Recent Urban Tree Loss in Egypt: Implications for Heat Resilience, Biodiversity, and Human Well-Being

Wasim M. K. Helal [a] and Dina M. Elshenawi [b,*]

Recent ongoing removal of roadside and public-space trees in Egypt has become a governance concern. In an arid, densely urbanizing country, mature trees provide shade, evapotranspirative cooling, particulate capture, carbon storage, habitat, and cultural value. Evidence from Cairo and other Egyptian cities shows declining and unevenly distributed green space, and rising heat stress, which contrast with substantial cooling benefits from parks and connected green-blue infrastructure. This editorial argues that tree cutting should be treated as cumulative loss rather than isolated landscaping. It is proposed here that there be open inventories, as well as separate evaluations of the impact replacement rates that depend on what the trees do. There should be rules that make sure people can take part in the decision before any cutting happens.

DOI: 10.15376/biores.22.1.17-20

Keywords: Urban trees; Cairo; Urban heat island; Green infrastructure; Environmental governance

Contact information: a: School of Mechanical and Electrical Engineering, Quanzhou University of Information Engineering, Quanzhou, 362000, P.R China; b: Quanzhou University of Information Engineering, Quanzhou, 362000, P.R China;
** Corresponding author: drdina@126.com; 3698657092@qq.com*

Introduction

Trees in Egyptian cities are not decorative accessories; they are functioning components of urban infrastructure. Their canopies intercept solar radiation, lower radiant heat, redistribute moisture through evapotranspiration, reduce wind-blown dust, store carbon, and create habitat in a landscape where natural vegetation is scarce. These services become more valuable as impervious surfaces expand and heat waves intensify. The recent visibility of tree cutting along roads, medians, public gardens, and construction corridors therefore deserves examination through environmental science rather than through aesthetics or short-term project convenience.

The Cairo evidence is especially clear. In this regard, Aly *et al.* (2022) reported a reduction of 2,128,280 m^2 of public green areas from 2006 to 2020, where the reduction in the period of 2017 to 2020 stood at 910,894 m^2. Moreover, they found that green spaces were not only insufficient but also had an inequitable distribution. These findings do not provide justification to believe that the removal of every single tree caused the same level of ecological damage, but they do create a baseline against which damage caused by the removal of green spaces can be measured.

Why the Loss of Trees Matters in Egypt

The first adverse effect is thermal. In the Greater Cairo region, Abd-Elmabod *et al.* (2024) compared parks, agricultural areas, golf courses, lakes, and rivers using Landsat-8 land-surface temperature. In May, the reported cooling differentials were approximately 4.3 °C for parks and 3.3 °C for urban agriculture, while connected blue spaces produced

still larger cooling signals. Tree removal consequently converts a local cool island into exposed soil, asphalt, or concrete, thereby increasing heat storage during the day and reducing shade precisely where pedestrians and public-transport users need it most.

The second effect is human heat stress. Using MODIS time series and ENVI-met simulation for the El-Mansourah conurbation, Hamdi *et al.* (2024) observed persisting urban heat-island dynamics between 2001 and 2021 and a decreasing comfort level during hot seasons among inhabitants. This scenario demonstrated a predicted decrease of over 2 °C in the air temperature if green mitigation were to be applied on a given street. This finding is not showing individual trees providing a concrete temperature decrease but why a street, as part of a vegetation network, as well as a street profile and continuum of canopy cover must be preserved.

The third effect is ecological and social. Mature trees offer a complex canopy structure, cavities, nesting sites, and shaded soil compared to newly planted saplings. Removing a row of trees fragments habitat and interrupts movement corridors for birds and insects. This action also redistributes burdens. In districts, lost canopy may be replaced with private landscaping or air-conditioning. In lower-income neighborhoods people often rely on shade and accessible green space. Tree cutting is therefore an environmental-justice issue as well as a biodiversity issue.

Table 1. Scientific Interpretation of Common Tree-removal Consequences in Egyptian Cities

Impact Domain	Mechanism after Canopy Loss	Planning Implication
Thermal regulation	Less shade and evapotranspiration; more exposed, heat-storing surfaces.	Protect continuous canopy and quantify shade loss before road or utility works.
Air and carbon services	Lower particle interception, carbon storage, and local air-quality buffering.	Use canopy and biomass, not only tree counts, in replacement calculations.
Biodiversity and soil	Habitat fragmentation, disturbed soil, and reduced connectivity for urban fauna.	Retain mature trees and link parks, medians, waterways, and institutional grounds.
Health and equity	Greater pedestrian heat exposure and unequal access to cool public space.	Prioritize canopy in heat-vulnerable districts and around schools, clinics, and transit.

From Isolated Cutting to Cumulative Urban Risk

A central analytical mistake is to evaluate each removal as an isolated event. The effect of a single tree depends on age, crown size, species, location, soil volume, irrigation, and its relationship to neighboring vegetation. The loss of ten mature street trees may therefore be much greater than the gain from planting ten small saplings elsewhere. Replacement should be evaluated through canopy area, projected shade, survival probability, root-zone volume, and time to functional equivalence. A numerical "one removed, one planted" rule is scientifically weak when the removed trees are mature and the replacements are not.

Figure 1 summarizes the pathway. Cutting reduces both direct ecosystem services and the resilience of the remaining urban network. Heat exposure can then increase energy demand for cooling, while fragmented vegetation reduces the capacity of green-blue infrastructure to moderate local climate. The pathway is consistent with the Cairo green-

space assessment and with the broader evidence that tree canopy is a dominant local determinant of human heat-stress mitigation (Gillerot *et al.* 2024).

