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Mobility, Livability, and Sustainability

Balancing Economics, Ecology, and Equity

The UN General Assembly voted overwhelmingly in July 2022 to declare that the ability to live in "a clean, healthy and sustainable environment" is a universal human right. Although cities or settlements were not mentioned in the declaration, it is clear that cities must play a central role in this process. The declaration strikes at the heart of what cities hope to provide but often fail to do so. Among the great challenges of urban development and city building is to create opportunities and conditions such that residents can live in a home within a clean and healthy environment and allow them and the goods on which they depend to move about the city in a way that promotes economic advancement and equitable well-being, while also being resilient to environmental and economic shocks. And now in the context of the climate crisis, promote low- to zero-carbon lifestyles. These conditions in the past decade have been linked together under the rubric of urban sustainability.

Central to this ambition is a balance of factors that simultaneously (1) enhance mobility and limit congestion, (2) promote densities where healthy environments are maintained yet also restrain urban sprawl, (3) utilize, maintain, and enhance ecosystem services, and (4) allow all residents to at least live in affordable and accessible housing. This requires action to address several of the prominent problems that befall cities. Promoting these conditions forces cities to integrate axioms of urban sustainability that include social and environmental equity, economic development, and ecosystem integrity. This chapter is focused on examining how cities have dealt (or not) with this simultaneity of urban sustainability stresses and crises and the extent to which solutions presented have led to significant transitions and transformations.

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10.1 Background

Urban settlement has long been associated with the great tension between convenience and congestion, quality of life and environmental degradation, and access and exclusion. The focus of urban sustainability has been to define those qualities that promote well-being and livability while creating conditions for equity, economic development, and environmental enhancement for all. Urban sustainability can be promoted through shifts in how cities are built and rebuilt, how they are governed, and how their residents make everyday decisions on how they live their lives and the choices open to them.

As the form and shape of cities have been reimagined and reengineered in the past 150 years, there also has come fantastic urban growth. In 1900, approximately 300 million people lived in cities (~15% of the global population then 1.6 billion), and in the year 2000, the global urban population was estimated to be 2.9 billion, or almost 50% of the global population. By the year 2050, the United Nations currently estimates that the number of urban inhabitants will be between 6 and 7 billion. The urban transition and urbanization process have spread around the world. Coupled with this process has come terrible inequities in living standards and housing. Substandard housing is often described by the broad term of "slum". Policies that promote and sustain the world's slums are embedded in economic and political marginalization and racial and ethnic prejudice. How to address substandard housing in cities is one of the most significant stresses and crises facing cities. Currently, approximately 1 billion or ~23.9% of all city dwellers globally live in slums.[1]

Cities are places of high population density and as a result are often places that are difficult to move around in. Transiting to the central areas of a city can be time-consuming and when extremely difficult will limit commerce and diminish the quality of life for residents. In the nineteenth century, several solutions were presented as ways to address the problem. These solutions centered around restructuring urban form and promoting more effective modes of

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[1] The UN-HABITAT defines

> a slum household as a group of individuals living under the same roof in an urban area who lack one or more of the following: (1) Durable housing of a permanent nature that protects against extreme climate conditions. (2) Sufficient living space which means not more than three people sharing the same room. (3) Easy access to safe water in sufficient amounts at an affordable price. (4) Access to adequate sanitation in the form of a private or public toilet shared by a reasonable number of people. (5) Security of tenure that prevents forced evictions.

It also should be recognized that by this definition, substandard housing present in wealthier regions of world is not included this definition. The marginal housing present in and around many US cities and other similar wealthy countries is included in these numbers.

movement. The new urban forms and modes of transit worked synergistically. Starting in the mid-nineteenth century, new modes of urban transport to supplement locomotion by foot or horse began to appear. The trolley car, street car, railroad, and eventually the automobile in the early twentieth century transformed the urban form, and especially in the United States, Australia, and a few other countries. These modes of transit allowed residents and goods to travel greater distances, enabling movement out to the hinterlands at the cities' edge. At the same time, cities were restructured with straight broad boulevards and grid street patterns to promote mobility and commerce. In these situations, highly dense pockets were cut through by new transport corridors and often lost population as the city edges were urbanized and cities became more widespread and sprawling. By the late twentieth century, this type of urban sprawl had brought a series of negative environmental consequences and a variety of stresses for cities to face including increased air and water pollution and loss of nearby farmland and natural areas that provided food stuffs and ecosystem services.

As cities grapple with the demands of promoting mobility, avoiding wasteful and inefficient sprawl, and fulfilling the right to adequate housing, they also attempt to ensure that they do not destroy or so diminish the local agricultural resources and ecosystem services. Ecosystem services, including those that provide drinking water, construction material, other natural resources such as fishery products, and recreation, are critical to the function and sustainability of a city. Their importance is highlighted in Von Thunen's nineteenth-century model of land uses in and around a city (see Chapter 3). The abstract model presents rings of economic activity with each successive ring associated with a different uses and processes. The second ring just beyond the intensive farming and dairy ring is dedicated to forests as a critical source of fuel and other products. While the development of extensive supply chains and regional and global trade networks has replaced local resource requirements, the importance of locally produced materials and urban-based circular economies in recent years has spotlighted the importance of local ecosystem services and agricultural production.

While the concept of urban sustainability focuses on achieving and growing the integration between environmental quality, economic growth, and social equity, the implications of its implementation and practice force a series of additional challenges associated with the structure of cities, their function, and the interaction between cities and their residents and between the residents themselves. A key facet of this is the appreciation of cities as interlocking and codependent systems and the definition of comprehensive and coherent system-level function metrics. Widely agreed-upon metrics are critical for the civil discourse and managerial aspects of urban sustainability. For example, the UN

promulgated Sustainable Development Goals, generally, and with its Urban Goal, #11 includes a series of now-established metrics for urban sustainability.[2]

The transition to urban sustainability involves the adjustment of the city's systems and of those that are external on which they depend. The sequences of steps to move toward greater or lesser sustainability are often described through the narrative of pathways. The term pathways can be defined in a myriad of ways and is heavily utilized in the international environmental assessment process, specifically within the Intergovernmental Panel on Climate Change (IPCC). The IPCC 1.5°C Special Report, which heavily focuses on sustainability pathways, defines them as: "the temporal evolution of natural and/or *human systems* toward a future state. Pathway concepts range from sets of quantitative and qualitative *scenarios* or *narratives* of potential futures to solution-oriented decision-making processes to achieve desirable societal goals. Pathway approaches typically focus on biophysical, techno-economic, and/or socio-behavioral trajectories and involve various dynamics, goals and actors across different scales" (IPCC 2018).

