INTRODUCTION

BERLIN'S HISTORY THROUGH AN ENVIROTECH LOOKING GLASS

CONCEPTS AND CONTRIBUTIONS

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In the middle of Berlin's Grunewald forest, nestling under the Teufelsberg hill, lies a former waterworks that for the past forty years has taken a new lease on life. Originally built in 1872 to provide water to a nearby colony of villas and subsequently expanded to serve the (then) city of Charlottenburg, it was decommissioned in 1969. No longer able to fulfill the hygienic and technical standards of the day, the waterworks' fate seemed sealed. Plans for its demolition were submitted in 1974—but were then resisted by a group of nature conservationists. They had the idea to keep the historic buildings and original machinery, but to transform them into an environmental information and education center. After much political wrangling the environmentalists won their case and Ökowerk, as it became known, was opened to the public in 1985. Today, visitors can not only marvel at Berlin's largest remaining steam-powered water pump and delight in the reverberating echoes afforded by a cavernous underground water basin, but also revel in the vibrant ecologies of the surrounding site, which boasts ponds teeming with wildlife, an exhibition on the urban water cycle, and various gardens so biodiverse that they attract more than 120 species of bees. At Ökowerk the environmental background of a water supply infrastructure has become the foreground, as captured on the cover of this book. An artifact of the technopolis of Berlin has spawned multiple new ecologies, human- and nature-based.

The Ökowerk story is indicative of the thrust of *Grounding Berlin*. This book targets something we generally take for granted—like waterworks providing a basic service—and shows how its functions and meanings can differ in perception and change over time. It highlights the infrastructures and natures grounded in Berlin's physical geography as well as the processes through which they base urban life.[1] It reveals the rich entanglements of the environmental, the technical, and the social in urban infrastructure and in urban nature, as captured in the subtitle *Ecologies of a Technopolis*. It positions these socially mediated "envirotech"[2] worlds within the more familiar political history of Berlin. In this way the book tells novel narratives of the city through the lens of technologies and environments. It performs not merely "infrastructural inversion,"[3] foregrounding infrastructures in the analysis, but what I term *infra-ecological inversion*, placing envirotech assemblages center stage. Passing through this looking glass of Berlin's oft-told history confronts us, as in Lewis Carroll's tale, with unfamiliar, enlightening, and disturbing insights into these taken-for-granted elements of the city.

Grounding Berlin: Ecologies of a Technopolis, 1871 to the Present draws attention to how urban nature gets "infrastructured" and how urban infrastructures reflect, as well as mediate, biogeophysical conditions. These processes, it is argued, are just as social as they are material. Municipal ambitions, economic development, cultural preferences, gendered attitudes, and geopolitical competition play out through the environments and infrastructures of Berlin across its turbulent modern history. The book spans the past 150 years, from Berlin becoming the capital of the German Reich in 1871 to the present day. This period covers a huge diversity of political regimes, providing fascinating insight into how Europe's archetypal "technopolis"[4] mobilized, transformed, disfigured, and celebrated environments in different ways at different times. Repeated and dramatic shifts in political regimes—as well as frequent instances of socioeconomic disruption—provide an ideal setting for exploring changes and continuities to socio-material configurations of techno-environmental urbanism. Indeed, the overall ambition of the book, beyond the new perspectives it sheds on Berlin's history, is to critically appraise the relationship between urban environments and infrastructures in general. Bringing environmental history and the history of technology into dialogue around a single city presents a way of framing urban metabolisms that privileges neither technology nor natural resources but seeks to reveal their deep and dynamic interdependencies.

This book sets out to make six original contributions to urban, environmental, and infrastructure history. First, it encompasses both environmental and infrastructure histories, targeting the entanglements and tensions

between technology, nature, landscape, and resource use in a city. In this way the book demonstrates how urban environmental history and urban infrastructure history can enrich each other. Second, the book reveals the pioneering contribution of Berlin to urban technology and urban ecology. This ranges from its flagship infrastructures and alternative technologies to creative criticism by scientists, environmentalists, and social movements. Third, Berlin's recent history offers a unique opportunity to study how a wide range of political systems affected urban infrastructures and environments. Here, the interest lies in unpacking how the material and the social of the modern city have shaped each other under different regimes, as expressed in contested policies, projects, and practices. Fourth, the long period of time covered by the book permits in-depth analysis of infrastructures and environments in changing use. This entails looking beyond how envirotech configurations were designed to perform to how they functioned in practice and adapted over time. Fifth, the book seeks to demonstrate how a city's infrastructure and environment are never exclusively urban in scope. Berlin's material, socioeconomic, and political dependence on territories beyond its own jurisdiction make for a telling case of spatial and scalar interaction in the ordering of urban metabolisms. Finally, the period of analysis is deliberately taken up to the present day to explore the legacies of the past for infrastructure and environmental policy and practice. Using the city's history to challenge and inspire contemporary debates on the sustainable city is particularly valid given the transformative agendas associated with urban technology and urban nature in Berlin today.

This introduction sets the scene by reviewing state-of-the-art research into ways of conceptualizing the environment and infrastructure in cities by historians. The focus on historians, rather than humanities or social science scholars more generally, is justified by the desire to demonstrate how historians have in recent years been engaging with relevant concepts and approaches developed beyond the discipline and how they are bringing new thinking to bear on human-environment-technology relations. For this reason the literature discussed below does not include the vast body of scholarship in other disciplines—notably science and technology studies (STS), human geography, and anthropology—that has been so formative in today's understandings of these relations. The overarching purpose is to encourage historians to deepen their interdisciplinary exchanges, social scientists to recognize the value of history to their own work, and a wider public to reflect upon the contemporary relevance of environmental and infrastructure histories.

The remainder of this introductory chapter does three things: it justifies the selection of Berlin in terms of its contribution to the theme and existing research on the city, it elaborates the book's approach with reference to

broader, conceptual literatures of environmental and infrastructure history, and it introduces the themes used to structure the book, highlighting the contribution of each chapter.

ENVIRONMENTS AND INFRASTRUCTURES IN BERLIN'S HISTORY

How can an envirotech perspective enrich our understanding of Berlin's history? What makes Berlin so instructive for urban envirotech history? Berlin merits an anthology of this kind because it is such an emblematic and insightful case. The rapid industrialization and urbanization it witnessed after 1871 make it ideal for exploring the ambitions and tensions involved in transforming environments through technology. Providing the expanding metropolis with sufficient energy, water, and land required massive interventions in the metabolism of the city and its surrounding region. Berlin became a pioneer in urban technology to meet these challenges, earning itself a global reputation in the early twentieth century as Europe's "electropolis"[5] and a model networked city. This reputation for infrastructural innovation was fanned during the Weimar Republic and revived—in very different ways—to cope with political isolation in West Berlin after 1949, to embrace a sustainability agenda in the early years of the reunified city, and to decarbonize the city today. The book traces the socio-technical trajectories of the city's key energy, water, and waste systems to illuminate the dynamic relationship between Berlin and its infrastructures.

Beyond urban technology Berlin is renowned for its history of environmentalism. This has ranged from political activism against environmental degradation, experimentation with alternative technologies, and science-driven policies of urban ecology since the 1970s to campaigns for climate justice and remunicipalizing energy and water utilities today. These creative discourses on how nature and natural resources are given meaning and value in the city have inspired urban policy reform and attracted academic attention. Recent research is looking further back in time to reveal experiences of using and shaping the urban landscape from the Kaiserreich to the postwar era.[6] This book brings together a variety of perspectives on the use of urban nature to reveal the significance of diverse ecologies to the networked city.

