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Urban Forests as Nature-Based Solutions for Climate Resilience and Human Well-Being in Urban Landscapes.

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Abstract. Rapid urban expansion has increased environmental pressures in cities, including rising urban temperatures, declining air quality, higher stormwater runoff and flood risk, and growing public health concerns. Nature based solutions have gained attention as cost effective and multifunctional approaches to address these challenges, with urban forests representing one of the most strategic forms of green infrastructure. This study reviews recent scientific evidence on the role of urban forests as naturebased solutions for strengthening climate resilience and improving human wellbeing in urban landscapes. A structured literature review was conducted using Scopus, Web of Science, and Google Scholar, focusing on peer reviewed journal articles published between 2021 and 2025 and indexed with DOI. Findings were synthesized thematically across key ecosystem service pathways, including urban heat regulation, stormwater and runoff control, carbon storage and sequestration, air quality improvement, and wellbeing related benefits. The reviewed literature indicates that urban forests contribute to climate adaptation by reducing heat exposure through shading and evapotranspiration and by supporting stormwater regulation through rainfall interception and improved infiltration. Urban forests also contribute to climate mitigation through carbon storage and ongoing sequestration, while providing co benefits for human health through recreation opportunities, psychological restoration, and improved quality of life. However, effectiveness depends on long term canopy continuity, appropriate species selection, maintenance capacity, and governance arrangements, with common challenges including limited land availability, funding constraints, and unequal access to green spaces. Overall, urban forests function as multifunctional naturebased infrastructure that can enhance urban resilience and human wellbeing when integrated into long term planning and participatory management.

Keywords: climate resilience, ecosystem services, human wellbeing, naturebased solutions, urban forest

INTRODUCTION

Urban areas are expanding rapidly, often at the expense of natural and semi-natural ecosystems[1]. This growth increases the concentration of people, infrastructure, and economic activity in landscapes that are highly exposed to climate-related hazards such as extreme heat, intense rainfall, flooding, drought, and declining air quality[2]. As climate impacts intensify, cities must pursue adaptation and mitigation strategies that are not only effective, but also socially beneficial and feasible to implement in densely built environments[3], [4], [5]. In this context, nature-based solutions (NbS) have emerged as an important approach because they can address multiple urban challenges simultaneously while supporting environmental sustainability and human well-being[6].

Among the various NbS options**,** urban forests including street trees, parks, riparian buffers, urban woodlands, and other tree-dominated green spaces are widely recognized as one of the most multifunctional forms of urban green infrastructure. Beyond their ecological role, urban forests contribute to the day-to-day livability of cities by enhancing microclimate comfort, reducing exposure to environmental stressors, and providing spaces for recreation and social interaction. Recent scientific discussions emphasize that NbS in cities should be understood as more than "adding greenery," but instead as a strategy that connects ecosystem functions with urban planning and governance to strengthen long-term resilience and sustainability[6], [7], [8].

A central contribution of urban forests to climate resilience is their capacity to regulate urban microclimates. Tree canopy cover can lower surface and air temperatures through shading and evapotranspiration, helping reduce heat stress during hot periods and improving outdoor thermal comfort. Evidence from recent reviews highlights that tree canopy cooling effects vary across spatial contexts and canopy characteristics, reinforcing the need for careful placement, species selection, and management to maximize benefits[9]. In addition to cooling, urban forests provide hydrological regulation by intercepting rainfall, enhancing soil infiltration, and reducing stormwater runoff, functions that are increasingly critical as cities face more intense precipitation events and flooding risks. A comparative synthesis of studies on stormwater management shows that tree functional types, canopy structure, and mixed-species stands can significantly influence runoff reduction, indicating that urban forestry design should be integrated into broader drainage and flood mitigation planning[10].

Urban forests also support climate change mitigation by storing carbon in biomass and soils and by continuing to sequester carbon through growth, although the magnitude of mitigation depends strongly on tree health, species composition, and land-use context. Empirical assessments demonstrate that even in pollution-stressed and semi-arid urban environments, urban trees can provide substantial carbon storage and annual sequestration benefits, which are valuable for local climate strategies[11], [12]. At the same time, urban forests contribute to air quality improvement by removing gaseous pollutants and particulate matter through deposition and uptake processes. Recent i-Tree Eco–based assessments highlight that urban trees can generate meaningful pollution-removal services and associated economic benefits, even though the overall impact may be constrained in cities where emissions are extremely high or green space per capita is low[12], [13].

