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Urban tree cover targets: The good, the bad and the SMART

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ABSTRACT

Urban tree cover (UTC) is a commonly used metric in policy and management activities, including urban forest resources assessment, equity and distribution, and ecosystem services modelling. Despite the well-established benefits associated with urban tree canopy, declining tree cover has catalysed many cities into setting UTC targets. In this short communication, we used an assessment of UTC targets set by 57 cities worldwide to discuss the merits and drawbacks of setting UTC targets and to inform recommendations for setting effective UTC targets. We found that UTC targets range in ambition, varying between 4 % and 50 %. To meet these targets, cities would have to increase their current UTC by between 0.47 and 23.3 percentage points within stated timelines of between 3 and 51 years. We found that cities with lower current UTC set ambitious targets, requiring relatively large annual increases in canopy cover. Moreover, cities in xeric or dry biomes set lower targets (< 20 %) than cities in temperate or tropical biomes (> 25 %). We found that setting UTC targets can provide a range of benefits, but achieving a UTC target at the expense of other indicators of urban forest structure and quality poses risks. We reflect on pathways to set specific, measurable, achievable, resourced, and time-bound UTC targets, while acknowledging the associated issues. This exploration of UTC targets will help ensure that UTC remains a useful metric for urban forest management and planning.

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1. Urban forests and tree canopy cover

Urban forestry, the management of public and private trees within urban landscapes, relies on various measures and metrics, including tree abundance (Crown et al., 2018) and spatial distribution (Duan et al., 2019), growth and structure (Morgenroth et al., 2020; North et al., 2018), health (Blair et al., 2019), and diversity (Blood et al., 2016). Among these numerous measures, with varying metrics, urban tree cover (UTC) has garnered increased attention in recent years after being introduced almost 50 years ago (e.g., Harrell, 1978; McBride and Jacobs, 1976; Rowntree, 1984). We define UTC as proportion of land covered by canopy (i.e., leaves, branches and stems) when viewed from above. UTC represents tree canopy as a percentage of land area and can be mapped to reveal spatial differences within or across areas. It can be measured using various sampling and mapping methods, though estimate quality depends on scale (e.g., sampling vs. census) and whether data are collected terrestrially or aerially (Klobucar et al., 2021).

UTC is a widely used urban forestry metric. For example, all of the United Kingdom's 5749 urban wards have assessed their UTC (Sales et al., 2023), while 11 of 14 Canadian cities discussed UTC in their urban forest management plans (Ordóñez Barona et al., 2024b). UTC data are typically used for resource assessment, goal setting, implementation strategies, and monitoring and evaluation (Kimball et al., 2014). But UTC also supports broader applications like modelling ecosystem services (Selim et al., 2023), human health outcomes (Konijnendijk, 2023), or environmental equity (Leets et al., 2022).

Despite being a common and valuable metric, setting targets or goals for UTC can lead to distorted or siloed perspectives. This is particularly true when maximising canopy comes at the expense of other measures of urban forest quality (e.g., diversity or health). Understanding how UTC targets are set and used by urban forest policy and decision makers, managers, and other stakeholders is an important but underexplored topic. In this short communication, we examine the use and utility of UTC targets. To achieve this, we 1) report on global UTC targets, 2) consider the benefits and drawbacks of setting UTC targets, and 3) suggest effective UTC target setting strategies.

2. Global UTC targets

2.1. Guidance on UTC targets

Many cities have adopted UTC targets, but what those targets are and how they are set varies. In Europe, the Nature Restoration Law recommends a minimum of 10 % UTC (Lungman et al., 2023). In China, the 'Indicators for National Forest City' guideline specifies UTC targets ranging from 25 % to 35 % depending on annual precipitation (State Administration for Market Regulation of China, 2019). Konijnendijk (2023) proposes that all neighbourhoods should have at least 30 % UTC in his 3–30–300 rule, where '3' refers to having three well-established trees in view from every home, school, and place of work, and '300' refers to the maximum distance each residence should be from a public greenspace.

Notably, an often-cited UTC target has recently been retracted. American Forests no longer recommends that American cities aim for 40 % canopy cover (Leahy, 2017). Instead, they suggest that cities in forest biomes might be able to reach 40 % UTC or more, but that cities in grassland biomes might only reach 20 % UTC, and those in desert biomes 10 % UTC. This illustrates that universal UTC targets do not sufficiently address local contexts, including ecological, physical, climatic, and sociopolitical conditions. To account for these, many cities have established their own UTC targets.

