

Research Article

The Socio-Economic and Environmental Imperatives of Trees

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Abstract

Due to environmental concern, this paper focuses attention on the imperative of trees to the environment and to man's welfare on a sustainable basis. Using a systematic literature assessment, the study examines the environmental, socio-economic, and health-related contributions of trees in urban settings. Research has identified trees in urban cities as important landscaping elements with valuable benefits that promote socio-economic and environmental sustainability. The value of trees and plants in most cities is often overlooked as significant and valuable assets of the urban environment. This paper identifies that beyond their environmental and economic benefits, trees play a critical role in human health and wellbeing, influencing the overall quality of life in communities. However, some disbenefits of trees have been noted, whose costs are easier to quantify and can readily be managed by land administrators yet these drawbacks remain fewer than the potential benefits. Finally, the paper recommends that urban planners and developers incorporate trees on building sites and along streets, and further enlighten the public to develop a deeper interest in the environment, so as to harness the potential gains of trees in addressing environmental challenges associated with constructing energy-consuming buildings that disrupt macroclimatic equilibrium, particularly in urban areas that frequently exhibit higher mean temperatures than surrounding rural regions.

Keywords

Economic, Environmental, Social, Benefits, Landscaping, Trees

1. Introduction

Throughout history, *Homo sapiens* have continuously interacted with the environment, leaving a lasting impact on landscapes across the globe. This interaction has often resulted in significant alterations to natural ecosystems—many of which have proven harmful both to the environment and to humanity. In many regions, forested areas have been cleared for cattle grazing or burned to make way for agriculture, only to be later converted into residential or commercial developments. This ongoing transformation and exploitation of the environment has become so widespread that it is now difficult to find any part of the planet untouched by human influence.

These patterns of human activity have contributed to global challenges such as climate change and global warming. A particularly notable outcome is the Urban Heat Island (UHI) effect, where urban areas consistently record higher average temperatures than their rural surroundings [38]. This is one of many observable consequences of human-induced environmental change, especially since the Industrial Revolution, which marked a period of rapid population growth and the rise of sprawling "concrete jungles," often developed with little regard for ecological balance.

Other visible impacts of environmental degradation include

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Received: 7 November 2025; Accepted: 1 December 2025; Published: 29 December 2025



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increased occurrences of earthquakes, landslides, floods, and desertification—phenomena now affecting various parts of the world. The poet John Ruskin (1819–1900) poignantly captured this destructive relationship, stating: “Man in his ignorance crushes natural sublimely, and in return, nature crushes human beings.” In essence, humanity and nature appear locked in a destructive cycle, each bearing the consequences of the other’s actions.

In Nigeria, the pursuit of economic growth and access to social amenities has often overshadowed awareness of environmental degradation. Many people remain unaware of, or disconnected from, the natural concept of a symbiotic ecosystem. Human interference with nature has disrupted delicate ecological balances, often to irreparable levels, posing serious risks to human health and survival.

Landscaping, as a field of design and planning, plays a critical role in addressing these challenges. It offers practical solutions to restore, protect, and enhance the quality of the environment. By fostering harmony between living and non-living elements, landscaping contributes to ecological balance while also delivering socioeconomic and environmental benefits.

Globally, the human population has been steadily rising, with an increasing proportion of people living in urban areas. As cities expand, it becomes more important for urban dwellers to understand and harness the numerous benefits provided by trees and other forms of vegetation. Urban tree planting brings with it a wide array of economic, environmental, and social advantages.

From an economic perspective, planting trees can reduce heating and cooling costs and boost property values. Environmentally, trees support biodiversity, enhance stormwater management, improve air quality, sequester carbon, and help mitigate the Urban Heat Island (UHI) effect [5]. Beyond their visual appeal, many horticulturists and landscape architects have highlighted the energy-saving potential of trees, shrubs, and lawns—particularly their ability to cool urban microclimates [7, 18].



Figure 1. Building Site without Tress [16, 34], buildings are exposed to direct sunlight.