Beyond resilience and mitigation, urban forests play a major role in human well-being. Public green spaces have been linked to multiple well-being dimensions, including mental restoration, reduced stress, improved perceived safety, social cohesion, and opportunities for healthy lifestyles. A systematic review of public urban green spaces found consistent evidence that vegetation quantity (e.g., canopy cover and park size), biodiversity, and perceived naturalness are among the green-space characteristics most frequently associated with positive well-being outcomes[14]. More recent meta-analytic work on NbS underscores that health and well-being co-benefits often occur alongside climate and environmental benefits, strengthening the argument that urban forests are not only ecological assets but also public-health-supporting infrastructure [6], [8].

Despite their broad potential, urban forests are not automatically “beneficial by default.” Their performance is shaped by ecological suitability, climate stress, land availability, maintenance capacity, governance arrangements, and social equity considerations. Urban forests themselves can be vulnerable to climate extremes (e.g., heatwaves, drought, storms) and urban pressures (e.g., soil compaction, limited rooting volume, pollution), requiring management approaches that explicitly address resilience, long-term canopy continuity, and adaptive planning[7]. In addition, cities often face practical barriers such as limited data on tree conditions and ecosystem services, fragmented management responsibilities, and weak integration between environmental planning and infrastructure development.

Methodological advances, such as combining remote sensing with ecosystem service tools are increasingly recommended to improve city-scale assessment, monitoring, and decision-making for urban forests[15].

Given the urgency of urban climate risks and the need for interventions that also support livability, this paper discusses urban forests as nature-based solutions for climate resilience and human well-being in urban landscapes. Specifically, it synthesizes key ecosystem services provided by urban forests (cooling, runoff reduction, carbon sequestration, and air quality regulation), highlights their links to human well-being, and outlines practical considerations for planning and management to strengthen long-term benefits and reduce trade-offs in rapidly changing urban environments.

MATERIAL AND METHODS

Study design

This article was prepared using a structured literature review to synthesize recent peer reviewed evidence on the role of urban forests as naturebased solutions in supporting climate resilience and human wellbeing in urban landscapes. The review focuses on ecosystem services that are frequently linked to urban climate risks and quality of life outcomes, including microclimate regulation, stormwater and runoff control, air quality improvement, carbon storage and sequestration, and human wellbeing benefits.

Information sources and search strategy

A literature search was conducted using Scopus, Web of Science, and Google Scholar. These databases were selected because they provide broad and complementary coverage of peer reviewed journal literature relevant to urban forestry, ecosystem services, climate adaptation, and urban sustainability. The search was limited to articles published from 2021 to 2025 to capture recent evidence. Only peer reviewed journal articles with DOI were considered to ensure traceability and academic reliability. The reporting structure and transparency were guided by PRISMA 2020 as a methodological reference (DOI: 10.1136/bmj.n71). The databases used and the search field coverage applied in each platform are summarized in Table 1.

Table 1. Databases and search field coverage

Database	Field coverage used in search	Purpose in this review
Scopus	Title, Abstract, Author Keywords	Primary indexed database with advanced field search support
Web of Science	Topic field (Title, Abstract, Author Keywords)	Secondary indexed database to cross check coverage and reduce selection bias
Google Scholar	Relevance ranked search results	Supplementary search to capture additional recent studies not consistently indexed

Table 1 shows that Scopus and Web of Science were used as the main sources because they support structured field searching and indexing filters, while Google Scholar was used to broaden coverage and identify additional relevant recent studies.

Search query formulation

The search query was designed to reflect the key concepts of this article. It consists of three concept groups. The first group represents the core topic of urban forests and closely related terminology. The second group represents the conceptual framing used in this paper, namely naturebased solutions, ecosystem services, and green infrastructure. The third group represents the main outcomes linked to climate resilience and human well being, including heat, stormwater, air quality, carbon, and wellbeing. The final query used in Scopus and its equivalent forms in other databases are presented in Table 2.