2.2. Cities with UTC targets

The scientific literature generally lacks data on UTC targets, so to understand the current use of UTC targets worldwide, we reviewed online urban forest management plans, strategies, or planning documents. The authors used their diverse local knowledge and language backgrounds to search publicly available online sources for documented UTC targets. Different languages were used, but search terms included 'urban', 'city', 'tree', 'forest', 'canopy', 'target', 'goal', 'objective' and other synonyms. Searches were not universally systematic, but rather tailored by the authors to use terms and language local to the regions they represented. The aim was not to develop a comprehensive list of cities with UTC targets, but rather to ascertain UTC targets for a sample of geographically diverse cities; we provide these details for 57 cities in Supplemental Material.

Individual cities reported current UTC and a target UTC in their urban forest management plans, strategies, or planning documents. Current UTC was estimated in various ways, using field-based (Fiala et al., 2006) or remote sensing-based sampling approaches (Parmehr et al., 2016), or alternatively, by mapping UTC from aerial imagery or LiDAR data (Guo et al., 2019). The management plans, strategies, or planning documents did not provide a rationale for how specific UTC targets were established, but targets always exceeded current UTC cover values. The expressed UTC targets ranged from 4 % for Ho Chi Minh, Vietnam to 50 % for São Paulo, Brazil and exceeded current UTC by between 0.47 and 23.3 percentage points (Fig. 1). Some cities set modest targets, for example, Beijing, China with a 2017 UTC of 39.53 % aimed to raise it by 0.47 percentage points to 40 % over three years. Bogotá, Colombia proposes to raise its UTC on land in public tenure by 0.5 percentage points from 5.3 % in 2018–5.8 % by 2030. In contrast, other cities have ambitious UTC targets, with proposals to raise UTC by more than 15 percentage points from their UTC baseline. These targets would require relative increases in UTC of between 82 % for Melbourne (current UTC = 22 % to target UTC = 40 %) and 330 % for Jakarta (current UTC = 4.65 % to target UTC = 20 %) (Fig. 2). Considering the number of years that cities allowed to reach their UTC targets, most cities (44 of 56) targeted a relative UTC increase of less than 5 % per year. Only five cities (Ho Chi Minh, Bangkok, Phoenix, Milan, and Jakarta) set targets of more than 10 % per year relative increase in canopy cover and four of these (excluding Bangkok) had low current canopy cover (less than 10 % UTC) (Fig. 2).

UTC targets varied by biome (Fig. 3). Cities in desert or xeric shrublands or tropical or subtropical dry broadleaf forests set average UTC targets below 20 %, reflecting their relatively low current UTC. In contrast, cities in other biomes set average UTC targets exceeding 25 %; those other biomes were generally in temperate climates, but also included tropical and subtropical moist broadleaf forests and Mediterranean forests, woodlands, or scrub.

3. Advantages and drawbacks of setting UTC targets

3.1. Advantages of setting UTC targets

Setting a UTC target has numerous benefits, including boosting the profile of urban forests for a broad range of stakeholders. UTC targets communicate urban forest aspirations, especially in management plans and strategies (e.g., Birmingham, UK (Rogers et al., 2023); Toronto, Canada (City of Toronto, 2013); Melbourne, Australia (City of Melbourne, 2012)). Politicians appreciate the conceptual simplicity of UTC targets for engaging with their constituents (Farmer, 2010). Residents, business owners, and environmental non-governmental organisations can be motivated by UTC targets, with some undertaking tree planting (Pincetl et al., 2013), protesting tree removals (Heydon, 2020), or engaging in education, research, or advocacy to help meet UTC targets (Roman et al., 2021a).

Setting UTC targets can also stimulate investment for urban forest staffing and activities. Including a UTC target in a management plan can lead to government budget allocation as achieving it requires investment in growing or purchasing new trees, acquiring land, planting, and maintaining trees. Tree planting initiatives to meet UTC targets often also attract non-governmental investment (Eisenman et al., 2021). For example, the 'Million Trees NYC' planting campaign attracted hundreds of millions of dollars from donors, including Michael Bloomberg, David Rockefeller, and musicians Bette Midler and Sting (Young, 2011).