Sustainability pathways by definition involve recommendations and adjustments to the pattern of resource demand, use, and production. These shifts can be instituted through policy adjustments and associated market forces and can include incentives as well as disincentives or penalties, or outright restrictions. Urban sustainability actions have experienced a wide range of support from strong to minimal or none. In many cases, environmental sustainability efforts have been controversial and often opposed, such as in the case of eliminating the use of plastic bags at stores and congestion price surcharges for those bringing private automobiles into downtown areas. The question of how to implement sustainable development practice into a city or neighborhood speaks to the question of the "right to city" and what power residents have to define their own everyday life and what they consider important to their quality of life (Merrifield 2011). The transition to urban sustainability will be uneven and not without conflict. It is increasingly recognized that if the practice and movement are to be successful, it will need to be based on the conditions of equity, transparency, and co-production.

10.2 Case Studies

The chapter includes an examination of four cities that have struggled with these challenges and to one degree or another have addressed them. These cities

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[2] See https://sdgs.un.org/goals/goal11 for more discussion of UN SDG11.

highlight the process of integrating mobility and settlement within the broader frame of urban sustainability. The cities include Miami, US; Oslo, Norway; St. Georges, Grenada; and Shenzhen, China.

10.2.1 Miami, US

The city of Miami's short history is one of massive urban growth, pressing environmental challenges, and harsh social and economic divisions and inequities. The city's nickname is the "Magic City" because even with all these issues, it seems to grow, like magic. The city was founded in 1896 with the advent of a railroad built by a northern industrialist focused on building a railway from north Florida to Key West, which then was a strategic but remote US outpost 265 kilometers (165 miles) southwest of Miami at the southern end of the islands that make up the Florida Keys. In 1900, the population of the city was approximately 1,681; by 1960, 291,688; and by 2020, 442,241. The city of Miami since 1957 has been administratively linked to Dade County in a two-tier governance system. The Miami-Dade County population is just over 2.7 million (in 2020), while the US Census-designated Miami Metropolitan Region, which includes Dade, Broward, and Palm Beach counties, known as the Gold Coast, had a 2020 population of approximately 6.2 million residents.

The landscape of the region is almost without any relief and very low lying, with about 25% of the county's land less than 1 meter above sea level (Molinaroli et al. 2019). The settlement of Miami began on the slightly elevated ridgelines and barrier islands at the ocean front.

The city of Miami and surrounding urbanized land area grew rapidly in the twentieth century through the dramatic transformation of the local environment by converting "land into water and land into water."[3] A complex and integrated set of canals and water impounds allowed land to be drained for settlement and contained water for agricultural use and flood control. The advent of inexpensive automobile travel in the first half of the twentieth century and then airplanes in the second half of the century made the southern peninsula of Florida much more accessible to the population centers of the US. The development of effective and inexpensive air conditioning also made the region much more habitable, where the humid subtropical climate can make the summer nighttime temperatures especially uncomfortable. The application of these strategies opened the area for the rapid increase in the number of permanent residents and vacationers.

[3] First part of the title of Blake's (1980) seminal work on the history of water management in Florida.

10.2.1.1 Stress

The glittering skyline of Miami masks a series of profound stresses that underlie the city's past, present, and future. The last several decades have brought these stresses to exposure as the pressure of dramatic and rapid development is revealed and recognized. By the early 1990s, the narrative of the region was one of unsustainability. The 1970s and 1980s had evolved with significant ethnic tensions and racial strife, often becoming widespread and tragic with massive police intervention. A series of urban riots and uprisings took place in the city from the late 1960s through the 1980s. An especially devastating multi-day rebellion with extensive looting and arson followed the trial of white police officers found nonguilty of murdering a local Black motorist (Grove et al. 2020). The case was widely recognized as a miscarriage of justice and abetting the racism and abuse of the local police. The immense water control projects and agricultural and urban water withdrawals caused large-scale ecological disruption to the region's Everglades – a site of globally significant biodiversity. Rapid urbanization brought mobility congestion and environmental quality declines and enormous income inequities that added to social strife and racial conflict and tensions (Grove et al. 2020). Local newspaper columnist and author, Carl Hiaasen, in a series of popular satirical books, presented the region and its residents as often unhinged and always heading toward crisis. Prominent social scientists described Miami as the "city on the edge" (Portes and Stepick 1993).

In response, stakeholders and reformers in the Miami region began a series of efforts to address these stresses. A comprehensive plan was put together to promote ecological sustainability in the Everglades (Harwell et al. 1996), elements of which were integrated into the Comprehensive Everglades Restoration Plan, which is a massive, several-decade, multi-agency effort led by the State of Florida and the US Army Corps of Engineers. Recognition of the social inequities and ethnic/racial divisions enabled more dialogue across the various communities. And even a free mass transit monorail system through downtown Miami, a stretch of just 7 kilometers, was started in 1986 and later expanded in 1994, in an attempt to promote mobility and reduce automobile dependency. The city and region also benefited from the long tradition of planning and regional management by the state, which was effective for formulating comprehensive regional water planning and land use policies as well as a regional consciousness. In the 1970s, the state of Florida was at the forefront of land use and environmental regional planning and management efforts. The legacy of these traditions has remained even though the politics in the state has become more conservative in the past several decades.

10.2.1.2 Crisis

Stark climate projections, increasingly evident climate change impacts in the region, and significant, yet not worse-case scenario near hurricane misses, (particularly in 2004), dramatically accelerated the narrative of how climate change was understood in 2000s metropolitan Miami. Political leadership in the region, bucking the trend of climate denialism in the state, formed the Southeast Florida Regional Climate Compact in 2010 as a partnership between Broward, Miami-Dade, Monroe, and Palm Beach Counties to work collaboratively through multi-level government partners, the private sector, community groups, and scientists to reduce regional greenhouse gas (GHG) emissions, implement adaptation strategies, and promote building in a climate-resilient fashion while ensuring that the region continued to grow economically. The Compact's work was designed to focus on three overarching objectives: (1) share regional tools and knowledge, (2) increase public support and political will, and (3) coordinate action. The threat of sea level rise (SLR) rose significantly during this time as advanced climate projections presented ever more concerning future flooding scenarios. In 2012, the Compact produced a Regional Climate Action Plan with 110 key action items related to climate action and urban sustainability more broadly. While ambitious, the early initiatives to address the crisis had begun at the city and county levels and had limited direct political or financial support at the state or national levels, except for extensive beach renourishment projects (Molinaroli et al. 2019).

It had become clear that Miami was among the world's leading cities, if not the lead city, with respect to assets exposed to SLR, and among the top 10 with respect to population at risk (Hallegatte 2013). By the end of the 2010s, climate change was increasingly being woven together with local stresses into a storm of interconnected problems. A recent round of research papers and reports has brought out a clear connection between the endemic social, economic, and environmental problems of Miami and climate change. The work highlights how climate change impacts whether it be increased flood potential (e.g., Czajkowski et al. 2018), SLR-driven relocation and gentrification (Keenan et al. 2018), or extreme heating will bring a series of first-order and second-order impacts. The intensity of discussion regarding climate change has further increased with more compelling evidence of and experience with sunny day (or nuisance) flooding coming with exceptionally high tides (i.e., King Tides), harsh projections of loss and damage estimates of a major direct hit hurricane,[4] and growing concern about summer extreme heat (First Street

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[4] The 1926 hurricane is the storm of record in the Miami area. If that same intensity storm hit the region today, it could cause up to 500 billion USD of loss and damage (Molinaroli et al. 2019).