The celebratory (and often self-congratulatory) messaging of both these narratives, however, conceals hidden histories of how Berlin's environments were shaped and how infrastructures have mediated not only urban metabolic flows but, significantly, also human-environment relations. These lesser-known stories often relate to everyday uses of nature or technology, to alternative and small-scale infrastructures beyond the dominant system, or to forms of resistance against extractive urban infrastructures. This book gives a voice to these more critical takes on Berlin's metabolism, highlighting

the ambivalences embedded in public policy of infrastructure and the environment, but also the contestations it engendered. Building on a critique of the "modern infrastructural ideal"[7] and the processes of urban knowledge production that induced it, the book makes the case for a more "modest imaginary"[8] of urban envirotech history that foregrounds concealed practices, relativizes the dominant system, and creates openings for alternative trajectories.

This directs attention to the politics of urban envirotech trajectories. Berlin's infrastructure and environmental history is powerfully framed by the regime shifts, socioeconomic turbulence, and geopolitical interventions that make the city so captivating. Over the past 150 years Berlin has witnessed a gamut of political regimes, ranging from imperial rule, National Socialism, and state socialism to various enactments of capitalist democracy—arguably the most varied witnessed by any modern city. For much of this period it has also been in the limelight of global politics, most notably during the Cold War. This has attracted debate among scholars over whether Berlin's history is exceptional[9]—and therefore of limited value as a generative case—or whether it merely reveals in sharp relief and in rapid succession what many other cities have experienced.[10] The long-term perspective of the book allows us to explore how these radical regime shifts and geopolitical tensions have shaped the city's infrastructures and environments and, conversely, how far urban technology and the urban environment could, or could not, be enrolled in political agendas and under what conditions. More broadly, such analysis generates fresh insight into the techno-politics of the urban environment and how its foci, modes, and impacts can change over time.

Grounding Berlin is original in combining multiple perspectives on Berlin's environmental and infrastructure history in a single book. Rather than uncritically advocate a hybridized ideal with terms such as *envirotech* or *ecologies of the technopolis*, the chapters of this book seek to disturb any notion of neat integration, using the juxtaposition of infrastructure and the environment to unpack the tensions, interdependencies, and dislocations pervading this relationship and reveal the politics behind attempts to regulate it. Several research monographs from the humanities and social sciences already exist on selected aspects of the city's environmental or infrastructure history, some of them authored by contributors to this volume. These include the editor's own book on Berlin's energy and water infrastructures;[11] Jens Lachmund's analysis of urban ecology and nature preservation in the city;[12] Kristin Poling's case study of landscapes on Berlin's periphery;[13] Matthew Gandy's works on changing cultures of nature in Weimar and postindustrial Berlin;[14] Bettina Stoetzer's book on the relationship between people, animals, and plants in the city;[15] Harald Bodenschatz and Doroth-

ee Brantz's edited volume on urban greening since the creation of Greater Berlin in 1920;[16] and Ross Beveridge's monograph on the privatization of Berlin's water utility in the 1990s.[17] By contrast, this book embraces in a single volume new research from established and early career scholars with expertise in environmental history, STS, urban geography, history of technology, and urban politics, making it unique in its range and composition.

Infrastructures and environments are largely absent in general histories of Berlin. This applies to books dating back to the Cold War era on both sides of the political divide.[18] It is also true of more recent works, although here transportation—whether by road, rail, or waterways—often merits inclusion as the only infrastructure deemed significant to the political and economic history of the city.[19] This does not mean that there exist no book-length studies on urban technology or nature in Berlin. The city's energy and water infrastructures have indeed been the subject of several books, but these are authored by civil engineers or urban planners with a strong focus on technological advancement and architectural design.[20] The urban environment has also been the topic of prominent books, notably created or inspired by the Berlin school of urban ecology.[21] However, most of these are by ecologists and physical geographers and, like the technical works on infrastructure, generally lack a critical social science perspective. This is changing, with several recent books by urban geographers and planners exploring the cultural meanings and political symbolism attached to nature in the city.[22] It is beyond the scope of this introduction to draw generic observations on the burgeoning number of journal articles and book chapters on Berlin's infrastructure and environmental histories. Suffice to say that they are testaments to a growing interest in seeing the city's past through a socio-technical or socio-ecological lens.

As this brief review of Berlin's historiography implies, the *ecologies* of the book's subtitle have more than one meaning. In the first instance they refer to environmental ecologies of biogeophysical phenomena encountered in the city and how they interact with the infrastructured technopolis. The second, sociological meaning addresses the relationship between human groups and their physical environment. Yet there is also a third, figurative meaning of *ecologies* at work here, relating to communities of interest that have emerged, often at odds with mainstream paradigms, to enrich ways of thinking about and interacting with both urban nature and urban technology.

CONCEPTUALIZING URBAN ENVIRONMENTAL AND INFRASTRUCTURE HISTORIES

A core purpose of this book is to use the Berlin case to enhance scholarship on the history of urban environments and infrastructures in general.

The stories told and arguments made are intended to stimulate and provoke. Given Berlin's turbulent and vibrant recent history there is a rich and unusual experiential resource to draw on. Yet, if we are to counter the challenge of exceptionalism, it is crucial to embed our narratives in wider debates about the relationship between cities, environments, and infrastructures in historical research. At this interface there are emerging today novel ways of conceptualizing urban environments and infrastructures that can provide orientation for our empirical analysis, but also help frame our original contributions to scholarship. Historians have a reputation for being theory-averse, relying on the power of the empirical narrative. However, environmental history and the history of technology, as relatively new subdisciplines, have often drawn on other disciplines for conceptual inspiration. They are increasingly engaging with theories about human-environment relations, socio-material agency, and techno-politics that have emerged from human geography, STS, and anthropology. Recent work by environmental and infrastructure historians is using this scholarship to explain past phenomena through concepts and to demonstrate how historical research can enrich, and sometimes challenge, current conceptual thinking. In the following section the state of the art of this research is presented in terms of five analytical lenses that are pertinent to this book: envirotech entanglements, socio-natural and socio-technical agency, decentering the networked city, power relations and social inequalities of techno-nature, and usable envirotech pasts.

Envirotech Entanglements

Interdependencies between infrastructures and environments have long been acknowledged by both historians of technology and environmental historians.[23] This applies especially to work targeting cities[24] and to German-speaking scholarship.[25] Pioneering historians of technology, such as Joel Tarr, have been engaging with issues of environmental degradation since the 1970s. By the 1990s they were publishing special issues in environmental history journals and historiographical syntheses on the two subdisciplines.[26] Here they argued that the combined study of technology and the environment was a fertile ground of scholarship reflecting shifts in contemporary environmental science and technology. Environmental historians, meanwhile, have not been negligent in addressing how infrastructures have shaped urban environments. A seminal contribution from 1991 was William Cronon's study of how technology was essential in enrolling and exploiting nature in the urbanization of Chicago.[27] However, these early works rarely gave equal consideration to technology and the environment, as they conceded.[28] Each subdiscipline tended to privilege its own subject matter and "black-box" the other:[29] technology studies would relegate the

environment to a background factor, while environmental history treated technology largely as a source of environmental degradation.