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Database	**Final query used**
Scopus	TITLE ABS KEY ("urban forest" OR "urban forestry" OR "urban tree*") AND TITLE ABS KEY ("nature based solution*" OR "ecosystem service*" OR "green infrastructure") AND TITLE ABS KEY ("climate resilience" OR "urban heat" OR "heat island" OR "stormwater" OR "runoff" OR "air quality" OR "carbon sequestration" OR "wellbeing" OR "well being")
Web of Science	TS = ("urban forest" OR "urban forestry" OR "urban tree*") AND TS = ("nature based solution*" OR "ecosystem service*" OR "green infrastructure") AND TS = ("climate resilience" OR "urban heat" OR "heat island" OR "stormwater" OR "runoff" OR "air quality" OR "carbon sequestration" OR "wellbeing" OR "well being")
Google Scholar	("urban forest" OR "urban forestry" OR "urban trees") AND ("nature based solutions" OR "ecosystem services" OR "green infrastructure") AND ("climate resilience" OR "urban heat" OR "stormwater" OR "air quality" OR "carbon sequestration" OR "wellbeing")

Table 2 documents the search logic used to retrieve the literature. In Scopus, the query was applied to the title, abstract, and author keyword fields using the TITLE ABS KEY operator. In Web of Science, the TS operator was used as the closest equivalent for topic searching. In Google Scholar, field specific operators are not consistently supported, therefore a simplified version of the same concept structure was applied. The wildcard symbol * in Scopus and Web of Science captures multiple word endings, for example, “urban tree” and “urban trees”.

Eligibility criteria

Eligibility criteria were defined to ensure that included studies were recent, peer reviewed, and directly relevant to the review scope. The criteria used during screening are summarized in Table 3.

Table 3. Inclusion and exclusion criteria.

Category	**Criteria**
Inclusion	Peer reviewed journal article, DOI available, published 2021 to 2025, focuses on urban forests or urban trees in urban or peri urban areas, addresses nature based solutions, ecosystem services, or green infrastructure, reports evidence related to climate resilience or at least one targeted outcome such as urban heat, stormwater and runoff, air quality, carbon sequestration, or wellbeing
Exclusion	Not a journal article, no DOI, conference abstract only, editorial or opinion paper, not focused on urban forests, or does not address ecosystem services linked to resilience outcomes or wellbeing outcomes

Table 3 strengthens selection transparency and ensures that the final set of studies supports the objectives of this review without including non traceable or off scope sources.

Screening and study selection process

Screening was conducted in two stages. First, titles and abstracts were reviewed to determine relevance to urban forests, ecosystem services, and climate resilience or well being outcomes. Second, full text screening was carried out to confirm eligibility and ensure that the study provided meaningful findings for synthesis. Duplicate records retrieved from multiple databases were removed before full screening to prevent repeated assessment of the same publication.

Data extraction

A standardized extraction framework was applied to all included studies to ensure consistent synthesis across publications. Extracted information included publication year, study location, study design, ecosystem service focus, indicators assessed, and key findings relevant to climate resilience and human wellbeing. The extraction items and thematic grouping used in this review are presented in Table 4.

Table 4. Data extraction items and synthesis themes

Theme	Data extracted	Examples of indicators or outputs
Urban heat regulation	Canopy attributes, shading role, cooling mechanisms, heat exposure outcomes	Air temperature reduction, surface temperature reduction, thermal comfort improvement
Stormwater and runoff control	Interception, infiltration, runoff response, vegetation structure effects	Runoff volume reduction, peak flow reduction, retention capacity
Carbon benefits	Carbon storage and sequestration outcomes, stand structure variables	Total carbon stored, annual sequestration rate
Air quality improvement	Pollutant removal processes, deposition patterns, valuation where available	Particulate matter removal, gaseous pollutant uptake
Human well being	Health and social outcomes, recreation values, perceived benefits	Psychological restoration, recreation use, perceived wellbeing improvement

Table 4 shows how evidence from different studies was organized into comparable themes, allowing synthesis even when study contexts, indicators, and methods vary.

Data synthesis

Due to heterogeneity in study designs, indicators, and spatial scales, findings were synthesized using a narrative thematic approach rather than statistical meta analysis. Evidence was compared within each theme to identify consistent outcomes, mechanisms, and limitations. Particular attention was given to implementation constraints reported across the literature, including land limitations, governance barriers, funding issues, maintenance capacity, and competing urban land use priorities in rapidly developing urban areas.