Foundation 2022). In late 2022, Miami-Dade launched an aggressive extreme heat action plan and mitigation effort (Miami-Dade 2022).

10.2.1.3 Transition

Taken together these threats have pressed the discourse of climate action and sustainability to heightened new levels by the end of the 2010s. Frequent public meetings, workshops, and media events have significantly raised these issues. Within the region generally and Miami-Dade specifically, initial activities have included setting a range of planning goals but with little tangible implementation. Much of the local response is dominated by a wait-and-see, low-regrets incremental approach. Local governments were and continue to be hesitant to "overadapt" because of the scientific uncertainties regarding future climate change and the effectiveness of adaptation strategies. An exception is the wealthy and progressive City of Miami Beach (separate from the City of Miami), which started efforts to elevate some of its streets, set up flood pump systems, and approve new flooding-relevant construction regulations.

The costs of climate action and sustainability efforts in Miami are massive. Adaptation costs for addressing SLR flooding and storm surge flooding alone could be $51 billion and $130 billion. The City of Miami voters approved a $400 million general obligation bond (the Miami Forever bond), of which half of it is earmarked for SLR mitigation and flood prevention projects. But this is a fraction of the total resources needed. Without direct support from state or federal sources, any meaningful progress toward the broader climate action goals will be impossible.

10.2.1.4 Transformation

The multiple strands of growing concern about the sustainability of Southeast Florida coalesced in the 2010s and helped a broad coalition of stakeholders press for an integrated planning process to address the concurrent challenges. While this transition has taken place, any prospect of extensive or long-term action is limited. This transition in the Miami metropolitan region can be described as incomplete and the transformation that could emerge from it is not possible at this time. The broad goal of this transformation would be to link together climate mitigation, climate adaptation, and development goals within a framework of sustainability for all residents and interests in the region. Right now, the key limiting factor is financing; however, the debate during these early phases of the transition has revealed several other structural impediments to a broader transformation. These restructuring of the tax regimes in the region to promote more sustainable development; adjustment of the existing water control infrastructure to be more sensitive to climate change conditions;

and perhaps most profound, meaningfully attempt to address the underlying racial and social inequities that consistently disrupt opportunities for profound social and environmental change.

Part of the financing challenge revolves around the fact that local municipalities have extremely limited revenue-generating capacity coupled with the condition that the state of Florida does not have an income tax. Because the state lacks this basic source of tax revenue, local municipalities are highly dependent on property taxes to finance government services and as a result are reliant on continued large-scale development of high-value properties, which are most often in high-value and highly vulnerable sites near or at the water edge (Conyers et al. 2019).

South Florida is a human-dominated and constructed landscape. How to connect with this legacy and the ongoing demands that the present structures embody (e.g., complex water management regimes) to the new pressing demands of urban sustainability is quite difficult operationally and managerially, and in the broader and long-term context of public policy. For example, when faced with growing flooding concerns in mid-twentieth century, South Florida opted to pursue structural, hard infrastructure engineering solutions (typical for the day). In the 1990s, it became clear that flood control solutions had begun to cause significant environmental damage in the region. Furthermore, it is now understood that the flood control infrastructure also reduced the potential of nature-based solutions to climate change. To make matters worse, the comprehensive package of ecological restoration projects proposed in the early 2000s and now partially implemented did not take into consideration climate change and SLR (Molinaroli et al. 2019).

How best to adjust and link the ongoing Everglades restoration efforts with pressing coastal resilience efforts is still to be debated. While the ambition and opportunity to connect them provide an excellent opportunity for innovation, it also requires dynamic and aggressive communication and outreach strategies to bring together the variety of constituent groups and stakeholders. The conversation and debate center around the innovative use of nature-based solutions and resilient building design. It also has brought up difficult questions regarding where and how to implement these strategies, recognizing that some sites and communities might be more at risk and less able to be maintained in their current form.

The added challenge for southeast Florida, generally, and Miami, specifically, is the deep underlying racial and ethnic tensions that have defined their history. During the past decade, local civic leaders celebrated the rise of regional resilience initiatives as a mechanism to improve the everyday lives of long-marginalized communities. This ambition was especially forwarded by the application of the Rockefeller Foundation 100 Resilient Cities (100RC)

planning process that frontloaded social and environmental equity as core planning issues. While on the face of it this represented a significant advance, the planning process, as Grove and others (2020, p. 135), write hit an impasse as "the inclusion of equity concerns in Miami's resilience planning fails to address the wider structural and material 'environment' that absorbs racialized violence, abandonment and deprivations in the rhythms of everyday life."

10.2.2 Oslo, Norway

Oslo is the capital of Norway and has the country's largest population at 700 thousand and has a metropolitan population of slightly more than double that. Today, Oslo is often described as a global leader in urban sustainability with a wide variety of progressive environmental policies and well-structured and endowed welfare programs. It is well underway to implementing a series of comprehensive plans and strategies to become one of the first major cities to be genuinely low carbon and sustainable. The question to be addressed is how and why did the city of Oslo embrace this policy. Under what context did this transition take place?

Oslo was first marked as a city in 1050 and remained relatively small until the nineteenth century when its increasing trade and integration into the European economy promoted growth. Located at the head of a fjord, the development and history of the city have been closely connected to the sea and trade. Mobility around the metropolitan region and to areas outside has been stymied by the irregular terrain with deep bays and inlets and substantial hills extending down to the waters' edge. The country has grown immensely wealthy with the development of its vast oil and natural gas reserves. Norway, by many measures, is among the top 10 oil and natural gas producers in the world, and given its relatively small population (5.4 million), it is also one of the largest exporters. Even though Norway's economy has flourished in the past several decades, the display of wealth and prosperity is relatively recent. While the streets and buildings in nearby Copenhagen, Denmark, and Stockholm, Sweden, illustrate past imperial greatness, Oslo is a much smaller city with a relatively fragmented layout and few monumental structures and edifices. Until the mid-1900s, Norway was largely perceived to be on the edge of Europe, relatively poor, and without a grand history. The Norwegian welfare state was planned and built in the years following World War II, and was not until the mid-1970s and beyond that the oil economy began to infuse the system with abundant resources and enable a significant change in Norwegian society generally and Oslo, specifically. Besides being regularly ranked as one of the most livable sustainable cities, Oslo is listed as one of the most expensive.

