



Introduction

BOSTON FROM PENINSULA TO METROPOLIS

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IN 1630, English settlers established the town of Boston. Four years later, William Wood, a visitor to the frontier outpost, published a description of its physical features. His book, *New England's Prospect*, became for many readers an early example of boosterism, as it extolled the virtues of this bountiful new land. Wood's picture of Boston is especially revealing because the town that he described bore only a remote resemblance to the city since created by centuries of land making. In his vivid portrayal, Boston stood on a mostly square peninsula connected to the mainland at Roxbury by a very narrow neck. "Tramont," Wood's term, denominated the peninsula's most prominent feature, the three hills that looked down on the town.

Boston's home, the Shawmut Peninsula, was in the most precarious of locations, exposed to a deep-channeled harbor and the unpredictable Atlantic Ocean. An isthmus 120 feet wide at high tide supported the single road (the future Washington Street) that connected the town to the mainland. Although we now think of Boston as a major coastal city, a product of centuries of engagement in global trade, its modest origins identify it before the early nineteenth century as effectively an island. Tidal mudflats—the

Back Bay with the Charles River running through it—separated the town from the mainland. Despite some land making—namely, a wall to seal off the rising sea and some rocks, gravel, sand, and soil dumped for fill—as late as the early 1800s, the center of gravity of this small and constricted community remained its downtown, which consisted of Beacon Hill, the North End, and the West End.

With an expanding commercial global economy, symbolized by wharves that thrust toward the deep water of the harbor, land making became a necessity. Rope making was a thriving industry in a town where sailing ships dotted the harborscape, for example, and by the end of the eighteenth-century rope makers had to have new space to work. “Using hemp fibers and flammable tar,” the geologist William A. Newman and the sociologist Wilfred E. Holton have written, “ropes were woven in a straight line while the rope makers walked backward in long wooden sheds, called ropewalks.”¹ Fires, a constant threat in crowded cities built with flammable materials, visited Boston throughout its early history, and in 1796 one of its most serious blazes destroyed six ropewalks as well as ninety-six other buildings. Fear of recurring conflagrations inspired ropewalk owners to petition the town for permission to construct facilities over marshlands and mudflats west of Boston Common. Thus a long history of land making started with a municipal and commercial agreement.

Land making began on Charles Street with gravel from Mount Vernon, west of Beacon Hill, in 1803. The new land connected Charles Street to the new West Boston Bridge, linking Cambridge to Boston, and created new housing in the Charles Street and Beacon Street area. Additional land making widened the neck connecting Boston to Roxbury in the 1820s, and within thirty years new land extended along Beacon Street to the present location of Clarendon Street. By 1822, when incorporation legally changed the town into a city, major transformations were already under way. In response to a growing population, the marshes and mud flats became a sink for dumping. Recycling animal and human wastes were a principal attribute of the complex ecosystem here, and when the process overwhelmed human senses and sensitivities, efforts commenced to find relief. Land making served as a remedy, and it also responded to the need for urban space for a growing population. Capital growth, commercial and residential construction, and the din of busy city streets could not mask Boston’s growing ecological footprint. A city with a manageable population of about 61,000 in 1830, it reached 177,000 within three decades. Boston’s growing population of humans and

draft animals metabolized increasing quantities of food to do work. Disposal of wastes continues to be an ongoing challenge for all cities, including Boston; as a coastal city, Boston's adjacent waterways served the function of ultimate sink.

With nineteenth-century industrialization and the construction of mill dams using tidal power to run factory machinery, the ability of ten-foot tidal surges to flush the flats each day disappeared. The process of harnessing waterpower began in colonial Boston with the damming of the cove separating the North End and the West End and creating the Mill Pond. The construction of the Mill Dam and the Cross Dam coupled with the creation of a Full Basin and a Receiving Basin sealed off the Back Bay from Boston Harbor in the 1820s. As a significant engineering achievement that allowed industry to run around the clock, these dams and basins made a noteworthy contribution to Boston's built environment. Commercial success, however, did not mask the effects of these engineering marvels on the natural rhythms of a coastal environment. Sewage and trash accumulated and solidified in the basins. Rather than moving out to sea with the ebb tide, waste became a constant reminder to Boston's growing population that manufacturing and wealth creation left as an unseemly by-product.

