access to sewage systems tends to be low-income and to reside in either peripheral areas of legal subdivisions with many unpaved streets and few services, or in self-constructed *favelas* of uncertain legal title as well as a lack of basic infrastructures. Foreigners tend to view *favelas* as synonymous with "slums," but in Brazilian parlance they differ from deteriorated inner cities and peri-urban residential subdivisions

by appearance and location. Typically, *favelas* arise on steep hillsides, low-lying wetlands, along railroad lines or highways, or on other undesirable sites.[12]

Officially 18.7 percent of Rio's population lived in 513 *favelas* in 2000, but these figures were conservative. In 2002 Rio's planning agency found 39.4 percent of the city's dwelling units (839,855 houses or apartments) "irregular" and without legal title, although clearly not all were *favelas*.[13] Legislation of 1937 recognized *favelas* as "groups of two or more irregular shacks, constructed of improvised materials." Since 1950, the Brazilian census has considered *favelas* to be groups of 50 or more dwellings of a "rustic appearance" without land title, full or partial absence of public services, and lack of street paving, numbers, and signage.[14] The initial rudimentary shacks often give way in time to improved dwellings, if the *favela* is secure from landslides, flooding, and eviction. Indeed, Brazilian elites and policymakers have tried alternatively to ignore, eradicate, or upgrade and integrate *favelas,* while their residents or *favelados* have continued to provide cheap labor and services for the urban economy.

Despite policy changes, *favelados* continue to be viewed in largely negative ways by society at large. Janice Perlman once famously argued that such views reflected dominant ideologies, which steadfastly ignored evidence that *favelados* were not passive and marginal but rather were "in fact integrated into society, albeit in a manner detrimental to their own interests."[15] Follow-up interviews based on the original 1968–1969 study, more than three decades later (1999–2003), found a transformation from "the myth of marginality" among aspiring recent migrants to "the reality of marginality" among continuing residents faced with few prospects of social mobility. Although objective living standards, urban services, and education had improved among those interviewed in three selected *favelas,* previously upbeat attitudes had soured: the inability to move into affluent neighborhoods and to achieve better jobs frustrated *favelados,* while pervasive fear of gang violence heightened their pessimism. Other scholars also have noted ominous trends in urban segregation, income inequality, rates of violent crime, and social and racial polarization under neoliberalism since Brazil's return to democracy in 1985.[16]

This attitudinal downturn among *favelados* also reflects environmental injustice, including a dearth of vital urban services among low-income communities. Such ecological lapses highlight the city's social geography of north-south polarization, which contrasts the industrial working-class districts (both peripheral subdivisions and *favelas*) concentrated around Guanabara Bay with the affluent districts near the scenic Atlantic beaches. Densely inhabited and highly segregated by socioeconomic status and race, the city of Rio reached a population of 6.1 million in 2006—over half the 11.5 million residents in the metropolitan region, comprised of twenty municipalities covering 1,809 square miles (4,686 square kilometers). The city's Southern Zone (Zona Sul), centered on such beachfront communities as Copacabana and Ipanema, includes 27 *favelas,* according to 2000 data. The rapidly growing Western Zone (Zona Oeste) encompasses Barra da Tijuca and other wealthy beachfront districts, along with such struggling communities as the City of God and 262 other *favelas.* Central Rio includes the downtown business district, diverse residential districts, and 61 hillside *favelas.* The city's Northern Zone (Zona Norte) and suburbs of the Fluminense Lowlands (Baixada Fluminense) encompass a vast urban region with the port, shipyards, oil refineries, chemical plants and other industries, and 354 *favelas*.[17]

At a metropolitan scale, human development indices (HDI)—including education, health,

income, and housing—are highest in populous Rio and Niterói, which now have relatively low rates of demographic growth. These cities rank second and first in HDI, respectively, among the state's ninety-two municipalities. Table 1 compares the seven *municípios* encircling Guanabara Bay: while not encompassing the bay's entire watershed, they comprise three-quarters of the metropolitan population. Beyond the core cities of Rio and Niterói, the others are poorer, offer fewer urban services, and generally have lower quality of life. Much of the peripheral urban populations remain unconnected to the public water supply and sewerage systems. City residents without sewage connections in 2000 officially ranged from 43 percent in Duque de Caxias, 60 percent in São Gonçalo, to even higher proportions elsewhere. Even in relatively well-served Rio de Janeiro, 22 percent of the urban population lacked sewerage, while in Niterói the figure rose to 27 percent.[18] Community groups argue that official figures understate such problems:

> Currently about 12 percent of households in Rio de Janeiro do not have running water, over 30 percent do not have sewage connections, and official electricity connections reach only 70 percent of the population. In *favelas*—which make up the bulk of the households without these urban services—residents use illegal connections (*gatos*) to water and electricity, and sewage is often dumped straight into rivers, drainage ditches, and lagoons.[19]

After this metropolitan overview, we shift to the environmental history of Rio de Janeiro's urbanization with a focus on evolving perceptions and policies. Basically, I argue that elite ideologies have shifted successively from the *favelas'* assumed disease, filth, and moral depravity in the

Table 1. Population and human development in Greater Rio de Janeiro, 1996–2006

MUNICIPALITIES ON GUANABARA BAY	AREA (MI² / KM²)	POPULATION % URBAN 2000	POPULATION TOTAL 2006	POPULATION % ANNUAL CHANGE 1996–2006	PUBLIC WATER 2000*	PUBLIC SEWERAGE 2000*	STATE HDI RANK**
Duque de Caxias	180 / 465	99.6	854,509	1.9	69.5	56.6	52/92
Guapimirim	139 / 361	67.4	45,251	3.9	49.0	25.6	63/92
Itaboraí	164 / 424	94.5	222,722	3.9	23.8	28.9	67/92
Magé	149 / 386	94.2	236,748	2.9	47.5	31.1	57/92
Niterói	50 / 129	100	476,561	0.6	78.3	73.0	1/92
Rio de Janeiro	456 / 1,182	100	6,134,892	1.0	97.8	78.0	2/92
São Gonçalo	96 / 249	100	972,854	1.7	80.4	40.3	23/92
7 municipalities on bay (total)							
	1,234 / 3,196	99.6	8,943,537	1.3	—	—	—
20 municipalities, Rio de Janiero metro region (total)							
	1,809 / 4,686	99.3	11,460,463	1.4	—	—	15/33

Sources: Instituto Brasileiro de Geografia e Estatística, http://www.ibge.gov.br/; Fundação CIDE—Centro de Informações e Dados do Rio de Janeiro, *Rio de Janeiro em Dados*, http://200.156.34.70/cide/index.php; Instituto da Baía de Guanabara, http://www.portalbaiadeguanabara.com.br/; United Nations Development Program, Brazil, *Atlas do Desenvolvimento Humano do Brasil—2003*, http://www.pnud.org.br/home/.

* Percent of urban population.
**The United National Human Development Index combines various quality-of-life indicators, including education, health, income, and housing. Municipalities are ranked according to the ninety-two jurisdictions in Rio de Janeiro state (x/92); the metropolitan region is ranked according to the thirty-three such areas studied in Brazil (x/33).

nineteenth- and early twentieth-century sanitary city, to their supposed social marginalization, behavioral deviance, economic dependence, and general pathology in the mid-twentieth-century "modernist city," and more recently to the environmental problems, geohazards, and violent threats they purportedly pose to the contemporary sustainable city. Biases against *favelas* have been reconfigured according to the pressing problems of each historic era: policies have evolved, but *favelas* have consistently been diagnosed in negative terms that reinforced stereotypes and stigmatized residents. The following brief historical geography examines the emergence of Rio's contemporary ecological problems with regard to long-term issues of social equity, spatial segregation, and environmental justice.

The Sanitary City: Urban Reforms to "Civilize" Rio (1808–1920)

Concern with pollution, sanitation, and tropical disease first arose in colonial Rio de Janeiro. Despite a splendid natural harbor, the irregular site and uneven topography—composed of coastal inlets, low-lying marshes and lagoons, and steep hills—constrained urban expansion, while the humid tropical climate and uneven terrain created problems of stagnant water, ideal for the proliferation of mosquitoes and other insect vectors of disease. As early as 1613 a yellow fever epidemic caused high mortality rates, especially among slaves. Soon thereafter, the filling of central lagoons and construction of drainage ditches began to modify the city's natural landscape. Despite such early efforts, ecological problems steadily mounted along with urban growth.[20] The 1763 transfer of the viceregal capital from Salvador da Bahia to Rio de Janeiro, which featured a convenient port of entry to the inland gold and diamond mines of Minas Gerais, reflected the city's increasing size and status. As Preston James once noted: "Gold made Rio de Janeiro, as surely as sugar made São Salvador and Recife and, as later, coffee made São Paulo."[21]

The royal family's sudden arrival in 1808, after fleeing Lisbon to escape the Napoleonic invasions, overnight made Rio the capital of Portugal's vast overseas empire. Under this centralized power, one historian notes, "Rio's landscape began a process of monumental change that would extend well into the twentieth century."[22] Finding a city of narrow and irregular streets, unhealthy swamps, crowded housing, and few urban amenities, Dom João VI ordered the building of roads, botanical gardens, parade grounds at Campo Santana, and other parks, monuments, and buildings. Powered by slave labor, royal projects also included filling swamps, leveling low hills, and shoreline landfills. The influx of some 10,000 Portuguese with the court, coupled with liberalization of foreign trade, dramatically accelerated urbanization. The Bragança royal family and leading aristocrats began an exodus of the wealthy from the city center: the monarch set up court at Quinta da Boa Vista on the city's outskirts, returning to the Imperial Palace downtown only for ceremonial functions, while nobles built luxurious hillside estates (fig. 4).[23]