RESULTS AND DISCUSSION

The findings from the selected literature were synthesized into five interconnected themes: (1) urban heat regulation and thermal comfort, (2) stormwater and runoff control, (3) carbon storage and sequestration, (4) air quality improvement and possible trade offs, and (5) human health and subjective well being. These themes reflect how urban forests contribute to climate resilience while simultaneously supporting social and public health outcomes in urban landscapes. Evidence from recent systematic reviews, meta analyses, and empirical studies confirms that urban forests provide multiple benefits, but their performance depends strongly on local context, species composition, and management quality[6], [8], [15]. The ecosystem service pathways and commonly used indicators discussed across the literature are summarized in Table 5.

Table 5 shows that urban forests act as multifunctional green infrastructure. Their strongest advantage as a naturebased solution is the ability to provide multiple services simultaneously, meaning that a single intervention can contribute to both climate risk reduction and human wellbeing improvement.

Table 5. Summary of ecosystem service pathways, indicators, and resilience relevance

Ecosystem service theme	Main mechanisms	Common indicators used in studies	Contribution to climate resilience and well being
Urban heat regulation	Shading, evapotranspiration, microclimate buffering	Air temperature, land surface temperature, thermal comfort indices	Reduces heat exposure and improves outdoor comfort, especially during hot periods
Stormwater and runoff control	Rainfall interception, infiltration improvement, delayed runoff response	Runoff volume, peak flow reduction, retention and infiltration capacity	Reduces flood risk and supports adaptation to intense rainfall events
Carbon storage and sequestration	Biomass accumulation, long term carbon storage	Carbon stored, annual sequestration rate, CO2 equivalent	Supports climate mitigation and strengthens climate policy justification
Air quality improvement	Pollutant deposition, stomatal uptake, local concentration reduction	PM removal, ozone removal, gaseous pollutant uptake	Supports healthier urban environments and reduces pollution related risks
Human well being	Recreation, restoration, stress reduction, social cohesion	Subjective well being, satisfaction, perceived health, visitation patterns	Improves mental health, physical activity, and quality of life outcomes

Urban heat regulation and thermal comfort improvement

Urban heat is one of the most consistently documented climate risks in cities. Across the literature, urban forests reduce heat exposure primarily through shading and evapotranspiration, which cool surrounding air and surfaces. A systematic review focused on tree canopy cooling benefits highlighted that cooling effectiveness depends on canopy configuration, spatial scale, and evaluation methods, meaning that the same canopy cover can produce different outcomes depending on urban form and climate setting[9].

Empirical evidence reinforces the significance of shade. Rahman et al. (2021) demonstrated that shade and surface conditions jointly influence heat load reduction and that tree shade provides added cooling benefits during summer drought conditions[16]. More recently, Giraldo Charria et al. (2025) reported that urban forests reduced temperatures by up to 7 °C during peak heat hours in a vulnerable tropical city and could reduce lethal heat days by 23 percent, emphasizing that cooling benefits can be substantial during extreme heat conditions[17].

These findings suggest that urban forests are highly relevant for climate resilience strategies targeting heat exposure, particularly in tropical and rapidly urbanizing regions where heat stress is increasing. However, cooling performance is not automatic. It depends on canopy density, species traits, available soil moisture, and long term maintenance. Therefore, cooling benefits are strongest when urban forests are designed with sufficient canopy cover, connected green corridors, and management practices that support tree health under future climate conditions[7], [9].

Stormwater management and runoff control

Urban flooding and stormwater runoff are major concerns in fast growing cities where impervious surfaces expand quickly. Urban forests contribute to stormwater control through rainfall interception, delayed throughfall, soil infiltration improvement, and transpiration. Rahman et al. (2023) compared stormwater related functions of urban forests and emphasized that rainfall partitioning and tree characteristics influence stormwater management outcomes, supporting the argument that urban forests can reduce runoff and contribute to flood mitigation if implemented at appropriate scales and in suitable locations[10].

Beyond individual studies, broader evidence also supports nature based solutions as effective tools for climate adaptation hazards such as floods. A meta analysis by Ferrario et al. (2024) concluded that nature based solutions show measurable benefits for urban resilience and climate adaptation, including impacts related to floods and heatwaves, which strengthens the justification for integrating urban forests into stormwater planning[18]. Overall, the reviewed evidence indicates that urban forests support stormwater control most effectively when combined with land use planning that protects permeable areas, improves soil function, and prevents fragmentation of green spaces. This means that urban forests should be treated as core infrastructure rather than decorative green elements, especially in flood prone urban districts.