Turning these effluent-gathering mudflats into land upon which to build fashionable residences for the city elites solved two problems. It addressed the matter of waste management and stemmed the flight of the wealthy to the suburbs. This greatest of land-making projects lasted for almost a quarter of a century until its completion in 1885.² Today, Boston's Back Bay bears no resemblance to its premodern conditions and the memory of its history is lost to many of its residents and visitors. Victorian townhouses bordered Commonwealth Avenue, a two-hundred-foot-wide thoroughfare in the tradition of the grand boulevards of Napoleon III, with a wide, tree-lined walking path in the center. Its green promenade, characteristic of the nineteenth-century walking city, integrated nature into an urban-built environment. The avenue's green space "would later be connected to a string of green spaces stretching out to Franklin Park known as Boston's 'Emerald Necklace'; the Back Bay is thus an important link in the park system that starts with [the] Boston Common and the Public Garden."³

Although Commonwealth Avenue is a particularly distinctive feature of Boston's urban design, Back Bay today brings walkers into contact with an array of late-nineteenth- and early-twentieth-century stone and brick residences along many tree-lined streets. The magnet that attracts residents,

professionals, and visitors is the vitality of the district. Two modern urban malls, Copley Place and the Prudential Center, fill daily with shoppers, while expensive boutiques and art galleries on Newbury Street cater to upper-income tourists. Boylston Street—a mixture of fashionable shops, chain stores, and office buildings—bustles with activity. A walker in the city encounters many of the Back Bay’s landmarks: Trinity Church and the Boston Public Library in Copley Square, Symphony Hall, the Massachusetts Historical Society, the Charles River Esplanade, and many other centers of the city’s cultural and educational life.⁴

Land making, although vital to Boston’s physical expansion, represented only a fraction of the city’s growth. An era of annexation turned many of the nation’s nineteenth-century cities into metropolises. For Boston, annexation began rapidly with Roxbury in 1868, followed by Roslindale in 1873, and the following year Charlestown, Dorchester, Brighton, and West Roxbury. Failure to annex Brookline in 1911, however, brought an end to this activity. Expansion broadened Boston’s tax base, gave it access to much needed potable water, and provided a protective umbrella of city services to the smaller residential communities.

At the time of this writing, Boston’s population approached 560,000, after a modest decline of 5 percent during the first five years of the twenty-first century. It is a relatively young city, with a median age of thirty-one and with more than 33 percent of the population under forty. Women outnumber men in Boston 52 percent to 48 percent, while Caucasians represent 54 percent, African-Americans 25 percent, Asians 8 percent, and others 13 percent. The city covers 48.4 square miles of land, with an average elevation of 20 feet above sea level and 41.2 square miles of water. Physical changes in Boston’s environment are a central theme throughout this book. Other continuing themes include the link of rural and urban spaces and how Bostonians made sense of their environment. Each of the collection’s three parts—on the Boston Harbor, on the town and the countryside, on and on the climate and the weather—begins with an introduction and then turns to two or more contributions on particular aspects of the section’s theme. The editors offer the more specific chapters as examples of current work in urban environmental history and models for scholars to emulate.

