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Environmental Histories of China's Provinces

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Introduction

This book asks a simple but generative question: what can we learn about China's environments by treating each province as an ecological unit across time? By following climate variability, land-use change, and the institutions that shape them, we trace how deforestation, irrigation, floods, and modern environmental policy have assembled distinct regional ecologies—and how those regional stories connect. The result is a mosaic view of environmental history that helps explain both shared national trajectories and place-specific pathways of change.

Throughout these chapters, “province” is used in a capacious, analytical sense to denote provincial-level jurisdictions where governance, data, and environmental decision-making are organized. This includes provinces in the narrow sense as well as selected autonomous regions and municipalities whose ecological histories illuminate adjacent provincial systems. The aim is not encyclopedic coverage but a representative, diverse set of cases—coastal and inland, humid and arid, mountainous and alluvial—sufficient to support rigorous cross-provincial comparison.

Our temporal lens spans from late imperial land reclamation and frontier settlement, through Republican-era experiments, socialist transformations of watershed and forest management, and reform-era market integration, up to contemporary climate adaptation and biodiversity conservation. Sources include local gazetteers, hydrological and forestry records, satellite imagery, ecological surveys, and oral histories. By aligning documentary archives with biophysical indicators—forest cover, river discharge, groundwater levels, soil erosion, and species distributions—we reconstruct how policy, markets, and climate interacted to produce today's landscapes.

Several cross-cutting themes organize the analysis. First is the politics of water: grand canals, river diversions, polders, and dam cascades have redistributed risk and productivity, often shifting flood exposure and sediment regimes downstream. Second is the forest frontier: cycles of logging, reforestation, and ecological compensation have repeatedly redefined livelihoods and habitats. Third is agrarian change: terrace-building, rice-wheat rotations, rubber and tea expansions, and the intensification of peri-urban horticulture show how markets and technology reshape land and labor. Finally, we attend to hazards—drought, flood, landslide, dust storm, and typhoon—as windows onto environmental governance and social resilience.

The comparative framework is explicit. Each chapter follows a common structure: physical setting and climate; historical land use and major engineering works; signature hazards and their management; turning points in regulation and policy; and

current sustainability challenges. This allows readers to compare, for example, groundwater stress on the North China Plain with deltaic subsidence along the eastern seaboard, or to juxtapose grassland governance in steppe regions with biodiversity stewardship in montane southwest provinces. Side-by-side, these cases reveal patterns of path dependence, unintended consequences, and successful adaptation.

Policy relevance is central. As planners confront accelerating climate risks and seek to align conservation with development, provincial-scale histories provide an actionable baseline for resilience strategies. Understanding how past afforestation campaigns altered fire regimes, how irrigation raised yields while depleting aquifers, or how coastal defenses shifted ecological burdens helps design interventions that avoid familiar pitfalls. The concluding sections of each chapter translate historical insight into decision tools—portfolios of nature-based solutions, indicators for early warning, and governance arrangements that match ecological scales.

Above all, the book invites readers to see provinces not as administrative abstractions but as living socio-ecological systems—oases and estuaries, plateaus and deltas—whose futures will be decided by choices made under uncertainty. By situating present-day policy within deep environmental time, we hope to equip environmental historians and policymakers with comparative insight: to discern durable lessons, anticipate tradeoffs, and plan for resilience and conservation that is both locally grounded and nationally coherent.

CHAPTER ONE: Beijing: Metropolitan Watersheds, Urban Heat, and Greenbelts

Beijing, a city with a history spanning over three millennia, has served as China's capital for more than 800 years, evolving into a sprawling international metropolis. Situated at the northern edge of the North China Plain, the municipality is encircled by mountains to the west, north, and northeast, gradually sloping towards the Bo Hai (Bo Sea). The city proper rests on relatively flat terrain, with elevations typically ranging from 20 to 60 meters above sea level, while its mountainous areas reach between 1,000 and 1,500 meters. Donglingshan Mountain, located in the northwest Mentougou District, stands as Beijing's highest peak at 2,303 meters. This unique topography, a semi-circular basin formed by mountains, plays a crucial role in shaping Beijing's climate and environmental dynamics.