More recent work at this interface is critical of these earlier historical narratives, which either celebrated technology for mastering nature or demonized infrastructures for disrupting ecological systems,[30] challenging the binary distinction between *technology* and *environment* in the past. An emergent field of research termed the environmental history of technology is encouraging an appreciation of the ambivalence of technology, posing both environmental problems and solutions and generating new understandings of nature.[31] Similarly, it is advancing notions of the environment as an infrastructure, performing critical functions for networked societies. Sara Pritchard has been prominent in advancing this envirotech nexus between environmental history and the history of technology.[32] She argues that not privileging one dimension over another but focusing on entanglements of the technical and the environmental can show us how technology both reflects and mediates human-environment interfaces and how technology shapes, but is also shaped by, nonhuman nature. In this framing of historical analysis, no one category—whether the environment, society, or technology—forms merely the context for the other. The relationship among the three is being advanced rather in terms of concepts of porosity (addressing their permeable and unclear boundaries), hybridity (about phenomena being at once social, ecological, and technological), and multiplicity (embracing the many functions and meanings a single category can have).[33]

Envirotech historians acknowledge that they are drawing heavily on disciplines beyond history as well as experiences beyond the Western model of development.[34] Anthropologists, geographers, and others have not only generated new ways of conceptualizing "technonatures,"[35] "natures-cultures,"[36] or other such hybrids, but also instructive insights into crossovers between infrastructure and the environment through empirical analysis.[37] Studies of the environment and technology in the Global South are lending further weight to this line of argument by demonstrating the ambivalences, interdependencies, and multifunctionality of technology and environments in colonial and postcolonial settings.[38] Sensitivity to different cultural and historical contexts is revealing limitations to conventional categories of technology and the environment.[39] Historical research at the environment-technology interface is now well established, with active networks in the United States, where the Envirotech special interest group was established in 2000,[40] and Europe, with the Tensions of Europe network.[41]

Many of the chapters in this book focus explicitly on the relationship between infrastructures and the environment, developing novel facets to the scholarship above. Ute Hasenöhrl addresses the environmental nuisance

factor experienced following the introduction of electric street lighting in Berlin. Rita Gudermann explores how the city's sewage system became embroiled in debates about environmental pollution and urban metabolism in the early twentieth century. Jonas Stuck and Heike Weber study waste management strategies and competing models of resource recycling in East and West Berlin. Dorothee Brantz describes how Berlin's infrastructures of war (both hot and cold) were turned into supposed landscapes of peace.

Socio-natural and Socio-technical Agency

Much of this recent research on envirotech entanglements is dedicated to decentering people as the sole agents of historical change. Past narratives of human prowess in developing new technologies or in controlling nature have given way to broader notions of agency in which human volition and action are merely one aspect.[42] Scholarship on materiality and the agency of nonhuman entities coming from the fields of STS, cultural anthropology, and human geography, but also acknowledgment of humans' historical dependence on nature,[43] have inspired historians of the environment and technology to embrace a relational understanding of agency. From these socio-natural or socio-technical perspectives, the material qualities of environments or infrastructures are not more or less malleable to human intervention but are themselves constituent factors co-shaping historical trajectories. In Frank Trentmann's words: "The material is recognized as a conduit of political processes that helps shape (and not just reflect) political identities, concerns, and fields of action."[44] From this vantage point industrialization was shaped by nonhuman forces as well as by humans.[45] Technologies in use have helped develop human competencies and guide development expectations.[46] Verena Winiwarter and Martin Schmid have developed the concept of "socio-natural sites" to describe the traces of past interactions between human practices and the material world.[47] They see humans not as motors of history, but as partners in a communicative process with living and inanimate nature. Summarizing this recent historical scholarship on materiality, Sebastian Haumann shows how the debate has moved on from simple interactionist models between neatly demarcated material objects and social phenomena to a notion of environmental and social dynamics closely intertwined.[48]

Such hybridized understandings of agency are opening up not only the thematic scope but also the methodological toolbox of environmental and infrastructure histories. They are challenging the narrow anthropocentrism of much past research, embracing more-than-human histories.[49] They are debunking universalist narratives—often modeled around dominant Western worldviews—and revealing a plurality of interactions between humans, environments, and technologies in past practices around the world, calling

for more contextualized research on transformations.[50] They are critiquing linear notions of technological advancement and the simple periodizations accompanying them, highlighting instead how messy, unpredictable, and reversible processes of de- and reassembling socio-technical or socio-natural configurations can be.[51] They are undermining assumptions of human superiority with past evidence of material objects resisting enrollment and the uncontrollable effects of human engagement with the environment and technology.[52]

Most, if not all, the authors of this book advocate some form of socio-material relationality. One example is the chapter by Matthew Gandy on postwar rubble landscapes as unusual socio-ecological assemblages that—through a combination of human intervention and neglect—bring forth spontaneous forms of urban biodiversity. In a similar vein Kristin Poling analyzes how landscapes on the urban periphery attracted working-class Berliners in search of relaxation, nourishment, and communality, thereby generating value out of areas dismissed as wasteland. The chapter by Timothy Moss and Theresa Frommen reveals the limitations to human knowledge about, and control of, the city's groundwater resources, resulting in rising or falling water tables impinging on urban development. Nina Lorkowski assesses the efforts of Berlin's energy utilities to shape household consumption of electricity and gas to fit the load management requirements of their infrastructure networks.

Decentering the Networked City

The city has long been a choice locale for studying histories of the environment and technology. Indeed, it is twenty-five years since Jeffery Stine and Joel Tarr wrote, "Historians have paid more attention to the interplay of technology and the environment in urban settings than in most other contexts."[53] Attention has always been attracted to cities as artifacts of technology,[54] but also as sources of environmental pollution[55] and hubs of resource flows.[56] Many pioneering works of environmental and infrastructure history have an urban focus, such as the books by Richard Evans on the Hamburg cholera epidemic of 1892, William Cronon on the regional metabolism of Chicago, and Matthew Gandy on the social relations behind New York's water provision.[57] The promise of urban modernity often came in the guise of networked infrastructures, with their suggestive control over nature.[58]

Cities have attracted attention not merely as places of intensive, technologically mediated resource use. Histories of urban environments and urban infrastructures are being used to gain a better understanding of cities themselves. Drawing on the kind of relational thinking described above, scholars of urban environmental history are dismissing artificial bound-

aries between the city and nature, revealing how urbanized nature can be and how cities are themselves part of the natural environment.[59] Similarly, historians of urban technology are demonstrating how infrastructures are both medium and manifestation of the urban condition, framing as well as reflecting city life over time.[60] From both perspectives historical change is conceived of as a constant coevolutionary process between cities, inhabitants, nature, and technology.[61] By exploring how environments, technologies, and urban contexts constitute each other in dynamic relationships of interdependence, this scholarship is deconstructing essentialist notions of the city as a bounded entity or agent.[62] It is unpacking the multi-scalarity of the urban, showing how urban infrastructures and environments reach far beyond a city's limits, but also how they can differ hugely within a single city. In doing so, historians of urban environments and infrastructures are effectively decentering the networked city, directing attention to regional and international entanglements while highlighting hidden interactions with urban nature and technology in everyday encounters.[63] This relativizes dominant narratives around the large technical systems or protected green areas of a city to reveal the rich variety of urban metabolisms mediated through environments and infrastructures in practice.[64] It also shows how urban envirotech trajectories are often far from linear, characterized rather by multiple temporalities, layered transformations, and conjunctions of continuity and change.[65] Unraveling and explaining processes of de- and reassembling socio-natural or socio-technical configurations over time has become a key task of urban history.