Carbon storage and sequestration potential

Urban forests also contribute to climate mitigation through carbon storage and carbon sequestration. While carbon sequestration rates vary widely across cities due to differences in tree density, species composition, and maintenance, studies show that carbon benefits can be substantial at city scale. Rasoolzadeh et al. (2024) quantified carbon sequestration and storage using i Tree Eco in Tehran and reported annual sequestration of approximately 60,102 tons of carbon per year, equivalent to about 220,393 tons of CO2, illustrating the mitigation relevance of urban trees even in polluted and semi arid contexts[11].

These findings suggest that carbon benefits from urban forests can support municipal climate commitments, but the magnitude depends on long term survival and growth of trees. As a result, carbon outcomes require strategies that reduce mortality risk, improve soil quality, and maintain tree health under increasing climate stress[7].

Air quality improvement and species dependent trade offs

Urban forests can improve air quality through pollutant removal via dry deposition on leaves and stomatal uptake. However, the evidence also emphasizes that tree impacts on air quality depend on species composition and that some urban trees emit biogenic volatile organic compounds that can contribute to ozone formation under certain atmospheric conditions.

Rasoolzadeh et al. (2024) assessed pollutant removal by urban trees using i Tree Eco and reported measurable contributions of urban trees toward mitigating air pollution, emphasizing that air quality benefits can be quantified and valued as an ecosystem service[13].

A detailed study in Geneva by Kofel et al. (2024) showed that urban trees removed between 4 and 19 percent of anthropogenic PM10 emissions depending on the method, while also emitting substantial BVOCs that could contribute to ozone formation under favorable conditions. This demonstrates that air quality benefits are real but must be evaluated together with possible disservices, especially in cities with strong ozone formation potential[19].

Therefore, the literature supports an air quality strategy that prioritizes appropriate species selection, spatial placement that targets pollution hotspots, and monitoring approaches that account for both pollutant removal and BVOC related risks.

Human health and subjective wellbeing benefits

Evidence on human wellbeing consistently indicates that urban forests provide benefits related to psychological restoration, recreation, social cohesion, and physical activity. Reyes Riveros et al. (2021) systematically reviewed evidence linking public urban green spaces with human wellbeing and found that green space structure, biodiversity, and naturalness are frequently associated with positive wellbeing components[14].

Recent empirical evidence also shows that access and user experience matter. Maleknia and Korcz (2025) examined pathways linking urban forests to subjective wellbeing in Tehran and found that perceived access was a strong predictor that increased satisfaction and wellbeing outcomes, while satisfaction showed the strongest direct relationship with subjective well being. Their model explained 69.8 percent of variance in subjective well being, highlighting that social benefits are not only influenced by the existence of urban forests but also by how accessible and satisfying they are for residents[20].

In addition, a systematic review by Raza et al. (2024) suggests that improvements to urban green spaces can support physical activity outcomes, but evidence gaps remain for mental health impacts and consistent outcome measurement, implying that future research should strengthen evaluation designs and indicators[21].

Together, these findings support the argument that urban forests contribute to well being through both direct and indirect pathways, including improved environmental comfort, opportunities for daily recreation, and stress reduction. The literature also implies that equitable access and management quality are essential for maximizing well being outcomes.

Governance, equity, and implementation challenges

Despite strong evidence of ecological and social benefits, implementation barriers remain a major limitation in many cities. A systematic review on urban climate resilience highlights that nature based solutions face challenges related to implementation, contribution, and effectiveness, including gaps in monitoring and difficulties in scaling[6].

Governance factors strongly shape success. Pike et al. (2024) reviewed equitable urban forest governance and emphasized that distributional justice is commonly used in studies, but procedural and recognitional justice remain underexplored, suggesting that future urban forest planning should incorporate community centered decision making and more inclusive governance processes[22].

More broadly, Martin et al. (2025) identified an implementation gap for nature based solutions driven by governance barriers such as lack of expertise, limited evidence bases, stakeholder conflict, and funding constraints, while highlighting that co design and polycentric governance can support wider adoption[23].

Urban forest planning reviews also emphasize practical constraints such as land competition, maintenance costs, and long term management complexity, reinforcing the need for integrated and adaptive planning rather than isolated tree planting initiatives[7].

Quantitative examples supporting key themes

To make the evidence more direct and easier to connect with manuscript arguments, Table 6 provides examples of recent quantitative results used in this review.