Rio's population more than doubled from about 50,000 in 1808 to 112,000 by 1821, when a Portuguese constitutionalist revolt forced King João VI's return to Lisbon. He left his heir, Dom Pedro I, to govern Brazil. As imperial capital, main port, and cultural center of an independent Brazil after 1822, Rio de Janeiro overshadowed the country's other nineteenth-century cities. Rio boasted a population of 274,972 in 1872, compared with 31,385 in São Paulo. Spurred by the rural-urban migration resulting from railroad expansion and abolition of slavery in 1888, the city's

Figure 4. Rio de Janeiro, 1812–1817.

growth continued unabated after the Republic's proclamation in 1889. As Rio's population grew by nearly 7 percent annually from 1872 to 1900 (table 2), infrastructural deficiencies mounted in the provision of fresh water, sewerage, and transportation. One-quarter of the city's population crowded into central tenements called *cortiços* (literally, "beehives"), which raised concerns for public health. For example, a smallpox epidemic killed 4,160 people in 1849, and recurring epidemics of yellow fever, malaria, typhoid, and cholera led to periodic international quarantines that damaged commerce. Sanitation was abysmal. Dirty water was disposed by throwing it from windows into the street, often with little more than a shouted warning to passersby: "Agua Vai!" Fecal material was stored in barrels and dumped by slaves known as "tigers" for the brown streaks

Table 2. City and metropolitan populations of Rio de Janeiro, 1808–2010

YEAR	CITY OF RIO DE JANEIRO		RIO DE JANEIRO METROPOLITAN REGION	
	POPULATION	% ANNUAL CHANGE	POPULATION	% ANNUAL CHANGE
1808	50,000	—	—	—
1821	113,000	9.7	—	—
1836	139,000	1.5	—	—
1850	180,000	2.1	—	—
1872	274,972	2.4	—	—
1900	811,443	6.9	—	—
1920	1,157,873	2.1	—	—
1940	1,764,141	2.6	—	—
1960	3,281,908	4.3	4,874,619	—
1980	5,090,700	2.7	9,014,274	4.2
2000	5,857,904	0.7	10,894,156	1.0
2010	6,320,446	0.8	11,835,708	0.9

Note: Populations of metropolitan regions are available starting in 1960.

Sources: *Anuário Estatístico do Brasil 1984*, Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística (IBGE), 1985, 81–82; *Contagem da População 1996*, Rio de Janeiro: IBGE, 1997, vol. 1, 25–26; *Anuário Estatístico do Brasil 1996*, Rio de Janeiro: IBGE, 1997, 42; Cities@ IBGE, http://www.ibge.gov.br/cidadesat/topwindow.htm?1; and *Sinopse do Censo Demográfico 2010*, http://www.ibge.gov.br/home/estatistica/populacao/censo2010/ [accessed April 23, 2010].

that often stained their clothes. As historian Lise Sedrez notes: "Sanitation predates beautification as the Holy Grail of *Carioca* engineers in the 19th century."[24]

In 1862 the government contracted a British firm, the City Improvements Company, to provide sewers and waste treatment. Initially three districts were established, each with sewers and treatment plants—known as Casas das Máquinas—based on the latest European designs. Despite the chemical treatment and filtering of wastes, critics complained of nauseating odors, rains overwhelming the system, and generally dubious sanitary effects. Growing concerns with sanitation, disease, and social problems in the urban core continued the suburban exodus of elites. Transportation improvements allowed affluent classes to gravitate to the Zona Sul, where speculative real-estate development steadily increased the residential densities.[25] By 1902 nine sewerage districts struggled to process mounting wastes: eight districts released 6.4 million liters (1.7 million gallons) of waste per hour in Guanabara Bay, while the Leblon station dumped refuse into the Atlantic Ocean. Still, sewers served only about 60 percent of buildings.[26]

Hillside shantytowns also arose during this period of rapid urbanization. Although informal settlements began as early as the 1870s, the first one actually called a *favela* appeared in 1897–1898, when squatters occupied the Morro da Providência, then known as the Morro da Favella. One account explains the settlement as resulting from the demolition of a central tenement called Cabeça do Porco ("Pig's Head"), whose dislocated residents then occupied the hillside. Another popular explanation points to returning veterans of a war against the separatist movement of Antônio Conselheiro in Bahia: the name of the Rio shantytown recalled a plant common in the northeastern

backlands, identified with the Alto da Favela battlefield at Canudos. In fact, other informal settlements emerged during this period, but Favela Hill came to symbolize the phenomena.[27] Valladares argues that this persistent myth of origin arose as public intellectuals and journalists read *Os Sertões,* Euclides da Cunha's classic account of the Canudos rebellion, first published in 1902 and later translated into English as *Rebellion in the Backlands.* Historian Bradford Burns argues that da Cunha emphasized "the struggle of man against nature, of civilization against barbarism. . . . The villain of the plot was the cities; the victims were Antônio Conselheiro and his rustic followers."[28] By extension, then, the *favela* arose just as rural-urban migration projected barbarism into Rio de Janeiro.

Whatever the precise historical and etymological origins, the term *favela* soon became generalized as informal communities grew from a shortage of affordable housing, exacerbated by displacement from central tenements. As the city's population approached a million in 1900, downtown was increasingly congested, the outmoded port delayed shipping, and pressure mounted for new housing and transportation arteries. In response, new President Rodriguez Alves announced ambitious urban reforms in 1902. Francisco Pereira Passos, appointed mayor of the Federal District, acquired sweeping powers of eminent domain to allow expropriation and demolition without judicial review. As mayor from 1902 to 1906, Passos and backers in the influential Engineering Club aspired to make Rio into a "tropical Paris." The city administration worked with federal public health authorities, under Oswaldo Cruz, in a campaign to end yellow fever. Health experts and civil engineers stressed the need to vanquish disease through sanitation and science, which conveniently complemented general elite concerns with "civilizing" Rio.[29]

Turn-of-the-century reformers regarded Rio's narrow streets, dating from colonial days, as dangerous, unsanitary, and backward. Despite popular discontent, authorities demolished over 500 buildings to carve Avenida Central (now Avenida Rio Branco) through downtown, allowing construction of the School of Fine Arts, the National Library, the Supreme Court, the Municipal Theater, and other neoclassical buildings along what quickly became a fashionable thoroughfare. Jeffrey Needell notes: "Much of the *Cidade Velha's* narrow, dank, and muddled working-class world was destroyed: it's streets were widened, given light and air, and better connected by demolishing old buildings, changing old streets, and building new ones."[30] Not coincidentally, the short-lived but violent "Revolt of the Vaccine," a destructive spree by rampaging downtown mobs in 1904, prompted by popular indignation over mandatory yellow-fever inoculation, also reflected widespread displacement from the renovated central district. Protestors targeted the municipal streetcars for destruction, along with streetlights and new buildings downtown.[31]

Fin-de-siècle reforms also modified the city's shoreline (fig. 5). Previously the marshes and swamps, common in low-lying areas, were the primary focus of filling and leveling. With the Pereira Passos reforms, authorities began using landfills *(aterros)* to reclaim broad swaths of Guanabara Bay for urban development. The port was transferred from the cramped urban core, around Praça XV de Novembro, to enlarged facilities with railroad connections on the north side. Completed by 1920, the expanded port complex straightened the northern shoreline and eliminated the historic inlets. South of the central district, the Passos administration completed the Avenida Beira-Mar, the "Seaside Avenue," built on a landfill behind a seawall from downtown to Botafogo. Coupled with subsequent twentieth-century landfills, traditional beaches here disappeared under

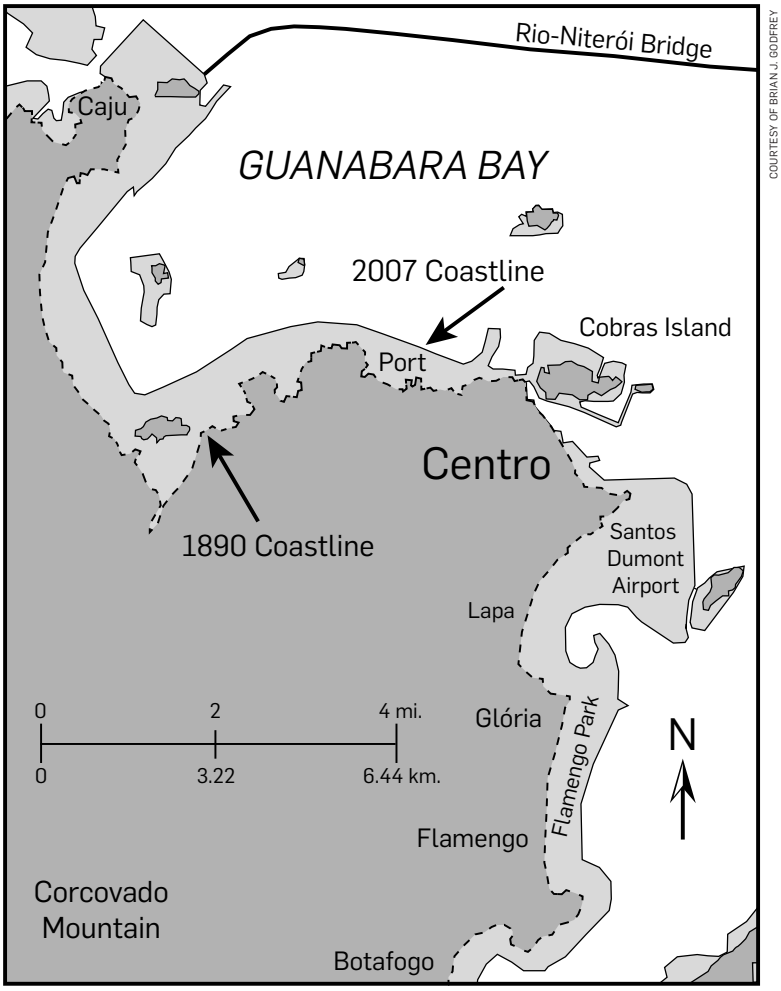


Figure 5. Coastlines of Central Rio de Janeiro, 1890 and 2007.

