

**Comparative Analysis of Urban Forest Policy:
Case Studies of Copenhagen (Denmark) and Lahore (Pakistan)**

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Declaration by the Candidate

I, Mohammad Taha Arsalan Qureshi, hereby declare that this thesis entitled “Comparative Analysis of Urban Forest Policy: Case Studies of Copenhagen and Lahore” is an authentic record of my own research conducted under the supervision of Professor Dr. Lukas Gießen and Dr. Kendisha Hintz at the Technical University of Dresden. The results presented in this thesis have not been submitted, either in part or in full, for any other degree or diploma at this or any other institution.

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Table of Contents

LIST OF ABBREVIATIONS	6
ABSTRACT	7
CHAPTER 1: INTRODUCTION	8
1.1 BACKGROUND	8
1.2 JUSTIFICATION	9
1.3 STATE OF THE ART	10
1.4 OBJECTIVES	19
CHAPTER 2: ANALYTICAL FRAMEWORK.....	20
2.1 THEORETICAL FOUNDATION AND CONCEPTUAL POSITIONING	20
2.2 ANALYSIS OF POLICY ISSUES	21
2.3 ANALYSIS OF POLICY GOALS	21
2.4 ANALYSIS OF POLICY INSTRUMENTS	22
2.5 ANALYSIS OF IMPLEMENTATION PROVISIONS	23
2.6 CROSS-CASE SYNTHESIS AND COMPARATIVE ANALYSIS	23
CHAPTER 3: METHODOLOGY	27
3.1 STUDY AREA AND CASE SELECTION	27
3.2 RESEARCH DESIGN	30
3.3 DATA SOURCES AND COLLECTION METHODS	30
3.4 ANALYTICAL FRAMEWORK OPERATIONALIZATION.....	32
3.5 DATA ANALYSIS METHODS	32
3.6 TRIANGULATION AND VALIDITY	33
3.7 ETHICAL CONSIDERATIONS.....	33
CHAPTER 4: RESULTS	35
4.1 URBAN FOREST POLICY OF COPENHAGEN.....	35
4.2 URBAN FOREST POLICY OF LAHORE.....	52
4.3 CROSS-CASE COMPARATIVE ANALYSIS	71
4.3.1 PURPOSE, STRUCTURE, AND ANALYTICAL BASIS	71
4.3.2 COMPARATIVE ANALYSIS OF POLICY ISSUES.....	72
4.3.3 COMPARATIVE ANALYSIS OF POLICY GOALS	73
4.3.4 COMPARATIVE ANALYSIS OF POLICY INSTRUMENTS	74
4.3.5 COMPARATIVE ANALYSIS OF IMPLEMENTATION PROVISIONS	75
CHAPTER 5: DISCUSSION	77
5.1 PURPOSE OF THE DISCUSSION CHAPTER.....	77
5.2 KEY FINDINGS	77
5.3 INTERPRETING DIFFERENCES	78
5.4 INSTRUMENT MIXES AND COHERENCE.....	79
5.5 IMPLEMENTATION GAP, ADMINISTRATIVE CAPACITY, AND THE PLANTING VS. CANOPY OUTCOME PROBLEM	80
5.6 EQUITY, ENVIRONMENTAL JUSTICE, AND DISTRIBUTIONAL OUTCOMES.....	81
5.7 POLICY IMPLICATIONS AND RECOMMENDATIONS	82
5.8 LIMITATIONS OF THE STUDY	83
5.9 FUTURE RESEARCH DIRECTIONS	83
CHAPTER 6: CONCLUSION.....	85
REFERENCES.....	88

List of Abbreviations

ADP	Annual Development Program (Punjab)
CBAP	Copenhagen Biodiversity Action Plan
CET	Climate, Environment and Technical Administration (City of Copenhagen)
CPH	Copenhagen
CSR	Corporate Social Responsibility
DKK	Danish Krone
EBSCO	Elton B. Stephens Company (EBSCO research database)
EIA	Environmental Impact Assessment
EPD	Environment Protection Department (Punjab/Lahore)
EU	European Union
EUR	Euro
FAO	Food and Agriculture Organization of the United Nations
GCU	Government College University (Lahore)
GDF	Green Development Fund (Punjab)
GIS	Geographic Information System
HUD&PHE	Housing Urban Development & Public Health Engineering (Department)
ICT	Information and Communication Technology
IPCC	Intergovernmental Panel on Climate Change
LDA	Lahore Development Authority
LG&CD	Local Government & Community Development (Department)
LID	Low-Impact Development
M&E	Monitoring and Evaluation
MIS	Management Information System
NOC	No Objection Certificate
NGO	Non-Governmental Organization
PHA	Parks and Horticulture Authority (Lahore)
PKR	Pakistani Rupee
PM2.5	Particulate matter ≤ 2.5 micrometers (fine particles)
PSS	Punjab Spatial Strategy
PUPUF	Punjab Urban and Peri-Urban Forest Policy (2019)
SPAP	Spatial Planning Authority Punjab
WHO	World Health Organization

ABSTRACT

This thesis comparatively analyzes urban forest policy in Copenhagen (Denmark) and Lahore (Pakistan) to examine how two contrasting urban contexts define policy issues, formulate goals, select instruments, and structure implementation provisions. Grounded in Krott's forest policy analysis framework and informed by policy design and implementation theory, the study applies a qualitative comparative case study design using document analysis and semi-structured expert interviews. The findings show that both cities frame urban forests as important for climate resilience, biodiversity, and urban livability, but their policy architectures differ significantly according to context. Copenhagen's policy is shaped primarily by densification, spatial competition, and the need to integrate urban nature into a compact city, leading to a stronger emphasis on quality, multifunctionality, and institutionalized partnerships. Lahore's policy is driven by severe canopy scarcity, air pollution, climate stress, and rapid urbanization, resulting in stronger emphasis on expansion, safeguarding, and large-scale institutional mobilization. While both cases show substantial coherence between identified issues and stated goals, the main divergence lies in implementation feasibility. Copenhagen benefits from relatively stable institutional capacity and planning integration, whereas Lahore faces greater coordination, enforcement, and long-term maintenance challenges. The study concludes that effective urban forest policy depends not only on ambition, but on the coherence between problem diagnosis, goals, instruments, and implementation capacity. It further argues that planting targets alone are insufficient unless supported by monitoring, maintenance, and explicit attention to distributional equity.

Keywords:

Urban Forest; Urban Forest Policy; Policy Issues; Policy Goals; Policy Instruments; Policy Implementation Provisions; Qualitative Content Analysis; Comparative Analysis

CHAPTER 1: INTRODUCTION

1.1 Background

Urban forest is defined as the assemblage of trees, woodlands, and associated vegetation within and around urban areas (FAO, 2017). They have become central to contemporary debates on urban sustainability and climate resilience (Ferreira et al., 2023). Rapid urbanization and accelerating climate change have intensified pressures on cities worldwide (Ren et al., 2022). According to the United Nations Department of Economic and Social Affairs, 55% of the global population resided in urban areas in 2018, a figure projected to rise to 68% by 2050 (*World Urbanization Prospects*, 2019). This demographic shift increases demand for infrastructure, housing, and services, while simultaneously exacerbating exposure to climate-related risks such as heatwaves, flooding, and air pollution. The Intergovernmental Panel on Climate Change (IPCC, 2022) emphasizes that cities are highly vulnerable to climate impacts and identifies green and blue infrastructure including urban forests as critical components of adaptation pathways (Pörtner et al., 2022). Historically, the conceptual roots of urban forestry can be traced to 19th-century public health and landscape movements, where urban parks were designed to counteract the environmental and social consequences of industrialization with Frederick Law Olmsted's design of Central Park in the 1850s emphasizing nature's role in promoting social and physical well-being amid crowded, polluted cities (Larice & Macdonald, 2013). The term 'urban forest' crystallized in the 1960s and 70s as environmental awareness grew, with the U.S. Forest Service launching programs to tackle pollution and sprawl by treating trees as a unified ecological system, marking a shift toward systemic urban greening (French, 1983). Over time, the understanding of urban trees evolved from ornamental and recreational elements to integral components of ecological systems. The consolidation of 'urban forestry' as a distinct field in the late 20th century marked a shift toward systemic management of urban tree resources (Konijnendijk et al., 2005). Contemporary urban forestry scholarship emphasizes that urban forests provide multiple ecosystem services, including microclimate regulation, carbon sequestration, stormwater mitigation, biodiversity support, and aesthetic and cultural value (Konijnendijk et al., 2006; Roy et al., 2012). Empirical research demonstrates that urban trees can significantly reduce ambient temperatures through shading and evapotranspiration, thereby mitigating urban heat island effects (Bowler et al., 2010). In addition to environmental benefits, urban green spaces are associated with improved mental and physical

health outcomes, including stress reduction and enhanced social cohesion (WHO, 2016). These multifunctional benefits have positioned urban forests as critical infrastructure for sustainable urban development rather than merely aesthetic amenities.

However, the delivery of these benefits is not automatic. Urban forest outcomes are strongly shaped by governance structures, policy design, and institutional capacity. Urban forest governance typically involves multiple actors across planning, environmental management, public works, and community organizations, often resulting in fragmented responsibilities and coordination challenges (Lawrence et al., 2013). Studies of urban forest management plans indicate that while many cities articulate ambitious canopy targets and planting initiatives, implementation mechanisms, monitoring provisions, and cross-sector integration frequently lack clarity (Ordóñez & Duinker, 2013). Moreover, urban densification strategies can place additional pressure on green space unless integrated planning approaches explicitly safeguard and expand urban tree cover (Haaland & van den Bosch, 2015). These governance complexities suggest that urban forests must be understood not only as ecological systems but also as policy domains. Effective urban forest expansion and maintenance require coherent policy frameworks that align clearly defined issues with realistic goals, appropriate instruments, and operational implementation provisions. Structured policy analysis offers a systematic way to evaluate these components and assess whether policy ambition is supported by institutional arrangements (Krott, 2005). Within this context, this thesis analyzes urban forest policy in Copenhagen (Denmark) and Lahore (Pakistan), two cities representing distinct socio-economic, political, and environmental contexts. By comparing how each city defines urban forest issues, articulates goals, selects policy instruments, and structures implementation, this research seeks to generate context-sensitive insights into urban forest governance.

1.2 Justification

The importance of urban forests in global sustainability discourse has expanded considerably in recent decades. As urban populations grow and climate risks intensify, cities increasingly rely on nature-based solutions to enhance resilience and improve livability (Pörtner et al., 2022). Urban forests contribute to climate adaptation by moderating heat, reducing flood risks, and enhancing ecological connectivity, while also supporting mitigation through carbon storage and energy

demand reduction (Roy et al., 2012). Furthermore, public health research underscores the role of urban green space in promoting well-being and reducing environmental health burdens (WHO, 2016). Despite this growing recognition, a significant gap remains in the comparative analysis of urban forest policies across different governance contexts. Much of the existing literature focuses on ecological assessment, canopy cover measurement, or ecosystem service valuation (Krajter Ostoić & Konijnendijk van den Bosch, 2015), while comparatively fewer studies examine the internal structure of urban forest policies, including coherence between goals and implementation mechanisms. Governance research suggests that institutional arrangements and policy coordination play decisive roles in shaping environmental outcomes (Lawrence et al., 2013). However, systematic cross-continental comparisons of urban forest policy design remain limited. This gap is particularly relevant when considering differences between cities in the Global North and Global South. Urban forest policy in European cities often operates within established planning systems and relatively stable institutional frameworks (Scheuer et al., 2024), whereas rapidly urbanizing cities in South Asia may face more acute land-use pressures, institutional fragmentation, and resource constraints (Arfanuzzaman & Dahiya, 2019). These contextual variations raise important questions about whether urban forest policy models are transferable across regions or must be adapted to local governance realities. By comparatively analyzing urban forest policies in Copenhagen and Lahore, this study addresses this research gap. The selected cases represent diverse governance systems, climatic conditions, and socio-economic structures, enabling structured comparison across different urban contexts. The study is therefore justified not only by the pressing sustainability challenges faced by cities but also by the need to understand how urban forest policy design and implementation vary across political and institutional settings. Through a structured analytical framework grounded in forest policy analysis (Krott, 2005) and policy design theory, this thesis aims to contribute to both academic scholarship and practical policymaking by clarifying how coherence between issues, goals, instruments, and implementation provisions influences urban forest governance outcomes.

1.3 State of the Art

1.3.1 Urban Forests in the Era of Climate Urbanism: From Amenity to Infrastructure

Urban forests have undergone a profound conceptual transformation over the past two decades. Historically treated as aesthetic or recreational amenities managed by parks departments, urban

trees are now increasingly framed as critical urban infrastructure delivering climate mitigation, climate adaptation, biodiversity, and public health benefits (Qu et al., 2025). This shift reflects broader changes in urban environmental governance and sustainability discourse, particularly the emergence of ecosystem services frameworks and nature-based solutions paradigms. Early urban forestry scholarship focused on tree inventories and municipal tree management (Konijnendijk et al., 2006). However, the influential work of Nowak and colleagues fundamentally reoriented the field by quantifying ecosystem services such as carbon sequestration, pollutant removal, and avoided energy consumption (Nowak et al., 2022; Nowak & Dwyer, 2007). These valuation studies were critical in elevating urban forests within policy arenas by translating ecological functions into economic metrics. Subsequent research expanded beyond valuation to emphasize urban heat island mitigation, particularly under climate change scenarios. Studies demonstrate that canopy cover reduces surface and air temperatures through shading and evapotranspiration (Bowler et al., 2010; Ziter et al., 2019). In heat-vulnerable cities, tree canopy is increasingly framed as a public health intervention (Harlan et al., 2006). This has elevated urban forestry into climate adaptation strategies, as reflected in municipal climate action plans across Europe. However, a critical strand of literature questions the technocratic framing of trees as purely functional climate tools. Kabisch et al., (2017) argue that nature-based solutions must be understood within socio-political contexts, as their benefits are unevenly distributed and may reproduce urban inequalities. Anguelovski et al., (2018) similarly caution that green infrastructure expansion can contribute to ‘green gentrification,’ displacing marginalized communities. Thus, while ecosystem services discourse legitimizes urban forest investment, it may obscure power dynamics and distributive consequences.

In Global South contexts, urban forests are frequently situated within different environmental pressures. Rapid urbanization, informal settlements, air pollution crises, and weak planning enforcement complicate canopy expansion strategies (Nagendra & Gopal, 2010). Rather than incremental canopy improvement, many Global South cities face baseline deficits in green space. This creates fundamentally different policy problem structures compared to mature Northern planning systems. The literature therefore reveals a conceptual tension: urban forests are celebrated as universal climate solutions, yet their governance realities vary significantly across socio-economic contexts. This tension underlines the importance of analyzing urban forest policy not

only through ecological metrics but also through institutional design and governance capacity - a gap that structured policy analysis can address.

1.3.2 Urban Forest Governance: Institutional Fragmentation and Multi-Level Complexity

Urban forest governance scholarship increasingly emphasizes that policy effectiveness depends less on ecological knowledge and more on institutional coordination and political prioritization. Lawrence et al., (2013) propose a governance framework highlighting actor networks, institutional mandates, and decision-making arenas. They argue that urban forest management often suffers from institutional fragmentation, where responsibilities are divided among multiple municipal departments, leading to inconsistent implementation. Ordóñez & Duinker, (2013), analyzing Canadian urban forest plans, identify common weaknesses including unclear accountability, insufficient performance indicators, and weak integration with broader land-use planning. Their findings suggest that even well-developed policy documents may lack operational coherence. Multi-level governance theory adds another layer of complexity. Bulkeley & Betsill, (2005) demonstrate that urban climate governance is shaped by interactions between local authorities, national governments, and transnational networks. Urban forestry, increasingly embedded in climate adaptation and biodiversity frameworks, must therefore navigate vertical governance structures. In European contexts, municipal strategies often align with EU biodiversity and climate directives. In Pakistan, urban governance involves provincial authorities, local governments, and specialized agencies such as Parks and Horticulture Authorities, often with overlapping mandates. These governance structures shape how urban forest policies define issues and allocate responsibilities. For example, cities with integrated spatial planning systems may embed tree protection within zoning codes, whereas others rely primarily on project-based planting initiatives.

Equity has emerged as a central theme in governance scholarship. Boone et al., (2009) and Schwarz et al., (2015) document significant disparities in canopy cover across socio-economic and racial lines in U.S. cities. These findings have prompted calls for equity-centered canopy targets. Yet, policy integration of equity remains inconsistent, and few comparative studies evaluate how equity is institutionalized within urban forest policy frameworks.

Another critical dimension concerns participation and co-production. Urban forestry frequently relies on community engagement programs, volunteer planting initiatives, and NGO partnerships. While participatory approaches may enhance legitimacy, they may also shift maintenance burdens onto communities without addressing structural inequalities (Conway & Bang, 2014). The governance literature thus underscores that urban forest outcomes are shaped not only by environmental necessity but by institutional design, resource allocation, and political commitment. This insight reinforces the importance of examining implementation provisions alongside policy rhetoric.

1.3.3 Policy Design, Instrument Mixes, and Coherence

Policy design theory provides conceptual tools for examining how governments translate problem definitions into actionable strategies. Howlett, (2023) argues that effective policy design requires logical consistency between problem diagnosis, goal articulation, and instrument selection. Misalignment between these elements frequently produces symbolic or ineffective policies. Vedung, (1998) classic typology distinguishes regulatory, economic, and informational instruments. Urban forest policies commonly employ all three: tree protection ordinances (regulatory), planting subsidies (economic), and canopy inventories (informational). However, more recent scholarship emphasizes that policies operate through instrument mixes, and their effectiveness depends on coherence and complementarity (Howlett & Rayner, 2018). For example, ambitious canopy targets require not only planting programs but also protection mechanisms to prevent net loss, maintenance budgets to ensure survival, and monitoring systems to track progress. In many cities, canopy goals are articulated without parallel investment in maintenance, leading to high mortality rates - a common implementation gap documented in urban forestry research (Roman et al., 2014). Krott's (2005) forest policy analysis framework offers a structured approach that aligns closely with policy design theory. By distinguishing issues, goals, instruments, and implementation provisions, Krott provides a logical sequence linking problem construction to operationalization. However, Krott's work primarily focuses on traditional forest sectors, and its application to urban governance remains underexplored in comparative contexts. Recent research in environmental policy coherence further highlights the importance of alignment across sectors (Nilsson et al., 2012). Urban forestry intersects with housing policy, transportation planning, and infrastructure development. In densifying cities, tensions between compact development and

canopy expansion create structural conflicts. Evaluating policy coherence thus requires analyzing not only urban forest documents but their integration within broader spatial planning systems. Critically, much urban forestry scholarship evaluates canopy outcomes but rarely interrogates the internal coherence of policy design. Few studies systematically assess whether problem definitions logically correspond to instrument selection and whether implementation structures are adequate for stated ambitions. This analytical gap justifies the application of structured policy analysis within a comparative framework.