Research by [2] underscores this point, demonstrating notable differences in cooling energy usage between homes

surrounded by trees (landscaped sites) and those without them (non-landscaped sites). Despite these clear benefits, [5] observed that the social and health-related advantages of urban trees are still underappreciated. However, a growing body of evidence now supports the value of urban trees in enhancing mental and physical health, improving academic outcomes—especially in school environments that incorporate natural views—and fostering stronger community ties. Additionally, the presence of trees in urban spaces has been linked to reductions in crime rates, making them essential not only for environmental restoration but also for promoting healthier, safer, and more cohesive communities.

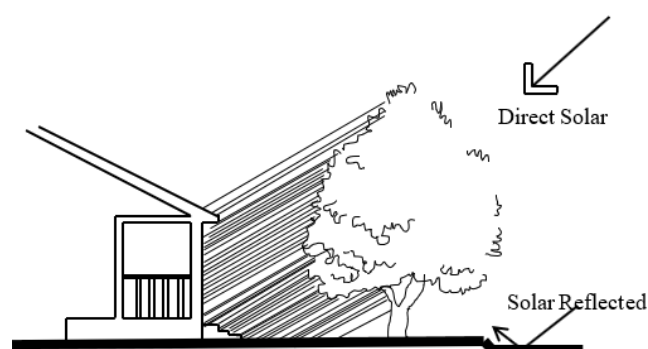


Figure 2. Building Site with trees Tress [16, 34], shade buildings from direct sunlight.

2. Landscaping

Like every purposeful activity, landscaping serves a distinct and meaningful function. Its primary aim is to harmonize natural elements—such as land, water, and vegetation—with functional spaces like playgrounds, parking areas, and roads. It also integrates major structures, including buildings and dams, as well as minor features like drainage systems and utilities, together with people and other living organisms. Since all these components are shaped by natural forces such as wind, sunlight, and rainfall, effective landscape design requires both scientific understanding and artistic creativity.

Constructing a home involves more than just building its physical structure—thoughtful landscaping of the surrounding outdoor space is equally important to create a welcoming and comfortable environment. A well-designed landscape enhances the aesthetic appeal of a property, increases its value, and transforms otherwise dull areas into attractive, and inviting spaces. Through the use of landscape elements like trees, shrubs, grasses, and flowers, ordinary homes can be made extraordinary, and office buildings can become warm and liveable environments.

Overall, trees and other vegetation offer three key sustainable benefits—economic, environmental, and social that underscore the importance of integrating landscaping into the built environment.

2.1. Economic Imperative

The economic significance of trees as landscape elements is rooted in their intrinsic connection to nature [12]. This highlights how the economic benefits of trees are closely linked to environmental factors, and together they contribute to sustainable outcomes [43]. As one of the three core pillars of sustainable development, the economic dimension has been widely studied within the field of landscape architecture—particularly in relation to urban trees, which serve as measurable indicators of landscape economic performance. These indicators are especially important to real estate developers and other stakeholders who often invest in the development of green spaces.

Zhen et al [43] noted that in some cases, landscape projects alone have significantly influenced property values, acting as the primary driver of economic benefit. In other instances, where landscaping occurred alongside rezoning, new development, or other contributing factors, the landscape intervention still played a significant role—enhancing property values, though not as the sole factor as in the first scenario.

Other economic benefits include:

a) Visitor Spending:

This refers to the financial expenditures made by visitors to a landscaped site, offering both economic and social benefits. Well-designed landscape projects can attract local, regional, national, and even international visitors, often generating revenue through entrance or membership fees [43]. Major and renowned sites have been known to draw hundreds of thousands to millions of visitors annually, significantly boosting local and regional economies through tourism-related spending. In addition to economic benefits, such visits foster social interaction, cultural exchange, and a broader understanding of people and places.

b) Increase in Tax Base:

According to [43], an increase in the tax base represents a public-sector benefit linked to rising property values. As attractively landscaped areas become more desirable and popular, they draw more residents and businesses, thereby generating higher tax revenues for local governments.

c) Construction Cost Savings:

Zhen et al. [43] highlight that even non-plant landscape elements, such as concrete, can contribute to economic and environmental savings. Reusing concrete from demolished structures on-site eliminates the need for purchasing new materials and reduces the environmental footprint by lowering the demand for raw materials and the energy required to produce them. Additionally, this practice cuts costs associated with hauling and disposal.

d) Economic Development:

Shafik [37] observed that the aesthetic appeal of landscaping can significantly influence the economic development of a site, neighbourhood, or city. Well-designed landscapes attract increased occupancy and consumer spending, as evidenced by growth indicators and rising revenue. In areas

directly impacted by landscape development, certain typologies—such as tree-lined streetscapes, transit-oriented developments, and waterfront redevelopments—are particularly effective in generating measurable economic benefits [1, 22].