Illustrations of this decentered approach to urbanism abound in this book. Marion Steiner shows how Berlin's celebrated role as an electropolis conceals the international reach of the city's powerful electrical industry. Ross Beveridge embeds the privatization of Berlin's water utility in aspirations of global connectivity for the city following German reunification. Both Rita Gudermann and Sophie Lange describe how Berlin relied on its regional hinterland as a sink for waste products, addressing wastewater and solid waste respectively. Other chapters zoom in to parts of the city often overlooked in the grander narratives, such as the urban periphery (Kristin Poling), wastelands (Matthew Gandy), transitional sites (Dorothee Brantz), and the home (Nina Lorkowski).

Power Relations and Social Inequalities of Techno-nature

The urban envirotech entanglements described above are never politically benign. The "metabolic urbanization" of nature, as Erik Swyngedouw and others have persuasively argued, is deeply imbued with political aspirations, power relations, and social inequities.[66] Historians of technology and the environment have long given prominence in their work to the techno-

politics[67] of infrastructures and the political appropriation of nature.[68] Challenging techno-managerial or depoliticized narratives of past infrastructures and environments has been constitutive to their research agenda. They have revealed how power relations got inscribed into infrastructures and how modes of resource use reflect political ambitions. Thus infrastructures helped enact imperial power and have acquired new layers of political leverage in postcolonial contexts.[69] Environmental problems have been shown to accentuate social inequalities and cultural segregation.[70] Infrastructures, it is revealed, have reproduced social inequality through their impact on the environment and created intergenerational burdens through the waste products they have left behind.[71] Historical analysis has been particularly adept at demonstrating the significance of chronic environmental disasters over a long time period, looking beyond single dramatic crises, and the structural injustices they entail.[72] At the same time historical interest has targeted past efforts to improve the environment, whether through state regulation of environmental protection and infrastructure provision[73] or through interventions by civil society. Popular protests over resource use and environmental degradation have been instrumental not only in changing state environmental and infrastructure policies, but also in empowering citizens to strive for improvements for their own and others' well-being.[74]

The book's chapter by Astrid Kirchhof elaborates on how environmental groups in East and West Berlin sought to raise awareness, and effect mitigation, of environmental pollution in the context of the Cold War divide. Sören Flachowsky explores how Berlin's waste utility became embroiled in the Nazi regime of terror, racial hatred, and nationalism, revealing stark politicization of an essential urban service. The Cold War was an era of heightened geopolitical tension that manifested itself in the division of Berlin's water and energy infrastructures, as Timothy Moss explains. Sophie Lange recounts how East and West Berlin reached a trade deal over waste incineration that was heavily criticized by environmental groups on both sides of the divide. Ute Hasenöhrl's chapter addresses a more subtle field of political contestation: public lighting by electricity and gas in the early twentieth century. Ross Beveridge discusses depoliticization as a deliberate strategy of the 1990s Berlin Senate to ease the process of privatizing the city's own water and wastewater utility.

Usable Envirotech Pasts

The final topic distinctive to this research field is the penchant to draw lessons for the present from historical analysis. Mobilizing pasts to inform, disturb, or inspire current debates is, within the discipline, especially pronounced among historians of technology and the environment. While many mainstream historians are reluctant to bring their knowledge to bear

on today's challenges, those studying environmental and infrastructure history tend to engage to a greater degree with people shaping envirotech futures. This tendency dates back to the 1970s when historians of technology were among the pioneers of applied history, explaining how history matters to technology and environmental policy.[75] It has since been invigorated by the public history activities of environmental and infrastructure historians, reaching out to wider publics as a source and medium of historical knowledge.[76] The concept of "usable pasts" is a further strand in this line of historical research generating productive forms of remembering histories of technology and the environment.[77] These scholars are following the admonition of environmental historian Frank Uekötter that the future of environmental history depends on whether it is bold enough to become political once more.[78]

Research on usable envirotech pasts is highlighting aspects of historical knowledge capable of enriching current debate on key societal challenges. It generates appreciation of lost urban environments, such as dark nights or pollution-free air.[79] It is also identifying historical precursors of modern technologies—for instance, for renewable energies—and reflecting on their troublesome trajectories,[80] as well as revealing the long-term costs and constraints of past technology choices.[81] At the same time it is suggesting that socio-technical pathways were rarely as linear and path dependent as is widely assumed, displaying frequent ruptures, reversals, and reconfigurations.[82] All these phenomena can challenge assumptions underpinning many current debates on urban envirotech futures.

Several authors of this book go the extra mile, explicating the value of their historical analysis for the problems Berlin is facing today. The chapter by Timothy Moss and Theresa Frommen argues that historical knowledge of the city's groundwater levels has become an issue of contestation between environmental regulators, residents, and urban planners in recent years. Ross Beveridge shows how infrastructure politics after 1990 was driven by a storyline of Berlin as a future global city that was used to justify the commercialization and sale of its long-standing municipal utilities—a legacy with which the city continues to grapple to this day. Ute Hasenöhrl uses her historical analysis of conflicts over light pollution a century ago to provide pointers for a discourse today around the role of lighting in improving energy efficiency, nocturnal environments, and aesthetic experiences of the city at night.

THEMATIC SECTIONS OF THE BOOK

This book speaks to all five of these foci of recent envirotech history that permeate all the chapters to a greater or lesser degree. Given their crosscut-

ting nature, these analytical lenses are not suitable as structuring entities. The book is organized instead around four thematic parts that highlight distinctive dimensions of city-environment-infrastructure relations in Berlin: Engineering Environments, Molding Metabolisms, Politicizing Pollution, and Nurturing Natures. Each part comprises chapters that cover a variety of infrastructures, landscapes, or natures. Many of the chapters are not restricted to a specific time in Berlin's political history but transcend conventional periodizations. This allows for powerful insights into the significance of regime change and long-term continuities to urban environments and infrastructures.

Engineering Environments

This first part explores the socio-technical configuration of the urban environment through infrastructure—and its limitations. How networked technologies have shaped the city over time and how environmental and political conditions got inscribed into Berlin's infrastructures are focal points of interest. Marion Steiner begins the section by unpacking the celebratory hype surrounding Berlin as an electropolis, revealing the fossil logic underpinning electricity expansionism by Berlin's new entrepreneurial elites of the Kaiserreich. This, she argues, generated long-standing dependencies on coal-mining regions across Germany as well as imperial ambitions to conquer electricity markets worldwide. Turning to the Cold War era, Timothy Moss shows how Berlin's energy and water infrastructures were not just targets but also tools of political division. Urban infrastructures were reengineered spatially, materially, and politically in response to the ideological divide between West and East. Jonas Stuck and Heike Weber explore how the Cold War affected the policies and practices of recycling solid waste in West and East Berlin. Their analysis demonstrates distinctive trajectories of waste recycling that reflected not only the different political economies, consumerist tendencies, and physical geographies of the two cities but also divergent practices of recycling by their citizens. Ross Beveridge studies how Berlin's ambition to become a global city following reunification in 1990 manifested itself in a strategy to commodify its water and energy utilities and how this strategy unraveled in the face of a fiscal crisis in which the utilities themselves were imbricated. The partial privatization of Berlin's water utility, initially feted as a means of garnering global expertise to enable market expansion, was subsequently reframed as a necessary sale to relieve the city budget.

Molding Metabolisms

The second part looks at the flows of natural resources and energy into and through the city, as mediated by socioeconomic and political forces.