1.3.4 Implementation, Administrative Capacity, and the Politics of Delivery

While policy design scholarship emphasizes coherence between issues, goals, and instruments, implementation research reminds that policy success ultimately depends on administrative capacity, institutional clarity, and political commitment (Hill & Hupe, 2022). In urban forestry, the gap between ambition and delivery is particularly visible. Cities frequently announce large-scale planting targets - often framed within climate narratives - yet long-term canopy outcomes remain uncertain due to maintenance deficits, fragmented responsibilities, and fiscal instability. Implementation theory challenges the assumption that well-designed policy instruments automatically produce intended outcomes. Pressman & Wildavsky, (1973) classic implementation studies demonstrated that the number of actors and decision points increases the probability of failure. Urban forest governance often involves multiple municipal departments (parks, planning, environment, public works), utility companies, private developers, and community organizations. Each additional coordination layer introduces potential slippage. Roman et al., (2014) highlight a critical blind spot in urban forestry practice: tree survival rates. Planting programs frequently emphasize quantity (number of trees planted) over quality (long-term survival and growth). Without sustained watering, monitoring, and protection from development pressures, mortality rates can undermine canopy targets. This raises a central theoretical question: are urban forest policies designed as symbolic climate gestures, or as sustained infrastructural commitments?

Administrative capacity is unevenly distributed globally. In high-income contexts such as Northern Europe municipalities may possess technical inventories, GIS-based canopy assessments, and dedicated forestry staff. In rapidly urbanizing Global South cities, limited staffing, budget volatility, and overlapping mandates complicate implementation (Nagendra & Ostrom, 2012;

Pauleit et al., 2021). Thus, while canopy targets may appear comparable across cities, the institutional conditions underlying their feasibility differ substantially. Moreover, implementation is inherently political. Urban trees compete with other land uses - housing, transport infrastructure, commercial development. In densifying cities, spatial constraints create structural conflicts between compact urbanism and canopy expansion. Scholars debate whether urban densification and greening are inherently contradictory or can be reconciled through innovative spatial design (Wolch et al., 2014). The literature suggests that without integrated planning frameworks, urban forestry may be marginalized in land-use decisions. This implementation-focused critique underscores the importance of analyzing not only formal policy documents but also institutional arrangements, resource allocation, and monitoring systems. It strengthens the argument that a structured analytical framework examining implementation provisions is necessary for meaningful policy evaluation.

1.3.5 Urban Forestry in the Global South: Structural Constraints and Alternative Trajectories

Much urban forestry scholarship has been produced in Europe, North America, and Australia. However, applying these frameworks to rapidly urbanizing cities in the Global South requires caution. Nagendra & Gopal (2010) and Ahmad et al., (2025) argue that urban green governance in developing contexts is shaped by informal settlements, weak enforcement, and rapid land-use change. Under such conditions, the institutional capacity assumed in Northern literature may not exist. In South Asian megacities, urban forests are often embedded within contested land regimes, where public land is scarce and political pressure favors development over conservation. Additionally, environmental governance may be centralized at provincial or national levels, limiting municipal autonomy (Ribot, 2002). These structural factors fundamentally shape policy design possibilities. Air pollution crises in cities such as Lahore or Delhi have elevated tree planting within public discourse. However, critics argue that tree planting initiatives may serve as visible, politically attractive interventions that distract from structural emission reduction policies (Anamika & Pradeep, 2016). This critique parallels broader debates in climate governance, where visible 'green' projects may substitute for systemic transformation.

Another dimension concerns equity and environmental justice. While Northern literature often highlights racialized canopy disparities (Boone et al., 2009), Global South contexts may exhibit

different patterns of inequality linked to informal settlements, elite enclave developments, and uneven service provision. Yet comparative empirical research examining how urban forest policy addresses these inequalities across contexts remains limited. Furthermore, Miyawaki-style dense plantation initiatives - prominent in several South Asian cities - raise theoretical debates about ecological authenticity versus rapid greening. Critics question whether such high-density monoculture plantings constitute sustainable urban forest systems or short-term symbolic interventions (Barns et al., 2025). This debate highlights the tension between ecological science and political expediency in urban forestry policy. The Global South literature therefore complicates universalist narratives of urban forestry as a straightforward climate solution. It suggests that policy analysis must account for structural governance constraints, political incentives, and contextual socio-economic realities.

1.3.6 Equity, Environmental Justice, and the Politics of Distribution

The integration of equity into urban forest governance represents one of the most significant shifts in recent scholarship (Nesbitt et al., 2018). Historically, urban trees were considered neutral environmental goods. However, empirical studies demonstrate persistent spatial inequalities in canopy distribution. Schwarz et al. (2015) and Nesbitt et al. (2019) document correlations between lower-income neighborhoods and reduced canopy cover across multiple cities. These findings have prompted calls for equity-driven canopy targets. Yet scholars debate how equity should be operationalized. Should policies prioritize areas of greatest canopy deficit, heat vulnerability, and/or socio-economic deprivation (Nesbitt et al., 2018, 2019)? The choice reflects normative assumptions about justice and public good provision. Anguelovski et al. (2018) introduce the concept of green gentrification, arguing that urban greening projects can increase property values and displace vulnerable populations. This critique challenges simplistic assumptions that more trees automatically produce socially beneficial outcomes. It implies that urban forest policy must be integrated with housing affordability and anti-displacement strategies.

Equity considerations also intersect with participation. Community-based tree planting programs may empower residents, yet they may also transfer maintenance responsibilities to communities without adequate support (Nesbitt et al., 2018). Thus, participatory approaches must be critically evaluated rather than assumed inherently equitable. Importantly, equity scholarship remains

unevenly integrated into formal urban forest policy analysis. While canopy assessments increasingly include socio-demographic overlays, few studies systematically examine how equity principles are embedded within policy instruments and implementation provisions. Comparative research across cities operating in different political cultures could illuminate whether equity is substantively institutionalized or rhetorically invoked.

1.3.7 Urban Forests within Climate Governance and Policy Coherence Debates

Urban forest policy increasingly operates within broader climate governance frameworks. Cities adopt climate action plans that include tree planting as mitigation and adaptation measures. However, climate governance literature warns against policy siloing. Nilsson et al. (2012) emphasize the importance of policy coherence, arguing that environmental goals may conflict with economic or infrastructural priorities if not integrated across sectors. For instance, transportation infrastructure expansion may reduce canopy cover unless tree protection is embedded in zoning regulations. Similarly, housing densification strategies may limit space for tree planting unless green infrastructure is explicitly mandated. Howlett & Rayner (2018) argue that policy mixes must be internally consistent and mutually reinforcing. In the urban forest context, this implies that canopy targets must align with land-use regulation, development incentives, budget allocations, and monitoring systems. Yet empirical studies suggest that many urban forest plans operate parallel to, rather than integrated with, spatial planning frameworks (Ordóñez & Duinker, 2013). Climate urbanism also raises questions about scale. Urban forests are local assets, yet climate mitigation operates at global scale. The symbolic appeal of tree planting in climate discourse may overshadow more complex emission reduction policies. This tension invites critical scrutiny of how urban forest policy is framed within climate narratives and whether it functions as substantive infrastructure or symbolic gesture.

1.3.8 Comparative Urban Environmental Policy: Methodological Gaps

Comparative urban environmental governance research has expanded in recent decades, yet structured comparisons of urban forest policy remain rare. Most studies focus on single-city case studies, limiting generalizability. Where comparisons occur, they often emphasize ecological metrics rather than governance architecture. Structured, focused comparison (George & Bennett, 2005) provides a methodological foundation for examining how similar policy domains operate under different institutional conditions. However, applying this rigor to urban forestry requires a

clearly operationalized analytical framework. Few studies explicitly compare how cities define urban forest problems, set goals, select instruments, and structure implementation. Even fewer integrate Global North and Global South cases within a single analytical model. This methodological gap limits theoretical development in urban forest governance scholarship. By applying a structured policy framework across Copenhagen and Lahore, this study contributes to comparative environmental governance literature and addresses a significant empirical void.

1.3.9 Repositioning Forest Policy Analysis in Urban Governance Scholarship

While urban forestry scholarship has expanded rapidly in ecological, spatial, and justice-oriented directions (Allegretto et al., 2022; Roy et al., 2012), its engagement with structured policy analysis remains comparatively limited. Much of the literature evaluates canopy outcomes, ecosystem services performance, or socio-spatial distribution (Allegretto et al., 2022; Roy et al., 2012), but fewer studies systematically interrogate the internal architecture of urban forest policy itself. This represents a critical conceptual gap. Max Krott's (2005) forest policy analysis framework offers a structured analytical logic linking issues, goals, instruments, and implementation provisions. Originally developed for traditional forest governance at national or regional scales, Krott's framework conceptualizes policy as a coherent sequence beginning with problem definition and culminating in operational delivery. Yet its application to urban forestry has been limited and largely untheorized within comparative urban governance contexts. From a contemporary policy design perspective, Krott's model aligns closely with Howlett's (2023) argument that effective policy requires logical consistency between problem framing and instrument choice. However, Krott's framework predates more recent debates on policy coherence, instrument mixes, and governance complexity. Without theoretical updating, it risks appearing overly linear and technocratic.

Urban forest governance, as demonstrated in previous sections, is embedded within multi-level governance systems, spatial planning conflicts, equity debates, and climate politics (Lawrence et al., 2013; Ordóñez et al., 2019). Therefore, applying Krott's framework requires reinterpretation within contemporary governance theory. Rather than viewing issues → goals → instruments → implementation as a purely sequential process, it must be understood as an iterative and politically contested cycle. Problem definitions are shaped by power relations; goals may reflect political compromise; instruments may be constrained by institutional capacity; implementation is

influenced by administrative fragmentation. This reinterpretation strengthens Krott's framework rather than replacing it. By embedding it within governance, implementation, and policy coherence scholarship, the framework becomes a structured comparative lens capable of interrogating internal policy consistency and institutional feasibility across diverse urban contexts.

1.4 Objectives

1.4.1 General Objective

To systematically analyze and compare urban forest policies in Copenhagen and Lahore.

1.4.2 Specific Objectives

1. To assess the issues addressed in the urban forest policies of the two cities.
2. To evaluate the goals articulated in the urban forest policies of the two cities.
3. To examine the policy instruments used in each city.
4. To analyze the implementation provisions of urban forest policy in each city.
5. To systematically compare the urban forest policies of Copenhagen and Lahore across issues, goals, instruments, and implementation provisions.

1.4.3 Research Questions

1. What key issues are addressed in the urban forest policies of Copenhagen and Lahore?
2. What goals are articulated in each city's urban forest policy?
3. What policy instruments are used in each case?
4. What implementation provisions structure urban forest policy delivery in each city?
5. What patterns of convergence, divergence, and institutional variation emerge between the two cities?

CHAPTER 2: ANALYTICAL FRAMEWORK

2.1 Theoretical Foundation and Conceptual Positioning

This research adopts the structured policy analysis framework developed by Max Krott in *Forest Policy Analysis* (2005) as the core analytical lens for examining urban forest policies. Krott conceptualizes policy as a political and administrative response to societal problems and proposes that it can be systematically analyzed through four interrelated components: **issues, goals, instruments, and implementation provisions**. These components together form a coherent structure that links problem definition to political intention, policy design, and operational execution. While Krott's framework was originally formulated for national forest policy, its analytical logic is directly applicable to urban forest governance, where tree management, canopy expansion, biodiversity protection, and climate adaptation are shaped by political choices, institutional arrangements, and competing land-use pressures. However, to ensure theoretical robustness and contemporary relevance, this study does not rely exclusively on Krott. Instead, Krott's framework is situated within broader policy design and governance scholarship.

Policy design theory emphasizes that effective public policy requires coherence between problem definition, objective formulation, and instrument selection (Howlett, 2023; Howlett & Rayner, 2018). Similarly, implementation research highlights that institutional capacity, administrative coordination, and accountability structures critically shape policy outcomes (Hill & Hupe, 2022). Urban forest governance literature further stresses the importance of multi-level coordination, cross-sectoral integration, and socio-spatial equity in urban green infrastructure management (Lawrence et al., 2013; Ordóñez & Duinker, 2013). By embedding Krott's structured analytical categories within these broader theoretical debates, this study develops a comprehensive framework capable of evaluating both the internal coherence and governance capacity of urban forest policy systems. Importantly, the framework functions not only as a descriptive tool but as a comparative analytical matrix. Drawing on principles of structured, focused comparison (George & Bennett, 2005) and comparative case study methodology (Yin, 2018), each city - Copenhagen, and Lahore - is examined using identical analytical components and evaluation criteria. This standardization allows systematic cross-case comparison and minimizes subjective interpretation.

The framework thus enables identification of patterns of convergence, divergence, and institutional variation across distinct political-administrative systems.

2.2 Analysis of Policy Issues

Within Krott's framework, issues represent the societal or environmental problems that justify policy intervention. The construction of issues is not merely technical but political; it reflects how policymakers interpret environmental challenges and prioritize certain concerns over others. As policy design scholarship emphasizes, the way a problem is framed strongly influences subsequent goal setting and instrument choice (Howlett, 2023). In this study, the comparative analysis of issues examines how Copenhagen and Lahore diagnose urban forest-related challenges and how those diagnoses are supported by empirical evidence. The analysis considers whether issues are framed primarily in ecological terms - such as declining canopy cover, biodiversity loss, urban heat island effects, or stormwater management - or whether they are articulated as socio-spatial problems related to unequal green space distribution, public health disparities, or environmental justice. Urban development pressures, including densification, infrastructure expansion, and land-use conflicts, are also examined as drivers of policy intervention. A key comparative objective is to assess whether issue framing reflects local contextual conditions or broader global sustainability discourses. For instance, in some contexts urban forestry may be primarily embedded within climate mitigation and adaptation agendas, while in others it may be positioned as a response to rapid urbanization or governance fragmentation. The analysis further evaluates whether issue definitions are supported by systematic inventories, canopy mapping, climate modeling, or other data-driven tools, thereby assessing the analytical robustness of problem construction. By comparing how issues are defined across the two cities, the study reveals how institutional capacity, political priorities, and socio-economic conditions shape the foundational diagnosis of urban forest policy.

2.3 Analysis of Policy Goals

Policy goals represent the intended outcomes formulated in response to identified issues. Goals express normative priorities and reveal the strategic orientation of policy systems. In urban forest governance, goals may encompass ecological objectives such as canopy expansion and biodiversity enhancement, social objectives such as equitable access to green space, economic

objectives such as ecosystem service valuation, or governance-oriented objectives such as improved coordination and monitoring. This research comparatively evaluates the goals articulated in the urban forest policies of Copenhagen and Lahore by examining their scope, clarity, ambition, and coherence. Drawing on policy design theory, the study assesses whether goals are internally consistent and logically aligned with identified issues (Howlett & Rayner, 2018). Particular attention is given to whether goals are measurable and time-bound, as the presence of quantified targets and monitoring mechanisms indicates higher policy maturity and accountability. The comparative analysis also evaluates the integration of equity and sustainability principles within goal structures. Contemporary urban forestry literature increasingly emphasizes distributive justice and spatial equity in canopy allocation (Ordóñez & Duinker, 2013). Therefore, the study examines whether social and spatial disparities are explicitly addressed within policy goals or remain implicit. By comparing goal structures across the two cities, the research identifies differences in strategic ambition, normative emphasis, and policy coherence. This allows assessment of whether urban forest policy is primarily framed as an environmental management tool, a climate resilience strategy, a social equity intervention, or a governance reform instrument in each context.

2.4 Analysis of Policy Instruments

Policy instruments constitute the practical tools through which goals are pursued. According to classic instrument theory, public policy tools can be categorized as regulatory (“sticks”), economic (“carrots”), and informational (“sermons”) mechanisms (Vedung, 1998). More recent scholarship emphasizes that policies typically operate through instrument mixes and that coherence within these mixes is essential for effectiveness (Howlett & Rayner, 2018). In this study, instruments are comparatively analyzed across regulatory, economic, informational, and cooperative dimensions. Regulatory instruments include tree protection ordinances, zoning provisions, development requirements, and enforcement mechanisms. Economic instruments encompass budget allocations, financial incentives, penalties, and funding programs. Informational instruments include urban tree inventories, canopy mapping systems, reporting platforms, and public awareness campaigns. Cooperative instruments refer to cross-departmental coordination, participatory planning processes, and public-private partnerships. The comparative evaluation examines whether the instrument mix in each city aligns with stated goals and whether tools are mutually reinforcing or contradictory. For example, ambitious canopy targets require not only

planting initiatives but also long-term maintenance funding, regulatory protection, and monitoring systems. The study assesses whether instrument design addresses both public and private land, whether maintenance is emphasized alongside expansion, and whether equity considerations are operationalized through targeted interventions. By comparing instrument structures, the research identifies differences in policy design sophistication and evaluates the internal consistency of urban forest governance systems across cases.

2.5 Analysis of Implementation Provisions

Implementation provisions define how policy instruments are translated into action. Implementation research emphasizes that policy outcomes are heavily influenced by institutional capacity, administrative clarity, and accountability mechanisms (Hill & Hupe, 2022). Thus, examining implementation structures is essential for understanding whether policy ambition is matched by operational feasibility. This study comparatively evaluates implementation arrangements in Copenhagen and Lahore by examining institutional responsibilities, resource allocation, procedural mechanisms, and monitoring systems. The analysis considers whether lead agencies are clearly designated, whether mandates are fragmented or coordinated, and how vertical governance relationships function. It further assesses financial stability, staffing capacity, technical expertise, and operational infrastructure. Procedural clarity is examined through the presence of standardized planting guidelines, maintenance cycles, reporting requirements, and enforcement mechanisms. Particular attention is given to accountability systems, including monitoring frameworks and compliance provisions. The comparative analysis seeks to determine whether institutional arrangements are coherent and capable of delivering stated goals or whether structural weaknesses may undermine policy effectiveness. Through this component, the research reveals variations in governance maturity and administrative capacity across the two cities.

2.6 Cross-Case Synthesis and Comparative Analysis

Following the within-case analyses, the study conducts a structured cross-case synthesis in line with comparative case study methodology (George & Bennett, 2005; Yin, 2018). This stage systematically evaluates patterns of convergence and divergence across the four analytical components. The synthesis assesses the degree of alignment between issues, goals, instruments, and implementation provisions within each case and compares overall policy coherence across

cities. The cross-case evaluation identifies whether similar challenges generate similar policy responses or whether contextual governance structures produce divergent policy architectures. It further evaluates the integration of urban forestry within broader spatial planning systems, the incorporation of equity considerations, and the relative strength of institutional capacity. By applying a consistent analytical framework across diverse socio-political contexts, the study moves beyond descriptive case studies and develops a theoretically grounded comparative assessment of urban forest governance systems. Through the integration of Krott's structured forest policy framework with contemporary policy design, governance, and comparative methodology scholarship, this analytical framework provides a rigorous foundation for evaluating and comparing urban forest policies in Copenhagen and Lahore.