10.2.2.1 Stress

The fjord location of Oslo can be broadly described as a bowl and includes a relatively small flat area close in around the main port facilities, then with small rising hills around reaching higher elevations the further one goes from the city. The history of Oslo's development can be divided into five periods (Nystad 2004). The two earliest periods include a small medieval settlement and later a small walled city. The industrial period starting in the nineteenth century is next. The population was centered in and around the downtown and near the port and associated shipping and ship-building industries. The wealthier residents moved to the west of the city into then-wooded hill lands. In many cases they also built summer homes in the extended metropolitan region. New factories and industries developed to the east of downtown and around them were constructed new neighborhoods for lower- and working-class residents, many of whom worked in the new facilities. While the new urban development continued to flow into ever more distant pockets of easily developable land, the 1930 general plan for the city reflected the planning profession's strong desire to control growth and consolidate the city into a "gesamtkunstverk," defined as a unified mosaic of neighborhoods and zones supported by ring roads and radial arteries. During this time, the single-family home was becoming increasingly popular and were built out along the rail lines up through the 1930s. At that time, Oslo was described as having completely filled in what a chief city planning officer at the time called the city's "natural body" of surrounding fjords and hills.

10.2.2.2 Crisis

After the end of World War II in 1945 to the 1980s, Oslo's built environment physical was impacted most significantly by concentric and relatively diffuse growth, consistent with patterns seen for other European cities. This decentralization was especially acute during the 1950s to the 1970s and exceeded the rate of population growth. In Oslo, the postwar period also came with a significant extension of the subway system – accelerating spatial growth, integration of modern spatial planning concepts in a state-controlled and state-subsidized housing program, and sprawling new manufacturing and transport areas. Within Oslo's continuous urban area, the population density declined by approximately 1.4% annually between 1955 and the early 1980s (Næss et al. 2011). This pattern of urban spatial development was driven by several underlying tensions including (1) the conflict between post-World War II pattern of urban decentralization in Europe and the growing role of all levels of government in urban planning coupled with the rise of the welfare state, (2) the rapid growth of Norwegian energy export wealth, and (3) the

particular site characteristics of Oslo that, besides the relatively small coastal plain around the harbor, consisted of a few isolated pockets of low relief and easily buildable land.

It is during the 1980s that metropolitan Oslo experienced a policy "crisis" during which these tensions converged simultaneously. A key factor was the articulation and expansion of the Norwegian welfare state policies. After World War II, the policies of the Norwegian welfare state were rapidly expanded. Access to adequate housing became one of the foundations of the state and as such integral to planning efforts (Bojer 2011, referenced in Forsberg 2016). These policies are driven by the broader and system-level understanding that one's residence is not just an atomized good consumed individually; it and one's experience living in it are also affected by the local environment and in turn affect the same environment. As such, access to decent housing for urban residents became not only a political debate around access and just distribution. It also was a debate focused on how planning can achieve good and improved living conditions for the entire neighborhood that in turn will provide benefits back to the residents. This approach fed into other government planning policies focused on ensuring good and better health for residents. The municipalities and counties in Norway also were regarded as responsible for safeguarding and promoting the health of their inhabitants via progressive social and land use policies. For example, residential access to outdoor recreational land and associated activity opportunities was seen as very important in spatial planning and land use designation in the country (Forsberg 2016). This agenda translated into urban policies and resulted in significant impacts on the urban form of cities. The ambition of the new regime went beyond the regulation of the physical surroundings of the city, it extended to multiple aspects of community planning including architecture and aesthetics of the city, building strategies, and linking national social and economic goals to local landscapes (Nystad 2004). Urban densification was presented as preferable to outward urban expansion if done so to enhance environmental protection of biodiversity natural landscapes and social equity by providing effective mass transit and accessibility and reducing the amount of car-dependent travel (Næss et al. 2011).

10.2.2.3 Transition

While the pillars of the welfare state were put together in the post-World War II era, the capacity of the national government and regional and local governments to implement the policies in full effect only came with the rapid rise of energy exports during the 1970s and overall growth of the Norwegian

economy and access to capital resources.[5] Since the mid-1980s, Oslo followed and was able to enforce the urban containment policy agenda. By the 1990s, it was able to break the long-lasting trend of spatial expansion. The implementation of the urban land use reforms set in motion a series of immediate changes in the pattern and process of urban spatial development in Oslo. The shift in the pattern of urban spatial development from predominantly outward expansion to densification and re-urbanization started to take place in the early 1980s. In the period 1984–1992, the earlier recorded drop in population density almost came to a halt, with annual decline reduced to only 0.1%. Furthermore, the urban development that did take place during this period occurred largely as infill and occurred in locations considerably closer to the city's center than in previous decades. The stabilization of population density in the early 1980s was then followed in the early 1990s by a shift to population density increases, particularly within the borders of the city of Oslo itself. At the broader metropolitan scale, the trend of re-urbanization and density increase – or at least reduced sprawl – was also present even though some development took place outside the continuous urban areas of the region.

The process of densification continued into the next decade – the 2000s. The density of the urban population of Oslo grew from 2000 to 2009 by more than 11%. While the urban core population grew from 132,700 in 1989 to 180,400 in 2009, with an increase in population density by as much as 36% (Municipality of Oslo 2009). The municipality of Oslo found most of its opportunities for densification through the use of "brownfield" sites, as well as, in some cases, remaining pockets of green open space within the urbanized part of the city. These brownfield and open space sites provided locations for housing, new schools, and other structures needed with increased population density. Other important improvements occurred in the public transport sector including a new metropolitan ring rail link, new street car lines and bus lanes, and more frequent departures for street car and metropolitan region trains to specifically encourage automobile drivers to take public transit. The impact of the transition was dramatic. As a result of all these actions, the annual consumption of land for urban expansion of metropolitan Oslo declined from an average of 3.8 sq. km annually during the period 1955–1985 to just 0.7 sq. km from 1985 to 2015, despite a population growth that was more than double than during the earlier period (Næss et al. 2020).

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[5] As an illustration, Norway's GDP per capita in 1970 was $3,306 in comparison to the US value of $5,234 and by 1980 Norway had $15,772, while the US number had only grown to $12,575.

10.2.2.4 Transformation

Overall, the population density in Oslo's continuous urban area increased by as much as 27% during the period 1985–2011 (Næss et al. 2011). The population density increase was particularly elevated in the central Inner Zone of the city. The number of residents in the zone grew from 132,700 in 1989 to 184,500 in 2010, with no increase in the urbanized land, yet a 39% increase in population density. Figure 10.1 illustrates the rebound of urban residential densities in Oslo.