Trees and green infrastructure provide a wide range of environmental benefits and ecosystem services—such as improved air quality, mitigation of the Urban Heat Island (UHI) effect, and enhanced urban habitats—all of which contribute to economic gains. These include increased property values, energy savings through reduced cooling demands, and higher occupancy and business revenues. [21] further noted that businesses located near urban green spaces often experience increased customer traffic, attract skilled workers who value clean air and recreational opportunities, and benefit from rising property values.

From the perspective of energy conservation, trees function as natural "evaporative coolers." According to [15, 23], a single tree can use up to 100 gallons of water per day through evapotranspiration, which equates to a cooling potential of approximately 230,000 Kcal per year. [13] reported that this cooling effect can lead to a temperature difference of up to 5°C between forests and adjacent open land during peak noon hours, and a 3°C difference between irrigated millet fields and bare ground. Even more substantial cooling effects have been observed in large urban parks, where the combination of evapotranspiration and wind can create temperature differences of up to 4°C compared to surrounding neighbourhoods.

In recognition of these benefits, the American Forestry Association in 2002 developed a framework for quantifying the annual economic value of trees, encompassing four key benefit categories based on market prices at the time, as;

i) Soil Protection:

Trees play a vital role in preventing soil erosion, with their roots anchoring the soil and their leaves slowing down rainfall, allowing more water to absorb into the ground rather than running off. This service has been valued at approximately \$106,000 for soil erosion control.

ii) Air Pollution Control:

Trees contribute to cleaner air by absorbing carbon dioxide—a major greenhouse gas—as well as other harmful pollutants like ozone. This service, valued at around \$71,000, also includes the microclimatic benefits of pollution deposition on leaves, which has been linked to positive health outcomes. Such ecosystem services hold significant economic value [32].

iii) Wildlife Habitat Provision:

Trees provide essential habitats and food for wildlife, with an estimated value of \$75,000. For example, oak trees alone support about 96 species of birds and mammals by offering food and shelter.

iv) Evapotranspiration and Cooling:

Through the process of evapotranspiration, trees release water vapor into the air, contributing to natural cooling valued at approximately \$103,000. This cooling effect is especially noticeable in dry environments and outdoor settings.

In the United States, homeowners can significantly reduce energy costs by strategically planting trees. Deciduous trees planted to provide shade can lower summer electricity bills by 10 to 50%, while evergreen trees used as windbreaks can reduce winter heating costs by up to 80% [11].

In Europe, energy-efficient building design has become a major focus, driven by policies such as the Energy Performance of Buildings Directive (2010), which aims to reduce the energy demand of new buildings to near zero [38].

According to the Africa Development Bank Group's Energy Sector Policy, many African countries face inadequate access to affordable and reliable modern energy, especially among low-income populations. Africa has the lowest electrification rate globally, with only about 42% of the population having access to electricity—compared to 75% in other developing regions. Even where electricity is available, it is often costly and unreliable. If current trends persist, fewer than half of African countries are expected to achieve universal electricity access by 2050. Given these challenges, African countries should consider leveraging the diverse economic benefits of trees as part of their strategies to meet energy demands and promote sustainable development.

2.2. Environmental Imperative

From an environmental standpoint, trees play a crucial role in enhancing regional biodiversity, improving the visual appeal of urban landscapes, and sequestering carbon. They provide numerous environmental benefits. For example, research from the Manchester project by [10] demonstrated that trees can reduce surface runoff by up to 60%. Trees also provide significant cooling effects: shading can lower urban air temperatures by 4 to 7°C and surface temperatures by 15 to 20°C, while evapotranspiration can dissipate up to 50% of incoming solar energy.