Table 6 reinforces that many benefits of urban forests are measurable and policy relevant. At the same time, outcomes depend on context and design choices, meaning that urban forests must be planned and managed strategically to maximize co benefits and reduce unintended impacts.

Table 6. Examples of quantitative evidence reported in recent studies (2021 to 2025)

Theme	Example evidence	Study and DOI
Urban heat regulation	Urban forests reduced temperatures by up to 7 °C during peak heat hours and could reduce lethal heat days by 23 percent	Giraldo Charria et al., 2025, 10.1016/j.uclim.2025.102311 [17]
Urban heat mitigation mechanisms	Tree shade provides added cooling benefits and surface type influences heat load reduction	Rahman et al., 2021, 10.1016/j.ufug.2021.127223 [16]
Stormwater management	Urban forests influence rainfall partitioning and stormwater performance varies with land use and climate context	Rahman et al., 2023, 10.1038/s41598-023-28629-6 [10]
Carbon sequestration	Annual sequestration approximately 60,102 tons carbon per year, equivalent to about 220,393 tons CO2	Rasoolzadeh et al., 2024, 10.3390/f15091488 [11]
Air quality and trade offs	Trees removed 4 to 19 percent of anthropogenic PM10 emissions, but also emitted BVOCs that could contribute to ozone formation	Kofel et al., 2024, 10.1016/j.ufug.2024.128513 [19]
Subjective well being pathways	Perceived access strongly predicted satisfaction and subjective well being, and the model explained 69.8 percent of well being variance	Maleknia and Korcz, 2025, 10.3390/f16101503 [20]
NbS effectiveness for climate risks	Meta analysis supports measurable benefits of NbS for heatwaves and floods	Ferrario et al., 2024, 10.1016/j.scitotenv.2024.175179 [18]

Implications for urban landscape planning

The reviewed literature collectively indicates that urban forests represent a highly strategic naturebased solution that can strengthen climate resilience while improving human well being. Cooling benefits are strongest when canopy cover and tree health are maintained under future climate stress. Stormwater benefits require integration with land use planning and soil management to support infiltration and retention. Air quality benefits depend on the balance between pollutant removal and BVOC related risks, making species selection and placement essential. Social and well being outcomes depend heavily on accessibility, quality, and long term management that supports safe, inclusive, and satisfying urban forest experiences[9], [22], [23].

Overall, this evidence supports the conclusion that urban forests should be treated as multifunctional green infrastructure that contributes to both ecological resilience and social sustainability, but requires integrated governance, adequate financing, monitoring, and community centered planning to deliver benefits fairly and effectively.

CONCLUSION

Urban forests represent a highly strategic nature based solution that can strengthen climate resilience while also improving human well being in urban landscapes. Evidence from recent peer reviewed studies shows that urban forests contribute to cooling urban environments through shading and evapotranspiration, reducing heat exposure and improving thermal comfort, particularly during extreme hot periods.

In addition, urban forests support stormwater and runoff control by intercepting rainfall, improving infiltration, and moderating peak flows, which can help reduce flood risk in cities experiencing rapid land cover change and increasing rainfall intensity.

Urban forests also contribute to climate mitigation by storing and sequestering carbon, although the magnitude of these benefits depends on canopy continuity, tree survival, and long term management. Their ability to improve air quality through pollutant removal further supports healthier urban living, yet planning must consider species selection and site context to avoid unintended impacts such as ozone formation risks associated with certain emissions under specific conditions.

Beyond ecological functions, urban forests provide important social benefits by supporting recreation, psychological restoration, and quality of life. The literature consistently indicates that the wellbeing benefits of urban forests are strongly influenced by accessibility, perceived safety, and user satisfaction, meaning that good design and equitable distribution are essential for maximizing benefits.

Despite their multifunctional value, urban forests are not automatically effective. Key challenges include limited land availability, maintenance capacity, inconsistent funding, and fragmented governance. Therefore, integrated and adaptive urban forest management is required, including long term planning, monitoring based on ecosystem service indicators, and participatory approaches that align urban forest development with community needs.

Overall, this review confirms that investing in urban forests can deliver multiple co benefits for climate resilience and human wellbeing, but successful outcomes depend on site appropriate implementation, long term stewardship, and governance systems that ensure benefits are sustained and shared fairly across urban populations.

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