Like many edited collections, this one does not aim for comprehensive coverage of its subject. The history of Boston’s “remaking” since the seventeenth century is so complicated that such a book would have to be many

times the size of this one to address every aspect. Among the topics this collection does not consider systematically are industrial air pollution, the search for an adequate water supply, and the legal aspects of the cleanup of Boston Harbor. As a transoceanic trading center that focused its manufacturing strategically on light industries, such as textiles and shoes, Boston is distinctive among American metropolises for the relative unimportance of industrial air pollution. Boston avoided the toxic clouds which choked cities that produced iron and steel or refined petroleum. A windy city located on the coast, its upper atmospheric currents carried away what air pollution its factories did produce. Neither mountains nor valleys trapped pollutants causing temperature inversions and stagnation.⁵ Moreover, such topics as the provision of an adequate supply of potable water and the judicial history of the harbor cleanup are already the subjects of important monographs and do not require further attention here.⁶

Despite its focus on Boston's urban and environmental history, neither is this collection limited to the research of historians. *Remaking Boston* contains contributions from specialists from such fields as earth science, environmental engineering, biology, cartography, geography, and urban planning as well as urban and environmental history. This multidisciplinary approach to the urban and environmental history of a single city adds contextual richness to the topic. Each discipline possesses its own theoretical structure and glossary of terms, and the contributors studying Boston from different disciplinary perspectives enhance the understanding of place. Similar to other urban places, settlers and then residents reshaped Boston's fragile ecology. Each chapter reformulates prior understanding by crossing disciplinary boundaries with new research findings about the city's history.

The Harbor and Land at the Water's Edge

As a thriving coastal city, Boston's urban and environmental history represents an opportunity to examine the transformation of space from a natural habitat into a vibrant metropolis. In this context its physical space includes the deep-channelled harbor that entrepreneurs developed into a waterway to support flourishing commercial enterprises. Harbors, as the most prominent geographical feature of coastal cities, do not inhabit a fixed economic, cultural, or social space. For this reason geographers, geologists,

hydrologists, cartographers, and historians study harbors in contextualized spatial terms. Boston was no exception as its transatlantic commercial partners turned the harbor into a booming port engaged in global transactions.

The beginning of the harbor's spatial transformation predated human habitation by many millions of years. Knowing its prehistory, which extends back in time to its geological origins, pushes at the boundaries of urban and environmental history. This earliest history encompasses the geographical space beyond the water's edge to include more than the commercial traffic in clipper and steam-driven ships on the harbor's surface. In this sense the water's edge, the harbor islands, its channels, and its sediments are manifestations of complex geological and human actions. With the end of the last ice age, 11,600 years before the present (BP), the evidence of 96,800 years of accumulated ice approximately 1.25 miles high at its zenith left a topography and physical space familiar to the region's early Native American inhabitants. Glaciers sculpted the harbor's edge and the region's landscape. Hills of undifferentiated soil composition, sand, clay, and gravel on the surface of the land, in the harbor's islands, and in its bottomlands are reminders of the city and the region's earliest history. Runoff from the land carved the harbor's channels, inundated coastal zones, and created the shoreline that early settlers, both Native American and European, encountered. Rebounding of the land from the weight of mile-high glaciers continued in juxtaposition with slowly rising sea levels.

In the book's first part, "The Harbor," earth scientists Peter S. Rosen and Duncan M. FitzGerald point out in their chapter, "The Drowning of Boston Harbor and the Development of the Shoreline," that "glaciers of the most recent ice age were the indispensable agents in the creation of the harbor."⁷ At the water's edge the harbor became the scene of dynamic change rather than a fixed container impervious to natural and human interventions. In geological time, changing sea levels sculpted the boundaries defining the water's edge until a point of stability was reached four thousand to five thousand years ago. The natural world at the water's edge remained relatively unchanged until early English communities intervened beginning in the seventeenth century. The reshaping of the landscape by glacial deposits encompassed both the harbor and the land and defined the topography of the harbor's sediments, its islands, and Boston's hills, valleys, and flatlands as well as its rivers, streams, and ponds.