It explores relationships between control over and dependence on nature, trajectories of resource reuse, organizational structuring of urban metabolisms, and everyday practices of energy and resource consumption, all from a historical perspective. Rita Gudermann opens the part with a study of wastewater disposal mediating relations between Berlin and the surrounding region of Brandenburg. What appeared initially as an exemplary arrangement for a circular economy, whereby Berlin's wastewater was irrigated on sewage farms that produced food for the region, deteriorated over time into one she terms environmental colonialism as the city's wastewater became increasingly polluted by industrial effluents, severely damaging the local environment. Timothy Moss and Theresa Frommen investigate the astonishingly close relationship between groundwater levels and economic development trends in Berlin since the 1870s. The ways in which up- and downturns in the city's economy were mirrored in groundwater levels were, they argue, never purely material, but frequently resulted in disputes over knowledge about the subterranean city and how it responded to human interventions. Nina Lorkowski takes us into the home to explore how the introduction of new gas and electricity appliances during the 1920s and 1930s altered—or failed to alter—household routines. In her account energy transformations in private households cannot be reduced to grateful consumers adopting new technologies but represented complex processes of negotiation between households and energy utilities. Sören Flachowsky studies how waste collection in Berlin was reconfigured under the Nazi dictatorship. In demonstrating how the municipal waste utility was politically purged after 1933 and subsequently enrolled in national autarky plans to reuse waste with the help of forced labor, he reveals the utility to have acted as a willing beneficiary and accomplice of the Nazi regime, illustrating starkly the techno-politics of Berlin's material metabolisms.

Politicizing Pollution

The third part investigates how issues of environmental and landscape degradation have, since the early twentieth century engendered popular protest and contestation, but also served political interests of control. The section addresses shifting attitudes to the urban environment and environmental pollution, civic activism around infrastructures and the environment, contested technologies of pollution abatement, and the influence of national politics and geopolitics on urban pollution policies. Ute Hasenöhrl scrutinizes the contentious development of lighting infrastructures in Berlin from the 1880s to 1980s as a window on contested urban modernism. Her analysis of professional and public discourses of lighting and light pollution reveals an entanglement of aesthetic, cultural, and economic interests that reverberate to this day. In her comparative analysis of environmental

activism in postwar West and East Berlin, Astrid Kirchhof reveals striking differences between the two that reflected their respective political contexts. It was these differences in thematic foci, modes of operation, and institutional positioning—rather than limitations to cross-border communication—that resulted in only sporadic contacts between environmental groups in East and West prior to the fall of the Berlin Wall. Sophie Lange takes the case of an incineration plant for West Berlin's waste on East German territory to unpack issues of political cooperation and environmental contestation during the Cold War. The discursive divide she reveals is not between East and West, but between collaborative governments exploiting synergies from a waste infrastructure and environmentalists on both sides critical of the technology.

Nurturing Natures

The fourth part discusses how particular landscapes in Berlin have been mobilized for recreation, survival, renewal, or protection and how discourses around contested natures have altered the ways urban nature is envisioned and enhanced in the city. The chapters address shifting meanings and uses of urban nature, ways of reading Berlin's transformations through landscape, Berlin as a site of experimentation with nature, reimagining peripheral urban landscapes, and infrastructured socio-natures. Kristin Poling explores self-provisioning in the city by urban working classes as a window on the intersection of environmental history and the history of everyday life. She argues that extensive practices of foraging and recreation on the outskirts of the city gave significance to undervalued urban landscapes and challenge persistent dichotomies between parks and wastelands. Dorothee Brantz pursues this theme with her study on the multiple uses (planned and enacted) for Berlin's Teufelsberg, a hill built out of rubble from the war-damaged city. Recounting its highly varied past, she demonstrates how Teufelsberg has linked technology, architecture, landscape architecture, and ecology into a highly politicized and deeply militarized assemblage and biotope of war and peace. Finally, Matthew Gandy recounts the emergence, appreciation, and loss of Berlin's urban wastelands (*Brachen*) that have been produced by shifts in the use and disuse of urban land across its turbulent recent history. Bringing the debate up to the present, he lays down the challenge of protecting these special urban landscapes that, by their very nature, are transitory and beyond control.

INFRA-ECOLOGICAL INVERSION

Through the looking glass of these chapters, *Grounding Berlin* turns the city's history inside out. What gets foregrounded are the environmental

conditions and technological systems underpinning life in the city. The more familiar narratives of political turbulence, socioeconomic development, and urban planning are not absent, but illuminated afresh through the prism of urban environments and infrastructures. The infra-ecological inversion permeating this book does more, however, than front-end the socio-natural and socio-technical; it goes a step further by bringing to the fore perspectives of Berlin's environmental and infrastructural history that have been largely hidden from view in the city's historiography. The backstories of environmental groups reappraising urban infrastructure, wastelands becoming sites of novel human-environmental interactions, or electricity consumers resisting enrollment in utilities' strategies are revealed to be critically important to our understanding of urban life in Berlin's recent history. Infra-ecological inversion represents a novel approach to urban historical research advocated by this book, but it reflects a practice that has been performed by generations of Berliners themselves.

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INTRODUCTION: BERLIN'S HISTORY THROUGH AN ENVIROTECH LOOKING GLASS

1. The book's title is a nod to the edited volume *Grounding Urban Natures* by Henrik Ernstson and Sverker Sörlin.

2. *Envirotech* has recently been coined to denote the nexus of environmental history and the history of technology; Pritchard and Zimring, *Technology and the Environment in History*, 2. It is used here not as a conceptual tool, but as shorthand for the interplay between environment and technology, each socio-materially conceived.

3. Geoff Bowker, qtd. in Hetherington, "Introduction," 6.

4. Peter Hall, "Berlin: Rise and Fall of the Pioneer Technopolis," *The Globalist*, September 28, 2004. A *technopolis* is usually defined as a technologically advanced city.

5. Dame, *Elektropolis Berlin*.

6. Poling, *Germany's Urban Frontiers*.

7. Graham and Marvin, *Splintering Urbanism*, 43.

8. Lawhon, Nakyagaba, and Karpouzoglou, "Towards a Modest Imaginary?"

9. Latham, "Berlin and Everywhere Else."

10. Cochrane, "Making Up Meanings"; Moss, "Socio-technical Change," 1435.

11. Moss, *Remaking Berlin*.

12. Lachmund, *Greening Berlin*.

13. Poling, *Germany's Urban Frontiers*.

14. Gandy, *Fabric of Space*; Gandy, *Natura Urbana*.

15. Stoetzer, *Ruderal City*.

16. Bodenschatz and Brantz, *100 Jahre Groß-Berlin*.

17. Beveridge, *Politics of Inevitability*.

18. For West Berlin perspectives, see Ribbe, *Geschichte Berlins*; Kotowski and Reichhardt, *Berlin als Hauptstadt*. For an East Berlin view, see Lange, *Das Wilhelminische Berlin*; Lange, *Berlin in der Weimarer Republik*.

19. Examples are Bisky, *Berlin*; Large, *Berlin*; Wildt and Kreutzmüller, *Berlin 1933–1945*.

20. Bärthel, *Die Geschichte der Gasversorgung*; Bärthel, *Geklärt!*; Bärthel, *Wasser für Berlin*; Tepasse, *Stadttechnik im Städtebau Berlins. 1945–1999*; Tepasse, *Stadttechnik im Städtebau Berlins. 20. Jahrhundert*; Mohajeri, *100 Jahre Berliner Wasserversorgung und Abwasserentsorgung*; Dame, *Elektropolis Berlin*.