Table 2.1: Analytical Framework for Urban Forest Policy Analysis

Urban Forest Policy	Component		Analytical Focus	Key Indicators	Expected Analytical Output
	1. Issues (Problems that necessitate policy intervention)		Identify and assess the primary urban forestry challenges the policy seeks to address.	- What environmental, social, and equity problems are identified - Are issues recognized through data, research, or stakeholder consultation? - How context-specific are the issues (local relevance vs. global trends)?	Understanding of each city's core urban forestry challenges and their policy recognition; establishes the problem baseline.
	2. Goals (Desired outcomes to address the issues)		Examine the policy's vision and measurable objectives in addressing identified issues.	- What are the stated canopy cover targets or environmental performance goals? - Do goals include social, ecological, and equity aspects? - Are goals measurable and time-bound? - Do goals align with issues?	Comparative synthesis of policy ambitions and priorities - clarity, measurability, and inclusiveness of goals.
	3. Instruments (Policy tools to achieve the goals)	Regulatory	Analyze the means and mechanisms used to achieve policy goals.	- What regulatory tools exist? - What economic tools are implemented? - What informational tools are considered? - What participatory practices are in place? - Are instruments balanced across regulatory, economic, informational, and cooperative dimensions? - Are instruments in-line with goals?	Evaluation of policy instrument mix - its coherence, comprehensiveness, and effectiveness in addressing urban forest challenges.
		Economic			
		Informational			
		Cooperative			
	4. Implementation Provisions (Mechanism to operationalize the instruments)	Who	Assess how policies are operationalized through institutions, processes, and resources.	- Which agencies or departments are responsible for implementation? - How are funding mechanisms structured and sustained? - Are enforcement provisions clear and effective? - How are stakeholders (citizens, NGOs, private sector) engaged? - Is there a timeline or phased approach to implementation?	Insight into governance capacity and practical effectiveness - identifying institutional strengths, coordination gaps, and implementation barriers.
		What			
		When			
		Which Resources			
		How Much			
		Actors/ Partners			

Table 2.1 illustrates the comparative analytical framework applied in this study. The framework is structured around four interrelated components derived from Krott's (2005) forest policy analysis model: Issues, Goals, Instruments, and Implementation Provisions. These components are positioned sequentially to reflect the logical flow of policy design: problem definition (Issues) informs objective formulation (Goals), which guides the selection of policy tools (Instruments), and ultimately shapes operational execution (Implementation Provisions). Each of the four components contains standardized sub-components that are applied consistently across the two case studies: Copenhagen and Lahore. This structured, focused comparison ensures analytical consistency and enables cross-case evaluation.

The framework operates on two analytical levels:

- 1. Within-Case Analysis Level:** Each city's urban forest policy is independently analyzed across the four components.
- 2. Cross-Case Comparative Level:** The results from each city are systematically compared to identify patterns of convergence, divergence, and institutional variation.

Arrows between the four components indicate interdependence and feedback loops. For example, weak implementation capacity may undermine ambitious goals, while poorly defined issues may produce incoherent instruments. The outer comparative layer represents the cross-case synthesis stage, where alignment, coherence, equity integration, and governance strength are evaluated across the cases. This framework thus allows the study to move beyond descriptive policy review and toward structured comparative evaluation of urban forest governance systems.

CHAPTER 3: METHODOLOGY

3.1 Study Area and Case Selection

This study examines urban forest policy in Copenhagen (Denmark) and Lahore (Pakistan) through a comparative case study design. The two cities were selected purposively to represent contrasting but globally relevant governance and urbanization contexts, enabling an analytically rich comparison of policy design and implementation across different institutional systems, development pressures, and climatic regimes. The case selection supports a “most-different” logic in comparative research, where variation in socio-political and environmental settings helps reveal how different contexts shape policy problem framing, goal-setting, instrument choice, and implementation capacity (George & Bennett, 2005; Hupe & Sætren, 2015; Yin, 2018). At the same time, the cases share important comparability as large metropolitan centers facing common urban forestry pressures such as densification or sprawl, infrastructure expansion, climate risks, and uneven distribution of urban green benefits. This combination of diversity and comparability strengthens the analytical value of the cross-case synthesis.

3.1.1 Copenhagen

Copenhagen provides a European and Nordic governance lens, reflecting strong municipal planning traditions and the integration of urban nature into broader sustainability agendas. The City of Copenhagen municipality as shown in figure 1 covers roughly 90 km² and had a population of 667,099 with a larger urban area of about 525 km² and approximately 1.4 million residents (Statistics Denmark, 2025). The city’s urban forest and “urban nature” agenda is formalized through strategic policy instruments such as the Tree Policy 2016-2025, which explicitly aims to increase the number of trees and improve growing conditions while pursuing a headline target of planting 100,000 new trees within the policy period. It has an estimated urban tree crown of 18-20% as of 2025. Copenhagen’s Urban Nature Strategy 2015-2025 also emphasizes access and livability; the city’s strategy documents include accessibility objectives such as ensuring that a very high share of residents in urban development areas can reach parks or similar blue-green spaces within a short walking time of 15 minutes. Climatically, Copenhagen falls within the temperate oceanic (Cfb, where C= Temperate, f=No dry season, b=Warm summer) zone in standard Köppen-Geiger climate classifications, and its policy environment is increasingly shaped by adaptation priorities related to intense rainfall events and coastal/sea-level risks (Köppen

Climate Explorer, 2025; WMO, 2025). Despite its northern latitude, the climate is moderated by the North Atlantic Drift, resulting in mild winters and cool summers. Average summer highs hover around 20°C, while winter temperatures typically fluctuate near freezing. Annual precipitation is approximately 66 cm, and the city is increasingly focused on climate adaptation to manage rising sea levels and storm surges (EBSCO, 2023). These characteristics make Copenhagen a highly relevant case for analyzing how a well-resourced municipality embeds urban forestry within climate adaptation, biodiversity, and quality of life planning.

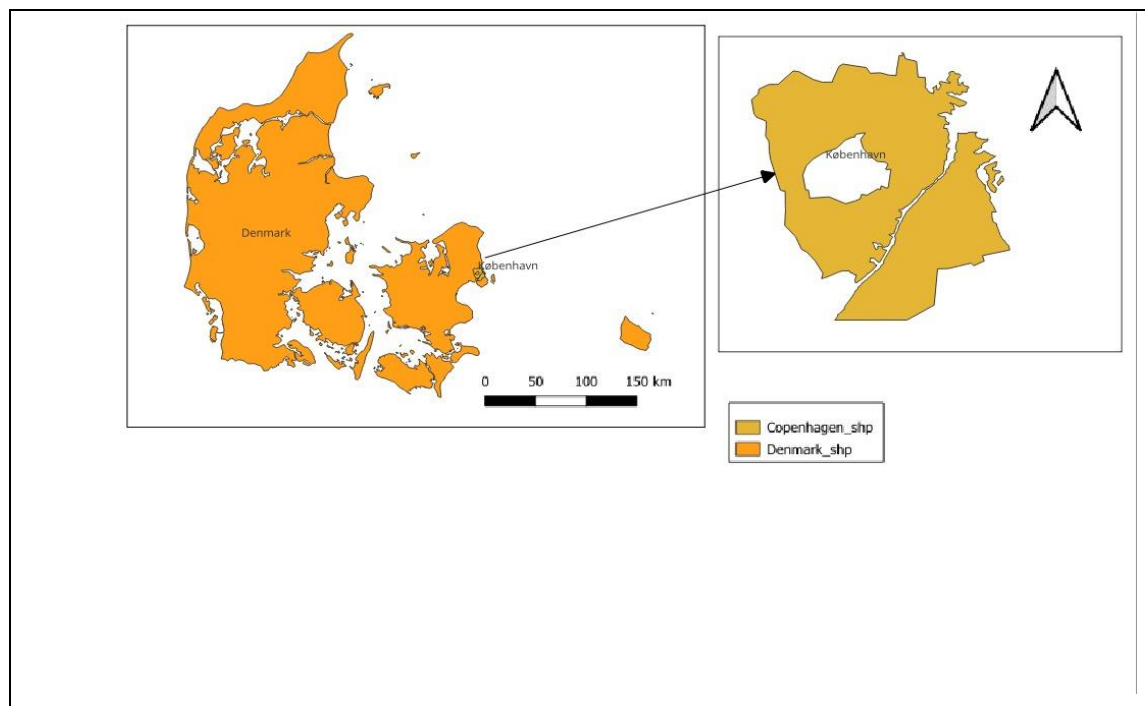


Figure 1: Copenhagen City Map

3.1.2 Lahore

Lahore provides a South Asian megacity context characterized by rapid urbanization, high population density in built-up zones, and acute environmental stressors. For the purposes of this study, Lahore is treated primarily at the district/metropolitan scale consistent with how many official planning and environmental documents report land area and administrative responsibilities. Lahore District as shown in figure 2 covers approximately 1,772 km², and official sources based on Pakistan's 2023 census report a population of roughly 13 million for the district (Population Census, 2023). Lahore's climate is commonly classified as hot semi-arid (BSh; B=dry, S=Semi-arid, h=Hot) bordering humid subtropical conditions, with extreme summer heat and seasonal monsoon dynamics that intensify heat exposure and flood risks (Köppen Climate

Explorer, 2025; Weather Spark, 2026). These conditions make urban trees particularly relevant for cooling, air quality, and livability outcomes. At the same time, recent policy and remote-sensing based assessments describe Lahore's urban green and tree resource base as critically constrained. For example, the Lahore City Biodiversity Action Plan (2025) reports that total green area derived from remote sensing - parks and forests combined - constitutes approximately 32 km², which is about 1.8% of Lahore's total district area (The Urban Unit, 2025), which is significantly below global urban forestry standards (Shirazi & Kazmi, 2016). Alongside these constraints, Lahore has also seen high-profile urban greening initiatives, including Miyawaki-style urban forest projects promoted through provincial government communications and associated with local implementing bodies such as the Parks and Horticulture Authority. Lahore therefore offers an analytically important case for examining how policy goals and instruments respond to severe green-space scarcity, rapid development pressure, and institutional fragmentation, and how implementation provisions (resources, coordination, maintenance, monitoring) condition the feasibility of urban forest policy ambitions.

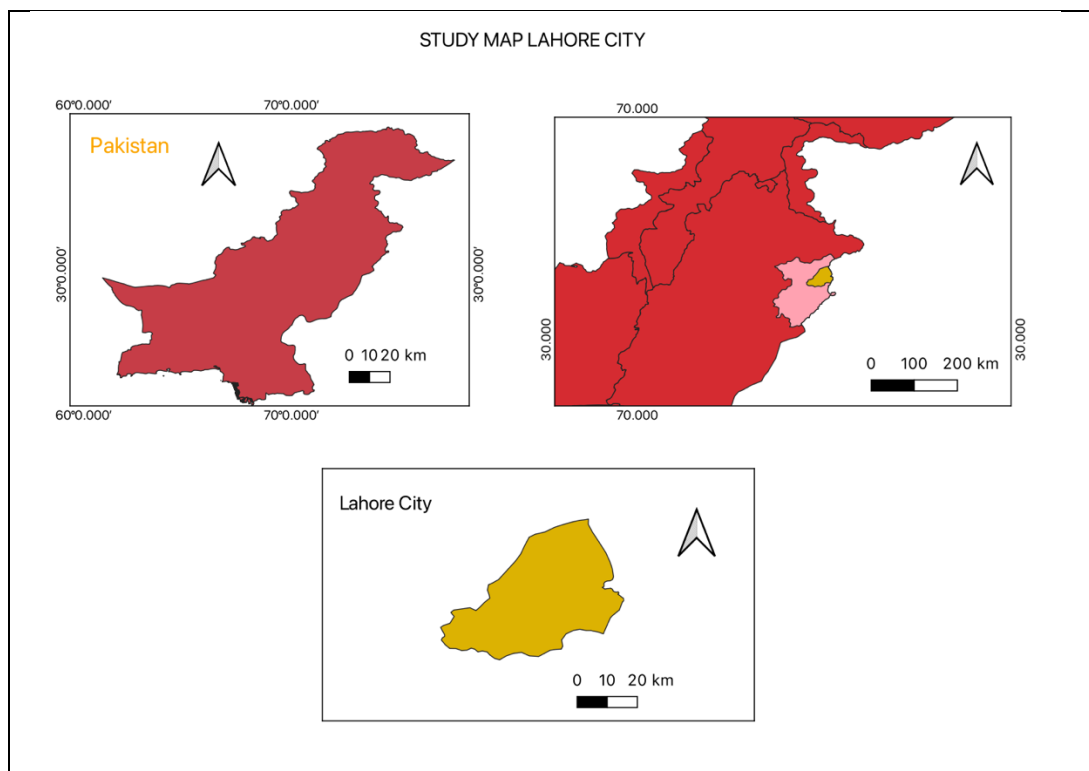


Figure 2: Lahore City Map

Across the two cases, the study area design intentionally captures variation in (i) governance and planning systems (Nordic municipal planning; multi-tier provincial/municipal arrangements), (ii) urban form and growth dynamics (compact/densifying vs spatially expansive vs rapidly urbanizing megacity), and (iii) climatic and environmental stress profiles (temperate coastal adaptation vs humid subtropical heat stress vs hot semi-arid heat and air quality risks). This variation creates a strong empirical basis for applying the thesis analytical framework - issues, goals, instruments, and implementation provisions - consistently across cases while generating meaningful comparative insights about policy coherence and implementation capacity.

3.2 Research Design

This study adopts a qualitative comparative case study design to examine urban forest policy in Copenhagen (Denmark) and Lahore (Pakistan). The research seeks to understand how urban forest policies are structured, operationalized, and implemented across distinct governance systems. Rather than measuring causal relationships quantitatively, the study aims to develop a theory-informed comparative analysis of policy design and governance capacity. The research design follows the logic of structured, focused comparison (George & Bennett, 2005), whereby each case is examined using identical analytical questions derived from a shared theoretical framework. This approach ensures analytical consistency across cases and allows meaningful cross-case comparison. The case study design is further guided by Yin's (2018) principles of case study research, particularly the emphasis on maintaining a clear connection between theoretical propositions, data collection, and analysis. The selection of Copenhagen and Lahore reflects a purposive strategy aimed at capturing variation in governance structures, socio-economic conditions, climatic contexts, and levels of institutional capacity. The comparative design therefore enables examination of how different political-administrative environments shape urban forest policy formulation and implementation.

3.3 Data Sources and Collection Methods

The study relies on two primary sources of qualitative data:

1. Document analysis
2. Semi-structured expert interviews

3.3.1 Document Analysis

The core of the analysis is based on official policy documents, including urban forest strategies, municipal development plans, climate action plans, tree protection ordinances, strategic frameworks, and implementation reports. Only formally adopted or publicly recognized documents were included to ensure analytical legitimacy. These documents provide insight into formal policy structures, including problem definitions, objectives, instrument choices, and institutional arrangements. Supplementary materials such as acts, canopy assessments, monitoring dashboards, and municipal budget summaries were also reviewed where available. Documents not originally available in English (particularly those from Copenhagen) were translated using Google Translate. To enhance translation accuracy, key policy terminology and technical terms were cross-checked with official English-language summaries where available. In cases where ambiguity arose, contextual interpretation was verified through expert interviews and secondary literature. While machine translation may introduce minor linguistic imprecision, careful cross-validation minimized risks of conceptual misinterpretation.

3.3.2 Semi-Structured Expert Interviews

To complement document analysis and strengthen contextual understanding, semi-structured interviews were conducted either in person or online with relevant authorities and experts involved in urban forest governance. Interview participants included municipal officials, technical administrators, planners, and policy actors directly engaged in urban forestry or related environmental governance. Semi-structured interviews were selected because they allow flexibility to explore policy processes in depth while maintaining consistency across cases (Kvale & Brinkmann, 2009). An interview guide was developed based on the four analytical components of the theoretical framework: issues, goals, instruments, and implementation provisions. This ensured alignment between interview questions and the document analysis structure.

The interviews served three main purposes:

1. To clarify ambiguities in policy documents
2. To understand implementation realities beyond formal documentation
3. To assess institutional coordination and operational challenges

Interview data were used primarily for triangulation and contextual enrichment rather than as standalone empirical narratives. Where appropriate, interview insights were used to validate or nuance document-based findings.

3.4 Analytical Framework Operationalization

The analytical framework is grounded in (Krott's (2005) forest policy analysis model and strengthened through policy design and governance theory (Hill & Hupe, 2022; Howlett, 2023). The four core analytical components - issues, goals, instruments, and implementation provisions - structure both document analysis and interview interpretation. Each component was operationalized into standardized analytical criteria applied consistently across the cases. This ensured comparability and minimized interpretative bias. Policy issues were analyzed to identify how each city defines urban forest challenges and whether these definitions are empirically grounded. Policy goals were assessed in terms of ambition, measurability, internal coherence, and alignment with identified issues. Policy instruments were categorized into regulatory, economic, informational, and cooperative mechanisms, following established policy instrument theory (Vedung, 1998). Implementation provisions were examined through institutional roles, resource allocation, procedural clarity, and accountability structures. The same analytical coding scheme was applied to both documentary material and interview transcripts to ensure integration of findings.

3.5 Data Analysis Methods

Data analysis was conducted using qualitative content analysis with a deductive coding strategy (Creswell & Creswell, 2017; Mayring, 2014). Deductive coding involves applying predefined theoretical categories to empirical material. In this study, the four analytical components formed the primary coding framework.

The analysis proceeded in two stages.

First, within-case analysis was conducted independently for Copenhagen and Lahore. Each city was systematically examined across the four components to produce a structured policy profile. The analysis involved the extraction of information either verbatim or through interpretation to

ensure completeness. During this stage, interview data were used to clarify institutional dynamics, validate interpretations, and provide additional insight into implementation practices.

Second, cross-case synthesis was undertaken. Following comparative case study methodology (Creswell & Creswell, 2017; George & Bennett, 2005; Yin, 2018), patterns of convergence and divergence were identified across cases. The cross-case comparison focused on:

1. Alignment between problem definition and policy goals
2. Coherence between goals and instrument selection
3. Consistency between policy ambition and implementation capacity
4. Institutional coordination and governance strength

This two-level analytical structure ensured both in-depth understanding within each case and systematic comparison across cities.

3.6 Triangulation and Validity

To enhance credibility and analytical rigor, the study employs methodological triangulation by combining document analysis and semi-structured interviews. Triangulation strengthens construct validity by cross-verifying information from multiple sources (Yin, 2018). Construct validity is further enhanced through the use of clearly defined analytical categories derived from established policy theory. Reliability is supported through the consistent application of a standardized coding framework across cases. Because this study is qualitative and comparative, it aims for analytical generalization rather than statistical generalization. The findings contribute to theoretical understanding of urban forest governance by identifying structural patterns in policy design and institutional arrangements.