Analyses of urban land-use patterns have focused on human interventions. Landscape origins, gleaned from the work of geologists, deepen our

knowledge of spatial relationships and expand our definitions of landscape patterns. Of similar importance is the way in which geological origins serve to integrate the harbor and the land, to see them as a unit rather than as separate entities. By focusing on the physical environment, Rosen and FitzGerald recognize its fundamental importance in shaping the urban space that would become Boston and its surroundings. Its hills, navigable rivers, soil composition, water quality, and much of the natural world around it shaped its subsequent expansion. The city's future capacity to create a vibrant economy and to expand geographically to accommodate waves of immigrants needed a physical space with abundant natural resources devoid of economic, legal, and social bottlenecks.

Historian Michael Rawson's chapter, "What Lies Beneath: Science, Nature, and the Making of Boston Harbor," reminds us that encroaching upon the harbor's physical space through land making engendered opposition from many of the city's mariners and some of its engineers. Drawing on shifting paradigms in science, the competing interests of stakeholders, and federal and state policy, Rawson constructs a convincing argument about the role of scientific thought in shaping Boston Harbor and the larger subject of the interrelationship of the harbor, the city, and nature. Land making, a nineteenth-century initiative of pro-growth real-estate interests, legislators, and some corporations, violated the fragile ecological integrity of the harbor's physical space, its bottomlands and navigable channels. Rawson points out that urban and environmental historians should study coastal zones from the perspective of shoreline activities from the harbor's waters to ships exchanging cargo at port sites: "They have not dived deep enough to make it to the bottom of harbors."⁸

Boston Harbor was part of a larger complex hydraulic system linking the harbor's waters to the inland with sea levels rising as much as eight to ten feet with the incoming tides. From the perspective of mariners, the filling by landowners of the mudflats and marshes that constituted many miles of shoreline disrupted the natural kinetic energy of the tides to scour the harbor's bottomlands. The result was a degraded and increasingly precarious harbor for entering and departing ships. For much of the nineteenth century, proponents of the science of hydrology shaped public policy regarding Boston's harbor. In filling the tidal flats, the Commonwealth of Massachusetts charged Boston by the cubic yard of tidewater lost. The commonwealth's Harbor Commission used such fines to construct seawalls, engage in dredging operations, and make improvements to the harbor's navigational system.

Powerful commercial and economic opponents waged a sustained campaign against an equally powerful preservationist lobby of shipowners and their allies in science, engineering, and government. A scientific paradigm shift in the early years of the twentieth century revealed the scouring theory to be erroneous, however. The evolving science of geology and its theories about glaciers and their meltwater explain the existence of Boston Harbor's deep channels and not the alleged scouring capability of the tides or the rivers that emptied into it. Rawson offers a compelling argument about the ways in which scientific paradigms along with economic and political factors have shaped the production of urban and environmental spaces.

In his contribution "Remaking Boston Harbor: Cleaning Up After Ourselves," environmental engineer Steven M. Rudnick unravels the long and protracted history of the harbor as a sink for metabolized waste. He details the efforts over time to rid the harbor of its most objectionable matter. Definitions of what constituted waste have changed historically from nuisance to pollution, from solid waste to any decaying odorous biological matter. With the intervention of scientific analysis in the twentieth century, microscopic particles on the surface, in the water, or buried in the sediment at the bottom of the harbor became the domain of newly imposed federal regulations in postwar Boston. While recognizing the growing burden that effluent placed on the harbor, centuries of neglect by mayors, aldermen, state legislators, select committees, and commissions resulted either in denial about the severity of the harbor's health or in shortsighted measures that delayed the eventual and inevitable cleanup. A pattern of discharging effluent further away from its point source in Boston and the surrounding towns into the harbor and its outer islands characterized much of the public policy about human waste disposal. With advances in engineering technology available to public officials in the nineteenth and twentieth centuries, the construction of main drains, submerged tunnels, and combined sewer outfalls pushed effluent so far away from its point source that residents of Cape Cod in the 1990s challenged the legality of an outfall 9.5 miles from the shoreline.

