RISK REDUCTION GUIDANCE

TREE COVER AND GREENSPACE

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ABSTRACT

Increasing urban tree cover has multiple health benefits, one of the most dramatic of which is reduced heat-health risks. Trees reduce urban heat islands and thereby reduce heat hazard intensity and thus adverse health effects of heat exposure. Tree canopy cover of at least 30% to 40% is optimal for health protection, and simulation studies have found that increasing tree canopy cover to this level results in reductions of hundreds of heat-attributable premature deaths annually in medium to large cities in Europe and the US. There are few reports of the implementation time or cost of large scale tree planting campaigns. Young trees generally require decades to mature and other health protections should be considered in tandem with tree planting, particularly in highly impacted communities, in order to provide immediate benefits while tree canopy interventions reach their maximum impact over several decades.

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What is the intervention?

Increasing the amount of tree cover, or the total area of land in a city that is shaded by trees, has been one of the proposed solutions for decreasing temperatures in urban areas. Trees help cool the surrounding air by providing shaded areas and transpiring water, reducing temperatures and decreasing the amount of energy spent on other cooling methods (McDonald et al. 2020).

The effects of increased tree cover are more significant in hotter climates and in the daytime, with hotter cities like Phoenix receiving more cooling benefits from tree cover than more temperate cities like Zurich (Meili et al. 2021). Temperature decreases nonlinearly with increasing canopy cover, and is maximized when canopy cover exceeds 40% and at the scale of the city block (approximately 60-90 meters squared) (Ziter et al. 2019).

There are a number of other health and ecological benefits associated with increased tree cover. Trees act as carbon sinks, decreasing greenhouse gasses, can absorb and filter rainwater during heavy precipitation (Using Trees and Vegetation to Reduce Heat Islands 2014), and reduce air pollution. Trees and greenspace have other health benefits (Wolf et al. 2020) including benefits for mental health (Ulmer et al. 2016; Browning et al. 2019), cardiovascular health (Nguyen et al. 2021), and violence reduction (Garvin et al. 2013; Sadatsafavi et al. 2022). There is a burgeoning literature on the potential for tree cover to reduce health disparities (Rigolon et al. 2021). Increasing tree cover can not only provide climate benefits, but can also reduce the need for pavement maintenance and can improve local quality of life by providing habitats for wildlife and reducing noise pollution (Using Trees and Vegetation to Reduce Heat Islands 2014).

How effective is the intervention at protecting people's health?

Increasing tree cover reduces the urban heat island and protects health by reducing heat hazard intensity. One recent study of 93 European cities found that the average urban heat island effect was 1.5°C (Iungman et al. 2023). A study investigating data from approximately 300 European cities showed that the presence of trees in urban areas was associated with reductions in surface temperature 2-4 times greater than reductions in surface temperature in urban green spaces without trees. Surface temperatures in tree-covered areas were 0-4°C lower in Southern European regions and 8-12°C lower in Central European regions (Schwaab et al. 2021).

This temperature reduction translates into reduced heat-attributable mortality, health care utilization, and electricity consumption. Evidence from the US suggests that urban tree cover currently helps avoid 245-346 deaths in the US annually (McDonald et al. 2020). As tree cover is inequitably distributed, tree cover in non-Hispanic white neighborhoods provide 0.19 more cooling than in predominantly people of color (POC) neighborhoods (McDonald et al. 2023). A health impact assessment simulating reductions in the urban heat islands in 93 European cities cities and found that, if tree canopy cover was increased to 30%, the urban heat island would decrease by 0.4C and that 2,644 premature deaths

(1.84% of all summer deaths) could be avoided (Iungman et al. 2023). A health impact assessment of Philadelphia, Pennsylvania's goal of 30% tree cover by 2025 found that the intervention would reduce premature deaths by 403 per year if the policy were fully implemented (Kondo et al. 2020).

Increasing tree cover can act synergistically with other interventions. For example, one study found that vegetation cover alone decreased average urban temperatures by 0.48°C, increased roof albedo alone decreased average temperatures by 0.50°C, and a combination of vegetation and increased roof albedo decreased average temperatures by 0.63°C (Schubert and Grossman-Clarke 2013).

How long does the intervention take to implement?

The implementation of tree cover is variable and is dependent on the local climate and the types of trees considered for use. Planting and growing a tree is a longitudinal process and can take several years, and there are multiple uncertainties related to tree survival and other factors that hamper estimation of intervention timing and cost (Kondo et al. 2020). However, studies have suggested that higher temperatures within cities have made it so that trees grow faster in urban settings compared to rural settings (Pretzsch et al. 2017).

How much does the intervention cost?

There are relatively few studies reporting cost estimates for tree planting and maintenance. Programs touting the ability to plant a tree for a dollar have come under scrutiny and consensus holds that this estimate is likely significantly below what is required for a robust process that includes site assessment, tree choice, and maintenance that will enhance tree survival (Oakes 2021). While several studies have examined cost-effectiveness of tree planting, relatively few of which included health benefits, and overall there is no consensus on the cost-effectiveness of tree planting efforts due to diversity of methods and reporting (Song et al. 2018).

Are there downsides to consider?

There are several potential downsides of focusing on increasing tree cover as a heat protection strategy. One is that increasing tree cover is a complex intervention requiring expertise outside of the health sector to implement. Another is that, while the time required for the intervention to reach full effect depends on multiple factors, the time to maximal effect is likely over a decade and in some cases considerably longer. Other interventions with more immediate effect should also be considered to protect vulnerable populations while longer-term interventions are implemented. In addition, there is an inverse correlation between urban tree cover, population density, and impervious cover, meaning that tree planting interventions in densely populated urban areas may require additional interventions to remove impervious cover in order to be effective. Significant increases in tree cover necessitate commitment of sufficient water resources over the duration of the intervention, a consideration that may be increasingly challenging for some areas as the climate continues to warm. Lastly, large-scale tree planting has the potential to increase property values and result in gentrification and displacement of existing residents, and care should be taken to consider and minimize such unintended consequences of tree planting interventions.

What other strategies should be considered?

As noted, other interventions with more immediate protective effects should be considered in tandem with tree planting in highly vulnerable communities. In addition, tree cover has been shown to be substantially lower in POC neighborhoods, a factor that may contribute to differences in the rates of heat injury and heat-related deaths between POC neighborhoods and non-POC neighborhoods (McDonald et al. 2023). Therefore, attention should be paid to POC neighborhoods and vulnerable communities when implementing programs to increase tree cover.

What are some good sources of additional information?

How to expand your city's tree canopy cover from C40
How to set effective, evidence-based urban tree canopy goals from PlanITGeo

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