According to [9] trees enhance the environment in several important ways:

- 1) *Noise Reduction*: Trees absorb sound, with a belt of trees measuring 98 feet wide and 49 feet tall capable of reducing highway noise by 6 to 10 decibels. The presence of birds and the rustling of leaves also help mask unwanted noise.
- 2) *Water Filtration*: Trees filter and clean water, playing a key role in controlling salinity and ensuring the provision of fresh water from streams and rivers—often regarded as forest products.
- 3) *Energy Conservation*: Trees help conserve energy by blocking cold winter winds (such as the harmattan) and shading buildings from the summer sun.
- 4) *Recreation*: Forests provide opportunities for outdoor activities like camping, hiking, nature study, photography, filming, and more.
- 5) *Aesthetic Value*: Trees and shrubs beautify the environment with their flowers, adding colour and texture to otherwise gray urban landscapes.

6) *Property Value*: According to the U.S. Forest Service, trees can increase the value of a house by 5 to 6%, which translates to an average increase of about \$5,000 per home nationwide.

7) *Oxygen Production*: A large shade tree can produce enough oxygen annually to support ten people.

8) *Urban Cooling*: Trees help mitigate the Urban Heat Island effect, which causes cities to be warmer than surrounding rural areas due to the abundance of heat-absorbing surfaces like concrete and dark infrastructure.

2.3. Social Imperative

Since the 19th century, research has suggested that urban trees improve human mental and physical health, enhance academic performance in schools with access to trees and forest views, increase social cohesion, and in some cases, help reduce crime [5]. Urban trees offer a wide range of social benefits to residents, workers, and park visitors, but these benefits are often unevenly distributed. This inequality is especially noticeable in many Nigerian cities, where tree cover and related advantages tend to be concentrated in wealthier neighborhoods like Government Reserved Areas (GRAs), while lower-income areas frequently lack adequate green spaces.

To ensure environmental justice, it is important that the benefits of trees are accessible throughout entire cities and not limited to certain socioeconomic groups. [10] noted that cool air generated by trees and parks spreads across urban areas, but temperature differences between green and non-green zones can underestimate the overall positive impact of urban vegetation.

Urban green spaces provide significant health and social benefits. [5] highlighted that exposure to large urban green areas such as parks and trails—often called “urban bathing”—improves mental health and cognitive function. Numerous studies have linked human exposure to urban forests with mental and physical health improvements ([20, 25, 27]). These benefits are largely attributed to phytoncides—natural substances released by trees to protect themselves from insects and germs—which, when inhaled by humans, can reduce stress hormone levels and enhance immunity for up to 30 days.

Japanese research [28] on Shinrin-yoku, or forest bathing, shows similar benefits: increased energy, attentiveness, friendliness, and self-confidence, alongside decreased hostility, boredom, depression, anger, and fatigue. Shinrin-yoku also lowers cortisol levels, blood pressure, pulse rate, and stabilizes nervous system activity, helping reduce symptoms such as headaches, muscle tension, and even enhancing anti-cancer proteins [26]. The term Shinrin-yoku literally means “forest bathing,” referring to immersing oneself in nature using all five senses, thereby reconnecting humans with the natural world [29].

In the UK, [3] studied the mental health effects of moving from less green to greener urban neighborhoods and vice versa. They found that moving to greener areas improved mental health overall, supporting earlier findings by [20, 25, 27]. However, Alcock and colleagues could not fully explain the mechanisms behind these improvements or the temporary declines in mental health sometimes experienced during moves, which later researchers attribute to the influence of phytoncides emitted by trees.

a) Improved Academic Performance

Numerous studies have found a positive link between exposure to green spaces and improved attention spans in both children and adults, which in turn enhances academic performance. For example, [40; 42], as well as [20], investigated the impact of natural views from classroom and dormitory windows on students. Using various measures of attention, they discovered that students with views of natural surroundings performed better.