As Rudnick has pointed out, the harbor cleanup required the application of biological and chemical solutions to waterborne pollution, the technology of primary and secondary sewer treatment, the imposition of federal water quality standards, and an edict from a federal judge establishing an independent regulatory authority with powers to levy fees on all municipalities that contributed to using the harbor as an ultimate sink. A contributing factor to consider in the harbor's renewal was the expectation among the com-

monwealth's citizens for the amenities associated with healthy beaches. At the water's edge beaches had become another physical space dedicated to recreation, much like the emerging park system that offered a respite from the toil of daily life for the city's growing twentieth-century population.

The town's original shoreline configuration has remained a matter of inquiry among cartographers attempting to identify the city's original boundaries and its geographical relationship to the harbor. Mapping Boston is the subject of many books and museum exhibitions. In "In Search of the Shawmut Peninsula: Using Modern Cartographic Analysis to Discover the 'Original' Boston Shoreline," Stephen T. Mague uses the latest scientific methods to consider this ageless conundrum. His contribution addresses the effects of urban infrastructure on flora and fauna from a cartographer's perspective by using historical maps and technical analysis to examine alterations of the land at the water's edges. His investigation of spatial transformations of the shoreline cuts across the disciplinary boundaries of law in property rights and real-estate transactions, of civil engineering, and of urban design to solve such problems as groundwater incursions and land subsidence and the potential for earthquake disruptions of Boston's built environment and its supporting infrastructure. The city's coastal configuration and attention to the relationship of the land to its harbor reflected an ongoing deliberation among Boston's stakeholders engaged in economic and commercial activities. Legal title to land created from tidal pools, mudflats, and marshes defined private waterfront property with warehouses, wharves, docks, and offices. At the same time, regulations guaranteed, restricted, or denied public access to tidelands. Land at the water's edge represented Boston's dynamic expansion, and its newly built environment became a contested space. Mague's chapter provides a nuanced definition of what constitutes urban and environmental space by analyzing how it was created, contested, and maintained.

Implied in Boston's land-making history is its transformation of the land the glaciers left and the effects of a growing population on the surrounding countryside. Initial patterns of settlement and later development began the transformation of the woodlands into fields, meadows, and woodlots. Domesticates and wildlife at life's end became the ingredients of a tanner's vat. Offal, flesh, and hair entered the waterways, providing early examples of the water pollution in a commercial city with a growing population drawing on the countryside's resources to sustain itself. William Wood's 1634 descriptions of New England's natural bounty would become a lost memory a century later, as settlers changed much of nature into salable commodities.

The Interrelationship of City and Countryside

The book's second part, "The Town and the Countryside," analyzes another major theme in urban and environmental history: the relationship between the city and its hinterland. This section elaborates on the expanding metropolitan economy and the relationship between Boston and the countryside. Although much early environmental history focused on the American West, on definitions of "wilderness," and on an agro-ecological interpretation of environmental history, William Cronon's *Nature's Metropolis*, a pathbreaking study of Chicago and its relationship to the vast natural resources of the American West, inaugurated a new and vital period of scholarship into the intimate connections between cities and their outlying regions.⁹

Using historian and critic Lewis Mumford's categorization of energy regimes of the eotechnic, paleotechnic, and neotechnic, historian Brian Donahue, in "Remaking Boston, Remaking Massachusetts," provides a panoramic view of the community's relationship to the countryside. He notes that throughout colonial history, town and countryside inhabited separate economic and social spaces. Donahue points out that Massachusetts yeomen practiced sustained self-sufficient farming, while Boston's merchants with little in the way of domestic produce to sell looked outward and engaged in the vibrant world of Atlantic trade. With the coming of the paleotechnic age, the networked city was connected to hinterlands and other metropolitan areas by coal-burning, steam-powered railroads. Commercial agriculture replaced self-sufficient family farming. Rural space underwent sustained social, economic, and cultural transformations. Nature's forested landscape and abundant wildlife were degraded by the power of market capitalism. In Boston's networked city, land making paralleled similar changes in the countryside. Sustained spatial transformations in the city and the countryside expanded productive processes, making them interdependent yet vulnerable to forces beyond their control.