new roads, parks, and buildings. Venerable churches and other landmarks, once located on the shoreline, were located a halfmile or more from the water's edge after 1910.[32]

The Modernist City: Twentieth Century Urban Renewal (1920–1985)

While turn-of-the-century urban reforms removed the poor from the central business district in the interests of sanitation and beautification, subsequent twentieth-century urban renewal emphasized the needs for "modernization and development." Urban planners at midcentury continued to reshape the urban built environment and to promote sociospatial polarization by race and class, but the dominant rationale shifted somewhat. While concerns about public health and "social hygiene" continued, reference to "civilizing" the masses fell out of favor with the rise of populism. This ideological shift became noticeable during the 1922 Modern Art Week of São Paulo, which depicted such Brazilian realities as social conflict, racial diversity, urbanization, and

popular culture. The modernist influence was particularly strong among painters and poets, but other intellectuals collaborated in rethinking national life. Urban planners and architects, inspired by the Radiant City of modernist master Le Corbusier, proposed leveling large parts of the city to make way for new traffic arteries and high-rise buildings. The Agache Plan of French architect Donat-Alfred Agache proposed in 1926–1930 to transform Rio into a "monumental city" through redevelopment, land-use rationalization, and *favela* removal:

> Built contrary to all rules of hygiene, without piped water, without sewerage, without garbage collection, without order, with irregular materials, the *favelas* constitute a permanent risk of fire and epidemic infections for neighborhoods they infiltrate. Their leprosy fouls the beaches and neighborhoods gracefully endowed by nature, strips the hills of their adorning greenery, and corrodes even the edges of the forest on the lower slopes of the coastal hill range . . . [Their destruction is important] for social order and security, as well as the general hygiene of the city, to say nothing of aesthetics.[33]

With the Revolution of 1930 and the rise of Getúlio Vargas, the Agache Plan was never fully implemented. Given his populist leanings, Vargas generally left the *favelas* intact as he centralized political control from 1930 to 1945, although Rio became his urban showcase for modernization. With the expansion of state power under the Estado Novo, modernist urban renewal took on a new transformative scale (table 3). The leveling of historic Castelo Hill during the 1920s "in the

Table 3. Historical periods of physical transformation in Rio de Janeiro

PERIOD	INTERVENTIONS	OBJECTIVES	CONSEQUENCES
17th–19th centuries	Demolition of low hills, filling of wetlands, waterfront development	Occupation of irregular site, defense, commerce, political centralization	Urban expansion, port development, environmental degradation, tropical disease
1902–1906	Urban renewal, Pereira Passos administration	Sanitation, public health, beautification, functional efficiency	Transport and port efficiencies, tenement (*cortiço*) removal, favela growth, demolition of historic patrimony
1920s–1940s	Castelo Hill leveled, expansion of central business district (CBD), opening of Avenida Presidente Vargas	Urban expansion, high-rise commercial and real estate development, new transportation arterials	Destruction of Rio's colonial historic patrimony, social displacement, verticalization of CBD
1950s–1960s	Santo Antônio Hill razed, diverse traffic arterials, Flamengo Park landscaped	CBD modernization, vehicular circulation, public recreation, real estate development	New high-rises and parks, bay pollution, shoreline expansion, CBD-waterfront separation, affluent move to Zona Sul, removal of selected *favelas*
1970s	Construction of Rio-Niterói Bridge, opening of metro/subway system	Mass transport, metropolitan integration, suburbanization, multiple urban nuclei	Destruction of historic structures, formation of open spaces, bay pollution, further urban decentralization
1980s	CBD Cultural Corredor, renovation of historic squares and buildings, tenements (*cortiços*)	Historic preservation, urban revitalization	Preservation of built heritage, commercial displacement of central housing by the Decree 322/76
1990s	Guanabara Bay conservation programs, waterfront renewal, cultural projects	Upgrading, commercial revitalization, renewed urban centrality	Cultural renewal of CBD, restoration waterfront linkages, occupation of open spaces

COURTESY OF BRIAN J. GODFREY

Figure 6. Flamengo Park, built on a landfill that expanded the shoreline dramatically, opened in the early 1960s.

interests of ventilation and hygiene" destroyed the city's site of colonial foundation but provided debris for construction of the Santos Dumont Airport on Guanabara Bay and opened space for new modernist buildings, such as the Ministry of Education and Health between 1936 and 1945.[34] A monumental boulevard, Avenida Presidente Vargas, torn through the city's historic core between 1941 and 1944, improved downtown's access to growing northern districts. Several new railroad lines of the Central do Brasil, along with opening of Avenida Brasil in 1946, attracted more migrants to the burgeoning informal settlements of the Zona Norte and northern *subúrbios*.[35]

Subsequent urban programs continued to increase the social distance among the city's diverse socioeconomic groups. During the 1950s, demolition of Santo Antonio Hill provided landfill to widen the shoreline along Flamengo Beach: beside the seaside boulevard of Passos, Governor Carlos Lacerda opened massive Flamengo Park, landscaped by Roberto Burle Marx, in the early 1960s (fig. 6). Such urban amenities encouraged further realestate development in the southern zone, as beachfront towers for affluent classes sprouted along the water. Meanwhile, construction of elevated roadways along the central waterfronts, expansion of Avenida Brazil and other highways in the northern zones, and expansion of the two airports, ruptured urban linkages with Guanabara Bay. These projects further segregated the city, as racial disparities increasingly coincided with patterns of residence.

Table 4. Number of *favelas* in Rio de Janeiro, 1950–2000

URBAN ZONE	1950		1980		2000	
	NUMBER	%	NUMBER	%	NUMBER	%
Central (Centro)	20	19.0	45	12.1	61	8.7
Southern (Zona Sul)	26	24.8	25	6.7	27	3.8
Western (Zona Oeste)	11	10.5	86	23.1	262	37.2
Northern Rio and Suburbs (Zona Norte/Subúrbios)	48	45.7	216	58.1	354	50.3
Total	**105**	**100.0**	**372**	**100.0**	**704**	**100.0**

Sources: Favela Tem Memória, http://www.favelatemmemoria.com.br/; Instituto Brasileiro de Geografia e Estatística, 1991 and 2000 censuses.

Favelas, first legally defined in 1937, were systematically counted by the Federal District in 1949. The city initially found 119 such informal settlements with a population of 280,000 inhabitants. Using somewhat different criteria, the demographic census of 1950 found 105 *favelas* with 169,305 residents, or 7 percent of Rio's population. The postwar decades, characterized by industrialization and urban renewal, saw the number of *favelas* rise dramatically. By 1980 the number of *favelas* officially rose to 372, representing 628,170 residents, or 12 percent of the city's total. While growth stabilized downtown and in the Zona Sul, the number of favelas in the Zona Norte and its northern suburbs reached 58 percent of the total (table 4).[36] This growing North-South socioeconomic divide had dire consequences for Guanabara Bay, as one observer has noted:

> Squatter settlements throughout much of the Guanabara Bay basin, an almost complete lack of basic sanitation systems able to service urbanized areas, industrial pollution, landfills covering large areas of the bay, clear-cut hillsides, silting up and reductions in depth—all this took place during the 20th century, mainly from the 1950s onwards.[37]

Government policy has called for the eradication of *favelas* since 1937, and the 1947 Commission for the Eradication of the *Favelas* even proposed "returning *favela* residents to their states of origin, committing *favela* residents over the age of 60 to State Institutions, and expelling from the *favela* all families whose income exceeded a minimum." Although a shortage of resources previously prevented such draconian measures, the military *coup d'état* of 1964 provided the central authority required for a massive program of *favela* removal. Along with the National Housing Bank (NHB), the military regime created the Coordination of Social Interest Housing of the Greater Rio Metropolitan Area (CHISAM) to assure that there would be "no more people living in the slums of Rio de Janeiro by 1976."[38] With funding from the NHB, CHISAM began to demolish *favela* communities in the Zona Sul, where real estate interests most benefited from urban redevelopment. The agency's goal was to remove 100 families each day, and between 1962 and 1974 almost 140,000 residents from eighty different communities were displaced from their homes.[39] Despite the massive displacement of *favelados* from affluent districts, overall the *favela* populations tripled between 1950 and 1970, reaching 13.3 percent of the population. Consistently, *favelas* have grown much faster than the city's general rate of demographic increase: *favelados*