Similarly, [30, 35] studied 101 public schools in Michigan to assess how exposure to green spaces influenced student success. They found a positive correlation between nature exposure and academic outcomes such as standardized test scores, graduation rates, college enrolment intentions, and reduced criminal behaviour. These results held even after accounting for socioeconomic status and ethnicity. Interestingly, the strongest relationship was between student performance and views of natural landscapes during lunch breaks, despite the limited time spent in cafeterias compared to classrooms. In contrast, views dominated by buildings and hard surfaces lacking natural features were negatively associated with academic success. The researchers concluded that natural views likely support recovery and attention restoration during lunch breaks.

b) Increased Social Cohesion

Access to urban forests and green spaces has been shown to strengthen social connections and interactions. [8], along with [36], explored how the amount of greenery around two public housing projects in Chicago influenced residents' use of outdoor common areas. Their findings revealed that the presence of trees increased the frequency of outdoor space usage and attracted a wider range of age groups, promoting

social interaction and stronger community ties.

In related research, [6, 24], hypothesized that higher vegetation levels (trees and grass) foster more robust social ties among neighbours compared to those living near barren areas. Their results supported this hypothesis, showing that green outdoor common spaces encourage informal gatherings that improve social bonds.

c) Children's Play

[39], along with [31], examined the influence of vegetation on children's outdoor activities. Their research showed that children play more frequently and engage in more creative play in areas with abundant trees. Vegetated spaces provide softer, more stimulating environments that enhance children's play experiences, foster social cohesion, and contribute positively to their health and development [5].

d) Influence on Crime Rate

Research has identified a potential connection between urban forests and crime rates, with several studies showing that increased tree canopy correlates with reduced crime. For example, [41], and [17] found that a 10% increase in tree coverage corresponded with a 12% decrease in crime rates in Baltimore. While these studies acknowledged that other factors might influence this relationship, they confirmed a genuine association between more trees and less crime.

However, opposing findings have emerged. [14], along with [4], reported that trees on private property were more likely to be linked with crime than those on public land. They suggested that trees on private properties could provide hiding spots for criminals, emphasizing the need for careful selection, placement, and maintenance of trees to reduce such risks. This contradiction raises questions about whether criminals prefer private spaces due to less public access, highlighting a research gap needing further exploration.

e) Job Creation

According to [19], landscape development projects often create full-time jobs for land managers, maintenance crews, and support staff. Additionally, projects that are not fully volunteer-based tend to generate temporary employment opportunities during the construction and implementation phases [43].

Table 1. Summary of the Imperatives of Tree.

S/N	Economics benefits	Environmental benefits	Social benefits
1	Reduce heating & cooling cost	Noise Reduction	Reduce stress level and fatigue.
2	Increase Residential Land value	Water quality, improvement (stream & rivers Salinity control)	Aesthetics Value.
3	Increase Commercial land values	Air quality improvement	Provide recreation
4	Boast occupancy rates	Cool air temperature	Improve academic performance
5	Increase revenue base of an area by visitor (tourist)	Green house reduction	Increase social cohesion

S/N	Economics benefits	Environmental benefits	Social benefits
6	Increase home sales prices	Wild life habitat	Decrease in crime rate
7	Consumer patronage	Reduce stormwater runoff (erosion).	A living memorial
8	Reduce stormwater runoff, means fewer facilities (drainage)	Moderate the heat-island effect	They provide privacy
9		Protection of home from wind storm	Emphasis views.
10		Control wind speed & direction.	Direct pedestrian traffic
12		Reduce glare and reflect lights	They screen ugly views
13		They absorb or deflect radiation from sun.	Enhance architecture
14		Natural harmony is restored to the urban environment	They provide soft background for play
15			Provide food as Fruit
16			Job creation
17			A feel of serene, peaceful, restful & tranquil in a grove of trees

2.4. Disbenefits of Trees

According to [33], understanding the environmental, economic, and social benefits of nature—particularly trees and forests—is essential for improving vegetation management and design. This knowledge helps optimize environmental quality and human health for both current and future generations. [33] emphasizes that while trees offer numerous economic and ecosystem services that benefit communities, they can also generate various economic and environmental costs.

With proper planning, design, and maintenance, trees can enhance urban well-being by moderating climate, reducing building energy consumption and atmospheric carbon dioxide (CO₂), improving air quality, creating aesthetically pleasing environments, providing recreational spaces, mitigating stormwater runoff and flooding, reducing noise pollution, and delivering other social and environmental services.

However, poor landscape design, inappropriate tree species selection, and inadequate maintenance can lead to increased environmental costs. These include higher pollen production, emissions from trees and maintenance activities that contribute to air pollution, increased energy use in buildings, waste generation, infrastructure damage, and greater water consumption.