3.7 Ethical Considerations

This study adheres to standard ethical principles governing qualitative research. All interview participants were informed of the purpose of the research, the voluntary nature of participation, and their right to withdraw at any time without consequence. Informed consent was obtained prior to conducting interviews. Participants were assured that their responses would be treated

confidentially. Where requested, identities were anonymized in the thesis to protect professional and institutional sensitivities. Interview data were securely stored and used exclusively for academic purposes. Given that the study involves analysis of public policy and institutional practices rather than sensitive personal data, ethical risks were minimal. Nevertheless, care was taken to ensure accurate representation of participants' statements and to avoid misinterpretation of institutional positions. For non-English documents, machine translation was used solely for analytical purposes. Interpretations were cross validated through interviews and secondary sources to minimize the risk of misrepresentation due to translation inaccuracies. The research was conducted in accordance with academic integrity standards and institutional research ethics guidelines.

CHAPTER 4: RESULTS

4.1 Urban Forest Policy of Copenhagen

4.1.1 Issues

1. Insufficient Green Space Per Capita

With the rapid population growth with the rate of 1.1% per annum trajectory as per city population index which led to current population of 667,099 as of 2025 with the population density of 7.339 per km² in the urbanized area of 90.90 km² (City Population, 2025), these contemporary statistics had been visualized while devising the policy and strategy documents a decade ago. Therefore, insufficient green space per capita due to population growth and urban density is considered a core issue. The rapid population increase is outpacing green space expansion, leading to reduced access to nature per person compared to other cities. As indicated that until 2025, Copenhagen's population is projected to grow by nearly 100,000 (Urban Nature, 2015). Such a growth reduces the amount of green space per capita. The strategy document compares Nordics cities such as Oslo, Helsinki and Aarhus, highlighting Copenhageners already have much less green space per capita. However, the comparison remains unclear as what parameters makes those cities comparable (Urban Nature, 2015, pp. 5, 17).

2. Difficulty in Creating New Large Green Areas

The expanding city limits space for large-scale nature development. Although the new areas to accommodate the growing population is under consideration, the challenge of creating new green areas remain an issue that needs an attention. Moreover, the City of Copenhagen is seen as a city of bicycle, and to keep this status intact, a bicycle lane is very important (Sustainable Cities, 2014). Such a huge area also halts the expanding of green space areas on the roads. In addition, increasing demand of parking lots and the proper waste storage areas occupy big spaces along with routes from which a vehicle can reach the trash area to pick up the waste (Urban Nature, 2015, pp. 4, 17)(RC1, RC2, RC6).

3. Climate Change Impacts

A devastating cloudburst in 2011 caused over DKK 5-6 billion in damage in Copenhagen. Due to climate change, future weather projections point to an increase in extreme rainfall events during summer, an increase in precipitation during winter, more days of high wind, and rising sea levels. Extreme rainfall events present enormous challenges which vary from area to area and cannot, therefore, be solved by a single initiative such as upgrading the sewerage system (Cloudburst Management Plan, 2012). Considering the fact, the municipality of Copenhagen has taken climate change impacts an impending threat; however, to mitigate the climate effects like heavier rainfall, cloudburst, flooding, and heatwaves, the current infrastructure and nature are insufficiently resilient. That leads to a challenge of making an adaptive city to future climate conditions (Urban Nature, 2015, pp. 3, 5, 15, 19).

4. Decline in Biodiversity and Ecosystem Health

The City of Copenhagen has lost three species of Yellow Wagtail, Sand Lizards, and Adders as well as several species of plants over the years. The municipality believes that loss of biodiversity affects the overall ecosystem health and should be addressed. Not only that, but also the city has these Great Bats which due to contemporary situation appeared to be declining. Such a scenario led to the decline in biodiversity, native species and nature types (Urban Nature, 2015, pp. 3, 5, 15, 19) (RC3).

5. Negative Impacts on Human Health, Well-Being, and Quality of Life

The Copenhagen municipality realizes that urban nature has significant impacts on human health, overall well-being and quality of life. Limited urban nature contributes to stress, obesity, reduced physical activities, and poorer mental health; it also limits recreational opportunities (RC2). There is a direct relation between stress and distances to the green areas. People living at a distant to the nature, parks, or urban trees could feel more stressed than otherwise. Moreover, people who live more than one kilometer away from a green area have a heightened risk of being obese ($BMI \geq 30$) than people who live less than 300 meters from a green area. Considering the facts, the city of Copenhagen wants to give importance to urban nature which if would not consider seriously may lead to disastrous consequences on people living in Copenhagen (Urban Nature, 2015, pp. 13, 19).

6. Poor Micro-Climate and Environmental Quality

The City of Copenhagen is vigilant about the issues like high temperatures, poor air quality, noise pollution, and lack of air circulation. Such issues are exacerbated by the insufficient greenery (Urban Nature, 2015, p. 15).

7. Lack of Integration and Prioritization of Urban Nature in Development

Over the years, the local plan and urban planning do not sufficiently prioritize and integrate nature, especially on non-municipal land, leading to missed opportunities. Residence democracy within the non-municipal areas decides whether they want a parking lots or trees. In Copenhagen, trees on the private lands can be cut uninformed (RC6). Such a scenario leads to quick attention as the city is very densely populated with urbanized areas mostly owned by the private entities.

4.1.2 Goals

Vision #1: Creating More Urban Nature in Copenhagen

The City of Copenhagen addresses the issues with broad vision which encompasses multiple factors that answer directly or indirectly the challenges. Creating more urban nature in this regard focus on quantitative expansion, addressing issues like insufficient green space and urban density. It aims to integrate nature across all land types. As a rule, the existing trees must be preserved, and those felled must be replaced unless it is physically impossible as Principle 1 and 2 of Tree policy 2016 highlighted. The purpose is to ameliorate urban nature on municipal and non-municipal land, including tree courtyards, rooftops, and species protection during development. The urban nature strategy aims to embrace all urban areas and to ensure that municipal as well as non-municipal land is included in the effort to create more and better urban nature in the city as Principle 3 of Tree Policy 2016 suggests. The ambition is to see more trees along the streets, more green courtyards, and more urban nature on rooftops and to ensure that the species living in the city are prioritized as the city is developed and transformed. Where urban nature already exists, it should be maintained and strengthened in order to enhance and expand the nature experiences that Copenhageners call for. The City of Copenhagen aims to develop, strengthen and safeguard urban nature as a whole even as the city undergoes constant development and transformation. The vision

includes the following aspects as priority goals to accomplish and sustain the perception and recognition of Copenhagen as a Green City (Urban Nature, 2015, pp. 5, 7, 17).

Biodiversity: To expand and strengthen initiatives that support biodiversity, ensuring that biodiversity considerations are consistently integrated into urban development and transformation processes. This approach aims to protect, enhance, and expand urban nature across the city.

Climate Adaptation: To ensure that climate adaptation measures contribute to increasing urban green spaces, improving biodiversity, and enhancing recreational opportunities for residents.

Nature Areas: To develop and maintain Copenhagen's natural areas with a strong focus on biodiversity enhancement and the improvement of nature-based experiences.

Parks: To manage and develop city parks by balancing cultural heritage, recreational demands, and ecological considerations.

Cemeteries: To maintain and develop cemeteries as multifunctional green spaces that contribute to recreational life in Copenhagen, while respecting their primary function as places of peace, quiet, and remembrance.

Urban Development: To ensure that local planning processes incorporate clear requirements for both the quality and quantity of urban nature, and to promote the creation of green municipal spaces within new urban development areas.

Municipal Land: To require high standards for the quality and extent of urban nature when municipal areas, streets, and buildings undergo renovation or redevelopment.

Non-Municipal Land: To actively encourage and support green initiatives on privately owned land by motivating, inspiring, and collaborating with private stakeholders and landowners.

Trees: To increase the overall number of trees in Copenhagen by providing favorable growing conditions for both new and existing trees and promoting diversity in tree species selection.

Spatial Qualities: To ensure that urban nature is planned, developed, and maintained with a strong emphasis on human-scale design and a coherent urban character.

Vision #2: Improving the Quality of Urban Nature in Copenhagen

This vision emphasizes qualitative improvements, using the five parameters to ensure urban nature is functional, resilient, and contextually appropriate. It addresses issues like biodiversity decline, climate vulnerability, and human well-being. The purpose is to enhance the quality of urban nature in the city (Urban Nature, 2015, pp. 5, 19). The city plans to do this by improving the quality and growth condition of both new and existing urban nature and to ensure the varied selection of species in the city as Principle 4 and 5 of Tree Policy 2016 underlined respectively. To achieve high-quality urban nature, five key quality parameters have been established: biodiversity, climate adaptation, functionality, spatial qualities, and care and maintenance. Importantly, the quality of urban nature is context-dependent and differs across various locations within the city. These quality objectives are intended to serve as minimum standards.

Biodiversity Parameter

Copenhagen has a responsibility to halt the decline of biodiversity, native species, and natural habitats. As a result, urban nature should contribute to biodiversity enhancement wherever possible. The level of biodiversity may differ depending on location and land use. Natural areas are expected to support high biodiversity, characterized by a wide range of species and habitats, with a particular emphasis on native species. These areas should reflect natural continuity and ecological authenticity. In contrast, parks, cemeteries, streets, and other urban spaces may support lower biodiversity levels and can incorporate non-native species and cultivated plants that fulfill functional and aesthetic requirements.

Climate Adaptation Parameter

Climate change poses significant challenges in Copenhagen, making climate adaptation a central quality objective for urban nature. Green spaces should play an active role in strengthening the city's resilience to climate impacts, including extreme weather events, emerging diseases, and the introduction of new species. Urban nature should contribute to effective stormwater management

by absorbing, retaining, and delaying rainwater, while also supporting evaporation processes that improve the local microclimate. Parks, streets, cemeteries, and natural areas should collectively enhance climate comfort and environmental resilience across the city.

Functionality Parameter

Urban nature provides the foundation for a wide range of recreational activities and everyday experiences. A key quality objective is to ensure that both new and existing green spaces are planned, developed, and managed to respond to residents' needs for recreation while accommodating increasingly intensive use. As Copenhagen is a high-density city with diverse spatial demands, urban nature must often serve multiple purposes simultaneously. In built-up areas, green spaces need to be robust enough to withstand high levels of use and function as part of integrated, multi-purpose solutions. In contrast, natural areas may be more sensitive and should prioritize nature-based experiences over intensive recreational use.

Spatial Qualities Parameter

Urban nature functions as a vital architectural and design element that enhances the visual and experiential quality of the city. It contributes to well-designed urban spaces by reinforcing human scale, coherence, identity, and character. Across changing seasons, vegetation enriches the urban landscape through variations in color, light, texture, and atmosphere, adding sensory depth to city life. A key quality objective is to ensure that urban nature is planned and maintained in a way that strengthens architectural qualities, improves public spaces, and enhances the overall character of neighborhoods.

Care and Maintenance Parameter

Effective care and maintenance are essential to preserving the quality, functionality, and appearance of urban nature. Maintenance strategies should be adapted to the specific function, context, and intensity of use of each green space. In highly frequented urban spaces and streets, maintenance should support intensive use and promote social and cultural activities. In natural areas, management practices should prioritize biodiversity conservation, species diversity, and rich

nature-based experiences. Tailored maintenance approaches are therefore fundamental to sustaining high-quality urban nature throughout the city.

4.1.3 Instruments

Regulatory Instruments

Green Planning Tool: This tool specifies quality and quantity demands in planning and projects in the city of Copenhagen. Developing the Greenification tool that the municipality use to specify demands concerning the quality and quantity of urban nature in local planning and public works projects. The tool is to accommodate any planning challenges and must include an assessment of the economic consequences. The tool calculates a “green factor” for each project site, which quantifies both the scope and quality of the urban nature on it. It is a key part of implementing the strategy via tangible actions in public construction projects and in local development plans. The numeric values vary from 0 - 2, with 0 the lowest and 2 the highest. The categories are low (0-0.4), medium (0.5-0.9) or high (1-2.0). The scope of urban nature constitutes the total area of grass surfaces, permeable surfaces, water surfaces, flower beds, hedges, trees, bushes, green roofs and green façades on the project site. The quality is defined by four factors: uniqueness, climate adaptation, biodiversity and recreation. The green planning tool helps the City of Copenhagen systematically incorporate more and better urban nature into public construction projects and local development plans (Urban Development, 2015; Urban Nature, 2015, pp. 28, 32).

Tree Policy and Guidelines: Tree policy and administrative guidelines are used for preserving, planting and caring for trees in the city of Copenhagen. Those secure the selection of species of trees and safeguard trees deemed worthy of preservation (Tree Policy, 2016; Urban Nature, 2015, p. 32).

Policy for Cemeteries: A policy for the cemeteries owned by the Copenhagen increases the focus on the cemeteries’ recreational potential and ensure that they are included as an active part of Copenhageners’ recreational life. Cemeteries are managed as public parks for lounging, walking, and quiet reflection, alongside their primary function for mourning (Urban Nature, 2015, p. 24) (RC1).

Economic Instruments

Urban Nature Fund: It is an annual urban nature fund to supplement existing works budgets, where it is relevant to strengthen urban nature. The fund accepts applications from all administrations in the City of Copenhagen. Also, it supports private initiatives aimed at creating more urban nature in the city. Among other purposes, the funds may be used to co-fund the planting of trees in private streets, volunteer nature management and efforts to safeguard endangered species. Moreover, the fund may also be used to apply for co-funding from external foundations (Urban Nature, 2015, pp. 32, 36).

Funding for Acquiring Land for New Green Areas: The municipality develops and implements an action plan for the strategic selection and purchase of areas for establishing new green municipal areas in urban development areas. This initiative may also include areas in the existing city (Urban Nature, 2015, p. 28).

Economic Benefits Analyses: The city develops analyses of green areas to document the value of green areas in Copenhagen. This includes a dialogue with developers and clients and the development of business cases. The initiative may be carried out in cooperation with institutions of higher learning (Urban Nature, 2015, p. 28).

Informational Instruments

Catalogue of Urban Nature Solutions: The city administration develops a catalogue of solutions that involve urban nature to be used in connection with urban development, public works projects, and to be used in non-municipal areas. The catalogue should include key figures as well as initial and operational costs for the individual solutions (Urban Nature, 2015, pp. 28, 32, 36).

Communication and Learning about Urban Nature: The City of Copenhagen coordinates the initiatives regarding communication about urban nature and launching new communication and learning initiatives. The new initiatives should have particular emphasis on the learning perspective for children and young people. These initiatives to be implemented in cooperation with the City's nature schools and staffed playgrounds (Urban Nature, 2015, p. 24).

User Studies: The City of Copenhagen conducts the user studies in green municipal areas, through which the citizens' behavior and needs are documented in annual user interviews and park counts (Urban Nature, 2015, p. 24).

Mapping Urban Nature: The Administration charts existing nature resources in Copenhagen. The initiative is carried out in cooperation with local citizens and green interest organizations (Urban Nature, 2015, p. 24).

Urban Nature in Urban Planning Analysis: It analyzes how the city of Copenhagen currently incorporates urban nature into urban planning and developing a new procedure for incorporating urban nature into the planning process (Urban Nature, 2015, p. 28).

Cooperative Instruments

Strategic Framework: The City of Copenhagen develops a new concept for district-specific action plans designed to coordinate current initiatives and set a clear course for the evolution of urban nature. Accompanied by a pilot project, these plans focus on comprehensive nature management across city-owned green areas, prioritizing the eradication of invasive species, nature rehabilitation, and adaptive management while simultaneously strengthening administrative competencies. Central to this strategy is a dedicated focus on biodiversity, including an annual effort to protect at least one endangered species within the city. Furthermore, the city implemented an ambitious plan to plant 100,000 trees by 2025, a goal that encompasses street trees, park trees, and partnership-based planting initiatives. To tie these efforts together, a plan for "green links" is being established; this includes mapping existing and potential corridors to support climate adaptation, biodiversity dispersal, and recreational connectivity. Ultimately, these integrated action plans aim to elevate awareness and prioritize green links within the city's broader planning agenda (Urban Nature, 2015, pp. 24, 32).

Urban Greening Partnerships: The City of Copenhagen is fostering a diverse network of partnerships to enhance urban nature through targeted collaboration across municipal and private lands. This strategy begins with green municipal areas, where the city works alongside

volunteer nature managers and grazing guilds to maintain and develop existing ecosystems. In urban development zones, these partnerships shift focus toward establishing temporary green spaces and innovative urban nature. This effort extends to municipal land through the cultivation of urban gardens and flower beds at schools and nursery schools, ensuring that nature is integrated into the daily lives of citizens. To sustain this momentum, the city collaborates with companies, non-profit housing associations, and green enthusiasts to facilitate knowledge sharing and events that inspire public contribution to the urban landscape. Finally, the initiative addresses climate resilience by partnering with utility companies and private landowners to launch projects dedicated to managing rainwater on private property. Together, these efforts create a comprehensive framework for a greener, more sustainable Copenhagen (Urban Nature, 2015, pp. 24, 28, 32, 36).

Urban Biodiversity Partnership Model: Copenhagen's "Together for Biodiversity" partnership represents a landmark cross-sectoral approach to urban conservation, uniting the municipal government with 19 major private landowners to oversee more than 40% of the city's total land area. By integrating ecological health into all stages of urban development - from initial planning and new construction to daily operations and renovations - the coalition aims to enhance existing green-blue spaces while fostering new habitats across traditionally disparate public and private boundaries. The initiative's commitment to accountability is anchored by the inaugural Biodiversity Status Report 2024, which provides a data-driven framework for monitoring progress and serves as a scalable roadmap for sustaining biodiversity within a densifying urban landscape (Together For Biodiversity, 2024) (RC2).

Strategic Management and Organizational Changes: The City of Copenhagen launches a pilot project for the long-term strategic management of urban nature, focusing on establishing clear priorities for operational funding, resource allocation, and the continuous improvement of green infrastructure. By conducting this pilot across administrative boundaries, the project seeks to utilize existing professional competencies more efficiently and foster inter-departmental collaboration. While the immediate focus is on testing these strategies, the ultimate long-term goal is to successfully scale these integrated management practices across a much larger geographic area (Urban Nature, 2015, pp. 24, 32).

Climate Adaptation Think Tank: The City of Copenhagen establishes a dedicated think tank tasked with setting a strategic course and inspiring visionary approaches for integrating urban nature into cloudburst management plans. This collaborative body focuses on creating a comprehensive catalogue of green solutions specifically designed to mitigate the impact of cloudbursts. By bridging creative vision with practical application, the initiative aims to transform how urban environments respond to extreme weather events through nature-based infrastructure (Urban Nature, 2015, p. 32).

4.1.4 Implementation Provisions

Who (Responsible Entities)

The Government of the City of Copenhagen: The city government is the supreme political body with respect to power designated under the Danish Constitution and the Local Government Act that give the legal right to manage local affairs independently, within the framework of national legislation. The government is headed by Lord Mayor and Mayors of the 7 standing committees- one among them is The Climate, Environment, and Technical Committee- and the City Council of 55 members. The city government holds the collective responsibility of urban development, urban nature and greening, environmental and climate concerns, and the like (CPH Govt, 2025).