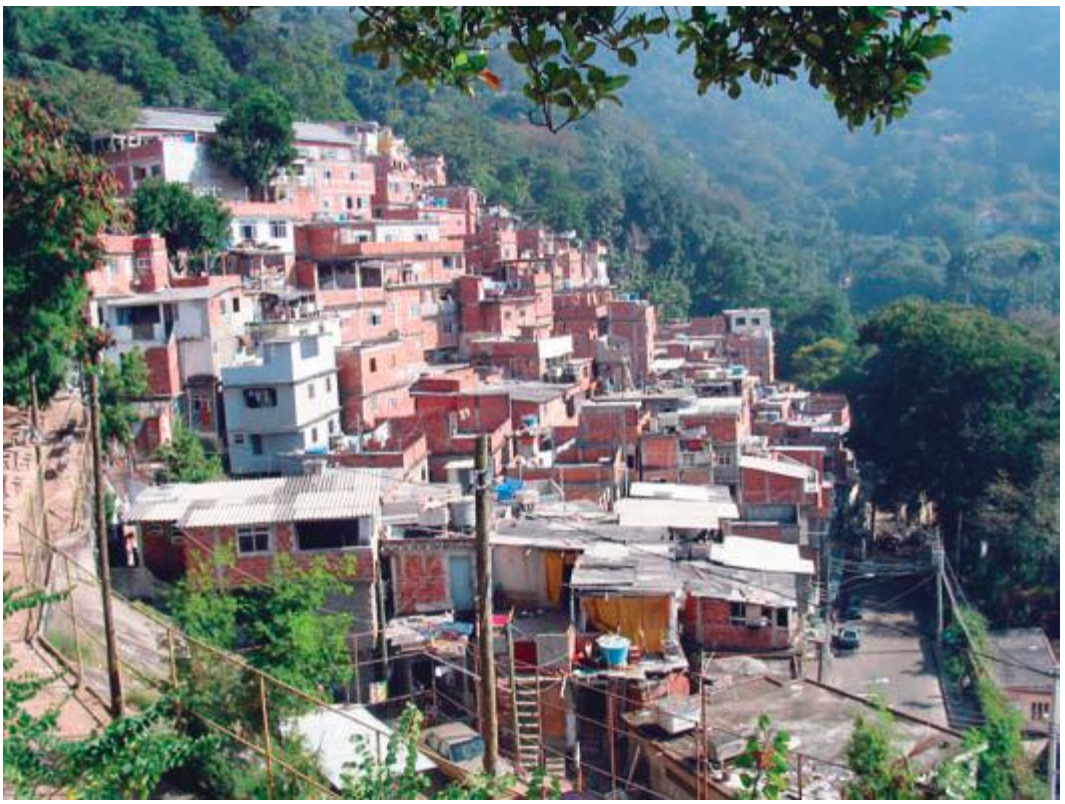
Table 5. Population growth in *favelas* of Rio de Janeiro, 1950–2000

YEAR	*FAVELA* POPULATION	*FAVELAS* AS PART OF RIO POPULATION (%)	ANNUAL CHANGE IN *FAVELA* POPULATION (%)	ANNUAL CHANGE IN RIO POPULATION (%)
1950	169,305	7.2	—	—
1960	337,412	10.2	9.9	4.1
1970	563,970	13.3	6.7	2.9
1980	628,170	12.3	1.1	2.0
1990	882,483	16.1	4.0	0.8
2000	1,092,958	18.7	2.4	0.7

Sources: Favela Tem Memória, http://www.favelatemmemoria.com.br/; Instituto Brasileiro de Geografia e Estatística, 1991 and 2000 censuses.

officially represented over a million residents, or nearly 20 percent of Rio's total population, by 2000 (table 5).

To the military regime (1964–1985), urban renewal would integrate *favelados* into society: "The first objective is the economic, social, moral, and hygienic reclaiming of the slum families . . . These



COURTESY OF BRIAN J. GODFREY

Figure 7. View of a small section of Rocinha, one of Brazil's largest *favelas*, with an official population of 56,313 in 2000, although unofficial estimates go as high as 150,000.

COURTESY OF BRIAN J. GODFREY

Figure 8. The view of a narrow and winding passageway in the hilly terrain of Rocinha, illustrating the improvised character of this informal settlement.

families then become completely integrated in the community, especially in the way that they live and think."[40] Such stereotypes were inaccurate, since in fact *favelados* were thoroughly integrated into the workforce and social institutions, if excluded from participation on equal terms. Behind the rhetoric, *favela* eradication concentrated on valuable real estate in the Zona Sul. Such urban renewal further marginalized the poor: a 1966 study found that relocated residents had to travel two hours each way on public transportation, costing one-third of their wages. Policies of *favela* removal waned as the military gradually allowed a return to democratic government with local and state elections after 1983, when political parties began to court the *favela* vote by promising infrastructure improvements and land security.[41] Large *favelas* such as Rocinha increasingly have been viewed as established urban neighborhoods, although disparities in service provision and drug-related violence still set them apart (figs. 7 and 8).[42]

Modernist programs of urban renewal struggled to provide sewage treatment for the growing city. In 1947, as the ninety-year contract with the City Improvements Company ended, the Federal District's new Water and Sewers Service (Serviço de Aguas e Esgotos) inherited 440 miles

(708 kilometers) of sewers and seven treatment stations. Service had deteriorated due to lack of investments, leaving the public sector to modernize and expand the dilapidated system. By 1960, as the Federal District moved to Brasília, Rio's network of sewers had grown to 710 miles (1,142 kilometers). The most significant subsequent accomplishment was the 1969–1975 construction of the Ipanema offshore discharge, which carried sewage 2.7 miles (4.3 kilometers) into the Atlantic Ocean. Serving one million city customers, peak capacity of the Ipanema system reached 424 cubic feet per second (12 cubic meters per second).[43]

The Sustainable City: Contemporary Programs of Environmental Justice (1985–present)

In contrast to the modernist city's emphasis on economic development, urban renewal, and *favela* removal, contemporary proposals for sustainability stress goals of economic development with social equity and environmental protection. Concern with the growth of inequality, pollution, and deforestation during the Brazilian "economic miracle" (1967–1973) gave rise to new institutions. In 1975 the state of Rio de Janeiro created the Environmental Engineering Foundation (FEEMA), one of the country's first environmental agencies. In 1985 a civilian was elected president, and subsequent democratic politics allowed nongovernmental groups to also become active in promoting environmental protection. For example, the Guanabara Bay Institute, founded in 1993, became one of the most active NGOs working "to study and resolve the environmental, social, and urban problems of the bay and its watershed."[44]

With democratization came new state programs aimed at sustainable development. In the wake of the 1992 "Earth Summit" in Rio, authorities launched in 1994 a massive, ten-year Guanabara Bay Cleanup Program (Programa de Despoluição da Baia de Guanabara) with a budget of US$793 million, funded largely by US$350 million from the Inter-American Development Bank and US$237 million from Japan's Overseas Economic Cooperation Fund. Plans called for a 90 percent reduction in industrial pollution by 1999, as well as drastic reductions in untreated domestic sewage discharges. About half of the funds were destined for residential sewage systems, including plans to connect twenty-nine *favelas,* along with other underserved areas around the bay. The most encouraging results came in better monitoring and reducing pollution from some 400 polluting industries—including textiles and food-processing plants, the naval and port facilities, shipyards, and several oil refineries. Yet results in the residential sector remained disappointing. Even in the informal communities served by sewerage, residents often could not pay sanitation fees and resisted domestic hookups; without sewers, wastewater drained into the surface runoff—often ending up as dark streaks on public beaches.[45]

Although the 1994–2004 cleanup program promised the bay's salvation, it soon lagged behind schedule and ultimately fell far short of expectations. Pollution continued from various sources. In 1975 and 2000, oil spills befouled the bay's beaches, marine life, and mangroves. Tankers often wash out their hulls at night in the bay. In addition to such port activities, continuing contamination comes from the discharge of domestic and industrial wastewater. Guanabara Bay received about 706 cubic feet per second (20 cubic meters per second) of wastewater in 2005: about 30 percent received primary treatment and only 15 percent benefited from further secondary

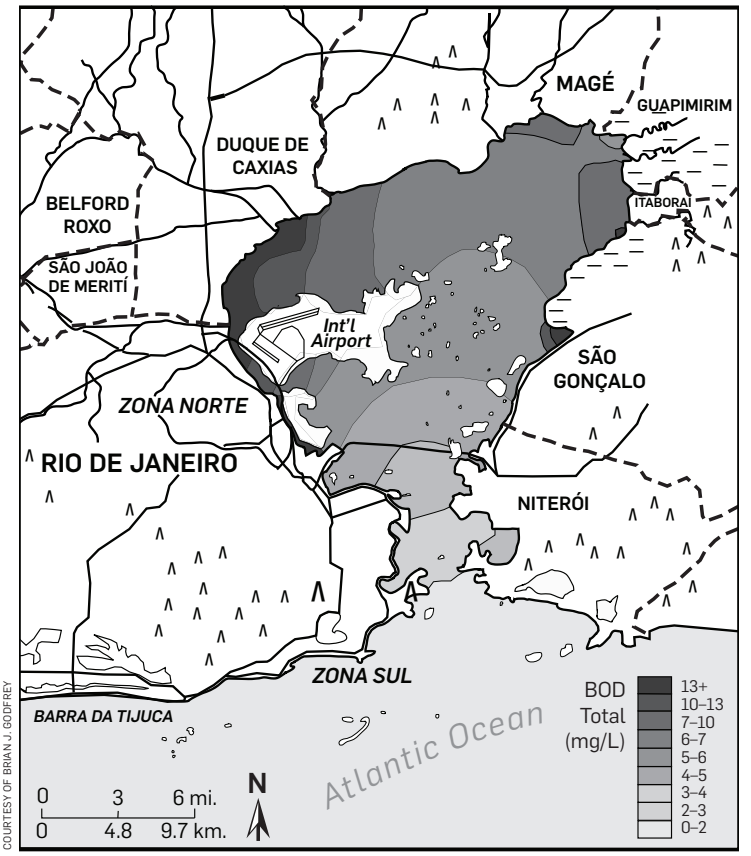


Figure 9. Water Quality in Guanabara Bay.