The implementation of the welfare state policies on social and environmental conditions of Oslo urbanization set in motion a series of significant changes including a set of positive feedback effects. For example, urban densification has resulted in benefits for mass transit efficiencies (Næss et al. 2020). Since its initial successes in the 2000s, Oslo has been able to continuously innovate and bring forward other urban sustainability initiatives. In the 2010s, Oslo put forward very aggressive climate mitigation goals (i.e., 95% GHG reduction by 2030 from 2009 values) including policies to discourage automobile use in the downtown (i.e., a congestion charge with different rates for EV vs. gasoline vehicles) and further advance public transit (Hofstad and Torfing 2017).
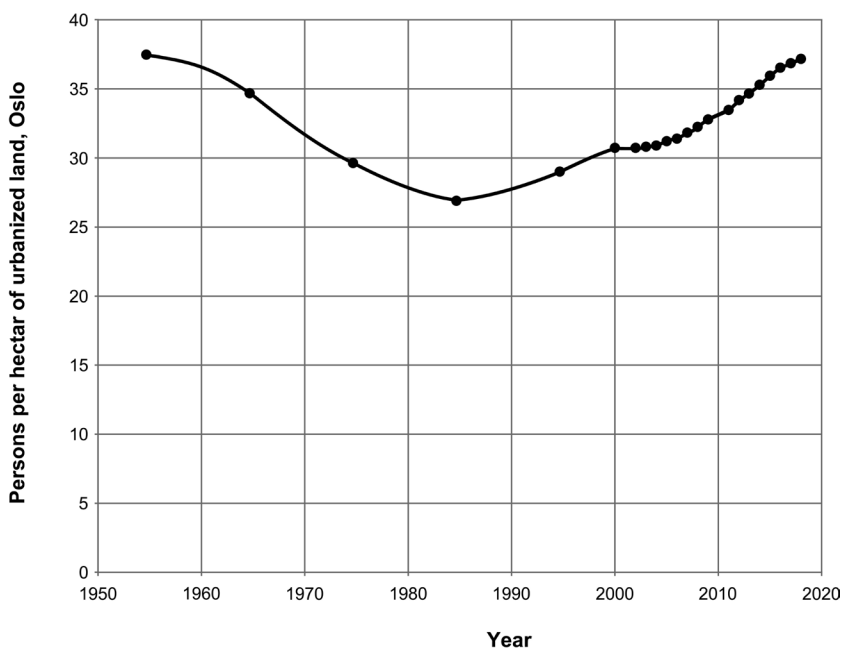

Figure 10.1 Population density within the continuous urban areas of Greater Oslo from the mid-1950s to 2009. Source: Næss et al. (2020).

At the same time, this transformation remains fraught with significant challenges and the process is far from complete. The ambition to move to and access the outlying areas remains strong. In the part of the Oslo metropolitan region beyond the continuous urbanized zone, low-density development took place for a longer time, with a high proportion of detached single-family houses among the new residences built (Næss et al. 2011). Moreover, a considerable expansion of the road capacity also has taken place – a condition responsible for some of the new land conversions present in the intra-urban green areas and periurban areas. The city of Oslo also has continued to build highways (often toll) that are especially technically complex with expensive tunnels to more effectively link together the far-flung parts of the metropolitan region. As in the 1980s, the fantastic wealth created by energy exports brought to Oslo the opportunity to both further its welfare society agenda while also providing amenities, access, and regional integration for the city's residents who are financially able and interested to use them.

10.2.3 St. Georges, Grenada

The island nation of Grenada is 348.5 sq. km (134.6 sq. mi) and has an estimated population of 112,523. Grenada is a member of a group of nations defined as small island developing states (or SIDS or simply small island states [SIS] or small islands). Almost one quarter of the United Nations member states are SIDS. The aggregate population of all the SIDS is roughly 65 million, slightly less than 1% of the world's population. One of the main concentrations of SIDS is in the Caribbean Basin. Grenada is located toward the southern end of an arc of islands called the Lesser Antilles that extend almost to the South American continent and form the border between the Caribbean Sea to the west and the Atlantic Ocean to the east. Most of the island's population is in the southwest around the capital of St. Georges, which itself has a population of approximately 34 thousand. Also located in the southwest is the country's international airport, a large private university with a major medical school (St. Georges University), and the numerous resorts and beach rental properties. Most of the 36% of the country's population that live in an urban area live in St. Georges. The country suffers from significant income inequities, with a poverty rate of 37% and another ~15% of the population at risk of falling into poverty (UN Office for the Coordination of Humanitarian Affairs 2020).

10.2.3.1 Stress
SIDS face a series of unique and significant social, economic, and environmental chronic stresses and vulnerabilities (Barrientos 2010). The economies

of many SIDS are heavily dependent on the export of raw materials and/or agricultural products or tourism. They are typically dependent on the large-scale importation of food stuffs, equipment, and technology, and often essential resources such as energy and building supplies. Even fresh water resources are typically limited and need to be closely managed. Grenada is known as the Island of Spice because of its long history as a spice-exporting site. Its economy in recent decades while still including significant spice exports is mostly structured around beach and water sport tourism. Grenada is widely recognized as being located slightly to the south of the typical Atlantic hurricane (typhoon) tracks and as a result is a place where yacht owners like to harbor their boats. Grenada, similar to many other SIDS, faces a very heavy debt burden. In 2017, government debt service payments ran about 25% of total revenues, and in 2020 the debt was 71.4% of the nation's GDP. The economy was significantly negatively impacted by the COVID pandemic as that resulted in a collapse of the tourism economy. The airport was closed in March of 2020 and did not reopen until late October of that year, and even so almost no tourism took place until April of 2022 when many of the remaining travel restrictions to the island were lifted (Gregor 2022). Other stresses involve mobility and housing. Reflecting the extractive and export-oriented colonial economy, much of the transportation infrastructure is focused on the port facilities of St. Georges, limiting the internal development of the island and the mobility of the residents. Typical traffic time on the main coastal road to go from the south end of the Island to the north, a distance of 45 kilometers, could take 1.5 hours or more by vehicle. While only 6% of the housing is defined as slum housing by the World Bank, much of the local resident housing (nontourist) is quite modest and most often located near exposed coastlines, riverbanks and steephill slopes significantly increasing vulnerability.

10.2.3.2 Crisis

Although seen as too far south to get significantly impacted by hurricanes on a year-by-year basis, St. George's and the rest of Grenada were massively devastated by Hurricane Ivan in 2004. The storm caused widespread impact and crippled the island's infrastructure, with approximately 90% of the homes and buildings sustaining damage. St. Georges experienced significant destruction with many prominent and administrative buildings damaged or made useless, including the two largest hospitals in the country. Forty-one people were killed and the losses totaled $830.7 million (~$1.2 billion in current 2022 dollars), which represented almost twice the national GDP in 2004 (Asonuma et al. 2018). The following year, Hurricane Emily hit the island resulting in more but not as much damage as Ivan. These two storms significantly disrupted

the agricultural export economy, making the country increasingly reliant on tourism for economic growth (Bhola-Paul 2015). The aftermath of the two storms and the growing global financial recession of the late 2000s manifested a national crisis in Grenada. The government debt crisis ballooned in the years following the storm and the national economy remained highly vulnerable to global economic crises and shocks. The national debt had been around 40% of the GDP in the 1990s and in 2001, it was still at 44.6%, but 10 years later, it was steadily at or slightly above 100% of the national GDP. While the international donor community did provide approximately $150 million in aid following the storms, there was a clear need to structure a new development pathway for the nation.