Many of these costs are straightforward to quantify as they are direct expenses borne by land managers, such as planting, pruning, tree removal, property repairs (e.g., from lifted sidewalks, fallen branches, clogged drains), injury liabilities from falling trees, forest fire damage, and leaf removal. Land managers typically recognize and can estimate these costs.

Yet, there are also indirect costs borne by land manag-

ers or society that are less visible or harder to measure. These disbenefits include allergy-related health issues from tree pollen, emissions of volatile organic compounds (VOCs) from plants that contribute to ozone, carbon monoxide, and particulate pollution, trees obstructing pollutant dispersion near busy roads, increased winter energy consumption due to tree shading, and invasive plant species disrupting local biodiversity.

3. Conclusion and Recommendation

It is evident that much of the world's landscape has been degraded, with only limited pockets of trees remaining in most urban areas globally. As the population continues to grow, society must begin to recognize and repay the invaluable environmental services once taken for granted—such as fertile soil, clean water, flood control, vast recreational spaces, and abundant timber resources. Faced with this sobering reality, people need to appreciate the vital role that reclaiming damaged landscapes plays in supporting the economy and overall well-being.

It is crucial for individuals to develop a deeper connection with the natural environment in which they live and to acknowledge the extent of environmental degradation around them. More importantly, solutions must be sought and implemented to restore these landscapes. Landscape design offers a promising avenue to conserve and protect the environment.

Looking ahead, particularly in developing countries, there is hope that proactive measures will be taken to promote landscape design through effective policies that prioritize sustainability in urban development. The importance of urban vegetation—especially trees—has been strongly recognized

in many developed nations, with policies actively encouraging tree planting.

In developing countries such as Nigeria, it is imperative that all levels of government adopt policies mandating tree planting on residential properties. Prospective developers should be required to include tree planting in their building plans, with government agencies responsible for physical development overseeing and enforcing compliance. Furthermore, as a matter of social equity, governments should educate the public about the benefits of trees, acquire land within neighborhoods, and establish green spaces for recreation. Such spaces not only enhance community well-being but also provide safe, soft grounds for children to play, and promoting healthier development.

Abbreviations

UHI	Urban Heat Island
EPA	Environmental Protection Agency
GRAs	Government Reserved Areas
CO ₂	Carbon Dioxide
VOCs	Volatile Organic Compounds

Conflicts of Interest

The authors declare no conflicts of interest.