With the onset of a period of agricultural intensification and the elimination of many less productive farming enterprises, forests regenerated and the forest products industry revived to meet consumer demands for furniture and packing materials. Physical rearrangements of space once again suggest the contextual richness of rural places, neither fixed nor immobile in time or space. The combination of abandoned farms, a growing population, Boston's decaying housing stock, the glitter and affordability of automobiles, and favorable federal housing loan programs turned vacant land

into sprawling suburbs. Networks of new roads connected the city and the countryside as auto mobility, despite its dependence on oil, a paleotechnic energy source, represented the neotechnic world of transformed segregated space based on class, race, and gender.

In geographer William B. Meyer's chapter, "A City (Only Partly) on a Hill: Terrain and Land Use in Pre-twentieth-century Boston," the glaciated world of Boston's drumlins mostly disappeared, as leveling the land of the Shawmut Peninsula became public policy. Unlike the lengthy historical analysis Donahue provides, Meyer's contribution remains intensely focused on the geographical alterations of Boston before vertical space—tall buildings and skyscrapers—became symbols of wealth, status, and power. Living and working at ground level dominated life within the city's boundaries. Walking up steep hills, climbing flights of stairs to reach upper-level living quarters, reflected lower-class status. Only the hovels of the poor and elite mansions, which the owners reached by horse-drawn carriages, inhabited vertical space. As Meyer points out, interior spatial representations indicative of social class have been an unexplored domain for urban and environmental historians. The focus has been outward, drawing on the pioneering work of J. Heinrich von Thunen's geographical model of concentric circles and Ernest W. Burgess's model of cities. As such, geographers, sociologists, and historians have written about the physical city as class and racialized spaces.

"A City (Only Partly) on a Hill" explores the spatial patterns of urban land use when the human and economic costs of access to people and products dominated city planning. The city's core was its vital center, where business activity and elite housing dominated the physical space. Its poor, its charitable institutions, and its cemeteries inhabited the city's periphery. Because Boston's hilly core violated this rational spatial pattern, removing the hills and using the fill for ongoing land-making activities served dual purposes. The newly landscaped horizontal center rearranged social and economic space while land making expanded the zone of elite housing and commercial activities. As Meyer points out, Boston's spatial patterns, much like those of other cities, reflected modes of transportation. As these modes changed and mobility by streetcar, railroad, and automobile made the periphery accessible to a growing middle class, suburban sprawl became a new spatial pattern.

The next two chapters—by the historian David Soll, "Reforestation in Norfolk County, Massachusetts, 1850–1910," and by the urban planner James C. O'Connell, "How Metropolitan Parks Shaped Greater Boston,

1893–1945”—are focused on Boston as a central place, showing how the city’s influence had intended and unintended consequences for the surrounding communities. Soll’s contribution shows market forces at work, transforming economic relationships between Boston and the surrounding towns. As grain from the American West became available to feed Norfolk County dairy cows, the need for extensive pastures diminished. With fewer acres required, the land reverted to woodlands at a time when the production of dairy products increased substantially to meet the needs of Boston’s growing population. Again, spatial rearrangements responded to changing economic imperatives. Reforestation became one of its unintended consequences. O’Connell describes the consequences of regional planning in establishing the park and parkway system, the first formal effort nationally. Market forces played little or no role in this endeavor, while growing population density in Boston and its closest towns provided the incentive to establish a network of parkways to connect the city and countryside. In the process, access to the towns transformed their spatial relationship to Boston, making them more urban and less rural, and more densely populated than before.