10.2.3.3 Transition

Prior to Hurricane Ivan, much of the development planning in Grenada was not reflective of sustainability principles even though in the late 1990s, the national government had already established a Sustainable Development Council, had developed sustainability practices in its forestry sector, and received support for sustainable development projects from several international development agencies and banks (Rosenberg 2010). In order to address the multiple crises spurred on by Ivan, the government began a process to outwardly reimagine itself and respond to the country's vulnerability to economic shocks and increasing climate change and associated climate disasters. Before the end of 2004, just a few months after the storm, the government of Grenada published a recovery plan that emphasized environmental sustainability practices and programming in all areas (Rosenberg 2010).

The country leaders put forward a set of interconnected efforts to promote sustainability and a green economy and promote itself as a SIDS leader in sustainability. In response to internal and external pressure from international development and loan entities (Rosenberg 2010), the national government of Grenada in 2007 put forward the National Development Strategy for Grenada. One of the main objectives of the Strategy was to promote and provide for disaster risk reduction and climate change adaptation. More specifically, the Strategy stated that climate change was among the main threats faced by Grenada, and defined a series of particular objectives. These included: "integrating environmental and physical development considerations into national development" (i.e., land planning, building renewal, disaster risk reduction, awareness raising, and education) and "an enhanced economic infrastructure sector supporting the country's development (i.e., exploration of alternative energy sources, increasing energy independence, addressing vulnerability of energy infrastructure to natural disasters)" (Grantham Research Institute ND).

10.2.3.4 Transformation

Over the past decade, Grenada has attempted to deepen and extend its sustainability ambitions through further efforts to develop green energy systems, enhance climate and economic resilience, improve mobility and housing quality, and promote ecotourism. To initiate the transition to a low-carbon economy and thereby hope to advance national economic development and improve the country's competitiveness, the government of Grenada approved a National Energy Policy in 2011. The new policy provided a framework to advance low-carbon energy technology and energy conservation and efficiency strategies. In 2012, the government went on to propose the Grenada Vision 2030 designed to enable Grenada to be "one of the first countries in the world to go virtually 100 percent green by 2030" (Emanuel and Gomes 2014). The Grenada Vision 2030 was composed of four major projects. Three of the projects concentrated on the growth of energy utility scale generation from geothermal, wind, and waste-to-energy sources, with the fourth focused on distributed solar. These projects were seen as quite feasible since they were expected to not require much capital investment, given the small size of the economy and energy demand (Roberts 2017). In addition to the national recovery plan and energy plan, the Grenada government during the decade also brought out several other high-profile sustainability plans and initiatives including the Grenada Strategic Program for Climate Resilience in 2011, the Grenada Disaster Vulnerability Reduction Project and Resettlement Policy Framework in 2011, the National Climate Change Policy in 2017, and the National Sustainable Development Plan 2020–2035 in 2019.

Grenada also attempted to more directly link sustainability and resilience goals with their growing economic focus on tourism, particularly via ecotourism. Ecotourism provided protection to the natural environment through designated entrance fees. These funds have enabled additional natural resource management work and the expansion of protected areas, such as some of Grenada's innovative underwater marine parks, Molinere and Dragon Bay (N. Joseph, personal communication, January 20, 2012, in Bhola-Paul 2015). An increased focus on ecotourism allowed the national economy to be less and less dependent on agricultural exports, which were seen as increasingly vulnerable to climate shocks such as hurricanes and droughts (which negatively impacted agricultural exports in 2018).

Even with the rhetorical and planning advances that the Grenadian government has made regarding sustainability, a large disconnect still exists between this progress and actual implementation. A wide set of institutional challenges such as lack of institutional capacity, a persistent focus on resilience to extreme events as opposed to long-term sustainability, continued funding deficits, and

pursuing other priorities (Rosenberg 2010). With these limits, the opportunity for mainstreaming sustainability remained elusive, but Rosenberg (2010) defines elements in Grenada that provide optimism. These include an engaged and participatory democracy, advanced awareness and understanding of climate change risks, and meaningful connections and collaboration with international funders, such as the Green Climate Fund and the German Agency for International Cooperation (GIZ) that continue to encourage and promote socially and environmentally sustainable development.

10.2.4 Shenzhen, China

The story of Shenzhen is amazing and is much more than its fantastic recent history of rapid growth and industrialization over the past four decades. With respect to environmental protection and sustainability, the city also has been widely described as a forefront Chinese city over the last two-plus decades (Liu et al. 2007; Johnson and Weliwata 2019). While typically not ranked among the very top cities with respect to sustainability (i.e., not at a level of Oslo), Shenzhen has been increasingly recognized as a world leader in advancing urban sustainability practice. Shenzhen has been presented as a pioneer city and experimental in character, and paving the way for other places (Meng et al. 2020). At the same time, it has also been described as China's instant city (Du 2020), popping up from the mud flats of the Pearl River Delta in a matter of decades.

The land on which the City of Shenzhen was built is low-lying, well-drained land in a deltaic region intersected by numerous rivers and islands and situated between the historic city of Guangzhou and the global financial capital city of Hong Kong. Shenzhen's recent growth took off with its declaration by the central Chinese government as a Special Economic Zone (SEZ) for manufacturing, export, and trade in 1980. This initiative was part of China's ambitious "Open Door" policy to promote rapid economic development in the country. In 1979, 20 thousand engineers were brought to the city to start to plan the development of a great industrial and export center (UN Habitat 2019). Since that time the city has been completely metamorphosed from a small provincial city to one of the great economic engines of growth in China and the world. In 1979, the population of the city was approximately 20,000–30,000 (documented estimates vary).

By 1990, the population was 1.67 million, and by 2000, it was 7.0 million. The 2020 population is 17.56 million, of which 5.87 million are registered as local permanent residents (i.e., hukou holders), with the rest being non-permanent residents who work in the local manufacturing facilities and other

businesses. The rate of economic growth in Shenzhen during the decades was fantastic, with values equal to or exceeding any recorded since the dawn of industrialization. In 1979, the level of added value from industrial production in the city was $3.37 million USD; in 1990 it had increased to $945.60 million USD, but by 2008 it was $53,054.55 million USD. The city's GDP grew at similar levels – from $0.04 billion in 1980 to $12.35 billion in 1990 and $114.47 billion in 2008 (Yuan et al. 2010). Yet as mentioned earlier, the story of incredible urban development and economic growth is only part of Shenzhen's contemporary legacy. In the early 2020s, the city also was recognized as a world leader in advanced urban sustainability practice. How a great ambition for urban sustainability was integrated into its amazing development trajectory provides a quite informative case study.