References

- [1] Abdul, F., Ahsan, A., Muhammad, A., Ghulam, S., & Zulficar, A. L. (2024). A validity of environmental Kuznets curve under the role of urbanization, financial development index and foreign direct investment in Pakistan. *Journal of Economic and Administrative Sciences*, 40(2), 288–307.
- [2] Akbari, H., Pomerantz, M., & Taha, H. (2001). Cool surfaces and shade trees to reduce energy use and improve air quality in urban areas. *Solar Energy*, 70(3), 295–310.
- [3] Alcock, I., Mathew, P., White, B. W., Wheeler, L. E., & Michael, H. D. (2014). Longitudinal effects on mental health of moving to greener and lesser-green urban areas. *Environmental Science & Technology*, 48(2), 1247–1255. American Chemical Society.
- [4] Blair, A. B. (2018). Green infrastructure and violence: Do new street trees mitigate violent crime? *Health & Place*, 54, 43–49. <https://doi.org/10.1016/j.healthplace.2018.08.015>
- [5] Bowyer, J., Bratkorich, S., Fernholz, K., Howe, J., Groot, H., & Pepke, O. (2016). The human health and social benefits of urban forest. Dovetail Partners Inc. <http://www.dovetailinc.org/reportpdfs/2010/werc64010finalreportsm.pdf>
- [6] Calvin, W., Geoffrey, Q. S., & Stella, C. (2021). Underlying relationships between public urban green spaces and social cohesion: A systematic literature review. *City, Culture and Society*, 24, 100383.
- [7] Chengcong, W., Zhibin, R., Peng, Z., Yujie, G., Shengyang, H., Wenhai, H., Xinyu, W., Ruoxuan, G., & Fanyue, M. (2024). Impact of vegetation coverage and configuration on urban temperatures: A comparative study of 31 provincial capital cities in China. *Journal of Forestry Research*, 35(1), 142. <https://doi.org/10.1007/s11676-024-01794-8>
- [8] Coley, R. L., Sullivan, W. C., & Kuo, F. E. (1997). Where does community grow? The social context created by nature in urban housing. *Environment and Behavior*, 29(4), 468–494.
- [9] Department of Environmental Protection Division of Parks and Forestry. (2020). Division of Parks and Forestry. Trenton, NJ. <https://www.nj.gov>
- [10] Ennos, R., Armson, D., & Rahman, M. A. (2015). How useful are urban trees: Lessons from the Manchester research project. In *Trees, People and the Built Environment II* (pp. 62–70). Conference proceedings.
- [11] Environmental Protection Agency EPA (2024). *2-year milestone evaluations on Chesapeake Bay cleanup effort; cites challenges, progress and potential*. America Forest Service. <https://www.epa.gov>
- [12] Faber, M. and Frick, M. (2019). Conceptual and political foundations for examining the interaction between nature and economy. *University of Heidelberg, Department of Economics, Discussion Paper Series No. 659*. <https://www.researchgate.net/publication/331113326>
- [13] Geiger, R. (1957). *The climate near the ground* (2nd ed.). Harvard University Press.
- [14] Geoffrey, H. D., & Prestemon, J. P. (2010). The effect of trees on crime in Portland, Oregon. *Environment and Behavior*, 44(1), 3–23. <https://doi.org/10.1177/0013916510383238>
- [15] Gupta, S. K., Jeet, R., & Hukum, S. (2018). Comparative study of transpiration in cooling effect of tree species in the atmosphere. *Journal of Geoscience and Environmental Protection*, 6(8).
- [16] Haque, M. T., Tai, L., & Ham, D. (2004). *Landscape design for energy efficiency*. Clemson University Digital Press.
- [17] Holtan, M. T., Dieterlen, S. L., & Sullivan, W. C. (2015). Social life under cover: Tree canopy and social capital in Baltimore, Maryland. *Environment and Behavior*, 47(5), 502–525. <https://terrapublica.org/studies/view/2>
- [18] Huan, Y. J., Akbari, H., Taha, H., & Rosenfeld, A. H. (1987). The potential of vegetation in reducing summer cooling loads in residential buildings. *Applied Sciences Division, Lawrence Berkeley Laboratory*, 26, 1103–1116.
- [19] Hubbard, P. (1995). Urban design and local economic development: A case study in Birmingham. *Cities*, 12(4), 243–251. [https://doi.org/10.1016/0264-2751\(95\)00041](https://doi.org/10.1016/0264-2751(95)00041)
- [20] Hui, S., Han, L., Yawei, W., & Shin, W.-S. (2024). The influence of different forest landscapes on physiological and psychological recovery. *Forests*, 15(3), 498. <https://www.mdpi.com/1999-4907/15/3/498>