The climate of Beijing is characterized as a temperate, continental monsoon climate. This means short springs and autumns, hot and rainy summers, and cold, dry winters. While relatively close to the sea, the predominant air circulation from the northwest throughout most of the year minimizes maritime influences. January is typically the coldest month, with an average temperature of -2.7°C (27.1°F), while July is the warmest, averaging 27.2°C (81.0°F). Annual precipitation averages around 570 millimeters (22.4 inches), with the majority falling during July and August.

This distinct climate brings with it seasonal environmental patterns. Winters are long, cold, and dry, dominated by winds from Siberia and Mongolia that bring little snow. Spring, though brief, is often windy and sees rapid warming, leading to high evaporation rates that can contribute to agricultural droughts. Dust storms, exacerbated by desertification in Inner Mongolia, are a common springtime occurrence, blanketing the city in dust and contributing to air pollution. Summers are hot and humid, influenced by warm, moist air from the southeast, and are the primary season for rainfall. The combination of high temperatures and humidity in summer can also contribute to severe smog problems, as air pollutants become trapped in the basin.

Historically, Beijing's water supply largely depended on an intricate network of canals fed by mountain springs to its north and west. These canals, some dating back over 900 years like the Gongyigou in Mentougou District, were vital for agriculture and sustaining the ancient city. The Gongyigou canal, for instance, once irrigated a vast 4,400 hectares. However, deforestation in the surrounding mountains gradually reduced the yield of these springs, necessitating a shift in Beijing's water strategy. Groundwater and reservoirs built in the 1950s in the areas surrounding Beijing

became the primary sources of water supply.

The city falls within the Haihe River basin, a region known for its high water stress. While Beijing has five main rivers and over 200 smaller ones within its municipal boundaries, many have nearly dried up. The Miyun and Guanting reservoirs are crucial surface water sources for the Greater Beijing region, although 96% of the Guanting Reservoir's water originates from the Yanghe River Watershed, which is mainly within Zhangjiakou. The increasing reliance on these reservoirs and groundwater highlights the long-standing challenges of water scarcity in the region.

One of the significant environmental transformations in Beijing's history has been the loss of its natural forest cover. Imperial construction, especially the grand palaces of Beijing, placed immense demands on timber resources. For example, the rebuilding of the Ming Ancestral Temple and other Forbidden City structures after fires in the 16th century required vast quantities of old-growth timber, often sourced from the distant forests of southwest China. This logging, a "millennial event" as some historians describe it, removed centuries of growth and demonstrates the far-reaching ecological footprint of the capital even in early imperial times. In more recent times, from 2001 to 2025, Beijing lost 980 hectares of tree cover. In 2020, natural forests covered 23% of Beijing's land area.

The rapid urbanization of Beijing has brought about the phenomenon of the urban heat island (UHI effect), where urban areas experience higher temperatures than surrounding rural areas. This is primarily due to the replacement of natural vegetation with impervious surfaces like roads and buildings, which absorb and retain more heat. Studies have shown that Beijing's UHI intensity has been increasing, with the scope of the heat island spreading alongside urban expansion. The UHI effect can be significant, with urban-to-rural temperature differences reaching up to 8°C during winter nights. This intensified heat can contribute to more frequent and prolonged periods of high temperatures, exacerbating existing environmental issues.