The Climate, Environment, and Technical Administration: The administration is responsible for the City's environmental and climate activities, development of the traffic area, development of new urban areas and for several authoritative functions. The administration devises the policies, strategy plans, guidelines and standard operation procedures (SOPs) upon the recommendation of the City Government. In addition, the administration oversees the City's green areas. The activity portfolio covers operation and construction activities in relation to roads and parks, parking facilities, operation of cemeteries and cleaning services. Also, the administration oversees the implementation of strategic plans, such as the CPH 2025 Climate Plan and policies for vulnerable urban areas (CETA CPH, 2025) (RC1, RC2, RC3).

Local Citizens and Green Interest Groups: Local citizens and green interest groups serve as co-responsible actors in urban nature governance by contributing local knowledge to

mapping and planning processes and by participating in partnerships that support the implementation and maintenance of green initiatives (Urban Nature, 2015, p. 24).

Private Landowners, Developers, and Utility Companies: They refer to non-municipal actors that own, manage, or control land and infrastructure within the City of Copenhagen but outside direct municipal ownership. These actors include individual and corporate property owners, real estate developers responsible for new construction or redevelopment projects, and utility providers managing technical infrastructure such as energy, water, sewage, and transport-related installations (Urban Nature, 2015, p. 36) (RC1, RC2).

What (Specific Actions)

Political Will and Public Demand: The city government commits to the political will to make the city of Copenhagen as a green city. The government translates the public demand and makes the city clean, green, and biodiverse with additional 100,000 trees by 2025 out of status quo. Therefore, they ask the thinktanks and technocrats from the administration to come up with policy, strategy, and plan and get them approved for their execution (RC1, RC2, RC3).

Action Plans and Policies: The administration develops district-specific plans, policies for cemeteries/trees, and targeted management. Developing a new concept for action plans for each urban district which coordinate current initiatives and set the course for the development of urban nature in each district. A pilot project is carried out in connection with the action plans. Moreover, the administration develops and implements an action plan for planting 100,000 trees in Copenhagen by 2025, which include initiatives for street trees, park trees, and partnership trees (Urban Nature, 2015, pp. 24, 32) (RC1, RC2).

Quality, Quantity and Solutions: The administration makes sure to use greenification tool to specify quality and quantity of urban nature in local development plans and public projects, considering the five principles of Tree Policy and political commitment of planting 100.000 trees. Further, the administration considers the catalogue of solutions that collectively focuses on urban development, public works projects and in the non-municipal areas, and it underscores initial and operational costs of solutions. The city established 10-12 green courtyards a year, that serve as

crucial green oases where citizens get together and enjoy nature and changing seasons closely. Courtyards also play an important role in climate adaptations, since the courtyard renovation typically involve a dedicated efforts to secure local rainwater drainage (Urban Nature, 2015, pp. 28, 36) (RC1, RC2, RC3).

Studies and Mapping: The administration conducts user studies, analyses, and resource charting in green municipal areas. The citizens' behaviors and needs are documented in annual user interviews and park counts (Urban Nature, 2015, p. 24).

Funds and Land Acquisitions: The administration establishes funds and acquire land for urban greening and nature. It develops and implements an action plan for the strategic selection and purchase of areas for establishing new green municipal areas (Urban Nature, 2015, p. 28) (RC1, RC2).

Partnerships and Communication: The administration forms collaborations and launches initiatives. It establishes partnerships between city of Copenhagen, local citizens, companies, green enthusiasts, non-profit housing associations, developers, and private landowners, focusing on knowledge sharing, maintenance initiatives, communication and events-emphasizing on learning perspective for children and young people in cooperation with the City's nature schools and staffed playgrounds (Together For Biodiversity, 2024; Urban Nature, 2015, p. 36) (RC2).

When (Timelines)

By 2025 Overall: Most indicators and major goals, like 100,000 tree planting and increasing canopy cover by 20% are targeted to be achieved by 2025. However, the administration annually launches two nature maintenance projects (Urban Nature, 2015, pp. 23, 32).

Annual Actions: On an annual basis, the City of Copenhagen undertakes a series of recurring actions to ensure the continuous management, improvement, and monitoring of urban nature. These include the initiation of multiple nature maintenance and management projects within municipal green areas, alongside the development and implementation of an action plan for

endangered species that guarantees at least one targeted conservation effort each year. The city also conducts systematic user studies in municipal green spaces through annual interviews and park-use counts to document citizens' behavior, needs, and patterns of use. To support implementation, an annual urban nature fund is established to complement existing operational budgets and finance initiatives that strengthen urban nature across administrative boundaries, while also supporting private and partnership-based projects. This includes co-funding tree planting in private streets, volunteer-based nature management, and biodiversity conservation efforts, as well as enabling access to external foundation funding. In parallel, the city carries out a substantial number of 50 partnership projects each year, reinforcing collaboration with non-municipal actors and embedding urban nature initiatives into long-term, citywide practice (Urban Nature, 2015, pp. 24, 36).

Pilot to Long-Term Sequencing: Pilot projects are carried out across administrative boundaries to test new approaches to the strategic management of urban nature and to improve the efficiency of existing green operational competences within municipal administrations. These pilots focus on developing coordinated management practices, defining strategic priorities for operational funding, and guiding decisions related to the replacement, enhancement, and long-term maintenance of urban nature. By experimenting with cross-sectoral collaboration and resource allocation in a controlled setting, the municipality can evaluate institutional, financial, and operational arrangements before wider application. In the long term, successful pilot models are intended to be scaled up and embedded into citywide management structures and routine administrative practice (Urban Nature, 2015, pp. 24, 32).

Which Resources (Assets Needed)

Human/Organizational Resources: Institutional competence within the city administration is a fundamental requirement for the effective management and rehabilitation of natural assets. To ensure strategic alignment, a dedicated think tank serves to integrate urban nature initiatives into broader cloudburst management frameworks. According to official administrative data, this operational capacity is supported by a total workforce of 2,200 employees. This figure includes 1,200 technical and administrative staff, complemented by 1,000 personnel dedicated to daily maintenance and on-ground operations (Urban Nature, 2015, pp. 25, 28) (RC2).

Physical/Material Resources: The Climate, Environment, and Technical Administration maintains comprehensive solution catalogues that detail key performance indicators alongside initial capital and ongoing operational expenditures. Physical resources include specialized planting tools, machinery, and maintenance vehicles; any specialized equipment gaps are addressed through targeted short-term rentals. While the administration does not operate in-house tree nurseries, it secures biological assets through external procurement from commercial plantations (Urban Nature, 2015, p. 28) (RC1).

Informational Resources: The administration's operational framework is underpinned by a robust data infrastructure, integrating comprehensive tree inventories, spatial mapping, and academic research. To ensure these resources remain current and evidence-based, the city maintains active collaborations with universities and various communication platforms. This knowledge-sharing ecosystem allows for the continuous update of environmental data, ensuring that urban nature management is informed by both longitudinal internal records and the latest scientific developments (Urban Nature, 2015, p. 24) (RC2).

Third Party Services: The Administration utilizes a structured procurement framework to engage external support for extended operational tasks. Selection is conducted through a transparent tendering system, wherein qualified private entities - including contractors and entrepreneurs - are invited to submit competitive bids. This protocol is designed to ensure equitable access to opportunities and to guarantee that the Administration secures the most advantageous terms for all specific service requirements (RC3).

How Much (Budgets, Quantities, Scales)

Quantifiable Targets/Indicators: 75% of Copenhageners perceive the city as a green city, with 95 % of the users are satisfied with the quality of the parks, cemeteries, and nature areas in Copenhagen city. 50% of Copenhageners are satisfied with the amount of vegetation in streets, alleys and city squares. And at least 90% of Copenhageners in urban development areas are within less than a 15-minute walk from a park, beach, nature area or harbor bath. 20% of Copenhagen's total area is covered by tree crowns – a canopy cover. 10% of Copenhageners find that they take

active part in the effort to create more and better urban nature; therefore, the City of Copenhagen annually carries out 50 partnership projects with a focus on urban nature (Urban Nature, 2015, pp. 23, 27, 31, 35).

Budgets and Funds: There is an annual fixed budget of 1.8 billion Danish Kroner DKK (~241.04 million Euros) as per 2025 which the administration uses for its all functions and operations. Almost 500 million DKK (~66.94 million Euros) are specifically utilized for the urban nature and greening of the city. However, all the initiatives are not funded through the annual budget and therefore require subsequent economic priorities. Additional funding is primarily found in the annual budget negotiations or by reallocating operational funds. This includes annual urban nature fund to support private initiatives aimed at creating more urban nature in Copenhagen. Among other purposes, the fund may be used to co-fund the planting of trees in private streets, volunteer nature management and efforts to safeguard endangered species. The fund may also be used to apply for co-funding from external foundations (CETA CPH, 2025; Urban Nature, 2015, p. 36)(RC1).

Scales/Quantities: The administration plans to achieve the target of planting 100,000 trees across the city by 2025. In addition, it establishes 10 - 12 green courtyards every year as they serve as important green oases in the city where Copenhageners meet their neighbors and experience nature and the changing seasons up close (Urban Nature, 2015, pp. 32, 37).

Actors/Partners (Collaborators/Networks)

Public-Private Partnerships: The administration inspires, motivates, and engages in partnerships with private actors and landowners to ensure that the city of Copenhagen actively supports green initiatives on non-municipal land. Such a partnership also helps develop new urban areas; thereby, the administration aims to enable a flexible and creative use of urban areas, and to support initiatives and activities that help create more urban nature in urban development areas, focusing on establishing temporary green areas and urban spaces. The city of Copenhagen carries out 50 partnership projects as non-municipal land makes up about 57% which include non-profit housing, private detached homes, co-op housing associations, state-owned areas, and companies. For example, 19 major private landowners to oversee more than 40% of the city's total land area,

supporting biodiversity initiatives together with the municipality. Amid climate impact and its adaptation, the partnership between the administration, utility companies, and private landowners' association ensures some privately owned streets to be transformed into green cloudburst streets. Such a public private venture focuses on knowledge sharing, communication and events that engage and motivate citizens to contribute to the effort of creating more urban nature (Urban Nature, 2015, pp. 28, 36) (RC2).

Community and Interest Groups: Copenhageners are co-creators of future urban nature. The administration believes that locals' support is very crucial towards the efforts to create more and better urban nature. Therefore, the city administration inspires and motivates citizens to get involved making the city greener and also supports communities that contribute to creating more and better urban nature, including volunteering with nature management to grazing guilds and local urban gardens (Urban Nature, 2015, pp. 21, 24).

Educational and External Entities: Schools and staffed playgrounds play vital role in highlighting significance of urban nature and launching new communication and learning perspective for children and young people. Higher learning institutions develop economic benefit analyses of green areas, doing dialogue with developers and clients and the development of business cases. External foundations may also collaborate and be part in activities to support park renovations, tree planting and biodiversity (Urban Nature, 2015, pp. 24, 28).

4.2 Urban Forest Policy of Lahore

4.2.1 Issues

1. Insufficient Urban Forest Canopy Cover

Lahore, the second largest city of Pakistan by land and by population, was historically called the City of Gardens. This very title has vanished (Alam & Lovett, 2019). The city is deficient in urban tree with estimated canopy cover from 1.8 to 6% of its land area (CBAP Lahore, 2025, p. 26; Hugs Green, 2024; PUPUFP, 2019, p. 11; Shirazi & Kazmi, 2016). However, Saleem & Saleem, (2016) highlighted that the shrubs are considerably increased from 7% in 1994 to 52% in 2014 while tree cover in 1994 was 8% and it got declined to 0.38% in 2014. Such a drastic decline presents a serious concern for Lahore's green infrastructure and raises significant questions about the city's environmental sustainability.

2. Uncontrolled and Unregulated Land Use Patterns

The city of Lahore has expanded significantly over recent decades, with urban sprawl accounting for approximately 18 % of overall expansion - a growth driven not only by demographic and economic forces but also by weak land-use regulations and poor implementation of planning policies (Nadeem et al., 2021; PUPUFP, 2019, p. 11). As GIS and satellite-based studies reveal, the built-up area has increased at the expense of fertile agricultural land and vegetation, with expansion largely following linear road networks rather than a coordinated master plan, resulting in haphazard, low-density development (Sarwar et al., 2025)(RL1). This uncontrolled growth pattern reflects broader issues of inadequate governance and unregulated land conversion, conditions that are consistent with global definitions of urban sprawl as the spread of urban land uses without effective planning controls (Nasar et al., 2025).

3. Urban Air Pollution and Smog Concerns

Lahore's urban air pollution is driven by a combination of high vehicular density, industrial emissions, and seasonal meteorological conditions that trap pollutants, making smog a recurring public health crisis (Mehboob, 2025). During winter, temperature inversions and stagnant air worsen pollutant accumulation, regularly pushing particulate matter (PM_{2.5}) levels far above safe

thresholds recommended by the World Health Organization (Farrukh & Khwaja, 2024). Rapid increase in vehicles - with millions of cars, motorcycles, and other modes of transport - combined with weak emission controls and poor vehicle maintenance, has significantly worsened Lahore's air quality (PUPUFP, 2019; Safdar, 2024b). The city is now the second worst throughout the world in terms of air quality (Khalid et al., 2025).

4. Climate Change Extreme Events

Last two decades have been very challenging in term of the vivid impacts of climate change in the country. Lahore city has been the under its direct influence (RL1, RL3). Pakistan's climate is becoming increasingly volatile, with floods, droughts, erratic rainfall, and heatwaves occurring with greater frequency and severity, closely associated with rising global temperatures and changing atmospheric dynamics. These events not only threaten rural communities and agriculture but also impact urban centers such as Lahore, where infrastructure and public services struggle to cope with extreme weather pressures (A. Ahmed, 2025). Intense monsoon rainfall has repeatedly overwhelmed drainage systems and river embankments, leading to urban flooding that disrupts economic activity and damages property, while prolonged heatwaves aggravate public health and energy demand in densely populated cities (Sheikh, 2025). At the same time, erratic rainfall patterns and prolonged dry spells contribute to drought conditions that reduce water availability and stress agricultural and urban water supply systems, underscoring the multifaceted impacts of climate change on both people and ecosystems (Safdar, 2024a).

5. Rapid Population Growth and Urbanization

The city population is around 13 million and is increasing with 2.8% annually (Population Census, 2023). Population growth has produced substantial adverse impacts on the environment (Malik et al., 2025). Such a figure poses grave challenge to management of the city and fulfilling the urban greening demands. Moreover, urban growth would likely to mount pressure as it would increase by double by the mid-century. Rapid urban expansion and rural-to-urban migration are major contributors to population growth in Lahore, with people moving for employment, education, and economic opportunities (Malik et al., 2025). Studies show urban growth in Lahore has led to the

conversion of agricultural land to built-up areas, a trend linked closely to population increases (Zahran et al., 2023).

6. Threat of Biodiversity Decline

Rapid urbanization, habitat destruction, and expansion of built-up areas in Lahore have led to the decline of natural ecosystems and native species, diminishing the city's biodiversity. Research shows that green spaces and ecosystems have shrunk significantly as vegetation is replaced by concrete, undermining habitats that once supported a variety of birds and wildlife (Khalid et al., 2025). Studies and expert reports indicate that many native bird species have become rare or absent in Lahore due to urban expansion, air pollution, loss of nesting sites, and reduced indigenous vegetation (S. Ahmed, 2025). According to the Lahore City Biodiversity Action Plan, there has been a noticeable decline in both migratory and resident bird species, reflecting broader biodiversity stresses exacerbated by habitat fragmentation and climate influences (CBAP Lahore, 2025, pp. 16, 43).

7. Peri-Urban Land and Housing Pressures

The rapid expansion of Lahore has increasingly shifted development into peri-urban areas, placing mounting pressure on agricultural land and housing markets at the city's fringe (Cermeño, 2021; PUPUFP, 2019, p. 101). Peri-urban regions around Lahore have seen intensive real-estate speculation and the engulfment of rural settlements, as high population growth, rural-urban migration, and weak governance frameworks drive scattered housing developments and land conversion without comprehensive planning or services provision. This process has resulted in the loss of fertile agricultural land, disrupted traditional rural livelihoods, and strained public infrastructure and service delivery, as peri-urban residents often lack formal zoning, tenure security, and basic amenities (Shah & Abbas, 2015). Scholars argue that such unregulated peri-urban growth reflects entrenched inequalities in access to land, housing, and services, and underscores the urgent need for integrated planning strategies to manage peri-urban expansion sustainably and equitably (Cermeño, 2021).

4.2.2 Goals

Vision: An attractive and livable province (Lahore City) with a thriving urban forest that provides economic, ecological and social benefits as part of Punjab's green and sustainable valued infrastructure (PUPUFP, 2019, p. 28).

Goal 1: Enhancing the Quality and Quantity of the Urban Forest

The policy goal is to mandate a strategic increase in both the quality and quantity of the city's urban forest and green infrastructure under the Urban Forest Policy, establishing it as a vital foundation for public health by strengthening ecological resilience and economic security through the enhanced provision of ecosystem services such as air purification, carbon sequestration, and microclimate regulation. To perpetuate these benefits across generations, the policy emphasizes continuous public-private partnerships that protect biodiversity and maintain the city's cultural and aesthetic heritage (PUPUFP, 2019, pp. 27, 28).

Goal 2: Safeguarding Urban Forest Resources Amid Urban Development

The policy goal is to foster a sustainable urban forest in Lahore by strategically balancing urban development with conservation efforts, thereby safeguarding the city's green assets amid growth pressures. This objective emphasizes the minimization of tree loss during construction activities and mandates that all new land-use changes prioritize the protection and enhancement of essential green infrastructure, ensuring long-term ecological resilience and urban livability (PUPUFP, 2019, p. 28).

Goal 3: Integrating Urban Forestry into Urban Planning Processes

The policy goal is to seamlessly integrate urban forest planning with existing local and regional land use and master planning processes, ensuring that tree canopy development aligns with broader community development objectives for sustainable growth. Complementing this, the policy seeks to enhance the compatibility of trees and vegetation with buildings and infrastructure by promoting innovative practices in planning, design, engineering, and arboriculture, thereby minimizing conflicts and maximizing environmental, aesthetic, and functional benefits in urban environments (PUPUFP, 2019, p. 28).

Goal 4: Strengthening Knowledge, Research, and Monitoring

The policy goal is to enhance knowledge and understanding of Lahore's urban forest, encompassing its ecological processes, social, environmental, and economic benefits, as well as optimal management practices to ensure its vitality and resilience. This objective also emphasizes the establishment of long-term monitoring systems to track changes in the urban forest over time, enabling adaptive, evidence-based decision-making that supports sustainable stewardship across generations and aligns with broader regional strategies in Punjab (PUPUFP, 2019, p. 28).

Goal 5: Promoting Community Participation in Urban Forest Governance

The policy goal is to recognize communities as essential partners in the stewardship of urban forests, fostering a sense of social ownership, heightened awareness, and active participatory governance to cultivate resilient and sustainable cities. This approach aims to align local efforts with national and global sustainability commitments, including the Sustainable Development Goals, thereby empowering residents to contribute meaningfully to environmental preservation and long-term urban well-being (PUPUFP, 2019, p. 28).