10.2.4.1 Stress

Historically, the Pearl River Delta was an important agricultural and fisheries region. Long-term human occupation and alteration of the landscape helped it become a regionally important site for food production (Shidong et al. 2001; Weng 2007). The designation of the SEZ status and the Open Door Policy fundamentally changed the delta's development path. The rate of growth picked up speed during the 1980s and really accelerated during the 1990s. It was already well understood that the pace and pattern of development were already profoundly altering the local environment and that a comprehensive system of environmental protection was needed to sustain the rate of population expansion and resource demand increase and also control the level of waste generation and pollution.

To help meet these great concurrent challenges, the Chinese Environmental Protection Agency in 1997 named the city as the first national model city for environmental protection (Liu et al. 2007). While the designation was significant, the pattern and pace of environmental transformation and degradation continued. By the early 2000s, urban planners began to call for a slowing of growth and a dramatic rethinking of the city (UN Habitat 2019). In 2002, Shenzhen was recognized as a United Nations Environment Programme (UNEP) Global 500 Roll of Honor city as a result of its efforts to simultaneously create both economic and environmental gains (UNEP, 2002). Shenzhen was seen as an attempt to rapidly develop an economy while not significantly damaging the environment, or what was described as a "win–win" strategy (Liu et al. 2007).

10.2.4.2 Crisis

In the mid-2000s, it was clear that the level of environmental degradation in Shenzhen had increased and had become a serious public policy question

(Liu et al. 2007; Shen 2008) and that prospects for a future environmental crisis at current growth rates were high (Güneralp and Seto 2008). Most standard environmental metrics showed the amount of change that occurred. The amount of arable land in the city declined from 35,000 hectares (532 thousand Mui – a Chinese unit of land) in 1979–1,900 hectares (29 thousand Mui) in 2006. Grain production almost ceased during this same time, declining from 132,584 tons in 1979 to 59 tons in 2006 (Shen 2008). The rate of rural to urban land conversion was dramatic as space was needed for factories, infrastructure, and migrant labor housing. The levels of water and air pollution, and waste generation recorded also showed significant changes, although not nearly as great as the rate of land conversion.

Most fundamentally, the settlement that was Shenzhen in 1979 no longer existed by the mid-2000s and at the same time, the city that was present was still in a state of becoming and from the perspective of Chinese urban planners, it was almost a *tabula rasa* – a blank slate to build on. Shenzhen's then-mayor Li Hongzhong in March of 2005 declared at a high-level gathering that the city's growth "speed" was unsustainable, particularly because of the rapid conversion of land for urban construction and development. It was clear that a new set of planning initiatives and technical measures needed to be taken to redevelop existing areas to use the land more efficiently, significantly increase focus on nature-based solutions, and create momentum for clever urbanization (Qi et al. 2020).

10.2.4.3 Transition

Creating a new identity and model sustainable city was now a central goal. The old settlement was gone, and the question was how to build a new city in the same place but without historical reference to the social and ecological systems that were there before, except at the most broad extent – the climate was still in a sub-tropical climate and the setting still a large-scale delta region with remnant beauty but also subject to high water tables and flooding. The ambition was to build a technologically smart city-driven, sustainable conurbation. Research literature was presented to illustrate how Shenzhen would be able to fundamentally link development and pollution reduction together in a way to overcome the urban environmental transition demands required by the Kuznets curves (Bao et al. 2023). Meaning that Shenzhen would not have to become highly polluted and environmentally degraded before it became wealthy enough to overcome it. Shenzhen could continue to rapidly develop economically while also becoming more sustainable and "green," and in effect pierce the curve. This policy transition was driven by a coordinated confederation of government officials, engineers, planning officials, technocrats, academics,

and other interest groups. The efforts centered on promoting rapid urbanization and economic development in a way that promotes sustainability with a focus on mobility and quality of life in a very controlled, top-down governance structure. A strong link existed between the interests of the central Chinese state and the local pattern and pace of development.

10.2.4.4 Transformation

Shenzhen's sustainability efforts now connect with all aspects and sectors of the city – including its transportation system. The city by the late 2010s was the first in the world to ensure that almost all of the local taxis and buses were electric. This action reduced noise pollution and resulted in an significant drop in carbon dioxide emissions (Jiang et al.2022). Sustainability practice also has been closely integrated into the open space planning and management as well. The "basic ecological control line" policy (BECL) was implemented in Shenzhen to rezone the city to enhance ecology and reverse the environmental degradation and provide opportunities to enhance the local ecology in a way to reorder urban space to increase quality of life amenities and promote new economic development (Lin and While 2022). The massive land alteration of Shenzhen created a myriad of waterlogging, drainage, and flood issues. In response, Shenzhen was able to employ a sustainability-focused, sponge city program designed to manipulate and control the flow of rainwater through open green spaces and parks, sunken rain gardens, waterways, and other permeable surfaces (Wang et al. 2022). While creating striking urban landscapes, these approaches also have been associated with a broad suite of urban "ecological gentrification" and "environmental enclosure" through which environmental controls attract and retain wealthy residents and higher-value, nonpolluting, or low-polluting economic development (Lin and While 2022).

The connection between the central government and local transformation was further enforced with the application of the urban sustainability practice to Shenzhen. As an example, in February of 2018, the Chinese State Council issued the "Approval of Shenzhen City's Construction of the National Sustainable Development Agenda Innovation Demonstration Zone." The document stated that Shenzhen would take on a lead innovation role in the development of sustainable megacities. The Chinese State Council has the chief administrative authority of the Chinese government, and among its other duties, it directly oversees all actions of the provincial-level governments. The approval of this statement then required Shenzhen to focus aggressively on all aspects of urban sustainability with a clear focus on technical, engineering, and systems-based approaches, including optimization, efficiency, and carry capacity analysis (Zhang et al. 2021). This situation, as was the case for much

of the past forty-plus years of Shenzhen development, highlighted the overwhelming authority and control of the central state to affect change in comparison to those abilities of local interests and the citizenry. In sum, the crises and transitions had been heavily mediated and orchestrated from afar.

10.3 Discussion

The case studies highlight the intricate process of building for urban sustainability that also enhances quality of life and livability of the everyday life for the city's residents. The set of cities shares a situational characteristic that provides perspective for those actors interested in re-imagining the cities. All located on an edge or a transitional space – Miami is the edge of North America and the Caribbean; Oslo is on the edge of Europe; St. Georges is on the edge of the Caribbean and South America; and Shenzhen is on the edge of China and the rest of the world. These vantage points gave the people guiding the growth of the cities some space – but literally and figuratively – to define innovative urban sustainability pathways. The analysis also shows that the cities' struggles with development and sustainability were both a very local and unique effort and one that was an archetype of what other cities will go through.