- [21] Ioppolo, G., Cucurachi, S., Solomone, R., Saija, G., & Shi, L. (2016). Sustainable local development and environmental governance: A strategic planning experience. *Sustainability*, 8, 180.
- [22] Khalid, A., & Wei, L. (2012). Environmental Kuznets Curve and Pakistan: An empirical analysis. *Procedia Economics and Finance*, 1, 4–13. <https://www.sciencedirect.com>
- [23] Kramer, P. J., & Kozlowski, T. T. (1960). *Physiology of trees*. McGraw-Hill.
- [24] Kuo, F. E., Sullivan, W. C., Coley, R. L., & Brunson, L. (1998). Fertile ground for community: Inner city neighbourhood common spaces. *American Journal of Community Psychology*, 26, 823–851.
- [25] Lee, J., Park, B. J., Tsunetsugu, Y., Kagawa, T., & Miyazaki, Y. (2011). Effect of forest bathing on physiological and psychological responses in young Japanese male subjects. *Public Health*, 125(2), 93–100.
- [26] Li, Morimoto, Nakadai, Inagaki, Katsumata & Shimazu (2007). Forest Bathing Enhances Human Natural Killer Activity and Expression of Anti-Cancer Proteins Journal International Journal of Immunopathology and Pharmacology. <https://doi.org/10.1177/03946320070200S202>
- [27] Li, Q. (2010). Effect of forest bathing trip on human immune function. *Environmental Health and Preventive Medicine*, 15(1), 9–17.
- [28] Li, Q. (2018). *Shinrin-yoku: The art and science of forest bathing*. Penguin Random House UK.
- [29] Li, Q. (2022). Effects of forest environment (Shinrin yoku/Forest bathing) on health promotion and disease prevention – The establishment of "Forest Medicine". *Journal of Balneology, Climatology and Physical Medicine*, 73(1), 22–23. <https://doi.org/10.11390/onki.73.22>
- [30] Matsuoka, R. H. (2010). Student performance and high school landscape: Examining the link. *Landscape and Urban Planning*, 97, 273–283. <https://doi.org/10.1016/j.landurbplan.2010.03.010>
- [31] Nelly, D. S., Tim, S. N., Pauline, H., Congrong, W., Harry, A. R., Payam, D., Michelle, P., & Esmée, M. B. (2023). Residential green space improves cognitive performance in primary school children independent of traffic-related air pollution exposure. *Environmental Health*, 22(33), 1–13. <https://doi.org/10.1186/s12940-023-00982-z>
- [32] Norwak, D. J., Crane, D. E., & Stevens, J. C. (2004). Air pollution removal by urban trees and shrubs in the United States. *Urban Forestry & Urban Greening*, 4, 115–123.
- [33] Nowak, D. J. (2017). Assessing the benefits and economic values of trees. In F. Ferrini, C. C. K. Van den Bosch, & A. Fini (Eds.), *Routledge Handbook of Urban Forestry* (Chap. 11, pp. 152–163). Routledge.
- [34] Prashanti, R., & Janmejy, G. (2020). Energy-efficient landscape design. In *Journal of Design of Cities and Buildings - Sustainability and Resilience in the Built Environment* (pp. 1–16). <https://doi.org/10.5772/intechopen.94904>
- [35] Raquel, B., Mathew, B., Kevin, J., Lucy, R., & Patricia, F. (2023). School greenness and student-level academic performance: Evidence from the Global South. *GeoHealth*, 7(8), 1–10. <https://doi.org/10.1029/2023GH000830>
- [36] Son, T., Tonia, G., & Kumara, W. (2022). Enhancing urban nature and place-making in social housing through community gardening. *Urban Forestry & Urban Greening*, 72, 2–8. <https://doi.org/10.1016/j.ufug.2022.127586>
- [37] Shafik, N. (1994). Economic development and environmental quality: An econometric analysis. *Oxford Economic Papers*, 46, 757–773.
- [38] Szkordilis, F., & Kiss, M. (2016). Potentials of vegetation in improving indoor thermal comfort and natural ventilation. *Applied Mechanics and Materials*, 824, 278–287. <https://doi.org/10.4028/www.scientific.net/AMM.824.278>
- [39] Taylor, A. F., Wiley, A., Kuo, E. F., & Sullivan, C. W. (1998). Growing up in the inner city: Green space as places to grow. *Environment and Behavior*, 30(1), 3–27.
- [40] Tonnessen, C. M., & Cimprich, B. (1995). Views to nature: Effect on attention. *Journal of Environmental Psychology*, 15, 77–85.
- [41] Troy, A., Grove, M., & O'Neil-Dunne, S. (2012). The relationship between tree canopy and crime rate across an urban-rural gradient in the greater Baltimore region. *Landscape and Urban Planning*. <https://doi.org/10.1016/j.landurbplan.2012.03.010>
- [42] Ya'ou, Z., Yanhong, T., Xiangquan, W., & Yuanlong, T. (2024). The effects of natural window views in classrooms on college students' mood and learning efficiency. *Buildings*, 14(6), 1557. <https://doi.org/10.3390/buildings14061557>
- [43] Zhen, W., Yan, B., Li, S., & Binder, C. (2016). *Economic Benefits: Metrics and Methods for Landscape Performance Assessment*. *Sustainability*, 8(5), 424. <https://doi.org/10.3390/su8050424>