4.2.3 Instruments

Regulatory Instruments

Mandatory Land Reservations for Forests and Green spaces: The regulatory policy instrument enforces mandatory land reservations for forests and green spaces to promote sustainable urban and peri-urban development, stipulating that in peri-urban area planning, a minimum of 10% of the total land use must be designated exclusively for green spaces and tree plantations. For any public or private landowner holding at least 12 acres (4.85 hectares), it is required to allocate 1 acre (0.40 ha) out of every 12 acres for forest establishment, in strict compliance with policy regulations governing the quantity and species of plants per acre, along with standards for harvesting, cutting, and replenishment to maintain ecological balance. In cases of smaller landholdings, owners must plant a minimum of 10 trees per acre to contribute to overall green coverage and biodiversity enhancement (PUPUFP, 2019, p. 32) (RL1).

Housing Rules for Urban Forests: The regulatory policy instrument amends the Punjab Housing Societies and Land Sub-division Rules 2010 to integrate urban forestation standards into housing society planning, mandating that developers reserve at least 7% of the total area for open spaces or parks while incorporating a dedicated 2.5% allocation (drawn from within the 7% open space provision) specifically for urban forests. This requirement ensures compliance with established policy guidelines on the number and type of species and plants to be cultivated per acre, along with protocols for cutting, harvesting, and replenishment to sustain ecological integrity and long-term forest health in residential developments (PUPUFP, 2019, p. 32) (RL1).

Plan Submission and Approval Processes: The regulatory policy instrument mandates that all existing and new housing societies submit their Urban Forest Plans to relevant departments and authorities, including the Lahore Development Authority (LDA), Cooperative Department, Local Government & Community Development (LG&CD), Housing Urban Development & Public Health Engineering (HUD&PHE), Development/Housing Authorities, Environment Protection Department (EPD), and Parks and Horticulture Authority (PHA), for thorough review and approval to obtain a No Objection Certificate (NOC). The formal submission process is directed to the LDA, which in turn requires NOCs from the aforementioned entities, culminating in the issuance of plan approval and the final NOC to ensure compliance with urban forestation standards and sustainable development practices (PUPUFP, 2019, p. 32) (RL1, RL3).

SOPs and Bylaws for Landscaping and Drainage: The regulatory policy instrument mandates that the City's landscape regulations and stormwater management regulations be fully aligned to require mandatory integration of landscaping elements with Low-Impact Development (LID) urban catchment approaches in all planning, development projects, and approvals. All plans shall incorporate integrated design principles that simultaneously achieve multiple urban forestry and urban catchment objectives, including native vegetation preservation, enhancement of urban ecology and landscape ecology, landslide management, native soil retention and soil amendment, and stormwater dispersion, retention, and infiltration. The departments concerned, including LG&CD, HUD&PHED, PHA, EPD, LDA, and the Cooperative Department, shall jointly prepare landscaping plans and sustainable urban drainage designs, develop a unified legal framework with detailed plans and SOPs for implementation, and incorporate the necessary provisions of this

policy into their respective bylaws, building regulations, and approval processes (PUPUFP, 2019, p. 36).

Restrictions on Tree Cutting: The regulatory policy instrument mandates that the Parks and Horticulture Authority (PHA) Lahore strictly prohibits all unauthorized tree removal and cutting. No person shall cut, damage, or remove any tree on public land or any place outside private premises without obtaining prior permission in writing from the Authority, except for routine or reasonable trimming of a tree outside private premises carried out by the occupant himself or under intimation to the occupant (PUPUFP, 2019, pp. 73, 80)(RL1).

EIA Compliance and Tree Planting Mandates: The regulatory policy instrument mandates that the Environmental Protection Department (EPD) issues Environmental Impact Assessment (EIA) reports for all types of infrastructure development, including industrial and other related enterprises. All such EIAs mandatorily ensure the implementation of conditions regarding tree plantation and, where necessary, obtain assistance from the Parks and Horticulture Authority (PHA) for the effective execution of these tree plantation conditions, with explicit priority given to urban and peri-urban areas (RL1, RL2)(PUPUFP, 2019, p. 74).

Legal Frameworks and New Laws: The regulatory policy instrument mandates that all concerned departments, agencies, and authorities may, within their respective capacities, propose necessary changes or additions to their legal instruments to align their roles towards the promotion of tree plantation. However, the overall ownership and execution of this policy shall vest exclusively with the Parks and Horticulture Authority (PHA) Lahore (PUPUFP, 2019, p. 12) (RL1).

Regulatory Mechanisms in Spatial Planning: The regulatory policy instrument mandates that urban forestry is treated as an integral component of Punjab's urban structure. Therefore, it is managed as part of the overall city structure with common goals and not in isolation. Lahore city urban forestation initiatives utilize a wide range of tools, including spatial planning and regulatory mechanisms, adequate funding for planting and monitoring, capacity building, research, public awareness, and active inclusion of all stakeholders. Spatial planning supports evidence-based decision making and prioritization of activities accordingly (PUPUFP, 2019, p. 29).

Economic Instruments

Green Development Fund (GDF) and Budget Allocations: The economic policy instrument establishes the Green Development Fund (GDF) under the auspices of the provincial government in collaboration with the Spatial Planning Authority Punjab (SPAP) to address funding gaps in urban forestry activities, ensuring adequate resources for stakeholder departments beyond their standard development and non-development allocations. This fund targets underfunded initiatives such as nursery establishment, land preparation and planting, ongoing maintenance through protection, weeding, irrigation, and the creation of green spaces, with exceptions noted for entities like the Parks and Horticulture Authority, Forestry Department, and other development authorities that already receive sufficient support. The GDF is financed through a diverse array of sources, including provincial government grants, loans, aids, donations from provincial, national, or international agencies, and fees as prescribed by SPAP, thereby mobilizing both public and private contributions to sustain long-term urban greening efforts. Primarily, the fund is allocated toward plantation projects, monitoring and evaluation mechanisms, educational programs, innovative practices, community engagement, and strategic partnerships, all aimed at advancing urban forestry (PUPUFP, 2019, p. 51).

Financial Incentives for Green Roofs: The economic policy instrument promotes the adoption of green roofs - defined as extensions of existing roofs incorporating high-quality waterproofing membranes, root repellent systems, drainage mechanisms, filter cloths, lightweight growing media (soil), irrigation systems, and suitable vegetation - to enhance urban sustainability, stormwater management, and energy efficiency in buildings. To encourage widespread implementation, it provides direct financial incentives in the form of grants and subsidies targeted at property owners, developers, and installers to offset initial installation and maintenance costs. Complementing these, indirect incentives include fee reductions for permitting and regulatory processes, as well as floor space density bonuses that allow for increased building density (PUPUFP, 2019, p. 37).

Self-Revenue Generation Mechanism by PHA Lahore: The economic policy instrument implements a self-revenue generation mechanism for the Parks and Horticulture Authority (PHA) Lahore to ensure financial autonomy and sustainability in managing urban green spaces, primarily

through the regulation and monetization of outdoor advertisements such as billboards, banners, LCD screens, and posters within its jurisdiction, with revenues derived from associated fees, rents, and permits directed back to the authority for operational and developmental purposes. Additionally, the mechanism encompasses income from renting, leasing, and conceding facilities like canteens, shops, lodges, and event spaces under PHA control, as well as charging substantial fees to private entities, including telecommunication companies, for utilizing designated spaces, thereby creating diversified revenue streams that support ongoing urban forestry initiatives, maintenance, and expansion (RL1).

Informational Instruments

Research Initiatives and Innovation: The informational policy instrument establishes structured research initiatives and innovation mechanisms for urban forestry by mandating the creation and maintenance of continuous feedback loops between researchers, academia, and urban forest stakeholders to ensure that scientific inquiry directly addresses real-time policy and management needs. It promotes active collaboration and formal partnerships among educational institutions - particularly Government College University Lahore (GCU) and other universities and research organizations - and relevant government departments, authorities, and community groups, facilitating joint research projects, knowledge exchange, and the adoption of cutting-edge trends and innovations (PUPUFP, 2019, p. 62).

Public Awareness, Education, and Capacity Building: The informational policy instrument focuses on public awareness, education, and capacity building to enhance urban forest management and stewardship in the city, mandating that concerned departments integrate environmental education frameworks emphasizing learning IN, FOR, and ABOUT the environment to foster citizenship actions such as tree planting and conservation. It aims to broaden public understanding of the urban forest's importance, its social, environmental, and economic benefits, and effective management techniques, thereby cultivating greater community involvement and responsibility. To amplify outreach, the instrument leverages media channels - including electronic, print, and social platforms - by utilizing the 10% airtime allocation for Public Service Messages mandated by the Pakistan Electronic Media Regulatory Authority (PEMRA), while engaging the Youth Affairs Department to launch targeted campaigns and training programs

for the next generation. Furthermore, it requires the incorporation of environmental education into school curricula, textbooks, and teacher training programs, supplemented by periodic outdoor student excursions for hands-on plantation and conservation activities, as well as the establishment of voluntary green societies or clubs in schools and universities to promote active participation in urban forestry. Complementing these efforts, the instrument prioritizes broad-scale knowledge enhancement and skill development for key stakeholders, particularly from public sector departments, recognizing urban forests as dynamic ecosystems profoundly influenced by human activities, thus equipping them with the tools for adaptive and sustainable management (PUPUFP, 2019, pp. 62, 63).

Technical Guidelines and Tools: The informational policy instrument provides comprehensive technical guidelines and tools through the Urban Unit, functioning as a dedicated think tank, to assist relevant departments in the formulation of Peri-Urban Forest Plans, ensuring alignment with best practices for sustainable land use and green infrastructure development. It extends technical support for the creation of specialized tools and techniques aimed at maximizing the multifaceted benefits of urban forestry, including ecological, social, and economic advantages. Complementing these efforts, the instrument incorporates essential standardized guidelines such as the Tree Conservation Guidelines, Tree Removal Guidelines, Street Tree Asset Guidelines, Master Urban Forest Guidelines, and Tree Plantation Guidelines, which collectively offer detailed protocols for tree management, preservation, and enhancement to guide stakeholders in achieving resilient and thriving urban forests (PUPUFP, 2019, pp. 31, 32, 36).

Data-Driven Systems: The informational policy instrument promotes data-driven systems for the effective management of Lahore's urban and peri-urban trees as dynamic living assets prone to growth and decay, emphasizing an asset-based approach with a cyclic perspective focused on maintenance, renewal, and adherence to designated service levels to ensure long-term sustainability. It mandates the integration of Information and Communication Technology (ICT) and Geographic Information System (GIS) tools alongside systematic information systems to enhance comprehension of urban ecosystem processes, interactions, and their intrinsic as well as monetary values, thereby facilitating informed stewardship. Furthermore, the instrument requires the development and implementation of specialized tools and guiding frameworks that align with the Punjab Spatial Strategy (PSS) to support evidence-based decision-making, complemented by

the establishment of a centralized data repository with a particular emphasis on geospatial data to consolidate resources, enable real-time monitoring, and drive the achievement of urban forestry objectives (PUPUFP, 2019, pp. 28, 29, 124).

Cooperative Instruments

Departmental Integration and Coordination: The cooperative policy instrument facilitates departmental integration and coordination by mandating the involvement of a diverse array of disciplines, stakeholders, and relevant departments in urban forest management processes, ensuring that policy implementation draws on multidisciplinary inputs to achieve cohesive outcomes in environmental stewardship. It underscores the critical role of integrated management in effectively overseeing, developing, protecting, and conserving urban ecosystems, thereby addressing complex challenges through unified strategies and shared responsibilities. To operationalize this, the Director General of the Spatial Planning Authority Punjab (SPAP) is empowered to lead coordination efforts among all governmental departments and private entities (PUPUFP, 2019, pp. 28, 57).

Stewardship and Partnerships: The cooperative policy instrument promotes stewardship and partnerships to raise awareness of street trees' and urban forests' benefits and health threats, through collaborative programs that strengthen community involvement and ownership. It acknowledges that strong stewardship advances urban forestry goals, elevates leadership, civic pride, engagement, and public understanding of natural systems, yielding better environmental results. Accordingly, it requires integrated program development via partnerships between government, communities, non-profits, private sector, and others, centered on education and outreach to empower participants, share knowledge, and drive collective efforts for protecting and enhancing urban green spaces (PUPUFP, 2019, p. 61).

Roles of Stakeholder Departments: The cooperative policy instrument assigns roles to key stakeholder departments to drive effective urban forestry implementation. Departments including the Forest Department (FD), Local Government & Community Development (LG&CD), Cooperative Department (CD), Environmental Protection Department (EPD), Public Health Engineering Department (PHED), Housing & Urban Development Department (HUD), Board of

Revenue Department (BRD), Agriculture Department (AD), School Education Department (SED), and Irrigation Department (ID) are required, within their respective capacities, to plan, ensure, establish, promote, assist, and take all necessary actions to enhance urban plantation and greening as recommended by the Urban and Peri-Urban Forest Policy (PUPUFP, 2019, pp. 72-80).

Community Integration and Participation: The cooperative policy instrument promotes community integration and participation by recognizing that urban forests create a unique local identity for the city, making citizens direct stakeholders in formulating and implementing urban forest measures. It requires broad consultation with the community, including local experts, conservation groups, indigenous groups, and professionals from engineering, urban planning, architecture, and related fields, to ensure inclusive, representative, and effective urban forestry outcomes (PUPUFP, 2019, p. 29).

Enabling Instruments for Coordination: The cooperative policy instrument develops and implements enabling instruments and a guiding framework aligned with the PSS to ensure evidence-based decision-making. It prioritizes and aligns public sector investments according to localized competitiveness, needs, and priorities, applying a clear set of principles and criteria through ICT. It further establishes a provincial data ecosystem that integrates national statistical data and encompasses departments, agencies, and the private sector to support frameworks for integrated planning (PUPUFP, 2019, pp. 124, 128).

4.2.4 Implementation Provisions

Who (Responsible Entities)

The Government of Punjab: The Punjab Provincial Government is the highest political authority in the province, with decisive political will concentrated in the Chief Minister and the Provincial Cabinet, who control agenda-setting, prioritization, and final approval. The formulation of an urban forest policy typically begins when political and administrative leadership recognize the need for policy intervention. A technical draft is then prepared by relevant provincial departments, often with support from specialized institutions such as the Urban Unit, which provide research inputs and baseline data. The draft undergoes inter-departmental consultation and legal vetting before being compiled into a Cabinet Summary for submission to the Provincial

Cabinet. Upon approval and notification in the Official Gazette, the policy becomes an authorized framework guiding urban forestry initiatives across Punjab (RL1).

Spatial Planning Authority Punjab (SPAP): The SPAP serves as a central coordinating body responsible for planning, monitoring, and enforcing spatial and environmental policies, including urban forestry initiatives. It coordinates urban forest development and management activities among relevant provincial departments and organizations to ensure alignment with policy objectives. SPAP provides strategic direction to both public institutions and private entities operating within urban areas, guiding implementation measures related to afforestation and urban forest management. It also oversees the allocation and utilization of funds and promotes public education and awareness regarding urban forestry (PUPUFP, 2019, pp. 55, 56).

Parks and Horticulture Authority (PHA) Lahore: The PHA Lahore is a municipal agency responsible for the development, maintenance, and beautification of public parks, green belts, and open spaces within Lahore. It also regulates outdoor advertising and organizes cultural and horticultural activities that promote environmental awareness and urban aesthetics. PHA Lahore operates under the Housing and Urban Development (HUD) Department. Policy direction related to urban forestry is provided by the Spatial Planning Authority Punjab (SPAP) to the HUD Department and is subsequently operationalized at the city level through PHA Lahore (PHA Act, 2012; PUPUFP, 2019, p. 75) (RL1).

Stakeholder Departments: As the provincial capital, Lahore functions through coordinated action among multiple provincial government departments. Public lands, infrastructure, and properties under the jurisdiction of various provincial agencies are expected to align with the broader vision of urban greening. Accordingly, these departments contribute within their institutional mandates by allocating land, mobilizing resources, and assigning funds to support urban forestry and plantation initiatives (PUPUFP, 2019, pp. 51, 76) (RL1).

NGOs and Private Foundations: Various non-governmental organizations and private foundations, such as Al-Khidmat Foundation, Chaoon Foundation, and Faizan Global Relief Foundation, contribute to urban greening efforts within their respective capacities. Their

involvement typically includes donating saplings to PHA Lahore or organizing plantation campaigns to support afforestation and environmental awareness initiatives in the city (RL1, RL5).

Private Landowners and Housing Societies: Private landowners (industries and large companies) and housing societies builders hold huge responsibilities for urban greening and plantation in the city. Amid current expansion of the city and mass migration towards Lahore for economic reasons, private players play wide role in creating urban forestry infrastructure (PUPUFP, 2019, pp. 61, 74)(RL1, RL3).

What (Specific Actions)

Forest Ecosystem Restoration Plans: For the effective implementation of urban forestry initiatives, the Spatial Planning Authority Punjab (SPAP) develops Forest Restoration Plans. These plans are prepared at the tehsil (sub-district) level based on baseline assessments. Baseline data are generated through mapping and analysis of urban tree counts and canopy cover using high-resolution satellite imagery. The collected information is compiled into a geo-database with detailed classifications at the site, locality, housing society, union council, and tehsil levels to support evidence-based planning and monitoring (PUPUFP, 2019, p. 44).

Enhancing the Quantity and Quality: Given that Lahore's canopy cover is estimated at approximately 1.8 - 6% of the city's total area, PHA Lahore, under the authority granted by the PHA Act (2012) and in accordance with directives from higher authorities, undertakes plant propagation in its nurseries to support urban plantation efforts. Plant propagation involves the controlled reproduction of plants through seed-based (sexual) or vegetative (asexual) methods to generate planting material for urban forestry and ecosystem restoration. To enhance the quality of the urban forest, emphasis is placed on the selection of native tree species suited to Lahore's climatic conditions, the conservation and restoration of natural habitats, the integration of green spaces, and the promotion of biodiversity. Effective plantation practices, along with systematic maintenance and monitoring, are prioritized to strengthen climate resilience and ensure the sustainability of the urban ecosystem (PHA Act, 2012) (RL1).

Monitoring and Evaluation(M&E) System: M&E constitutes a central component of policy implementation, aimed at assessing the extent to which policy measures are executed as

designed and the degree to which intended objectives are achieved. Overall monitoring is conducted by the Spatial Planning Authority Punjab (SPAP), which undertakes internal assessments to evaluate institutional performance. This process involves identifying functional areas that demonstrate strong performance and those requiring improvement, with clear justification for each classification. Areas needing improvement are subsequently prioritized to guide corrective action and resource allocation (PUPUFP, 2019, p. 47).

Urban Forest Management Information System (MIS): It is a GIS-supported platform designed by SPAP to facilitate the planning, monitoring, and management of urban forest resources. It integrates functionalities related to mapping existing forest cover and tracking temporal changes, identifying potential sites for afforestation, managing forest assets and protected areas, and promoting forestry initiatives on private lands. The system also supports public education, capacity building, research, and training in various forestry disciplines, as well as problem identification and the development of training modules for improved conservation practices. Key components of the MIS include a forest inventory and asset management module, a complaint management system, GIS-based mapping of existing and newly planted trees, monitoring and follow-up of plantations, and spatial analysis of different tree and plant species to support evidence-based decision-making (PUPUFP, 2019, p. 49).