3.2. Drawbacks of setting UTC targets

In many parts of the world, a large proportion of the trees in towns and cities are owned by private individuals, commercial or industrial organisations, and educational, military, religious, and health institutions. The local government authority may own or manage relatively few trees on land in public tenure (Mincey et al., 2013). While UTC targets on land in public tenure may be relatively simple to mandate, targets for land in private tenure may be difficult to achieve due to landowner preferences, private property rights, and challenges around enforcement and compliance.

Setting UTC targets can also lead to poor decisions focused solely on meeting the target, for example, by planting inappropriate species or by retaining existing trees whose disservices or risk might otherwise lead to their removal. This is because some tree species are invasive, some trees

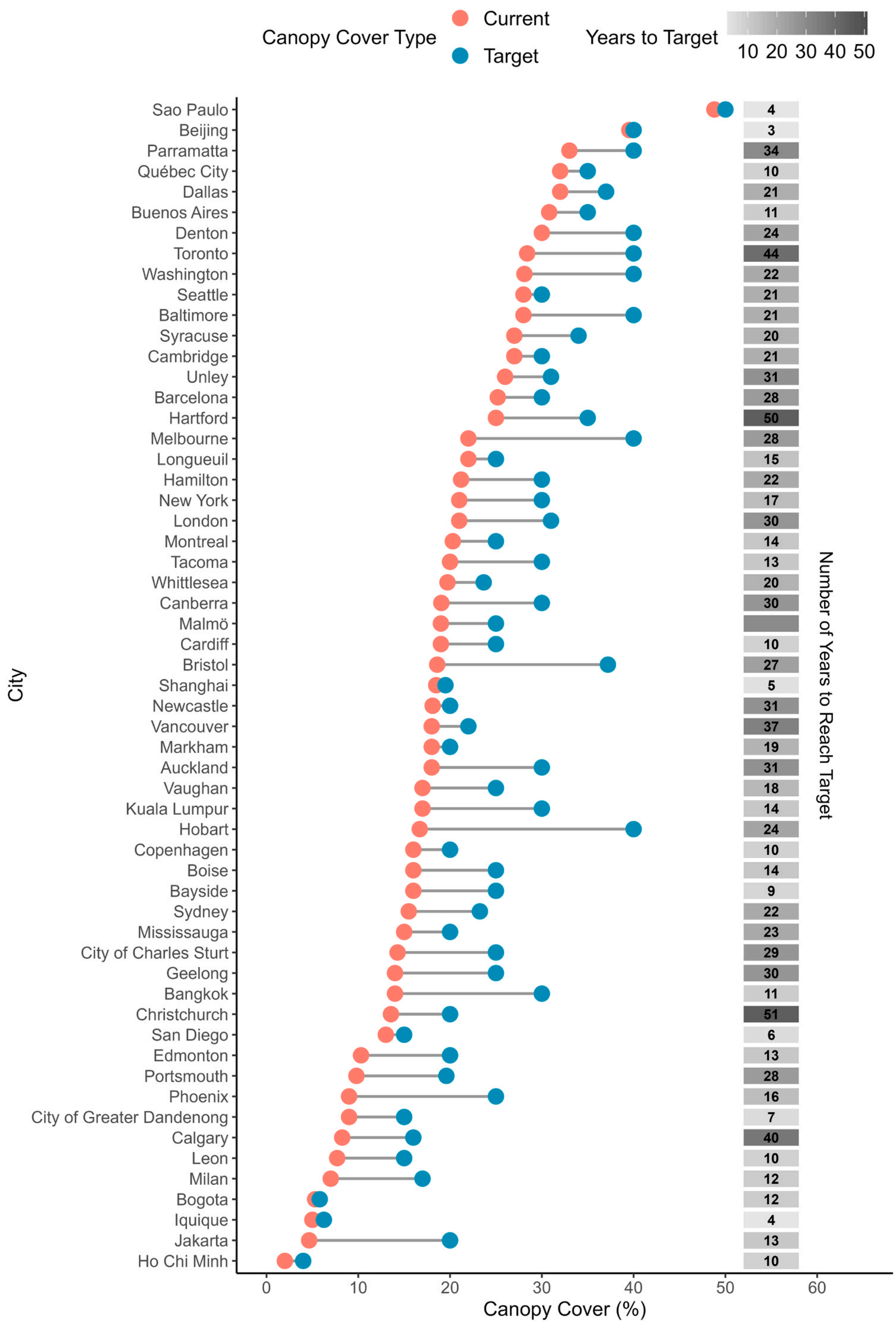

Fig. 1. Current (red) and target (blue) UTC values for sampled cities, ordered by current UTC. The number of years each city will take to meet their UTC target is shown on the right of the figure, shaded from short timescales (light grey) to long timescales (dark grey). N.B. Malmö did not provide a timeframe to reach its UTC target.