treatment. Industry now accounts for about 20 percent of the solid waste deposited in the bay, while the remainder stems largely from untreated residential wastewater. In 2005, at the end of the cleanup program, the bay still received some 881,849 pounds (400 tons) of untreated sewage, 141,095 pounds (64 tons) of industrial waste, 22,046 pounds (10 tons) of oil, and 661 pounds (300 kilograms) of heavy metals. Since 2005, Guanabara Bay's water quality continues to worsen and its beaches remain polluted. Given the bay's narrow entrance and shallow depths, it takes 200 days for the water to be fully renewed outside of deep shipping channels.[46] If such trends continue, the bay will suffer a dramatic reduction in size during coming decades, particularly in the heavily polluted northwestern parts (fig. 9).[47]

Besides the scenic, recreational, and economic impacts of pollution, the widespread lack of basic sanitation—especially sewerage and trash removal—endangers the health of *favelados* and other low-income residents. For example, infant mortality rates vary according to socioeconomic status. Rio's affluent Zona Sul had an infant mortality rate of 17 per 1,000 live births in 1986, while the rate was 45 per 1,000 in the Fluminense suburbs; among the 7,000 infants who died under one year of age in metropolitan Rio that year, only 230 (3.2 percent) occurred in the Zona Sul, while 2,764 (39 percent) were in the Baixada Fluminense. Clearly, the human toll of pollution remains enormous among the poor populations of urban Brazil.[48]

Despite such problems, there has been an encouraging shift in public discourse. At least rhetorically, sustainable development has emerged as the preferred policy framework. For example, concern for social and environmental justice has been evident in the Favela-Bairro (shantytown-neighborhood) program, administered by Rio de Janeiro with funding from the Inter-American Development Bank and the European Union. Begun in 1994, Favela-Bairro initially sought to upgrade infrastructures in thirty-eight *favelas.* The first phase sought to work with existing physical structures and social networks to improve water pipelines, sewage lines, and pathways. The program's second phase began in 2000, when Favela-Bairro II introduced job training, health clinics, and other forms of community development. One anthropologist emphasized: "There is a change in the attitude of officials . . . *Favelas* are there to stay; they cannot be eradicated or ignored."[49] Residents of the affected communities often have mixed reviews, as in Santa Marta after eleven years of the Favela-Bairro program: "To many of the community's residents the unfinished stairs and tram symbolized another era of the government's broken promises. Hundreds of power lines ran through the streets, the result of illegally tapping power. The urbanization program includes providing light and power, but like the other objectives, they have yet to be completed."[50]

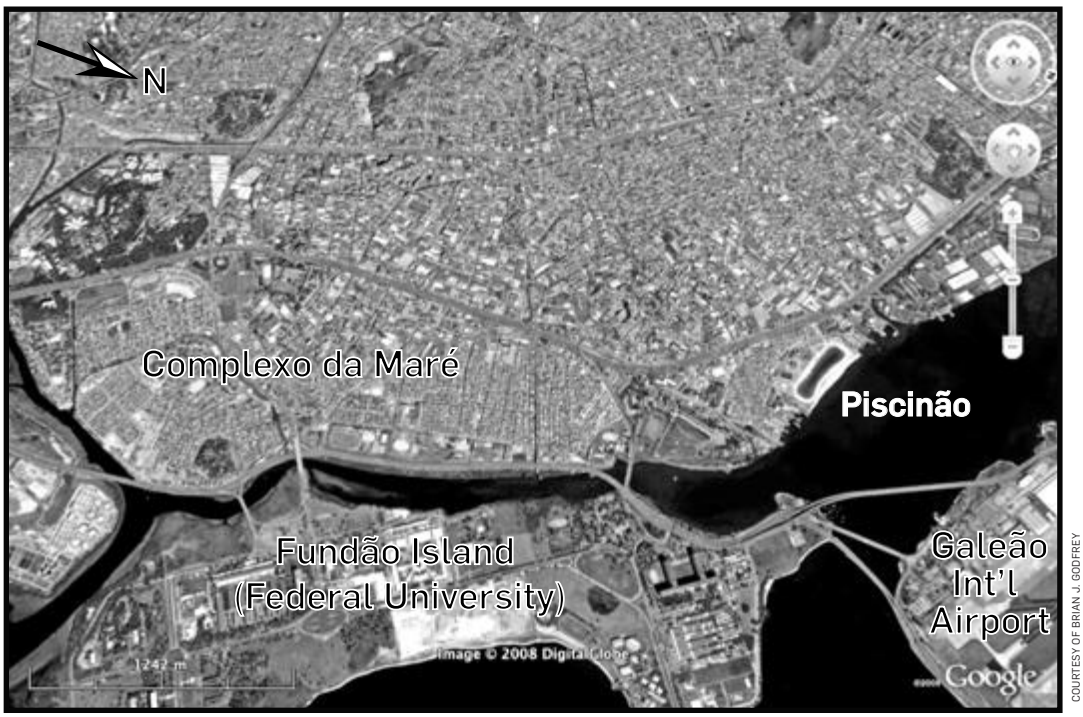
Critics assert that Favela-Bairro's limited infrastructural improvements, while largely ignoring social services, limit social mobility and segregate the city. Indeed, calls for *favela* removal have reemerged in recent years. Based in part on concern over drug-related violence and impacts on nearby property values, discussions have also relied on "environmentalist" arguments of developers, the Globo chain and other news media, state agencies, and community groups. With the rise of environmentalist discourse, conservation has become a new tool to displace or at least control the *favelas.* As Mario Fuks noted: "the declared aim is now not to 'socially integrate' the 'contaminated' sectors, but to protect or recover environmental resources. That is, the *favela* dweller is not seen simply as contaminated by the surrounding filth, but as a causative agent of pollution of the urban environment."[51]

This argument for *favela* removal stresses environmental degradation, including increased pollution and deforestation: removal of vegetation along with the dumping of trash and inadequate sewage allegedly make the *favelas* detrimental to the city's general sustainability, reduce the urban quality of life, and devalue potentially valuable property. Indeed, realestate interests have long argued that the prime locations made available through the *favela* eradication would allow construction of luxury condominiums, thus making the areas safer and more "sustainable." Interestingly, such arguments are not made with regard to *favelas* in the Zona Norte and the Fluminense Lowlands but to the affluent Zona Sul, pointing to social class and racial difference as implicit concerns. For example, after torrential rains led to widespread landslides and the collapse of scores of hillside shacks in February 1998, Rio's leading newspaper, *O Jornal do Brasil,* called *favelas* the city's "biggest urban problem":

> The city has 223 areas of risk, which every summer create floods and landslides. There are *favelas* like Rocinha in which urbanization is the only solution, such is the area occupied. But a *favela* like Santa Marta should be eradicated, as it poses an eternal threat to its residents. . . . Before being swallowed by *favelas,* Rio needs to revive old plans to urbanize *favelas* that are urbanizable, and to remove *favelas* that are removable.[52]

After the disastrous summer rains of 1988, the Reconstruct Rio Program (Programa Reconstrução Rio) funded infrastructure improvements with US$150 million loans from the World Bank and federal governments.[53] The underlying ecological problems, however, resisted easy resolution: deforestation and compaction of soil on Rio's hillsides have increased flooding during the summer storms. Fifty years ago, the city's forested hills would have absorbed roughly 70 percent of the rainfall, but today perhaps only 30 percent—leaving 70 percent of precipitation to run off into swollen streams and storm drains during heavy rains.[54] To call for *favela* removal, as did the *Jornal do Brasil,* effectively blamed the victims for causing environmental hazards. Such ideologically charged rhetoric reflects how the environment can be constituted as a social problem in an era of sustainable development. The new calls for *favela* removal reflect the increasing social polarization of contemporary Brazilian cities, given trends toward social exclusion, segregation, and inequality since the country's return to democracy.[55]

Certainly the expansion of informal communities, badly served by sewage treatment, complicates environmental protection. The most serious problems lie in the Zona Norte and northern suburbs. For example, the vast informal settlement at Complexo da Maré ("Slum of the Tide"), which arose on tidal flats after World War II, now releases a steady stream of raw sewage into the Cunha Canal. Emitting an acrid stench, this toxic stream empties into the shallow waters around Fundão Island (site of the Federal University) and Governador Island (site of the international



COURTESY OF BRIAN J. GODFREY

Figure 10. Complexo do Maré, showing the Piscinão, parts of the international airport, and the Federal University of Rio de Janeiro on Fundão Island.

airport). Fifty years ago the waters here were safe to swim in, but today they pose a threat to public health. During this period, the Maré Complex has become one of the city's largest *favelas,* with a population variously estimated at between 70,000 and 130,000.[56] Given the heavy local pollution, in 2002 the city opened a large artificial swimming pool, the Piscinão de Ramos, on the bayshore nearby. Despite reported problems with the maintenance of clean water, the pool has become popular among local residents, who are spared the long trip to southern beaches. Critics claim that this project keeps the poor away from the Zona Sul and thus maintains segregation by class and race (fig. 10).