Flooding has been another recurring hazard for Beijing, a city prone to both flash floods and broader inundation events. The July 2012 Beijing flood, for example, saw the city deluged by the heaviest rainfall since 1951, resulting in significant evacuations, fatalities, and extensive damage. Fangshan District was particularly hard-hit, receiving a record-setting 460 mm of rain. The causes of increased urban flooding are multifaceted, including the limited capacity of urban drainage networks, the loss of natural water bodies, and the expansive land conversion associated with urbanization. More recently, in August 2023, Beijing experienced its heaviest rainfall in at least 140 years, with 744.8 millimeters (29.3 inches) falling between Saturday and Wednesday morning. This record-breaking downpour, remnants of Typhoon Doksuri, led to severe flooding, road destruction, power outages, and contaminated drinking water. Tragically, these floods also resulted in fatalities.

In response to these growing environmental challenges, Beijing has increasingly focused on greenbelt policies. The concept of a greenbelt in Beijing dates back to its first modern master plan in 1958, which proposed green spaces between decentralized urban conglomerates to prevent sprawl. The first Greenbelt Policy was officially introduced in 1994, supporting the Beijing Master Plan of 1991, with a second implemented in 2003. These policies have aimed to increase vegetation cover, preserve urban green spaces, and protect water bodies and forests, with studies indicating a significant positive impact on vegetation indices. However, the implementation of these greenbelts has not been without its complexities, sometimes becoming intertwined with real estate development and land businesses.

Efforts to green the capital have intensified, with Hebei Province, which largely encircles Beijing, pledging to create a "green necklace" for the city. This initiative involves restoring wetlands, planting trees on industrial wastelands, and connecting existing green areas, using natural features like rivers and mountains to form protective greenbelts. The broader "Green Great Wall" project, a vast network of forest strips, also aims to protect Beijing and other regions from desertification and sandstorms, due for completion by 2050. These ambitious plans reflect a growing recognition of the interconnectedness of Beijing's urban environment with its surrounding ecological systems.

Modern environmental policy in China has seen a significant shift, particularly since the 2010s. The government has increasingly prioritized environmental protection, evident in policies like the signing of the Paris Climate Accord and the 2015 Environmental Protection Law reform. Beijing, as the capital, has often been at the forefront of these initiatives. In 2013, the "Air Pollution Prevention and Control Action Plan" mandated Beijing to reduce air pollution by 33%, leading to the closure of coal-fired power stations and restrictions on coal-burning heaters. These efforts have yielded positive results, with a significant increase in days with good air quality and a dramatic reduction in heavily polluted days in Beijing by 2025.

Beyond air quality, a broader "war on pollution" was declared in 2014, with comprehensive plans to address particulate air pollution, cut production in overcapacity industries, and promote renewable energy. A revised Environmental Pollution Law increased penalties for polluters and integrated environmental performance into the evaluation of local officials. More recently, in March 2020, China issued a guideline to establish a modern environmental governance system, aiming for a sound system by 2025 that emphasizes government responsibility, public participation, and stronger supervision. This framework promotes a greener approach to production and encourages innovation in pollutant reduction.

Looking ahead, Beijing's "Garden City Plan (2023-2035)" outlines ambitious goals for urban greening. The plan aims to increase forest coverage in urban areas to over 45%

by 2035, safeguard 1.66 million mu of arable land, and establish a 500-kilometer-long water-and-green belt. It also targets an increase in per capita green space in parks to over 17 square meters and ensuring that over 95% of park green spaces are within a 500-meter radius in built-up areas. These initiatives demonstrate a commitment to creating a more livable and sustainable urban environment, balancing continued development with ecological preservation.

However, challenges remain. Beijing, like much of China, grapples with the tension between economic growth and environmental protection. While efforts to "green" China are significant, the nation's reliance on polluting industries for short-term economic support can contradict long-term sustainability goals. Furthermore, China's environmental footprint extends beyond its borders, with its demand for certain commodities linked to deforestation in other countries. The ongoing need for water resource management, particularly in the context of climate change and continued urbanization, will also remain a critical concern for Beijing and its surrounding watersheds. The interplay of metropolitan expansion, resource demands, and evolving environmental governance will continue to shape Beijing's ecological destiny.

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