21. Sukopp, *Stadtökologie*; Zimm, *Berlin (Ost) und sein Umland*; Schwenk and Weisspflug, *Umweltschmutz und Umweltschutz in Berlin (Ost)*.

22. Gandy and Jasper, *Botanical City*; Lachmund, *Greening Berlin*; Stoetzer, *Ruderal City*; Bodenschatz and Brantz, *100 Jahre Groß-Berlin*.

23. Pritchard, "Toward an Environmental History of Technology," 227–29; Hetherington, "Introduction," 6.

24. Bernhardt, "Concepts of Urban Agency"; Schott, "Resources of the City"; Tarr, "City as an Artifact"; Melosi, "Humans, Cities, and Nature"; Culver, "Confluences of Nature and Culture"; Haumann, Knoll, and Mares, "Urban-Environmental History."

25. Schott, "Resources of the City," 5; Heßler and Weber, "Provokationen der Technikgeschichte," 15.

26. Stine and Tarr, "At the Intersection of Histories," 603–9.

27. Cronon, *Nature's Metropolis*.

28. Stine and Tarr, "At the Intersection of Histories," 626.

29. Pritchard, "Toward an Environmental History of Technology," 229.

30. Melosi, "Humans, Cities, and Nature," 6; Haumann, Knoll, and Mares, "Urban-Environmental History," 10; Wöbse and Kupper, *Greening Europe*.

31. Pritchard, "Toward an Environmental History of Technology," 235–37.

32. Pritchard, "Toward an Environmental History of Technology"; Pritchard and Zimring, *Technology and the Environment in History*.

33. Pritchard, "Toward an Environmental History of Technology," 241–45; Pritchard and Zimring, *Technology and the Environment in History*, 7–10.

34. Pritchard, "Toward an Environmental History of Technology," 240; Soens et al., "Introduction," 5.

35. White and Wilbert, "Introduction."

36. Haraway, *When Species Meet*.

37. For example, the underground as infrastructure: Ballestero, "The Underground as Infrastructure?"; or abandoned infrastructures becoming nature: Jasper, "Acoustic Botany."

38. E.g., Lawhon, Nakyagaba, and Karpouzoglou, "Towards a Modest Imaginary?"

39. Pritchard and Zimring, *Technology and the Environment in History*, 3.

40. Envirotech, accessed May 19, 2023, https://www.envirotechhistory.org/. See Pritchard and Zimring, *Technology and the Environment in History*, vii.

41. Tensions of Europe, accessed May 19, 2023, https://www.tensionsofeurope.eu/.

42. Pritchard, "Toward an Environmental History of Technology," 235.

43. Uekötter, *Umweltgeschichte im 19. und 20. Jahrhundert*, 6.

44. Trentmann, "Materiality in the Future of History," 307.

45. Pritchard and Zimring, *Technology and the Environment in History*, 43.

46. Trentmann, "Materiality in the Future of History," 298.

47. Winiwarter and Schmid, "Socio-natural Sites," 35, 38–39.

48. Haumann, "Materiality and Practice Theory," 51.

49. Uekötter, *Umweltgeschichte im 19. und 20. Jahrhundert*, 3.

50. Uekötter, *Im Strudel*, 13; Heßler and Weber, "Provokationen der Technikgeschichte," 16; Trischler and Will, "Die Provokation des Anthropozäns."

51. Pritchard and Zimring, *Technology and the Environment in History*, 51; Uekötter, *Im Strudel*, 14; Moss, *Remaking Berlin*, 23–24.

52. Haumann, "Materiality and Practice Theory," 54.

53. Stine and Tarr, "At the Intersection of Histories," 613.

54. Tarr, "City as an Artifact."

55. This is evidenced by the series of roundtables on urban and environmental history in Europe held since 2000. Bernhardt, *Environmental Problems in European Cities*; Schott, Luckin, and Massard-Guilbaud, *Resources of the City*.

56. Barles, "Urban Metabolism."

57. Evans, *Death in Hamburg*; Cronon, *Nature's Metropolis*; Gandy, *Concrete and Clay*.

58. Soens et al., "Introduction," 7.

59. Soens et al., *Urbanizing Nature*; Haumann, "Materiality and Practice Theory," 9; Otter, "Beyond Cities, Beyond Nature," 321.

60. Melosi, "Humans, Cities, and Nature," 4; Schott, "Energizing European Cities," 136; Moss, *Remaking Berlin*, 304–6.

61. Haumann, Knoll, and Mares, "Urban-Environmental History," 16.

62. Soens et al., "Introduction," 4, write of the city as "an assemblage of socio-natural sites, in which human practices materialize into more permanent arrangements, using technologies and infrastructures."

63. Debates on "decentering" the city are drawing heavily on urban studies of the Global South, illuminating the alternative urbanisms concealed by colonialist

practices and narratives; e.g., van der Straeten and Hasenöhrl, "Connecting the Empire."

64. Barles, "Urban Metabolism," 115; Otter, "Beyond Cities, Beyond Nature," 314; Weber, "Material Flows and Circular Thinking," 127–32.

65. Soens et al., "Introduction," 10; Moss, *Remaking Berlin*, 20–26.

66. Swyngedouw, "Circulations and Metabolisms"; Soens et al., "Introduction," 6, 17.

67. van Laak, *Lifelines of Our Society*; Mitchell, *Carbon Democracy*.

68. Hughes, *Networks of Power*; Högselius, Kaijser, and van der Vleuten, *Europe's Infrastructure Transition*; Blackbourn, *Conquest of Nature*; Uekötter, *Green and the Brown*.

69. van Laak, "Infra-Strukturgeschichte"; van der Straeten and Hasenöhrl, "Connecting the Empire"; von Schnitzler, *Democracy's Infrastructure*.

70. Pritchard and Zimring, *Technology and the Environment in History*, 11; Uekötter, *Im Strudel*, 621.

71. Soens et al., "Introduction," 17; Uekötter, *Im Strudel*, 621; Pritchard and Zimring, *Technology and the Environment in History*, 76; Weber, "Material Flows and Circular Thinking."

72. Pritchard and Zimring, *Technology and the Environment in History*, 105–7.

73. Pritchard and Zimring, *Technology and the Environment in History*, 11.

74. Kirchhof, "'For a Decent Quality of Life.'"

75. Stave, "Conversation with Joel A. Tarr"; Högselius, Kaijser, and van der Vleuten, *Europe's Infrastructure Transition*.

76. van der Vleuten, Oldenziel, and Davids, *Engineering the Future*.

77. Schipper, Emanuel, and Oldenziel, "Historicizing Sustainable Urban Mobility"; Moss, "Usable Infrastructure Pasts."

78. Uekötter, *Umweltgeschichte im 19. und 20. Jahrhundert*, 92.

79. Pritchard and Zimring, *Technology and the Environment in History*, 108.

80. Hasenöhrl and Meyer, "Energy Challenge in Historical Perspective."

81. Schott, "Resources of the City," 12–13.

82. Heßler and Weber, "Provokationen der Technikgeschichte"; Moss, "Usable Infrastructure Pasts."

BIBLIOGRAPHY

Ballestero, Andrea. "The Underground as Infrastructure? Water, Figure/Ground Reversals, and Dissolution in Sardinal." In *Infrastructure, Environment, and Life in the Anthropocene*, edited by Kregg Hetherington, 17–44. Durham, NC: Duke University Press, 2019.

Barles, Sabine. "Urban Metabolism." In *Concepts of Urban-Environmental History*, edited by Sebastian Haumann, Martin Knoll, and Detlev Mares, 107–24. Bielefeld: transcript Verlag, 2020.