Although mainstream media—newspapers, magazines, travel guides, and television newscasts—routinely depict horrific violence in Rio's *favelas* and stigmatize *favelados,* a significant contemporary counternarrative has emerged. Vibrant Afro-Brazilian samba, hip-hop, and funk subcultures emanate from *favelas* and strive to affirm the everyday struggles of residents. While television news, feature films, and documentaries often sensationalize *favelas,* some do depict life sympathetically. For example, the televised miniseries and subsequent feature film *City of Men (Cidade dos Homens),* tell fictionalized stories of young *favelados* who struggle to fulfill their aspirations amidst poverty, gangsters, and police corruption. *Favela Rising* documents the formation of the Grupo Cultural AfroReggae (AfroReggae Cultural Group), which used musical genres and dance—including hip-hop, rap, soul, percussion, and *capoeira*—to offer young *favelados* educational alternatives to drug traffic and gang violence in the violent district of Vigário Geral.[57] The term "Favela chic" suggests cultural currents that glorify and even commodify this image of urban poverty in music, fashion, and entertainment.

At the local level, community groups also have been active in representing *favelas* in positive terms. NGOs have developed innovative programs with websites offering oral histories, photography, statistics, and other materials to challenge the public's prejudices while enhancing pride of place among residents. For example, the Viva Favela program and the related website, *Favelas Have Heritage (Favela Tem Memória),* feature social histories and ongoing community issues. Another group, Favela Faces, focuses on "the problems facing *favela* residents, the ways in which they are working to overcome them, and how they have and continue to improve their communities with the limited resources available to them." While mentioning violence and drugs, depictions emphasize the circumstances forcing residents into the *favelas,* including the government's forced removals from affluent southern districts, as well as current community struggles. The Favela Painting program began in 2006 to improve the image of the *favelas* by enhancing and beautifying them: "In order for the lives of people living in the *favelas* to improve, the popular perception of their neighborhoods must improve. The core of our idea is to help this happen by painting an entire hillside *favela*." Since its inception in 2000, Catalytic Communities, or CatComm, has facilitated more than 130 community-based projects in nine countries. The program's founder, Theresa Williamson, traces her inspiration "to direct observation of positive things that were going on in our communities here in Rio de Janeiro." The work of such NGOs for positive social change at the community level, despite largely negative media representations of the urban poor, suggests the importance of community groups currently struggling to improve life in the *favelas*.[58]

Retrospect and Prospect for Guanabara Bay

Rio de Janeiro's mounting ecological problems have motivated the razing of hills, construction of drainage ditches, filling of wetlands, and landfills to extend the shoreline—starting in the seventeenth century and continuing with increasing environmental impacts. The massive urban renewal projects of the twentieth century intensified these long-term ecological processes with such ominous negative consequences as industrial and domestic pollution, socioeconomic inequity, and governmental negligence. The uneven distribution of environmental amenities and services, such as sewage treatment and potable water, coupled with continued erosion and runoff from the Guanabara watershed, threatens to reduce further the size and quality of the city's great bay. Environmental agencies and NGOs, while working to save Guanabara Bay, have been frustrated by a lack of funding and political influence. Despite marginal improvements, the bay's continued degradation reflects an unhealthy urban metabolism in need of corrective action.

The major contributing role of informal communities in the bay's degradation cannot be denied, but it raises politically charged debates about environmental causation, culpability, and social responsibility. Created by forces of regional migration, urbanization, and urban renewal, *favelas* arose as a way to house low-income populations whom the realestate market and government had not accommodated. In some ways, *favela* ecology has favored a healthy circular metabolism, since poverty has meant high levels of recycling, reliance on scavenged and used building materials, collective transport, sharing among households, and community collaboration. Undoubtedly, affluent districts are comparatively wasteful in their use of resources. What *favelas* have lacked are the vital services and infrastructures necessary to reduce levels of pollution. In this context, it seems cruelly ironic that elites have blamed *favelados* for a host of ills since the late nineteenth century. Arguments for *favela* removal have taken various forms over the decades, but consistently have attempted to relocate informal communities away from affluent sectors. This chapter has identified three major periods of public policy and political ecology:

The Sanitary City (1808–1920): Since the late colonial period's surge in urbanization, abysmal sanitation and tropical disease have given rise to public interventions, engineering projects, and urban reforms. As pollution became problematic, the British City Improvements Company began a long-term contract to provide sewerage in 1862. With the abolition of slavery in 1888 and the resulting rural-urban migration, elites emphasized the importance of "civilizing" the burgeoning poor and migrant classes. A prime strategy was to remove impoverished people of color from expanding downtowns and affluent districts. During and after the urban reforms of Pereira Passos from 1902 to 1906, images of rampant disease, hygienic problems, and social pathology among the city's poor and rural migrants justified their displacement from downtown tenement *cortiços* to peripheral shantytowns. The expanding northern districts, near Guanabara Bay, became the main recipients of the working classes.

The Modernist City (1920–1985): During the mid twentieth century, hygienic concerns gave way to greater stress on large-scale urban renewal projects and efforts to "integrate" the "marginal" *favela* populations into the socioeconomic mainstream. Given social biases of this period, the military regime aggressively sought to extricate *favelas* from the Zona Sul and to concentrate them in Rio's mushrooming northern and western zones. The poor were represented as criminal

and marginal elements of society, whom government policies sought to educate and if necessary remove. It was during this phase that spatial segregation became most pronounced and Rio's contemporary north-south divide emerged in stark relief, leaving large informal communities with inadequate urban services, concentrated largely around Guanabara Bay.

The Sustainable City (1985–Present): Since the end of the military regime, democratic politics and economic neoliberalism have given rise to concerns about sustainable development. On the one hand, the "sustainable city" has provided new forms of citizen participation, social organizing, and environmental advocacy. NGOs and community groups now work for social and environmental justice in ways that would have been unimaginable a generation ago. Unfortunately, the increasing levels of urban violence and growing awareness of environmental degradation also have given rise to a new set of rationales for *favela* exclusion. This ideological stance incorporates aspects of previous arguments, based on the unsightly buildings, lack of sanitation, danger of disease, fear of crime, and accusations of environmental ruin. Reflecting class prejudice and racial prejudice, these particular "environmentalist" contentions continue long-term efforts to promote urban segregation and distance the poor from wealthy communities. Although the Favela-Bairro program has marginally improved infrastructures and social services, the results have not remedied general problems of social immobility, lack of services, and violence that continue to trouble *favelas.*

Amid the long-term policy shifts, Guanabara Bay's degradation has continued largely unabated. Ambitious restoration plans have not succeeded, as witnessed by shortcomings of the 1994–2004 cleanup program. This unhealthy urban metabolism results largely from environmental injustice: the provision of vital urban services among the masses of the Zona Norte and its northern suburbs would do much to enhance Rio's general sustainability. The continuing devastation of Guanabara Bay threatens a vital scenic, recreational, and natural resource well worth saving. While governmental agencies and community groups have made significant efforts to address these problems, greater efforts are required to improve the prospects for social equity and ecological sustainability in this global megacity.

NOTES

Portuguese-English translations are my responsibility, unless otherwise noted. I thank John Browder, Colin Crawford, Maria Clara Dias, Carlos Alejandro Echeverria, Jurandyr Florentino Miguez, Maureen Hays-Mitchell, Rômulo S.R. Sampaio, Lise Sedrez, Igor Vojnovic, and Antoinette Winkler-Prins for their help at various stages of the research, presentation, writing, and editing of this chapter.

1. Coelho, *Baía de Guanabara*, 36–44; Eliane Canedo de Freitas Pinheiro, *Baía de Guanabara: Biografia de uma Paisagem* (Rio de Janeiro: Andrea Jakobsson Estúdio, 2005), 262; Instituto da Baía de Guanabara, Espelho d'Agua, http://www.portalbaiadeguanabara.org.br/portal/espelho1.asp.
2. Marlise Simons, Rio Journal: The Bay's a Thing of Beauty; Pity It's a Cesspool, *New York Times,* September 16, 1987; Pinheiro, *Baía de Guanabara,* 262.
3. Herman Melville, *White-Jacket; or, The World in a Man-of-War* (New York: Harper & Bros, 1850), http://www.melville.org/hmwjack.htm; Coelho, *Baía de Guanabara,* 19.
4. In 1973 the Brazilian National Institute of Historic and Artistic Patrimony (IPHAN) granted landmark status to Corcovado Mountain, five historic hills (Babilônia, Cara de Cão, Dois Irmãos, Pão de Açúcar [Sugarloaf], and Urca), and Tijuca National Park and Forest. Guanabara Bay, however, still does not figure in the list of 127 natural and cultural landmarks for

Rio de Janeiro (http://www.iphan.gov.br/).

