REPLY TO DRESCHER:

Interdisciplinary collaboration is essential to understand and implement climate-resilient strategies in cities

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We appreciate Drescher's perspective (1), which elaborates on several points made in our initial paper (2) and underscores the need for additional research on how trees can be used to mitigate urban heat.

We note in our paper that optimizing cooling with a limited number of trees can be achieved by increasing cover in areas where tree canopy cover is >40%, because benefits accrue rapidly above this threshold. However, Drescher (1) rightly emphasizes the greatest need for cooling is often in areas with <40% tree cover, and we agree that societal vulnerability to extreme heat must be considered in planning. It is for these reasons that we emphasize that "although prioritizing areas ≥40% canopy may increase cooling the most, it is important to ensure that planting efforts do not occur exclusively in areas in which tree cover is already high. Climate adaptation efforts must also consider the social and environmental (in)justice issues embedded within many cities" (2).

We suggest 40% canopy cover be considered as a quantifiable target to guide urban forestry efforts. Reaching this target in neighborhoods with low tree canopy cover requires greater investment but remains highly important. Furthermore, there are many cobenefits of urban trees that increase the importance of equitable planting (3, 4). Urban forestry decisions should consider this broader suite of benefits in addition to climate regulation.

Drescher (1) also highlights the barriers presented by urban form and low life expectancy of urban trees. As we note in our paper, there are certainly real-world constraints to achieving high canopy levels in existing cities, particularly in areas of compact urbanization. However, cities are composed not only of dense downtowns; cities also contain lower-density residential areas (5), typically with substantial potential for increased tree cover. Preserving space for trees is also an important consideration in the context of rapid urban expansion (6). Just as in climate change adaptation efforts more broadly, trees should be treated as part of a portfolio of solutions—which should also include built-infrastructure–based strategies and reduced greenhouse gas emissions (7).

Although the science of urban tree mortality (8) is beyond the scope of the present work, Drescher's (1) commentary raises the important point that a focus on tree planting alone is not enough. Increasing urban canopy cover also requires maintenance and retention of existing trees (9), which can be improved via tree protection regulations and incentives (10). Citizen stewardship is also critical for tree longevity (e.g., watering trees on private property or street terraces and avoiding damaging vulnerable young trees).

Finally, we agree that further knowledge of human behavior would complement our work. We intentionally measured air temperature 1.5 m above ground (rather than typical 3- to 5-m sensors or land-surface temperature) and at fine scales to conduct a more "human-scale" assessment of urban heat. However, urban heat exposure is complicated, and we collectively still have far to go to understand it fully. Future collaboration among experts in ecology, urban planning, engineering, and public health (among other fields) will be essential to more fully understand and implement climate-resilient strategies.

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