Bärthel, Hilmar. *Die Geschichte der Gasversorgung in Berlin. Eine Chronik*. Edited by Berliner Gaswerke Aktiengesellschaft (GASAG). Berlin: Nicolai, 1997.

Bärthel, Hilmar. *Geklärt! 125 Jahre Berliner Stadtentwässerung*. Berlin: Verlag Bauwesen, 2003.

Bärthel, Hilmar. *Wasser für Berlin: Die Geschichte der Wasserversorgung*. Berlin: Verlag für Bauwesen, 1997.

Bernhardt, Christoph. "Concepts of Urban Agency and the Transformation of Urban Hinterlands: The Case of Berlin, Eighteenth to Twentieth Centuries." In *Urbanizing Nature: Actors and Agency (Dis)Connecting Cities and Nature since 1500*, edited by Tim Soens, Dieter Schott, Michael Toyka-Seid, and Bert De Munck, 50–64. New York: Routledge, 2019.

Bernhardt, Christoph, ed. *Environmental Problems in European Cities in the 19th and 20th Century. Umweltprobleme in europäischen Städten des 19. und 20. Jahrhunderts.* Münster: Waxmann, 2001.

Beveridge, Ross. *A Politics of Inevitability. The Privatisation of the Berlin Water Company, the Global City Discourse, and Governance in 1990s Berlin*. Wiesbaden: VS Verlag für Sozialwissenschaften, 2012.

Bisky, Jens. *Berlin. Biographie einer großen Stadt*. Berlin: Rowohlt, 2020.

Blackbourn, David. *The Conquest of Nature: Water, Landscape, and the Making of Modern Germany*. New York: Norton, 2006.

Bodenschatz, Harald, and Dorothee Brantz, eds. *100 Jahre Groß-Berlin: Grünfrage und Stadtentwicklung*. Berlin: Lukas, 2019.

Cochrane, Allan. "Making Up Meanings in a Capital City: Power, Memory and Monuments in Berlin." *European Urban and Regional Studies* 13:1 (2006): 5–24.

Cronon, William. *Nature's Metropolis: Chicago and the Great West*. New York: W. W. Norton, 1991.

Culver, Lawrence. "Confluences of Nature and Culture: Cities in Environmental History." In *The Oxford Handbook of Environmental History*, edited by Andrew C. Isenberg, 553–70. Oxford: Oxford University Press, 2014.

Dame, Thorsten. *Elektropolis Berlin. Die Energie der Großstadt. Bauprogramme und Aushandlungsprozesse zur öffentlichen Elektrizitätsversorgung in Berlin*. Berlin: Gebr. Mann Verlag, 2011.

Ernstson, Henrik, and Sverker Sörlin. *Grounding Urban Natures: Histories and Futures of Urban Ecologies*. Cambridge, MA: MIT Press, 2019.

Evans, Richard J. *Death in Hamburg: Society and Politics in the Cholera Years 1830–1910*. Oxford: Clarendon Press, 1987.

Gandy, Matthew. *Concrete and Clay: Reworking Nature in New York City*. Cambridge, MA: MIT Press, 2003.

Gandy, Matthew. *The Fabric of Space: Water, Modernity, and the Urban Imagination*. Cambridge, MA: MIT Press, 2014.

Gandy, Matthew. *Natura Urbana: Ecological Constellations in Urban Space.* Cambridge, MA: MIT Press, 2022.

Gandy, Matthew, and Sandra Jasper, eds. *The Botanical City*. Berlin: Jovis, 2020.

Graham, Stephen, and Simon Marvin. *Splintering Urbanism: Networked Infrastructures, Technological Mobilities and the Urban Condition*. London: Routledge, 2001.

Haraway, Donna J. *When Species Meet*. Minneapolis, MN: University of Minnesota Press, 2007.

Hasenöhrl, Ute, and Jan-Henrik Meyer. "The Energy Challenge in Historical Perspective." *Technology and Culture* 61:1 (2020): 295–306.

Haumann, Sebastian. "Materiality and Practice Theory." In *Concepts of Urban-Environmental History*, edited by Sebastian Haumann, Martin Knoll, and Detlev Mares, 51–64. Bielefeld: transcript Verlag, 2020.

Haumann, Sebastian, Martin Knoll, and Detlev Mares. "Urban-Environmental History as a Field of Research." In *Concepts of Urban-Environmental History*, edited by Sebastian Haumann, Martin Knoll, and Detlev Mares, 9–20. Bielefeld: transcript Verlag, 2020.

Heßler, Martina, and Heike Weber. "Provokationen der Technikgeschichte. Eine Einleitung." In *Provokationen der Technikgeschichte. Zum Reflexionszwang historischer Forschung*, edited by Martina Heßler and Heike Weber, 1–34. Paderborn: Ferdinand Schöningh, 2019.

Hetherington, Kregg. "Introduction: Keywords of the Anthropocene." In *Infrastructure, Environment, and Life in the Anthropocene*, edited by Kregg Hetherington, 1–13. Durham, NC: Duke University Press, 2019.

Högselius, Per, Arne Kaijser, and Erik van der Vleuten. *Europe's Infrastructure Transition: Economy, War, Nature*. Basingstoke, UK: Palgrave Macmillan, 2016.

Hughes, Thomas P. *Networks of Power: Electrification in Western Society, 1880–1930*. Baltimore: John Hopkins University Press, 1983.

Jasper, Sandra. "Acoustic Botany: Listening to Nature in a Former Airfield." In *The Botanical City*, edited by Matthew Gandy and Sandra Jasper, 221–28. Berlin: jovis, 2020.

Kirchhof, Astrid Mignon. "'For a Decent Quality of Life': Environmental Groups in East and West Berlin." *Journal of Urban History* 41:4 (2015): 1–22.

Kotowski, Georg, and Hans J. Reichhardt, eds. *Berlin als Hauptstadt im Nachkriegsdeutschland und Land Berlin 1945–1985*. Berlin: Walter de Gruyter, 1987.

Lachmund, Jens. *Greening Berlin. The Co-production of Science, Politics, and Urban Nature*. Cambridge, MA: MIT Press, 2013.

Lange, Annemarie. *Das Wilhelminische Berlin*. Berlin: Dietz Verlag, 1984.

Lange, Annemarie. *Berlin in der Weimarer Republik*. Berlin: Dietz Verlag, 1987.

Large, David Clay. *Berlin*. New York: Basic Books, 2000.

Latham, Alan. "Berlin and Everywhere Else: A Reply to Allan Cochrane." *European Urban and Regional Studies* 13:4 (2006): 377–79.

Lawhon, Mary, Gloria Nsangi Nakyagaba, and Timos Karpouzoglou. "Toward a

Modest Imaginary? Sanitation in Kampala beyond the Modern Infrastructure Ideal." *Urban Studies* 60:1 (2023): 146–65.

Melosi, Martin V. "Humans, Cities, and Nature: How Do Cities Fit in the Material World?" *Journal of Urban History* 36:1 (2010): 3–21.

Mitchell, Timothy. *Carbon Democracy: Political Power in the Age of Oil*. London: Verso, 2013.

Mohajeri, Shahrooz. *100 Jahre Berliner Wasserversorgung und Abwasserentsorgung 1840–1940*. Stuttgart: Franz Steiner Verlag, 2005.

Moss, Timothy. *Remaking Berlin: A History of the City through Infrastructure, 1920–2020*. Cambridge, MA: MIT Press, 2020.