5. Information Habitat, *The NGO Alternative Treaties from the Global Forum at Rio de Janeiro*, 1992.
6. Stephen M. Wheeler and Timothy Beatley, eds., *The Sustainable Urban Development Reader* (New York: Routledge, 2004), 59.
7. Robert Bullard, "People-of-Color Environmentalism," in Wheeler and Beatley, *Urban Sustainability Reader*, *Sustainable Urban Development Reader,* 144.
8. On informal communities elsewhere in the developing world, see J. Hardoy, D. Mitlin, and D. Satterthwaite, *Environmental Problems in an Urbanizing World,* 2001; and K. Pezzoli, *Human Settlements and Planning for Ecological Sustainability,* 1998.
9. Bullard, People-of-Color Environmentalism, 144.
10. Herbert Giarardet, The Metabolism of Cities, quoted in Wheeler and Beatley, *Urban Sustainability Reader*, 125–26.
11. See Gerard T. Koeppel, *Water for Gotham: A History* (Princeton, NJ: Princeton University Press, 2001); E. Ezcurra, M. Mazari-Hiriart, I. Pisanty, and A.G. Aguilar, *The Basin of Mexico: Critical Environmental Issues and Sustainability* (New York: United Nations Press, 1999); Margaret Keck, Water, Water, Everywhere, and Not a Drop to Drink: Land Use and Water Policy in São Paulo, Brazil, in *Livable Cities? Urban Struggles for Livelihood and Sustainability,* ed. Peter Evans (Berkeley: University of California Press, 2002), 162–94.
12. Coelho, *Baía de Guanabara,* 58–72. According to this source, in southeastern Brazil the "organized city" accounts for 55 percent of the urban population, "peripheral areas" for 30 percent, and *favelas* for the remaining 15 percent. In my view, such figures are at best approximations.
13. Selma Schmidt, Mais de 800 mil casas irregulares: Estudo mostra que cidade informal vem crescendo e domicílios sem licença Já São 40%, *O Globo,* Rio de Janeiro, January 13, 2002, 15.
14. Licia Valladares, A gênese da favela carioca, *Revista Brasileira de ciências socialis* 15:44 (2000); Maria Lais Pereira Silva, *Favelas* do Rio de Janeiro: Localização e expansão através do espaço urbano (1928–1964), in *Rio de Janeiro: Formas, movimentos, representações—Estudos de geografia histórica carioca,* ed. Maurício de Almeida Abreu (Rio de Janeiro: Da Fonseca Comunicação, 2005), 176–78.
15. Janice Perlman, *The Myth of Marginality: Urban Poverty and Politics in Rio de Janeiro* (Berkeley: University of California Press, 1976), 195.
16. Janice Perlman, The Metamorphosis of Marginality: Four Generations in the *Favelas* of Rio de Janeiro, *Annals of the American Academy of Political and Social Science* 606 (2006): 154–77. See also T. Caldeira, *City of Walls: Crime, Segregation, and Citizenship in São Paulo* (University of California Press, 2000); and Robert Gay, *Popular Organization and Democracy in Rio de Janeiro: A Tale of Two Favelas* (Philadelphia: Temple University Press, 1994).
17. Instituto Brasileiro de Geografia e Estatística, 2007, http://www.ibge.gov.br/home/; Favela tem Memoria, http://www.favelatemmemoria.com/br/.
18. Ibid.; Fundação CIDE—Centro de Informações e Dados do Rio de Janeiro, *Rio de Janeiro em Dados,* 2007, http://200.156.34.70/cide/index.php.
19. Favela Faces, A Tale of Two Cities: The Asphalt and the Favela, http://www.favelafaces.org/.
20. Coelho, *Baía de Guanabara,* 19–22.
21. P. James, Rio de Janeiro and São Paulo, *Geographical Review* 23:2 (1933): 274–75.
22. Patrick Wilcken, *Empire Adrift: The Portuguese Court in Rio de Janeiro, 1808–1821* (London: Bloomsbury, 2004), 175.
23. B. Godfrey, Spanish and Portuguese Colonial Cities in the Americas: A Historical-Geographical Approach to Urban Morphology, in *Cities and Urban Geography in Latin America,* ed. Vicent Ortells Chabrara, Robert B. Kent, and Javier Soriano Marti, 8–29 (Barcelona: Publicacions de la Universitat Jaime I, 2005); Brian J. Godfrey, Revisiting Rio de Janeiro and São Paulo, *Geographical Review* 89:1 (January 1999): 94–121; Brian J. Godfrey, Modernizing the Brazilian City, *Geographical Review* 81:1 (January 1991): 18–34.
24. Lise Sedrez, The Bay of All Beauties: State and Nature in Guanabara Bay, Rio de Janeiro, Brazil, 1875–1975, PhD diss., Stanford University, 2004, 84; for demographic figures, see E. Bradford Burns, *A History of Brazil* (New York: Columbia University Press, 1980), 144–51; Coelho, *Baía de Guanabara,* 46; Pinheiro, *Baía de Guanabara,* 252; Júlio César Pino, *Family and Favela: The Reproduction of Poverty in Rio de Janeiro* (Westport, CT: Greenwood Press, 1987), 40.
25. Christopher G. Boone, Streetcars and Politics in Rio de Janeiro: Private Enterprise versus Municipal Government in Mass Transit Delivery, 1903–1920, *Journal of Latin American Studies* 27 (May 1995): 343–65; Christopher G. Boone, Streetcars and Popular Protest in Rio de Janeiro: The Case of the Rio de Janeiro Tramway, Light and Power Company, 1903–1920, *Conference of Latin Americanist Geographers Yearbook* (October 1994): 49–57.

26. Isabelle Macedo Gomes, Dois séculos em busca de Uma Solução: Esgotos sanitários e meio ambiente na cidade do Rio de Janeiro, in Abreu, *Rio de Janeiro*, 56–71.
27. Valladares, A gênese da favela carioca; Silva, *Favelas* do Rio de Janeiro, 176–78; Fabio Soares and Yuri Soares, The Socio-Economic Impact of Favela-Bairro: What Do the Data Say? Office of Evaluation and Oversight (OVE), Inter-American Development Bank, 2005; Pino, *Family and Favela*, 37; Favela Faces, A Tale of Two Cities: The Asphalt and the Favela, http://www.favelafaces.org/.
28. Burns, *A History of Brazil,* 317.
29. Teresa A. Meade, *"Civilizing" Rio: Reform and Resistance in a Brazilian City, 1889–1930* (University Park: Penn State University Press, 1997), 28; Sedrez, The Bay of All Beauties, 85.
30. Jeffrey D. Needell, *A Tropical Belle Epoque: Elite Culture and Society in Turn-of-the-Century Rio de Janeiro* (New York: Cambridge University Press, 1987), 34.
31. Meade, *"Civilizing" Rio,* 110; Boone, Streetcars and Popular Protest, 49–57.
32. John Deal, Brazil Brazil, http://www.brazilbrazil.com/rio440y.html.
33. Quoted in Mauricio de Almeida Abreu, *Evolução Urbana do Rio de Janeiro* (Rio de Janeiro, IPLANRIO/ZAHAR, 1987), 89.
34. Ibid., 76; David Underwood, *Oscar Niemeyer and Brazilian Free-Form Modernism* (New York: George Braziller, 1994).
35. Pino, *Family and Favela,* 42.
36. Valladares, A gênese da favela carioca, 23–24; Pino, *Family and Favela,* 44; Favela tem Memoria, http://www.favelatemmemoria.com/br/.
37. Pinheiro, *Baía de Guanabara,* 242.
38. Perlman, *The Myth of Marginality*, 200–2.
39. Gay, *Popular Organization,* 19.
40. Quoted in Soares and Soares, The Socio-Economic Impact of Favela-Bairro, 5.
41. Gay, *Popular Organization;* Perlman, *The Myth of Marginality*.
42. The Favela Tem Memória website indicates that Rocinha and other selected *favelas* have glaring disparities in socioeconomic status (income, employment, and literacy) and service provision (trash collection, sewage, and water provision) compared to citywide averages. See http://www.favelatemmemoria.com.br/.
43. Coelho, *Baía de Guanabara,* 57.
44. Instituto da Baía de Guanabara, http://www.portalbaiadeguanabara.com.br/sitenovo/.
45. Banco Interamericano de Desenvolvimento. *Relatório Final de Projeto: Programa de Saneamento Básico da Bacia da Baía da Guanabara (PDBG),* 1–39;Coelho, *Baía de Guanabara,* 68–70.
46. Coelho, Baía de Guanabara, 62–68; Sedrez, The Bay of All Beauties, 249–51; Tom Phillips, Sewage, Algae, and Rubbish Stain the Once-Pristine White Beaches of Rio, *Guardian International,* April 28, 2007, 28; Pinheiro, *Baía de Guanabara,* 263; Simons, Rio Journal: The Bay's a Thing of Beauty.
47. Map adapted from the Instituto Baía de Guanabara, based on tests of biochemical oxygen demand (BOD) in February 2000; concentrations of over eight milligrams per liter, considered highly polluted, encompass much of the bay's northern and western quadrants.
48. Coelho, *Baía de Guanabara,* 72.
49. Susie Seefelt Lesieutre, From Favela to Bairro: Rio's Neighborhoods in Transition, *ReVista-Harvard Review of Latin America* (winter 2001), http://drclas.fas.harvard.edu/revista/articles/view/530.
50. Kelly E. Graham, The Asphalt and the Favela: A Critical Examination of Contemporary Urban Segregation, senior thesis, Vassar College, 2007, 38–39.
51. Mario Fuks, Environmental Litigation in Rio de Janeiro: Shaping Frames for a New Social Problem, *International Journal of Urban and Regional Research* 22:3 (September 1998): 394–408.
52. Cabeça de Avestruz, *Jornal do Brasil* (February 13, 1998): 8.
53. Coelho, *Baía de Guanabara,* 60.
54. Uma Cidade Despreparada, *O Globo,* February 21, 1998, 12.
55. Perlman, The Metamorphosis of Marginality, 154–77; Caldeira, *City of Walls.*
56. Tom Phillips, Sewage, Algae, and Rubbish Stain the Once-Pristine White Beaches of Rio, *Guardian International,* April 28, 2007, 28; Viva Rio/Viva Favela, Retrato Matemático, 2008, http://www.favelatemmemoria.com.br/. The official Brazilian census indicates that Maré's population in 2000 was 69,851, but unofficial estimates put the figure much higher.
57. See the official film websites at http://www.palmpictures.com/film/city-of-men.php,http://cidadedoshomens.globo.com/, and http://www.favelarising.com/index.html.
58. See the diverse organization websites: http://www.vivafavela.com.br/; http://www.favelatemmemoria.com.br/; http://www.favelafaces.org/; http://www.favelapainting.com/; and http://www.comcat.org/novo/sobreacomcat.asp.