may be hazardous, or have disservices that offset their benefits (Roman et al., 2021b), yet UTC targets focus exclusively on increasing canopy, rarely considering the quality of the canopy. Furthermore, while most residents believe that trees are very important, not all desire more trees in specific spaces or situations (Ordóñez Barona et al., 2024a; Pearsall et al., 2024). Without considering species, risk, disservices, community preferences, and other factors, UTC targets may do more harm than good. Prioritizing UTC targets over other issues in urban forest management risks undesirable outcomes.

4. Setting an effective UTC target

Having considered the advantages and drawbacks, many cities will still include UTC targets in their urban forest plans or strategies. Achieving any target requires organisation, planning, monitoring, and effective management. Formal goal-setting frameworks include analyzing existing conditions, describing a future vision, and outlining guidelines to achieve it (American Planning Association, 2006). While numerous goal-setting frameworks exist, we demonstrate how the SMART framework (Specific; Measurable; Achievable; Resourced; Time-bound) could be used for setting an effective UTC target. SMART targets are appropriate because they provide measurable specificity and resource-focused planning that long-term urban forestry initiatives require, unlike more flexible frameworks designed for shorter business cycles.

Specific: Due to differences in climate, built form, cultural norms and a variety of other influences, there is no universal UTC target that is suitable for all contexts. Locally informed UTC targets are more appropriate. This could be implemented by specifying a single UTC target citywide. Targets may take the form of a stated percentage cover, e.g., 40 % UTC target for Hobart, Australia (City of Hobart, 2017), or a relative increase in existing canopy cover such as Copenhagen, Denmark which targets a 25 % relative increase in canopy cover (from 16 % to 20 %) between 2015 and 2025 (City of Copenhagen, 2015). Other cities set multiple UTC targets for different areas within their boundaries. For example, Christchurch, New Zealand has different UTC targets for open spaces (40 %), streets (15 %), waterways (75 %), residential (20 %), and commercial/industrial land (10 %) (Christchurch City Council, 2023). Setting targets for specific areas within a city can acknowledge the challenges of available planting space and help address inequities by focusing on low-canopy zones.

Measurable: Tracking progress toward a UTC target requires regular measurement of canopy cover over time. This can be achieved using fieldwork or desktop methods like point-based sampling or remote sensing (Parmehr et al., 2016), ideally aligned with a city's aerial imagery or LiDAR data acquisition cycle. Measurement precision is especially important for small changes in canopy cover. For example, Beijing, China's goal to increase UTC from 39.53 % to 40 % requires detecting an increase of 0.47 percentage points. Furthermore, it is critical that the methods used to estimate canopy cover over time reflect reality and are unaffected by measurement or methodological artefacts. For instance, phenological period can affect estimated UTC values (Kokubu et al., 2020), as can data type or analysis methods (Parmehr et al., 2016). Measurement approaches may account for these factors.

Achievable: Anecdotally, few cities have achieved their UTC targets, perhaps owing to the complexities and trade-offs inherent to increasing canopy cover (Tapsuwan, 2025). Modelling can help assess achievability by testing different planting plans, species selections, and mortality and removal rates to identify the most effective ways to meet targets. For example, Walters and Sinnett (2021) contrasted 16 different tree planting scenarios for their effect on UTC over a 27 year period in Bristol, UK, while Marcos-Martinez et al. (2025) undertook comparable canopy scenario modelling for Western Sydney, Australia. The achievability of UTC targets must also be considered in the context of community preferences for different vegetation types and species (Avolio et al., 2015; Nguyen et al., 2017), development pressures (Morgenroth et al., 2017), impermeable surface expansion (Nowak and Greenfield, 2020), limited soil volume and above-ground space (Pham et al., 2017), pests and diseases (Hostetler et al., 2013), water scarcity (Rasmussen et al., 2022), and extreme weather events (Landry et al., 2021).

Resourced: Sufficient funding and staffing are critical for meeting UTC targets. Guelph, Canada estimated that to meet its 40 % UTC target, it required a 400 % increase in funding (City of Guelph, 2023). A strategy or management plan with institutional funding streams can help to ensure UTC targets remain a priority despite changes in personnel or political leadership. Funding for tree planting to raise canopy cover towards a target may even come from other government departments, such as a transportation budget (for street trees) or through public-private partnerships as was demonstrated for the 'Million Trees NYC' tree planting campaign (Pincetl et al., 2013).