Moss, Timothy. "Socio-technical Change and the Politics of Urban Infrastructure: Managing Energy in Berlin between Dictatorship and Democracy." *Urban Studies* 51:7 (2014): 1432–48.

Moss, Timothy. "Usable Infrastructure Pasts: Mobilizing History for Urban Technology Futures." In *Infrastructural Times: Temporality and the Making of Global Urban Worlds*, edited by Jean-Paul Addie, Michael Glass, and Jen Nelles, 49–71. Bristol, UK: Bristol University Press, 2024.

Otter, Chris. "Beyond Cities, Beyond Nature: Building a European Urban Stratum." In Soens et al., *Urbanizing Nature*, 313–28.

Poling, Kristin. *Germany's Urban Frontiers: Nature and History on the Edge of the Nineteenth-Century City*. Pittsburgh: University of Pittsburgh Press, 2020.

Pritchard, Sara B. "Toward an Environmental History of Technology." In *The Oxford Handbook of Environmental History*, edited by Andrew C. Isenberg, 227–58. Oxford: Oxford University Press, 2014.

Pritchard, Sara B., and Carl A. Zimring. *Technology and the Environment in History*. Baltimore: Johns Hopkins University Press, 2020.

Ribbe, Wolfgang, ed. *Geschichte Berlins. Zweiter Band: Von der Märzrevolution bis zur Gegenwart*. Munich: C. H. Beck, 1987.

Schipper, Frank, Martin Emanuel, and Ruth Oldenziel. "Historicizing Sustainable Urban Mobility." In *A U-Turn to the Future: Sustainable Urban Mobility since 1950*, edited by Martin Emanuel, Frank Schipper, and Ruth Oldenziel, 1–26. New York: Berghahn Books, 2020.

Schott, Dieter. "Energizing European Cities: From Wood Provision to Solar Panels—Providing Energy for Urban Demand, 1800–2000." In Soens et al., *Urbanizing Nature*, 135–56.

Schott, Dieter. "Resources of the City: Towards a European Urban Environmental History." In Schott, Luckin, and Massard-Guilbaud, *Resources of the City*, 1–27.

Schott, Dieter, Bill Luckin, and Geneviève Massard-Guilbaud, eds. *Resources of the City: Contributions to an Environmental History of Modern Europe*. London: Routledge, 2005.

Schwenk, Herbert, and Hainer Weisspflug. *Umweltschmutz und Umweltschutz in*

Berlin (Ost). Auswirkungen der DDR-Umweltpolitik in Berlin. Berlin: Edition Luisenstadt, 1996.

Soens, Tim, Dieter Schott, Michael Toyka-Seid, and Bert De Munck. "Introduction: Did Cities Change Nature? A Long-Term Perspective." In Soens et al., *Urbanizing Nature*, 3–25.

Soens, Tim, Dieter Schott, Michael Toyka-Seid, and Bert De Munck, eds. *Urbanizing Nature: Actors and Agency (Dis)Connecting Cities and Nature since 1500*. New York: Routledge, 2019.

Stave, Bruce M. "A Conversation with Joel A. Tarr: Urban History and Policy." *Journal of Urban History* 9:2 (1983): 195–232.

Stine, Jeffery K., and Joel A. Tarr. "At the Intersection of Histories: Technology and the Environment." *Technology and Culture* 39 (1998): 601–40.

Stoetzer, Bettina. *Ruderal City: Ecologies of Migration, Race, and Urban Nature in Berlin*. Durham, NC: Duke University Press, 2022.

Sukopp, Herbert. *Stadtökologie. Das Beispiel Berlin*. Berlin: Reimer, 1990.

Swyngedouw, Erik. "Circulations and Metabolisms: (Hybrid) Natures and (Cyborg) Cities." In *Technonatures, Environments, Technologies, Spaces, and Places in the Twenty-First Century*, edited by Damien F. White and Chris Wilbert, 61–84. Waterloo, ON: Wilfrid Laurier University Press, 2009.

Tarr, Joel, A. "The City as an Artifact of Technology and the Environment." In *The Illusory Boundary: Environment and Technology in History*, edited by Martin Reuss and Stephen H. Cutcliffe, 145–70. Charlottesville, VA: University of Virginia Press, 2010.

Tepasse, Heinrich. *Stadttechnik im Städtebau Berlins. 1945–1999*. Berlin: Gebr. Mann Verlag, 2001.

Tepasse, Heinrich. *Stadttechnik im Städtebau Berlins. 20. Jahrhundert*. Berlin: Gebr. Mann Verlag, 2006.

Trentmann, Frank. "Materiality in the Future of History: Things, Practices, and Politics." *Journal of British Studies* 48 (2009): 283–307.

Trischler, Helmut, and Fabienne Will. "Die Provokation des Anthropozäns." In *Provokationen der Technikgeschichte. Zum Reflexionszwang historischer Forschung*, edited by Martina Heßler and Heike Weber, 69–105. Paderborn: Ferdinand Schöningh, 2019.

Uekötter, Frank. *The Green and the Brown: A History of Conservation in Nazi Germany*. Cambridge: Cambridge University Press, 2006.

Uekötter, Frank. *Im Strudel. Eine Umweltgeschichte der modernen Welt*. Frankfurt: Campus, 2020.

Uekötter, Frank. *Umweltgeschichte im 19. und 20. Jahrhundert*. Munich: R. Oldenbourg Verlag, 2007.

van der Straeten, Jonas, and Ute Hasenöhrl. "Connecting the Empire: New Research Perspectives on Infrastructures and the Environment in the (Post)Co-

lonial World." *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin* 24 (2016): 355–91.

van der Vleuten, Erik, Ruth Oldenziel, and Mila Davids. *Engineering the Future, Understanding the Past: A Social History of Technology*. Amsterdam: Amsterdam University Press, 2017.

van Laak, Dirk. "Infra-Strukturgeschichte." *Geschichte und Gesellschaft* 27:3 (2001): 367–93.

van Laak, Dirk. *Lifelines of Our Society: A Global History of Infrastructure*. Cambridge, MA: MIT Press, 2023.

von Schnitzler, Antina. *Democracy's Infrastructure: Techno-Politics & Protest after Apartheid*. Princeton, NJ: Princeton University Press, 2016.

Weber, Heike. "Material Flows and Circular Thinking." In *Concepts of Urban-Environmental History*, edited by Sebastian Haumann, Martin Knoll, and Detlev Mares, 125–43. Bielefeld: transcript Verlag, 2020.

White, Damien F., and Chris Wilbert. "Introduction: Inhabiting Technonatural Time/Spaces." In *Technonatures, Environments, Technologies, Spaces, and Places in the Twenty-First Century*, edited by Damien F. White and Chris Wilbert, 1–30. Waterloo, ON: Wilfrid Laurier University Press, 2009.

Wildt, Michael, and Christoph Kreutzmüller, eds. *Berlin 1933–1945*. Munich: Siedler, 2013.

Winiwarter, Verena, and Martin Schmid. "Socio-natural Sites." In *Concepts of Urban-Environmental History*, edited by Sebastian Haumann, Martin Knoll, and Detlev Mares, 33–50. Bielefeld: transcript Verlag, 2020.

Wöbse, Anna-Katharina, and Patrick Kupper. *Greening Europe: Environmental Protection in the Long Twentieth Century—A Handbook*. Berlin: Walter de Gruyter, 2022.

Zimm, Alfred, ed. *Berlin (Ost) und sein Umland*. Gotha: Haack, 1988.