Corporate Social Responsibility (CSR) and Stewardship: The policy promotes a public-private partnership model in which industries and large business entities are encouraged to adopt designated land parcels or adjacent road green belts for the establishment and maintenance of urban forests as part of their Corporate Social Responsibility (CSR), following the lines of ‘Adopt-a-Road/School/Factory Programs’. In cases where industries are unable to meet green area requirements due to spatial constraints, they may sponsor the development of equivalent forest areas on public land identified by the Urban Unit. This mechanism aims to ensure compliance with greening regulations while expanding urban forest cover through collaborative arrangements (PUPUFP, 2019, p. 61).

Plant Donations and Voluntary Drive: Various non-governmental organizations (NGOs) and foundations actively contribute to voluntary tree plantation initiatives across the country, often engaging student volunteers in their activities. These organizations undertake plantation drives on

private lands or on public lands with prior approval from relevant authorities. In addition, they donate significant numbers of saplings annually to the designated public agencies responsible for urban plantation and greening efforts (RL1, RL5).

Research & Development (R&D), Capacity Building, and Awareness: Relevant authorities and departments collaborate with researchers and higher education institutions working in the field of urban forestry to establish feedback mechanisms that align research with policy and implementation needs. Particular attention is given to issues such as invasive plant species and their impacts on local ecosystems. Stakeholder departments also promote internal capacity-building programs to strengthen professional competencies in urban forest management. Furthermore, public engagement and awareness initiatives are conducted to highlight the importance of urban forests and environmental conservation. As primary beneficiaries of urban green spaces, public attitudes and participation play a crucial role in the success of plantation, conservation, and park management efforts (PUPUFP, 2019, p. 62).

When (Timelines)

Quarterly and Biannual Monitoring/Reporting: Spatial data and records from housing societies, public authorities, and relevant departments are digitized to develop and maintain an updated urban tree inventory. For that purpose, quarterly monitoring is conducted through repeated terrestrial photography of plantation sites to assess sapling survival and growth conditions. In addition, biannual monitoring using satellite or drone imagery is undertaken to evaluate plantation performance, canopy development, and overall spatial progress in urban greening efforts (PUPUFP, 2019, p. 47).

Annual Progress Reports: The District Administration prepares a management plan outlining proposed tree plantation activities to be implemented by relevant departments and autonomous bodies within the district. Based on these activities, an annual progress report is compiled to document implementation status and outcomes. Additionally, all stakeholder departments, in accordance with their respective mandates related to urban plantation, produce annual progress reports detailing their contributions and performance in urban greening initiatives (PUPUFP, 2019, p. 44)(RL1).

Long Term Strategic Timeline: The policy establishes phased targets for increasing urban forest cover across Punjab, including Lahore. The target is to increase urban forest cover by 7% by 2027, 10% by 2037, and 15% by 2047. These incremental milestones provide a long-term strategic framework for urban greening. Alongside canopy expansion targets, progress in addressing the underlying issues that necessitated policy intervention is also assessed to ensure comprehensive and sustained improvement (PUPUFP, 2019, p. 115).

Immediate Actions: In response to natural disasters, environmental emergencies such as severe smog, or administrative contingencies, immediate interventions may be initiated. Such actions are undertaken either upon directives from higher political authorities, including the Chief Minister, or in compliance with court orders. In such cases, the relevant departments are required to promptly design, plan, and implement targeted measures to address the identified issue (RL1).

Which Resources (Assets Needed)

Technical Resources (GIS, ICT, MIS): The availability of technical resources, including skilled personnel and digital infrastructure, is essential for effective urban forest planning and monitoring. Geographic Information Systems (GIS), Information and Communication Technologies (ICT), and Management Information Systems (MIS) support baseline assessments, spatial analysis, and monitoring of implementation on quarterly, annual, and long-term bases. In this regard, the Urban Unit and the Spatial Planning Authority Punjab (SPAP) provide technical data services and analytical support to facilitate evidence-based decision-making (PUPUFP, 2019, p. 58).

Human Resources: In the context of Lahore, PHA Lahore serves as the primary operational body responsible for implementing urban forestry plans, including plantation, maintenance, and site management, under the direction of higher authorities. The authority comprises approximately 8,000 employees dedicated to Lahore City, ranging from senior executive officials and technical staff to field workers and gardeners, ensuring the execution and upkeep of urban greening initiatives (RL1).

Media Resources: To promote public awareness and education regarding the importance of urban trees and greening initiatives, state media platforms are utilized, with approximately 10%

of allocated airtime reserved for public service messages. These campaigns aim to inform and engage citizens in urban forestry and environmental conservation efforts (PUPUFP, 2019, p. 62).

Planting and Equipment Resources: PHA Lahore operates 29 nurseries dedicated to plant propagation, producing seedlings and saplings to support urban plantation efforts. In terms of operational capacity, the authority is equipped with 37 water lorries (each with a capacity of 12,000 liters), 42 water bowsers, 72 tractor trolleys, one mechanical transplanter, and 480 portable pumps and turbines. Additionally, it maintains a substantial inventory of manual planting and maintenance tools, including shovels, spades, augers, pruning saws, shears, axes, and loppers, to facilitate large-scale plantation and upkeep activities (RL1).

How Much (Budgets, Quantities, Scales)

Budget and Funds: PHA Lahore operates with an annual budget of approximately PKR 5.5 billion ($\approx$ EUR 16.7 million; $\approx$ DKK 124 million). A substantial portion of this budget is generated internally. Approximately PKR 2 billion is raised through marketing and advertising activities, including billboards, LCD screens, posters, and banners across the city. Around PKR 0.25 billion is generated from renting, leasing, and concession agreements for canteens, shops, lodges, and event management. An additional PKR 0.75 billion is derived from private companies utilizing public lands under PHA's jurisdiction and from tree auctions. The remaining approximately PKR 2.5 billion is allocated by the Punjab provincial government (RL1).

Green Development Fund (GDF) Allocation: In principle, all stakeholder departments allocate 1% of their total Annual Development Program (ADP) budget to the Green Development Fund (GDF) for urban greening and plantation activities. These funds are utilized by PHA Lahore for the planting and maintenance of trees within designated areas. Of the total 1% allocation, 33% is allocated to the Urban Unit for monitoring, evaluation, and technical oversight of urban forestry initiatives (PUPUFP, 2019, pp. 51, 52).

Fees and Deposits: Private housing authorities, EIA-approved projects, industries, and other private sector entities are required to submit plantation plans for approval by the relevant competent authorities. Following approval, they pay prescribed fees to the Urban Unit for monitoring, compliance reporting, and data-based management of plantation activities, including

technical advisory support where necessary. The structure and amount of fees or deposits are defined in formal rules, approved by the Spatial Planning Authority Punjab (SPAP), and periodically reviewed by the Spatial Planning Commission (SPC) (PUPUFP, 2019, p. 52).

Tree Targets and Mandates: According to PHA Lahore guidelines, approximately 1,145 trees are to be planted per canal (0.0506 hectares). Plantation targets are further differentiated by land-use category, including 5% for street areas, 10% for urban areas, and 15% for peri-urban areas. A general standard of one tree per 10 meters is applied along city streets, roads, housing societies, and other public and private facilities. In alignment with these mandates, the policy sets progressive targets to increase urban forest cover to 7% by 2027, 10% by 2037, and 15% by 2047 (PUPUFP, 2019, pp. 48, 115) (RL1).

Earmarked Budgets: Various government departments and authorities allocate dedicated budgetary provisions within their respective jurisdictions to implement tree plantation activities. These earmarked funds contribute directly to achieving the broader objectives of the urban forest policy and ensure departmental accountability in advancing urban greening targets (PUPUFP, 2019, p. 52).

Actors/Partners (Collaborators/ Networks)

Private Sector and CSR Partners: Private companies, industries, and large business entities in Lahore collaborate with PHA Lahore to support the expansion of urban tree cover. As part of their Corporate Social Responsibility (CSR) commitments, they adopt designated land parcels or adjacent road green belts for the establishment and maintenance of urban forests, thereby contributing to the overall objectives of the urban forest policy (PUPUFP, 2019, p. 61).

Community and NGOs: Local communities and university students play an important role in urban greening through active participation in awareness and plantation campaigns. Non-governmental organizations (NGOs) and private foundations engaged in social development also contribute by supporting PHA initiatives, donating saplings, and undertaking plantation and maintenance activities within their respective capacities. Their involvement strengthens public engagement and enhances the implementation of urban forestry objectives in Lahore (RL1, RL5).

Academia and Research Institutes: Universities and research institutes are very supportive in providing contemporary research-based ideas and technical knowledge if required for the greater good. They also provide validation of imported species according to the local conditions, pest management potential, and suitability to biodiversity (PUPUFP, 2019, p. 62).

Multi-Stakeholder Coordination: A common council comprising representatives from relevant departments convenes regularly to address cross-sectoral challenges related to urban forestry. These include issues such as tourism management, ecological zone protection, urban development pressures, and transboundary pollution. This platform facilitates inter-departmental coordination and ensures integrated decision-making in the implementation of urban forest policy objectives (PUPUFP, 2019, p. 82).

4.3 Cross-Case Comparative Analysis

4.3.1 Purpose, Structure, and Analytical Basis

This chapter provides the cross-case synthesis of urban forest policy in Copenhagen and Lahore, building directly on the within-case results and applying the standardized comparative framework (Table 2.1). The analysis follows Krott's structured logic - Issues → Goals → Instruments → Implementation provisions - while interpreting the linkages as interdependent and iterative, consistent with the thesis' repositioning of forest policy analysis within urban governance scholarship. In line with policy design theory, the chapter evaluates not only what each city's policy contains, but whether there is logical coherence between problem framing, goal formulation, instrument selection, and implementation capacity (Howlett, 2023; Howlett & Rayner, 2018). Implementation analysis follows governance and delivery scholarship emphasizing the centrality of administrative capacity, coordination, and accountability (Hill & Hupe, 2022), and the risks associated with multi-actor policy delivery (Pressman & Wildavsky, 1973). To make the comparison transparent and auditable, this chapter incorporates cross-case matrix tables aligned to the analytical framework. These tables summarize the comparative findings and are referenced throughout the narrative synthesis.

4.3.2 Comparative Analysis of Policy Issues

Issues define the policy problem space and strongly condition the direction of subsequent goals and instruments (Howlett, 2023). The comparison therefore examines (i) dominant framing, (ii) the extent to which issues reflect ecological, socio-spatial, and equity dimensions, and (iii) evidence and diagnostic robustness (Table 2.1).

Table 5.1: Cross-Case Matrix of Policy Issues

Analytical criterion (Table 2.1)	Copenhagen	Lahore	Comparative interpretation
Dominant issue framing	Densification and spatial competition: 1. Declining green space per capita. 2. Difficulty creating new large green areas. 3. Climate impacts 4. Biodiversity concerns.	Deficit-and-exposure: 1. Low canopy cover and decline. 2. Rapid urban expansion and weak land-use control. 3. Air pollution/smog. 4. Climate extremes. 5. Biodiversity decline. 6. Peri-urban pressure.	Copenhagen frames a planning trade-off problem (nature within densification), while Lahore frames an environmental stress and scarcity problem under rapid urbanization.
Socio-spatial dimension	Access/livability is emphasized through green space per capita and proximity narratives (implicitly distribution-oriented).	Participation and scarcity framing are visible; inequity is implied through green deficit and exposure (heat/smog), though often not formalized as ‘ equity targets ’ in the issue.	Both cases contain equity-relevant problems, but mostly implicitly, which matters when assessing whether equity is operationalized through goals, instruments, and monitoring.
Evidence basis/diagnostic robustness	Strong strategic planning logic; issue construction draws on urban nature strategies and planning narratives (spatial trade-offs).	Uses multiple canopy estimates and references to satellite/GIS studies and official plans; includes explicit claims about canopy cover ranges and land conversion.	Lahore appears more explicitly quantified in parts, but robustness depends on whether monitoring systems are institutionalized.

The comparative finding is that both cities position urban forestry within climate and biodiversity narratives, but the dominant problem construction differs. Copenhagen frames urban forestry as a spatial planning challenge within densification, which leads to policy emphasis on integrating nature into streets, courtyards, and development routines. Lahore frames urban forestry as a response to acute deficit and exposure (low canopy, air pollution, heat stress) under rapid urban growth and governance complexity. This supports the theoretical expectation in the analytical framework that policy content is shaped by context-specific governance and problem pressure rather than by a universal ‘urban forestry template’.

4.3.3 Comparative Analysis of Policy Goals

Goals represent normative priorities and the intended outcomes formulated in response to issues. The framework requires evaluating goal scope, clarity, ambition, coherence with issues, measurability, and equity integration.

Table 5.2: Cross-Case Matrix of Policy Goals

Analytical criterion (Table 2.1)	Copenhagen	Lahore	Comparative interpretation
Goal orientation	‘More urban nature + better quality’ (parameters include biodiversity, climate adaptation functions, usability, spatial qualities, care/maintenance).	Formal multi-goal structure: quality/quantity expansion; safeguarding amid development; planning integration; knowledge/monitoring; participation.	Copenhagen emphasizes quality and integration; Lahore emphasizes expansion + safeguarding + institutionalization.
Measurability and time-boundedness	Headline targets and programmatic actions (e.g., 100,000 trees by 2025) are visible; quality parameters also guide action.	Includes staged long-horizon targets and explicit direction toward monitoring/knowledge systems.	Copenhagen presents output-oriented headline targets and quality criteria; Lahore leans toward trajectory/outcome orientation, increasing dependence on sustained implementation capacity.
Alignment with issues (issue-goal coherence)	Goals map directly onto densification constraints and biodiversity/climate issues through integration and quality management.	Goals map directly onto canopy deficit, pollution/heat, and governance needs through expansion, protection, planning integration, and monitoring.	High issue-goal alignment in both cases, consistent with the framework’s logic.
Equity and distribution in goal structure	Distributional concerns appear mainly as ‘access/livability,’ often implicit.	Participation and public engagement are explicit; distributional equity remains more implied than operationalized as targeted commitments.	Equity appears as an implicitly recognized dimension, and its operationalization is uneven in goal chains across both cases.

Both cities demonstrate strong issue-goal coherence, which aligns with the thesis’ policy design framing that effective policy requires consistency between diagnosis and objectives (Howlett & Rayner, 2018). The key divergence lies in the dominant orientation of goals: Copenhagen prioritizes integration and quality management under densification pressures, while Lahore emphasizes expansion and safeguarding in a context of severe canopy scarcity and high exposure. This distinction matters because goal ambition that is expressed through long-horizon outcomes increases the need for stable monitoring, funding, and enforcement - elements

emphasized and highlighted as common urban forestry gaps e.g., maintenance deficits and mortality in (Roman et al., 2014).

4.3.4 Comparative Analysis of Policy Instruments

Policy instruments are the operational tools used to pursue goals. Following instrument theory, tools can be grouped as regulatory (‘sticks’), economic (‘carrots’), and informational (‘sermons’) (Vedung, 1998), and contemporary scholarship emphasizes the coherence of instrument mixes (Howlett & Rayner, 2018). This study further treats cooperative mechanisms as a central dimension of urban forest governance, consistent with multi-level coordination literature.

Table 5.3: Cross-Case Matrix of Policy Instruments

Instrument category (Table 2.1)	Copenhagen	Lahore	Comparative interpretation
Regulatory instruments	Planning-embedded policies, guidelines, and standards designed to integrate nature into development and municipal routines.	Regulatory requirements connected to land-use control, project planning, and institutional mandates (as reflected in land-use and governance problem framing and goal structure).	Copenhagen relies more on planning-embedded regulation; Lahore relies more on mandate and control logic to steer multiple actors.
Economic instruments	Annual budget allocations and dedicated funding streams, including an urban nature fund for private initiatives and co-funding opportunities.	Financing is positioned as enabling expansion and monitoring (consistent with the policy’s ambitions and implementation orientation).	Copenhagen’s funding description is more visible at municipal operational scale; Lahore’s ambition implies high long-term funding needs tied to outcomes.
Informational instruments	Catalogues/knowledge tools and reporting/monitoring practices tied to urban nature management and biodiversity partnerships.	Emphasis on mapping, evidence generation and monitoring narratives in issues/goals (e.g., reliance on GIS/satellite studies and stated monitoring orientation).	Both recognize information as central but differ in governance logic: partnership reporting/planning knowledge vs. monitoring and tracking emphasis.
Cooperative instruments	Extensive public-private partnerships to work on non-municipal land (57% non-municipal), including ~50 partnership projects; ‘Together for Biodiversity’ with 19 private landowners (>40% land) and a Biodiversity Status Report (2024).	Broad coalition approach implied in goals (participation, coordination needs) and problem framing (fragmentation, land-use control challenges).	Copenhagen presents highly institutionalized partnership tools; Lahore relies on multi-actor coordination whose effectiveness depends on governance capacity and enforcement.

Both cities deploy instrument mixes rather than single-tool approaches, which aligns with the framework’s emphasis on complementarity and coherence (Howlett & Rayner, 2018). A distinct comparative feature is Copenhagen’s reliance on institutionalized cooperative instruments to

extend implementation beyond municipal land, including formal partnership structures linked to biodiversity accountability through reporting. Lahore’s policy orientation emphasizes mandates and expansion logic in a complex governance environment; based on the implementation scholarship, such environments face higher risks of coordination slippage without strong accountability structures (Hill & Hupe, 2022; Pressman & Wildavsky, 1973).

4.3.5 Comparative Analysis of Implementation Provisions

Implementation provisions determine how instruments translate into action and whether policy ambition is matched by institutional feasibility (Hill & Hupe, 2022). The framework requires analysis of institutional responsibilities, resources, procedural clarity, monitoring, and enforcement (Table 2.1).

Table 5.4: Cross-Case Matrix of Implementation Provisions

Implementation criterion (Table 2.1)	Copenhagen	Lahore	Comparative interpretation
Lead institutions and role clarity	City government and Climate, Environment, and Technical Administration (CETA) have clear roles in policy design and operational oversight; implementation includes citizen and interest group participation.	Multi-actor governance environment; implementation logic emphasizes planning integration, monitoring, and participation.	Copenhagen appears more institutionally consolidated at municipal level; Lahore is characterized by higher fragmentation risk, increasing the importance of coordination mechanisms.
Financial and operational resources	Annual fixed budget (1.8 billion DKK) with ~500 million DKK specifically for urban nature and greening; additional funding via negotiations/reallocation; urban nature fund supports private initiatives and co-funding.	Long-horizon ambition implies sustained funding and operational capacity needs; effectiveness depends on whether resources match the outcome trajectory and maintenance requirements.	Lahore’s ambition elevates risk of ‘planting-maintenance gap’ if survival and net canopy gain are not institutionally secured.
Procedural clarity	Multiple initiatives and partnership mechanisms; annual actions (e.g., green courtyards) and city-wide planting target provide operational direction.	Implementation is oriented to expansion, safeguarding, and monitoring; procedures depend on cross-agency coordination in land-use and development contexts.	Copenhagen’s procedures are embedded in municipal operations and partnerships; Lahore’s procedures are vulnerable to slippage where mandates involve many actors and decision points.
Enforcement capacity	Enforcement is largely mediated through planning integration and standards; effectiveness depends on how binding the tools are within development decisions.	Enforcement is challenged by rapid urban expansion and weak land-use control identified in the issue diagnosis; effectiveness depends on governance integration and administrative capacity.	Implementation theory suggests higher enforcement risk where multiple institutions and competing mandates exist, unless strong coordination and accountability reduce slippage.