Time-bound: Targets require appropriate timeframes. A hypothetical city with UTC of 20 % in 2025 that sets a target of 30 % by 2050 has 25 years to increase its UTC, a time period so distant that it could lead to initial complacency. To stimulate early action, that city could consider intermediate timeframes, for example, an intermediate UTC target of 22 % by 2030. Timeframes should also allow sufficient time for management actions to lead to change. For example, many cities embark on significant tree planting initiatives (e.g., 'Million Trees NYC' (Young, 2011) or the One Million-Mu Plain Afforestation Project in Beijing, China (Yao et al., 2019)). While tree planting may increase canopy cover

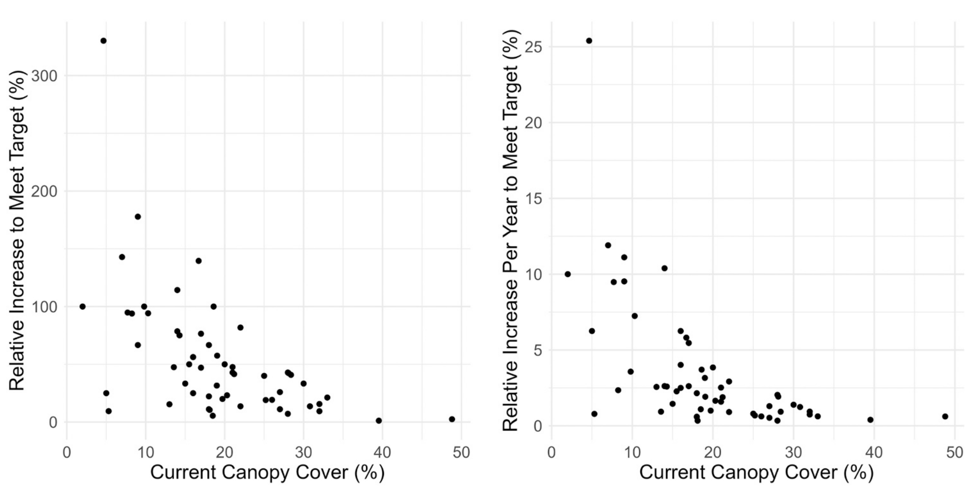

Fig. 2. Cities need to increase their UTC by between 1.2 % and 330 %, relative to current UTC (left). Accounting for the number of years to reach the UTC target, this results in relative increases in UTC of between 0.34 % and 25.4 % per annum (right).

over long periods of time, initial measurements may not capture the UTC gains due to the small initial size of planted trees and establishment failure (Roman et al., 2015).

5. Conclusion

UTC is a common urban forest metric that is included in resource assessment, goal setting, implementation strategies, as well as monitoring and evaluation. It is a building block for more complex policy- and management-related activities including modeling ecosystem service provisioning. Despite its importance, canopy cover in many cities has declined in recent years (Nowak and Greenfield, 2018). Perhaps in response to this, many cities have set out to increase their canopy cover by specifying a UTC target. These targets range in ambition but the data presented herein show that cities with lower current canopy cover have set relatively high targets that may be difficult to achieve. Data also confirm that cities in xeric or dry biomes set lower canopy cover targets than cities in temperate or tropical biomes, reflecting the biophysical challenges of growing trees in those environments.

UTC targets can be valuable as they can engage a community in tree planting, tree protection, and can even catalyse financial investment in urban forests. Despite the many benefits of setting a UTC target, doing so requires an understanding of local contexts and consideration of resourcing and achievability. Regular monitoring of UTC can aid in measuring progress towards the target. Broad, universal targets are likely less effective than specific, time-bound targets for individual cities, or for different areas within individual cities. Importantly, complementing UTC targets with diversity, health, and other targets related to canopy quality are likely to be more beneficial. By setting SMART UTC targets and understanding the potential benefits and drawbacks of having such a target, practitioners can avoid pitfalls and ensure that UTC remains a useful metric in urban forest management.

Supplemental material

The spreadsheet ‘Supplemental Material.xlsx’ provides details of canopy cover and targets for the cities included in this research.

Author statement

JM conceived the topic. All authors agreed to methods with JM, CD, KD, AK, COD, CS, JY undertaking search for data. JM did analyses and visualisations. All authors wrote sections of the original draft and provided feedback on revisions.