While the parkways became a vital link in the built environment, intended and unintended consequences resulted from this metropolitan plan. The establishment of a metropolitan commission to oversee construction and maintenance of parks and parkways minimized the collision of municipal interests, reduced delays, and enhanced administrative control over the environment and the social lives of citizens for whom these amenities were intended. The metropolitan park system integrated the natural world into a world of roadways and asphalt pavement. Greening urban space softened a built environment of concrete, steel, and asphalt, as parks beautified urban space and became the “green lungs” of the urban environment. By cutting networks of roads through both pristine and regenerated woodlands, the parkways unintentionally created fragmented ecological space, making it difficult or impossible for wildlife and walkers to traverse this newly developed built environment.

In “Reclaiming the Middle Charles River Reservation,” the urban planners Daniel Driscoll and Karl Haglund address the relationship of the river’s edge as a vital pathway to metropolitan Boston and the conflicts and compromises encountered in establishing access to all citizens. Efforts to reclaim the river and link it more closely to the harbor and its tributaries were part of a history a century and a half long. The river’s potential as a regional landmark and natural pathway connecting towns and neighborhoods became

fragmented over time by the built environment of railroad bridges and warehouses. As a result, the physical and visual river with mostly unobstructed views extended from the Harvard University campus in Cambridge and Allston to the esplanades and its basin and no further. Beyond the basin, the river disappeared visually as it approached the harbor. Likewise, the middle Charles, the river's longest expanse, suffered a similar fate, fragmented by residential and commercial development. Renewed efforts by the Metropolitan District Commission to reestablish the river as a major unobstructed and accessible pathway in the late twentieth century faced opposition from a number of abutters and stakeholders. Driscoll and Haglund's contribution documents grassroots democracy in action as local and oftentimes parochial interests came into conflict with regional planners intent upon reclaiming the middle Charles River and linking it through a series of connected paths to the river as a whole.

The Climate and the Weather

The three chapters in the final section of the book address a topic of increasing scholarly interest to researchers from many disciplines—the role of climate and weather in human life. Of the many global challenges facing us in the twenty-first century, the need for knowledge about the Earth's changing climate system is among the most serious. Until recently, this topic received little attention from urban and environmental historians for many reasons, notably a widespread belief in climate's marginal influence on historical developments. In "Boston's Weather and Climate Histories," William B. Meyer focuses on Bostonians' changing understanding of the weather from the colonial period to modern day, perceptions created by the rhythms of economic and social life. Snow-covered roads during the colonial eotechnic era reduced surface friction and therefore required less energy from humans and draft animals to move heavy loads. These same winter roads, however, became hazardous for the drivers of motorized vehicles of the modern neotechnic era. Bostonians imposed different meanings on their weather as the world of human inventions blunted its effects on their daily lives, their need for speed and punctuality in an increasingly competitive world of commerce, and their desire for ambient amenities. Although modern technology has overcome many weather and climate vulnerabilities from the past, Meyer notes, other likely more severe phenomena pose threats as

rising global temperatures, high winds, coastal storm surges, and land erosion at the water's edge compromise the city's quality of life.

Meyer points out how preconceptions influence our understanding of natural events, a fact common to every era. The historian Lauri Bauer Coleman, in her chapter “‘Rain Down Righteousness’: Interpretations of Natural Events in Mid-eighteenth-century Boston,” offers three examples of this process drawn from the middle of the eighteenth century: a drought in 1749, an earthquake in 1755, and a comet in 1759. Coleman explains how religious beliefs shaped the popular understanding of these surprising natural events. Drawing on both reformed Protestant scriptural exegesis and on widely held beliefs about God's role in the world, she shows how New Englanders made sense of natural phenomena for which they had no compelling secular or scientific explanations. The result is an account of extraordinary natural events seen through the eyes of those who experienced them.