REFERENCES

Abreu, Mauricio de Almeida. *Evolução Urbana do Rio de Janeiro.* Rio de Janeiro: IPLANRIO/ZAHAR, 1987.

Banco Interamericano de Desenvolvimento. *Relatório Final de Projeto: Programa de Saneamento Básico da Bacia da Baía da Guanabara (PDBG).* Brazil, 2006.

Boone, Christopher G. Streetcars and Politics in Rio de Janeiro: Private Enterprise versus Municipal Government in Mass Transit Delivery, 1903–1920. *Journal of Latin American Studies* 27 (May 1995): 343–65.

———. Streetcars and Popular Protest in Rio de Janeiro: The Case of the Rio de Janeiro Tramway, Light and Power Company, 1903–1920. *Conference of Latin Americanist Geographers Yearbook* (October 1994): 49–57.

Bullard, Robert. People-of-Color Environmentalism. Reprinted in *The Sustainable Urban Development Reader,* ed. Stephen M. Wheeler and Timothy Beatley, 143–49. New York: Routledge, 2004.

Burns, E. Bradford. *A History of Brazil.* New York: Columbia University Press, 1980.

Caldeira, T. *City of Walls: Crime, Segregation, and Citizenship in São Paulo.* University of California Press, 2000.

Coelho, Victor. *Baía de Guanabara: Uma História de Agressão Ambiental.* Rio de Janeiro: Casa da Palavra, 2007.

Deal, John. *Brazil Brazil.* 2008. http://www.brazilbrazil.com/rio440y.html.

Ezcurra, E., M. Mazari-Hiriart, I. Pisanty, and A.G. Aguilar. *The Basin of Mexico: Critical Environmental Issues and Sustainability.* New York: United Nations Press, 1999.

Favela Faces. A Tale of Two Cities: The Asphalt and the *Favela.* http://www.favelafaces.org/intro_eng.html.

Figueiredo, L.H.M. *Problemas Ambientais Globais: Conceitos Fundamentais e Instrumentos de Análise Ambiental.* Programa de Despoluição da Baía de Guanabara. Capacitação em Educação para a Gestão Ambiental. Rio de Janeiro: CEPUERJ/UERJ, 1997.

Fuks, Mario. Environmental Litigation in Rio de Janeiro: Shaping Frames for a New Social Problem. *International Journal of Urban and Regional Research* 22:3 (1998): 394–408.

Fundação CIDE (Centro de Informações e Dados do Rio de Janeiro). *Rio de Janeiro em Dados.*2007. http://200.156.34.70/cide/index.php.

Gay, Robert. *Popular Organization and Democracy in Rio de Janeiro: A Tale of Two Favelas.* Philadelphia: Temple University Press, 1994.

Giarardet, Herbert. The Metabolism of Cities. Quoted in *Urban Sustainability Reader,* ed. Stephen M. Wheeler and Timothy Beatley, 125–32. New York: Routledge, 2004.

Godfrey, Brian J. Modernizing the Brazilian City. *Geographical Review* 81:1 (January 1991): 18–34.

———. Revisiting Rio de Janeiro and São Paulo. *Geographical Review* 89:1 (January 1999): 94–121.

———. Spanish and Portuguese Colonial Cities in the Americas: A Historical-Geographical Approach to Urban Morphology. In *Cities and Urban Geography in Latin America,* ed. Vicent Ortells Chabrara, Robert B. Kent, and Javier Soriano Marti, 8–29. Barcelona: Publicacions de la Universitat Jaime I, 2005.

Graham, Kelly E. The Asphalt and the Favela: A Critical Examination of Contemporary Urban Segregation. Senior thesis, Vassar College, 2007.

Gomes, Isabelle Macedo. Dois Séculos em Busca de Uma Solução: Esgotos Sanitários e Meio Ambiente na Cidade do Rio de Janeiro. In *Rio de Janeiro: Formas, Movimentos, Representações—Estudos de Geografia Histórica Carioca,* ed. Maurício de Almeida Abreu, 56–71. Rio de Janeiro, RJ: Da Fonseca Comunicação, 2005.

Gouvêa, Ronaldo Guimarães. *A Questão Metropolitana no Brasil.* Rio de Janeiro: Editoria Fundação Getúlio Vargas, 2005.

Hardoy, Jorge E. Two Thousand Years of Latin American Urbanization. In *Urbanization in Latin America: Approaches and Issues,* ed. J. E. Hardoy, 3–56. Garden City, NY: Anchor Books, 1975.

Hardoy, Jorge, Diana Mitlin, and David Satterthwaite. *Environmental Problems in an Urbanizing World: Finding Solutions in Africa, Asia, and Latin America.* Sterling, VA: Earthscan, 2001.

Information Habitat. Concerning Guanabara Bay: Humankind's Heritage. *The NGO Alternative Treaties from the Global Forum at Rio de Janeiro.* 1992. http://habitat.igc.org/treaties/at-34.htm.

Instituto Brasileiro de Geografia e Estatística (IBGE). 2007. http://www.ibge.gov.br/.

Instituto da Baía de Guanabara. 2007. http://www.portalbaiadeguanabara.com.br/.

IPHAN (National Institute of Historic and Artistic Patrimony). 2008. http://www.iphan.gov.br/.

James, Preston E. Rio de Janeiro and São Paulo. *Geographical Review* 23:2 (1933): 271–98.

Keck, Margaret. Water, Water, Everywhere, and Not a Drop to Drink: Land Use and Water Policy in São Paulo, Brazil. In *Livable Cities? Urban Struggles for Livelihood and Sustainability,* ed. Peter Evans, 162–94. Berkeley: University of California Press,

2002.

Koeppel, Gerard T. *Water for Gotham: A History.* Princeton, NJ: Princeton University Press, 2001.

Lesieutre, Susie Seefelt. From Favela to Bairro: Rio's Neighborhoods in Transition. *ReVista: Harvard Review of Latin America* (winter 2001). http://drclas.fas.harvard.edu/revista/articles/view/530.

Meade, Teresa A. *"Civilizing" Rio: Reform and Resistance in a Brazilian City, 1889–1930.* University Park: Pennsylvania State University Press, 1997.

Melville, Herman. *White-Jacket; or, The World in a Man-of-War.* New York: Harper & Brothers, 1850. http://www.melville.org/hmwjack.htm.

Needell, Jeffrey D. *A Tropical Belle Epoque: Elite Culture and Society in Turn-of-the-Century Rio de Janeiro.* New York: Cambridge University Press, 1987.

Perlman, Janice. The Metamorphosis of Marginality: Four Generations in the *Favelas* of Rio de Janeiro. *Annals of the American Academy of Political and Social Science* 606 (2006): 154–77.

———. *The Myth of Marginality: Urban Poverty and Politics in Rio de Janeiro.* Berkeley: University of California Press, 1976.

Pezzoli, Keith. *Human Settlements and Planning for Ecological Sustainability: The Case of Mexico City.* Cambridge: MIT Press, 1998.

Phillips, Tom. Sewage, Algae, and Rubbish Stain the Once-Pristine White Beaches of Rio. *Guardian International,* April 28, 2007, 28.

Pinheiro, Eliane Canedo de Freitas. *Baía de Guanabara: Biografia de uma Paisagem.* Rio de Janeiro: Andrea Jakobsson Estúdio, 2005.

Pino, Júlio César. *Family and Favela: The Reproduction of Poverty in Rio de Janeiro.* Westport, CT: Greenwood Press, 1987.

Schmidt, Selma. Mais de 800 Mil Casas Irregulares: Estudo Mostra Que Cidade Informal Vem Crescendo e Domicílios Sem Licença Já São 40%. *O Globo,* Rio de Janeiro, January 13, 2002, 15.

Sedrez, Lise. The Bay of All Beauties: State and Nature in Guanabara Bay, Rio de Janeiro, Brazil, 1875–1975. PhD diss., Stanford University, 2004.

Silva, Maria Lais Pereira. *Favelas* do Rio de Janeiro: Localização e Expansão Através do Espaço Urbano (1928–1964). In *Rio de Janeiro: Formas, Movimentos, Representações—Estudos de Geografia Histórica Carioca,* ed. Maurício de Almeida Abreu, 176–201. Rio de Janeiro: Da Fonseca Comunicação, 2005.

Simons, Marlise. Rio Journal: The Bay's a Thing of Beauty; Pity It's a Cesspool. *New York Times,* September 16, 1987.

Soares, Fabio, and Yuri Soares. The Socio-Economic Impact of Favela-Bairro: What Do the Data Say? Office of Evaluation and Oversight (OVE), Inter-American Development Bank, 2005.

Underwood, David. *Oscar Niemeyer and Brazilian Free-Form Modernism.* New York: George Braziller, 1994.

United Nations Development Program (UNDP). *Atlas do Desenvolvimento Humano do Brasil—2003.* 2003. http://www.pnud.org.br/home/.

Valladares, Licia. A gênese da Favela carioca. *Revista Brasileira de ciências socialis* 15:44 (2000): 5–34.

Viva Rio/Viva Favela. Retrato Matemático. 2008. http://www.favelatemmemoria.com.br/.

Wheeler, Stephen M., and Timothy Beatley, eds. *The Sustainable Urban Development Reader.* New York: Routledge, 2004.

Wilcken, Patrick. *Empire Adrift: The Portuguese Court in Rio de Janeiro, 1808–1821.* London: Bloomsbury, 2004.