The cross-case comparison shows that implementation is where the two policy architectures diverge most in risk profile. Copenhagen's implementation provisions are characterized by comparatively stable municipal budgeting, institutional clarity, and the use of structured partnerships to extend action onto private land - an important feature given that non-municipal land accounts for a large share of the city. Lahore's policy ambition is structurally high because it must address deficit and exposure under rapid growth; therefore, implementation feasibility depends more heavily on multi-actor coordination and on the durability of monitoring and enforcement in practice - precisely the governance vulnerabilities emphasized by implementation scholarship (Hill & Hupe, 2022; Pressman & Wildavsky, 1973). A particularly important analytical distinction is between the capacity to plant and the capacity to sustain canopy outcomes. As highlighted that urban forest policies frequently announce large planting ambitions without parallel maintenance structures, producing mortality and implementation gaps (Roman et al., 2014). This is highly relevant for Lahore's outcome-oriented ambition and for evaluating whether the policy chain protects against net canopy loss in a high-pressure development environment.

CHAPTER 5: DISCUSSION

5.1 Purpose of the Discussion Chapter

The previous chapter presented a structured cross-case comparison of urban forest policy in Copenhagen and Lahore using the standardized analytical framework (Table 2.1). This chapter moves beyond comparative description to interpret what the findings mean in relation to the thesis' theoretical positioning in policy design, governance, implementation research, and socio-spatial equity. In line with policy design scholarship, the discussion evaluates whether the observed differences reflect distinct problem framings, varying degrees of instrument mix coherence, and divergent implementation feasibility conditions (Howlett, 2023; Howlett & Rayner, 2018). The chapter also interprets findings through implementation and delivery literature emphasizing the importance of administrative capacity, coordination, and accountability (Hill & Hupe, 2022; Pressman & Wildavsky, 1973). Finally, it reflects on the thesis' equity argument that urban forest benefits are not automatically distributed and that policy often institutionalizes equity inconsistently.

5.2 Key Findings

Across both cities, urban forestry is framed as a response to climate stress, biodiversity concerns, and urban development pressure, reinforcing the thesis' argument that urban forests are increasingly conceptualized as multifunctional infrastructure rather than only aesthetic amenities. Yet, the cross-case synthesis shows that similarities at the level of "issue domains" mask major differences in dominant policy framing and governance feasibility conditions.

First, Copenhagen's policy architecture is primarily shaped by densification and spatial trade-offs, with emphasis on integration of urban nature into the built environment, quality enhancement, and partnerships across landownership types. In contrast, Lahore's policy architecture is primarily shaped by deficit-and-exposure conditions (low canopy, smog, air pollution, heat extremes) alongside rapid urbanization and weak land-use control, resulting in a stronger emphasis on expansion, safeguarding, and institutional mobilization.

Second, both cases demonstrate strong issue-goal coherence (problems translate into stated intentions), and both employ instrument mixes rather than a single tool type. However, the

comparative evaluation suggests that the key difference lies in instrument-implementation coherence, where Lahore's ambitious trajectory and multi-actor delivery environment create higher conditionality and implementation risk.

5.3 Interpreting Differences

Policy design theory argues that policy effectiveness depends on consistent alignment between problem diagnosis, goals, and instrument choice. The cross-case findings strongly support the thesis' conceptual premise that problem framing acts as a 'design filter' that structures the rest of the policy chain.

5.3.1 Copenhagen: Policy as Planning Integration under Densification Constraints

Copenhagen's issue framing centers on the difficulty of creating new large green spaces in a growing, compact city, along with the risk that per-capita access declines as population increases. This framing is consistent with a policy logic that prioritizes integration into streetscapes, courtyards, roofs, and redevelopment processes, and emphasizes quality parameters (biodiversity, climate adaptation, functionality, spatial quality, and maintenance/care). From a policy design perspective, this reflects a strategy of embedding urban forestry into spatial planning routines to manage inevitable land-use conflict. This aligns with the theoretical argument that coherence in urban forestry also requires cross-sector alignment, because canopy expansion competes with housing, transport, and infrastructure in densifying cities (Nilsson et al., 2012; Wolch et al., 2014).

5.3.2 Lahore: Policy as Expansion and Safeguarding in a Deficit and Exposure Context

Lahore's issue framing, in contrast, is anchored in severe canopy scarcity and decline estimates, rapid land conversion, smog as a public health crisis, and increasing climate extremes. These diagnoses support a policy orientation toward expansion targets and safeguarding mechanisms, as well as governance-oriented goals such as planning integration and monitoring. This framing aligns with the Global South argument (Nagendra & Gopal, 2010) that environmental crises often elevate tree planting as a visible intervention, yet governance constraints (weak enforcement, contested land regimes, overlapping mandates) can limit whether ambitious goals translate into

sustained canopy outcomes. The Lahore case illustrates this tension directly: high ambition and strong rationale coexist with institutional conditions that increase delivery risk.

5.4 Instrument Mixes and Coherence

(Vedung, 1998)'s typology (regulatory, economic, informational) and subsequent policy-mix literature emphasize that instruments rarely operate alone; effectiveness depends on complementarity and coherence across a mix. The argument explicitly builds on this view and warns that canopy targets without protection, maintenance budgets, and monitoring lead to failure - an implementation gap documented in urban forestry research (Roman et al., 2014).

5.4.1 Copenhagen: Strong Cooperative Instruments as a Governance Strategy

A distinct feature of Copenhagen's policy system is its reliance on institutionalized cooperative tools to expand implementation beyond municipal land. The case notes that non-municipal land accounts for a large share and describes partnership projects and major private landowner collaboration, including biodiversity-focused cooperation and reporting instruments. This supports a broader governance interpretation: where municipal authority does not fully control land, cooperation becomes a central instrument type rather than an add-on.

5.4.2 Lahore: Mandate-Oriented Instruments and the Need for Enforceability

Lahore's policy narrative emphasizes the need to address uncontrolled land use and weak planning implementation, alongside environmental exposure and deficits. In such contexts, policy design often leans toward mandates, standards, and formal compliance structures to steer multiple actors. Yet the theoretical foundation cautions that as decision points multiply and actors increase, implementation failure becomes more likely (Pressman & Wildavsky, 1973). Lahore's instrument mix may appear comprehensive and ambitious, but its effectiveness is conditional on whether monitoring systems are institutionalized and whether mandates are enforceable across the multi-actor environment discussed in the governance and Global South arguments.

5.5 Implementation Gap, Administrative Capacity, and the Planting vs. Canopy Outcome Problem

Implementation theory reminds that even coherent policy design can fail if administrative capacity, coordination, and political commitment are insufficient. The theoretical foundation positions urban forestry as particularly vulnerable to the ambition-delivery gap: cities announce planting targets under climate narratives, while long-term canopy outcomes remain uncertain due to maintenance deficits and fragmented responsibilities.

5.5.1 Planting is not Canopy: Survival, Maintenance, and Protection

A central discussion implication is that ‘trees planted’ are not equivalent to ‘canopy gained’. Roman et al., (2014) highlight tree survival as a critical blind spot: without watering, monitoring, and protection from development pressure, mortality undermines canopy goals. This insight has direct relevance to both cases:

- In Lahore, deficit-and-exposure framing encourages rapid scale-up and ambitious trajectories, but these require institutionalized maintenance systems and protection against net loss in high-pressure development contexts.
- In Copenhagen, densification pressures mean trees compete with infrastructure and redevelopment; therefore, canopy outcomes depend on binding integration into planning and sustained care and maintenance emphasis.

5.5.2 Coordination in Multi-Actor Governance

Urban forest governance typically involves multiple departments and external actors, and each additional coordination layer creates potential slippage (Peters, 2018). Copenhagen addresses this partly through partnership institutionalization. Lahore addresses it through governance-oriented goals and coordination intent, but the policy environment described in the Lahore issue analysis (weak land-use control, rapid expansion, multiple pressures) implies higher coordination cost and enforcement difficulty. The cross-case comparison supports a key theoretical expectation: the same instrument type (e.g., planning requirements, public participation) can produce different

outcomes depending on administrative capacity and governance structure (Hill & Hupe, 2022; Nagendra & Ostrom, 2012).

5.6 Equity, Environmental Justice, and Distributional Outcomes

The theoretical foundation emphasizes that the benefits of urban forests are unevenly distributed and that equity integration in policy is often inconsistent. It also highlights a key critique: participatory approaches can shift maintenance burdens onto communities without addressing structural inequalities (Conway & Bang, 2014).

5.6.1 Copenhagen: Equity Risks through Distribution and Market Effects

In high-income contexts, equity issues often emerge through unequal access to high-quality green space and potential ‘green gentrification’ dynamics when urban greening interacts with land and housing markets (Anguelovski et al., 2018; Wolch et al., 2014). Copenhagen’s policy emphasizes access and livability, but it is to ask whether the policy chain operationalizes distribution through targeted prioritization and monitoring (who benefits, where interventions occur, and whether vulnerable neighborhoods are prioritized).

5.6.2 Lahore: Equity as Deficit and Exposure Reduction

In Lahore, equity concerns are likely to manifest more as green deprivation and exposure to heat and pollution. The Lahore issue framing includes smog and public-health risk narratives and highlights canopy scarcity, which provides a strong rationale for equity-centered targeting in implementation (e.g., prioritizing canopy-poor or heat-vulnerable areas).

In both cases, the equity contribution of urban forest policy depends on whether equity moves from an implicit concern to an institutionalized design feature across goals, instruments, and implementation provisions - particularly through monitoring indicators, spatial prioritization criteria, and accountability routines.

5.7 Policy Implications and Recommendations

The goal of recommendations is not policy copying but identifying transferable principles that align with each city's governance conditions, consistent with the 'most-different' comparative logic (George & Bennett, 2005; Yin, 2018).

5.7.1 Recommendations for Copenhagen

1. **Strengthen binding integration in development processes:** Given densification pressures, canopy protection and replacement should be ensured through mechanisms with clear enforceability, not only guidance, to reduce net loss risk.
2. **Operationalize equity explicitly:** Move beyond general access language by introducing spatially explicit prioritization and monitoring of distributional outcomes. This aligns with the equity literature emphasizing distributional green equity.
3. **Deepen cross-sector coherence:** Continue strengthening alignment with transport and housing planning to manage structural conflicts between compact city development and canopy expansion (Nilsson et al., 2012; Wolch et al., 2014).

5.7.2 Recommendations for Lahore

1. **Shift from planting-led metrics to canopy-outcome governance:** Prioritize survival, maintenance cycles, and replacement strategies as core implementation provisions to avoid mortality-driven failure (Roman et al., 2014).
2. **Institutionalize monitoring and make it actionable:** Ensure canopy baselines, GIS/MIS monitoring, and reporting routines are consistent, repeated, and linked to budget allocation and enforcement decisions - transforming 'information tools' into accountability instruments.
3. **Reduce coordination slippage through clearer role assignment:** Given the multi-actor environment and land-use control challenges described in the Lahore case, implementation should minimize veto points and clarify inter-departmental responsibilities, consistent with implementation theory warnings (Hill & Hupe, 2022; Pressman & Wildavsky, 1973).

4. **Equity-centered targeting:** Use deficit-and-exposure framing to justify targeted interventions in canopy-poor and heat-vulnerable areas, paired with transparent monitoring indicators.

5.8 Limitations of the Study

This thesis is qualitative and comparative, aiming for analytical generalization rather than statistical generalization. Several limitations should be recognized.

First, the analysis relies heavily on official and publicly available documents, and the scope of documents differs across contexts. Some Copenhagen documents required machine translation, and while the methodology includes cross-checking and interview validation to reduce misinterpretation risk, translation may still introduce minor linguistic imprecision.

Second, as with many policy analyses, there is an inherent difference between policy-on-paper and policy-in-practice. Interviews were used to triangulate and enrich interpretation rather than to produce independent empirical narratives, which strengthens construct validity but does not fully resolve implementation-performance measurement limitations.

Third, comparability is structured through (Table 2.1) and identical analytical components, but the two cities differ in governance systems, legal frameworks, and administrative capacities. These differences are not a flaw but the purpose of the ‘most-different’ comparative design; however, they constrain direct equivalence of indicators and reinforce the need for context-sensitive interpretation.

5.9 Future Research Directions

The thesis highlights several promising avenues for further research.

1. **Empirical evaluation of implementation performance:** Future work could examine evaluation of desired goals if they are implemented and achieved within the time framework and if the highlighted policy issues are addressed.

2. **Equity operationalization studies:** Comparative research could assess whether equity-centered canopy targets, spatial prioritization, or distributional monitoring are adopted and how they affect outcomes, building on green equity research.
3. **Cross-sector policy coherence:** Given urban forestry's intersection with housing, transport, and infrastructure, future research could examine how planning systems integrate (or marginalize) urban forestry across sectors.
4. **Comparative governance mechanisms:** Additional cases could be used to test whether the patterns observed (partnership institutionalization in high-capacity contexts; mandate-heavy design under deficit-and-exposure contexts) generalize to other cities.

CHAPTER 6: CONCLUSION

This thesis set out to compare how urban forest policy is designed and made implementable in two very different urban contexts: Copenhagen and Lahore. Rather than treating urban forestry as a generic set of best practices, the study approached policy as an internally connected chain - issues, goals, instruments, and implementation provisions - following the analytical framework established in (Table 2.1). The central analytical claim emerging from this work is that urban forest outcomes are not determined by ambition alone; they are shaped by how coherently a policy connects diagnosis to delivery, and by how governance context enables or constrains implementation. The cross-case analysis shows that both Copenhagen and Lahore position urban forests within contemporary sustainability agendas, especially climate resilience and biodiversity. Yet, the two cases diverge fundamentally in dominant problem framing, which then structures the rest of the policy architecture. In Copenhagen, the policy problem is primarily constructed around densification and spatial trade-offs - how to maintain and expand urban nature when land is contested by housing, infrastructure, and competing city functions. This framing encourages an approach that emphasizes integration into planning routines and the quality of urban nature (care, biodiversity, and functional performance) rather than only expansion. In Lahore, the policy problem is constructed around deficit and exposure - canopy scarcity and decline, smog and air quality burdens, heat stress, and rapid urbanization combined with land-use control challenges. This framing generates a policy orientation toward expansion and safeguarding, paired with governance-oriented goals (planning integration, monitoring, participation) intended to strengthen state and societal capacity to act at scale.

A key result of the comparative evaluation is that both cities demonstrate strong alignment between issues and stated goals. In both cases, the policy chain begins with plausible diagnosis and translates it into a recognizable strategic intent. The decisive differences emerge later in the chain, where the coherence logic becomes most explanatory: the greatest divergence lies in instrument - implementation coherence, not in the general rhetoric of sustainability. Copenhagen's policy design places strong weight on planning-embedded instruments and institutionalized cooperation across land ownership types, which is particularly important in a city where a significant share of land is non-municipal, and implementation must extend beyond direct government

control. Lahore's policy design is broad and ambitious, but it operates in a governance environment with more pronounced fragmentation risks and higher enforcement burdens, meaning that delivery depends heavily on the strength of coordination, monitoring durability, and the ability to protect trees from net loss under development pressure. The thesis also clarifies a major practical and analytical point: planting is not equivalent to canopy outcomes. Long-term effectiveness depends on survival, maintenance, replacement, and protection - features often under-institutionalized in urban forestry even when goals are ambitious. This distinction is consequential for both contexts, but it becomes particularly critical where deficit-and-exposure conditions incentivize rapid expansion and headline targets. Under such conditions, policies require robust implementation provisions - stable budgets, clear responsibilities, credible monitoring, and enforceable safeguards - to prevent a gap between visible planting activity and long-term canopy performance.

A further contribution of the thesis is the equity lens. The state of the art emphasized that urban forest benefits are not automatically shared and that procedural participation does not necessarily ensure distributive outcomes. The comparative findings suggest that equity concerns appear in both cases largely implicitly - through access and livability narratives in Copenhagen and through deficit/exposure and participation narratives in Lahore. The implication is that equity will remain uncertain unless it is operationalized through explicit targeting criteria and monitoring indicators that track where trees survive and canopy increases, and who benefits. This is especially important because different contexts produce different equity risks: in high-capacity planning environments, greening can interact with property markets; in deficit-and-exposure environments, inequity is often expressed through unequal vulnerability to heat and pollution. In methodological terms, this thesis demonstrates the value of applying a forest policy analysis framework to urban forestry: the framework makes it possible to compare policies systematically and to identify where differences are primarily rhetorical versus where they are embedded in mechanisms and institutional capacity. In substantive terms, the study reinforces a central conclusion: urban forest policy is governance dependent. Copenhagen's case shows how planning integration and institutionalized cooperation can support implementation under densification; Lahore's case shows how ambitious expansion and safeguarding agendas must be matched by enforceable coordination and long-term maintenance governance to realize canopy outcomes under high urban stress. Overall, the thesis

argues that effective urban forest policy should be assessed - and designed - as a coherent chain from diagnosis to delivery, supported by measurable accountability and explicit attention to distributional outcomes. This conclusion provides a foundation for more implementation-focused and equity-sensitive urban forestry research and practice across diverse urban contexts.

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List of the respondents interviewed from Copenhagen

Respondent	Code	Position/Role	Organization	Location
Respondent 1	RC1	Planting Developer	The Environment, Climate, and Technical Administration	Copenhagen Municipality
Respondent 2	RC2	Chief Consultant	The Environment, Climate, and Technical Administration	Copenhagen Municipality
Respondent 3	RC3	Subject Coordinator (Nature Care)	The Environment, Climate, and Technical Administration	Copenhagen Municipality
Respondent 4	RC4	Landscape Architect	The Environment, Climate, and Technical Administration	Copenhagen Municipality
Respondent 5	RC5	Director	The Tree Office (Consultant)	Denmark
Respondent 6	RC6	Landscape Architect	The Danish Non-Profit Housing Company (DAB)	Denmark

List of the respondents interviewed from Lahore

Respondent	Code	Position/Role	Organization	Location
Respondent 1	RL1	Director	Parks and Horticulture Authority (PHA)	Lahore
Respondent 2	RL2	Environmental Specialist	The Urban Unit, Government of Punjab	Punjab
Respondent 3	RL3	Director	Environmental Protection Department	Lahore

Respondent 4	RL4	Assistant Director	Forest Department	Lahore
Respondent 5	RL5	NGO	Al-Khidmat Foundation Pakistan	Pakistan

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Document	Year	Reference
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