As she points out, “supernatural rationalism”—a term invented by historians to explain the integration of ideas about natural-world phenomena and the omniscience of God—guided eighteenth-century discourse about natural events. The development of the scientific method and its findings in the centuries that followed make supernatural rationalism appear cumbersome and contradictory. In the mid-eighteenth century, however, New Englanders seeking larger meaning in disruptive events looked to sources seldom used by environmental historians—namely, sermons and discourses on natural philosophy that traced logically the causes of natural disasters back to sources in the supernatural. This worldview established a symbiotic relationship between scripture and the natural world. Although the supernatural-rational approach established a framework for interpreting such naturally occurring events as earthquakes, hurricanes, and droughts, determining their meaning created conflict and controversy among Boston's religious and secular elites. A wrathful God, using natural disasters to impose moral order on the wayward, was juxtaposed with a wise God whose universe inspired awe, not fear. Given the complexity of understanding extraordinary events and the range of attitudes and beliefs that merged to create what we now call supernatural rationalism, Coleman's chapter uncovers the underlying reasons for the intense debates surrounding nature's unpredictable and disruptive events.

The use of much nontraditional data in understanding the degree to which Boston's weather has changed in the past century is evident in the final contribution in this part, “Biological Responses to Climate Change in

Boston,” by plant biologists Abraham J. Miller-Rushing and Richard B. Primack. Using herbarium and archival collections that include preserved plant specimens, photographs, and personal journals, they document the magnitude of climate change in Boston since the nineteenth century. Archival collections including photographs and personal journals are familiar source materials for historians, while herbarium collections and preserved plant specimens remain the exclusive domain of plant biologists. Employing these seemingly unrelated materials to construct a coherent and convincing narrative about climate change in Boston represents interdisciplinary writing at its best.

The use of photographs that document the arrival of spring does not diminish the written text; in fact, pictures taken decades apart and juxtaposed one to the other speak particularly clearly about a changing Boston climate. Miller-Rushing and Primack’s most convincing evidence of a warming climate comes from the timing of spring events, the melting of snow, the migration of birds, and the flowering of plants. The personal journals of the noted naturalist Kathleen S. Anderson recorded the arrival of birds, butterflies, and amphibians as well as the timing of flowering plants on her forty-hectare farm in Middleborough, Massachusetts, from 1970 to 2003. Analysis of these data led to the surprising conclusion that Boston’s temperature rise of 2.7 degrees Fahrenheit in the past century equals the projected rise for the planet later in the twenty-first century. In the wake of a warming climate, their research resonates with the findings of other plant biologists and climatologists who track the movement of the Mountain Pine beetles, currently eating their way across forests from Colorado to British Columbia, killing millions of trees.

REMAKING Boston required reshaping and expanding its physical space and reordering its economic and social priorities. The physical space expanded by making, annexing, and reshaping land. As evidence of changing climatic cycles and human intervention, the movement of glaciers, sea-level rise, and a redefined built environment sculpted the land and the water’s edge. Bostonians leveled the land to suit their social and economic interests and dredged the harbor to make it a safer and more inviting space for ships. With twentieth-century prosperity the vertical city of steel and glass skyscrapers replaced the nineteenth-century horizontal city of wood and brick. Past impediments disappeared with the new integrated energy flows of electricity and internal combustion. Roads, turnpikes, canals, and railroads con-

nected the city to outlying farms in nineteenth-century greater Boston, but the arrival of the automobile turned recently abandoned farmland into sprawling suburbs. Low-density developments in Boston's surrounding communities expanded more rapidly than the high-density, high-rise buildings at the city's center.

As many of the contributors have pointed out, the social structuring of Boston underwent a transformation as physical spatial arrangements pushed the poor to the decaying residential center while the affluent moved to the newly designed periphery. As the commercial and financial entrepreneurs of twentieth-century Boston established air rights in the imagined space over the land, definitions of real estate acquired new meaning. In the process of these multiple remakings, the outlines of the city's major spatial relationships remained intact, as suggested by the harbor's enduring connection to the city. Yet each remaking possessed the human dimensions of changing social, cultural, and economic values that transformed Boston's environmental history.