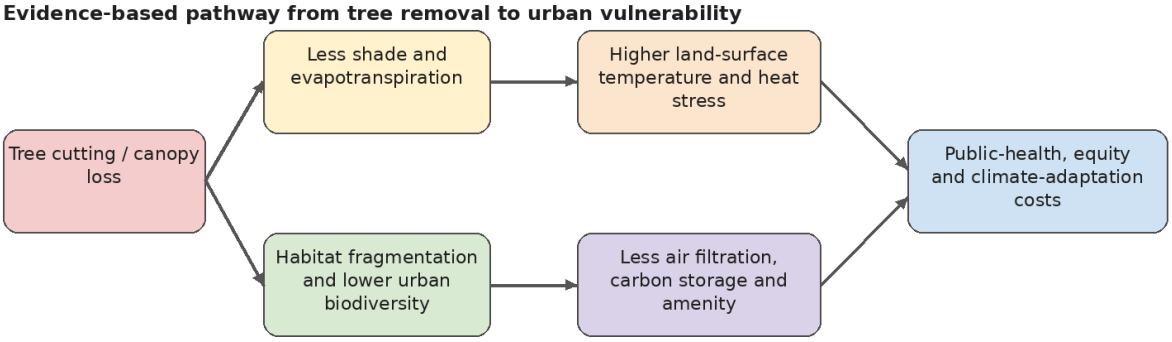


Fig. 1. Conceptual pathway linking tree removal to thermal, ecological, and social vulnerability

A Defensible Policy Response

Egypt needs an open system for managing trees that treats public trees as valuable assets that serve measurable purposes. Before any tree is removed, authorities should make public the tree's exact location, its species, diameter, canopy size, health condition, the reason for removal, the alternatives that were considered, and the plan to reduce harm. For trees long tree-lined streets, historic gardens, and areas where people are especially sensitive to heat, an independent expert review must be required. These reviews should look closely at options, such as redesigning the project, moving the tree, pruning, protecting the roots, or building in stages. These steps are needed before any removal is approved.

The protocol should also establish a public tree inventory linked to an accessible map and annual canopy accounting. Data should be disaggregated by district so that aggregate city-wide totals do not conceal severe local deficits. OECD 2024 points out that Egyptian cities have an opportunity for growing more green space and to make equitable access better. This idea works best when it comes with targets that can be enforced, budgets that stay steady for maintenance, and a defined responsibility, inside the institutions. Public participation is not a talk; it is a real chance. Residents are the people who notice when trees are cut. They notice once again when new plants do not grow or when shade disappears.

Finally, plant species need to be ecological, and not merely aesthetic. Planting needs to consider locally appropriate, drought-resistant plants, while also ensuring sufficient soil volume and irrigation in the early stages of planting. Green-blue corridors need to link parks, remaining agricultural areas, water sources, and institutional landscapes. This approach will resonate with the findings that the Egyptian green and blue infrastructure contributes significantly to seasonal cooling (Abd-Elmabod *et al.* 2024) and that the canopy helps in reducing human heat stress (Gillerot *et al.* 2024).

Conclusion

The recent phenomenon of tree cutting in Egypt is best understood as a cumulative reduction in urban climate capacity. The scientific record already shows declining and uneven green-space provision in Cairo, measurable heat-island and heat-stress dynamics in Egyptian cities, and substantial cooling benefits from parks and connected green-blue infrastructure. The appropriate response is not to oppose every infrastructure project, but rather to require evidence-based avoidance, transparent assessment, canopy-sensitive

replacement, and public accountability. Protecting mature trees is often the fastest and least expensive form of climate adaptation available at the street level. In Egypt's increasingly hot and densely urbanizing cities, tree retention should therefore be the default presumption, and removal the decision that requires proof.

References Cited

Aly, D., and Dimitrijevic, B. (2022). "Public green space quantity and distribution in Cairo, Egypt," *Journal of Engineering and Applied Science* 69, 2. https://doi.org/10.1186/s44147-021-00067-z

Abd-Elmabod, S. K., Gui, D., Liu, Q., Liu, Y., Al-Qthanin, R. N., Jiménez-González, M. A., and Jones, L. (2024). "Seasonal environmental cooling benefits of urban green and blue spaces in arid regions," *Sustainable Cities and Society* 115, article 105805. https://doi.org/10.1016/j.scs.2024.105805

Gillerot, L., Landuyt, D., De Frenne, P., Muys, B., and Verheyen, K. (2024). "Urban tree canopies drive human heat stress mitigation," *Urban Forestry & Urban Greening* 92, article 128192. https://doi.org/10.1016/j.ufug.2023.128192

Hamdi, I., Fawzy, M., Zelenakova, M., and Abbas, W. (2024). "Heat island dynamics and heat stress implications on the population of El-Mansourah conurbation, Egypt: Temporal and proposed solutions using MODIS imagery and ENVI-met simulation," *Geomatics, Natural Hazards and Risk* 15(1), article 2291328. https://doi.org/10.1080/19475705.2023.2291328

OECD. (2024). *OECD Green Growth Policy Review of Egypt 2024*, OECD Environmental Performance Reviews, OECD Publishing, Paris. https://doi.org/10.1787/b9096cec-en