CRediT authorship contribution statement

Justin Morgenroth: Writing – review & editing, Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kieron Doick:** Writing – review & editing, Writing – original draft, Project administration, Investigation, Data curation. **Richard Hauer:** Writing – review & editing, Writing – original draft, Project administration, Investigation. **Locke Dexter H:** Writing – review & editing, Writing – original draft, Project administration, Investigation. **Camilo Ordóñez Barona:** Writing – review & editing, Writing – original draft, Project administration, Investigation, Data curation. **Roman Lara A:** Writing – review & editing, Writing – original draft, Project administration, Investigation. **Conway Tenley M:** Writing – review & editing, Writing – original draft, Investigation. **Cynnamon Dobbs:** Writing – review & editing, Writing – original draft, Investigation. **Peter Duinker:** Writing – review & editing, Writing – original draft, Investigation. **Gulsrud Natalie M:** Writing – review & editing, Writing – original draft, Investigation. **C.Y. Jim:** Writing – review & editing, Writing – original draft, Investigation. **Koeser Andrew K:** Writing – review & editing, Writing – original draft, Investigation. **Shawn Landry:** Writing – review & editing, Writing – original draft, Investigation. **Stephen Livesley:** Writing – review & editing, Writing – original draft, Investigation. **Lorien Nesbitt:** Writing – review & editing, Writing – original draft, Investigation. **Shackleton Charlie M:** Writing – review & editing, Writing – original draft, Investigation. **P.Y. Tan:** Writing – review & editing, Writing – original draft, Investigation. **Jun Yang:** Writing – review & editing, Writing – original draft, Investigation.

Declaration of Competing Interest

The authors declare that they have no known competing financial

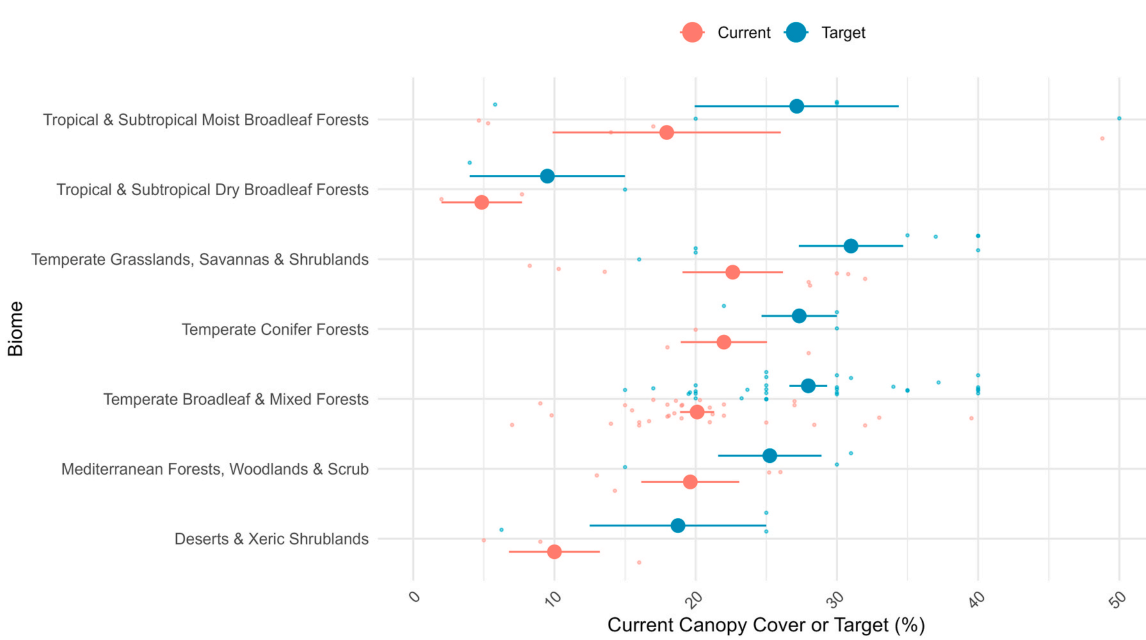

Fig. 3. Current UTC (red) and UTC targets (blue) by biome for the 57 cities in this study. Small points represent UTC values for individual cities, while large points and bars represent mean UTC and standard errors, respectively. Cities in dry or xeric biomes have the lowest current UTC and the lowest targets.

interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ufug.2025.128979.

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