10.3.1 Conditions of Crisis

The press for sustainability in the cities emerged out of what was observed and perceived as a crisis of environmental degradation. These crises within the case studies came at different speeds depending on the rate of environmental change and resulting threats. At the extremes, the rate of change in Oslo was relatively slow and was first noticed and debated in the 1950s, while in comparison, the rate of transformation in Shenzhen was incredibly fast and took place within a very narrow window of time – from very late 1990s to the early 2000s. While different modes and speeds of environmental change took place, the residents and leaders of each of the four cities similarly felt that what they saw as the most important qualities of life in the city were in jeopardy and that the growing crisis required a comprehensive and innovative new approach to urbanism. In each case, this new urbanism needed to simultaneously reflect local traditions and lifestyles and widely accepted norms of sustainability practice (e.g., promote walkability, enhance urban greening, climate resilience).

10.3.2 Drivers of Transitions

The root, context, and proximate drivers each played significant roles in the development of the crises and the transitions that occurred. In each case, the physical landscape has a crucial influence on the patterns and process of urbanization. At a specific point in the development history of each city,

Table 10.1 *Key drivers observed in each case study. Source: Author.*

	DRIVERS		
Case Study	Root	Context	Proximate
Miami	Complex interdependent connection between the Everglades system and urban development; social and economic inequities; city on the edge	Regional planning tradition; tension between Everglades and flood protection strategy and climate adaptation strategies; financing and structural conditions of the tax policy make action difficult	Climate projections of SLR and ever-stronger storms
Oslo	Social progressive policies – connection between individuals and community; complex physical geography of Oslo; massive oil and natural gas revenue	Norwegian welfare state development and implementation; focus on urban densification	Concern over urban sprawl
St. Georges Grenada	Economic and environmental vulnerability as a SID	Ambition to create a sustainable and climate-resilient SID; interconnected development with climate resilience and sustainability; limited financial and institutional capacity to affect change	Hurricane Ivan
Shenzhen	Ambition by the Chinese government to create a demonstration city; deltaic landscape;	Special Economic Zone designation; ambition to create a sustainable city demonstration	Evidence of environmental decline and projected future further loss

questions about the long-term viability of these trends came into question. This narrative was then brought to a heightened state in response to a range of immediate concerns of environmental/ecological decline or of their projected decline. Similar to the solid waste discussion in Chapter 9, part of the pressure for environmental policy transitions rested on the commitment that the environmental trajectory of the city needed to be changed in part to illustrate how a more sustainable society could be built. In this way, the decisions to create what was seen as a more sustainable city would be reflective of broader and more fundamental city and national goals. For example, Norway was driven to illustrate how to apply on the urban landscape its social progressive policies, as was China interested in building a state-of-the-art sustainable city to show its engineering and planning sophistication and capacity, and the success of its own brand of governance. Miami wanted to show that it could wrest itself from the Everglades while protecting it and maintaining its connection to the amazing local environmental amenities. St. Georges and Grenada were driven to create a model sustainable small island developing state while enhancing its attractiveness to ecotourists.

10.3.3 Spheres of Action and Legacies

All spheres of action were heavily engaged in each phase of the environmental policy transition process; however, the complement of the three spheres varied significantly from case to case. Perhaps most variable was the technology/infrastructure. The massive application of infrastructure to basically enable the construction of the Miami metropolitan region has charted the entire history of the city. For Shenzhen, the enormous infusion of engineering and technology to create a new sustainable city was similarly transformative. Conversely, technology and infrastructure were less important in the sustainable transition of Oslo and St. Georges. Within the social sphere of action, financing and access to capital is of course critical to the transition process as well. While Oslo and Shenzhen had access to sizable reserves of capital, the lack of financial reserves in Miami and St. Georges has continuously limited the ambitious sustainability planning efforts.

   Legacy as with the other comparisons across the cities varies widely. Miami and its metropolitan area, given its hydrologic history of transformation, in a way represent a massive fixed asset that was created by and dependent upon past planning and policy decisions. St. Georges, Grenada, and the countries of the Caribbean region live with the legacy of colonialism and with the present extractive and agricultural export/tourism-dependent economy. Legacy plays a fascinating role in the case of Shenzhen. At the broadest level, the city reflects

the long-term ambition of China's drive for economic growth and expansion, but at the local level, the landscape of the Pearl River Delta was almost literally wiped clean to create the new city and with it all local legacy was largely eliminated.

10.3.3.1 Urban Sustainability and Climate Change

The connection between urban sustainability and climate change is central to the question of livability in future cities. Climate change will simultaneously alter the environmental baseline of cities making everyday life in the places more subject to climate disruptions and making the goal of urban sustainability harder to attain. Those residents and businesses most vulnerable and disadvantaged will be the most adversely affected. The equity implications of such challenges will be significant. Climate adaptation and mitigation strategies also can limit the effectiveness of urban sustainability efforts by initiating maladaptive strategies (i.e., air conditioning to limit extreme heat exposure that also increases the carbon emissions). So, while urban sustainability and urban climate efforts should be in sync and often are, in many circumstances this might not be the case.

The case studies reveal several conditions and lessons drawn from urban sustainability efforts that can be translated into climate action practices.

- Layering public policy – urban sustainability practice develops and broadens via a series of building blocks and takes place through a process of layering one initiative over another. Unlike urban water supply policy or air quality policy shifts that can occur in massive transformative steps, sustainability policy practice because of its deep and profound connection to society and its psyche seems to emerge in steps. These steps can be large and they can be closely spaced but do not come in one single swoop.
- Deep connections – urban sustainability practice must be by definition closely linked to multiple aspects of a place (i.e., its ecology, environment, and economics) and the identity that place as expressed by its history, cultural norms and traditions, and residents' life experiences. The case studies for example illustrate how sustainability practices are in part created in response to the physical site characteristics of the place. For example, two of the sites are harbors surrounded by rugged upland areas – a Nordic fjord and a small volcanic Caribbean island – and other two are largely former wetland sites (the Everglades and the Pearl River Delta) connected to broad deltaic expanses. This physical geography provides the basis onto which sustainable practices are built and have to conform and be responsive to. It also is understood that any sustainability practice needs to be connected to what works with respect to the trajectory of local economic development.

The climate action also should promote economic activity and be in keeping with the economic requirements of the city – for example, promote commerce and exchange, tourism, and industry.

- Crisis of identity and identity of crisis – the crises that brought on the sustainability transitions in the case study cities in large part were driven by a sense of loss of identity or placelessness, or a fear thereof. In each locale, current patterns of development were seen as a threat to the identity of the city as it was desired or perceived by the residents and counter to how they wanted their city to present to the outside word – as a tropical paradise (Miami and St. Georges), as a place of Nordic sensibilities and lifestyle (Oslo), as an expression of Chinese dynamism and innovation (Shenzhen). This dual yearning to express and build a place that meets the desires and aspirations of insiders and outsiders became key to the drive for sustainability. To recognize and incorporate this same response to increasing climate change threats to a place's identity could provide a useful vehicle for galvanizing broad support in a city for accelerated and transformative climate action.